

Traffic control at work sites

Technical Manual

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Publication number:	RMS.18.898
Author:	Kellee McGilvray Director Traffic Engineering Services
Authorised by:	Jeff McCarthy Executive Director Technical Project Services

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Disclaimer

This manual has been produced by Roads and Maritime Services (Roads and Maritime) for its own purposes, and must be referred to and applied in relation to all Roads and Maritime road and bridge works. While the information provided by Roads and Maritime has been compiled with all due care, Roads and Maritime does not warrant or represent that the information is free from errors or omissions, is up to date or that it is exhaustive. Roads and Maritime does not warrant or accept any liability in relation to the quality, operability or accuracy of the information. Roads and Maritime disclaims, to the extent permitted by law, all warranties, representations or endorsements, express or implied, with regard to the information. Users who independently choose to apply the information will be responsible for making their own assessment of the information, and Roads and Maritime accepts no liability for any decisions made or actions taken in reliance upon any of the information. Any such decision or action is made or undertaken at the risk of the user of the information. Users wishing to rely on the information should seek their own expert advice.

Foreword

This technical manual has been developed by Roads and Maritime, and must be applied in relation to:

- All Roads and Maritime road and bridge work sites
- For works involving temporary traffic management being undertaken on behalf of Roads and Maritime (by contractors, local government and public utility bodies or similar)

This is the fifth version of the manual and its release brings it up to date with current work health and safety legislative requirements and developments made in risk management principles pertaining to temporary traffic management.

The information in this manual is provided to assist Roads and Maritime in meeting its obligations under the NSW *Work Health and Safety Act 2011* (WHS Act). This Act places a positive duty on persons conducting a business or undertaking (PCBU) to ensure the health and safety at work, so far as is reasonably practicable, of:

- Workers they engage or cause to be engaged
- Workers whose work activities they influence.

Roads and Maritime must also ensure, so far as is reasonably practicable, that the health and safety of other persons is not put at risk from work carried out as part of the conduct of their business or undertaking.

The NSW Work Health and Safety Regulation 2017 (WHS Regulation) prescribes the risk management approach that duty holders of a PCBU must apply. This includes:

- Identifying all reasonably foreseeable hazards that could give rise to risks to health and safety
- Assessing these risks
- Managing the risks to health and safety by firstly:
 - Eliminating risks to health and safety so far as is reasonably practicable
 - If it is not reasonably practicable to eliminate risks to health and safety, minimise the risks so far as is reasonably practicable.

The WHS Regulation describes the hierarchy of control measures that duty holders must implement if it is not reasonably practicable to eliminate risks to health and safety.

The manual does not provide an exhaustive list of controls and does not displace Roads and Maritime's duties under the WHS Act and WHS Regulation, including eliminating before minimising risk.

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1 Policy

Roads and Maritime has both a moral and legal responsibility for the safety of all persons at Roads and Maritime work sites. This includes Roads and Maritime'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 selecting or designing a specific plan for the control of traffic.

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

This manual contains a large number of example traffic control plans (TCPs) that outline the minimum controls to be applied in a particular situation. They can be used to assist in the development and implementation of site and project-specific TCPs, in conjunction with a traffic management plan (TMP), risk assessment or similar. It is important that each TCP is checked against identified risks to ensure that the means of controlling or reducing these risks is in place. These TCPs are not approved until they are reviewed and signed by a qualified person.

Where an example plan does not meet the traffic control needs of a particular site, this manual provides procedures for the design of a new or site-specific plan after a TMP and / or risk assessment has been developed. 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, *Manual of uniform traffic control devices - Traffic control 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 implementation or design of TCPs shall only be undertaken by competent persons who are qualified and authorised.

2 Introduction

2.1 Purpose and scope

This manual is for personnel responsible for Roads and Maritime road and bridge work sites. It contains:

- Example traffic control plans (TCPs) for a range of work activities
- Information on how to develop a TMP and risk assessment prior to development of a TCP
- Instructions on how to select an example TCP for a specific work activity
- Instructions on how to design new TCPs
- 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 Roads and Maritime work sites consistently complies with best practice. It is also intended to help personnel to comply with the Work Health and Safety Act 2011 and the Work Health and Safety Regulation 2017.

For works conducted by contract, the manual complements Roads and Maritime specifications;

- G10 (Traffic Management)
- G10M (Traffic Management (Maintenance Works))
- G22 (WHS Construction and Maintenance Works).

The principles outlined in this manual detail the minimum treatments required. Additional signs, devices or other treatments can from time to time be required at specific sites to ensure that risks identified during traffic management planning are controlled or mitigated. 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. If additional signs and devices are being considered, the potential safety effects to workers and drivers must be identified and managed to confirm these improve rather than detract from the safety of a worksite.

Any variations below the requirements of this manual shall only be made on the basis of a documented risk assessment.

2.2 Application

This manual shall be used on all Roads and Maritime road and bridge works.

Appendix D contains example TCPs covering many work activities. Where an example TCP does not exist for the work activity planned then a new TCP should be designed. Minor modifications to a TCP can only be made and approved by a person with a current qualification in Prepare Work Zone Traffic Management Plans.

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 'example TCP' refers either to any TCP contained in this manual or a TCP, duly authorised, and contained in the local office procedure. An example TCP must be signed by a person qualified in Prepare Work Zone Traffic Management Plan accreditation to be considered authorised or approved prior to implementation. The term 'new TCP' refers to a TCP which does not exist as an example TCP and shall be designed by a person with Prepare Work Zone Traffic Management Plan accreditation.

2.3 Definitions

Term	Definition
85th percentile speed (V85)	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
actuation	The electrical action produced by a vehicle (by means of a vehicle detector) to enable the controller to recognise its presence
adjacent to traffic	Work which is not undertaken on trafficked lanes 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
ADT (average daily traffic)	The total traffic volume during a stated period, divided by the number of days in that period
advance warning signs	Roadwork warning signs which have a general message – used in advance of other roadwork signs with a more specific message
advance warning vehicle	A vehicle used well in advance of mobile works to provide advance warning of those works, to following traffic
aiming distance	The distance between the flashing arrow sign and the eye of an approaching driver
all-red	A period of time for the clearance of traffic within the controlled areas, during which red displays are shown to all approaches
approach speed	The speed of traffic approaching the work site measured in km/h and may be the speed limit applying to the road
around, past and through	Traffic will move either around, past or through work areas:
around	A work area with traffic on a detour, side track or different carriageway
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
through	A work area with traffic over the area being worked on with or without a pilot vehicle and may intermingle with workers or plant
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
built-up area	Roadside development comprising property accesses at spacings averaging less than 100 m over distances of at least 500 m

Term	Definition
clear of traffic and plant	A location where traffic and plant would not normally be expected
competent person	A person who has, through a combination of training, qualification and experience, acquired knowledge and skills to enable that person to perform specified tasks
condition signs	Temporary signs indicating the condition of the road surface through the work area
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
controlled area	The area of roadway shared by conflicting traffic streams controlled by traffic signals
controller	The device which regulates the order and duration of the displays of the signal lanterns
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 private vehicles
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
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
cycle length	The time interval between the start of the green display on two successive cycles of the same phase
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 post-mounted reflectors
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)
dimension D	A distance expressed in metres and used for the positioning of advance signs and related purposes
display	An aspect which is illuminated
engineer	See definition for Project Manager
extension	The additional green time allocated to a vehicle actuating the detector during the green period
flashing arrow signs	Flashing electronic traffic control signs and associated equipment used at work sites and operated in one of the following modes:

Term	Definition
arrow left mode (AL)	The lamps are energised to display an arrow which directs traffic to move or merge to the left
arrow right mode (AR)	The lamps are energised to display an arrow which directs traffic to move or merge to the right
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 and generally in an emergency situation
warning mode (W)	A pair of opposite diagonal lamps flash to give a strong warning or caution to approaching traffic
footpath	The paved area in a footway
footway	A public way largely reserved for the movement of pedestrians
gap	The time interval between the detection of two successive vehicles in a traffic stream
independent person	A person, with respect to safety inspections, who is not directly a member of a work crew undertaking short term or long term work
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
lamp matrix	An arrangement of lamps that display a message or symbol when a set or pattern of lamps is turned on or flashed
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
lookout person	A person whose sole responsibility is to watch out for and warn workers of approaching traffic
maintenance engineer	See definition for project manager

Term	Definition
maximum green period	The maximum time that a green display can show for one phase when a demand has been made for another phase
may	Indicates the existence of an option
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
mobile work	Work which entails work vehicles moving continuously along the roadway at speeds significantly lower than other traffic
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
motorway	High capacity road, also known as freeway
off-time	The period of cycle time all the lamps are off. This is usually 50 to 40 per cent of the cycle time
on-time	The period of cycle time-specific lamps are on. This is usually 50 to 60 per cent of the cycle time
open road area	Roadside development less frequent than that specified for a built-up area
pedestrian movement plan (PMP)	A diagram showing the allocated travel paths for workers or pedestrians around or through a work site
phase	An interval which permits a particular traffic movement or combination of compatible movements
physical works	The visible on-site activity of workers, plant or trucks
portable traffic control device (PTCD)	An approved portable device allowing traffic controllers to perform their roles at a safe distance from traffic in high risk environments
portable traffic light signals	Traffic light signals and associated equipment used at work sites and operated in one of the following modes:
fixed-time mode (FT)	In which the duration and the sequence of displays are pre-set and do not vary with traffic flow
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

Term	Definition
project manager	The officer responsible for the selection, design, approval and implementation of the traffic control to apply on site. It may include the engineer, asset engineer, maintenance engineer, roadworks engineer, surveyor, supervising geotechnical scientist or other positions
remote location	A location that is generally clear of traffic but may include plant items or tip trucks
road occupancy	Consists of any activity likely to affect the operational efficiency of the road network, in other words, an activity that requires the road to be used in such a way as to affect traffic flow
road occupancy licence (ROL)	A permit which allows the applicant to use or occupy a specified road space at approved times, provided that certain conditions are met
road user	Any driver, rider, passenger or pedestrian using the road
roadside	That area between the reserve boundary and the nearest road shoulder
roadway	That portion of the road devoted to the use of vehicles, inclusive of shoulders and any auxiliary lanes
running lane	A portion of the roadway allotted for a single line of moving vehicles
safety barrier	A physical barrier separating the work area and the travelled way, designed to resist penetration by an errant vehicle and as far as practicable, to redirect errant vehicles back into the travelled path
shadow vehicle	A vehicle which provides close up protection to the rear of workers on foot
shall	Indicates a mandatory requirement or action
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
should	Indicates a recommendation and is not mandatory, ie Advisory or recommended
shuttle flow	Where a portion of the roadway is closed so that a single lane is used alternately by traffic from opposite directions. This is used where insufficient width is available for two lanes in opposite directions
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

Term	Definition
signal lantern	An assembly of one or more signal aspects
site supervisor	See definition for technician, for traffic signals work and works supervisor for road and bridge works
So far as is reasonably practicable (SFAIRP)	<p>That which is, or was at a particular time, reasonably able to be done to ensure safety, taking into account and weighing up all relevant matters</p> <p>That which is, or was at a particular time, reasonably able to be done to ensure safety, taking into account and weighing up all relevant matters, including:</p> <ul style="list-style-type: none"> The likelihood of the hazard concerned occurring The degree of harm that might result from the hazard What the person concerned knows, or ought reasonably to know, about: <ul style="list-style-type: none"> the hazard or the risk, and ways of eliminating or minimising the risk The availability and suitability of ways to eliminate or minimise the risk <p>After assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk. (Source: WHS Act section 18.)</p>
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 works and to enable the driver to alert workers ahead of any danger
TCP	See definition for traffic control plan / traffic guidance scheme
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.
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) / traffic guidance scheme	<p>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.</p> <p>Note: The use of traffic guidance scheme (TGS) and traffic control plan (TCP) are interchangeable. This manual will use TCP in reference to both terminologies</p>

Term	Definition
traffic controller	A trained person whose duty it is to control traffic at a work site
traffic management plan (TMP)	A plan detailing work to be undertaken and describing its effect on the general area, especially its effect on public transport and passengers, cyclists, pedestrians, motorists and commercial operations
travelled path	That part of the roadway which is available to vehicles and which may consist of one or more running lanes
truck-mounted attenuator (TMA)	A safety device fitted to slow moving or stationary vehicles.
variable message sign (VMS)	An electronic sign that displays electronically generated messages on a screen
vehicle detector	The equipment which senses the presence or passage of vehicles
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
vehicles per day (vpd)	The number of vehicles observed passing a point on a road in both directions within 24 hours
vehicles per hour (vph)	The number of vehicles in any particular hour
visibility distance	The maximum unobstructed distance the flashing displays are clearly seen under bright, daylight conditions with the specified lamps fully energised
work area	The specific area on the road or bridge or within the road reserve where the construction or maintenance work is being undertaken
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 preceding the work area and undertaking the work (such as a linemarking machine) or supporting the workers on foot behind it. For static sites it is positioned to best suit the work being undertaken
works supervisor	The first person in line management who directly supervises teams of field personnel

2.3.1 References

Document	Publisher
AS 1742.1, <i>General introduction and index of signs</i>	Standards Australia
AS 1742.2, <i>Manual of uniform traffic control devices</i>	Standards Australia
AS 1743, <i>Road signs - Specifications</i>	Standards Australia
AS 1906.1, <i>Retroreflective materials and devices for road traffic control purposes Retro-reflective sheeting</i>	Standards Australia
IC-QA-G10, <i>Traffic Management</i>	Roads and Maritime. Available on Roads and Maritime website
IC-QA-G10M, <i>Traffic Management (Maintenance Works)</i>	Roads and Maritime. Available on Roads and Maritime website
IC-QA-G22, <i>WHS Construction and Maintenance Works</i>	Roads and Maritime. Available on Roads and Maritime website
Roads and Maritime electronic Traffic Signs Register	Roads and Maritime. Available on Roads and Maritime website
TSI-SP-049, <i>Traffic Signal Systems</i>	Roads and Maritime: Request access from Roads and Maritime Traffic Equipment and Standards at ITSHelpdesk@rms.nsw.gov.au
TSI-SP-060, <i>Illuminated Flashing Arrow Signs</i>	Roads and Maritime: Request access from Roads and Maritime Traffic Equipment and Standards at ITSHelpdesk@rms.nsw.gov.au
TS200, <i>Register of ITS Field Equipment</i>	Roads and Maritime: TS200 Register of ITS Field Equipment
QA Specification 3352, <i>Fluorescent Plastic Traffic Cones</i>	Roads and Maritime. Available on Roads and Maritime website
QA Specification 3385, <i>Barrier Boards</i>	Roads and Maritime. Available on Roads and Maritime website
QA Specification M209, <i>Road Openings and Restorations</i>	Roads and Maritime. Available on Roads and Maritime website

2.4 Training

2.4.1 General

A competency-based training framework has been adopted for traffic control training and assessment, linked to nationally recognised competencies. All training organisations that provide traffic control training and assessments must be approved and registered.

It is a requirement of Roads and Maritime that all personnel undertaking traffic management on State roads or on behalf of Roads and Maritime are qualified to undertake traffic control tasks, as shown in Table 2.1.

Table 2.1: Traffic control competency accreditation

Qualification	Description	What this qualification does not allow for
Traffic controller	This course provides training for personnel who are required to control traffic with a stop/slow bat or portable traffic control device	A traffic controller qualification does not provide accreditation to set up or work with traffic control plans
Implement Traffic Control Plans	This course provides training for personnel who are required to set up and work with TCPs at a work site	An Implement Traffic Control Plan does not provide accreditation to control traffic with a Stop/Slow bat, to modify existing or example TCPs, or design new TCPs
Prepare Work Zone Traffic Management Plan	This course provides training for personnel who are required to approve example TCPs, modify example or existing TCPs, design new traffic management plans and TCPs for road works, produce major upgrades of standard plans or inspect traffic control plans on road construction sites	A Prepare Work Zone Traffic Management Plan accreditation does not qualify a participant to control traffic with a stop/slow bat or set up work with traffic control plans.

2.4.2 Audit of training effectiveness

Roads and Maritime will undertake an appropriate assurance and audit regime 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 WHS legislation
- Are aware of their responsibilities under this manual
- Know that field personnel are required to install, maintain and remove signs and other devices on the basis of TCPs

2.5 Traffic control safety inspections

A traffic control safety inspection is a structured procedure whereby a suitably qualified person, who is independent to the design and installation of traffic control, uses a checklist or other method to determine the level of compliance at work sites with the practices and requirements of this manual.

The overriding objectives of a traffic control safety inspection are:

- To ensure that the work site is operating safely
- To ensure that due consideration has been given to traffic management planning, risk identification and mitigation
- To ensure that, if required, a TCP has been provided and is on site, has been approved and has been implemented as approved
- To ensure any variations to the TCP (for instance in sign location due to shade, parked vehicles etc) are recorded on the TCP and approved
- To highlight discrepancies and, if appropriate, make recommendations.

All work sites are subject to traffic control safety inspections, both during day and night conditions.

An example of a traffic control at work sites safety inspection checklist is included in [Appendix E](#). Whilst independent inspections are to be undertaken the checklist can also be used by suitably qualified members of crews involved in any work as a further means of ensuring safe working conditions.

2.6 Liaising with external organisations

Roads and Maritime will endeavour to keep its example TCPs current by liaising with:

- Overseas road and traffic agencies (the formal liaison with the United States Highways Research Program is an example)
- Other road agencies in Australia and New Zealand through the Austroads liaison groups
- Local government (councils) and SafeWork NSW
- Relevant Australian Standards committees.

When new information becomes available and new techniques are developed, they will be assessed and if suitable incorporated into this manual. Any amendments to the manual will be made available on Roads and Maritime website.

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 not understanding the devices, particularly newer devices
- Drivers do not appreciate the dangers to workers and road users if traffic control devices are not given adequate respect, attention and appropriate response
- Drivers lose respect for signs, which are used incorrectly e.g. not removed or covered when not required.
- Drivers can be confused by the number of signs and devices
- Drivers can be distracted by other things e.g. mobile phones or other passengers
- Drivers can be fatigued.

For example, if the TRAFFIC CONTROLLER (symbolic) sign is displayed while there is no traffic controller present, then drivers could interpret this sign as meaning there could be a traffic controller ahead. This could lead to a lessening of the efficacy of the signs when next encountered by the drivers.

2.7.3 Methods

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

- Roads and Maritime websites
- VMS / static signs near worksites
- Approved social media
- Community consultation sessions
- Including suitable material in Roads and Maritime's *Road Users' Handbook*
- Conducting campaigns with the police to reinforce responsible behaviour on the roads especially at work sites
- Presenting road safety visuals and posters in public areas of Roads and Maritime offices, particularly Service NSW centres
- Making sure traffic control devices are set up appropriately with consideration of the driver's perspective
- Advertising the times and duration of planned works on various mediums e.g. radio or newspaper
- Explaining detour options
- Signs that thank drivers for their cooperation
- Communication about the road user or community safety benefits of the work being completed and contact details for enquiries or feedback.

2.8 Evaluation and review

Implementation of this manual will be evaluated as part of Roads and Maritime'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 and inspections. Feedback on the manual is welcome and encouraged and should be forwarded to Director, Traffic Engineering Services.

The committee is also responsible for:

- Evaluating and approving new example TCPs, signs and devices
- Developing strategies to improve safe systems of work
- Providing input into the evaluation of training and accreditation issues.

The committee has representatives from all divisions within Roads and Maritime.

The basic criteria for the evaluation and acceptance of a new sign, device or example TCP for general use throughout NSW applies as follows:

- It conforms with the principles in Section 3, General procedures and Section 5, Designing new traffic control plans (TCP)
- It has application in more than one area of the State
- Other standard signs, devices or TCPs are not suitable or ineffective.

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 Roads and Maritime traffic emergency patrollers (TEPs), and school crossing supervisors. These separate procedures have not been included in the manual because of the specialist activities of these groups.

2.10 Risk management

A documented risk assessment shall be undertaken for all types works to identify and analyse all hazards when developing a traffic management plan (TMP) and TCP for work zones or other working near traffic activities, to ensure appropriate measures are taken to manage these risks.

The TMP, or risk assessment, should:

- Consider how the existing road environment will influence the works
- Identify foreseeable risks and hazards
- Seek to eliminate risk to health and safety
- When elimination of risks to health and safety is not reasonably practicable, document the strategies for minimising risks SFAIRP
- Assess the effects.

The process to be followed is detailed as follows:

2.10.1 Step 1: Identify and list the hazards to health and safety

On any work site where traffic control is utilised, there are potential hazards. Some examples are:

- Moving traffic
- Queued traffic
- Exposure to live traffic
- Length of delays for road users
- Non-compliance with temporary speed limits
- Reduced lane and shoulder widths
- Compromised access points
- Reversing plant
- Overhead power lines.

2.10.2 Step 2: Assess the risks arising from the hazards

Assess the risks by determining how much harm or damage they can cause (consequence) and how likely they are to result in harm (likelihood). This analysis is based on all the identified controls being in place, with their established degree of effectiveness.

Consequence is the outcome resulting from a risk being realised. To select the appropriate consequence rating, Roads and Maritime uses the consequence measures contained in Table 2.2.

Table 2.2: Risk matrix – Consequence descriptions

Rating	Description
Insignificant	Illness, first aid or injury not requiring medical treatment No lost time
Minor	Minor injury or illness requiring medical treatment No lost time post medical treatment
Moderate	Minor injuries or illnesses resulting in lost time
Major	1 to 10 serious injuries or illnesses resulting in lost time or potential permanent impairment
Severe	Single fatality or 11 to 20 serious injuries or illnesses resulting in lost time or potential permanent impairment
Catastrophic	Multiple fatalities or more than 20 serious injuries or illnesses resulting in lost time or potential permanent impairment

Note: Serious injury or illness is defined by the *WHS Act, Section 36*.

Likelihood is the chance of something happening. To establish the likelihood rating, Roads and Maritime uses the likelihood measures contained in Table 2.3.

Table 2.3: Risk matrix – Likelihood descriptions

Rating	Description
Almost certain	<ul style="list-style-type: none"> Expected to occur multiple times (10 or more times) during any given year Expected to occur at least 1 in every 4 times the event or action occurs ie more than 25% chance of occurrence This risk is known to occur frequently
Very likely	<ul style="list-style-type: none"> Expected to occur occasionally ie 1 to 10 times during any given year Expected to occur between 1 in 4 and 1 in 10 times the event or action occurs ie 10 to 25% chance of occurrence This risk is known to occur often
Likely	<ul style="list-style-type: none"> Expected to occur once during any given year Expected to occur between 1 in 10 and 1 in 100 times the event or action occurs ie 1 to 10% chance of occurrence This risk is known to have occurred on occasions

Rating	Description
Unlikely	<ul style="list-style-type: none"> Expected to occur once every 1 to 10 years Expected to occur between 1 in 100 and 1 in 1000 times the event or action occurs ie 0.1 to 1.0% chance of occurrence This risk could occur but not often
Very unlikely	<ul style="list-style-type: none"> Expected to occur once every 10 to 100 years Expected to occur between 1 in 1000 and 1 in 10,000 times the event or action occurs ie 0.01 to 0.1% chance of occurrence It is unusual that this risk occurs but it has happened
Almost unprecedented	<ul style="list-style-type: none"> Not expected to occur in the next 100 years ie less than once every 100 years Expected to occur less than 1 in 10,000 times ie if ever the event or action occurs ie less than 0.01% chance of occurrence Any risk can occur but it is very improbable that this risk will occur within the large number of events.

The risk rating is determined by combining the consequence and likelihood measures by using the risk evaluation matrix provided in Figure 2-1:

			Consequence					
			Insignificant	Minor	Moderate	Major	Severe	Catastrophic
			C6	C5	C4	C3	C2	C1
Likelihood	Almost certain	L1	M	H	H	VH	VH	VH
	Very likely	L2	M	M	H	H	VH	VH
	Likely	L3	L	M	M	H	H	VH
	Unlikely	L4	L	L	M	M	H	H
	Very unlikely	L5	L	L	L	M	M	H
	Almost unprecedented	L6	L	L	L	L	M	M

Figure 2-1: Risk evaluation matrix

The definitions and required response or action is outlined in Table 2.4:

Table 2.4: Risk Matrix – Risk rating and required response or action

Risk rating	Definition	Response or action
VH	Very high	Significant and urgent action is required to eliminate the safety risk or reduce the consequence or likelihood of the risk and the overall risk exposure Activities exposed to this level of safety risk cannot proceed without the approval of the executive director
H	High	Immediate action is required and effort must be made to ensure that the safety risk is eliminated so far as is reasonably practicable (SFAIRP), or minimised SFAIRP if elimination is not reasonably practicable Activities exposed to this level of safety risk cannot proceed without the approval of the executive director, director or project director
M	Medium	Action is required and effort must be made to ensure that the safety risk is eliminated SFAIRP, or minimised SFAIRP if elimination is not reasonably practicable. Activities exposed to this level of safety risk cannot proceed without the approval of the responsible line manager or the change, project or program manager
L	Low	A level of safety risk that requires monitoring and review to ensure that the safety risk remains at this level.

2.10.3 Step 3: Treat the risks using risk controls

After assessing the risks, evaluate the controls required to treat the risks.

Controls to reduce the consequences or likelihood of the risk are considered using the hierarchy of controls (see diagram below).

In accordance with the Work Health and Safety Act 2011, risks are to be managed by seeking to eliminate, so far as is reasonably practicable (SFAIRP), before seeking to minimise risk – ‘elimination before minimisation’. If a hazard or risk cannot be eliminated then controls are chosen from the hierarchy – substitution, isolation, engineering, training & administrative and PPE controls, in that order.

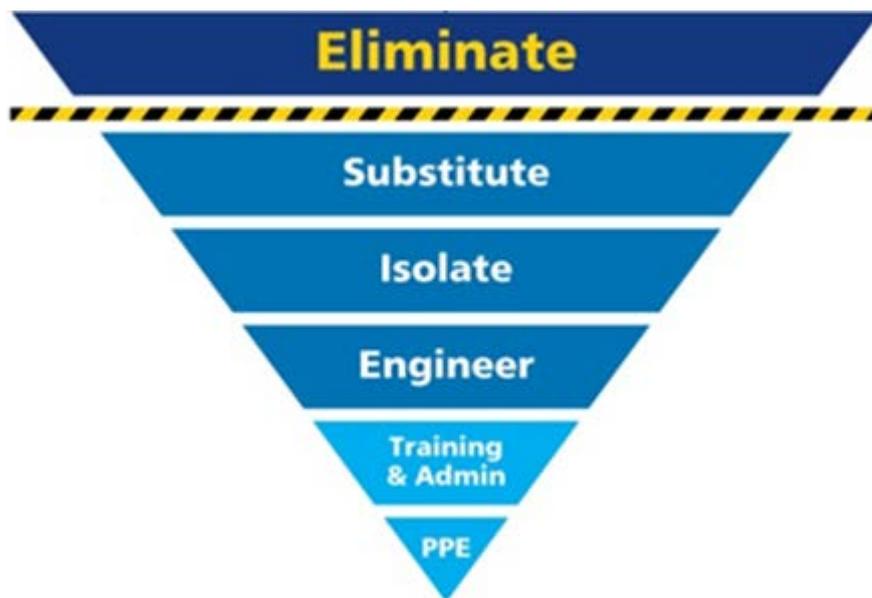


Figure 2-2: Hierarchy of controls

Table 2.5 provides further description on the hierarchy of controls and example traffic control mitigations:

Table 2.5: Traffic control mitigations

Control	Description	Traffic Control Example
Eliminate	The most effective control measure involves eliminating the hazard and its associated risk. If you cannot eliminate the hazard, eliminate as many of the risks associated with the hazard as possible	Redirecting traffic “Around the work site” (Section 3.1.2) to eliminate the risk of traffic impact on workers or implementation of contraflow to eliminate the risk of traffic impact on traffic controllers
Substitute	Substitute the hazard with something safer. This may not remove all the hazards associated with the process or activity and can introduce different hazards, but the overall harm or health effects will be lessened	This could involve using portable traffic control devices (Section 10) to substitute the requirement of a traffic controller working in or near traffic

Isolate	Isolate the hazard by physically separating the source of harm from people by distance or barriers. For example, restrict contact with plant and equipment, lock hazardous chemicals away and only use them under strict controls	These could be undertaken by the use of “Through the worksite” and “Past the worksite” arrangements (Section 3.1.2) and appropriately rated safety barriers (Section 9.6)
Engineer	Look for technological solutions that reduce risk, eg use machines to do work that would be hazardous to humans, or use more modern plant with in-built safety features	This could involve the implementation of a site-specific TMP or TCP etc.
Training and admin	Develop and document safe methods of work e.g. safe work procedures or safe work method statements and provide appropriate training, instruction and information to reduce the potential for harm	This could involve developing safe methods of work eg safe work method statements, providing appropriate training and instructions and police enforcement etc
Personal protective equipment (PPE)	Personal protective equipment (PPE) reduces workers’ exposure to the hazard. PPE includes safety gloves, protective eyewear, earmuffs, hard hats, aprons, safety footwear and dust masks. PPE is the last line of defence and must be used in conjunction with one or more of the other control measures.	This includes use of Hi Vis equipment and clothing, hard hat and safety boots etc

2.10.4 Step 4: Monitor and review

Regularly monitor and review the risk controls in place and ensure they are working as intended and their effectiveness.

Refer to the WHS Risk Management Procedure (PN066P02) for further information.

2.11 Dimension D (AS1742.3 Cl 4.1.5)

Dimension D is related to the speed of traffic and is defined as a distance expressed in metres. It is used for positioning of advance signs and related purposes. The signs shall be placed at specific distances apart so that road users have sufficient time to read and absorb their messages or instructions.

See also Section 3.2.3, *Advance warning sign distances (AS1742.3 Cl 4.7.4)*.

2.11.1 Determination of the value of D

Case (a) No roadwork speed zone or speed zone change

Where there is no roadwork speed zone in place or no change in the pre-existing posted speed zone, the value of D will be based on the pre-existing speed of traffic which will be the greater of:

- The posted speed limit in metres

- The estimated approach speed of traffic in metres if it is greater than 10% of the posted speed limit.

For instance:

- If the posted speed limit is 60 km/h and traffic is generally travelling at about 65 km/h or less then $D = 60$ m
- However, if the speed limit is 80 km/h and traffic is generally travelling at about 90 km/h then $D = 90$ m.

Case (b) 40 km/h or 60 km/h roadwork speed zones located 100 metres before start of work

Where a 40 km/h or 60 km/h roadwork speed zone begins 100 metres in advance of the work (in accordance with Section 8.2.3, Speed limit selection, then the value of D shall be based on the pre-existing speed of traffic as in Case (a) above. The start of the work shall be the start of transition area, traffic diversion or traffic control position.

Case (c) Speed zone change is less than 200 metres

Where there is a roadwork speed zone in place or a change in the pre-existing posted speed zone, the value of D shall be based on the speed of the traffic in Zone X where the speed zone change is less than 200 metres from the first advance warning sign after the speed zone sign.

This is shown in Figure 2-3:

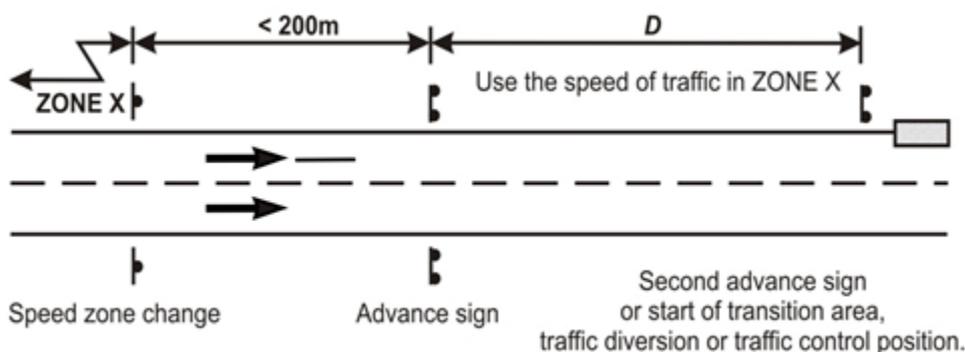


Figure 2-3: When the distance between the speed zone changes and the advance sign is less than 200 metres, use the speed of traffic in Zone X

Case (d) Speed zone change is greater than or equal to 200 metres

Where there is a roadwork speed zone in place or a change in the pre-existing posted speed zone the value of D shall be based on the speed of the traffic in Zone Y where the speed zone change is greater than or equal to 200 metres from the first advance warning sign after the speed zone sign.

This is shown in Figure 2.4:

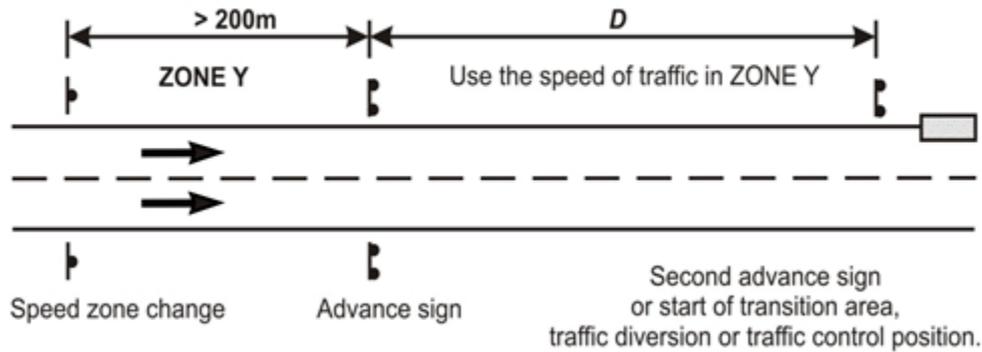


Figure 2-4: When the distance between the speed zone changes and the advance sign is greater than 200 metres, use the speed of traffic in Zone Y.

NOTE: Having determined the values of D, based on the speed of approaching traffic above, this value shall be used to determine the cone spacing or taper lengths as shown in Tables 5.1 and 5.2 respectively.

3 General procedures

3.1 Introduction

3.1.1 General (AS1742.3 Cl 1.5 & 2.1)

Work shall be arranged so that workers are able to work safely and are separated from road users wherever possible.

In planning and setting up traffic management at work sites the following broad principles shall be complied with:

- Traffic management plan (TMP)
 - Shall be completed by a person holding a current qualification in Prepare Work Zone Traffic Management Plans
 - Shall be completed prior to development and implementation of a TCP
 - Shall consider the effect the works will have on the road network and traffic flow. This may require traffic modelling to be completed for complex or high risk projects
 - Shall consider site-specific conditions
 - Shall include the outcomes of the site risk assessment
 - Shall explain the identified risks and mitigation measures that will be adopted
 - Shall include or refer to the approved TCP(s).
- Signs and devices:
 - Shall be placed before work begins and be removed as soon as they are no longer required
 - Shall be regularly checked to ensure they are still relevant, in good mechanical condition, clean, not faded and have good night-time visibility, if necessary
 - Shall be inspected to ensure they remain clearly visible to road users and are not obscured by vegetation, vehicles, plant or other signs and devices and are displayed in the correct sequence.
- Traffic controllers:
 - shall be appropriately qualified
 - 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)
- Work sites:
 - Shall be selected so that the minimum length and width of a road is closed at each stage to ensure minimum disruption and inconvenience to road users whilst maintaining working efficiency
 - Shall be staged to ensure minimum disruption to traffic especially at peak times, nights, weekends, holiday periods and during special events
 - Shall be monitored and action taken if excessive lengths of queues or delays occur.

3.1.2 Around, past or through a work site

Around (AS1742.3 CI 2.3.5 & 4.14)

Where traffic is moved on a detour using existing roads or a specially built side track or different carriageway using a cross over. See Section 9.19, *Detours, sidetracks and crossovers (AS1742.3 CI 4.14)*.

Past (AS1742.3 CI 2.3.4)

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.

Through (AS1742.3 CI 2.3.3)

Passage of traffic through a work area shall only be permitted where both the traffic and the work can be adequately controlled. Traffic controllers or traffic signals shall be 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. Traffic controllers may also be needed to control the movement of plant within the trafficable area.

3.1.3 Short-term and long-term work (AS1742.3 CI 1.4.15 & 1.4.5)

Short term work:

- Work requiring traffic control but taking less than or equal to one shift and where roadway conditions are returned to normal, with no traffic control, after the shift or part shift. An example is the maintenance of freeway safety barriers over a period of days, where the adjacent lane is closed during the shift. 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.
- Where traffic is moved on a detour using existing roads or a specially built side track or different carriageway using a cross over. See Section 9.19, *Detours, sidetracks and crossovers (AS1742.3 CI 4.14)*

Long-term work:

- 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.
- 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
- An example of long-term work would be a series of heavy patches along a length of road where, even though personnel are not in attendance after the shift, 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 a number of broad categories. Some examples of signs to be found in those categories are shown in Table 3.1:

Table 3.1: Examples of signs used for a typical category

Category	Example Signs	Sign number
at work site approaches and departures (AS1742.3 Cl 3.4).	ROADWORK AHEAD BRIDGEWORK AHEAD GRADER AHEAD END ROADWORK	T1-1 T1-2 T1-4 T2-16
for regulatory control of traffic (AS1742.3 Cl 3.5).	speed restriction signs roadwork speed restriction signs stop/slow bats prepare to stop stop here on red signal	R4-1 R4-212 R6-8 and T7- T1-18 R6-6
at detours (AS1742.3 Cl 3.6).	detour two-way traffic detour marker	T5-1, L or R W4-11 or T2-24 T5-6
to indicate road conditions (AS1742.3 Cl 3.7).	rough surface gravel road loose stones new work no lines marked	T3-7 T3-13 T3-9 T3-11
at lane and road closures (AS1742.3 Cl 3.8).	lane status signs such as road closed	T2-6-1 T2-4
at blasting works (AS1742.3 Cl 3.13.2).	T4-7 and T4-3.	
at pedestrian control signs (AS1742.3 Cl 3.14). –	pedestrians use other footpath	T8-2, L or R T8-3
at vehicle height and mass restriction signs (AS1742.3 Cl 3.15).	X.X m bridge load limit Xt gross	R6-11 R6-3
or other signs (AS1742.3 Cl 3.16).	traffic hazard ahead trucks	T1-10 T2-25

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 400 material complying with AS 1906.1. (AS1742.3 Cl 3.2.2).

3.2.2 Sign sizes (AS1742.3 Cl 3.2.3)

Standard signs shall be used wherever one suitable for the purpose exists. Individual signs are available in two main sizes described as (A) or (B). (For signs used on mobile work vehicles see Section 3.3.9, Vehicle-mounted signs and devices (AS1742.3 Cl 3.12.1) and Section 9.17.2, Operating principles (AS1742.3 Cl 4.6.3). Each category of sign shall be used under the following conditions:

- A size – any of the following:
 - At posted speeds up to 90 km/h where lateral offset of the sign from the travel path is not more than 8 metres
 - At traffic speeds up to 110 km/h where the offset is not more than 4.5 metres
 - Signs directed at pedestrians or cyclists.
- B size – any of the following
 - Where the conditions for A size signs are exceeded
 - On motorway type roads for added emphasis of the onset of works, detours or closures
 - Other critical safety messages
 - Where traffic speeds exceed 70 km/h and the relevant A size sign is less than 1 m² in area.
- C and D size
 - Larger signs may be used where there is considered to be a need to emphasise the message or there is excessive lateral offset of the sign.

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

Note: Details of standard sign sizes are contained in:

- Roads and Maritime electronic *Traffic Signs Register*
- AS 1742.1, General introduction and index of signs.

3.2.3 Advance warning sign distances (AS1742.3 Cl 4.7.4)

Local constraints may not allow signs and devices to be placed exactly in accordance with the designed and approved 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 and initialled on the TCP held on site, with the name of the person making the changes clearly shown.

Advance warning signs are not required in the following situations (AS1742.3 Cl 4.7.1):

- Where the work is sufficiently remote from a roadway that no action is required of road users
- Where the work is undertaken in gaps in traffic (see Section 9.1.2, Intermittent work (AS1742.3 Cl 4.3.2 and 4.4.6), in either open road or built-up areas or takes less than five minutes (see Section 9.1.4, Short term work in traffic (AS1742.3 Cl 4.3.3) – open road areas)
- If the effects of the works are confined to one direction of travel and no extra vigilance is required of road users travelling in the other direction
- On unsealed roads (see Section 9.20.3, Short term partial road closures).

The following distances, measured from the beginning of the taper area or beginning of a diversion associated with the work site, shall be used when placing advance warning signs (AS1742.3 Cl 4.7.4):

- Where there is only one advance sign, it shall be placed at 2D from the work area for approach speeds of 65 km/h or more, or D for approach speeds less than 65 km/h
- Where there is more than one advance sign position, the advance signs nearest the work area shall be placed D from the beginning of the taper area or diversion and other advance sign positions at successive spacings of D further in advance of the work area.

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 provided the 'NEXT 2KM' (T1-28) sign is displayed. This may be increased to 10 km for shoulder grading and verge mowing in open road areas and for maintenance grading on unsealed roads (see Section 9.20, *Works on unsealed roads (AS1742.3 Cl 4.5)*). See Section 9.1.5, *Frequently changing work areas (AS1742.3 Cl 4.3.4) – open road areas* and Section 9.1.9, *Shoulder grading and mowing on sealed roads (AS1742.3 Cl 4.3.5) – open road areas*.

For the purposes of sign spacing the value of D shall be as determined by Section 2.11, *Dimension D (AS1742.3 Cl 4.1.5)*.

3.2.4 Duplication of signs

Consideration should be given to duplicating signs as a measure to improve worker and road user safety when developing a TMP and TCP. Where practical, signs should be located on both sides of the roadway for undivided roads or on the left hand side and on the median for divided roads where there is sufficient median width. The details below provide some guidance on when duplication of signs may be warranted:

- On multilane roads (AS1742.3 Cl 2.5.2) with volumes of 10,000 vpd or greater
- For lane status signs (T2-6-1, T2-6-2 etc) regardless of vpd (AS1742.3 Cl 3.8.2)
- 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 as identified in the TMP or risk assessment.

Duplication of signs may be dispensed where this will introduce potential safety risks during installation or it is impracticable e.g. where it would be necessary to cross the road on foot carrying signs, the shoulder is too narrow to position the signs or to park the work vehicle, or where the duplicated signs might have too large a lateral offset as to not be obvious to motorists e.g. on a six lane, two-way undivided road. The decision to not duplicate signs in accordance with the above should be documented.

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 (symbolic) (T1-5), and TRAFFIC CONTROLLER (symbolic) signs (T1-34).

3.2.5 Erection of signs on display for longer than two weeks (AS1742.3 Cl 4.7.5)

Signs continuously required for works, which will be in progress for longer than two weeks, should, where appropriate, be erected in a permanent manner on posts sunk into the ground (AS1742.3 Cl 4.7.5). Permanent installation, however, may not be possible or appropriate in narrow cuttings, where underground utilities could be located, behind safety barriers where off-sets might be too great or where it is undesirable to be making holes.

Signs required for works which will be in progress for less than two weeks may also be erected in a permanent manner if it is considered to be justified. Otherwise less permanent mountings shall be used.

Workers shall not cross roads or carriageways on foot when erecting or removing signs.

3.2.6 Multiple sign displays (AS1742.3 Cl 3.3.2)

Where two signs are to be displayed together at the one position, eg a worker symbolic sign and roadwork speed zone sign, they may be displayed on the same mounting, either side by side or one above the other.

In this situation the size of the sign plate may be reduced to suit the mounting, provided that the size of legend, size of symbol or area occupied by the legend is unchanged from the standard sign and the total area of both signs combined is not less than 1 m² (Refer to Section [3.2.2](#)).

An additional sign (ROADWORK AHEAD) may also be displayed with the dual sign arrangement, eg worker symbolic sign and roadwork speed zone sign, if there is sufficient space available. Roadwork speed zone signs shall be erected a minimum of 600 mm above the ground to the underside of the sign and placed on the frame so that they are closest to the traffic. However, use of a multiple sign may not be appropriate where the speed of passing traffic is high or the lateral offset of the sign is near acceptable limits. In such situations, there could be insufficient time for drivers to fully read and comprehend the message being given. The use of irrelevant messages shall be avoided.

Also, where it is proposed to display the traffic controller symbolic and PREPARE TO STOP signs together, a second PREPARE TO STOP sign shall be displayed in advance of the multiple sign to give advance warning.

3.2.7 Sign mountings (AS1742.3 Cl 3.3.1)

If used sign mountings shall:

- Be quick and easy to install
- Provide secure sign attachment
- Be stable in windy conditions and from the effects of passing traffic
- Be suitable for both gravel and bitumen surfaces
- Be able to accommodate various sign sizes
- Be easy to handle, transport and store
- Not be a hazard if struck in their normal upright position or after being knocked over.

Signs may also be mounted by alternative means eg on posts or on guide posts. Where holes are to be dug, the locations of any underground utilities shall be determined.

Signs on long-term sites should be installed in accordance with AS1742.2-2009

3.2.8 Sign positions (AS1742.3 Cl 2.5.2)

Signs and devices shall be positioned and erected so that :

- They are properly displayed and securely mounted (see Section [3.2.7](#))
- They are within the line of sight of the intended road user ie at approximately 90 degrees to the line of sight
- They cannot be obscured from view eg by vegetation or parked cars
- Do not obscure other devices from the line of sight of road users
- Do not become a possible hazard to workers, pedestrians or vehicles
- Do not deflect traffic into an undesirable path
- Do not restrict sight distance for drivers entering from side roads or streets, or private driveways
- They are not installed using supports that could be a hazard if struck by a vehicle.

Delineating devices eg traffic cones, bollards, post-mounted delineators, should be placed in accordance with Section 3.3.11, [Edge clearances \(AS1742.3 Cl 4.13.4 and Appendix D\)](#).

Consideration shall be given for signs for works planned to take longer than two weeks to be mounted on posts, after considering Section [3.2.5](#).

Open road areas – signs on posts

In open road areas and roads without kerbing in built-up areas where signs are to be mounted on posts, signs should normally be placed clear of the outer edge of shoulder and, where possible, at least 2 m clear of the travelled way, whichever is the greater clearance. They should be erected 1.5 m minimum above the level of the nearest edge of the travelled path to the underside of the sign.

Built-up areas – signs on posts

On kerbed roads in built-up areas where signs are mounted on posts adjacent to a footpath or where vehicle parking can occur, signs should be placed a minimum of 300 mm clear distance behind the kerb and erected a minimum of 2.2 m above the level of the kerb or footpath to the underside of the sign, to reduce interference from parked vehicles.

Where neither pedestrians nor parked vehicles have to be considered, eg on a traffic island or median, a mounting height of 1.5 m can be more appropriate.

Portable supports (short-term works)

Signs mounted on portable supports used for short-term operation (see Section [3.2.7](#)) should generally be located as follows:

- In open road areas, on the road shoulder a minimum of 1 m clear of the travelled way, where possible
- In built-up areas behind the kerb if visible to oncoming traffic and not obstructing pedestrians, otherwise on the pavement as near as practicable to the kerb without the sign becoming obscured and without obstructing moving traffic.

Where a regulatory or detour sign and a road condition sign would normally be required at the same location, the former shall take precedence and the latter should be positioned at the best alternative location.

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 200 mm (AS1742.3 Cl 3.3.1) but signs may be placed on the surface subject to them being clearly visible to traffic and not be obscured.

For roadwork speed zone signs the minimum height to the lower edge of the sign shall be 600 mm.

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

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

3.2.9 Variable message signs (portable) (AS1742.3 Cl 3.16.6)

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

- The rationale for use shall be documented in the TMP and / or risk assessment
- They shall be shown on the approved TCP
- Messages shall comprise not more than four words or numbers on any one screen
- Letter forms and legend height shall be adequate to be comfortably read by drivers at the prevailing approach speed of traffic
- There shall not be more than two separate screens in any alternating series of screens
- Where there are alternating screens the 'on' time of each screen shall be 0.6 + 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.
- Symbols shall not be used unless they have been tested for comprehension in their on-screen format ie taking into account distortions due to pixel size limitations
- 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
- 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.

3.2.10 Signage for Portable traffic signals (AS1742.3 Cl 4.11)

Instructions on the use of portable traffic signals are given in Section 10, Portable traffic signals (AS1742.3 Cl 4.11).

Sight distance on the approach to traffic signals shall be 150 m to the primary signal face and the approach speed of traffic shall be no higher than 60 km/h. In open road areas where traffic signals might not be expected a signal ahead (W3-3) sign with an appropriate distance (W8-5) sign should be provided to give advance warning. The position of these signs should take into account the expected queue length from traffic signals and the stopping distance required for heavy vehicles, with this information included in the TMP / and or risk assessment. Consideration should also be given to installing a portable VMS on each approach as an additional form of advance warning.

3.2.11 Signage for illuminated flashing arrow signs (AS1742.3 Cl 3.12.2)

Instructions on the use of illuminated flashing arrows are given in Section 11, Illuminated flashing arrow signs.

The following three sign size designations are used:

- Type A – 1260 mm by 650 mm for roof mounting on light vehicles
- Type B – 1500 mm by 770 mm for cab mounting on trucks
- Type C – 2400 mm by 1200 mm for trailer mounting and using its own power source or cab mounting on a truck.

High intensity flashing lamps may be used in conjunction with this sign provided that the lamps are either appropriately shielded or laterally or vertically displaced from the edge of the sign to avoid visually corrupting the arrow shape or its directional effect.

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

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

3.3 Traffic guidance and delineation devices

3.3.1 Barrier boards (AS1742.3 Cl 3.8.3 (a))

Barrier boards shall comply with Roads and Maritime QA Specification 3385, *Barrier Boards*.

Barrier boards shall:

- Be used to prohibit access to the ends of work (where they may have flashing yellow lights mounted on them)
- Be used to prevent use of a traffic lane
- Be placed at right angles to traffic flow at a maximum spacing of 100 m.

Barrier boards shall not:

- Be used as delineation devices but may be used on footpaths for the guidance of pedestrians
- Be placed parallel to the direction of traffic flow as they will be difficult to see and can 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 (AS1742.3 Cl 3.10.1)

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.

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 0.5 m 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 stripes of contrasting colour and supported on posts approximately 1 m high such that the height of the tape above the ground is never less than 800 mm
- Tapes shall not be used for pedestrian containment adjacent to traffic.

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 such that the height of the tape above the ground is never less than 800 mm
- When used for containment from the travelled way the clearance requirements of Section 3.6, Safe clearances between workers and through traffic at static work sites (AS1742.3 Cl 4.2) shall be met.

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.

Containment fences should be used behind safety barriers to prevent workers entering the area of deflection of the safety barrier.

3.3.3 Cones and bollards (AS1742.3 Cl 3.9.1)

Traffic cones shall comply with Roads and Maritime QA Specification 3352, Fluorescent Plastic Traffic Cones and be used on short-term works under the following conditions:

- Small size cones 450 mm high
 - For most low speed urban and rural applications including footpaths, shared paths and bicycle paths where traffic speeds do not exceed 70 km/h:
 - Note: Cones smaller than 450 mm should not be used.
- Standard size cones 700 mm or higher:
 - For all other road applications where traffic speeds exceed 70 km/h
 - May also be used on lower speed roads.
- Temporary bollards:
 - Shall be at least 750 mm high and 100 mm in diameter
 - Shall be made from fluorescent red or orange material
 - Be resilient to impact
 - All other road applications where traffic speeds exceed 70 km/h
 - May also be used on lower speed roads.

Cones and bollards shall be used on works to define the traffic path past or through the work area. At no time shall they be used as a substitute for barrier boards and signs at either end of the work.

When used at night they shall have a white horizontal retroreflective band of Class 400 material 150 mm wide on the small cones and 250 mm wide on the standard cone and bollards.

They should 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. However, they may be used on long-term unattended works if they are securely fixed to the pavement or weighted to provide adequate stability.

Recommended spacing of cones is given in Table 5.1.

3.3.4 Roadworks delineators ('guideposts') (AS1742.3 Cl 3.9.2)

As a minimum, roadworks delineators shall be used as follows:

- For delineation of the travel path through or past the work site as an alternative to traffic cones or bollards with yellow delineators on both sides of the roadway
- For delineation of the roadway on detours and side-tracks with red delineators on the left side and white on the right (two-way roadway) or yellow on the right (one-way roadway).

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

Delineators should be erected 1 m minimum from the edge of the travelled path and at a uniform height of approximately 1 m above the road surface. Delineator posts should be frangible or otherwise non-hazardous and be installed to provide a single continuous line defining the travelled path. The spacing of delineators shall be as follows:

- Immediately adjacent to or through work areas:
 - 24 m maximum at traffic speeds up to 70 km/h
 - 60 m maximum at higher traffic speeds.
- On side tracks and detours as specified in Section 9.19, *Detours, sidetracks and crossovers (AS1742.3 Cl 4.14)*.

3.3.5 Traffic warning (roadwork) lamps –flashing yellow lamps (AS1742.3 Cl 3.11)

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

Unidirectional flashing yellow lamps (AS1742.3 Cl 3.11):

- These may be used to draw attention to a particular sign (AS1742.3 Cl 4.7.5) and shall be mounted above the sign or may be mounted on barrier boards indicating the ends of work sites. They shall not be used to delineate a path through a work site because of the confusing light pattern which a series of such lamps can produce. They may also be used to highlight safety barrier end treatments.

Rotating or flashing yellow lamps (AS1742.3 Cl 3.12.1):

- Shall be 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.

Strobe lamps: (AS1742.3 Cl 3.12.1 (b)):

- May be permitted if it can be shown that their on-time performance in each flash cycle is equal to or longer than that of the rotating or flashing lamp.

3.3.6 Temporary pavement markings and markers (AS1742.3 Cl 3.9.4 and 3.9.5)

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

- Barrier, lane and edge lines
- Turning arrows
- Raised retroreflective pavement markers.

All pavement markings shall be reflectorised and be in accordance with the relevant Roads and Maritime 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 sections of road. Where the adjoining road is edge lined, temporary roadworks shall be similarly edge lined.

Where temporary linemarking, ie linemarking not in its final location, is required on the final wearing surface, or adjacent pavement, preference is given to the use of pavement marking tape. White pavement marking tape is to meet the performance requirements of Roads and Maritime specification R145 (if white) shall be used. For yellow pavement marking tape, agreement must be received from the asset owner.

Where it is determined that the temporary pavement linemarking has become ineffective, remarking and delineation shall be undertaken as soon as practicable.

Where raised pavement markers have been dislodged or 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. Blacking out 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 shall not begin until adequate provisions have been made to complete the installation of the replacement markings. Pavement markings shall 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 shall 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 shall be promptly removed as the work progresses by acceptable methods.

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

It is important for pavement markings and markers to be considered in conjunction with the placement of other delineation devices, temporary barriers and channelising barricades, to ensure road users are safely directed through the site without conflicting messages.

3.3.7 Longitudinal channelising barricades (AS1742.3 Cl 3.10.2)

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 for workers or pedestrians or as delineation devices in situations where a road safety barrier system is not required. 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 restrictions below.

These units:

- Shall satisfy impact tests 70 and 71 of NCHRP 350 for work zone traffic control devices
- Shall not be used at locations where a safety barrier is required as indicated by this manual
- Shall each be marked as shown below in letters at least 50:mm high:

NOT A SAFETY BARRIER

- For night use, each unit shall be fitted with a reflector visible to approaching traffic as a minimum, and where used to channel pedestrians away from a pre-existing route, lighting shall be provided to the same level as the pre-existing pedestrian route
- 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
- Shall be placed at the appropriate edge clearance as shown in Section [3.3.11](#) (AS1742.3 Cl 4.13.4 (a)).

3.3.8 Unacceptable traffic control devices

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

- Steel drums
- Isolated or non-continuous safety barrier units
- Barrier boards parallel to the direction of traffic flow.

3.3.9 Vehicle-mounted signs and devices (AS1742.3 Cl 3.12.1)

Vehicle-mounted warning devices shall be displayed as follows:

- A single rotating or 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 9.1.3, [Mobile inspections \(AS1742.3 Cl 4.3.6\) – open road areas](#)
- A pair of rotating or 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
- An illuminated flashing arrow sign as specified in Section [3.2.1](#) for any work and for mobile works where indicated in Section 9.17, [Mobile work](#).

Strobe lamps shall be permitted if it can be shown that their on-time performance in each flash cycle is equal to or longer than the rotating or flashing lamp.

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 shall be displayed on vehicles other than mobile works where workers are working. For linemarking operations vehicles shall display LINE MARKING AHEAD (T1-15) or WET PAINT ON ROAD (T2-237) signs on the appropriate convoy vehicle.

The symbol size or legend size for these signs shall not be less than as specified for the A or B sign as required in accordance with Section 3.2.2, [Sign sizes \(AS1742.3 Cl 3.2.3\)](#). The sign background, however, may be varied to suit mounting conditions.

3.3.10 Truck-mounted attenuators (TMAs) (AS1742.3 Cl 3.12.5)

Truck mounted attenuators (TMAs) should be deployed to protect worksites from intrusion by an errant vehicle, and can be utilised on multi-lane divided carriageway for short to medium term maintenance or construction works where it is not practical to close the road or deploy temporary safety barriers for the protection of workers. They may be deployed as 'barrier' or 'shadow' vehicles depending on the static or mobile nature of the works.

During mobile works, advance vehicles warn and inform of changes to traffic conditions ahead, and provide motorists time to adjust their driving patterns. When using a TMA it is mandatory to use the minimum of one advance warning vehicle positioned approximately 1 km in advance of the work convoy. The Advance Warning Vehicle/s will need to be positioned safely on the road shoulder and not in the live traffic lane.

Prior to designing and implementing a TCP that incorporates the use of TMA, or for mobile works, a traffic management plan and / or risk assessment must be completed that identifies the risks and controls, throughout the proposed route.

In particular for mobile works, where the approach sight distance to the TMA is impaired by the road alignment and or road assets then consideration should be given to increasing the number of Advance Warning Vehicles. As well as providing the optimum available sight distance for approaching traffic to the TMA, the positioning of the Advance Warning Vehicles and the TMA will need to provide a continual visual presence, being evidence of the works in progress to the road user. This is achieved by each vehicle in the convoy being able to have visual contact with the work vehicle they are following.

Consideration should also be given to the appropriate the ‘roll ahead’ distance is achieved without having a direct effect on the work area that is being protected. This distance will differ depending on factors such as the weight of the impacting vehicle, the speed limit and the mass of the truck on which the TMA is fitted. These factors should be noted and documented as part of developing the TMP and TCP.

3.3.11 Edge clearances (AS1742.3 Cl 4.13.4 and Appendix D)

Clearance between edge of traffic lane and delineating devices or road safety barrier system shall be as shown in Table 3.2. This clearance shall be measured to the traffic-side edge of delineating devices or barrier. This edge shall also be the line from which clearances to the work area are measured for the purpose of determining treatments in Section 3.6, Safe clearances between workers and through traffic at static work sites (AS1742.3 Cl 4.2).

Table 3.2: Edge clearances

Edge of traffic lane to:	Edge Clearances
line of traffic cones, bollards or longitudinal channelising barricades	0.5 m for traffic speeds up to 60 km/h 1.0 m for traffic speeds above 60 km/h.
roadworks delineators or temporary hazard markers	1.0 m
road safety barrier system	0.3 m for traffic speeds 40 km/h or less 0.5 m for traffic speeds 41 to 60 km/h 1.0 m for traffic speeds 61 to 80 km/h 2.0 m for traffic speeds greater than 80 km/h.

If the edge of the traffic lane is kerbed, delineation devices shall be placed 0.3 m to 0.5 m clear behind the face of kerb.

Note:

- Road safety barriers should not be placed behind kerbs on high speed roads (above 70 km/h). However, where it is proposed to use them behind kerbs the effectiveness of the barrier positioning with respect to the kerb-barrier combination shall be considered during development of the TMP and as part the risk assessment
- Containment fences marking the limit of work area shall be placed as specified in Section 3.6.

If site conditions are such that it is not possible to provide the edge clearances listed above for the appropriate traffic then alternative treatments shall be adopted, based on a documented risk assessment. (See Section 2.1, Purpose and scope).

3.4 Sequence for erection and removal of signs and devices (AS1742.3 Cl 2.5.3)

3.4.1 Sequence of erection

Before work commences, signs and devices at the work site shall be erected in an order that is safe and efficient, in accordance with the approved TCP. The order of installation should be outlined in the TMP, and generally in the following order:

- Advance warning and regulatory signs
- All intermediate advance warning and regulatory 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 of the work area or side track
- All other warning and regulatory signs, including termination and end of temporary speed zone signs.

Delineation devices such as cones and bollards shall be placed in the same sequence ie 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 erected before they are required shall be covered by a suitable, opaque material and, if necessary, inspected at night (Refer [*Appendix E Inspection checklists and forms*](#)) to ensure they do not give conflicting messages. 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 rotating or flashing light(s) shall be positioned between the workers and approaching traffic during placement of traffic control devices.

Workers shall not cross roads or carriageways on foot when erecting or removing signs.

Long-term or recurring short-term sites:

- Consider marking the desired location of each sign or device on the road for easy 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 ie 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.

Workers shall not cross roads or carriageways on foot when erecting or removing signs.

Lane closures delineated by cones and bollards:

- A work vehicle shall 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, provided that this does not create motorist confusion or distraction, such as headlight glare at night.

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 shall 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 – SWMS etc) to complement the above general principles shall be adopted to maintain worker safety. These arrangements shall be documented as part of the TMP or risk assessment, and mitigation measures incorporated into the work practice that is adopted. This can 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 (Deleted)

3.5.2 Instruct and guide road users

If after completing the TMP it is identified that example TCPs are not appropriate for use at a work zone, 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 portable traffic control devices or traffic controllers to regulate traffic conflicts and to slow and stop traffic if necessary.

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
- Replacing signs damaged or disfigured in the work environment especially 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 ie during meal breaks.

3.5.4 Special safety guidelines

The following special safety guidelines shall be considered at work sites, and mitigation measures documented in the TMP or risk assessment:

- Where at a detour or crossover or other location, traffic is required to travel temporarily in the wrong direction special safety requirements may be needed for pedestrians. See Section 9.3.3, Reversed traffic direction (AS1742.3 Cl 4.14.8 (c))
- Keep pedestrians clear of work sites. This can be achieved by erecting containment fencing around the work site. See Section 9.3, Pedestrians
- Some drivers can 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
- Visibility to the end of a queue that can 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 (AS1742.3 Cl 4.7.8))
- Avoid undue delay to traffic as this can result in drivers speeding or taking unnecessary risks to make up time in the rest of their journey
- 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.

Note:

- Any traffic control arrangements that will affect the operation of the Traffic Control Signals or require them to be flashed yellow must be discussed with TfNSW's Traffic Management Centre (TMC).

3.5.6 (Deleted)

3.5.7 Avoiding end of queue collisions (AS1742.3 Cl 4.7.8)

(a) General

At an active traffic control position long queues can form, depending on traffic volumes and the length of delay. This can result in an increased risk of rear end collisions occurring.

These collisions can occur:

- Where queues are unexpected and can be short, for instance on rural highways, and can be due to the inattention of road users or fatigue
- Where queue lengths are long and can vary considerably, for instance in built-up areas, and can be due to queue ends extending beyond advance warning signs and devices.

Depending on speed of traffic and sight distance to the end of a queue, additional advance warning or other mitigation measures may be required to alert road users to the changed road conditions as a means 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 (temporary) speed zones (AS1742.3 Cl 4.9))

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

- Additional or oversized signs
- Duplication of 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'.

The use of such devices and techniques should be documented in the TMP or risk assessment, and included on the approved TCP.

Portable speed humps, which are usually supplied with a rise of 70 mm or greater, are not considered satisfactory where the speed of approaching traffic exceeds 40 km/h, as they could be hazardous to motor cycles and the method of fixing might cause damage to road pavements.

(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 distances or gaps between stopped vehicles
- The terrain at the site
- The site alignment, horizontal and vertical.

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 Section 3.5.7 (c) *Procedure for reducing end of queue collisions* below.

At work sites where longer than normal delays can be expected, such as the laying of bridge beams which can delay traffic for 20 or more minutes, extra planning may be required which is beyond the scope of this Manual. This planning must include the preparation of a TMP and site-specific or activity-specific risk assessment to identify the risks associated with such long delays.

(c) Procedure for reducing end of queue collisions

End-of-queue protection shall be provided whenever the TMP or risk assessment identifies there is a potential for end of queue collisions, the queue is likely to extend to a point less than D beyond the PREPARE TO STOP sign associated with the active control and either or both of the following apply:

- Approach speeds are greater than 70 km/h
- Sight distance to the end of the queue for approaching traffic is likely to be less than 2 D (open road areas) or 1.5 D (built-up areas).

The following are recommended options for providing end-of-queue protection where significant queues will form:

- Where the maximum queue length can be predicted in advance, the primary PREPARE TO STOP sign shall be located so that the distance from this sign to the end of the queue is never likely to be less than D, see Figure 3.1. The B size 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 primary prepare to stop sign needs to be placed more than 4D, approximately 15 seconds of travel time from the control point, repeater prepare to stop signs at intervals of not more than 4D should be provided between that point and the control point to provide for conditions after the queue has dispersed.

In any relocation of the primary prepare to stop sign the distance D to the roadwork ahead sign shall be maintained.

- A second traffic controller may be employed to move the PREPARE TO STOP sign and the ROADWORK AHEAD sign as necessary to maintain their minimum required distance in advance of the end of queue. The traffic controller may also display the SLOW bat at each location in which case a 60 km/h temporary speed zone shall be extended to cover that position.

All other advance and position signs required for the work shall be located at the distances otherwise specified from the start of the work area.

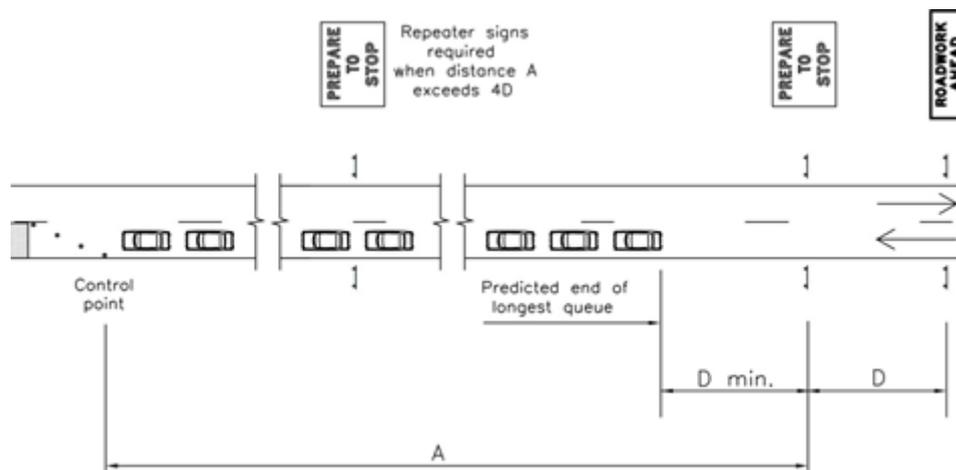


Figure 3-1: Avoiding end of queue collisions

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 (AS1742.3 Cl 4.1.6)

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:

Positioning of signs, length of tapers or markings:

- Minimum, 10% less than the distances or lengths given
- Maximum, 25% more than the distances or lengths given.

Spacing of delineating devices:

- Maximum, 10% more than the spacing shown
- 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. They may need to be exceeded where road features such as intersections or median openings intervene.

3.6 Safe clearances between workers and through traffic at static work sites (AS1742.3 Cl 4.2)

This section sets out minimum requirements for protecting workers from oncoming or passing traffic, and road users from hazards within the site at a static work site. The site-specific TMP and risk assessment should consider the risks and identify if protection above these minimum requirements is necessary. Intermittent and low-impact works permitted under Section 9.1 and mobile works permitted under Section 9.17 are exempt from these requirements and recommendations provided that a site or project-specific risk assessment is completed and the requirements of those sections are observed.

The clearances to edge of work area in the following Items shall be measured from the traffic-side edge of the line of delineating devices or barriers as specified in Section 3.3.11.

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.

The minimum 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. Additional controls and measures should be applied as identified and outlined in the project TMP or risk assessment. Short-term and low-impact works and mobile works are exempted from these requirements.

The requirements applying to pedestrians affected by works are included in Section 9.3, *Pedestrians*.

3.6.1 Work area 6 m or more clear of traffic

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

On high speed or high volumes roads, a risk assessment should be completed for any works to ensure road user and worker safety is maintained, which could require traffic management techniques to be employed, even when work is 6 m or more clear of traffic.

3.6.2 Work area 3 m to 6 m clear of traffic

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

- A WORKERS (symbolic) (T1-5) sign in advance of the work area when workers or small items of plant are present on the site.
- A vehicle-mounted warning device (see Section [3.3.9](#))
- In speed zones higher than 80 km/h, a temporary speed limit of 80 km/h or other measures resulting in the reduction of traffic speeds past the work area to 80 km/h where the traffic volume exceeds 10 000 vpd.

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

A containment fence (see Section [3.3.2](#)) should be used to delineate the clearance line for workers if the work area clearance is close to the 3 m minimum.

On motorway type roads, signs other than speed restriction signs at the start and end of a speed zone shall be placed on the left side of the roadway only.

3.6.3 Work area closer than 3 m to traffic

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

(a) Protection by safety barrier system

If the work area is protected by a road safety barrier system (see Section [9.6](#)), there will be no requirement to reduce traffic speeds for the protection of workers provided there is sufficient offset to the travel lane and area for deflection of the barrier system and a safe working width. However, if the safety barrier system is rated to a speed less than that of passing traffic then the speed of passing traffic shall be reduced to the rated speed.

Advance signing and delineation, including WORKERS (symbolic) (T1-5) signs when workers are on site, are required, and temporary speed zoning may be required for the safety of traffic negotiating the site outside the barrier. Steps should be taken to ensure that workers and plant will remain within the protection of the barrier. A containment fence behind the barrier as recommended in Section [3.3.2](#) or Section [3.3.7](#) should also be used.

(b) Clearance to traffic between 1.2 m and 3 m

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

- A WORKERS (symbolic) (T1-5) sign in advance of the work area.
- Delineation of the edge of the traffic lane by cones, bollards or similar means, see AS1742.3 CI 4.13.4.
- Separate delineation of the edge of the work area by means of a containment fence (see AS1742.3 CI 3.10.1) if there is a risk of workers or small items of plant infringing the clearance area.
- The speed of passing traffic shall be reduced to 60 km/h through one or more of the following:
 - The use of appropriate traffic control devices such as signs, flashing lights, traffic controllers and tapers
 - Imposing a temporary road work speed zone
 - A combination of the above.

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

A temporary 60 km/h speed zone shall be at least 150 m long. A site-specific risk assessment will also be completed.

These requirements are in addition to the requirements for other work site management devices specified in this manual.

3.6.4 Work area closer than 1.2 m to traffic

If the clearance requirement of 1.2 m cannot be achieved, all of the requirements of Section 3.6.3 (b) Clearance to traffic between 1.2 m and 3 m shall apply except that traffic speeds shall be reduced to 40 km/h or less using the methods specified in Section 3.6.3. A site-specific risk assessment will also be completed.

Use of a containment fence may be omitted if there is insufficient space to place it.

3.6.5 Protection of traffic controller

Traffic controllers are not subject to the requirements of Section 3.6.3 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 3.6.3. Consideration should always be given to use of a portable traffic control device instead of a traffic controller, as additional means of protection.

3.6.6 Speed control at hazardous sites

Where the TMP or risk assessment identifies that any one or more of the following conditions will apply at a static site, the traffic speed shall be reduced to a value less than 40 km/h using the methods specified in Section 3.6.3 together with a portable traffic control device, traffic controllers or pilot vehicles (see Section 5.2.7) as needed:

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

If traffic speeds are to be reduced by means of a temporary speed zone to less than 40 km/h, the length of the zone shall not exceed 200 m nor be less than 100 m.

3.6.7 Clearance requirements shown on TCPs

It is essential when designing TMPs and TCPs that the clearance requirements, including the positioning of any road work speed signs, are clearly documented and shown on the TCPs.

4 Traffic control plans (TCP)

4.1 Components of the work site (AS1742.3 Cl 4.1.4)

The work site is the 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 the figure below:

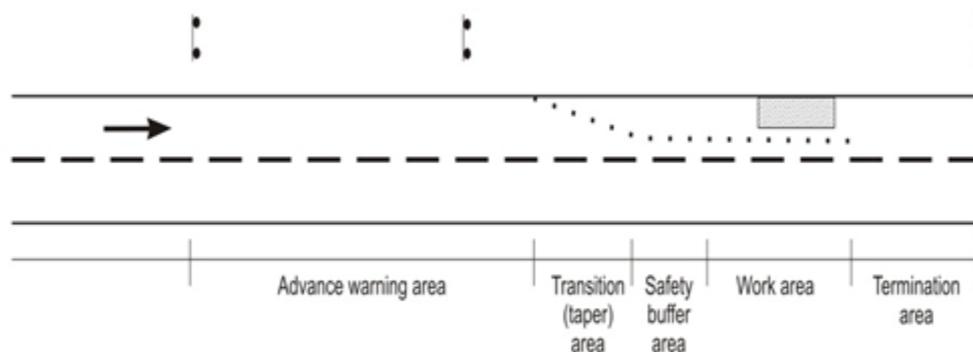


Figure 4-1: Components of a typical worksite

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

4.1.1 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.

4.1.2 Transition (taper) area:

Where traffic is positioned, usually by means of cones or bollards set out in a taper, to move safely past the work area.

4.1.3 Safety buffer area:

The unoccupied space between the transition and work areas to allow for an out of control vehicle to pull up before reaching the work area. A length of 20 to 30 metres is sufficient. Access to the work area is permitted through the safety buffer area.

4.1.4 Work area:

Where the work is being undertaken and is closed to through traffic and occupied by workers, plant and materials.

4.1.5 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, 84 and 101.

4.2 Dimension D (AS1742.3 Cl 4.1.5)

Dimension D is related to the speed of traffic and is defined as a distance expressed in metres and is used for positioning of advance signs and related purposes. The signs shall be placed at specific distances apart so that road users have sufficient time to read and absorb the message or instructions on the signs. (See Section 2.11, *Dimension D (AS1742.3 Cl 4.1.5)*).

4.3 Selecting traffic control plans (TCP)

4.3.1 Example TCPs

Selection

There are strict provisions placed on the ability to select and use an example TCP from this manual or a local procedure, in accordance with the qualifications of Implement Traffic Control Plans and Prepare Work Zone Traffic Management Plan. The minimum conditions related to use of an example TCP are shown below:

- An example TCP cannot be selected from this manual and used, unless it is signed off by a qualified person ie a person who holds a current Prepare Work Zone Traffic Management Plan qualification
- If an example TCP is approved by a qualified person, it must specify the distance D
- A TMP should always be developed in support of the example TCP
- An approved TCP must be current and have been approved within the previous 12 month period
- No modifications can be made to a TCP by a person holding the qualification of Implement Traffic Control Plan, other than those outlined in Section 3.5.8 of this manual, such as minor adjustments to tolerances and positioning of signs
- Tables are provided in *Appendix A Typical uses of TCPs* to assist in selecting an example TCP
- Example TCPs are baseline TCPs and as such outline minimum requirements only. Reference should be made to the TMP or risk assessment to ensure all TCPs incorporate and mitigate identified site-specific conditions and risks
- If a new TCP is required it can only be designed by personnel who hold the qualification of Prepare a Work Zone Traffic Management Plan and by referring to Section 5, *Designing new traffic control plans (TCP)*.

4.3.2 What the works supervisor shall do

Before works requiring traffic management begin, the works supervisor or equivalent qualified person shall:

- Determine the category of the work to be undertaken
- Review the TMP and / or risk assessment, or develop these if not done already
- Refer to *Appendix A Typical uses of TCPs* to select the appropriate example TCP detailed in *Appendix D Example traffic control plans*
- Refer to the local office procedure to select the appropriate approved and current TCP ie not greater than 12 months old
- If the example TCP requires modification, ensure this is completed and approved by a person holding a current qualification in Prepare Work Zone Traffic Management Plans
- Consult with the project manager, if necessary, to confirm that the proposed TCP is appropriate.

Note:

- The requirements in this Section relate generally to situations where work supervisors have frequent contact with work crews. Where the work supervisor is not available, due to the remoteness of sites, for example, personnel) who have successfully undertaken the Implement Traffic Control Plan or Prepare Work Zone Traffic Management Plan accreditation may be authorised to design, amend, select and implement approved TCPs ie team leaders, site supervisors, technicians amongst others.

4.3.3 What the project manager shall do

The project manager or equivalent qualified person shall:

- Complete the TMP and / or risk assessment for the site
- When requested by the works supervisor determine whether the TCP proposed by the works supervisor is appropriate with or without minor modification
- Determine whether it is necessary to design a new TCP ie if the example ones are inappropriate and do not meet the requirements as identified in the TMP and risk assessment
- Ensure that new TCPs are designed in accordance with Section 5, Designing new traffic control plans (TCP) and are supported by a TMP or risk assessment
- Determine sign sizes and whether duplication of signs is required, showing this information on the TCP.

4.3.4 Verification

The choice of TCP to be used shall be signed and recorded by a person qualified in Prepare Work Zone Traffic Management Plan.

4.4 Implementing TCPs

4.4.1 What the works supervisor shall do

Before work begins, the works supervisor or equivalent qualified person shall:

- Ensure that all signs and devices required by the TCP are available, are the correct size and are in good condition
- Ensure that the locations and types of devices are recorded in the diary
- Ensure that authorisations have been given for the use of any roadwork speed zones or portable traffic signals
- Ensure that, where flashing arrow signs are specified, only type-approved equipment complying with Specification TSI-SP-060 is used in accordance with Section 11, *Illuminated flashing arrow signs*
- Ensure that the TCP is implemented as approved and a copy is available on site.

4.4.2 What the team leader shall do

The team leader or equivalent person qualified in Implement Traffic Control Plans shall implement the approved TCP before physical work commences and ensure that a copy of the TCP is kept on site. 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. This drive through should also be completed at night if the traffic management will be in place after hours. 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 to 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 sunrise and sunset
 - Lateral offset to travel lanes
 - Height of signs
- 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
- 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.

4.4.3 What the project manager shall do

For contracts where Roads and Maritime G10 specification is applicable:

- Submit to the principal, a Traffic Management Plan in accordance with Roads and Maritime IC-QA-G10 specification, this manual and AS1742.3, including the relevant TCPs
- 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 road and bridge work the project manager shall also:

- If required by the TCP, seek or ensure that authorisation for a roadwork speed zone has been given in accordance with Section 8.2, Roadwork (temporary) speed zones (AS1742.3 Cl 4.9) and provide a copy of the authorisation to the works supervisor
- If the speed limit is not approved, reconsider the TCP
- Ensure that where portable traffic signals are specified authorisation is obtained (Section 10.5) for their installation, and that only type-approved equipment complying with specification TSI-SP-049 is used in accordance with Section 10, Portable traffic signals (AS1742.3 Cl 4.11) and provide a copy of the authorisation 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
- Inspect the traffic control arrangements prior to any traffic switch or major change, 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.
- Ensure they hold a current Prepare Work Zone Traffic Management Plan qualification.

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

- Liaise with communications team to arrange advice through local media of the work in progress or planned, where required in accordance with local procedures
- 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.

4.5 Modifications to TCPs

All modifications to an example TCP will need to be done by a person holding the Prepare a Work Zone Traffic Management Plan qualification, and will need to be supported by a TMP or risk assessment.

The only instance where a minor modification can be made by a person holding the qualification of Implement Traffic Control Plans is to vary the positioning of signs and devices in accordance with Section 3.5.8, Tolerances on positioning of signs and devices (AS1742.3 Cl 4.1.6)

4.6 General notes on TCPs in Appendix D

Where portable traffic control devices or traffic controllers are used, approach speeds of traffic shall be reduced to a maximum of 60 km/h. The example TCPs in Appendix D do not detail the signs required for posted roadwork speed zones. If it is intended to install a roadwork speed zone then a new TCP shall be designed to incorporate the principles of Section 2.11, Dimension D (AS1742.3 Cl 4.1.5), and Section 8.2, Roadwork (temporary) speed zones (AS1742.3 Cl 4.9).

ROADWORK AHEAD (T1-1) signs may be used for some short-term works. These signs have not been shown on the example TCPs.

4.7 New TCPs or modifications to example TCPs

If an example TCP does not exist for the work being planned, then either an example TCP will need to receive major modifications or a new TCP will need to be designed for the work.

Only persons holding a current Prepare Work Zone Traffic Management Plan qualification are able to design new TCPs or make modifications to example or approved TCPs. All TCPs shall be produced electronically, with hand drawn TCPs only accepted in extenuating circumstances, and at the discretion of Roads and Maritime.

5 Designing new traffic control plans (TCP)

5.1 New TCPs

5.1.1 What the works supervisor shall do

If, after developing or reviewing the TMP and risk assessment, it is determined that an example TCP does not exist for the work proposed or there are queries concerning the appropriateness of an example TCP, the works supervisor or equivalent person shall consult with the project manager.

5.1.2 What the project manager shall do

When consulted the project manager shall:

- Determine the appropriateness of the example TCP after reviewing the TMP and risk assessment, and arrange modification if necessary by a person who holds a current Prepare Work Zone Traffic Management Plan qualification
- If a new TCP is required,
 - Use a person who holds a current Prepare a Work Zone Traffic Management Plan qualification
 - Have a new TCP designed and added to the list of local TCPs and, if considered desirable, submit the new TCP to the Director, Traffic Engineering Services
 - Have a site-specific TCP designed
 - Ensure the new TCP is signed by the designer, lists the designer's certificate number, has been given an identifying number and is dated
- Approve or seek approval for the modified or new TCP before issue and use from a person holding Prepare Work Zone Traffic Management Plan qualification. This must not be the designer of the TCP
- Give a dated copy of the approved TCP to the works supervisor qualified in Implement Traffic Control Plans for implementation in accordance with Section 4.4, *Implementing TCPs*.

5.1.3 Approval

The project manager can give approval only after reviewing the TMP and risk assessment, after confirming all the guidance in Section 5.2, *Principles for designing TCPs*, has been observed, and they are appropriately qualified. The project manager shall seek approval 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
- Is for carrying out work using Roads and Maritime specification G10, *Traffic Management*.

For non-standard or unapproved signs or devices, approval should be sought from the Director Traffic Engineering Services.

5.2 Principles for designing TCPs

5.2.1 General

The TCP shall be designed on the basis that:

- The risks identified in the TMP and mitigation measures are considered and addressed
- Risks are eliminated so far as is reasonably practicable (SFAIRP)
- 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 portable traffic control device is considered prior to use of a manual traffic controller
- 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 and may be hazardous to traffic
- The needs of all non-vehicular users are provided for eg pedestrians, cyclists, school children etc
- The TCP is to be implemented in accordance with Section 4.4, *Implementing TCPs*.

For complex and high risk projects where traffic control arrangements involve changes in alignment, such as lateral shifts, it is recommended that TCPs are drawn to scale to ensure geometric standards are achieved and implemented.

5.2.2 Spacing of signs, cones and bollards (AS1742.3 Cl 3.9.1)

Signs shall be spaced in accordance with the broad principles of Section 3.2.3, *Advance warning sign distances (AS1742.3 Cl 4.7.4)*.

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

- Traffic control at beginning of tapers where there is a portable traffic control device or traffic controller prior to a single lane. Cones or bollards may be placed at 4 m spacing along the centre-line 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 91).

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

Table 5.1: Recommended maximum spacing of cones and bollards

Purpose and usage	Approach speed of traffic km/h ***	Recommended maximum spacing m
All purposes	≤ 50	4
Centre-line on approach to a traffic controller position	All cases	4
Outer edge of traffic lane ie works on shoulder or parking lane	51 - 70	18
	> 70	24*
Separating opposing traffic on two-lane, two-way road ie partial or complete lane closure	51 - 70	12
	> 70 km/h	18
Separating opposing traffic on a multilane undivided road ie as part of a lane closure	51 - 70	12
	> 70	18
Adjacent to a closed lane on a multilane undivided road	51 - 70	18
	> 70	24
Merge tapers	51 - 70	9
	> 70	12
Lateral shift tapers	51 - 70	12
	> 70	18
Protecting freshly painted lines	51 - 70	24
	>70	60**

Notes to Table 5.1:

- * This spacing may be extended to 60 m where the length of the line of cones or bollards exceeds 1 km but is not adjacent to locations where there are workers on foot
- **This spacing may need to be reduced on curves or crests or if the row of cones is not clearly defined at night. This should be documented in the project TMP and / or risk assessment and shown on the TCP
- ***The approach speed of traffic adopted shall be as determined in Section 2.11, Dimension D (AS1742.3 Cl 4.1.5).

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, and as supported by a site-specific TMP and risk assessment.

Table 5.2: Recommended taper lengths

Approximate speed of traffic km/h	Recommended taper length (m)		
	Traffic control at beginning of taper	Lateral shift taper	Merge taper
45 or less	15	0	15
46 - 55	15	15	30
56 – 65	30	30	60
66 - 75	N/A	70	115
76 - 85	N/A	80	130
86 – 95	N/A	90	145
96 – 105	N/A	100	160
Greater than 105	N/A	110	180

Notes to Table 5.2:

- Speed of traffic is the mid-point of each tabulated range
- The speed of traffic adopted shall be as determined in Section 2.11, *Dimension D (AS1742.3 Cl 4.1.5)*

5.2.3 Requirements for specific signs

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

- ROADWORK AHEAD (T1–1) (AS1742.3 Cl 3.4.2 & 4.7.2 (b)) or bridgework ahead (T1-2) (AS1742.3 Cl 3.4.3 & 4.7.2 (c)) signs shall be used at:
 - All long-term road and bridge work sites
 - A diversion of traffic along a side track or detour
 - Unexpected conditions, such as loose stones or the absence of linemarking
 - Short-term works where additional advance warning is warranted.
- ROADWORK X KM AHEAD (T1–16) (AS1742.3 Cl 3.4.2) or BRIDGEWORK X KM AHEAD (T1-29) (AS1742.3 Cl 3.4.3) signs shall be used X km in advance of road or bridge work where additional advance warning is considered to be necessary, where one or more of the following occur:
 - The approach speed exceeds 80 km/h
 - Sight distance is less than 150 m.

The siting of these signs needs careful consideration to ensure that any road users entering from side roads are given adequate warning.

- WORKERS (symbolic) (T1-5) (AS1742.3 CI 3.4.4 & 4.7.2(a)) sign shall be used at either or both of the following:
 - To give warning of personnel engaged in short-term works not involving the diversion of traffic along a detour or side track
 - At long-term works during all periods and at all locations where workers are actually working on or adjacent to the traffic path or are visible to oncoming traffic.

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 sign shall be used with the NEXT 2km (T1-28) sign at frequently changing work areas (see Sections 9.1.5)

- PREPARE TO STOP (T1-18) (AS1742.3 CI 3.5.2 & 4.7.3 (d)) sign shall be used to give advance warning where traffic may be required to stop in compliance with a portable traffic control device, temporary traffic signals, or the directions of a traffic controller. The sign shall be used with the signals ahead (T1-30 or W3-3) (AS1742.3 CI 3.5.4 (c)) or the traffic controller (T1-34) (AS1742.3 CI 3.5.2(b)) sign
- END ROADWORK (T2-16) (AS1742.3 CI 3.4.8) sign shall be used when ROADWORK AHEAD (T1-1) and ROADWORK X KM AHEAD (T1-16) (AS1742.3 CI 3.4.2) signs are specified and is used to indicate that normal traffic conditions have resumed. They shall be placed a distance D downstream from the last point on the roadway affected by the works (AS1742.3 CI 4.7.9). END ROADWORK signs should be placed adjacent to or beyond the end of any temporary speed zone ie after any signs indicating the reinstatement of a pre-existing limit (AS1742.3 CI 4.9.7)
- NEXT 2km (T1-28) (AS1742.3 CI 3.4.7) sign shall be used in conjunction with the WORKERS (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 (Sections 9.1.5 and 9.1.6). The distance may be increased to 10 km for shoulder grading and mowing in open road areas (Section 9.1.9) and for maintenance grading on unsealed roads (see Section 9.20.2). The TMP should consider the road conditions that will be encountered along the length of the specified route.
- TRAFFIC HAZARD AHEAD (T1-10) (AS1742.3 CI 3.16.5) 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) (AS1742.3 CI 3.9.3) per closed lane shall be used, in addition to cones, bollards etc if traffic is to be merged into an adjacent lane or be directed by a portable traffic control device or a traffic controller 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 can 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
- Trucks (W5-22, long term) and Trucks (T2-25) signs shall be used in accordance with Section 7.7, Signs for depots, stockpiles, quarries and gravel pits etc (AS1742.3 CI 3.16.2)
- Signs, such as SLIPPERY (symbolic) (T3-3), SOFT EDGES (T3-6), ROUGH SURFACE (T3-7), GRAVEL ROAD (T3-13), LOOSE STONES (T3-9) and LOOSE SURFACE (T3-14) and NEW WORK NO LINES MARKED (T3-11) shall be erected to warn motorists of conditions which render a roadway surface temporarily hazardous. On long work sites these signs may need to be repeated at intervals of not more than 500 metres (AS1742.3 CI 3.7.2.)
- NEW WORK NO LINES MARKED sign (T3-11) shall be erected in locations, such as multi-lane or one-way roads where there is no overtaking risk from oncoming vehicles. The NO LINES DO NOT OVERTAKE UNLESS SAFE sign (T3-12) shall be erected where barrier lines would normally be installed and should be used in any situation where there will be overtaking in an oncoming traffic lane (AS1742.3 CI 3.7.4)

- GIVE WAY (R1-2) (AS1742.3 CI 3.5.3) and ONE LANE (R9-9) sign assembly 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 work when:
 - The traffic volume is 1500 vpd or less and the traffic speed is 70 km/h or less
 - Each entry to the work area is visible from the other
 - The work area is less than 100m long
 - 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/ONE LANE assembly sign.
- Give way sign ahead (W3-2) sign shall be used with the R1-2 and R9 -9 signs where advance warning is required
- NO OVERTAKING OR PASSING sign shall be erected at the start of the single lane for traffic in the opposite direction.

5.2.4 Traffic controllers (AS1742.3 CI 3.5.2 & App C)

Consideration should always be given to use of portable traffic control device, such as portable traffic signals in place of a manual traffic controller to eliminate risk in accordance with the hierarchy of controls. This consideration should be documented in TMP and risk assessments. When a traffic controller is required:

- TRAFFIC CONTROLLER (symbolic) (T1– 34) 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, *How many traffic controllers*
- 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 (AS1742.3 CI 4.10.4)
- 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, and the type or mix of traffic ie 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 ten per cent to allow for some greater demand. Road users will generally need 2D sight distance to the end of expected queues in open road areas and 1.5D in built-up areas. See Section 3.5.7, *Avoiding end of queue collisions (AS1742.3 CI 4.7.8)*.

5.2.6 Mobile works (AS1742.3 CI 4.6)

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. See Section 9.17, *Mobile work*.

5.2.7 Pilot vehicle (AS1742.3 Cl 4.12)

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

- For any reason traffic fails to maintain safe speeds through the work
- Part of the length of the work site is out of view of the supervisor, work gang and the traffic controller
- The hazard to workers (Section 3.6.6) requires the traffic speed to be reduced to less than 40 km/h
- Traffic speed is required to be kept low to minimise damage to the work ie a newly laid seal
- 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 or flashing yellow lamp and may also display a special sign instructing traffic to follow it but not pass it. It can 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 Works in built-up areas

Where the work site is in a built-up 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 after ensuring an appropriate route and with the concurrence of stakeholders, such as the local council and police. Local residents shall be consulted and informed beforehand of a detour proposal.

Closing the road:

When a temporary road closure is necessary, careful pre-planning is required. This involves consultation with a wide range of stakeholders and can include the roads authority local council, police, emergency services, transport providers and residents. All such pre-planning should be documented in the TMP.

5.2.9 Dual carriageway and multi-lane 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.
- If a TMA is to be utilised as part of the lane closure.

Where work is undertaken on a dual carriageway:

- Signs and devices, excluding pavement arrows, shall be placed on both sides of the carriageway, where practical, in accordance with Section 3.2.4, *Duplication of signs*
- If the carriageway has three or more lanes and two lanes are to be closed then this should be done one lane at a time, with the distance between tapers at least 1.5D (AS1742.3 Cl 4.8.2).

5.2.10 Night works

See Section 9.2, *Working at night*.

The TMP and TCP shall specify that:

- All personnel on the site wear approved high visibility clothing
- The work site has appropriate flood lighting (See Section 9.2.5, *Lighting*)
- Additional signs and devices may be used where there is reduced visibility
- The traffic management arrangements are appropriately delineated in accordance with AS1742.3.

5.3 Checklist for new signs, devices and TCPs

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

- Feasibility ie the level of technology involved
- Useability ie the ease of use by workers
- Applicability ie how well they address the problems
- Effectiveness ie the ability to mitigate injuries and deaths of workers and lessen the hazard and inconvenience to road users
- Trade-offs ie the level of undesirable side effects produced
- Cost ie lifecycle cost including development, fabrication and maintenance.

Any new or modified signs must be submitted to the Director, Traffic Engineering Services for consideration and assessment, along with the above information.

5.4 New signs, devices and innovations

Any proposal for a new sign, device or innovation for inclusion in this manual is to be submitted, in the first instance, to Roads and Maritime, Director, Traffic Engineering Services. Proposals will be evaluated in a consultative manner as described in Section 2.8, *Evaluation and review*. Where Roads and Maritime 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 can be necessary to limit the initial use of new signs and devices to enable field assessment or trials before they can be adopted for general use. It is essential that any such trials be fully documented and that the requirements of Roads and Maritime publication *Management of Innovative Technologies, ILC-AM-TP1-305*, are followed. Any such trial will also be approved and monitored by the Director, Traffic Engineering Services.

6 Record keeping and reporting

6.1 Inspections and record keeping

In addition to traffic control safety inspections (see Section [2.5](#)), formal and documented daily (short-term) and weekly (long-term) inspections shall be undertaken at work sites by persons holding the Prepare Work Zone Traffic Management Plan qualification. Examples of typical checklists are included in [Appendix E](#) *Inspection checklists and forms*.

It is also important for any near miss incidents to be recorded and documented then reviewed as part of any inspection.

6.1.1 What the works supervisor shall do

For all long-term work sites the works supervisor who is appropriately qualified 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 and at least once every two months for the duration of work
- Review the reported near miss incidents
- 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 specified corrective action 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 a copy of the TCP used on site
- Record start and finish times and location of the works
- Record near misses
- 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
- Make these records available to authorised staff.

6.1.3 What the project manager shall do

The project manager shall:

- Ensure that a traffic control safety inspection (reference Section 2.5) is carried out at least once per month by a person qualified in Prepare Work Zone Traffic Management Plans and that the date, time and deficiencies are recorded
- Ensure that a traffic control safety inspection or road safety audit is carried out prior to the implementation of any changes in traffic control or a TCP
- Ensure that a traffic control safety inspection or road safety audit is carried out prior to the implementation of any lateral shift tapers to ensure that geometric requirements and delineation methods are in accordance with the approved TCP
- Ensure that near miss incidents are being reported and recorded then reviewed
- 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. 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 SafeWork NSW

6.2.1 What to report

By law, employers or occupiers are required to report work-related incidents to SafeWork NSW 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 if they are not the employer.

Serious incidents shall be notified to SafeWork 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.

Further details on SafeWork NSW's reporting requirements can be found at:

<http://www.safework.nsw.gov.au/health-and-safety/Report-an-incident-or-injury/notifying-us>

After a serious incident has been reported, the immediate area around the incident must not be disturbed (adhering to SafeWork NSW requirements), except to assist any injured persons, to avoid further injuries and issues or where SafeWork has authorised work to continue.

6.2.2 Reporting procedure for Roads and Maritime staff

The following reporting procedure is to be followed by Roads and Maritime staff on Roads and Maritime work.

Incidents involving Roads and Maritime employees

All workplace incidents and near misses shall be reported immediately to the workplace supervisor who is responsible for investigating the incident. The incident and investigation must also be recorded in Roads and Maritime's incident reporting system, SRIMS.

Contact the SRIMS Helpdesk on 1300 131 469 or SRIMS mailbox SRIMS@rms.nsw.gov.au for assistance.

Incidents involving non-Roads and Maritime employees on Roads and Maritime works

All workplace incidents that involve a non-Roads and Maritime employee including contractors, visitors and members of the public shall be reported immediately to Roads and Maritime workplace supervisor, who is responsible for investigating the incident. The incident and investigation shall also be recorded in Roads and Maritime's incident reporting system, SRIMS.

Contact the SRIMS Helpdesk on 1300 131 469 or SRIMS mailbox SRIMS@rms.nsw.gov.au for assistance.

7 Providing for works traffic

7.1 Responsibilities of drivers

Drivers of vehicles at work sites 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 at work sites. This is even more important for loaded trucks because, compared with lighter vehicles, longer time and distance is needed to accelerate and decelerate.

All trucks used on work sites shall have fitted and maintained both reversing alarms and reversing lights. Procedures shall be put into place to warn all workers of the potential hazard of reversing vehicles 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. (See Section 9.23, *Working on foot near plant*).

Contractors and agents of Roads and Maritime are strongly encouraged to adopt the principles contained in Roads and Maritime's Safe Driving Policy as specified in Roads and Maritime's Work Health and Safety Manual.

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 ie 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. The TMP or risk assessment should consider and document site entry and exit risks and treatments.

7.3 Hazardous movements

7.3.1 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 (6D 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 (see Section 7.8, *Median crossovers*) or in accordance with an approved TCP or VMP. Note: U–turns are illegal across unbroken centre-lines eg barrier lines or painted medians.

7.3.2 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 6D ie 20 seconds of travel time. Vehicles reversing in the work area are subject to the conditions outlined in Section 7.1, *Responsibilities of drivers*.

7.3.3 Stopping:

Work vehicles shall not remain stationary in lanes carrying through traffic unless broken down, in a traffic queue or protected by a portable traffic control device or traffic controllers.

7.4 Planning for movements of work vehicles

When planning works, attention shall be given to ensure that traffic associated with the works can safely manoeuvre to and from traffic streams, turn at work areas, depots, stockpile sites, quarries and 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 and gravel pits etc
- Gang trucks
- Works supervisors' vehicles etc.

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

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

7.5 Vehicle movement plans

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 [Table 7.1](#) and [Table 7.2](#) to determine the type of treatment to be adopted based on ADT, truck movements per shift and sight distance. For long-term, high risk or complex works, it is recommended that the appropriate subject matter experts, for example, road design or traffic engineering, are consulted when determining treatments.

On roads with approach speeds of less than 100 km/h but more than 80 km/h refer to [Table 7.3](#) and [Table 7.4](#) to determine the type of treatment to be adopted and for approach speeds between 80 km/h and 60 km/h inclusive refer to [Table 7.5](#) and [Table 7.6](#).

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

Table 7.1: Providing for truck movements where approach speed is ≥ 100 km/h and sight distance is $< 2D$

ADT	300 – 1500		More than 1500	
	≤ 20	> 20	≤ 20	> 20
Number of truck movements per shift	≤ 20	> 20	≤ 20	> 20
TCP with PTCO, traffic controllers or traffic signals		Yes ^a	Yes ^a	Yes ^a
VMP required	Yes ^a	Yes ^a	Yes ^a	Yes ^a
Warning signs required during shifts (TCP 195)		Yes ^a		Yes ^a

Note: ^a Under these conditions every effort should be made to choose turning locations where sight distance exceeds 2D.

Table 7.2: Providing for truck movements where approach speed ≥ 100 km/h and sight distance is $> 2D$

ADT	300 – 1500		More than 1500	
	≤ 20	> 20	≤ 20	> 20
Number of truck movements per shift	≤ 20	> 20	≤ 20	> 20
TCP with PTCD, traffic controllers or traffic signals		Yes	Yes	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 6D		If sight distance is less than 6D

Table 7.3: Providing for truck movements where approach speed is < 100 km/h but > 80 km/h and sight distance is $< 2D$ in built-up areas

ADT	300 – 1500		More than 1500	
	≤ 20	> 20	≤ 20	> 20
Number of truck movements per shift	≤ 20	> 20	≤ 20	> 20
TCP with PTCD, traffic controllers or traffic signals		Yes	Yes	Yes
VMP required	Yes	Yes	Yes	Yes
Warning signs required during shifts (TCP 195)		Yes		Yes

Table 7.4: Providing for truck movements where approach speed is < 100 km/h but > 80 km/h and sight distance is $> 2D$ including built up areas

ADT	300 – 1500		More than 1500	
	≤ 20	> 20	≤ 20	> 20
Number of truck movements per shift	≤ 20	> 20	≤ 20	> 20
TCP with PTCD, traffic controllers or traffic signals		Yes		Yes
VMP required		Yes		Yes
Warning signs required during shifts (TCP 195)		If sight distance is less than 6D		If sight distance is less than 6D

Table 7.5: Providing for truck movements where approach speed is > 60 km/h but < 80 km/h and sight distance is < 2D including built-up areas

ADT	300 – 1500		More than 1500	
	≤ 20	> 20	≤ 20	> 20
Number of truck movements per shift	≤ 20	> 20	≤ 20	> 20
TCP with PTCO, traffic controllers or traffic signals		Yes	Yes	Yes
VMP required		Yes		Yes
Warning signs required during shifts (TCP 195)		Yes		Yes

Table 7.6: Providing for truck movements where approach speed > 60 km/h and < 80 km/h and sight distance is > 2D including built-up areas

ADT	300 – 1500		More than 1500	
	≤ 20	> 20	≤ 20	> 20
Number of truck movements per shift	≤ 20	> 20	≤ 20	> 20
TCP with PTCO, traffic controllers or traffic signals		Yes		Yes
VMP required		Yes		Yes
Warning signs required during shifts (TCP 195)		Yes		Yes

In any instance where the use of Table 7.1 to Table 7.6 indicates that a portable traffic control device or traffic controller shall be used then the approach speed of traffic is to be reduced to at least 60 km/h.

7.6 Responsibilities

The project manager is responsible for:

- Ensuring that satisfactory arrangements are planned and implemented for vehicles associated with works
- Considering the need for VMPs at work sites and truck turning areas as indicated by Table 7.1 to Table 7.6 or other extenuating circumstances
- Where a VMP is required, approving it and making it available before work begins.

The works supervisor is responsible for:

- Planning arrangements for vehicles associated with works
- Confirming that the VMP is relevant for the work and the site where a written VMP is required by Table 7.1 to Table 7.6 or as specified by the project manager.

The team leader is responsible for:

- Ensuring that drivers of work vehicles are familiar with arrangements for traffic control
- Ensuring that Roads and Maritime’s *Safe Driving Policy*, Section 7.1, Responsibilities of drivers, Section 7.2, Site entry and exit and Section 7.3, Hazardous movements
- Instructing drivers how to enter and exit work sites safely and the routes to follow between work sites, depots and material sources etc
- Implementing written VMPs where they are provided.

7.7 Signs for depots, stockpiles, quarries and gravel pits etc (AS1742.3 Cl 3.16.2)

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 ie at roadside stockpile sites or via accesses to private property.

The appropriate signs are Trucks (W5–22, long-term) or (T2-25, short-term). These signs may be used in conjunction with TRUCKS TURNING (W5 205) and xx m ON LEFT/RIGHT (W8-207 (L) or (R) signs. A typical arrangement is shown in example, TCP 195. All signs shall be displayed before the haulage operation begins and removed or covered at the end of each shift.

7.8 Median crossovers

The main purpose of median crossovers on motorway type roads and similar high speed divided roads is to allow access for emergency vehicles ie police service, ambulance service and fire brigade and roadworks vehicles. Other drivers on these 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 usually respond more defensively in the vicinity of emergency vehicles than roadworks vehicles.

However, all vehicles should use median crossovers with the utmost care and caution and, whenever feasible, use a nearby interchange or intersection side road to U-turn rather than a crossover.

The location and serviceability of median vehicle crossovers is therefore critical. In planning works on motorways 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, subject to the following requirements:
 - Median crossovers should be located well clear of entry and exit ramps to ensure short weaving manoeuvres do not occur
 - Motorists shall not be required to stop or slow or swerve for roadworks vehicles using the crossovers
 - Having regard to the point above, at each crossover determine whether roadworks vehicles are to join the fast lane and accelerate or to cross the carriageway to the slow lane and accelerate.

Where the TMP and / or risk assessment identifies that these requirements cannot be met, either make provision for turning movements at a different location or develop 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 and gravel pits etc (AS1742.3 Cl 3.16.2) 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 portable traffic control devices, 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 ie fixed signals, designed in accordance with current Roads and Maritime specifications
- Portable, with one or two sets, in accordance with Section 10 of this manual.

An example 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 expected that this deposit will likely happen then consideration shall be given to the use of rumble grids and coarse gravel layers or hosing to clean the vehicles before they enter or cross the through road.

8 Traffic controllers and speed zones

8.1 Traffic controllers

8.1.1 General (AS1742.3 Cl 4.10.2)

Equipment

Roadworks traffic controllers shall wear approved high visibility safety clothing (AS1742.3 Cl per AS4602) displaying the words “Authorised Traffic Controller” and shall control traffic using a STOP/SLOW bat (AS1742.3 Cl 3.5.2 (c)), by manually operating a portable traffic signal, or the STOP sign mounted on a boom.

The TRAFFIC CONTROLLER (symbolic) (T1-34) sign shall be used to give advance warning of the presence of a traffic controller and the PREPARE TO STOP (T1-18) sign shall be used if traffic could be required to stop at the traffic controller location.

Traffic controllers are responsible for setting up and removing or covering these two signs and relieving traffic controllers are to check to ensure that the signs are installed correctly.

Training

Traffic controllers shall be appropriately trained in their duties and verified as competent. The minimum qualification needed to perform the duty of a traffic controller with a stop / slow bat or portable traffic control device is a Traffic Controller accreditation.

Authorisation

All traffic controllers must be authorised by the relevant authority ie Roads and Maritime or the council, to control traffic at a specific location prior to undertaking the work. Traffic controllers are not legally permitted to control traffic without displaying their authorisation.

Roads and Maritime traffic controllers or traffic controllers working for Roads and Maritime contractors on Roads and Maritime work shall display the words ‘**AUTHORISED TRAFFIC CONTROLLER**’ clearly on their high-visibility clothing.

Approach speed (AS1742.3 Cl 4.10.4)

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.

Visibility (AS1742.3 Cl 4.10.3)

Traffic controllers shall not be located in positions where the sight distance between them and oncoming traffic is less than 1.5D unless a site-specific risk assessment has been undertaken and additional measures to ensure safety are adopted.

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 jump because they cannot see the traffic controller at the head of the queue, then a portable traffic control device, an additional traffic controller or additional warning signs shall be placed at the end of the queue or another appropriate location. See Section 3.5.7, *Avoiding end of queue collisions (AS1742.3 Cl 4.7.8)*

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 can be useful to ensure that the control is suitable for the work situation.

Period of duty (AS1742.3 Cl 4.10.5)

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 may be required on both short-term and long-term work where traffic needs to be periodically stopped in approach to the work site and where a portable traffic control device is not going to be utilised.

Traffic controllers can also be necessary in some circumstances on mobile work on single carriageway roads eg two-lane, two-way and three-lane, two-way, particularly for mobile work with a slow rate of progression along the road. See example, TCP 71.

A traffic controller can control traffic in only one lane. When manual traffic control is required on multi-lane carriageways, a merge or merges shall be introduced upstream of the traffic controller so that the traffic controller is managing one lane only.

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 with one traffic controller located on each approach to the work area.

Suitable gaps are likely to be too infrequent where the ADT exceeds 1500 vehicles per day. To assess gaps in oncoming traffic, a traffic controller shall be able to see at least 300 m (400 m where pre-existing approach speeds exceed 100 km/h) or, for long work areas, 250 m (350 m where pre-existing approach speeds exceed 100 km/h) plus the length of the work area. This is illustrated in Table 8.1.

Traffic speeds shall be reduced to comply with the clearance to workers requirements of Section 3.6, Safe clearances between workers and through traffic at static work sites (AS1742.3 Cl 4.2).

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

For work at night, see Section 9.2, Working at night.

A traffic controller shall also be required on the other approach if any of the following conditions apply:

- The traffic controller shown in Figure 8-1 cannot clearly see the minimum distance shown to oncoming traffic
- The length of work area L (Figure 8-1 and Table 8.1) is greater than 250 m
- ADT exceeds 1500 vehicles per day.

Two-lane, two-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. Traffic speeds shall be reduced to comply with the clearance to workers requirements of Section 3.6, Safe clearances between workers and through traffic at static work sites (AS1742.3 Cl 4.2).

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

- No traffic controllers are required where all of the following conditions apply:
 - ADT is less than 100 vehicles per day
 - Each entry to the work site is visible from the other end
 - The work area is shorter than 100 m.
- One traffic controller is required where both of the following conditions apply:
 - ADT is 1500 vehicles or less
 - Sight distance from the traffic controller exceeds the minimum in [Table 8.1](#).

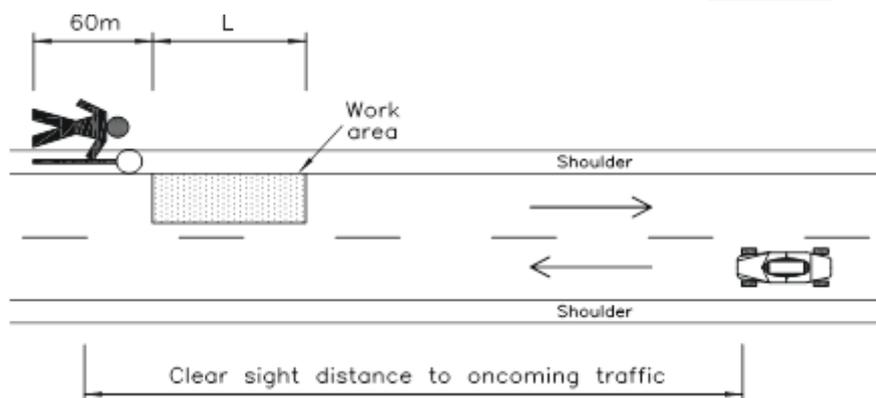


Figure 8-1: Traffic controller minimum sight distance

Table 8.1: Traffic controller minimum sight distance

Approach Speed (prior to 60 km/h zone)	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

- Two traffic controllers are required where any of the following conditions apply:
 - ADT is greater than 1500 vehicles per day
 - The work area is longer than 250 m
 - Sight distance from the traffic controller in the obstructed lane to the other approach is less than the minimum in [Table 8.1](#).

Three-lane, two-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. Benefits of the selected option should be included in the TMP and risk assessment (See example, TCP 80).

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 two-lane, two-way road. See example, TCP 90.

Where traffic is stopped intermittently in the single lane and allowed to proceed in the same lane and the opposing two-lane flow is not affected, one traffic controller is required. See example, 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::

- One traffic controller is required where both of the following conditions apply:
 - ADT is less than 1500 vehicles per day
 - Sight distance from the traffic controller exceeds the minimum in Table 8.1.
- Two traffic controllers are required and the slow lane closed where any of the following conditions apply:
 - ADT is greater than 1500 vehicles per day
 - The work area is longer than 250 m
 - 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 example, TCP 91.

Roads with four or more lanes

On single carriageway roads with four or more lane and on divided roads, lane closures can usually be arranged 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.

Note: A traffic controller shall control only one lane and merges upstream of the work area can be necessary.

A typical situation with a traffic controller on a divided road is shown in example, TCP 82.

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 symbolic (T1-34) signs 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 any other traffic controller and where the sight distance to oncoming traffic is at least 1.5D. Traffic controllers shall ensure that they are able to signal each other either directly or by using two-way radios, an intermediate person or other means. All radios shall be confirmed to be in working order before going to the work site. Radios shall not be used at blasting works
- Be appropriately trained and competent in the use of any portable traffic control device being used
- Stand facing the traffic, but just outside the travel path so that he or she can be seen for a minimum of 1.5D 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
- Use two way radio control. It is desirable in most cases, but essential if clear sight between operators is not available.
- Once the first vehicle has stopped, change position if necessary in order to be clearly visible to following traffic. The traffic controller shall 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 ie 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 – ie 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 – ie 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
- Use an illuminated wand to supplement the **STOP/SLOW** bat during night works or when visibility is limited
- Not leave their post until directed by the works supervisor or team leader or upon relief 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 the PREPARE TO STOP (T1-18) and traffic controller symbolic (T1–34) 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.

8.2 Roadwork (temporary) speed zones (AS1742.3 Cl 4.9)

It is essential that:

- The procedures outlined in this Section are followed to provide consistency of roadwork speed zone operations in NSW
- All speed zone signs are adequately covered or removed from site when not required
- 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 can lead to motorists not obeying signs correctly displayed. This will increase the risks to both workers and road users.

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 (AS1742.3 Cl 4.7.8)*.

8.2.1 General

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

Roadwork speed zones:

- Shall only be used where they are self-enforcing or will be enforced
- Shall not be used alone but used with other signs or devices required by the site-specific conditions
- Are not to be used in the place of more effective means of traffic control, but to complement such controls
- Shall only be used while work is being undertaken or temporary road conditions exist which undermine safety.

8.2.2 Location

Roadwork speed zones may be used where:

- There is an accident or an emergency
- Traffic travels through the work site
- Workers are endangered by high speed traffic
- Dust or smoke reduces visibility
- Loose material or stones are on the road surface ie during spray sealing works
- 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
- Detours or sidetracks are of a lower standard than the approaches
- Excavations are adjacent to the travel path of vehicles
- Bridges, which for reasons of structural safety, require a reduction in the impact loading caused by traffic
- Traffic is diverted onto the opposing travel lanes or carriageway.

8.2.3 Speed limit selection

The speed limit selected shall not exceed the maximum safe speed of travel for that work area. The 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. Using appropriate signs and devices together with, if considered necessary, an authorised roadwork speed limit, the speed of passing traffic shall be reduced to the following speeds:

80 km/h:

- Where workers on foot or operating plant are between 3 m and 6 m of traffic with no intervening physical barrier and traffic volumes exceed 10,000 vpd
- Where there are changed traffic conditions on the site such as high speed, high standard detours, reduction in the number of lanes and varying surfaces
- Where there are work vehicles entering or leaving the carriageway
- Where a transition zone in 110 km/h zones requires a 60 km/h or a 40 km/h roadwork speed zone at the site of the work and the use of a 60 km/h or 40 km/h ahead sign is considered inadequate.

60 km/h:

- Where workers on foot or operating plant are within 1.2 m to 3 m of traffic with no intervening physical barrier
- On approach to a traffic controller
- On approaches to temporary or portable traffic signals
- There is significant interaction between work vehicles and through traffic
- There is a reduced standard of alignment due to the works
- There is a loose surface such as gravel or a newly sprayed bitumen seal
- Plant is operating near through traffic
- Dust or smoke can reduce visibility
- Traffic is adjacent to an excavation.

40 km/h:

- Where workers on foot or operating plant are within 1.2 m of traffic with no intervening physical barrier or are working within the trafficked area
- There is a severe change in the alignment considering the surrounding speed environment
- On bridges where the deck has an inconsistent surface or there might be structural damage to the bridge by vehicles travelling at higher speeds.

Note:

- For bridges where the impact loading caused by traffic threatens the structural safety of the bridge the temporary speed limit, as determined by the project manager, may be set lower than 40 km/h. Consideration should also be given to erecting bridge load limit signs (R6-3).

Less than 40 km/h (AS1742.3 Cl 4.2(e))

Refer to Section 3.6.6, Speed control at hazardous sites.

8.2.4 Procedures

Duration

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

- Full-time basis for the duration of the roadworks
- 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.

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 are no obvious roadworks or bridgework activity.

40 km/h and 60 km/h roadwork speed zones shall be located so that the zone commences no closer than 100m before the start of the work, at the start of transition area or traffic diversion or the traffic control position. In general, 40km/h zones are only to be erected over the length where people are working or the other conditions listed in Section 8.2.3 40 km/h: exist. The roadwork speed zone shall end at least 50 m past the site where people are working.

The desirable lengths of roadworks speed zones are shown in Table 8.2.

Table 8.2: Desirable length of roadworks speed zones

	Minimum	Maximum
40 km/h	Not Specified	500 m
The maximum length of 500 m is for worker safety but the actual length shall be restricted to areas adjacent to where people are actually working and visible to road users.		
60 km/h	150 m	Not specified
80 km/h	500 m	Not specified
80 km/h transition zones	300 m	Not specified
For traffic safety, there is no maximum length specified above ie for long lengths of reseals etc, but physical restraint to traffic speed shall be considered ie pilot vehicles etc, for longer lengths.		

Roadworks speed zones may be staggered so that there is a different speed restriction for opposing directions of traffic. Staggering may be applicable:

- To reduce the length of speed restriction to traffic leaving the work site
- Where a speed zone is extended to protect the end of a queue
- On a divided road where roadworks affect traffic conditions on one side of the median only
- 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
- Where work is underway on the shoulder and does not affect traffic in the opposing traffic lane.

8.2.5 Signposting

Speed limit signs

Speed Limit AHEAD signs (see G9-79) shall be erected where the speed of traffic on the approach to the temporary speed zone is 30 km/h or more higher than the temporary limit. They shall also be considered for use:

- Where there is insufficient sight distance
- On downhill approaches
- Where, under normal driving expectations, the change in speed zone may not be apparent to road users.

The Speed Limit AHEAD (G9-79) signs shall be located 2 D in advance of the roadworks speed zone.

At the start of zones

At the start of a roadworks speed zone the Roadwork Speed Limit (see R4 212) signs shall be erected on both sides of the carriageway. Where this is not possible a second sign is to be erected 0.5 D from the start of the zone.

Repeater signs

Repeater signs (see R4-212) shall be erected on the left side of the carriageway at a maximum spacing of 500 m. They are also required where traffic enters from a side road within a roadworks speed zone.

End of zone

At the end of the roadworks speed zone, a speed restriction sign shall be erected showing the speed limit applying beyond the roadworks zone.

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, shall be covered or removed.

Sign size

Speed restriction signs used on all roads where the existing limit is 60 km/h or more are to be at least 'B' size. On motorways type roads, multi-lane roads or higher speed roads, 'C' size signs may be erected.

Erection of signs

Roadwork speed restriction signs shall be erected:

- Within 5 m of the edge of the outer travel lane
- A minimum of 600 mm above the ground to the underside of the sign
- To be clearly visible to traffic. In urban areas the location of the zone may be adjusted so that signs can be erected clear of parked vehicles, other signs or obstructions.

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 Section 8.2.4, *Minimum length of zones* may be used as a guide when designing the TCP in this instance.

Speed restriction road pavement markings

For long-term work the existing speed limit pavement numerals shall be obliterated or ground off. It is not normally necessary to provide pavement markings for roadworks speed zones.

Roadwork speed limits enforced signs

On long-term roadwork sites where a speed restriction is to be used for an extended period ie in excess of four weeks, and compliance with the roadwork speed restriction is expected to be challenging, ROADWORK SPEED LIMITS ENFORCED (T4-216) signs shall be erected.

If used, these signs shall be located:

- 100 m after each roadwork speed limit sign for speed limits of 60 km/h or less
- 125 m for speed limits greater than 60 km/h.

These signs may also be used if compliance becomes difficult during shorter periods of work.

Seeking police co-operation

It is desirable to advise local police of the installation of any temporary speed zones and to seek police co-operation to enforce those zones. In this regard consideration shall be given to the use of police speed enforcement or presence as part of the risk management process during the development, construction and maintenance stages of projects.

Potential projects requiring police involvement include:

- Long-term works on high volume or high speed roads
- Short-term work where traffic barriers cannot be employed to protect workers.

Procedures for involving police in enforcement or presence on roadworks are contained in Roads and Maritime technical direction *TDT 2009/07, Police Speed Enforcement or Presence on RTA Work Sites*.

8.2.6 Delegations and documentation

Roads and Maritime works on classified roads

Authorisation by a unit manager who holds a current qualification in Prepare Work Zone Traffic Management Plans eg Roads and Maritime Delegation Level 4 Officer, is required before a roadwork speed limit sign can be installed, displayed, altered or removed on any classified road.

Completion is required of an appropriate form (see end of Section 8) 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.

A copy of this authorisation shall be kept on site and will enable the erection of roadwork speed limit signs (see R4-212) at the specified location(s).

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 can 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 authorisation of Roads and Maritime to erect roadwork speed limit (see R4-212) signs.

Works on unclassified roads

Authorisation shall be carried out in accordance with Item 13 of Roads and Maritime's *Delegation to Councils – Regulation of Traffic (dated 31 October 2011)*.

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

- Authorisation of the use of the 'Roadwork Speed Limit' (R4-212) sign must be carried out by council or a sub-delegate who holds a current Prepare Work Zone Traffic Management Plan qualification issued by the Authority
- The nearest office of the Authority is to be notified in writing of council's intention to implement a roadwork speed limit prior to works commencing.
- The nearest police station is to be notified 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 six working days:

- Authorisation of the use of the 'Roadwork Speed Limit' (R4-212) sign must be carried out by council or a sub-delegate who holds a current Prepare Work Zone Traffic Management Plan qualification issued by the Authority
- The nearest office of the authority is to be notified in writing of council's intention to implement a roadwork speed limit seven days prior to works commencing
- The nearest police station is to be notified in writing of council's intention to implement a roadwork speed limit seven days prior to works commencing."

8.2.7 Records

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

- Roads and Maritime's or council's or its sub-delegate's written authorisation of the installation. The sub-delegate's Prepare a Work Zone Traffic Management Plan certificate number shall be shown.
- The location
- The installation time and date
- The removal time and date.

The 'Roadwork Speed Limit' (see 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 Section 8.

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

8.2.8 Inspection

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 are to be inspected and associated documentation examined on a regular basis.

9 Specific situations

9.1 Intermittent work and low impact works

9.1.1 General (AS1742.3 Cl 4.4.1)

The treatments in this Section are permitted in recognition of the need to allow certain short-term low impact works to be carried out without the use of fully protected static work sites or mobile works convoys which could otherwise lead to significant work inefficiencies. Since this involves a departure from safety standards, it is vital that a risk assessment (see Section 2.10, *Risk management*) be made of the proposed adoption of these treatments in particular environments taking account of factors, such as traffic volume and speed, road geometry and width and the general behaviour of road users. If the risk cannot be tolerated, a fully protected static work site (Section 3.6) or mobile works (Section 9.17) convoy will be required.

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

The speed limits specified are existing permanent speed limits. Temporary speed limits shall not be used unless a static site as specified in this manual is to be arranged.

9.1.2 Intermittent work (AS1742.3 Cl 4.3.2 and 4.4.6)

Planned

Work is classified as intermittent if it is undertaken within gaps in traffic without obstructing traffic and without compromising the safety of workers. It may be planned, unplanned or emergency work 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, removal of dead animals or debris, or litter collection etc. For this type of work, advance warning signs and delineation may be omitted provided the following conditions are met:

- A risk assessment has been completed. It is also recommended that a TMP is developed for the works
- Approved high-visibility external clothing as specified in AS 4602, is worn by all workers in line with Roads and Maritime's Work Health and Safety Policy Manual
- A contingency plan is in place so that work in progress can be abandoned immediately without risk to workers or traffic
- Where a look-out person is used, the person shall have good eyesight and be fully instructed in the look-out persons' duties
- Where a look-out person is used, there is no approaching traffic for at least a minimum distance as shown in Table 9.1 for the designated approach speed ie approximately equivalent to 10 seconds travel time or 3D
- Where used, the look-out person shall remain within sight and hearing distance of the worker(s) (generally within 2 m), and an advance look-out person may be required if the distances shown in Table 9.1 cannot be achieved. This advance look-out person should be within sight distance of the first look-out person or within radio contact if sight distance is not possible.
- Where a look-out person 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 ie approximately equivalent to 20 seconds travel time or 6D, and the work shall be expected to be completed in less than 10 seconds
- There is at least one operating rotating or flashing 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 WORKERS (symbolic) (T1-5) with NEXT 2KM (T1-28) or similar shall 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.

Unplanned

Where the work is unplanned or is an emergency, the use of signs as detailed above may be omitted. However, it is essential that personnel are able to substantiate that the work was unplanned and required urgently.

Table 9.1: Safe traffic gaps for intermittent work

Approach speed (D) km/h	Minimum sight distance (m)	
	With a look-out person	Without a look-out person
10 and 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

If vehicles in the traffic stream are randomly distributed and with a volume not exceeding 100 km per hour, suitable gaps are likely to occur every minute. However, in many places factors, such as traffic signals and slow vehicles often bundle traffic into platoons, and suitable gaps can occur more frequently.

9.1.3 Mobile inspections (AS1742.3 Cl 4.3.6) – open road areas

Where it is necessary for work vehicles (other than vehicles engaged in mobile works, see Section 9.17 *Mobile work*) to travel at speeds below that of other traffic, such as during routine patrol works or mobile 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 shall travel wholly within the traffic lane provided:
 - Travel speed is less than 20 km/h below the speed limit
 - Travel speed is at least 25 km/h on roads with less than 200 vpd.
- Vehicles have at least one rotating or flashing yellow light operating and visible to traffic following the vehicle

- Vehicles may travel at speeds greater than 20 km/h below the speed limit if they travel on the road shoulder or verge using gaps in traffic to pass obstructions and shall not straddle the edge line
- 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 shall be flashed
- If vehicles travel at speeds below those shown in the first point above, it shall operate as a mobile work.

Table 9.2: Slow speed range for work vehicles

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

9.1.4 Short-term work in traffic (AS1742.3 Cl 4.3.3) – open road areas

Workers with a vehicle or item of plant equipped with a vehicle-mounted warning device may work on the roadway or within 1.2 m of moving traffic without the use of advance signs provided the roadway at any one work site is not occupied for more than five minutes and the conditions listed below are applied. The period may be increased to 20 minutes for works within 3 m but more than 1.2 m.

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

- Greater than 150 m in a 60 km/h or lower speed zone
- Greater than 250 m elsewhere.

The vehicle-mounted device shall not be obscured eg by overhanging vegetation or a raised truck body.

The work shall not reduce either of the:

- Overall width to less than that required for safe passage for two-way traffic, or one way traffic if the volume is less than 50 vpd)
- The lane width adjacent to a barrier line to less than that needed for vehicles to proceed without crossing the line.

A look-out person 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, see Section 9.1.5, Frequently changing work areas (AS1742.3 Cl 4.3.4) – open road areas and Section 9.1.6, Frequently changing work areas (AS1742.3 Cl 4.4) – built up areas.

9.1.5 Frequently changing work areas (AS1742.3 Cl 4.3.4) – open road areas

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

- In all cases, the following requirements of Section 9.1.4 shall be observed:
 - Work vehicle positioning and length of occupation at any one site for a maximum of five minutes
 - Display of the vehicle-mounted warning device
 - Sight distance to the work vehicle for approaching traffic
 - The need for a look-out person to warn workers on foot on the roadway of approaching traffic.
- 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.
- At each advance sign location, either of the following signs shall be used:
 - WORKERS (symbolic) (T1-5) where there are workers on foot
 - Road plant ahead (T1-3-1) where moving road plant only will be encountered.

The sign NEXT 2 KM (T1-28) shall be placed beside whichever of the above signs is used.
- If any of the requirements of the first item in this list cannot be met at a particular location ie sight distance is substandard, the site shall be set up as a fully-protected static work site with advance signs as required.

9.1.6 Frequently changing work areas (AS1742.3 Cl 4.4) – built-up areas

Work not within a traffic lane (AS1742.3 Cl 4.4.2)

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

- Speed limit 70 km/h or less
- Minimum sight distance to oncoming traffic 50 m
- Maximum work period at any one location with one of the following durations:
 - 20 min at any traffic volume
 - 40 min at traffic volumes 150 vph or less
 - 1 hour at traffic volumes 40 vph or less.

The work area may move frequently between successive locations.

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

- Pit cleaning or repair
- Litter collection
- Tree pruning or planting
- Road signs or street furniture maintenance

- Street light maintenance.

Note: A static work site is required if these conditions cannot be met.

Work within a traffic lane (AS1742.3 Cl 4.4.3)

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

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

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

The following limitations apply:

- Speed limit 60 km/h or less
- Maximum work period at any one location, large item of plant, no workers on foot:
 - 20 min at any traffic volume
 - 1 hour at traffic volumes up to 40 vph.
- Maximum work period at any one location for workers on foot is one hour at traffic volumes up to 40 vph.

The shadow vehicle may not be necessary at volumes less than 60 vph if the sight distance to oncoming traffic is at least 50 m or 2D, whichever is greater.

The work may be moved frequently between successive locations.

Examples of work appropriate for this treatment are:

- Pavement marker laying other than on dividing lines
- Pavement testing
- Any of the items listed in *Work not within a traffic lane (AS1742.3 Cl 4.4.2)* where encroachment onto a traffic lane is likely to occur.

Note: A static or mobile work site will be required if these conditions cannot be met.

9.1.7 Works on medians, verges and footpaths (AS1742.3 Cl 4.4.4) – built-up areas

Access to medians is potentially hazardous because it is likely to involve unexpected manoeuvres to and from a fast lane. It is therefore necessary for work vehicles, including those driven by works supervisors, 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.

The following works may be carried out without any support vehicle on the roadway, subject to a risk assessment, the work duration being limited to a single shift and the listed conditions being met:

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

The following conditions shall be met:

- Large plant items only (see Note to Section 9.1.6, *Work within a traffic lane (AS1742.3 Cl 4.4.3)*)

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

- Speed limit 90 km/h or more, clearance shall be greater than 1.2 m
 - Speed limit 80 km/h or less, clearance may be less than 1.2 m but plant items shall not encroach onto the traffic lane.
- Workers on foot or small items of plant

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

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

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

Wherever there are workers on foot or small items of plant working 3 m or less clear of a moving traffic lane, cones or bollards, in accordance with Section 5.2.2, *Spacing of signs, cones and bollards (AS1742.3 Cl 3.9.1)*, shall be placed along the kerb line or edge of traffic lane if no kerb exists.

Note: A static or mobile work site will be required if these conditions cannot be met.

9.1.8 Street sweeping and garbage collection (AS1742.3 Cl 4.4.5) – built-up areas

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

- Vehicle to be equipped with a vehicle-mounted warning device
- Speed limit 70 km/h or less generally, or 80 km/h or less if the work vehicle can operate at least 1.2 m clear of the edge of nearest running lane
- The minimum sight distance for following traffic is 1.5D.

9.1.9 Shoulder grading and mowing on sealed roads (AS1742.3 Cl 4.3.5) – open road areas

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

- If sight distance to the vehicle-mounted warning sign on the grader or mower is at least 250 m throughout the section of road, advance signs road work next 10 km (T1-24) shall be placed at each end of the section. Loose stones (symbolic) (T3-9) or similar signs may be needed at the beginning and along the section
- If the sight distance falls to less than 250 m at some locations, grader ahead (T1-4) or road plant ahead (T1-3-1) together with next 2 km (T1-28) signs shall be used on each approach to the section to cover the location of diminished sight distance. A 60 km/h temporary speed zone will be required if the speed of traffic is 80 km/h or more, see Section 8.2.
- Subsections of 2 km or less in length created, as per above, shall be completed and signs including speed zone signs, if used, shall be relocated before proceeding with the next section. If there is difficulty turning a grader around at the end of a 2 km section, it may be extended to the next available turning point but not to more than 6 km in total length.

Where traffic volumes are greater than 1500 vpd the works shall be undertaken either as a mobile work, see Section 9.17 or as static work site, see Section 3.6, Safe clearances between workers and through traffic at static work sites (AS1742.3 Cl 4.2).

9.1.10 Slow moving plant

Plant items may travel 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 rotating or flashing yellow light operating. Plant items shall travel wholly within the traffic lane and shall not straddle lane or edge lines. They 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:

- Put in place a TCP to stop traffic while the plant is moved. It would normally be necessary to stop traffic only in the direction the plant item is travelling
- Use an escort vehicle or vehicles in accordance with Section 9.1.11, Escorting plant items
- Travel the plant item on the road shoulder or verge using gaps in traffic to pass obstructions and shall not straddle the edge line
- Float the plant item from site to site.

9.1.11 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 2D is available, the escort is to travel at the same speed as the plant item, at a distance of approximately 2D behind the plant item
- Where sight distance is less than 2D, the escort is to stop on the shoulder off the travel lane until the plant item has moved a maximum of 6D ahead. The escort is then to travel at normal speeds to a point near the plant item and stop on the shoulder once again
- Where sight distance is less than 1D, 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 shall be equipped with at least one operating rotating or flashing yellow light and a sign ROAD PLANT AHEAD. Similarly, all plant items shall be equipped with at least one operating rotating or flashing 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 shall 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 does not exceed 12 vehicles
- Escort vehicles may be cars, utilities or trucks, provided that trucks used as escorts shall not be heavily loaded and are not 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 60 m to 80 m shall be maintained between the plant items.

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 Roads and Maritime's current WHS policies, and are to keep all night gear clean and bright. Wet weather clothing requirements are also described in Roads and Maritime's current WHS policies.

Note:

These requirements are based on considerations of traffic safety. Other requirements for personal protection equipment, such as hearing protectors eg earmuffs and ear plugs etc, and safety footwear are also described in Roads and Maritime's current WHS policies.

9.2.3 (Deleted)

9.2.4 Flashing arrow signs

They are essential at night for lane closures on 'high' volume and 'high' speed roads and on busy roads in built-up areas. 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 made available on critical works.

Only type-approved flashing arrow signs shall be used in NSW. For information and approval requirements, see Section 11.2, *Approvals and specifications*.

9.2.5 Lighting

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

Portable traffic control devices or 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, adjacent dwellings or businesses. These checks shall 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, 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 can be more fatigued or alcohol-impaired
- Sight distance is significantly reduced on high beam and low beam and is only of the order of 100 m.

9.2.7 (Deleted)

9.2.8 Signs for night work

Roads and Maritime will now adopt the standard ROADWORK AHEAD (T1-1), WORKERS (symbolic) (T1-5) and TRAFFIC CONTROLLER (symbolic) (T1-34) signs for night works, in accordance with (AS1742.3).

The NIGHT ROADWORK AHEAD (T1-223), WORKERS (symbolic) (T1-224 and T1-5-2) and TRAFFIC CONTROLLER (symbolic) (T1-200-2 and T1-200-3) have been withdrawn.

These night road work signs were originally adopted with the intent of improving visibility in low light conditions and prior to the use of retro-reflective sheeting in the manufacturing process. All signs are now manufactured with Class 400 (retro-reflective) yellow sheeting, and therefore standardisation and harmonisation can be achieved with no impact on effectiveness and visibility.

A phase-out period of two years will be adopted to allow for existing signs to be replaced. No new signs should be manufactured from this time with this phase-out period ceasing on June 30 2020.

9.3 Pedestrians

9.3.1 General

In planning temporary arrangements for pedestrians, consider:

- The pedestrian and road environment
- The pedestrian accident history
- The surrounding land use
- The expected numbers of pedestrians
- Pedestrian requirements eg shopping trolleys or prams
- Where they will want to travel from and to eg desire lines, key routes, attractors, destinations or linked trips
- The needs of older pedestrians and pedestrians with impairments, such as vision impairment, hearing impairment or physical impairment eg of needs, personal space envelopes, motorised or non-motorised wheelchairs, walking frames or ramps
- The need for a road safety audit
- The needs of school children
- The need for extra signage, guidance eg pedestrian fencing, and protection eg crash barriers and crash cushions.

The safety and convenience of pedestrians requires paths and crossings locations to be maintained in an acceptable and hazard-free condition at all times of the day. Apart from concern for community safety, attention to this matter is essential to protect the organisation from injury or damage claims arising from accidents to pedestrians which may occur 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 either of the following:

- Plastic pedestrian fencing to the standard described in Section 3.3.2, *Plastic containment fences (AS1742.3 Cl 3.10.1)*
- More substantial fencing, such as rolled-top 'weldmesh' or pool fencing in very busy urban locations, such as shopping areas.

Where pedestrians have been diverted onto an existing roadway, the pedestrian path may be separated from vehicular traffic by a mesh fence, provided that there is sufficient width for the anticipated pedestrian volumes, storage and flow directions, and one of the following conditions apply:

- The clearance to the delineated edge of the traffic lane is at least 1.2 m and the speed of traffic is 60 km/h or less
- The clearance to the delineated edge of traffic is less than 1.2 m and the speed of traffic is 40 km/h or less.

Where these conditions cannot be met, a safety barrier or an alternative pedestrian path shall be provided or the worksite redesigned to pass a road safety audit based on pedestrian access.

9.3.3 Reversed traffic direction (AS1742.3 Cl 4.14.8 (c))

Where, traffic is required to travel temporarily in the wrong direction, at a detour, crossover or other location, special safety requirements may be needed for pedestrians. In particular:

- Containment fences may be required to control the crossing point
- Personnel may need to be positioned to guide and assist the pedestrians
- LOOK BOTH WAYS, TWO-WAY TRAFFIC (T8-5) signs may be required, especially where one carriageway of a divided road is closed. The signs shall be placed on both sides of the open carriageway facing pedestrians who about to cross.

9.3.4 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 including ramps over gutters that can have water velocities above 1 m/s
- Of equivalent material and performance to the adjacent footpaths and not pose a trip hazard for the range of pedestrians
- At local constrictions, not less than 1 m width. Elsewhere a width of at least 2 m shall be provided and any additional width to aid stopping sight distance to all road users.

Give care to maintaining good conditions and widths at points of concentration of pedestrians, such as in front of shops, schools at bus stops, mono rail stops, storage islands, medians and refuges.

9.3.5 Pedestrian crossings

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

Pedestrians shall be prevented from crossing, where:

- Traffic is flowing temporarily in the opposite direction
- Medians, refuges or other physical devices separate lanes of traffic flowing in the same direction
- Traffic speeds are higher or the drivers will not be alerted to pedestrians
- There is insufficient safe congregation space
- Stopping sight distance is not available to all road users.

In these circumstances active control is necessary by one of the following:

- Pedestrian-actuated traffic signals
- Supervisors eg traffic controllers, police officers or civilian school crossing supervisors
- Directing pedestrians in a chicane so that they face the direction of oncoming traffic with the required stopping sight distance before stepping on to the traffic lanes, as a minimum.

9.3.6 Monitoring pedestrian movements

At work sites where it has been necessary to introduce temporary arrangements for pedestrians, it is essential, especially during the first week, to observe movement patterns of pedestrians and make any changes necessary to ensure that pedestrians are able to move safely. Any observations should cover both day and night conditions as required by the road safety audit process and any amendments should be made to the approved traffic management plan.

9.3.7 Street lighting

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

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

9.3.8 Security guards or cameras

Where it is necessary to temporarily divert pedestrians, the works supervisor is to aid security and safety for pedestrians:

- In otherwise dark areas
- In areas that can shield offenders
- In storage areas that can be at a height that, if unstable, could be a hazard.

9.4 Cyclists

9.4.1 Policy

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

The provisions made for cyclists at a work site should be considered and determined during development of the site, project-specific TMP and risk assessment. Considerations would most generally include:

- Existing usage eg the number of cyclists
- Available width and alignments
- Traffic speeds and volumes
- Duration of work
- Surface material and condition

- Environmental effects
- Costs.

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

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, 2.0 m wide for one-way and 3.0 m 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).

9.4.2 (Deleted)

9.4.3 (Deleted)

9.4.4 Grooved roads

Milling of roads prior to re-surfacing can 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, also consider the following:

- On down-grades, cyclists can 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 in that they force cyclists away from space allocated to cyclists
- Roadworks signs should not block cycle ways

9.5 Oversize / over mass vehicles (OSOM)

Consideration should be given to the needs of oversize, overmass (OSOM) vehicles when planning worksites. An OSOM vehicle is a heavy vehicle that is carrying, or specially designed to carry, a large indivisible item. OSOM vehicles are defined as Class 1 vehicles under the Heavy Vehicle National Law and include:

- Agricultural machine, such as harvesters and grain auger
- Vehicle combinations carrying large indivisible items, such as mining and construction vehicles, bridge components or building
- Special purpose vehicles, such as mobile cranes, concrete pump trucks and drilling rigs.

Oversize vehicles can exceed the normal width, length or height requirements or a combination of all of these, and therefore may require special provision through the work site. Examples of this include:

- An over-width vehicle will require more road width due to the vehicle or load extending beyond the standard heavy vehicle width of 2.5 metres
- An over-length vehicle will require a larger turn sweep path
- OSOM vehicles may require special travel conditions, such as moving at a slower speed or straddling both lanes on bridges.

The unique performance characteristics of these vehicles require special consideration when developing the work site TMP and TCP to avoid conflicts between work site activity and the movement of the OSOM vehicle.

In particular, semi-permanent traffic control arrangements, such as the installation of temporary barriers or contra flow arrangements can have a significant effect on the movement of OSOM vehicles. When developing a TCP with these types of restrictions on the available road width or sweep path for vehicles, the proposed traffic control arrangements should be discussed with the Roads and Maritime road access management unit.

The Roads and Maritime road access management unit can provide advice on the movement of OSOM across all of NSW and can be contacted via email at spu@rms.nsw.gov.au or by phone on 1300 656 371.

9.6 Safety barriers

9.6.1 General

Safety barriers 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 *Road safety barrier systems* (AS 3845) and be approved for use by Roads and Maritime.

The list of approved temporary safety barrier systems and installation requirements can be found here:

<http://www.rms.nsw.gov.au/business-industry/partners-suppliers/approved-products-materials/safety-barriers/temporary.html> .

Safety barriers may be required where:

- Protection is required for workers and plant items, see Section 3.6.3, *(a) Protection by safety barrier system, Protection by safety barrier system)*
- It is necessary to separate opposing traffic streams where there are potentially hazardous conflicts, such as the risk of head-on collisions
- There are excavations or hazardous fixed objects close to the travelled way
- There is inadequate separation from temporary foot paths or bicycle paths, see Section 9.3.2, *Defining the work area*
- There are permanent or temporary embankments within the vicinity of works.

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 (Deleted)

9.6.3 (Deleted)

9.6.4 Warrants

The use of safety barriers during temporary works should be considered as part of the project TMP and risk assessment. The Austroads *Guide to Road Design Part 6: Roadside Design, Safety and Barriers* 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.

For long-term, complex or high risk projects, it is recommended that advice is sought from Traffic Engineering and / or Road Design in regards to safety barrier selection and design.

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 TMP and TCP.

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. It is recommended that an audit is undertaken on all temporary works arrangements prior to a traffic switch or similar being implemented at intersections. If the works are to be in

place during night time, the audit should also be done during night time to ensure appropriate delineation is in place.

9.8.2 Principles

The following principles are important when working at intersections:

- Ensure there is sufficient capacity and delays are kept to acceptable levels ie avoid excess capacity which can 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 prohibited 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 example TCPs at intersections. One such example for long-term work is given in this manual, see example, TCP 60.

Due to the complex nature of working at intersections, a site-specific TMP and risk assessment should always be completed prior to development of the TCP. 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 while maintenance or reconstruction 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 highly 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 ie at the 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 ie 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 m to 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 length, around 10 m to 15 m, 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 ie 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 or vehicles remain.

It is important for all such information to be documented in the site-specific TMP and risk assessment.

9.9.3 Examples

Example TCPs covering typical situations are described in Table A-15, and [Appendix A](#) and [Appendix D](#) *Example traffic control plans* for traffic signal works. These example TCPs show traffic control devices close to the work. If further advance warning is required then such signs should be erected in accordance with example, TCP 60. It should be noted that it is very difficult to cover all possible situations. The example 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)

Measures may need to be taken to prevent vehicles parking in the kerbside lane where another lane or lanes 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 roadsides (AS1742.3 Cl 4.3.7)

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 parked work vehicles:

- Take all tools and stores from the side of the vehicle or the rear if there is no risk of errant vehicles impacting on the rear of the vehicle further away from traffic
- Where possible, park work vehicles to shield workers from the path of errant vehicles.

See Sections [3.6.1](#) and [3.6.2](#) for guidance when working on roadsides.

For long-term work, where workers are close to the edge line 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 so that the clearance between it and the edge of the adjacent traffic lane is at least 1.2 m.

9.11 Excavations

Special consideration of the safety of both workers and traffic is needed while traffic flow is adjacent to excavations. Any safety barriers installed will be in addition to any barriers required for excavation fall protection of workers and pedestrians. 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 edge line 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. Additional controls or mitigation measures as identified in the TMP or risk assessment should also be installed eg safety barriers.

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 edge line. For distances outside of 3m, the requirement for a safety barrier should be considered during development of the TMP and risk assessment.

An appropriate safety barrier shall be used for isolating work areas with excavations where the excavation depth exceeds 200 mm if the following apply:

- The excavation remains open longer than two weeks
- The distance of the excavation to the travel path or edge line is less than any of the following:
 - 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 project manager considers that compliance with these requirements is not practical or warranted, a more thorough risk analysis should be made based on Austroads *Guide to Road Design Part 6: Roadside Design, Safety and Barriers*.

9.12 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 project manager 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 fall to the specified level.

Where road condition signs, such as slippery surface (T3-3) and LOOSE STONES (T3-9) etc, are installed, they shall remain in place until the above requirements, regarding loose aggregate particles, are met. Signs warning of the absence of linemarking are not to be removed until all linemarking is reinstated, see (AS1742.3 CI 3.7.2) and Section 5.2.3, Requirements for specific signs (AS1742.3 CI 3.7.4).

9.13 Surveying

The following are examples of activities that can be completed as short-term, low impact works. A risk assessment shall always be completed prior to any such works being conducted to ensure risks are identified and mitigated.

The survey party leader is responsible for the safety of the survey party.

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 an approved TCP.

For survey work on the roadside ie areas between the reserve boundary and the nearest road shoulder, all survey party members shall wear high-visibility garments in accordance with Roads and Maritime Policy contained in the WHS 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.

9.14 Vehicle inspections

9.14.1 General

Roads and Maritime Compliance Operations Inspectors (COI) carry out inspections of vehicles to determine compliance with the various Acts and Regulations administered by Roads and Maritime.

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 shall also be properly licenced and not exceed driving hour limits.

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

9.14.2 Stopping vehicles

COIs carry out inspections on vehicles day and night. These inspections are carried out at:

- Fixed sites, and:
 - Are specially designed facilities constructed off the carriageway to undertake all or some compliance operations tasks. In most cases, the site has permanently fixed signage identifying the Roads and Maritime inspection facility, however, portable signage is acceptable. Normal traffic goes around sites and the site is located off the carriageway with a maximum approach speed of 80 km/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, see TCPs VR101 and VR102.
- Planned sites, and:
 - Are not specifically constructed for compliance operations 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 compliance operations tasks. Some planned sites are used for other activities such as driver reviver when not used for inspection purposes, see TCPs VR201 and 202.
- 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. Roads and Maritime and target vehicles are mobile prior to interception and often the site is not selected by the intercepting officer. Limited compliance operations tasks are conducted according to TCP activity checklist and minimal time is 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, see TCP VR401 and VR403.
- 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 shall stand in the marked safe work zone as outlined in the site Vehicle Movement Plan. Compliance operations tasks are conducted according to TCP activity check lists, see TCP VR402
- 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 lists. 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, see TCPs VR301 to VR311.
- 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 COI 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.

9.14.3 Site risk assessment

To determine the appropriate TCP, an assessment shall 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 shall 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 6:00 am to 10:00 pm, 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 shall be used in TCP determinations.
3. Determine the appropriate TCP from the *Traffic Control at Compliance Operations Work Sites Manual*.

Table 9.3: Estimating ADT

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

Note:

Traffic shall be counted in both directions to determine the total traffic volume per 5 minutes.

9.15 Emergency incidents (AS1742.3 Appendix B)

Emergency incidents can occur at any time during or outside normal working hours. It is therefore essential that personnel be trained in the procedures and protocols to be followed at incidents and that they also work closely with emergency service organisations to ensure that the incident is safely and efficiently managed. Emergency incidents can involve minor partial road closures, major partial road closures or complete road closures due to vehicle crashes, oil spillages or debris from vehicles or fallen trees etc. When attending an incident, appropriate traffic control should be implemented in accordance with this manual and AS1742.3 as soon as possible.

The *Emergency Incident Management Checklist* provided in Appendix B is a guide for Roads and Maritime, and council staff who supervise and implement the traffic management services provided at emergency road-related incidents. It highlights the main issues to consider and actions required when attending and managing an incident.

9.16 Testing road condition

9.16.1 General

This section outlines traffic control considerations 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
- All members of the traffic control crew are familiar with the testing process.

Traffic control considerations and requirements will vary for these tests, according to the below factors;

- Type of test being conducted
- Speed at which the test is conducted
- Number of crew required to perform the test
- Location of crew performing the tests ie inside or outside of the vehicle
- Lane and intersection configurations
- Spacing or distance between tests
- Requirement for travel at a constant speed.

Typical types of road condition and monitoring tests undertaken on state roads include:

- Benkelman Beam
- Deflectograph
- Profilometer.

9.16.2 Typical condition tests and types of monitoring

Benkelman beam

Benkelman beam tests give an indication of pavement strength.

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.

Table A–8, TCPs for Benkelman beam testing (Appendix A), shows a number of example TCPs which should be considered when planning Benkelman beam testing. Example 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 Benkelman 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.

Deflectograph

A deflectograph gives an indication of pavement strength by measuring the deflection of a pavement under a standard load.

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 required.

Table A–10, TCPs for Deflectograph and Falling Weight Deflectometer (FWD) testing (Appendix A) shows the example TCPs for deflectograph testing.

Profilometer

A profilometer is generally used to measure the longitudinal and transverse profile of a pavement.

The only forms of traffic control necessary are a rotating or flashing yellow light and a warning sign mounted on the road testing vehicle, 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.

NAASRA roughness vehicle

A NAASRA roughness vehicle is used to test the riding quality of a pavement.

The only forms of traffic control necessary are a rotating or flashing yellow light and a warning sign mounted on the vehicle, 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.

SCRIM

A SCRIM measures the skid resistance of a pavement at constant speeds.

The only forms of traffic devices necessary are a rotating or flashing yellow light and a warning sign mounted on the vehicle, 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.

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.

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.

Refer Table A–10, TCPs for Deflectograph and FWD testing (Appendix A).

ROADCRACK™

The ROADCRACK™ equipment detects, measures, and classifies road cracking in real time and at highway speeds of up to 100 km/h.

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 or flashing yellow light and a warning sign mounted on the road testing vehicle, and clearly visible from the rear.

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.

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 or flashing yellow lights and warning signs mounted on the van, 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).

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.

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 look-out person. The look-out person 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 and low impact works*. 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.

9.17 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 and obstructing or partially obstructing traffic lanes. Direction of travel is the same as normal traffic flow. All signs and warning devices shall be mounted on moving vehicles in the convoy. All vehicles and plant items in the mobile works convoy, other than minor plant items, shall have fitted a flashing arrow sign.

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.

9.17.1 Work convoy arrangements (AS1742.3 Cl4.6.2)

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

A lead vehicle is required on two-way roadways when working on the dividing line. It precedes a work area and has three main purposes:

- It warns oncoming road users of the work
- The driver can alert following workers early to any impending danger from oncoming traffic

- 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 shall travel a clear distance of 20 m to 40 m behind the work vehicle and consideration should be given to fitting the vehicle with a truck-mounted crash attenuator when it is protecting workers in a traffic lane.

A 'tail vehicle' follows some distance behind the work area. The main purposes of a tail vehicle are:

- To warn following road users of the work
- To divert traffic around the work area
- To enable the driver to alert workers of any impending danger.

An 'advance warning vehicle' is positioned about 1 km behind the work convoy to give advance warning to following road users.

9.17.2 Operating principles (AS1742.3 Cl 4.6.3)

Advance warning (AS1742.3 Cl 4.6.3 (f))

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

- Where sight distance is good:
 - Lead vehicles travel 200 m to 400 m in open road areas or 30 m to 100 m in built-up areas in advance of the work vehicle
 - Tail vehicles travel 300 m to 500 m in open road areas or 200 m to 300 m in built up areas behind the work vehicle or shadow vehicle if one is being used. This vehicle may be dispensed with if the speed limit is 60 km/h or less.
- Where sight distance is poor:
 - The lead vehicle shall move as necessary beyond the distances given above to a point where good sight distance is regained, and remain there until the work vehicle catches up
 - 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 (AS1742.3 Cl 4.6.3 (e))

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.

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.

Traffic shall neither be directed to completely cross a dividing line into the path of oncoming traffic nor cross a freshly marked line if that would result in the marking being damaged.

Work on Motorway Type Roads (AS1742.3 Cl 4.6.3 (i))

A second tail vehicle shall be provided for work on motorways type roads. 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 (closer to the work vehicle) travelling in the occupied lane.

Supplementary vehicle-mounted signs (AS1742.3 Cl 3.12.3)

Additional signs, such as WORKERS (symbolic) (T1-5), where workers are on foot, WET PAINT ON ROAD (T2- 237) or ROAD PLANT AHEAD (T1-3-2), may be used on vehicles displaying a flashing arrow sign. Sign sizes shall be in accordance with Section 3.2.2, Sign sizes (AS1742.3 Cl 3.2.3).

9.17.3 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 multi-lane roads the arrow can be flashed to the direction where it is safe to pass.

A 40 km/h speed zone shall be installed where workers are within 1.2 metres of moving traffic.

9.18 Working in the vicinity of railway lines

To ensure compliance with the Rail Safety National Law (NSW), Rail Safety National Law National Regulations 2012 and duty of care under the Work Health and Safety Act 2011, the safety procedures outlined here shall be applied whenever work is carried out in the rail corridor.

It is recommended that the rail owner is consulted early during development of the TMP and risk assessment to ensure all constraints, risks and requirements are clearly identified and mitigated.

9.18.1 Rail terminology

‘Rail track owner’: 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 (rail)’: The authorised qualified worker responsible for protection and management of the safe interaction of work at the site, and the rail network

‘Danger zone’: Everywhere within 3 metres horizontally from the nearest rail and any distance above or below these 3 metres.

9.18.2 Working within the rail corridor

If the situation is such that either employees, contractors, plant, equipment or materials are located within or are likely to be within the rail corridor then the manager authorising the work is responsible for ensuring that:

- The rail track owner is advised
- Arrangements are made for the rail track owner to provide a protection officer (rail) to ensure the safe interaction between the work and the rail network.

The site supervisor understands that where a protection officer (rail) is provided, the following apply:

- They shall follow the instructions of the protection officer (rail)
- Work is not to be carried out if the protection officer (rail) is off-site.

The supervisor in charge of the site is responsible for ensuring that:

- All persons (Roads and Maritime staff and contractors) on-site understand the need to follow instructions of the protection officer (rail)
- All persons (Roads and Maritime staff and contractors) on-site shall wear approved rail standard safety vests and other personal protective equipment
- Where required, arrangements are made with the rail track owner to provide persons with rail safety awareness training
- All persons comply with the instructions of the protection officer (rail)
- Work is not carried out within the danger zone when the protection officer (rail) is off-site.

The workers on-site, whether Roads and Maritime, council, contractors, or public utility bodies, are responsible for the following:

- Working in accordance with instructions of the protection officer (rail)
- Not entering the danger zone when the protection officer (rail) is not present on-site.

If the work can affect the strength of the railway line or rail structures then the rail track owner shall be notified.

9.18.3 Separation by physical barriers

Notwithstanding the fact that the manager authorising the work may be satisfied that there is a physical barrier of solid construction that prevents persons or their equipment from coming into contact with rail traffic or overhead wiring, the manager shall still notify the rail track owner of the work and comply with the owner's requirements.

The supervisor in charge of the worksite is responsible for ensuring that the requirements set out in Section [9.18.2](#) are applied prior to commencement of work. In the event that the physical barrier becomes dismantled or damaged in such a way as to allow the possibility of persons coming into contact with rail traffic or overhead wiring then the supervisor shall stop all work on-site and notify the rail track owner so that the barrier can be re-established or the situation reviewed.

Persons on site are not to damage or attempt in any way to overcome a physical barrier.

9.19 Detours, sidetracks and crossovers (AS1742.3 Cl 4.14)

Where it is not possible to move traffic past or through a work area, the following forms of traffic detours should be considered:

- Sidetrack: A temporary roadway constructed near the existing roadway and may cater for one or both directions of travel
- Detours: Where existing roads are used 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 size vehicles: Shall be able to cater for heavy, high or long vehicles
- Exit closures on motorway type roads: Advice in advance of a closed exit is to be provided if a previous exit or succeeding exit is to be used.

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 (AS1742.3 Cl 4.14.6(b)(i)):
 - 20 m spacing on straights and curves greater than 200m radius
 - 6 m and 12 m on the outside and inside respectively of curves up to 200 m radius
 - On roads with volumes of 1500 vpd or less:
 - Up to 100 m on long flat straights
 - Up to 50 m on short and undulating straights
 - Up to 25 m on curves greater than 200 m 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 detailed design input and review.

9.20 Works on unsealed roads (AS1742.3 Cl 4.5)

9.20.1 General (AS1742.3 Cl 4.5.1)

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 this involves a departure from safety standards adopted for static works, it is vital that a risk assessment be made of the proposed adoption of these treatments in particular environments taking 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.

9.20.2 Maintenance grading and resheeting (AS1742.3 Cl 4.5.2)

Maintenance grading and resheeting may be carried out either with or without leaving a windrow as indicated below. Work done without leaving a windrow normally involves use of either a windrow eliminator or a second grader in tandem.

Wherever practicable, grading on the right side of the road against oncoming traffic should be avoided.

(a) Maintenance grading shall be undertaken as follows:

If the grader is always to operate leaving room for opposing traffic to pass it without driving off the roadway and the sight distance to the grader's vehicle-mounted warning device is at least 250 m throughout the entire section of road being worked on, no advance warning signs for either direction of travel are required. If these operating conditions cannot be met, the work shall be carried out as follows:

- The work shall be undertaken in bounds of not more than 10 km in length. The sign roadwork next 10 km (T1-24) shall be placed at each end of the section being worked on
- Where sight distance falls to less than 250 m the sign grader ahead (T1-4) or road plant ahead (T1-3-1) together with next 2 km (T1-28) shall be used at each end of each subsection with reduced sight

distance of up to 2 km in length. The signs shall be placed at least 100 m in advance of the start of any windrow

- Subsections of 2 km or less in length created as above shall be completed and signs including, if used, speed zone and end of zone signs, shall be relocated before proceeding with the next section which may be a further sight distance deficient sub-section or the remaining whole section. If there is difficulty turning a grader around at the end of a 2 km section, it may be extended to the next available turning point but not to more than 6 km in total length.

Road condition signs shall be placed at various locations if the freshly graded surface has loose material that may be a hazard. One or more of the following may be required depending on the nature of the hazard:

- Slippery (symbolic (T3-3))
- Loose Stones (symbolic (T3-9))
- Loose surface (T3-14).

Note:

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

(b) Maintenance resheeting

Maintenance resheeting shall be undertaken in accordance with the requirements for work length and signage for maintenance grading above.

9.20.3 Short-term partial road closures

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

Omission of advance signs

Advance signs may be omitted provided that all of the following conditions are met:

- The vehicle-mounted warning device on the work vehicle can be seen by approaching traffic for at least 250 m
- No traffic controller is required
- Either or both of the following:
 - Traffic volumes are 20 vpd or less
 - There is room for two-way traffic past the work area.

Using a single traffic controller

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

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

Other cases

Situations not meeting the above conditions (Omission of advance signs and Using a single traffic controller) shall be treated in the same way as sealed roads.

9.21 Motorcyclists

9.21.1 General

Motorcycles travelling through work sites require additional consideration, particularly in terms of the road surface provided. Motorcycles do not handle in the same way as 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.

9.21.2 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 1D 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 1D.

9.21.3 Grooved roads

Milling of roads prior to resurfacing can 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.

9.21.4 Steel plates

Materials, installation and maintenance of steel plates used to cover excavations shall comply with Roads and Maritime QA Specification M209, *Road Openings and Restoration*.

9.21.5 Drainage

Care shall be given to the drainage of roadworks so that water does not run across traffic lanes to a depth greater than 5 mm.

9.22 Repair and servicing of plant

9.22.1 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.

9.22.2 Principles

Personnel listed above shall 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 shall:

- 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 ie the site is level or, if not, then the plant or vehicle is immobilised by the use of park brake and chocks.

9.23 Working on foot near plant

This manual gives guidance on the selection, design and implementation of the following traffic control measures which cater for traffic movements around work sites or entering and leaving work sites:

- TCPs are generally in diagram form and show the location of temporary signs and devices arranged to warn traffic and guide it around, past or through work sites
- Vehicle Movement Plans are generally diagrams showing the preferred travel paths for vehicles associated with a work site entering, leaving or crossing the through traffic stream.

Of equal importance is the safety of personnel working within the work site close to mobile plant or vehicles and remote from other road users' vehicles. The principles outlined in this Section will provide guidance on the implementation of safe working practices within work sites.

9.23.1 General

Before any road or bridge work is undertaken, its effect on road users is assessed and if required a TCP is selected or designed and then implemented. This applies equally to major and minor works.

At the time of considering the need for a TCP any specific risks within the work site should be identified, bearing in mind the nature of the work to be undertaken, and safety measures adopted to eliminate or minimise those risks. For the purposes of this Section, 'plant' also includes trucks.

Risks that may be identified include:

- The possibility that site personnel or contractors can be injured
- The possibility of unauthorised persons entering the work site
- The proximity of people to mobile plant
- Vehicles being loaded or unloaded
- Plant being operated in reverse – where unavoidable reversing lengths occur they should be kept to a minimum
- Working close to the edge of embankments or cuttings
- Working below plant operating close to the edge of or on embankments or cuttings
- The proximity of people to revolving plant such as excavators
- Trenching operations
- High speed plant such as dump trucks
- Noisy work locations masking the sound of approaching plant
- Inappropriate location of compounds or site amenities
- The lack of adequately defined and safe crossing points
- Working at night
- Limited sight distances
- Intermittent crews visiting and being unfamiliar with the site
- Working beneath power lines
- Working beneath overhead activities ie bridge sites or steel erection
- The servicing or floating of plant items
- Parking plant items or vehicles in inappropriate locations ie too close to moving plant or in blind spots

- Workers jumping onto plant
- Workers, other than operators of plant, riding on plant
- Intensity, speed and acceptable clearance to any adjacent traffic.

A site Vehicle Movement Plan is to be prepared for vehicle movements within the work site where any of the following apply:

- There are repetitive movements of plant (> 20 per day)
- Plant on site is travelling at faster than 40 km/h
- Plant is reversing long distances (> 100 m)
- There are other specific hazards to pedestrians on site from plant carrying out the work.

This manual states that workers are not to work within 3 m of moving plant or within the area of influence of revolving plant. These are general requirements as there will be many instances where workers have to work within these limits. When they do so, it is essential that they are properly trained and that all operators are informed of the proximity of the workers.

Caution shall be exercised when delivering or moving materials. Personnel are to be aware of the effects that any additional or unplanned movement of those materials can have ie rolling pipes or spillage of aggregate etc.

Furthermore, sites shall be assessed to determine if extra precautions should be taken for the protection of open excavations, the use of traffic controllers within the site and the security of sites after hours.

Site Induction shall be given to all visitors to any site. At the time of the agreed site visit, visitors shall:

- Locate and report to the person in charge of the site who will advise who will provide the site induction
- Confirm the reason for their 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.

9.23.2 Mitigation risks to workers on foot

Workers on foot in proximity to plant are exposed to potential hazards and the following procedures shall be adopted to minimise risks:

- Reversing plant:
 - Ensure that plant items are fitted with an automatically activated, clearly audible and working reversing alarm and lights
 - Do not have workers working within 3 m of moving plant, such as rollers and graders water carts etc
 - Use a lookout person when plant is reversing near workers.
- Delivery vehicles:
 - Ensure that all delivery vehicles report to a designated location or person
 - Ensure that all delivery vehicles are fitted with working reversing alarms and lights
 - Ensure that where rigid, articulated and vehicles with dog trailers are tipping the ground is firm and relatively flat and there are no overhead powerlines that could contact with the tray of the vehicle
 - Ensure that people are well clear of tipping vehicles
 - Where vehicles are being unloaded by crane, ensure that workers not involved in the unloading are not within 3 metres of the area, there are no overhead powerlines that could contact the jib and a look-out is used when the crane is reversing.
 - If delivery vehicles are required to reverse near people, ensure that a look-out person is used.
- Revolving plant:
 - Ensure that exclusion zones are in place so workers are not working close to plant-like excavators to avoid being hit when the plant item revolves.

- Other plant:
 - Ensure that workers are not working within the area of influence of other plant items ie not working within the fall area of trees being pushed over by plant
 - Ensure adequate procedures are employed during night works especially relating to 'spot' lights on plant.

9.23.3 (Deleted)

9.23.4 (Deleted)

9.23.5 (Deleted)

9.23.6 Haulage

Haulage routes should be clearly defined and all workers shall be advised of their location. Workers on foot shall not be allowed to work on haulage routes. If workers are working near haulage routes, but not closer than 3 m, one or more of the following procedures shall be considered:

- Imposing a reduced speed limit on the route
- Installing designated crossing points and ensuring their location is advised to all workers and operators
- Varying the haulage route to move it away from the workers
- Clearly delineating the work area using barrier boards, plastic mesh fencing or similar and notifying the location of the workers to each driver of a haulage vehicle.

9.23.7 (Deleted)

9.23.8 (Deleted)

9.23.9 (Deleted)

9.23.10 (Deleted)

9.23.11 (Deleted)

9.23.12 Miscellaneous works

There are numerous activities that may be undertaken at a work site. Examples are:

- Concrete work
- Kerb and gutter extrusion
- Bitumen sealing
- Asphalt paving and milling
- Headwall construction
- Signposting
- Subsoil drainage construction
- Pipe laying
- Gabion basket and reno mattress work.

These activities may be carried out within 3 m of mobile plant performing other work or with plant helping with the work:

- In the first case where work is carried out within 3 m of mobile plant performing other work:
 - Protect the workers with use of barrier boards, plastic mesh, tape or similar so that the work location is highly visible to plant and vehicle operators.
- In the second case where plant is helping with the work:
 - Ensure that all delivery vehicles report to a designated location or person
 - When delivery vehicles are required to reverse near people ensure that they are fitted with an automatically activated, clearly audible and working reversing alarm and lights and a look-out person is used
 - Ensure that workers are not working within the area of influence of revolving plant-like excavators so that they can be hit when the plant item revolves
 - When using elevating platform vehicles ensure that the operator is qualified to use the item, it is supported on stable ground and there are no overhead power cables that could come into contact with the operator or platform
 - When using skid steer loaders and similar machines around workers, ensure that all workers are aware of the fact and that one of the workers is appointed to direct the activities of the machine. Because of the potential for conflict with workers on foot and skid steer loader operations, operators of these machines shall be given extra training in operating procedures near people on foot.

Table 9.4: Hazards and precautions to be taken when working on foot near moving plant

Hazard	Precautions to be taken	Work activity involved
Reversing plant	<ul style="list-style-type: none"> • Ensure that plant items are fitted with an automatically activated, clearly audible and working reversing alarm and lights • Preferably do not have workers working within 3 metres of moving plant, such as rollers • If the proximity of people to plant is unavoidable use a lookout person when the plant is reversing. The look-out person might be supplied with a whistle to attract attention of workers 	<ul style="list-style-type: none"> • Heavy patching • Excavation under traffic • Clearing and grubbing • Earthworks • Testing, surveying etc • AC paving • Bitumen sealing • Concrete paving • Kerb and gutter extrusion • Stabilising
Revolving plant	<ul style="list-style-type: none"> • Ensure that workers are not working close to plant like excavators such that they can be hit when the plant item revolves 	<ul style="list-style-type: none"> • Heavy patching • Excavation under traffic • Clearing and grubbing • Earthworks • Stockpiles

Hazard	Precautions to be taken	Work activity involved
Delivery vehicles	<ul style="list-style-type: none"> • Ensure that all delivery vehicles report to a designated location or person • If delivery vehicles are required to reverse near people ensure that they are fitted with working reversing alarms and lights and a look-out person is used. 	<ul style="list-style-type: none"> • Heavy patching • Excavation under traffic • Earthworks • AC paving • Bitumen sealing • Concrete paving • Kerb and gutter extrusion • Stabilising
Haulage vehicles eg dump trucks and scrapers etc	<ul style="list-style-type: none"> • Consider imposing a speed limit where workers are working near haulage routes • If required designated crossing points shall be installed and all workers and operators advised of their locations • The haulage route is to be varied to move it away from the workers • The work location is to be clearly delineated using barrier boards, plastic mesh fencing or similar and the location of workers advised to each driver of a haulage vehicle. 	<ul style="list-style-type: none"> • Haulage works • Earthworks

10 Portable traffic signals (AS1742.3 CI 4.11)

10.1 Introduction

This Section provides the basic information to effectively use portable traffic signals (PTS) to control traffic. It applies equally to both Roads and Maritime 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.

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

10.2 Delegated authority and legislation

Within Roads and Maritime, a person at or above the level of section manager has the delegated authority to authorise the installation of traffic control signals.

Outside of Roads and Maritime, councils have been given delegated authority to use PTS in specific situations. No other delegated authority has been given to other agencies or persons.

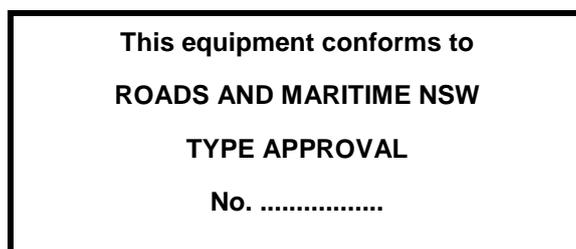
This means that public utility authorities and contractors working on public streets have no delegated authority in themselves to use PTS and will need to apply to Roads and Maritime for authorisation to do so.

A general condition applying to all delegations is that all PTS equipment used within NSW shall comply with Roads and Maritime TSI-SP-049 specification. This specification requires only equipment that has been type-approved by Roads and Maritime is to be used.

10.3 Specification and type approval

PTS systems shall be compliant to Roads and Maritime specification TSI-SP-049, *Traffic Signal Systems*.

Testing of equipment is to be undertaken by the Roads and Maritime's Intelligent Transport Systems Branch. After type approval has been issued, the manufacturer or selling agent shall affix, to the equipment, a durable marking plate in the following format:



The number shown on the marking plate shall be that shown on the type approval certificate issued by the Roads and Maritime's Intelligent Transport Systems Branch.

Arrangement for copies of the TSI-SP-049 and type approval testing should be directed to:

- "Roads and Maritime Traffic Equipment and Standards" at ITSHelpdesk@rms.nsw.gov.au
- A list of current type approved equipment can be found in Roads and Maritime specification TS200 (Register of ITS Field Equipment).

Type approved equipment is to be operated in accordance with this Section and the manufacturer's instructions. A record 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, see Table 10.7.

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

10.4 (Deleted)

10.5 Approvals

Before using PTS on a job, two approvals are required:

- Type approval of the equipment to Roads and Maritime, see Section 10.3, *Specification and type approval*
- 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 or generator
- Operational spares ie 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
- Remote manual control box.

10.6.1 Shuttle flow (AS1742.3 Cl 4.11.2 (a))

For shuttle working on a two-lane two-way road, one set of PTS 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 while the other faces a red display.

10.6.2 Plant crossing control

For heavy machinery crossing applications, one set of portable signals is required. This set is used to control traffic on the public road with 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 ie 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

TCPs 43 and 44 illustrate the example use of PTS.

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. 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. This should be clearly documented in the site-specific TMP and risk assessment. 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 thus imposes the penalty of longer all-red clearance times and increased traffic delays.

10.7.2 (Deleted)

10.7.3 Sight distance (AS1742.3 Cl 4.11.3)

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

In open road areas or higher speed environments where traffic signals might not be expected, a signal ahead (W3-3) sign with an appropriate distance (W8-5) sign should be provided to give advance warning. The position of these signs should take into account the expected queue length from traffic signals and the stopping distance required for heavy vehicles. Consideration should also be given to installing a portable VMS on each approach as an additional form of advance warning.

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. PTS complying with specification TSI-SP-049 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 whereby vertical adjustment is by adjusting the lantern on the stand and 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.

Table 10.1: Stopping sight distances for cars and laden trucks on level pavements

Vehicle speed (km/h)	Stopping sight distance (m)	
	Cars	Trucks
50	60	80
60	80	100
70	100	130
80	120	160

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 seconds or 5 seconds
- All-red time: pre-select in the range 2 seconds to 100 seconds for fixed-time and vehicle-actuated operation
- Maximum green time: pre-select in the range 20 seconds to 150 seconds for fixed-time and vehicle-actuated operation. The minimum green time is fixed at 15 seconds.

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

10.8.4 Communication

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

10.8.5 Vehicle detectors

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

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

Response of the microwave detector will be dependent 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 20 m to 5 m range from the unit
- Other larger motor vehicles moving within the 30 m to 5 m range from the unit.

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

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

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

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

An illustration of how the detectors work is given in *Figure 10-1*.

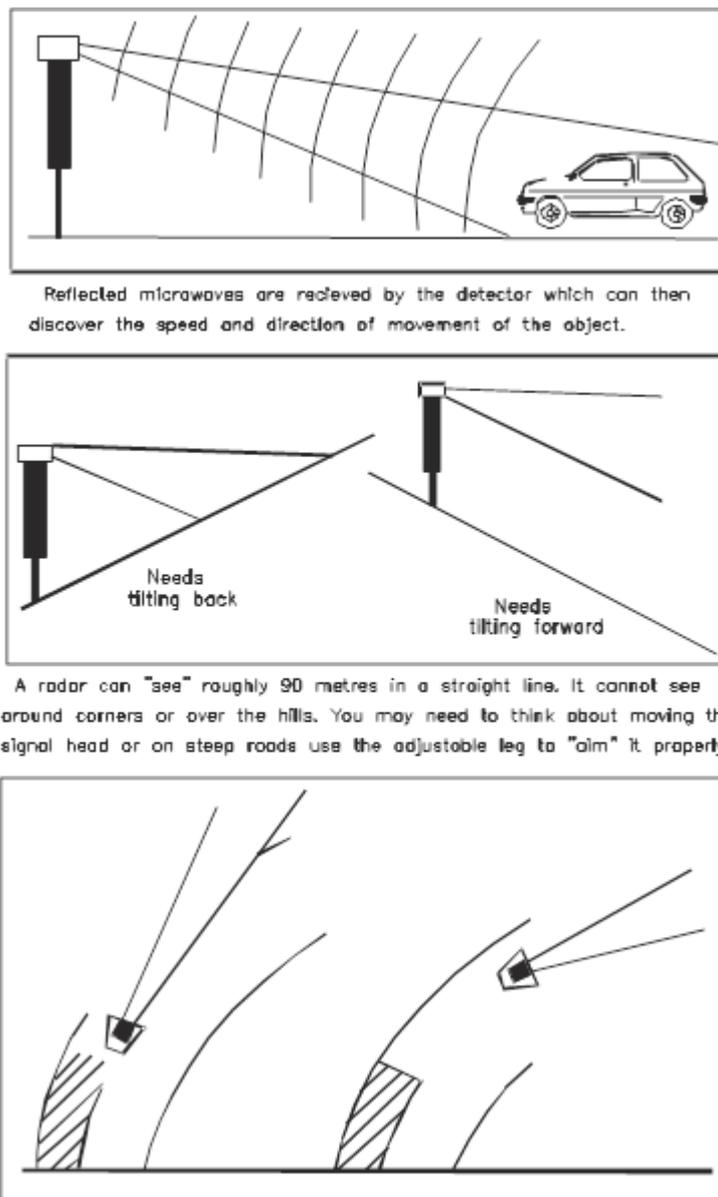


Figure 10-1: Illustration of microwave detector operation

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:

This Section does not replace the field service manual and operating instructions accompanying each set of equipment. It is most important that operators are 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:

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) (AS1742.3 Cl 4.11.2 (c))

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 either of the following occur:

- A risk assessment has demonstrated that use of portable traffic control device mitigates the risk associated with use of a manual traffic controller
- Movement of works traffic prevents the effective use of vehicle-actuated or fixed-time operation
- 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) (AS1742.3 Cl 4.11.2 (c))

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

Manual two-way operation is applicable when:

- All traffic needs to be stopped to allow the passage of traffic on a haul road
- 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 (AS1742.3 Cl 4.11.2 (a))

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

Vehicle-actuated operation is applicable when either of the following apply:

- Automatic control is required during working hours which allows the signals to operate unattended while still being responsive to changes in traffic flows
- Traffic control is required outside working hours so 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:

1. 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

2. After all phases have been called automatically for the first cycle, the signals will change only in response to vehicle demands
3. If vehicles approach consistently from only one direction, the controller holds the green display on that approach
4. When a vehicle is detected on another approach, the signals can change in one of two ways:
 - When vehicles approach the first phase as a steady stream, the phase holds for the 'maximum green' time before changing to the new approach
 - 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.

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 or approach which has not received a detector actuation for approximately 200 seconds.

10.10.4 Fixed-time operation (AS1742.3 Cl 4.11.2 (b))

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

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.

FT 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 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 can 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:

- Wait until a new vehicle joins the queue and actuates the detector
- Change to manual operation (once traffic is running again, the controller can be returned to vehicle-actuated operation)
- Wait until the controller (or detector) puts in an artificial demand ie 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 Roads and Maritime specification TSI-SP-049.

In the 'flashing yellow' mode, the red and green aspects remain blacked out, and all yellow aspects flash at a rate between 55 and 65 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 can 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 (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](#).

Table 10.2: General time setting

Mode	Operation	All red	Minimum green	Maximum green	Yellow
MAN/1	Shuttle	M	F	M	S
MAN/2	Two-way	M	F	M	S
FT	Fixed Time	S	F	S	S
VA	Vehicle Activated	S	F	S	S

Notes to [Table 10.2](#):

- 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.

Yellow time

Estimate approach speed. Select the yellow time from [Table 10.3](#).

Table 10.3: Yellow time setting

Approach speed	Yellow time
Below 70 km/h	4 seconds

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:

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.

Table 10.4: Initial signal time settings (low speed)

Distance between stop lines at traffic signals (m)	All red period* (seconds)	Maximum 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

*Note to *Table 10.4*: Based on a minimum clearance speed of about 20 km/h.

Table 10.5: Initial signal time settings (high speed)

Distance between stop lines at traffic signals (m)	All red period* (seconds)	Maximum 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

*Note to *Table 10.5*: Based on a minimum clearance speed of about 40 km/h.

10.11.3 Setting up

Set-up steps below are to be read in conjunction with the manufacturers requirements:

1. Set up stands with signal aspects facing oncoming traffic
 2. Connect controller to the generator and start generator
- DO NOT SWITCH CONTROLLER ON**
3. Set red and green times as required
 4. Select mode switch
 5. Ensure that the shuttle lane or haul road is clear and then switch on controller
 6. 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 Troubleshooting in VA mode

Details are shown in *Table 10.6*.

Table 10.6: Troubleshooting in VA mode

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

10.11.5 Examples

Site details

Work area 100 m long in a rural highway situation:

- Approach speeds 80 km/h
- Distance between stop lines 160 metres
- Minimum clearance speed 20 km/h.

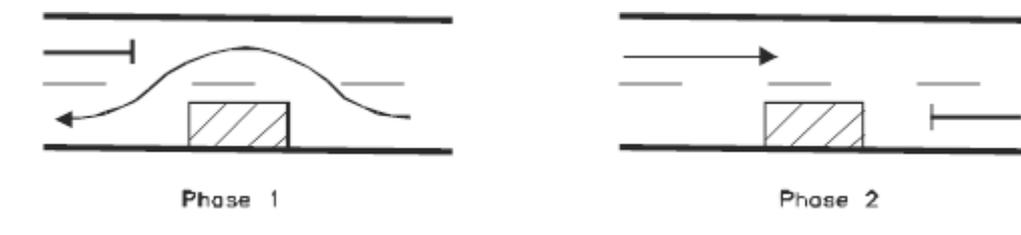


Figure 10-2: Illustration of site layout

Example of selecting times for “fixed-time” operation

1. From time setting instructions in Section [10.11.2](#) and [Table 10.3](#) and [Table 10.4](#), select initial controller settings:

Yellow 5 seconds

All-red 25 seconds

Max green:

- Phase 1 45 seconds
- Phase 2 45 seconds

2. 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 cycle	15	6

3. Adjust “maximum green” times for the two phases:

- Phase 1 – $15 \times 3 = 45$ seconds
- Phase 2 – $6 \times 3 = 18$ seconds (use the minimum setting of 20 seconds)

4. Check regularly that vehicles are not experiencing unnecessary delays due to incorrect settings.

Example of selecting times for “vehicle-actuated” operation

1. From time setting instructions in Section 10.11.2 and Table 10.3 and Table 10.4, select initial controller settings as for FT operation.
2. 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	45
• Second cycle	45	35
• Third cycle	45	30
3. Try extending the maximum green time for phase one by 5 to 10 seconds
4. If phase one is still running to its maximum green setting, repeat Step 3
5. 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 Roads and Maritime equipment

Maintenance is required on the various items of Roads and Maritime plant, for example:

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

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

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

Equipment problems, such as faulty wiring that can be corrected in the field may be rectified by a qualified electrician or radio service technician. 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:

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 10.7: Portable traffic signals, record of approval and use

Portable Traffic Signals Record of Approval and Use				
Approval: (To be completed by a person with delegated authority) Approval is given to the use of portable traffic signals which have been separately type approved to Roads and Maritime specification, TSI-SP-049 as detailed hereunder.				
Owner:		Signed:		
User:		Title:		
Project:		Date:		
Use: (To be completed by the Users representative)				
Job location:				
Portable signals in service				
Date	Time (24 hour)	Supervisors name, please print	Initials	Mode* of operation
This completed schedule should be kept by the relevant approving authority for a period of two years as a record of the display.				
*Note:				
<ul style="list-style-type: none"> • MAN/1 – Manual Shuttle Operation • MAN/2 – Manual Two-way Operation • VA – Vehicle Activated Shuttle Operation • FT – Fixed Time Shuttle Operation 				

11 Illuminated flashing arrow signs

11.1 Introduction (AS1742.3 Cl 3.12.2)

This Section provides the basic information to effectively use illuminated flashing arrow signs. These signs comprise a matrix of lamps or LED aspects 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 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. See Section 6, Record keeping and reporting for more information.

Flashing arrow signs are intended to be applied primarily where a lane is closed or a diversion of traffic is required, typically on a multi-lane 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.

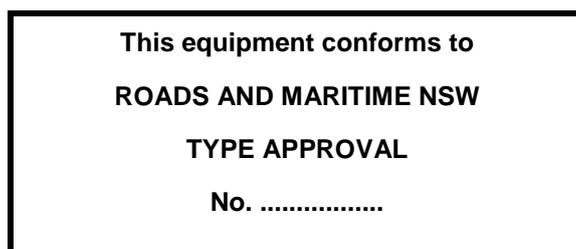
Note:

This Section does not replace the field service manual and operating instructions for each set of equipment. It is important that operators are fully acquainted with the manufacturer's instructions and recommendations before attempting to operate the equipment.

11.2 Approvals and specifications

Illuminated flashing arrow signs shall comply with the relevant Australian Standards, where they exist, and Roads and Maritime specifications TSI-SP-060, *Illuminated Flashing Arrow Signs*. The relevant Australian Standards are listed in TSI-SP-060. General operating instructions are given in this section.

Testing of equipment is to be undertaken by the Roads and Maritime's Intelligent Transport Systems Branch. After type approval has been issued, the manufacturer or selling agent shall affix, to the equipment, a durable marking plate in the following format:



The number shown on the marking plate shall be that shown on the type approval certificate issued by the Roads and Maritime's Intelligent Transport Systems Branch.

Arrangement for copies of the TSI-SP-060 and type approval testing should be directed to:

- "Roads and Maritime Traffic Equipment and Standards" at ITSHelpdesk@rms.nsw.gov.au
- A list of current Type Approved equipment can be found in Roads and Maritime specification TS200 (Register of ITS Field Equipment).

11.3 (Deleted)

11.4 General description of system

11.4.1 Illuminated flashing arrow sign equipment

The following three size designations are used.

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 11.1:

Table 11.1: Modes of operation

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 to Table 11.1:

- – Lamp off
- ■ Lamp on

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 reflective 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 must 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 m, 1000 m and 1500 m 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 can be obscured by alignment, buildings or heavy traffic. The use of larger signs may be considered for high approach speeds.

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 trigger the dimming facilities.

The flash rate for flashing arrow displays (AL, AR, and DA) can vary from 50 to 60 per cent on-time and 50 to 40 per cent 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 11.1](#).

11.5.2 Sign boards

Generally, the flashing arrow sign unit should be positioned so as to be as near as possible in the driver's line of sight. It is important to always locate signs to give the driver maximum visibility and 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 11.2](#). 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 11.2](#) 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:

Table 11.2: Typical sight distances for placement of flashing arrow signs

Sign type	Visibility distance (m)	Sight distance	
		Desirable minimum	Absolute minimum
A	500	250	150
B	1000	500	300
C	1500	750	450

Note to [Table 11.2](#):

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

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 11.3 lists the recommended aiming distances from the sign near the start of the taper defining the lane closure:

Table 11.3: Aiming distances for various approach speeds

Approach speed (km/h)	Aiming distance (m)		
	A	B	C
< 60	60	120	180
60	100	200	300
80	140	280	420
100	200	400	600
> 100	260	520	780

Notes to Table 11.3:

- 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 are not usually used on low speed roads.

Figure 11-1, Illustration of aiming and sight distance shows the relationship between these two distances used when setting up flashing arrow signs:

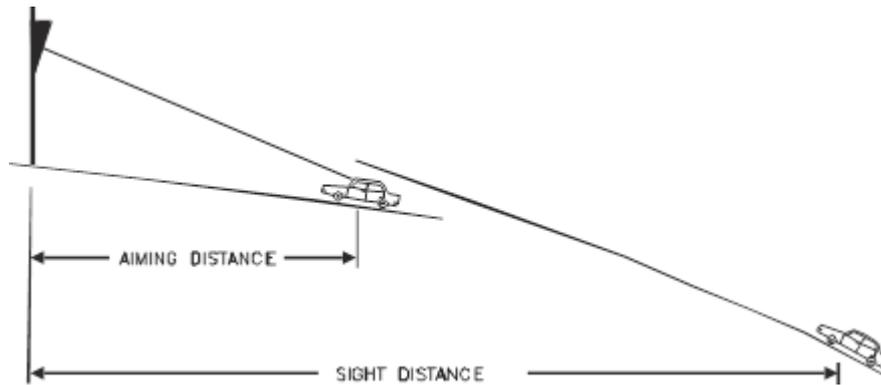


Figure 11-1: Illustration of aiming and sight distance

11.5.3 Controls

The controls available are:

- Power: On/Off
- Mode selection
- Mode monitoring (Type C signs only).

11.6 Operation

11.6.1 Control modes

Although the layout and switch configuration can 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 the specifications 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 or vehicle headlights falling on the photocell does not adversely interfere with the operation of the dimming feature. The photocell should be occasionally cleaned to maintain brightness.

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, check it and if it is blown, replace it with a new lamp. If all lamps are out or all lamps are too dim for the conditions, check the battery or generator for charge. If the charge is satisfactory, but the lamps are still too dim for the conditions, check 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 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

See local office procedures in respect of administration, costing and maintenance of flashing arrow signs as an item of small plant.

Appendix A Typical uses of TCPs

A1 Introduction

This Appendix contains example TCPs and it will assist a qualified person in selecting the most appropriate TCP for the circumstances. The example TCP will show what type of traffic control is necessary for your work situation, and what devices and signs to use as a minimum. A TCP must be approved for use by a person qualified in Prepare Work Zone Traffic Management before it can be implemented on a site, and should always be supported by TMP and / or risk assessment.

There are example TCPs for short term, long term and mobile work. There are no TCPs for intermittent work. Section 9.1, *Intermittent work and low impact works* describes the relevant requirements.

A2 Finding a suitable example 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.

Selection of an example TCP should occur after the TMP and risk assessment have been developed as the following information will have been identified and considered:

- 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 an example TCP:

- Section 4.3, Selecting example TCPs, gives guidance on responsibilities.
- Table A–1 is an index of work situations. It indicates either the relevant example TCP or the next table to examine.
- Tables A–2 to A–17 show which example 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 example TCPs.
- If Tables A–1 to A–17 do not mention your work, use Table A–18 to select a suitable example TCP by matching the details of your work situation with those on the TCPs in *Appendix D*.

If, after considering the requirement and risks documented in the TMP/Risk Assessment, it is considered that none of the example TCPs are suitable, refer to Section 5, *Designing new traffic control plans (TCP)* and Section 9, *Specific situations*.

Abbreviation	Meaning
A	Traffic goes around the work area
AV	Advance warning vehicle
Div	Divided carriageway
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 Appendix A

Note: Refer to Section [2.3 Definitions](#) for additional information if necessary.

Table A-1: Typical work activities and situations

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 <i>Lane closures</i>	Appendix A	Tables A-2 & A-3
Deflectograph and FWD testing	Appendix A	Table A-10
Drainage maintenance	Appendix A	Table A-7
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
Guard fence – 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

Work	Reference	
Machine patching, see Short term lane closure	Appendix A	Table A–2
Mechanical testing – Deflectograph and FWD	Appendix A	Table A–10
Mowing – ADT less than 1500	Appendix D	TCP 97
Patching, hand	Appendix A	Table A–6
Patching, machine – see <i>Short term lane closures</i>	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 <i>Drainage maintenance</i>	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
Weed spraying	Appendix D	TCP 76
Weight restriction	Appendix D	TCP 49

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 47 Full road closure - blasting 77 Up to 5 mins, ADT > 3,000 78 Up to 5 mins, ADT < 3,000 83 ADT > 1,500 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: <ul style="list-style-type: none"> 81 Traffic through work area 91 Traffic using opposing lane 826 Traffic using opposing fast lane In direction with two lanes: <ul style="list-style-type: none"> 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-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	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	52
			60	At urban intersection	96	Bitumen sealing in one lane
Middle					52	Carriageway closed
Fast		89	Chicane		52	Carriageway closed

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	67 Snow clearing 76 Weed spraying 451 Testing	In direction with one lane: <ul style="list-style-type: none"> • 71 General work • 452 Testing In direction with two lanes: <ul style="list-style-type: none"> • 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-5: TCPs for restoration and reconstruction

Lane	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
Left	43L Temporary traffic signals 45L Traffic diverted to shoulder 50L One lane side track 51L Two lane side track 53L One direction urban detour 54L All traffic detour – urban 60L At urban intersection 439L Give way signs 440S/L Traffic in work area		46L Shift centre line	52L Carriageway closed – side track crosses median
Middle			46L Shift centre line	52L Carriageway closed, side track crosses median
Fast		89S/L Chicane		52L Carriageway closed, side track crosses median

Notes to Table A-5:

- Use TCP 57 for roadwork speed limits
- Use TCP 195 for access to depots and gravel pits etc.

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	41S D < 60 km/h 77S ADT > 3,000, up to 5 mins 78S ADT < 3,000 108S ADT < 1,500 437S ADT ≥ 1500 Over 5 mins 831 Intermittent work	In direction with one lane: <ul style="list-style-type: none"> • 71M General work with TC • 81S Traffic through work area • 91S Traffic around work area In direction with two lanes: <ul style="list-style-type: none"> • 69M No delay in fast lane • 86S No delay in fast lane • 88S Occasional delay in fast lane 	74M No delay in fast lane	72M General work 92S No delay in fast lane
Middle				107M General work
Fast		70M General work without TC 80S Traffic controller 89S/L Chicane		82S ADT < 10,000, up to 5 mins 94S Over 5 mins 73M Wide median 75M Narrow median

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	41S D < 60 km/h 61S Footway closed 83S ADT > 1,500 84S ADT < 6,000 108S ADT < 1,500 42L Shoulder closed 45L Lane closed 50L Side track 51L Side track 60L At intersection 109L Footway closed 40M Clear of traffic	In direction with one lane: <ul style="list-style-type: none"> • 91S Traffic around work area In direction with two lanes: <ul style="list-style-type: none"> • 86S No delay in fast lane • 88S Occasional delay in fast lane 	46L Shift centre line 101S Slow lane work	92S No delay in fast lane 93S Occasional delay in fast lane 52L Carriageway closed
Middle				100S Traffic around work area 52L Carriageway closed
Fast		90S Traffic controllers 89S/L Chicane	102S Chicane 103S Both fast lanes	94S Traffic around work area 52L Carriageway closed

Table A-8: TCPs for Benkelman beam testing

Lane	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
Left	104S	In direction with one lane: <ul style="list-style-type: none"> • 91S In direction with two lanes: <ul style="list-style-type: none"> • 86S • 69M • 450M 	101S 74M	92S 72M
Middle				100S 107M
Fast		89S 70M	102S Chicane 103S 453M	94 73M

Table A-9: TCPs for bituminous surfacing

Width	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
One lane	95S D ≤ 60 km/h			96L All speeds, minor delay
Full width	56L ADT < 5,000 and D < 60 km/h 353L ADT > 5,000 and D > 80 km/h			

Table A- 10: TCPs for Deflectograph and FWD testing

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: <ul style="list-style-type: none"> • 452 In direction with two lanes: <ul style="list-style-type: none"> • 450 	445	448
Middle				446
Fast		449	447	444

Table A-11: TCPs for raised pavement markers and spotting

Lane	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
Left	77S ADT ≥ 3,000 78S ADT < 3,000 79M	In direction with one lane: 81S 71M In direction with two lanes: 80S 69M	74M	62M
Right Edge				82S 63M
Centre	108S ADT < 1,500 437S ADT > 1,500 106M	116M		
Lane		70M 80S		62M 75M 107M 82S

Table A-12: TCPs for kerb and gutter works

Location	TCP
Left side	42L Shoulder closed 45L Kerbside lane closed 53L Detour 60L At intersection 61S Footway closed 109L Footway closed
Median	94 Fast lane closed

Table A- 13: TCPs for line marking

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-14: TCPs for shoulder works

Work type	TCP
Short term	41 D < 60 km/h
	77 Minor traffic delay, ADT ≥ 3,000
	78 Minor traffic delay, ADT < 3,000
	97 Mowing
	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

Note to Table A-14:

- Typical uses of this table include: signs, guideposts, safety barriers, batters, grading, mowing, etc.

Table A-15: TCPs for traffic signal works

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/routine maintenance, no lane blocked 822A Short term emergency maintenance 822B Short term/routine maintenance, no lane blocked
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/routine maintenance, no lane blocked 822A Short term emergency maintenance 822B Short term/routine maintenance, no lane blocked
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 – median side lane > 80 minutes

Notes to Table A-15:

- 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 making request. Advise Supervisor when return to depot.
- Pedestrian crossings should not be blocked. If necessary, provide alternative crossing or assistance.
- For loop marking, use of a shadow vehicle with flashing lights ON to protect staff marking out loop is considered adequate.
- Reduced size signs will be used.
- 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.

Table A- 16: TCPs for surveying

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- 17: TCPs for roundabouts

Location	Traffic control
Kerb side lane	827S 4 lane/2 way
Median lane	828S 4 lane/2 way
Single lane approach	829S up to 10 minutes delay
Multilane approach	830S roundabout lane closure

Table A-18: Main features of example TCPs

TCP No	Lanes	Div or Un	ADT ^α	Where on the road is the work area?	Short (S) or long term (L), or mobile work (M)?	Around (A), past (P) or through (T) the work area?	Main type of traffic control ^β
40	2	Un	No limits	Clear of travel lanes	M	A	Signs
41	2	Un	No limits and D < 60 km/h	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

TCP №	Lanes	Div or Un	ADT ^α	Where on the road is the work area?	Short (S) or long term (L), or mobile work (M)?	Around (A), past (P) or through (T) the work area?	Main type of traffic control β
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
56	2	Un	< 5,000	Full width	L	T	TC
57	2	Un	No limits	Various	S & L	T	Speed Zone

TCP №	Lanes	Div or Un	ADT ^α	Where on the road is the work area?	Short (S) or long term (L), or mobile work (M)?	Around (A), past (P) or through (T) the work area?	Main type of traffic control β
58	4	Un	No limits	Lane line	M	A	LV & AV
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

TCP №	Lanes	Div or Un	ADT ^α	Where on the road is the work area?	Short (S) or long term (L), or mobile work (M)?	Around (A), past (P) or through (T) the work area?	Main type of traffic control β
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 ^z	No limits	Right lane	M	A	SV & AV
74	4	Un	No limits	In left lane or on left edge line	M	A	SV & AV
75	4	Un ^δ	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

TCP №	Lanes	Div or Un	ADT ^α	Where on the road is the work area?	Short (S) or long term (L), or mobile work (M)?	Around (A), past (P) or through (T) the work area?	Main type of traffic control β
78	2	Un	< 3,000	In lane, or edge line or on shoulder	S	T	TC
79	2	Un	No limits	In lane	M	A	SV & AV
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	> 1,500	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 occasionally moving in and out of fast lane	S	A	TC

TCP №	Lanes	Div or Un	ADT ^α	Where on the road is the work area?	Short (S) or long term (L), or mobile work (M)?	Around (A), past (P) or through (T) the work area?	Main type of traffic control β
89	3	Un	No limits	In fast lane	S & L	A	Signs
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	NA	< 1500	Mowing, shoulders and verges	S	A	Signs

TCP №	Lanes	Div or Un	ADT ^α	Where on the road is the work area?	Short (S) or long term (L), or mobile work (M)?	Around (A), past (P) or through (T) the work area?	Main type of traffic control β
99	2	Un	No limits	Shoulders and earth drains	S	A	Signs
100	6	Un	No limits	In middle lane	S	A	Signs
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	No limits	On centre line	M	A	TC, LV & AV
107	6	Div	No limits	Kerb lane restricted and middle lane closed	M	A	AV & SV

TCP №	Lanes	Div or Un	ADT ^α	Where on the road is the work area?	Short (S) or long term (L), or mobile work (M)?	Around (A), past (P) or through (T) the work area?	Main type of traffic control β
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
116	3	Un	No limits	Centre line, fast lane	M	A	AV, TC & SV
195	na	Na	No limits	Work vehicles turning on and off	S & L	na	Signs

TCP №	Lanes	Div or Un	ADT ^α	Where on the road is the work area?	Short (S) or long term (L), or mobile work (M)?	Around (A), past (P) or through (T) the work area?	Main type of traffic control β
353	2	Un	≥ 5,000 & D > 80 km/h	Full width of road	L	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

Notes to Table A-18:

^α Lane closures and similar temporary arrangements can 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 can 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 example TCP.

Appendix B Sign faces

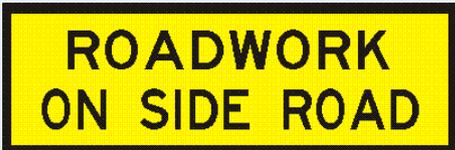
For sign sizes and layouts refer to:

- Roads and Maritime website Traffic Signs Register
- AS1743
- The relevant Table in AS1742.3, as shown on the following pages

References under the REMARKS column on the following pages refer to the relevant Section(s) in this Manual or the Clause in AS 1742.3.

Table B-1: Signs for work site approaches and departures

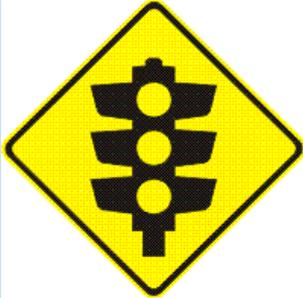
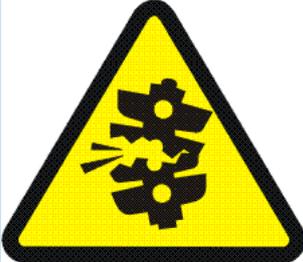
Description	Sign	Number	Remarks
ROADWORK AHEAD		t1-1	AS 1743
ROAD WORK AHEAD		t1-31	AS 1743
ROADWORK 1km AHEAD		t1-16	AS 1743
BRIDGEWORK AHEAD		t1-2	AS 1743
BRIDGEWORK 1km AHEAD		t1-29	AS 1743
Workers (symbolic) aka: WORKMEN SYMBOLIC		t1-5	AS 1743 Day-time use: Black symbol and border on fluorescent red or orange ground. Night-time use: Black symbol and border on orange retroreflective ground.

Description	Sign	Number	Remarks
ROAD PLANT AHEAD (3 lines)		t1-3-1	AS 1743
ROAD PLANT AHEAD (2 lines)		t1-3-2	AS 1743
GRADER AHEAD		t1-4	AS 1743
ROADWORK ON SIDE ROAD		t1-25	AS 1743
ROAD PLANT ON SIDE ROAD		t1-27	AS 1743
SIDE ROAD CLOSED		t1-32	AS 1743 AS1742.3 - 2009
NEXT 2km		t1-28	AS 1743
END ROADWORK		t2-16	AS 1743

Description	Sign	Number	Remarks
SHOULDER CLOSED		t2-19	Roads and Maritime
EXIT CLOSED		t2-20	Roads and Maritime
Brown St EXIT CLOSED USE ALTERNATIVE ROUTE		t2-21-1	Roads and Maritime

Table B-2: Signs for regulatory control of traffic

Description	Sign	Number	Remarks
PREPARE TO STOP		T1-18	AS 1743
TRAFFIC CONTROLLER (Symbolic)		T1-34	AS 1743
STOP Banner SLOW (bat)		R6-8(STOP) T7-1(SLOW)	AS 1743
STOP Banner		R6-8(STOP) T7-204(40)	AS 1743
GIVE WAY		R1-2	AS 1743
GIVE WAY SIGN AHEAD (symbolic)		W3-2	AS 1743

Description	Sign	Number	Remarks
ONE LANE		R9-9	Roads and Maritime
NO OVERTAKING OR PASSING		R6-1	AS 1743
TRAFFIC LIGHTS (symbolic)		W3-3	AS 1743
STOP HERE ON RED SIGNAL		R6-6	AS 1743
TRAFFIC SIGNALS OUT OF ORDER (symbolic)		T1-220	Roads and Maritime

Description	Sign	Number	Remarks
SPEED LIMIT (symbolic)		R4-1-100	AS 1743
SPEED LIMIT (symbolic)		R4-1-60	AS 1743
ROAD WORK		R4-3	AS 1743
Speed limit (as required) ROAD WORK		R4-212	Roads and Maritime

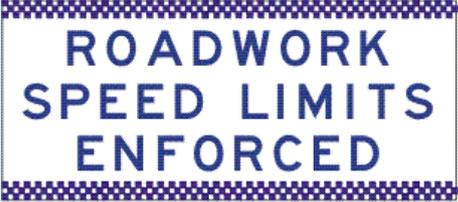
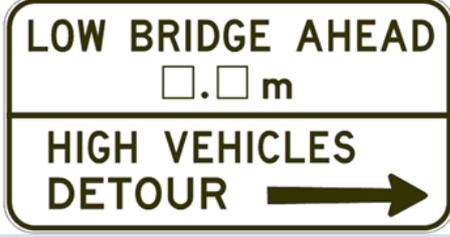
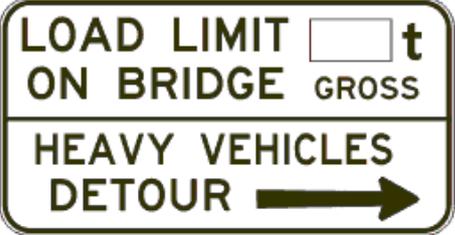
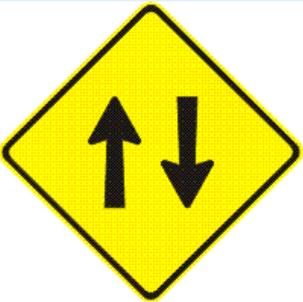
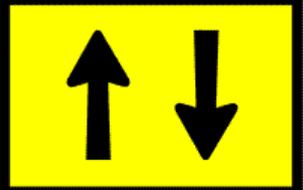
Description	Sign	Number	Remarks
Speed Limit AHEAD		G9-79	AS 1743
ROADWORK SPEED LIMITS ENFORCED		T4-216	Roads and Maritime

Table B-3: Signs for detours

Description	Sign	Number	Remarks
DETOUR AHEAD		T1-6	AS 1743
END DETOUR		T2-23	AS 1743
DETOUR (left arrow)		T5-1 (L)	AS 1743
DETOUR (right arrow)		T5-1 (R)	AS 1743
ARROW MARKER		T5-6	AS 1743
LOW BRIDGE AHEAD _ . _ m HIGH VEHICLES DETOUR - Left		G9-3(L)	AS 1743
LOW BRIDGE AHEAD _ . _ m HIGH VEHICLES DETOUR - Right		G9-3(R)	AS 1743

Description	Sign	Number	Remarks
LOAD LIMIT ON BRIDGE __t GROSS HEAVY VEHICLES DETOUR - Left		G9-4(L)	AS 1743
LOAD LIMIT ON BRIDGE __t GROSS HEAVY VEHICLES DETOUR - Right		G9-4(R)	AS 1743
DETOUR FOR HIGH VEHICLES (left ID sign)		G9-5-1(L)	AS 1743
DETOUR FOR HIGH VEHICLES (right ID sign)		G9-5-1(R)	AS 1743
DETOUR FOR HEAVY VEHICLES (left ID sign)		G9-5-2(L)	AS 1743
DETOUR FOR HEAVY VEHICLES (right ID sign)		G9-5-2(R)	AS 1743
HEAVY VEHICLES PREPARE TO STOP (fixed and hinged)		G9-232	Roads and Maritime
Roads and Maritime Services INSPECTORS 500m AHEAD (hinged)		G9-233	Roads and Maritime

Description	Sign	Number	Remarks
HEAVY VEHICLE INSPECTION BAY 1km		G9-260	Roads and Maritime
HEAVY VEHICLES STOP IF DIRECTED ____m		G9-262	Roads and Maritime
HEAVY VEHICLE INSPECTION (left angled arrow)		G9-263	Roads and Maritime
HEAVY VEHICLES STOP IF DIRECTED 300 m (with Roads and Maritime Services logo)		G9-265	Roads and Maritime
Two Way (symbolic)		W4-11	AS 1743
ONE LANE EACH WAY (Symbolic)		T2-24	AS 1743

Description	Sign	Number	Remarks
ALL TRAFFIC (Left - symbolic) ONLY		R2-14(L)	AS 1743
ALL TRAFFIC (Right - symbolic) ONLY		R2-14(R)	AS 1743

Table B-4: Signs for road conditions

Description	Sign	Number	Remarks
LINE MARKING AHEAD		T1-15	Roads and Maritime
WATER OVER ROAD		T2-13	AS 1743
CYCLE HAZARD GROOVED ROAD		T2-207	Roads and Maritime
WET PAINT ON ROAD		T2-237	Roads and Maritime
SLIPPERY (symbolic)		T3-3	AS 1743
SOFT EDGES		T3-6	AS 1743

Description	Sign	Number	Remarks
ROUGH SURFACE		T3-7	AS 1743
LOOSE STONES - AVOID WINDSCREEN DAMAGE (symbolic)		T3-9	AS 1743
NEW WORK NO LINES MARKED		T3-11	AS 1743
NO LINES DO NOT OVERTAKE UNLESS SAFE		T3-12	AS 1743
GRAVEL ROAD		T3-13	AS 1743
LOOSE SURFACE		T3-14	AS 1743
X km/h (portrait)		T3-16-1	AS 1743

Description	Sign	Number	Remarks
X km/h (landscape)		T3-16-2	AS 1743
WET BITUMEN		T3-216	Roads and Maritime
BITUMEN SPRAYING/POSSIBLE SHORT DELAY		T3-217	Roads and Maritime
DANGER GAS NO SMOKING		T4-4	AS 1743
POWER LINE WORKS IN PROGRESS		T4-5	AS 1743
SMOKE HAZARD		T4-6	AS 1743
START OF OIL SPILL		T4-214	Roads and Maritime
END OF OIL SPILL		T4-215	Roads and Maritime

Description	Sign	Number	Remarks
GRASS CUTTING		T6-201N	Roads and Maritime
WEED SPRAYING		T6-207N	Roads and Maritime
SNOW CLEARING		T6-233N	Roads and Maritime

Table B-5: Signs for lane and road closures

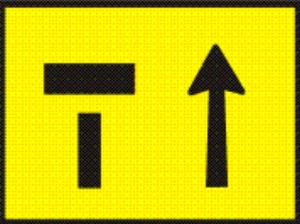
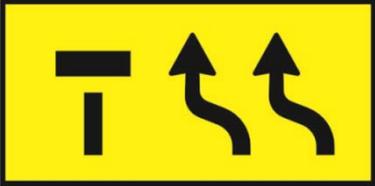
Description	Sign	Number	Remarks
ROAD CLOSED		T2-4	AS 1743
PART ROAD CLOSED		T2-5	AS 1743
LEFT LANE CLOSED (Symbolic - 1 lane in direction of travel)		T2-6-1	AS 1743
LEFT LANE CLOSED (symbolic - 2 lanes in direction of travel)		T2-6-2	AS 1743
			Roads and Maritime
			Roads and Maritime

Table B-6: Signs for delineating and indicating the travelled path

Description	Sign	Number	Remarks
HAZARD WARNING MARKER		T5-4	AS 1743
HAZARD WARNING MARKER		T5-5	AS 1743
LANE CLOSED (over hazard marker - left)		T2-235(L)	AS 1743
LANE CLOSED (over hazard marker - right)		T2-235(R)	AS 1743
LINE MARKING (left chevrons)		T6-1(L)	AS 1743
LINE MARKING (right chevrons)		T6-1(R)	AS 1743
LINE MARKING AHEAD		T1-15	Roads and Maritime

Table B-7: Signs for blasting and pedestrian control

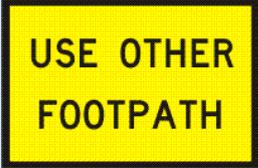
Description	Sign	Number	Remarks
BLASTING STOP AWAIT SIGNAL		T4-1	Roads and Maritime
END BLASTING AREA		T4-3	AS 1743
BLASTING AREA SWITCH OFF RADIO TRANSMITTERS AND MOBILE PHONES		T4-7	AS 1743
PEDESTRIANS WATCH YOUR STEP		T8-1	AS 1743
PEDESTRIANS (left arrow)		T8-2(L)	AS 1743
PEDESTRIANS (right arrow)		T8-2(R)	AS 1743
USE OTHER FOOTPATH		T8-3	AS 1743
FOOTPATH CLOSED		T8-4	AS 1743
LOOK BOTH WAYS, TWO WAY TRAFFIC		T8-5	AS 1743

Table B-8: Signs for vehicle height and mass restrictions

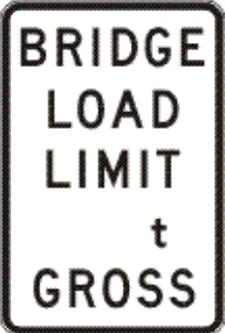
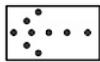
Description	Sign	Number	Remarks
BRIDGE LOAD LIMIT __t GROSS		R6-3	AS 1743
LOW CLEARANCE _ . _ m		R6-11	AS 1743
CLEARANCE _ . _ m		R6-12	AS 1743
LOW CLEARANCE __. __m		W4-8	AS 1743

Table B-9: Other signs

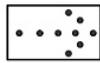
Description	Sign	Number	Remarks
TRAFFIC HAZARD		T1-10	AS 1743
TRAFFIC ACCIDENT AHEAD		T1-11	Roads and Maritime
Trucks (Crossing or entering) (Symbolic)		T2-25	AS 1743
Trucks (Crossing or entering) (Symbolic)		W5-22	AS 1743
xx m		W8-5	AS 1743
xx m ON LEFT		W8-207(L)	Roads and Maritime

xx m ON RIGHT		W8-207(R)	Roads and Maritime
STOP		R1-1	AS 1743
Traffic Signal STOP		R1-4	Roads and Maritime

Appendix C Standard symbols



Flashing Arrow Sign (Left)



Flashing Arrow Sign (Right)



Separation Line



Single Barrier Line – (BS)



Double Barrier Line – (BB)



Edge Line



Traffic Cones



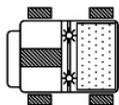
Delineators



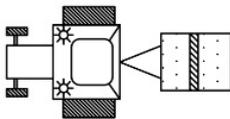
Grader or Snow Plough
(with flashing yellow lamps)



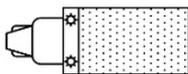
Work Vehicle and Trailer
(with flashing yellow lamps)



Linemaker
(with flashing yellow lamps)



Tractor with Mower
(with flashing yellow lamps)



Work Vehicle or Truck
(with flashing yellow lamps)

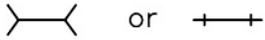


Work Area

Figure A-1: Standard Symbols 1



Antiglare screen



Barrier Board Position



Barrier Board



Daytime Strobe



Flashing Yellow Lamps
(for sign mounting)



Rotating Flashing Yellow Lamps
(for vehicle mounting)



Traffic Controller



Sign - single sided



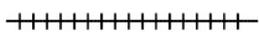
Sign - double sided



Traffic Signal Position

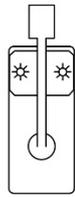


Traffic Signal Display



Pedestrian Containment Fencing

Figure A-2: Standard symbols 2



EPV



Ladder



Mastarm with Lante

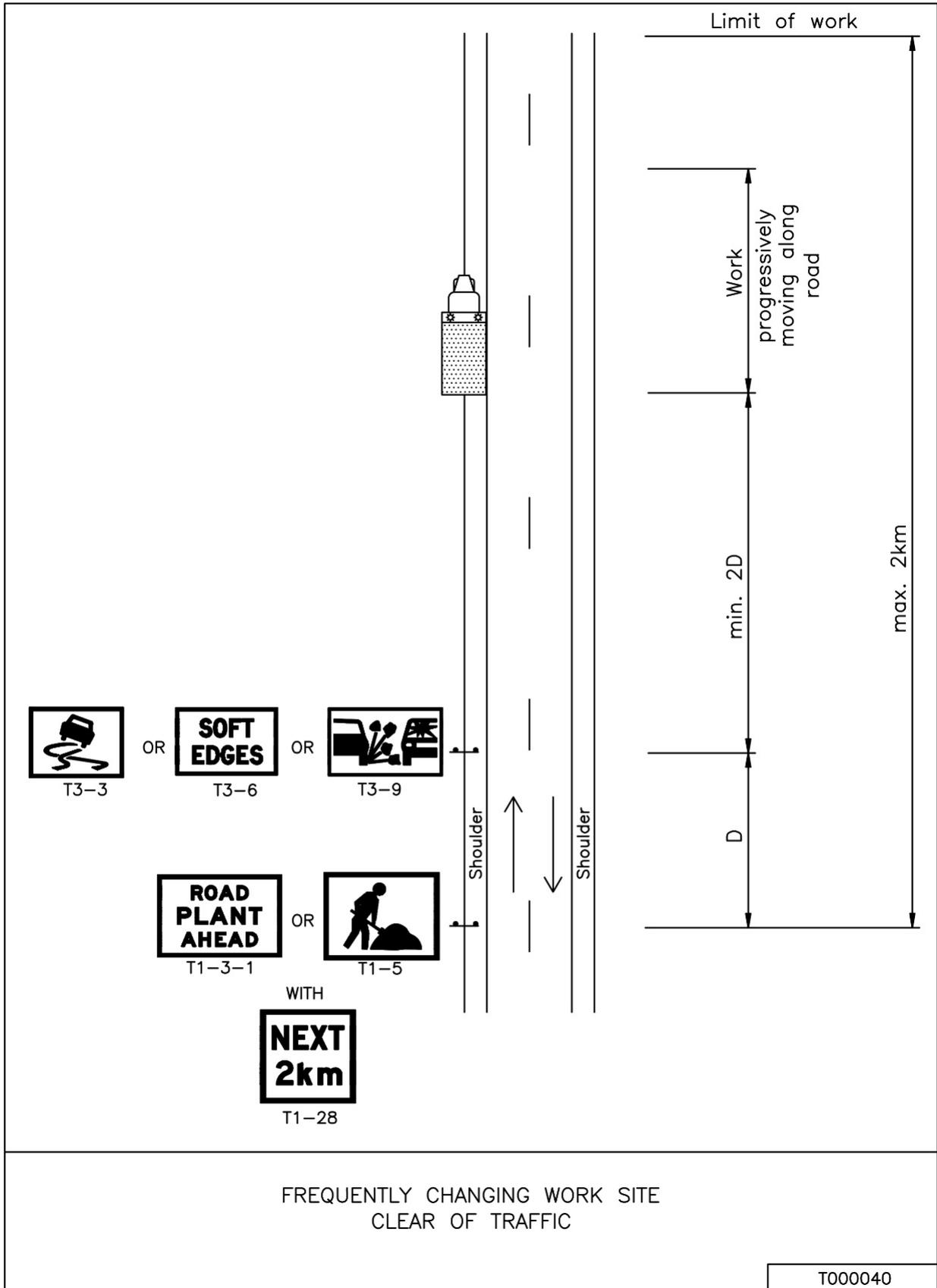
Figure A-3: Standard symbols 3

Appendix D Example traffic control plans

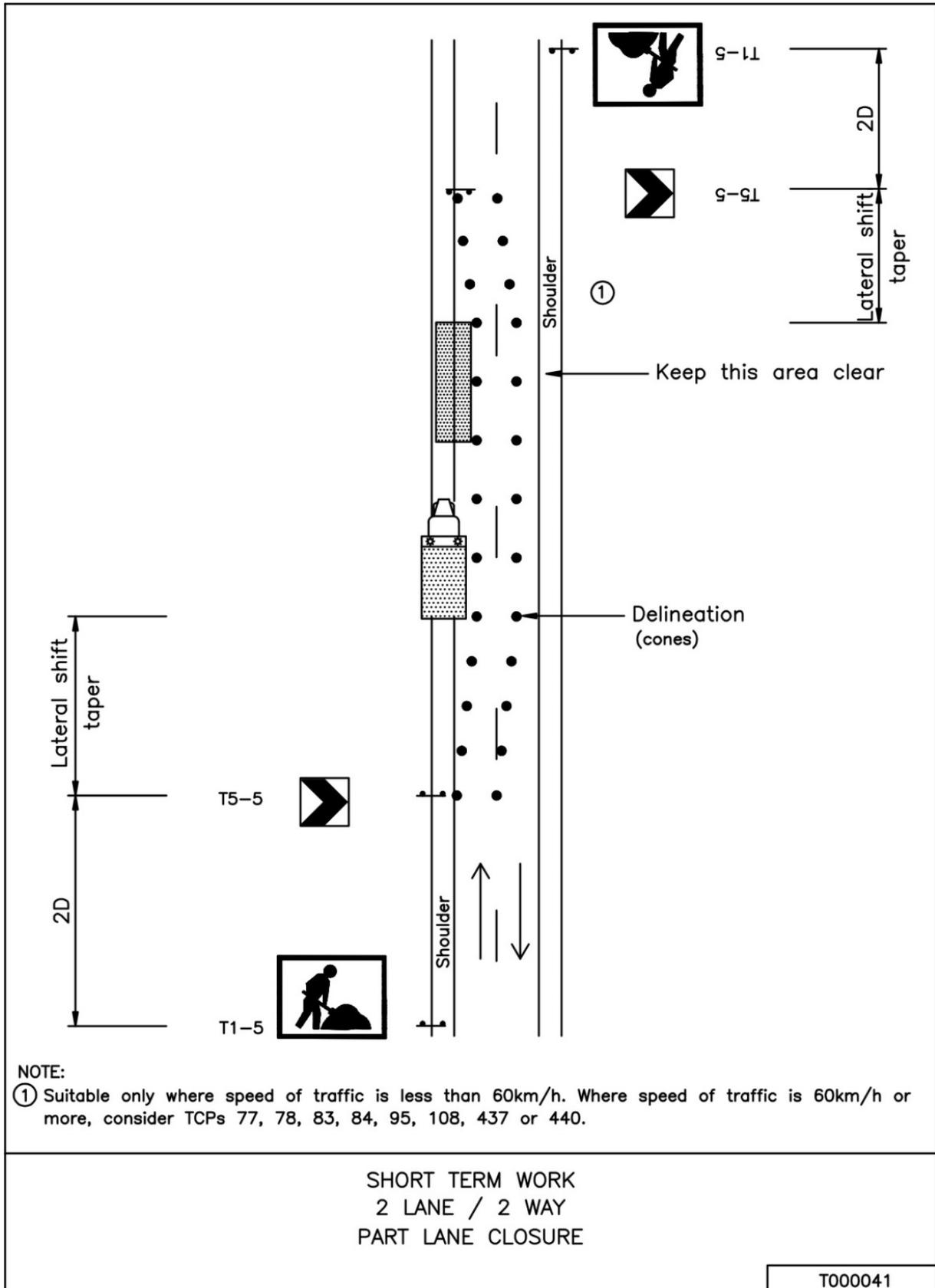
To assist in the assessment of risk at traffic control work sites this checklist has been devised and is to be used as follows: -

- An example TCP is to be selected or a new TCP designed for the work to be undertaken
- The checklist 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.

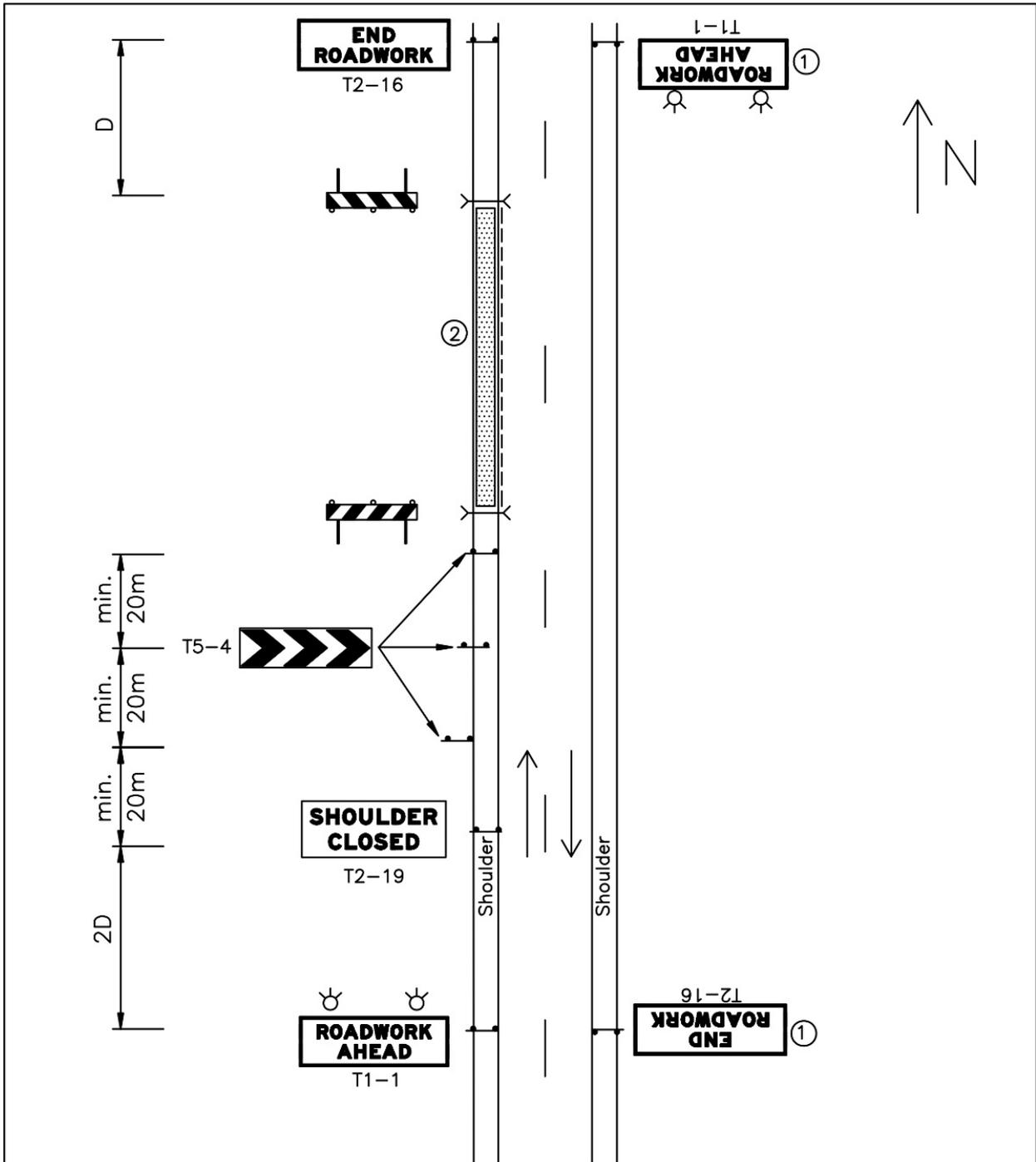
TCP 40



TCP 41



TCP 42



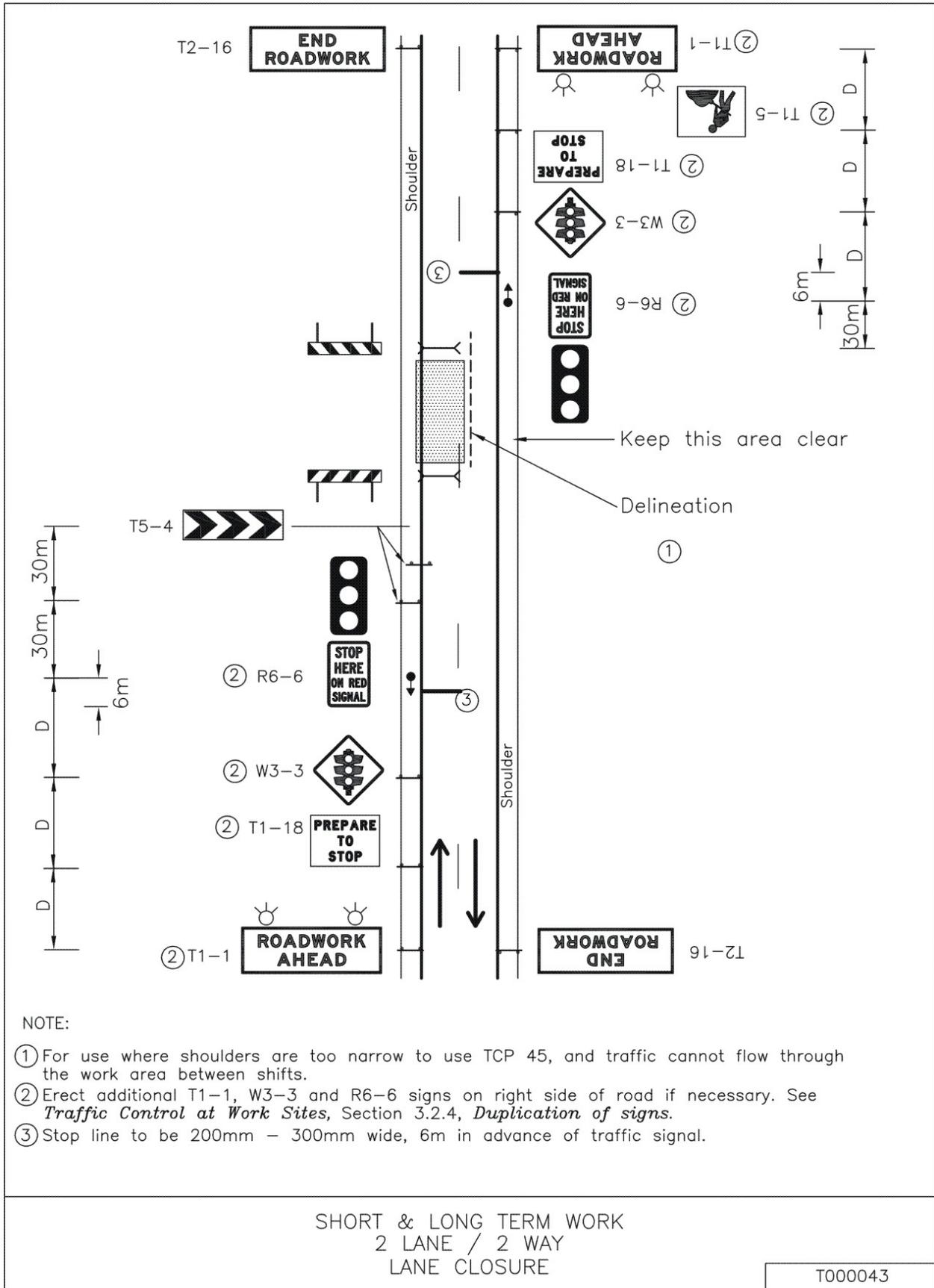
NOTE:

- 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 may be erected along the work site at right angles to the traffic flow.

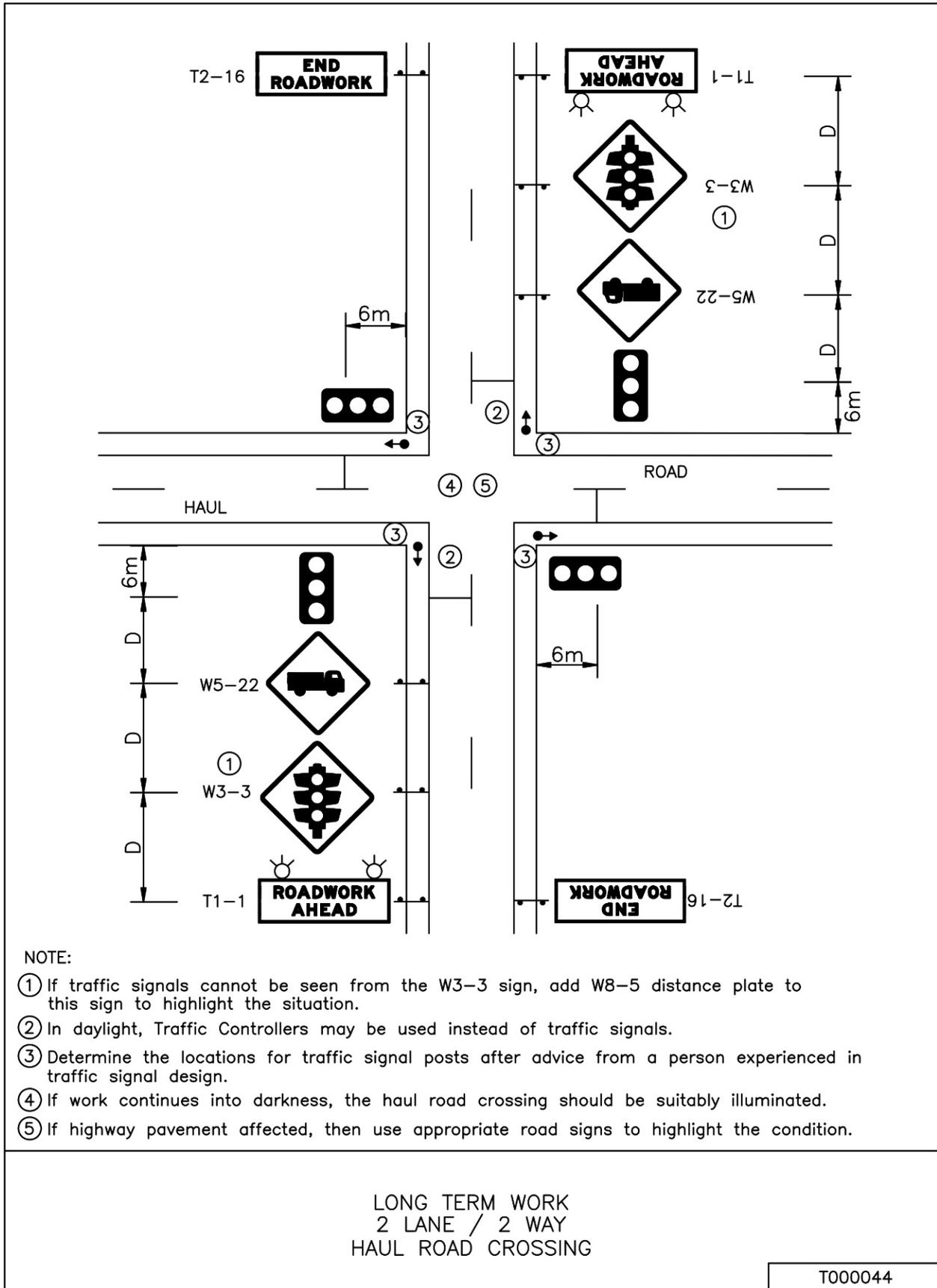
LONG TERM WORK
ALL ROADS
SHOULDER CLOSED

T000042

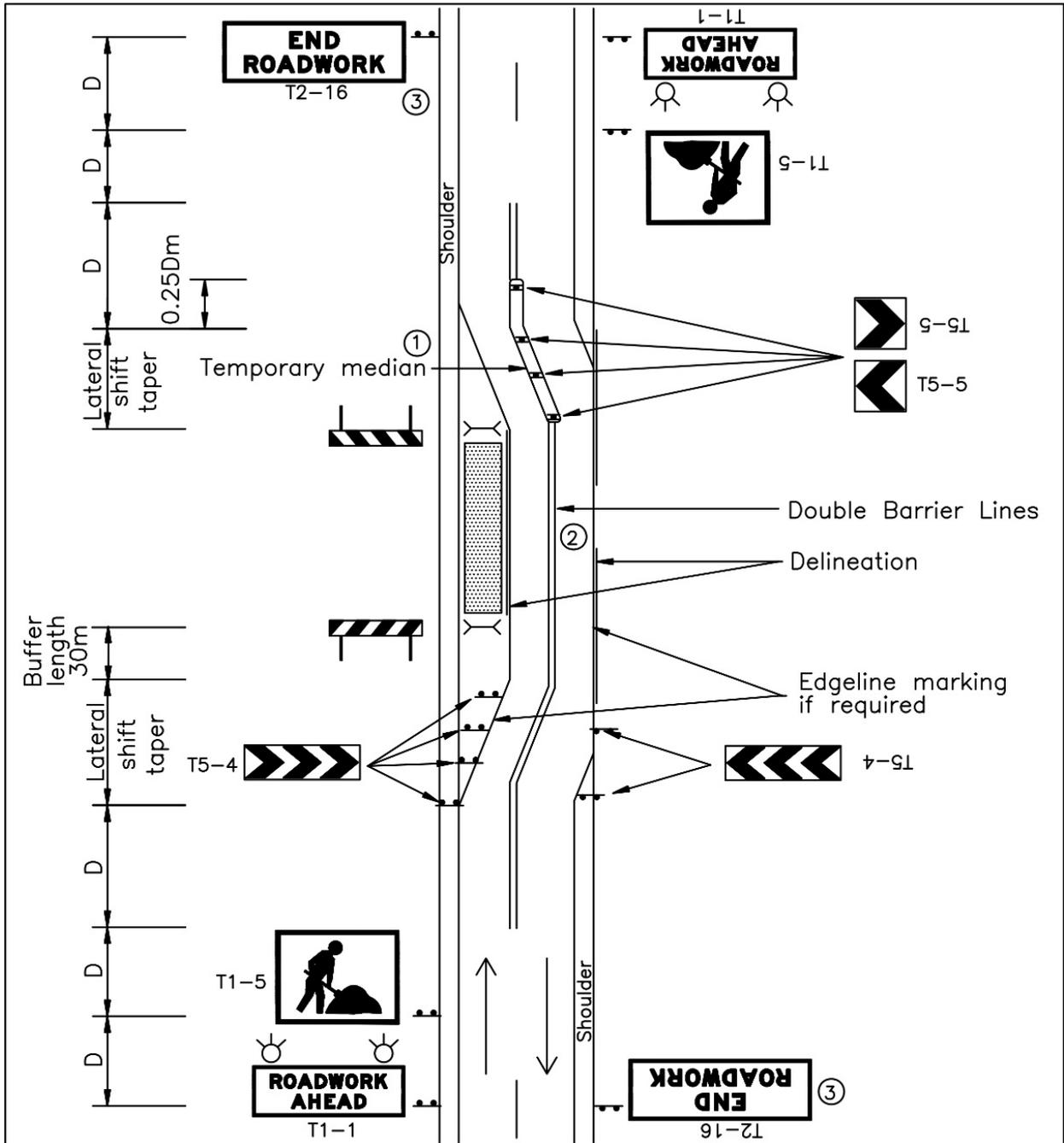
TCP 43



TCP 44



TCP 45

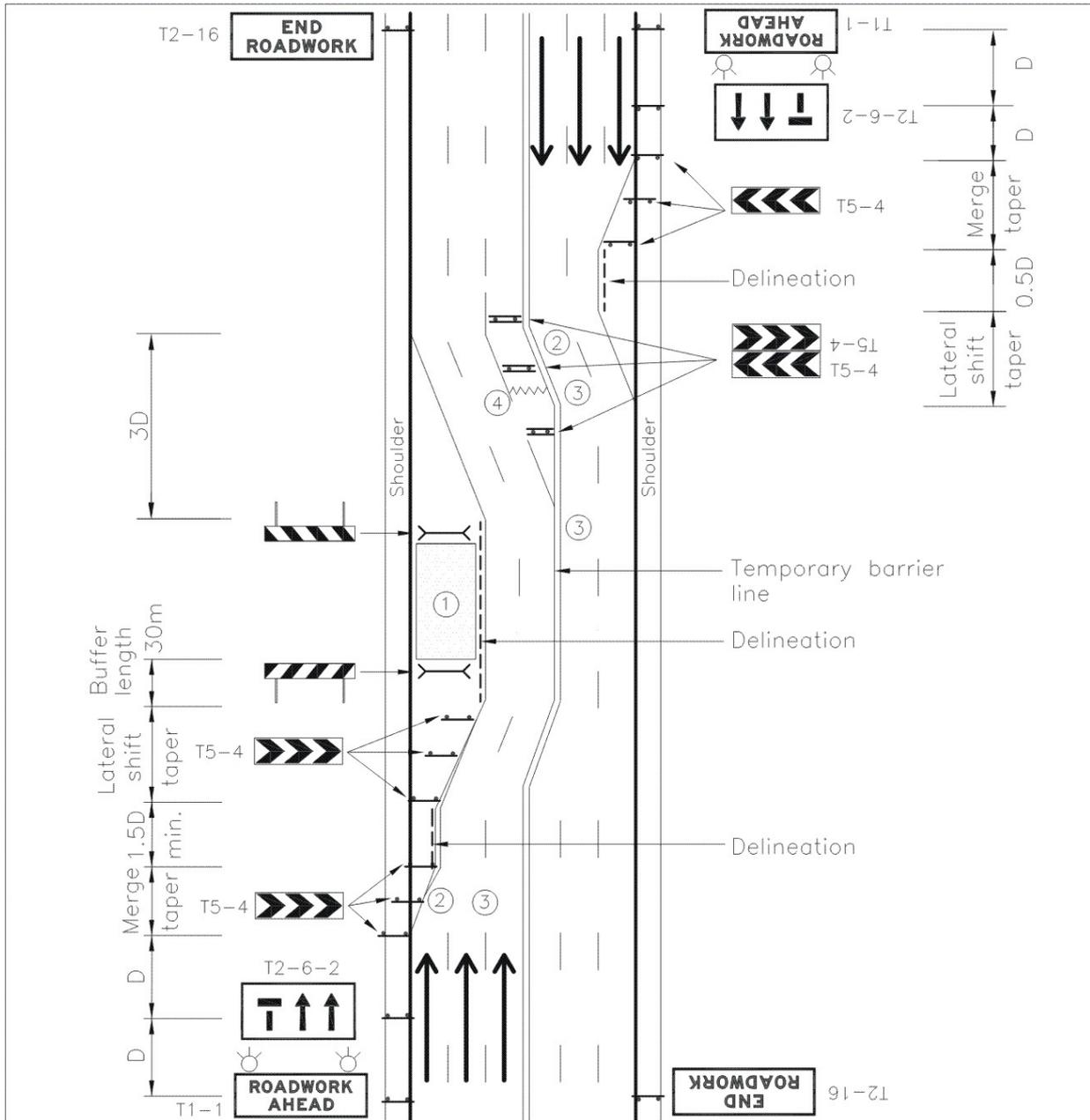


- NOTES:
- ① The temporary median should be a minimum width of 1.2m.
 - ② Place raised retroflective pavement markers adjacent to double barrier lines.
 - ③ Duplicate T1-1 sign on right side where necessary.

LONG TERM WORK
2 LANE / 2 WAY
LANE CLOSURE – NO CONTROL

T000045

TCP 46



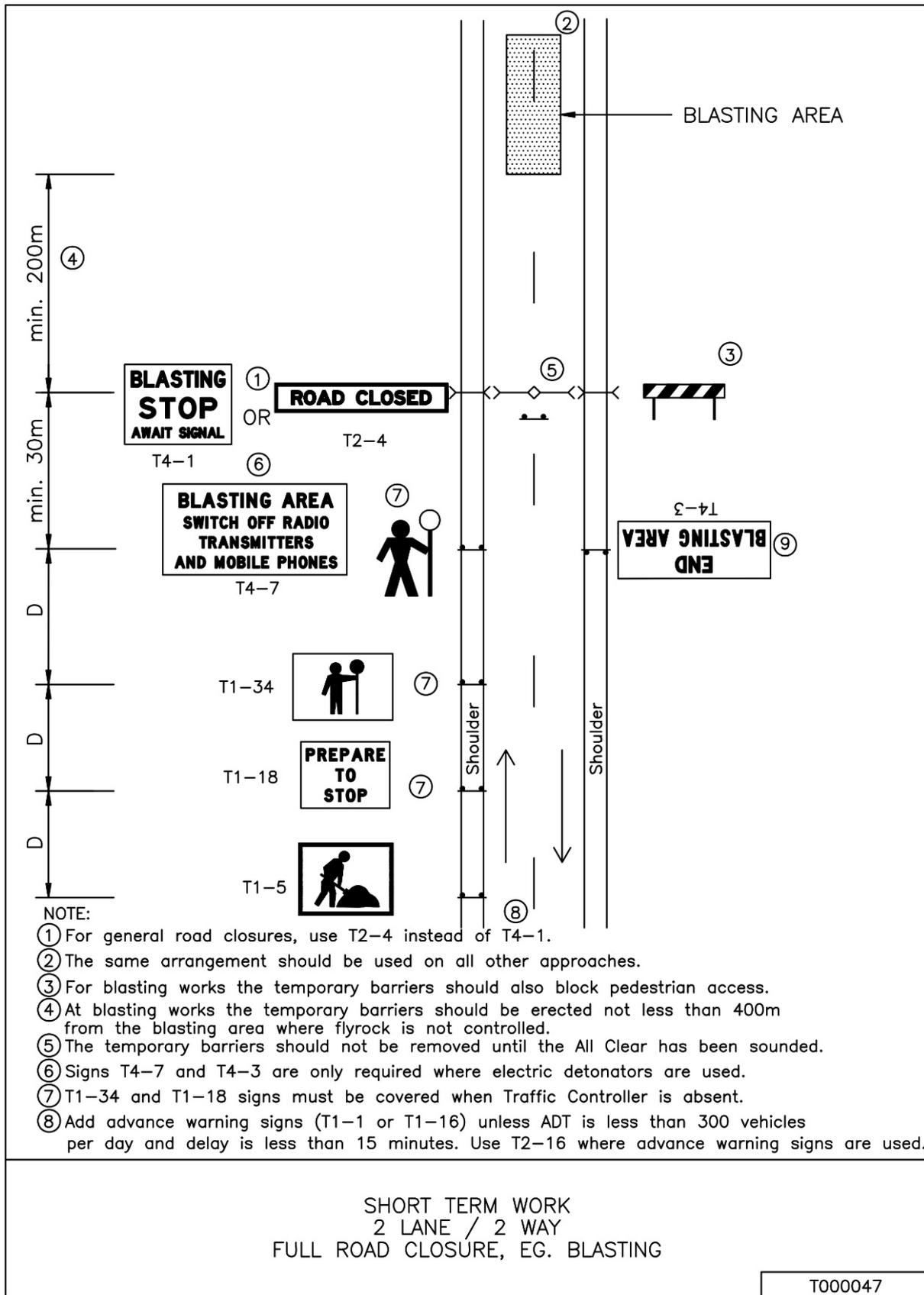
NOTES:

- 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.

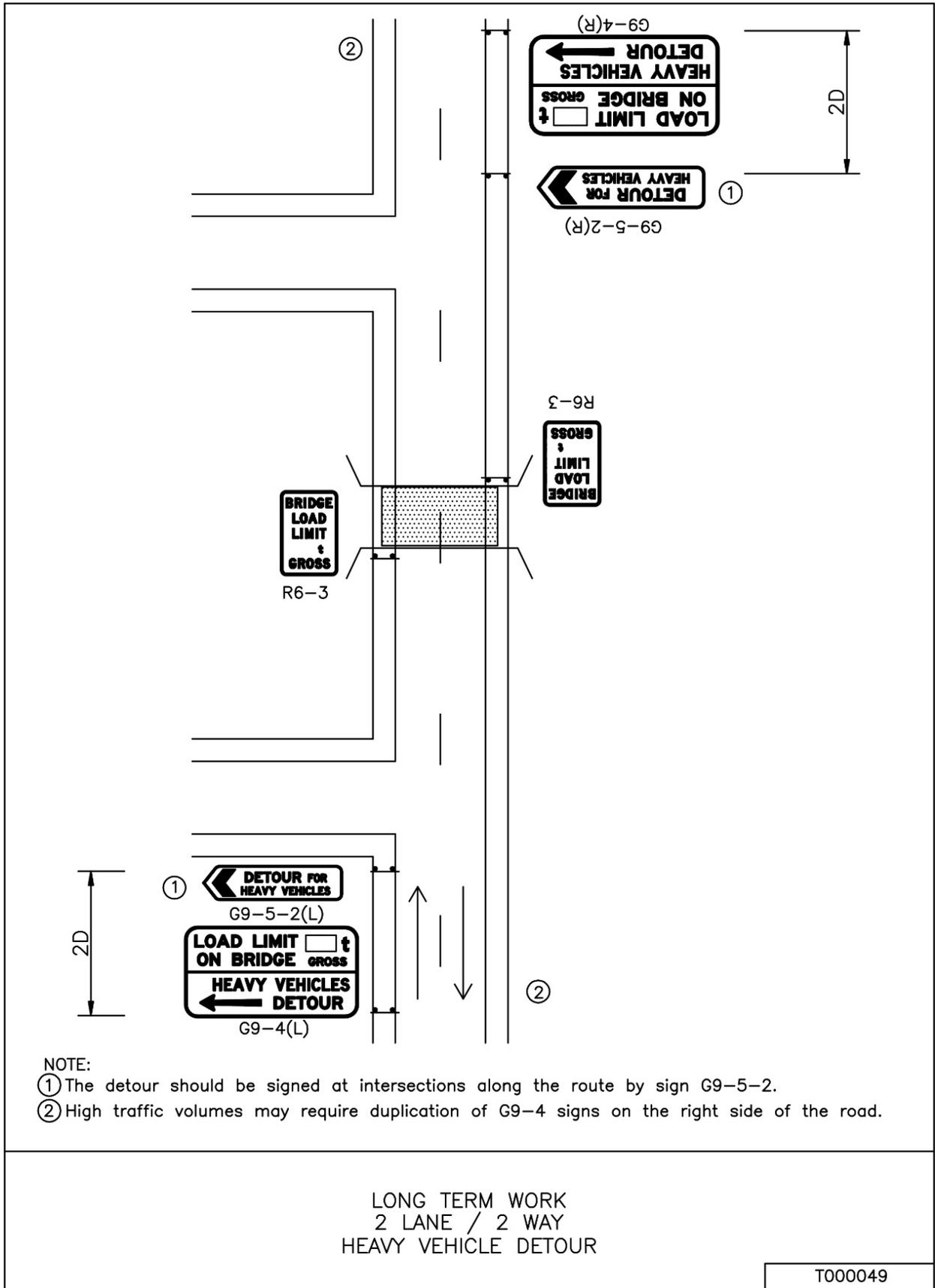
LONG TERM WORK
6 LANE / 2 WAY
TWO OUTER LANE CLOSURE

T000046

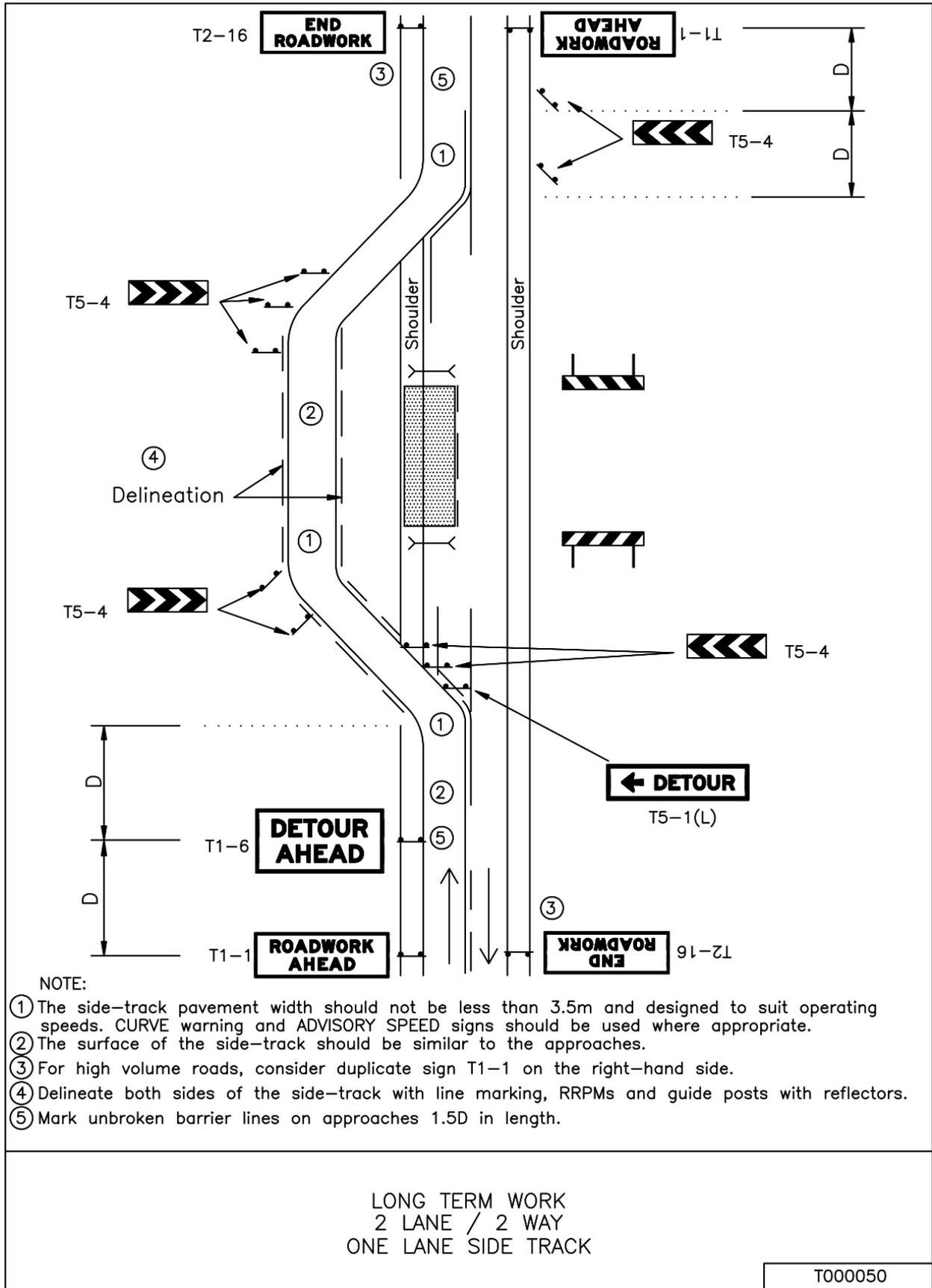
TCP 47



TCP 49



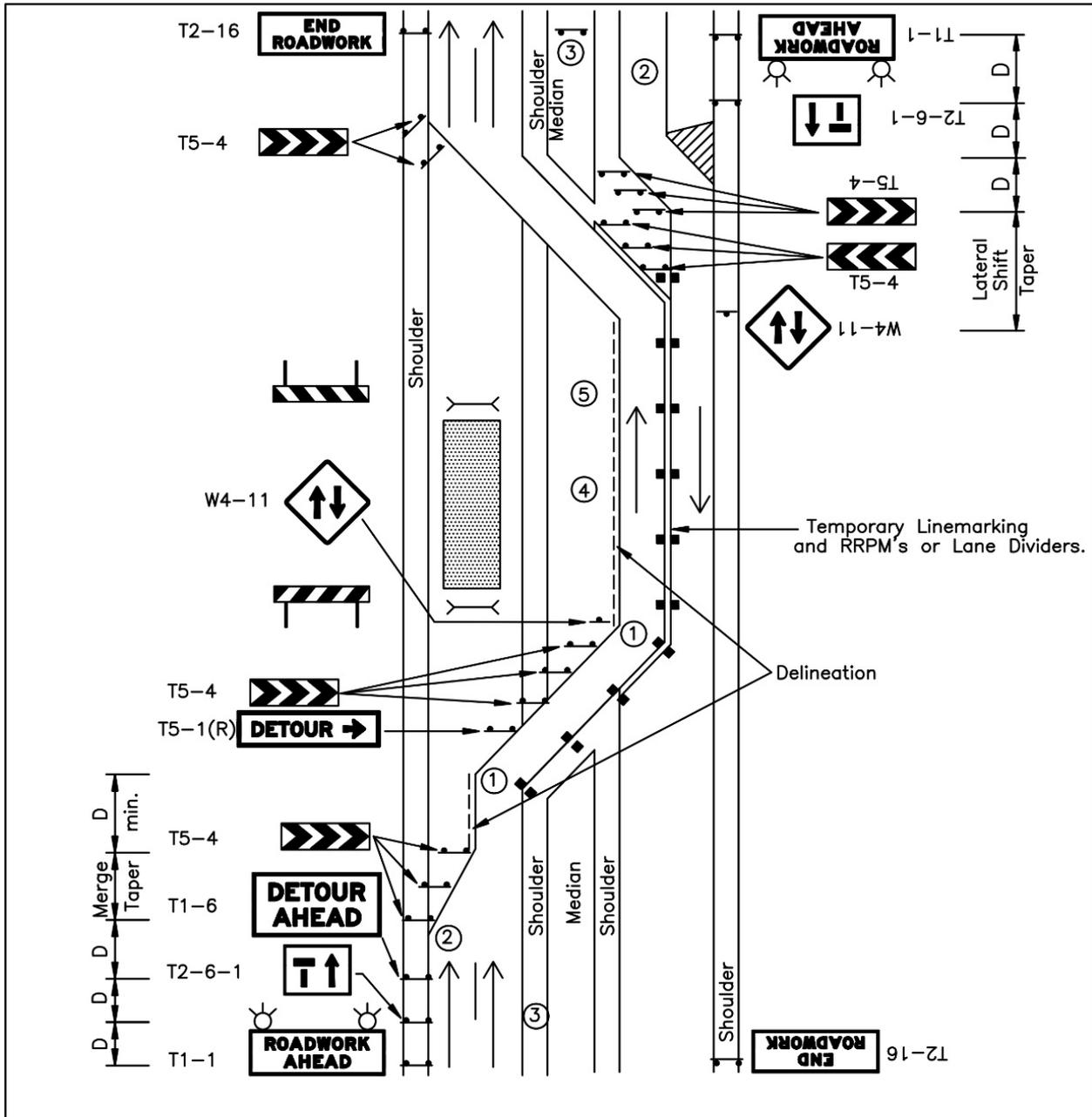
TCP 50



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 1.5D in length.

TCP 52



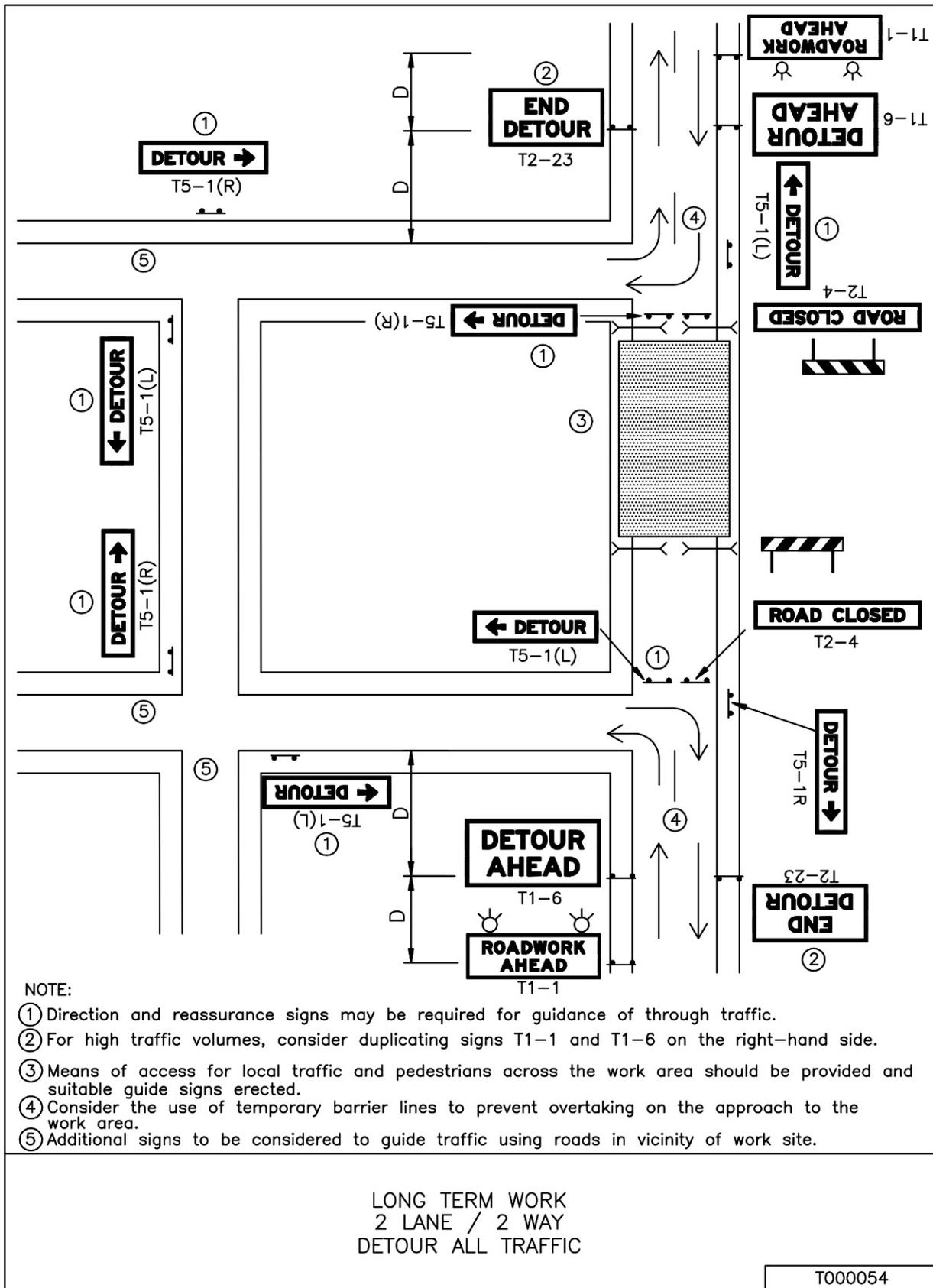
NOTES:

- ① The side-track pavement width shall be 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.

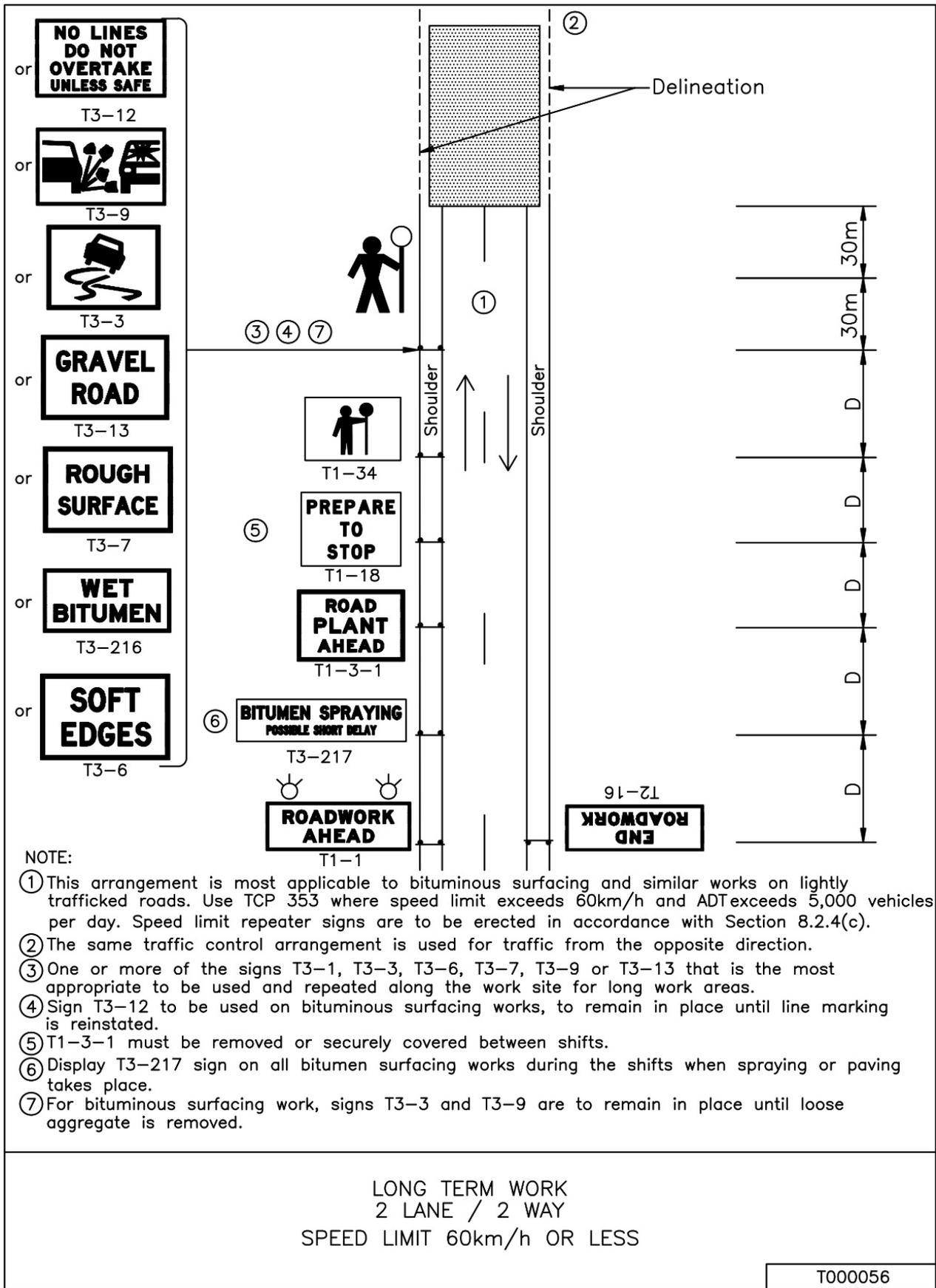
LONG TERM WORK
FOUR LANE / DIVIDED
SIDE TRACK CROSSING MEDIAN

T000052

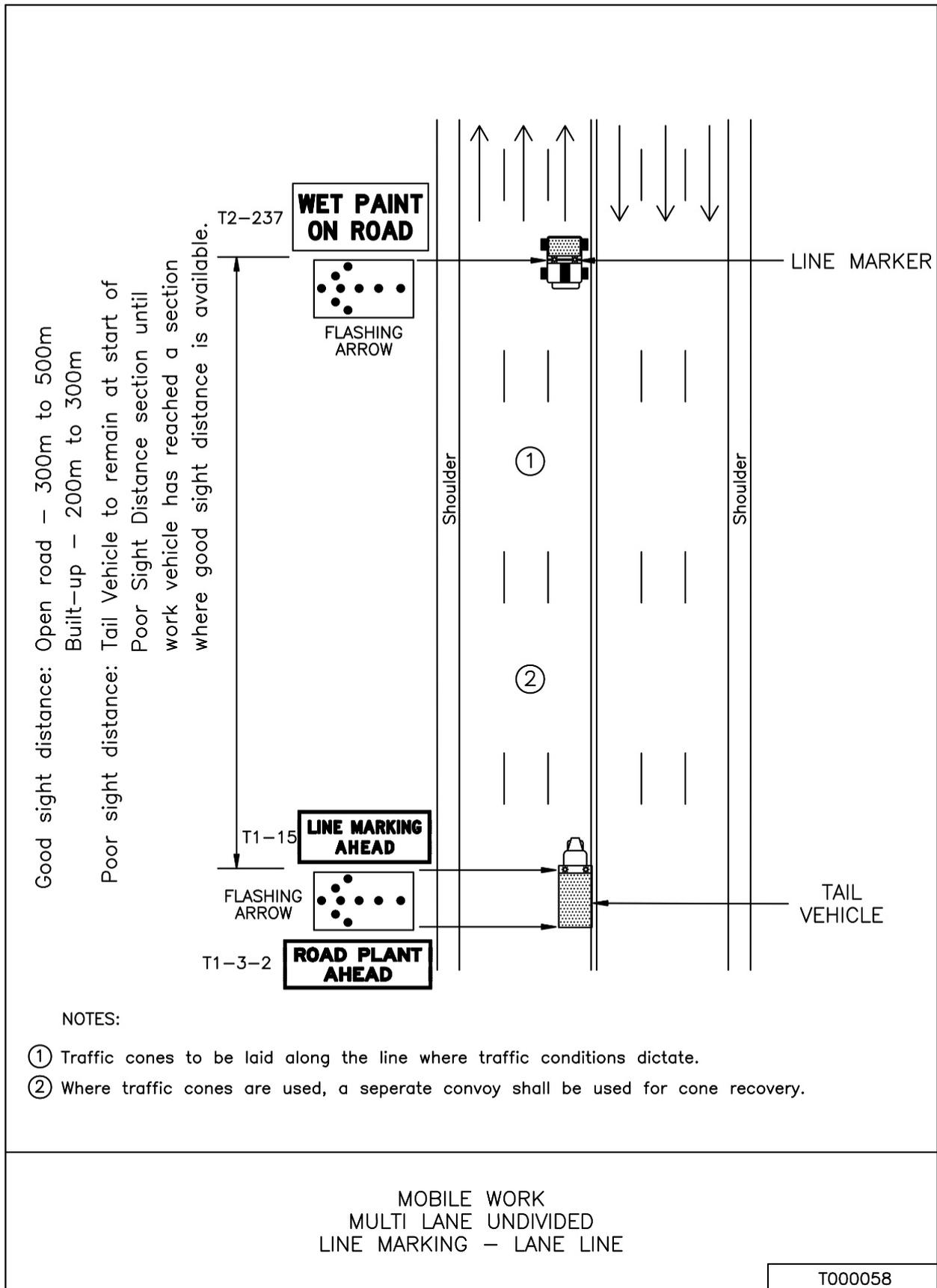
TCP 54



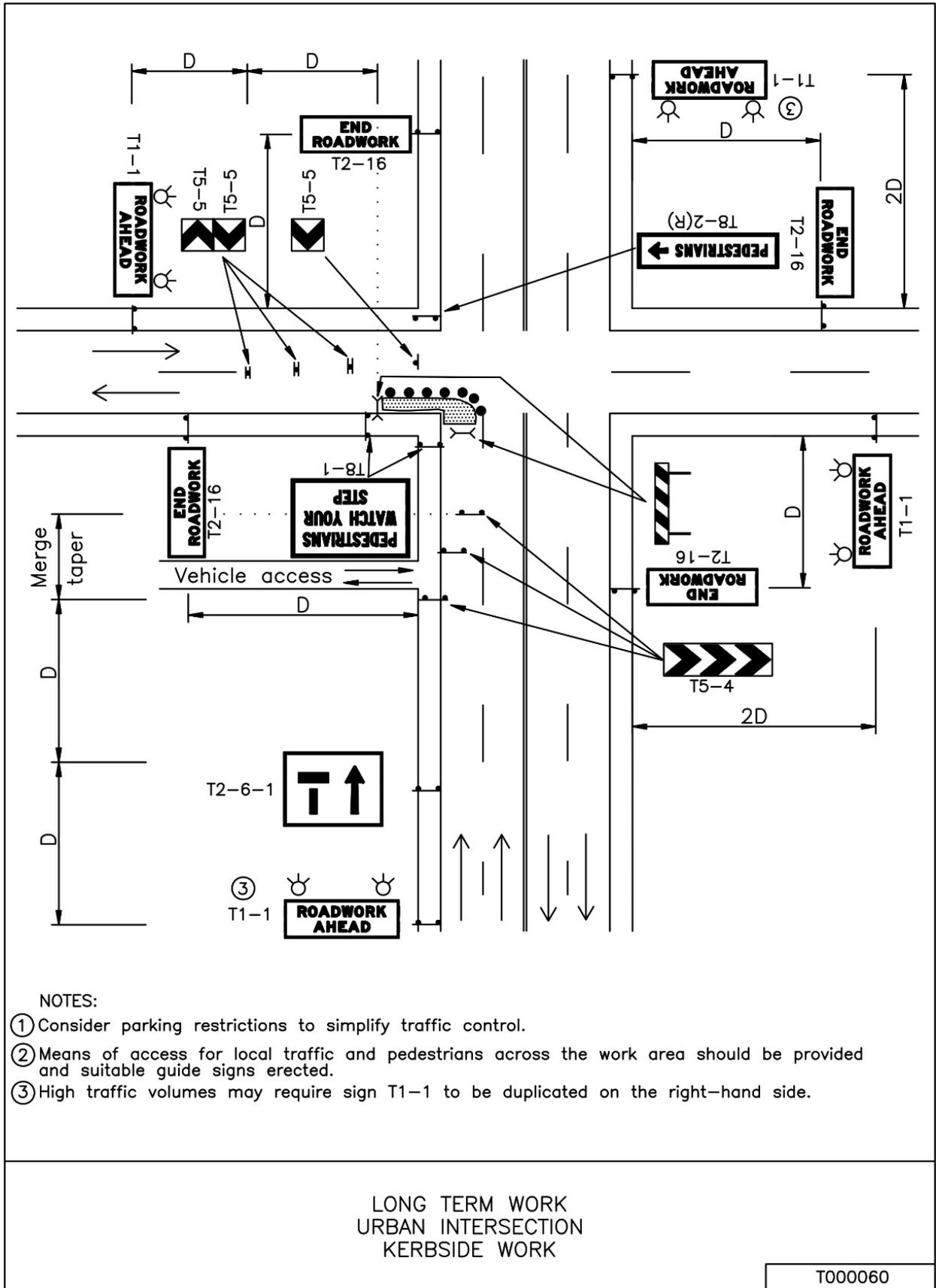
TCP 56



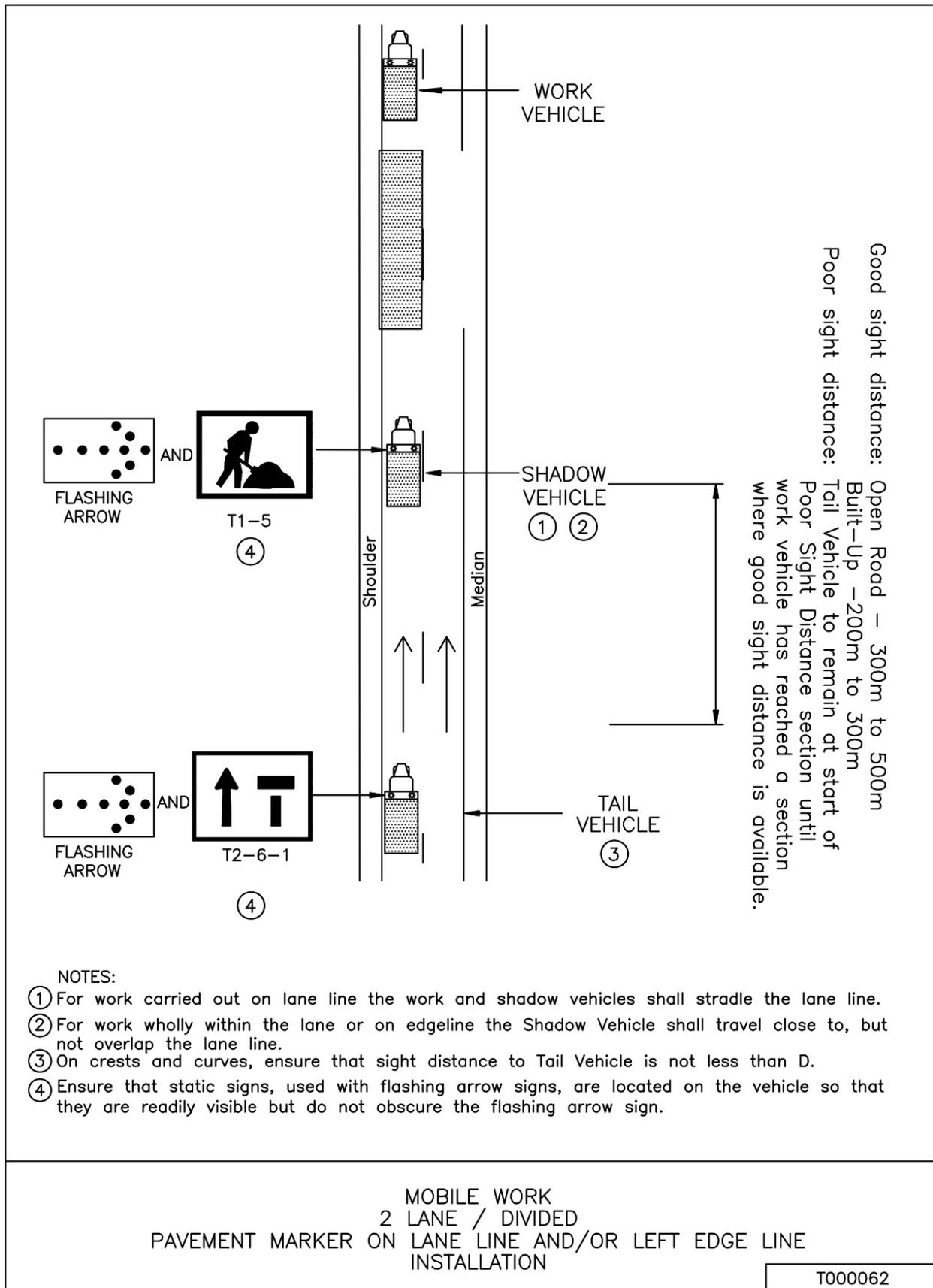
TCP 58



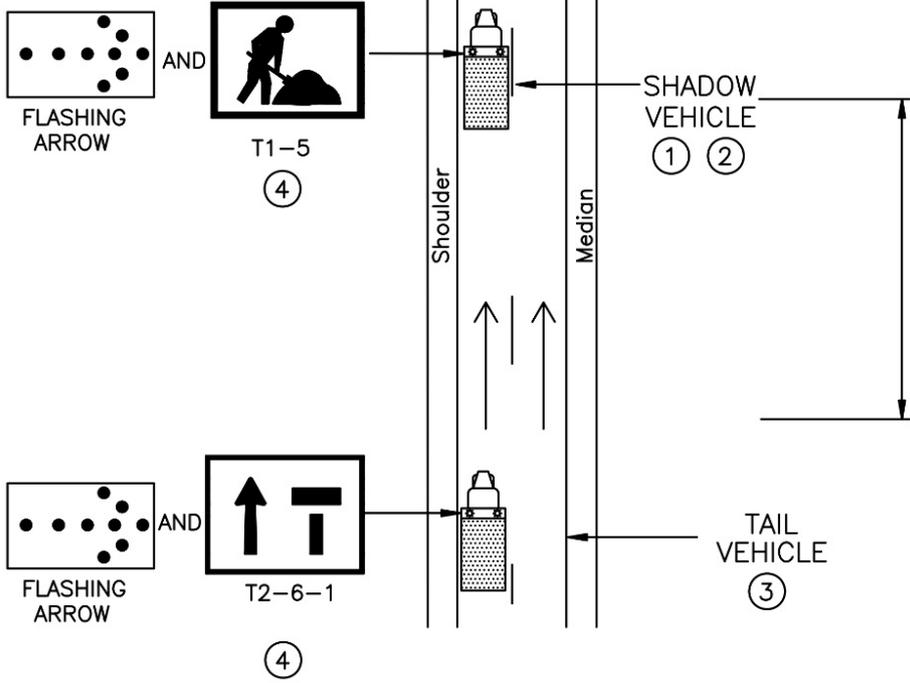
TCP 60



TCP 62

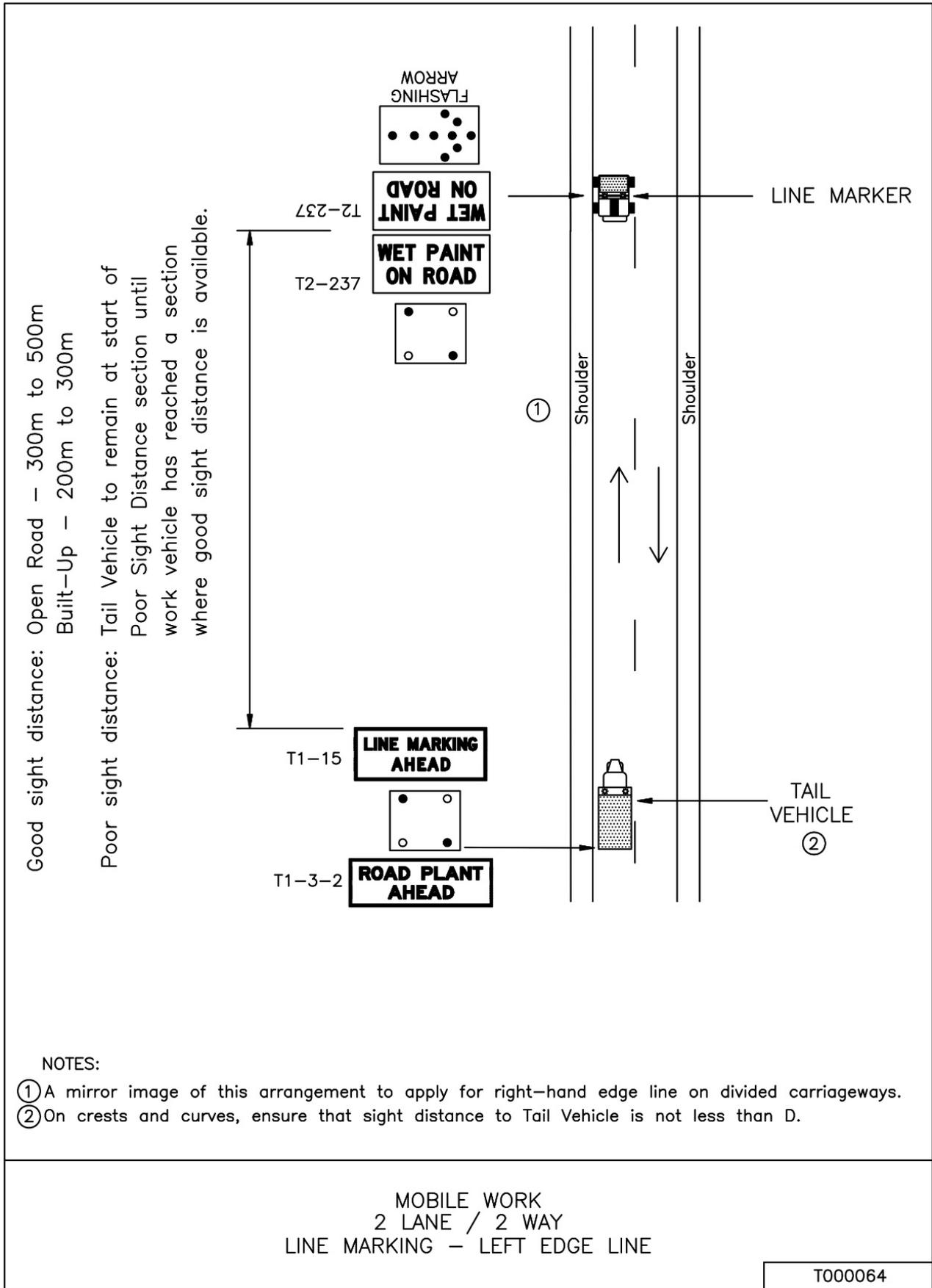


Good sight distance: Open Road – 300m to 500m
 Built-Up – 200m to 300m
 Poor sight distance: Tail Vehicle to remain at start of
 work vehicle has reached a section where good sight distance is available.



- NOTES:
- ① For work carried out on lane line the work and shadow vehicles shall straddle the 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 D.
 - 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.

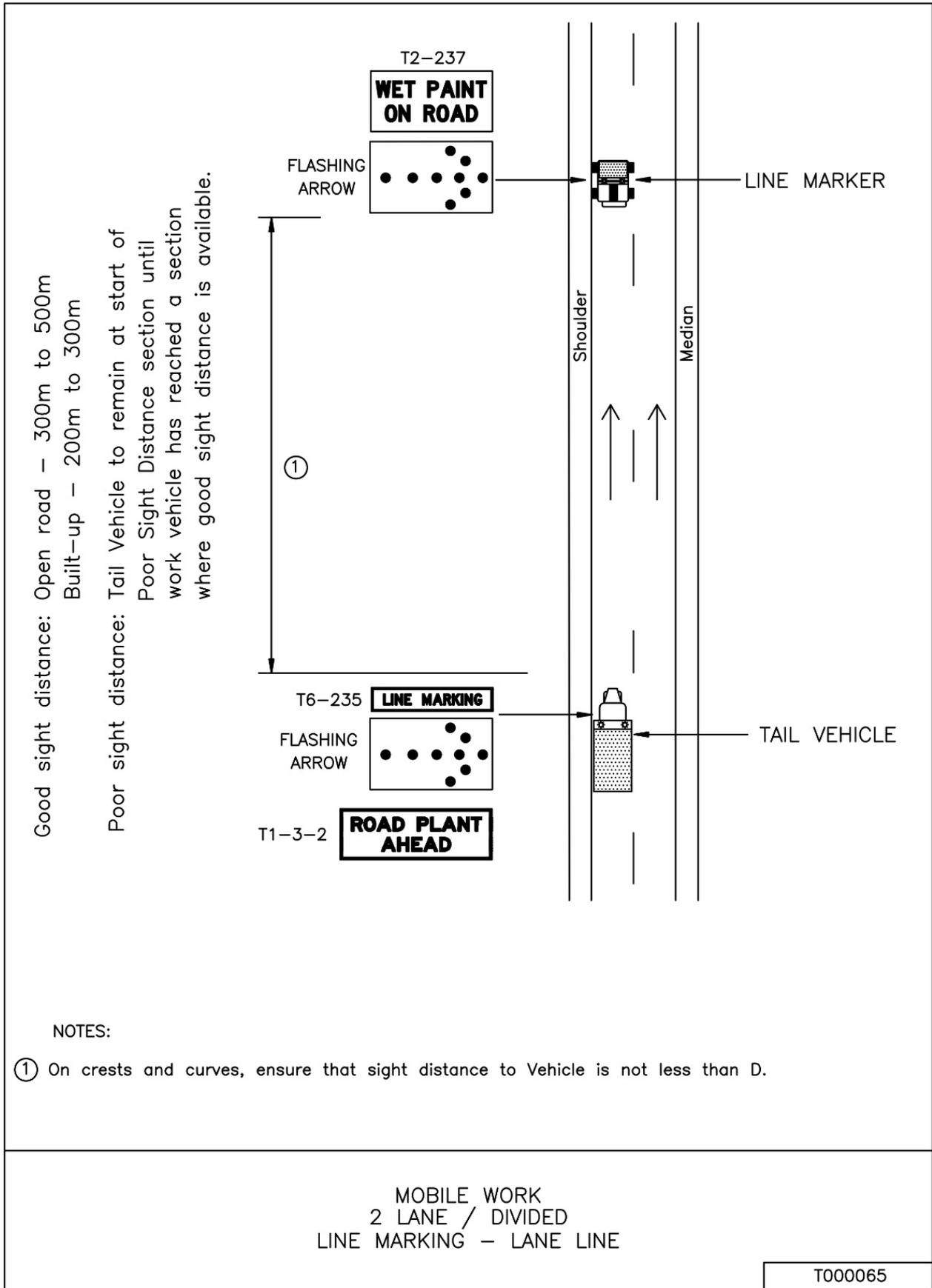
TCP 64



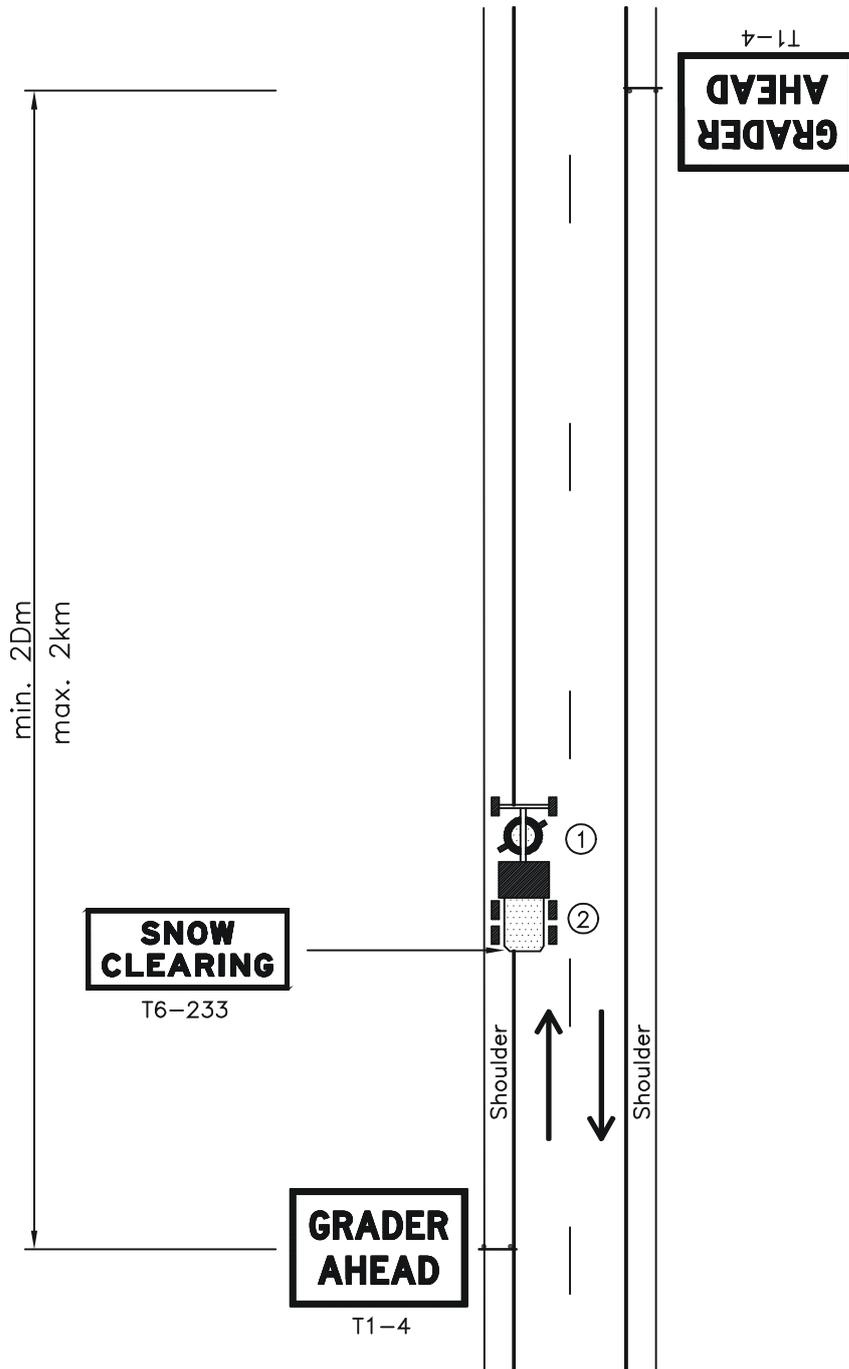
NOTES:

- ① A mirror image of this arrangement to apply for right-hand edge line on divided carriageways.
- ② On crests and curves, ensure that sight distance to Tail Vehicle is not less than D.

TCP 65



TCP 67



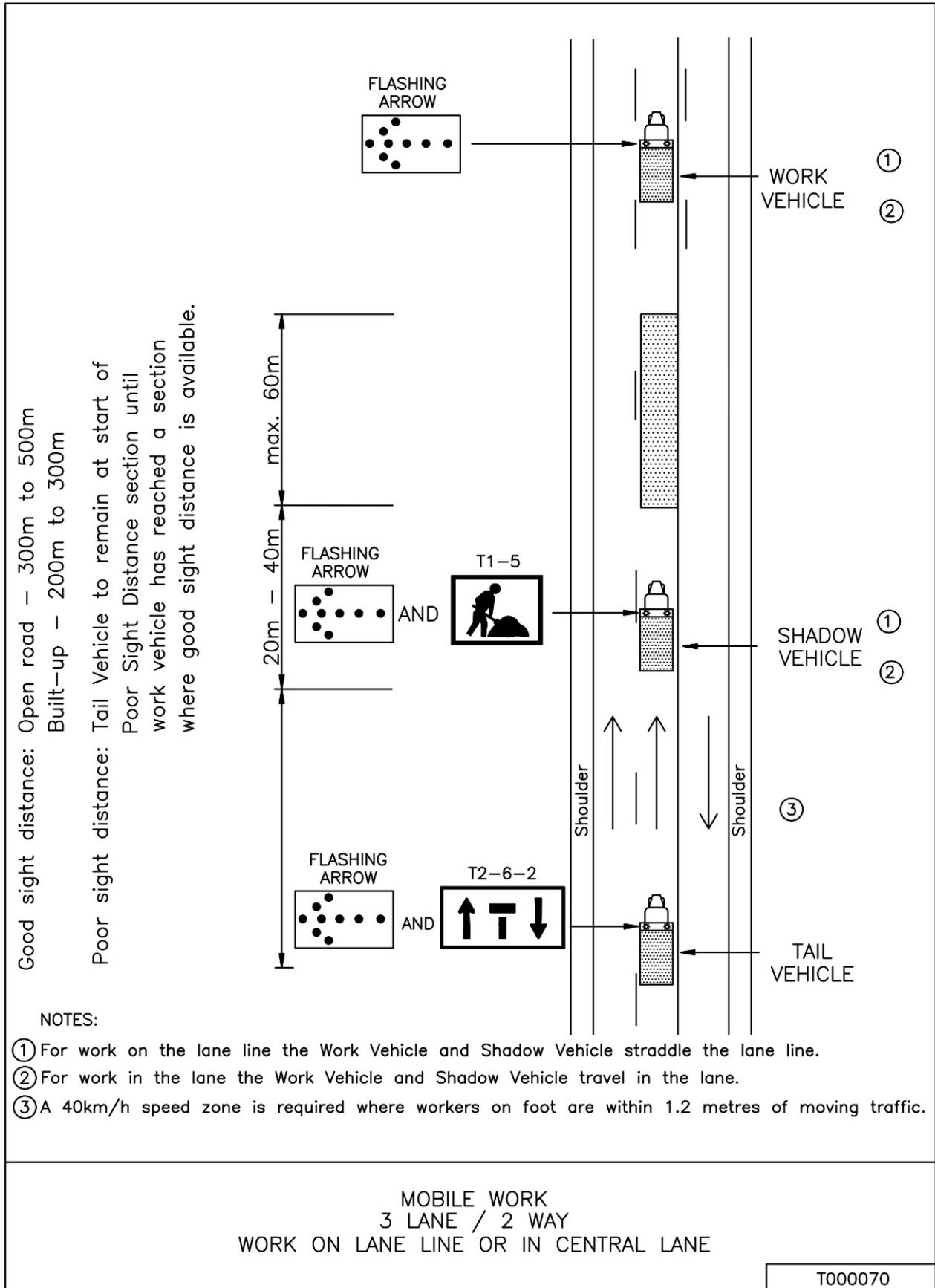
NOTE:

- ① Plant has flashing lights and floodlights.
- ② Grader should be driven in direction of traffic flow.

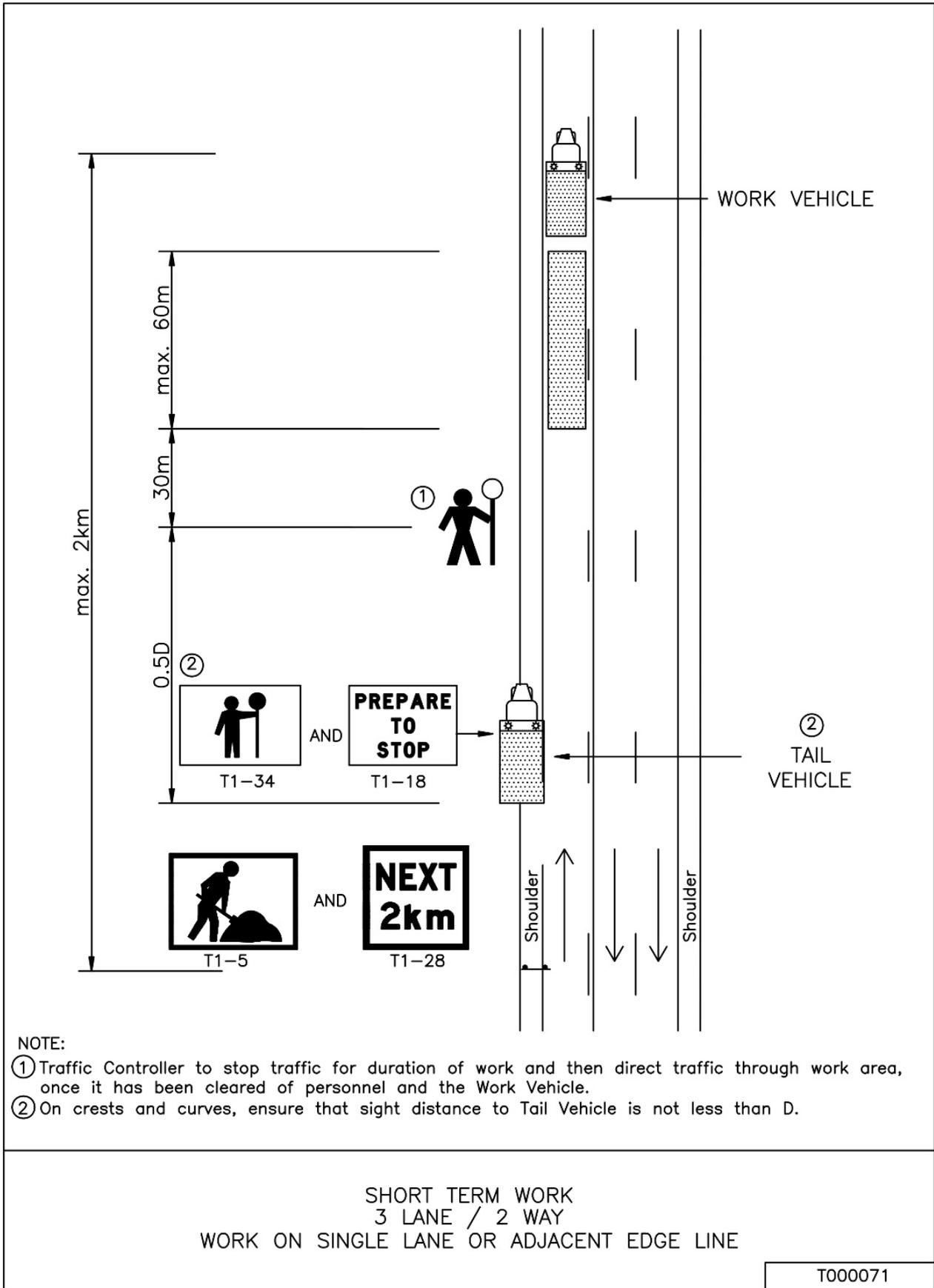
MOBILE WORK
2 LANE / 2 WAY
SNOW CLEARING

T00067

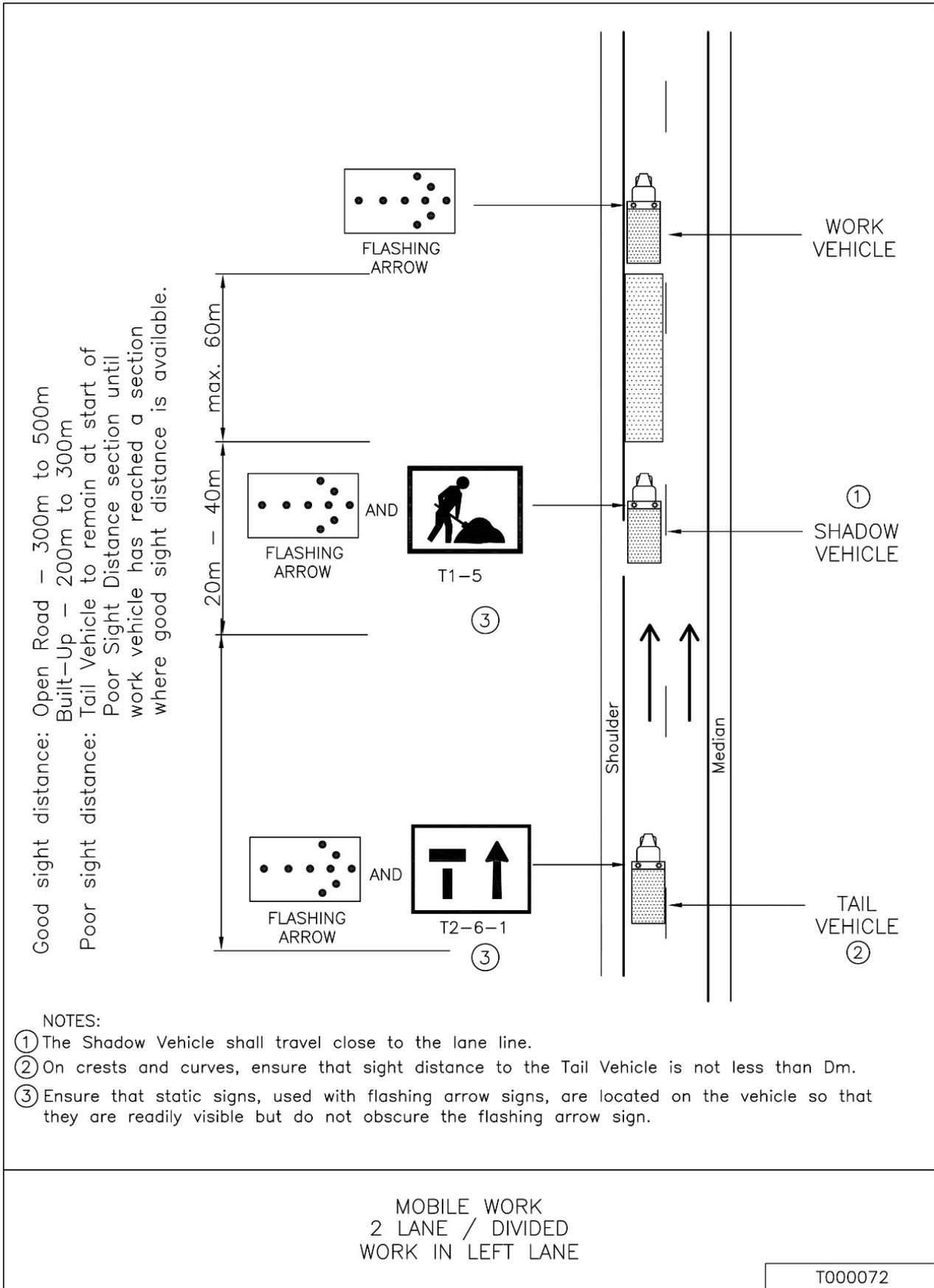
TCP 70



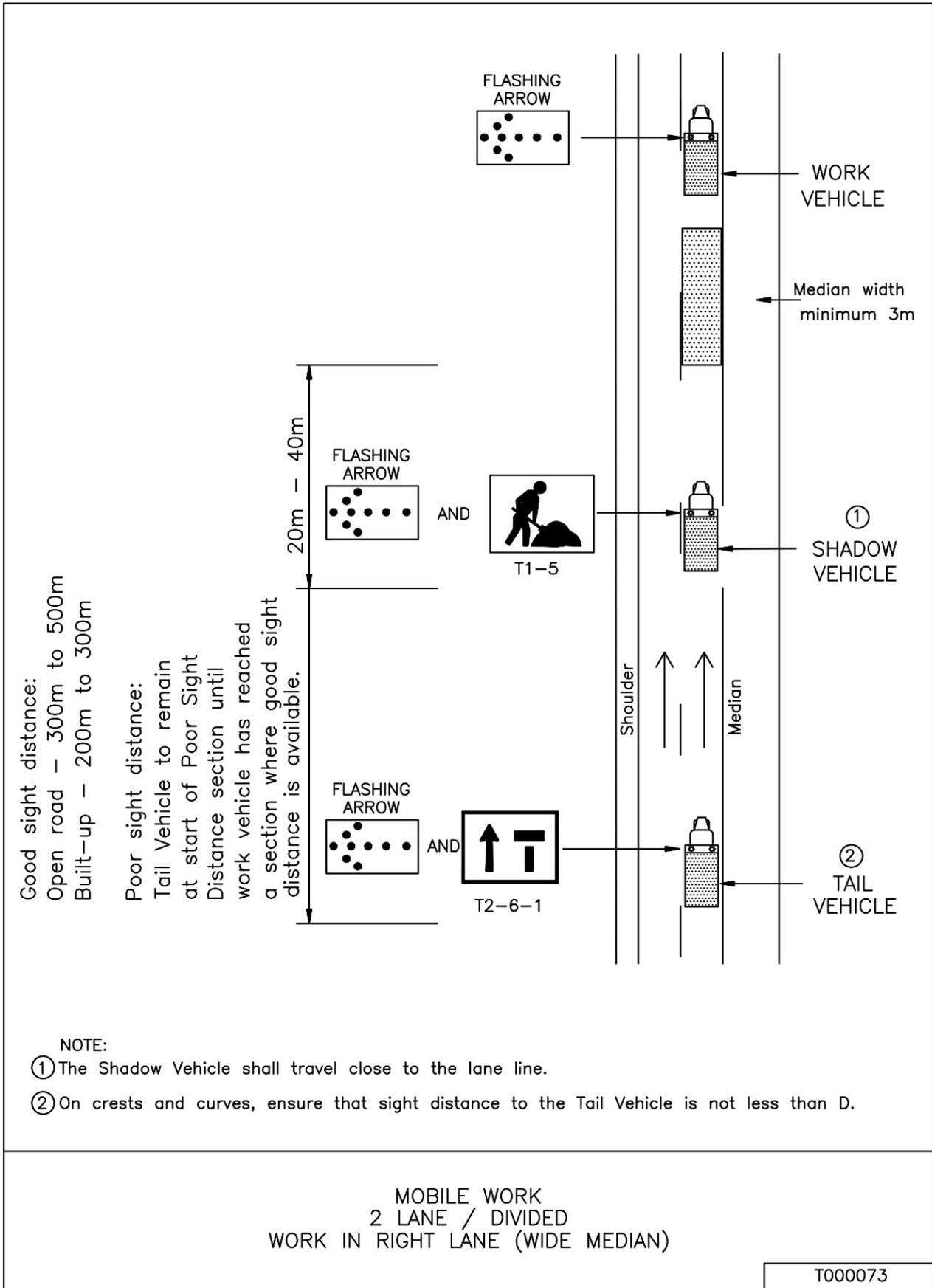
TCP 71



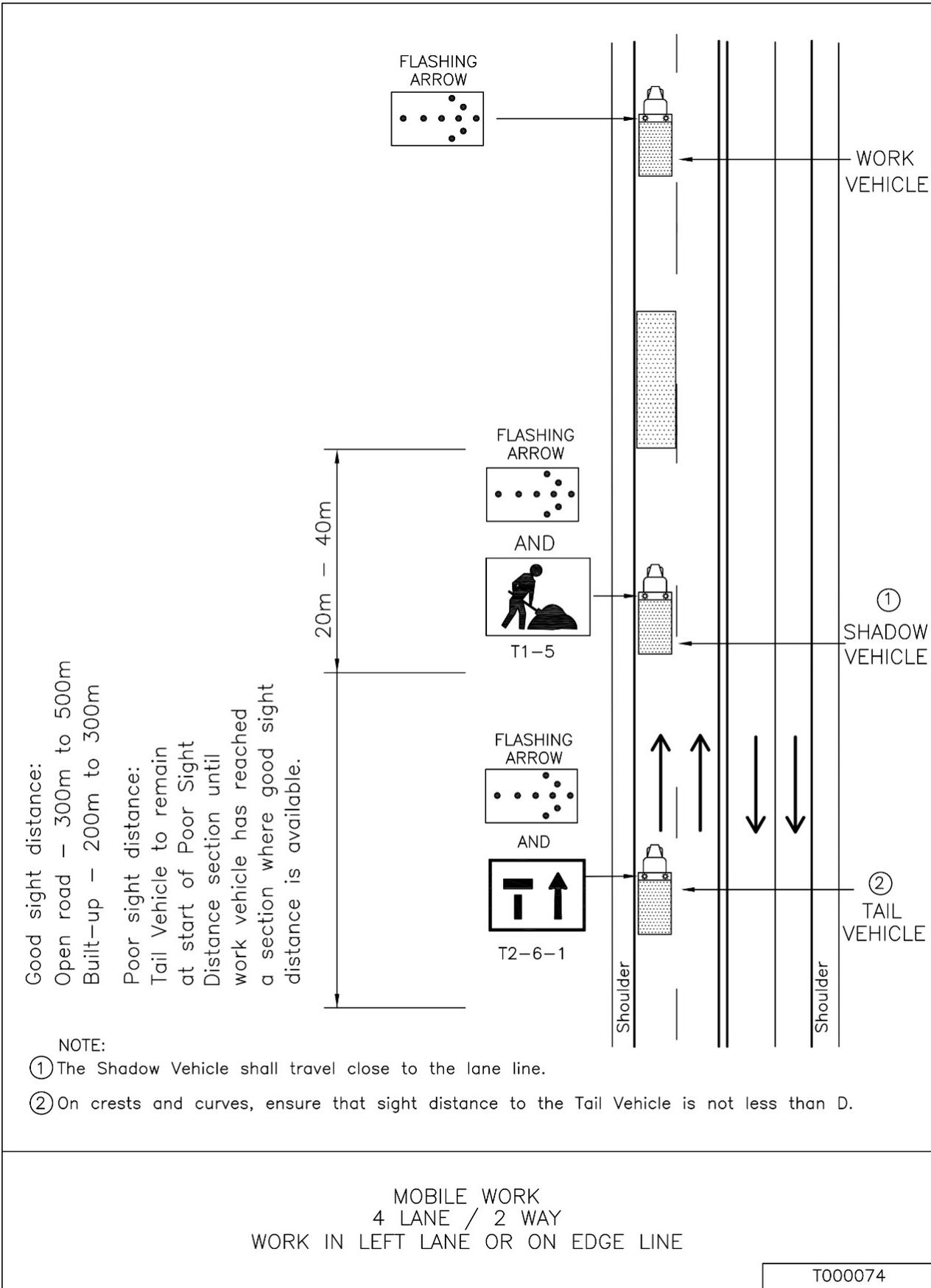
TCP 72



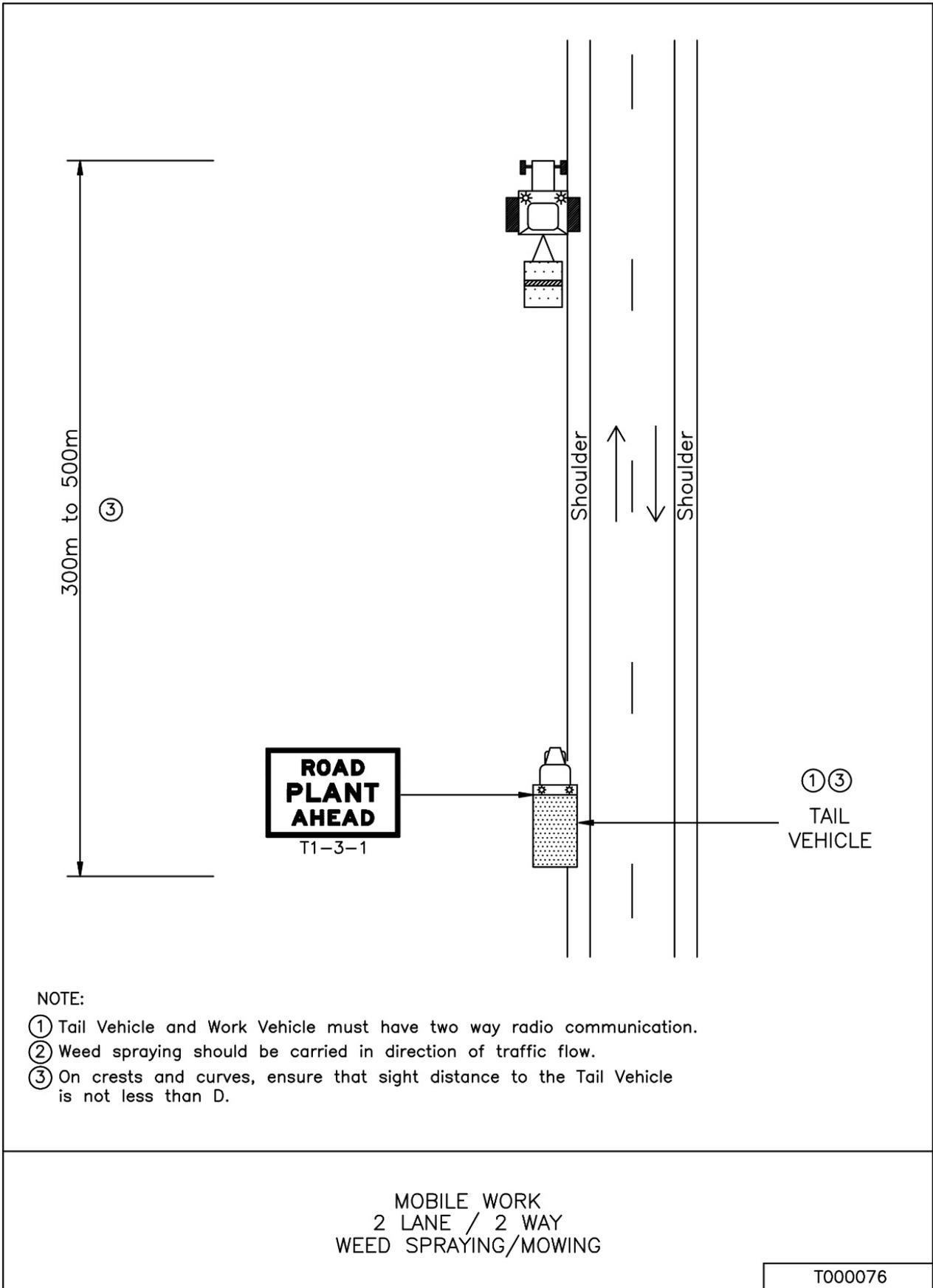
TCP 73



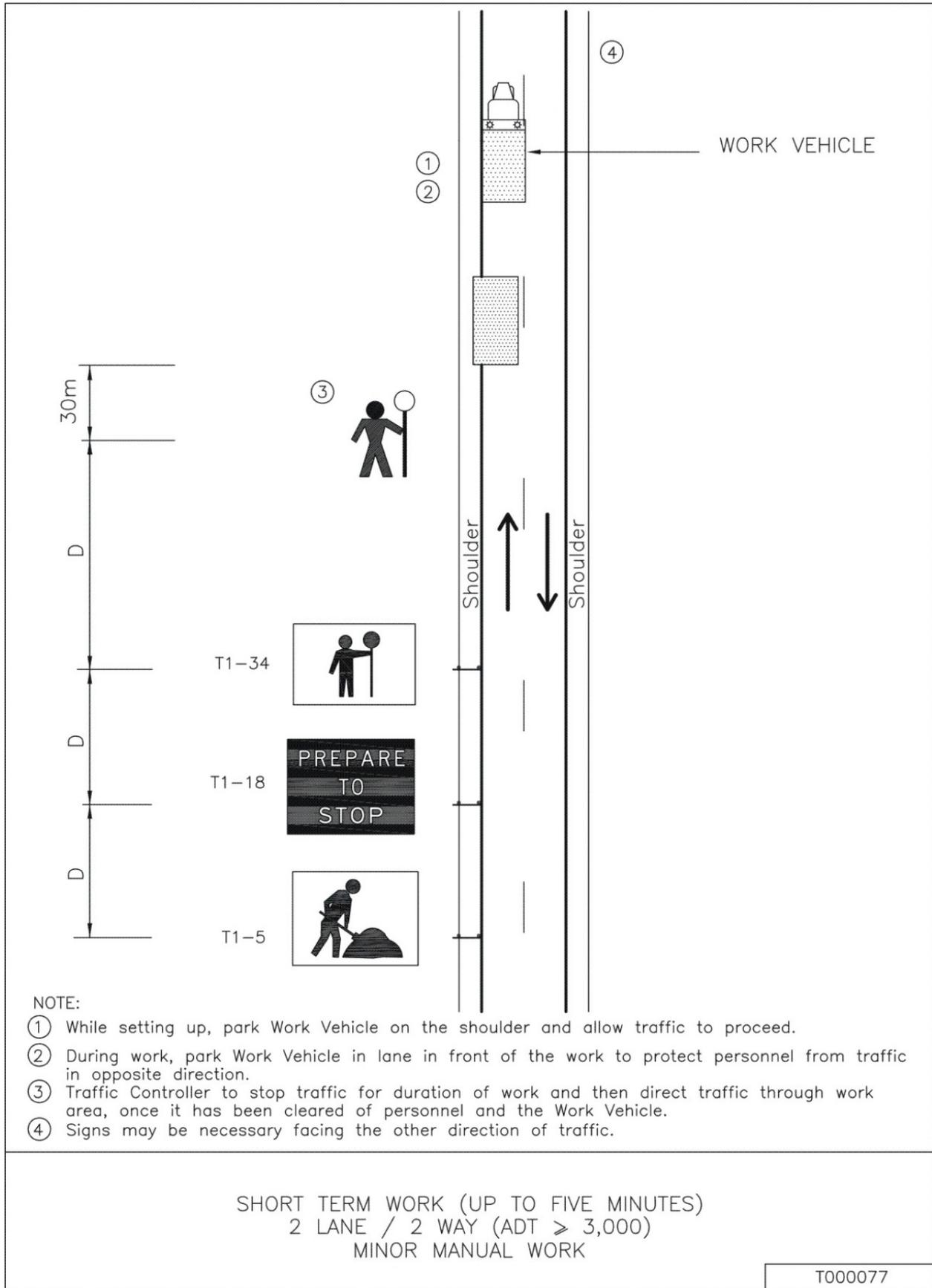
TCP 74



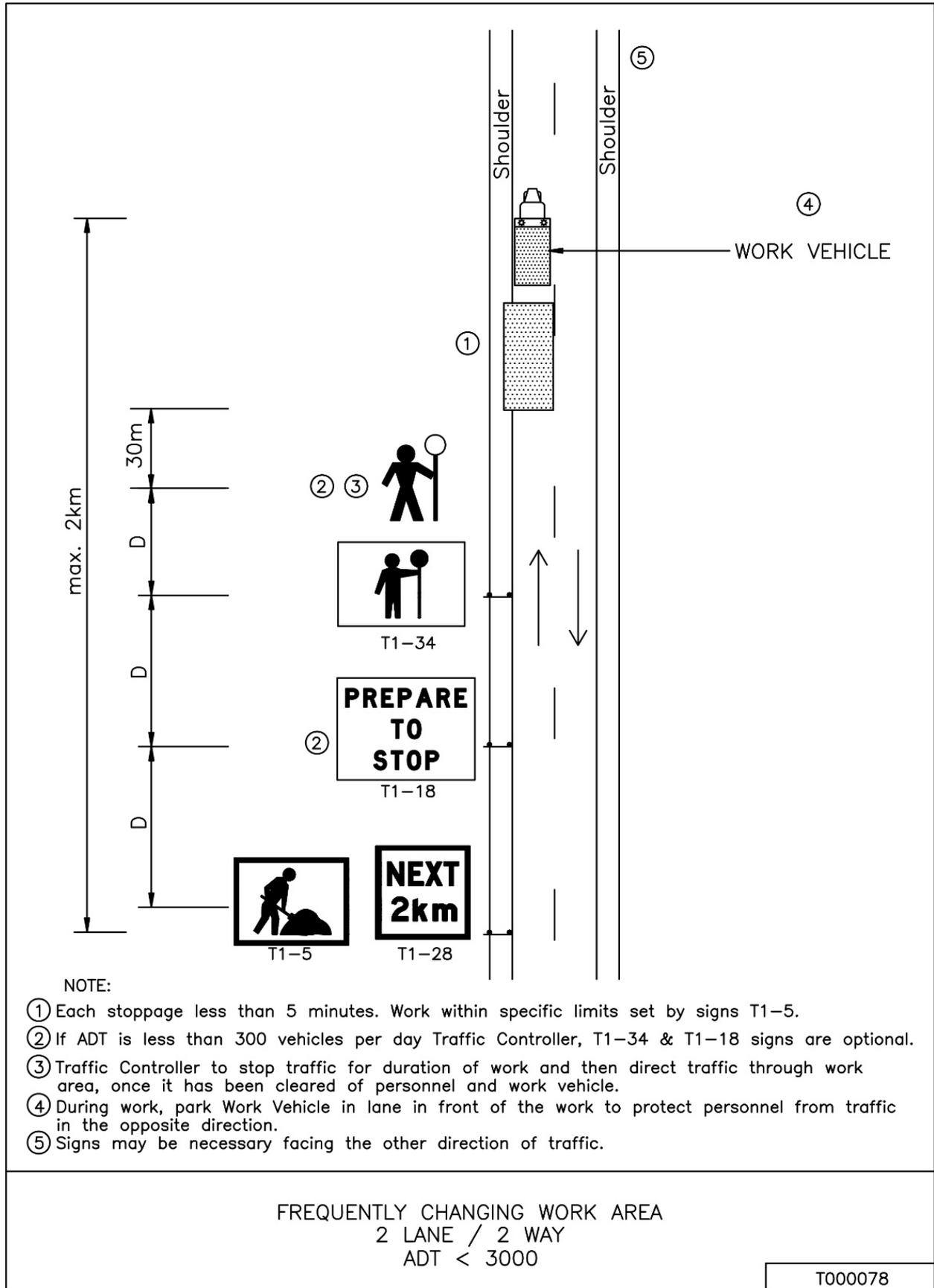
TCP 76



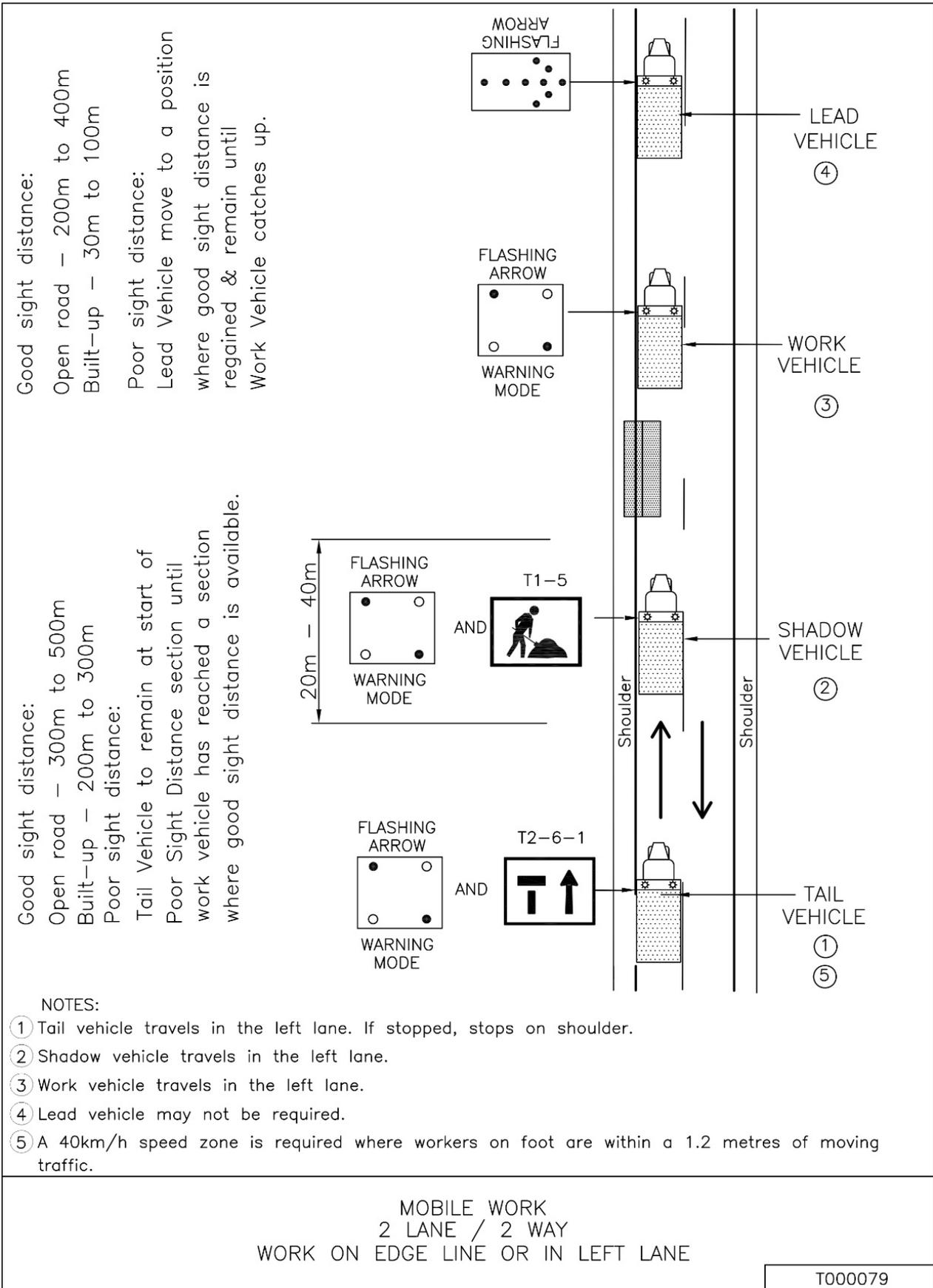
TCP 77



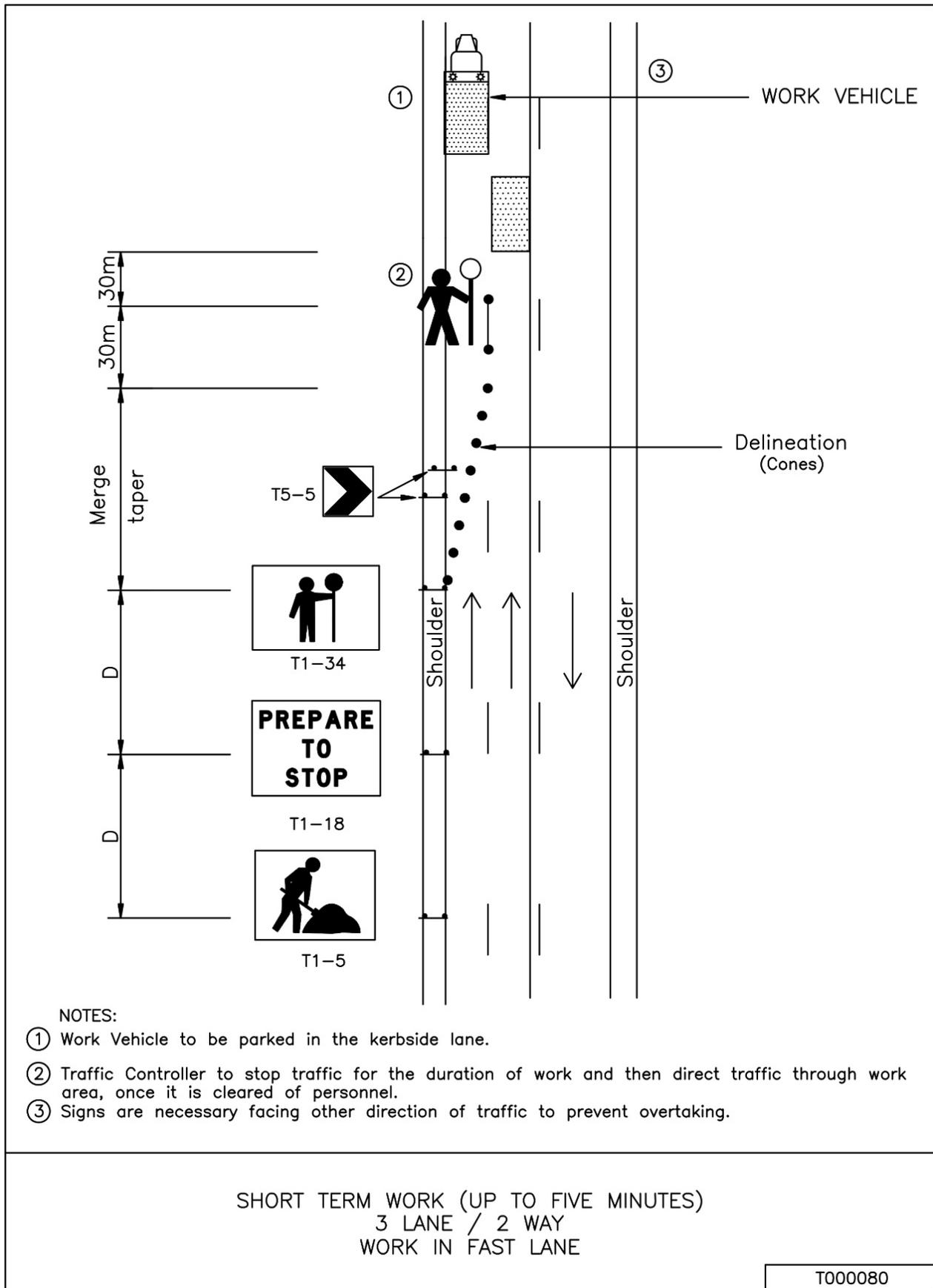
TCP 78



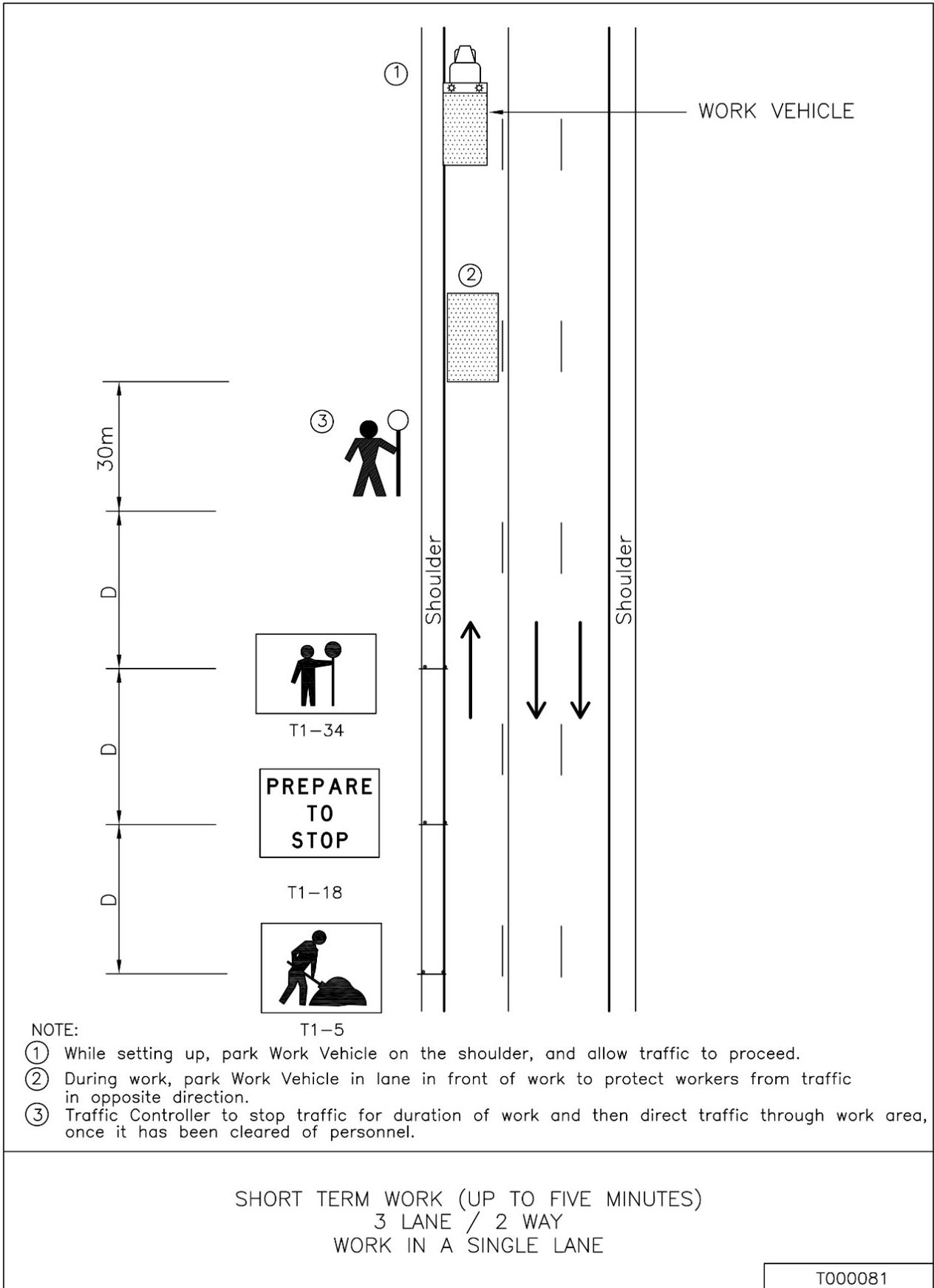
TCP 79



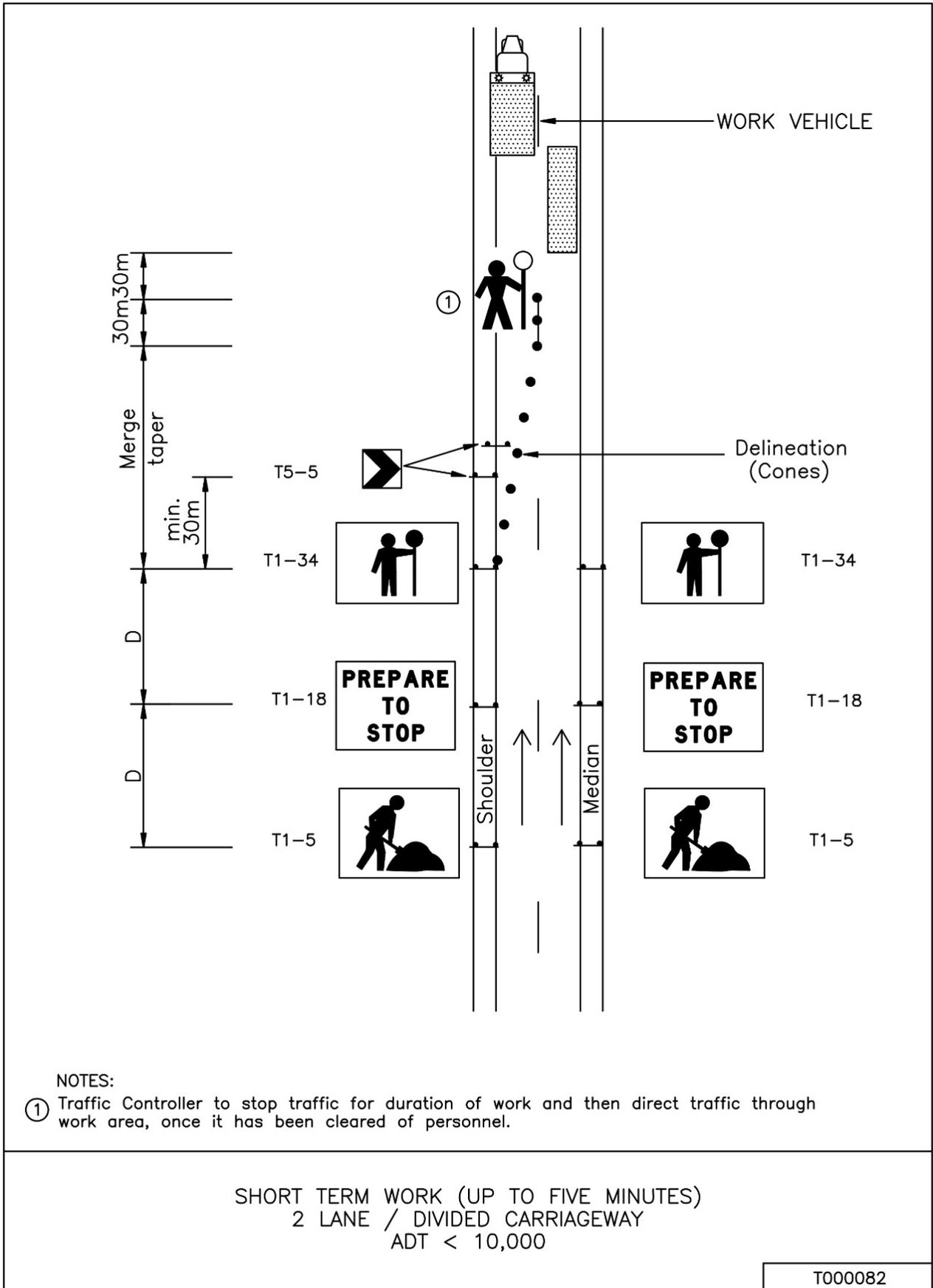
TCP 80



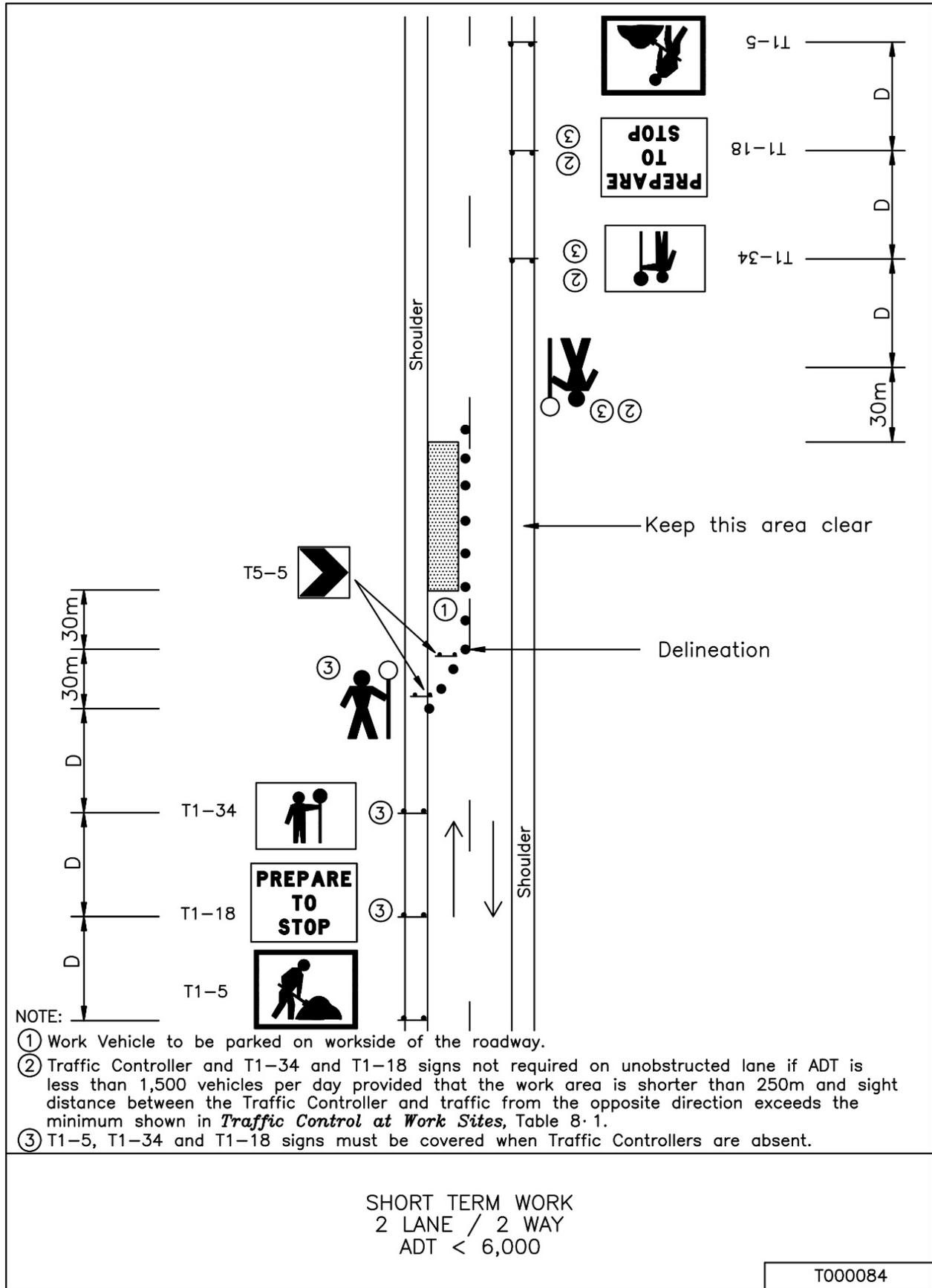
TCP 81



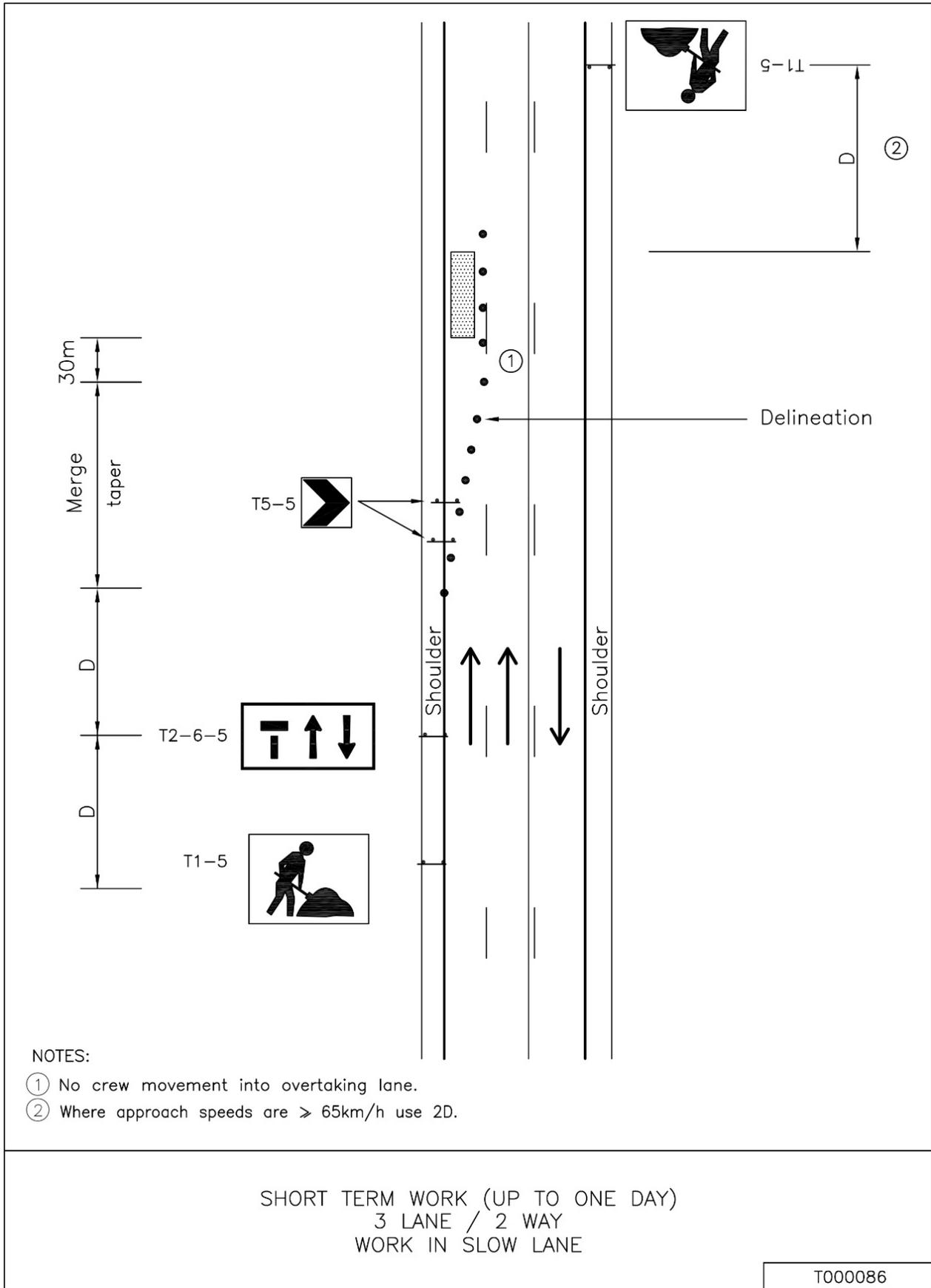
TCP 82



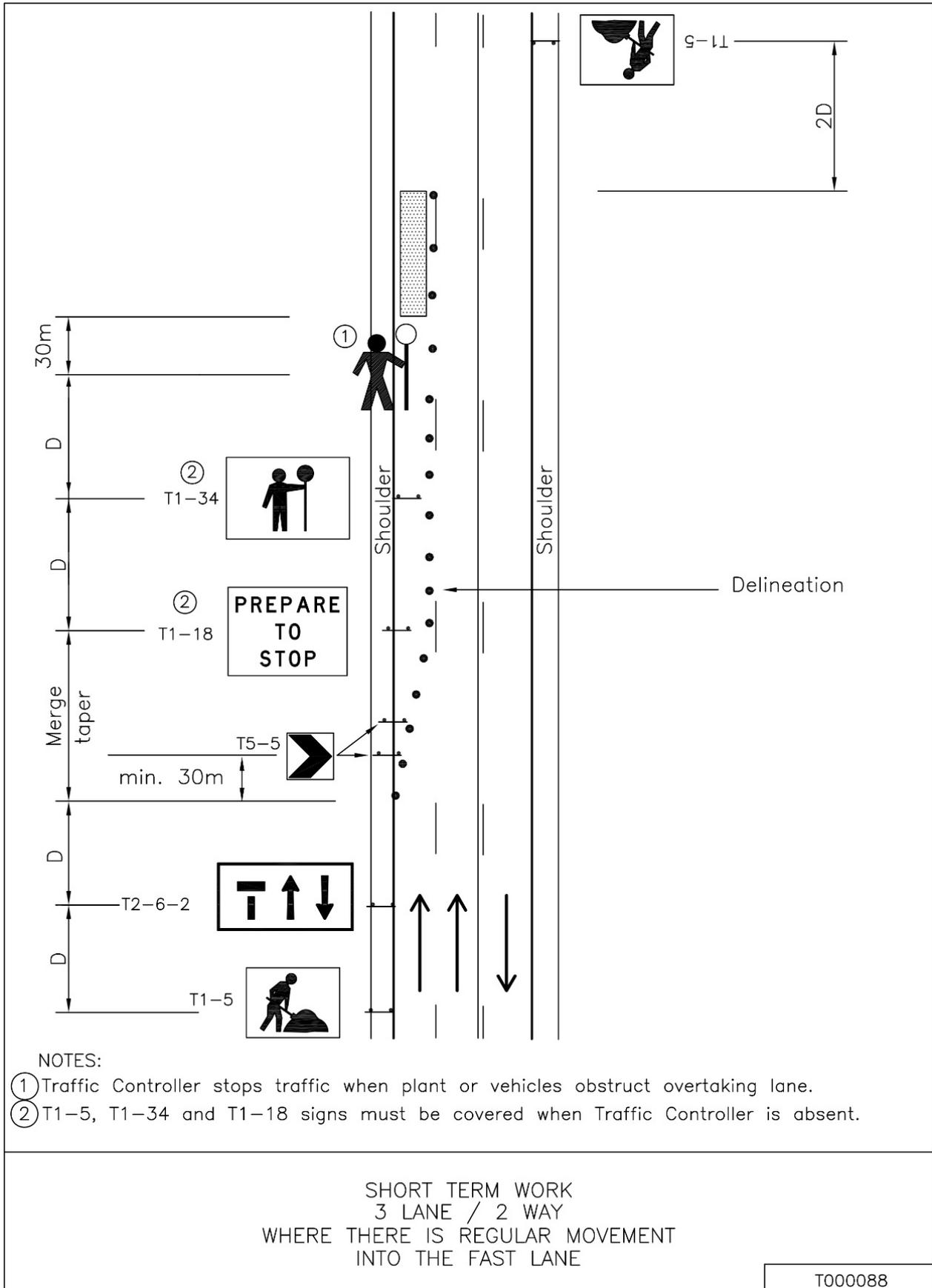
TCP 84



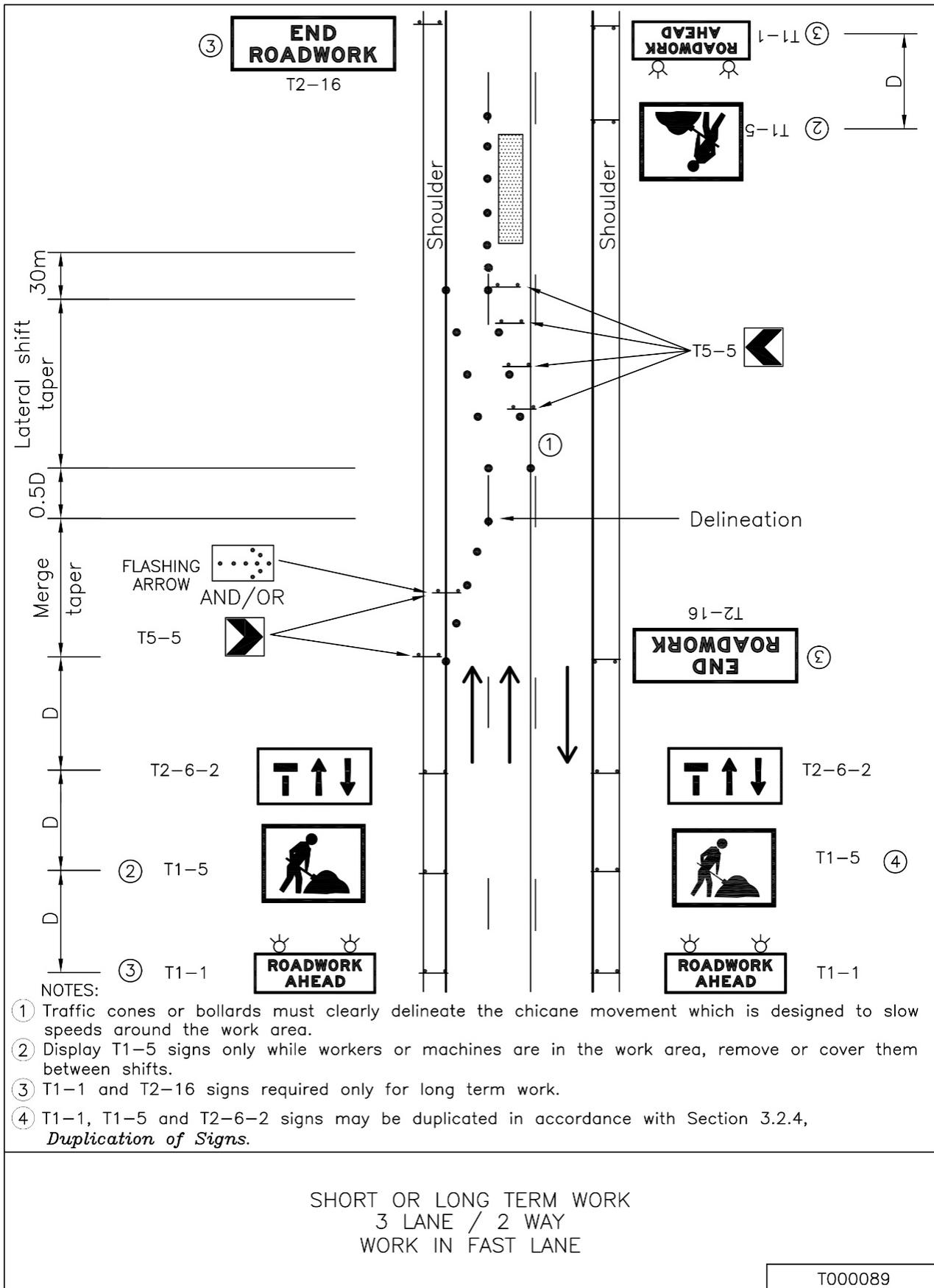
TCP 86



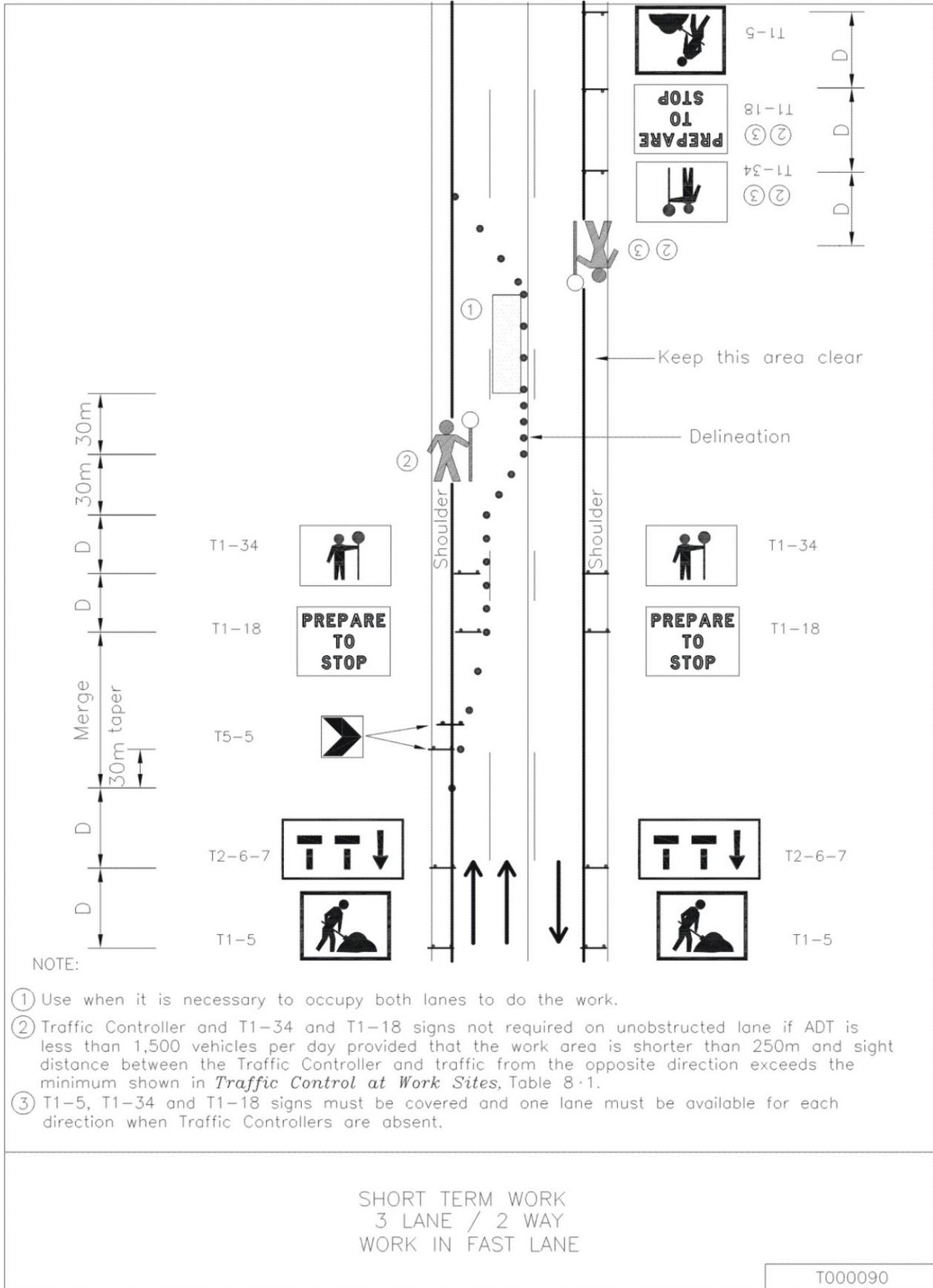
TCP 88



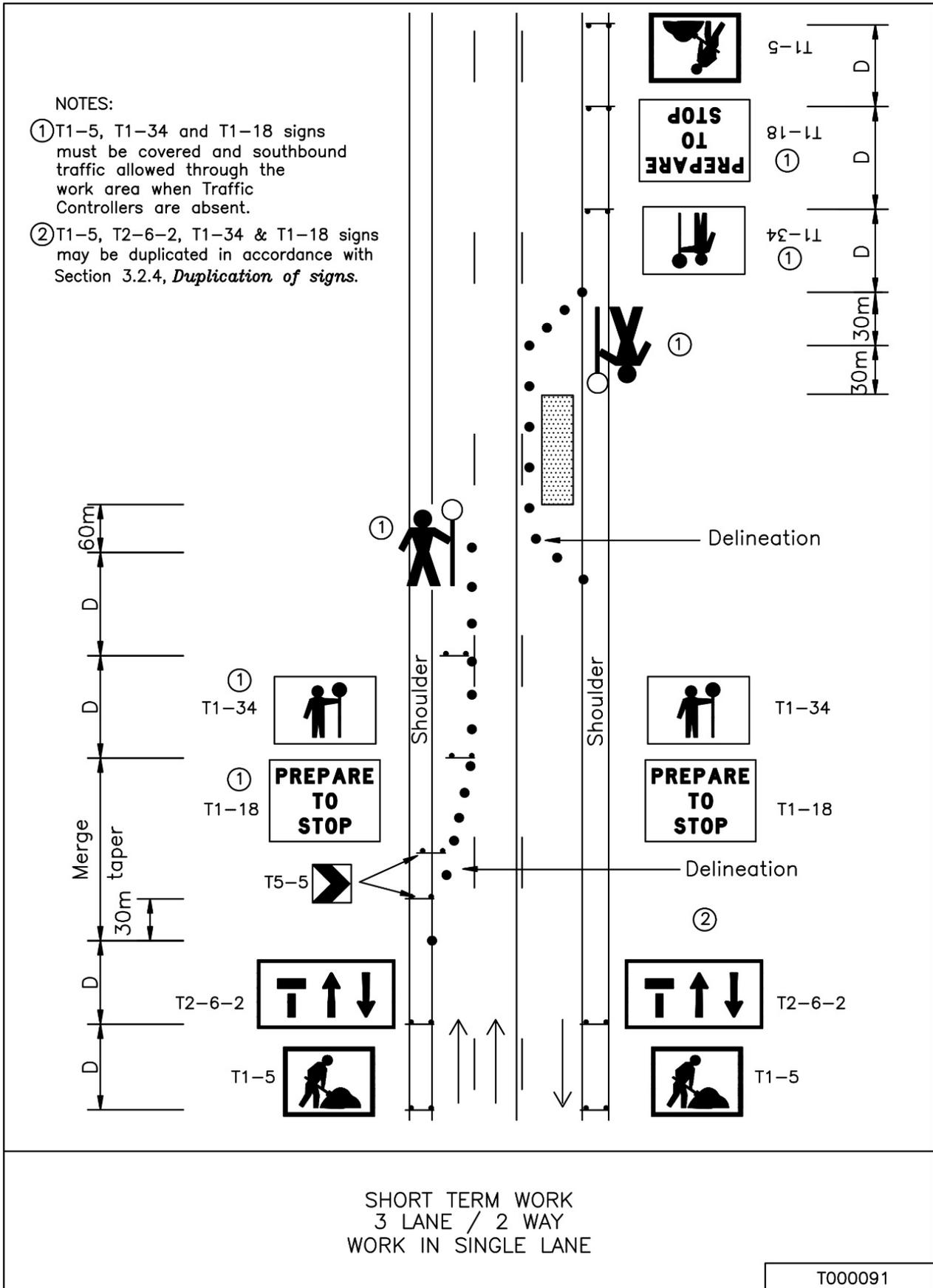
TCP 89



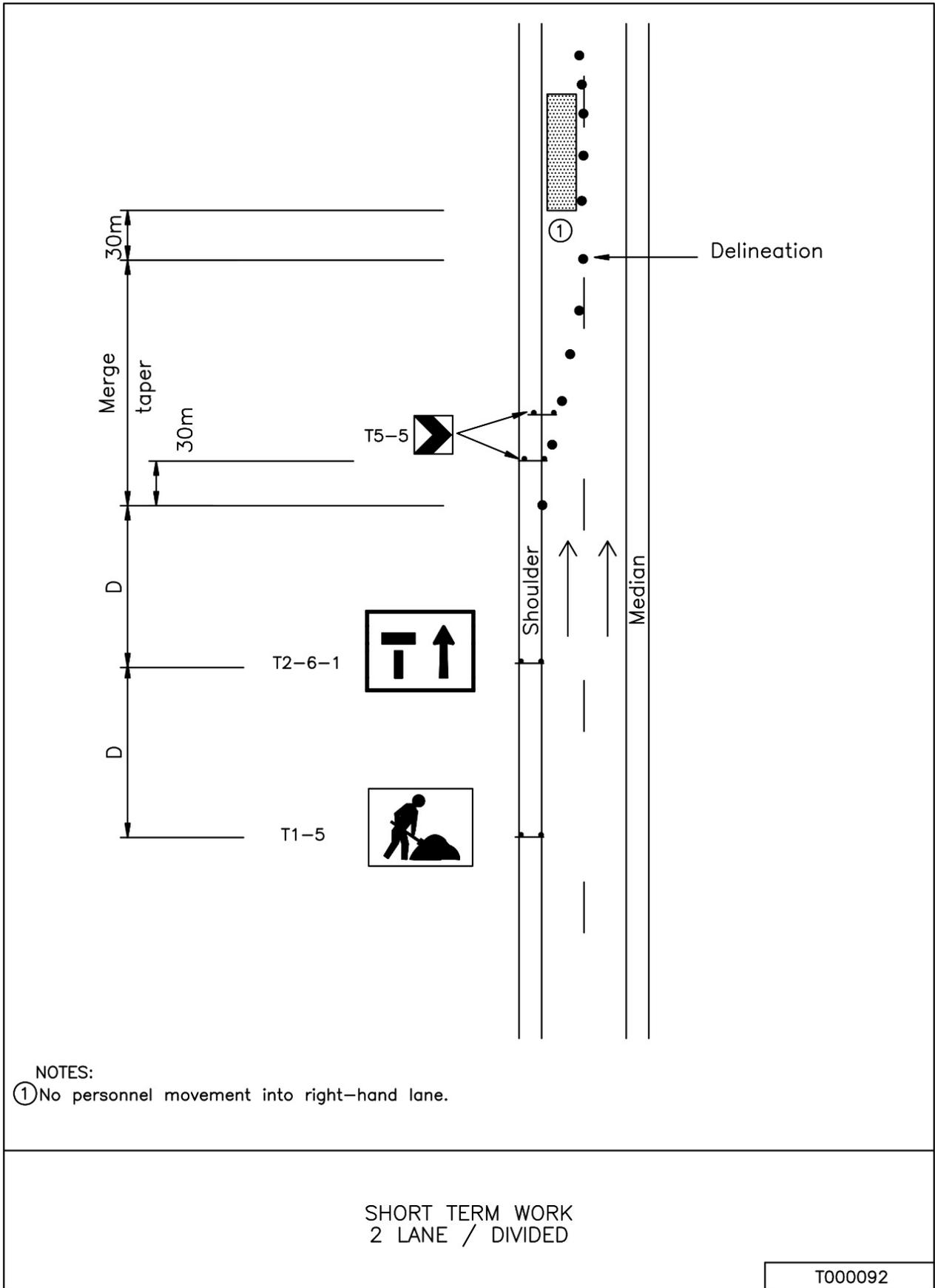
TCP 90



TCP 91



TCP 92

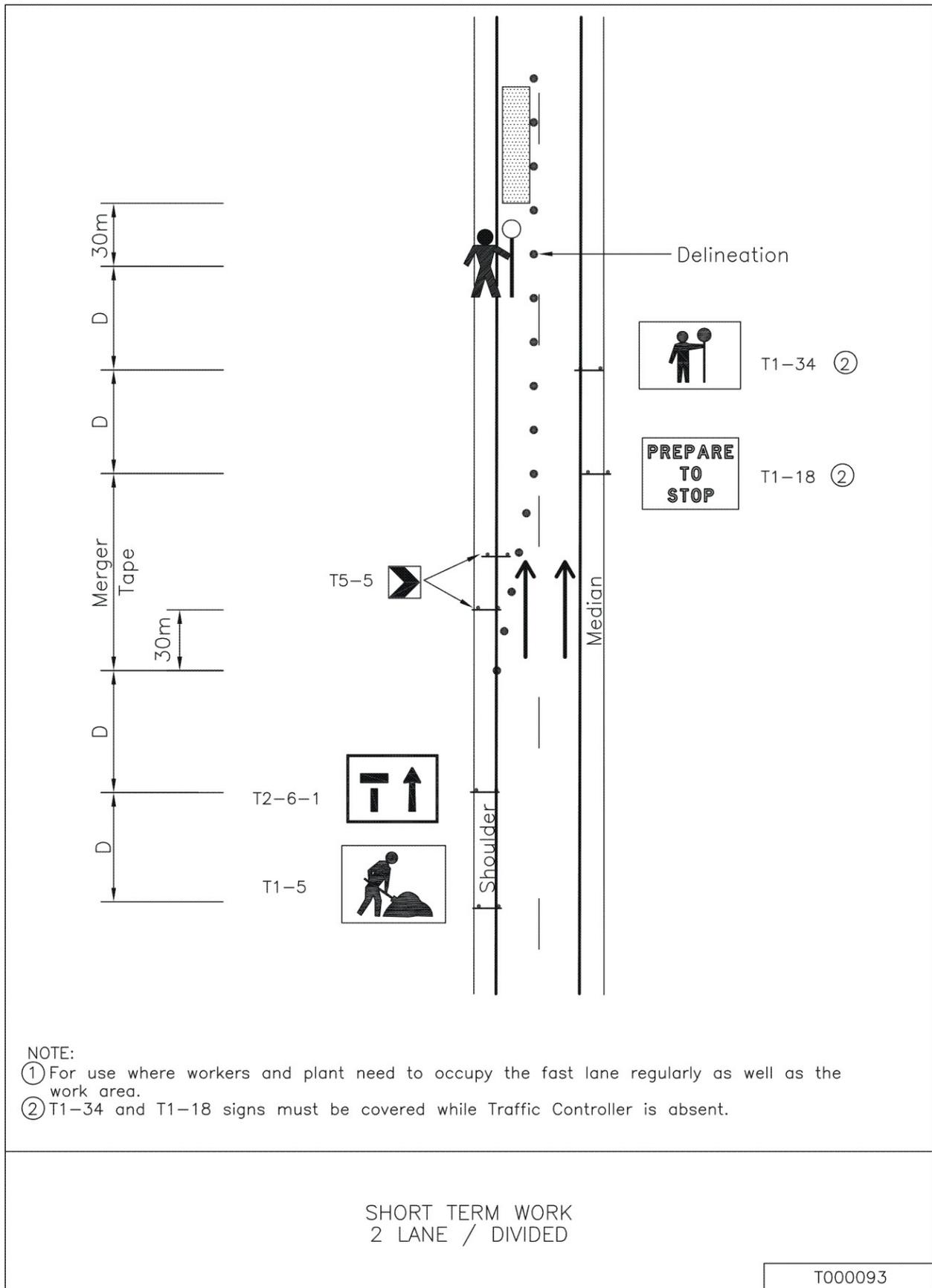


NOTES:
 ① No personnel movement into right-hand lane.

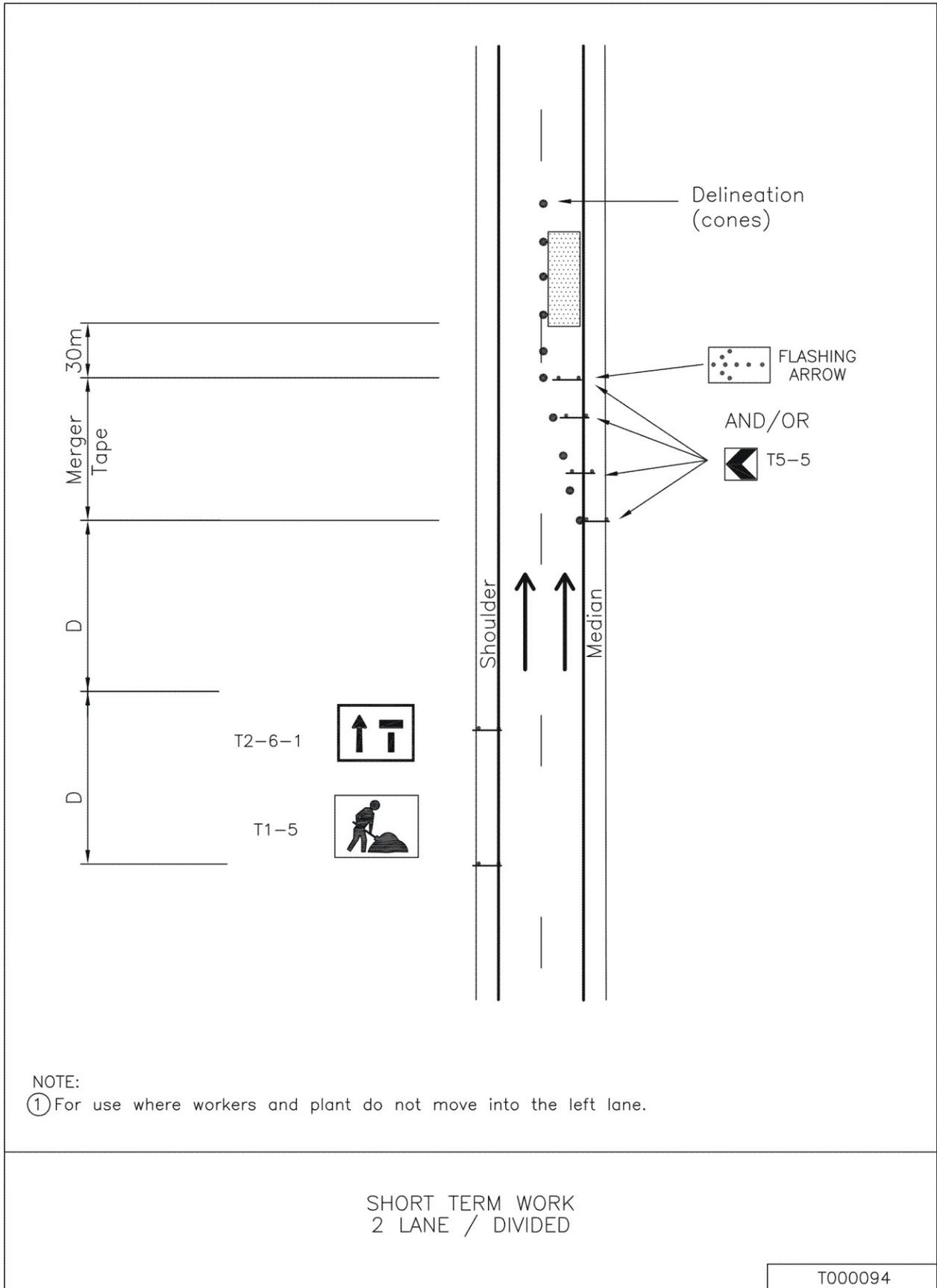
SHORT TERM WORK
 2 LANE / DIVIDED

T000092

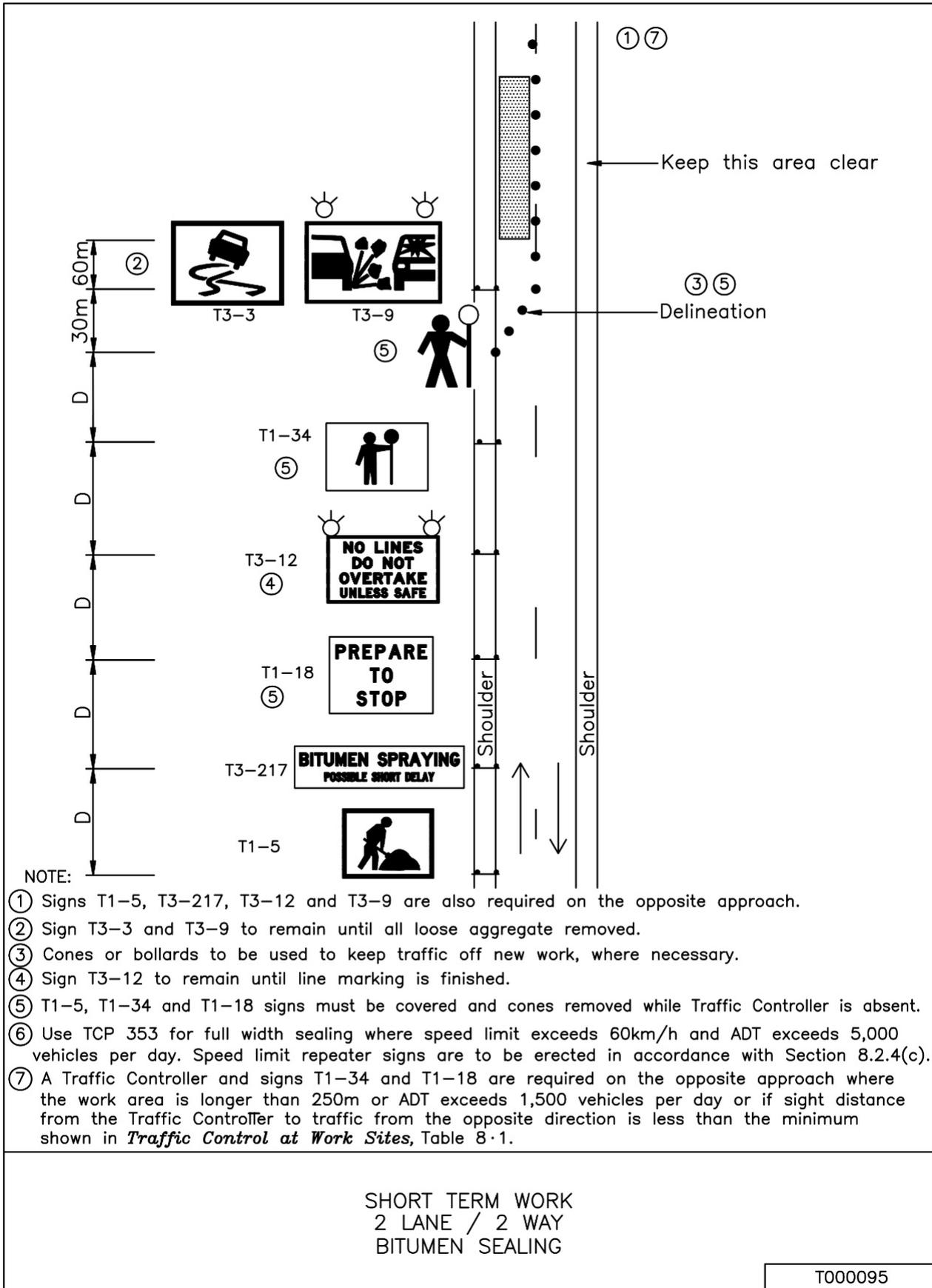
TCP 93



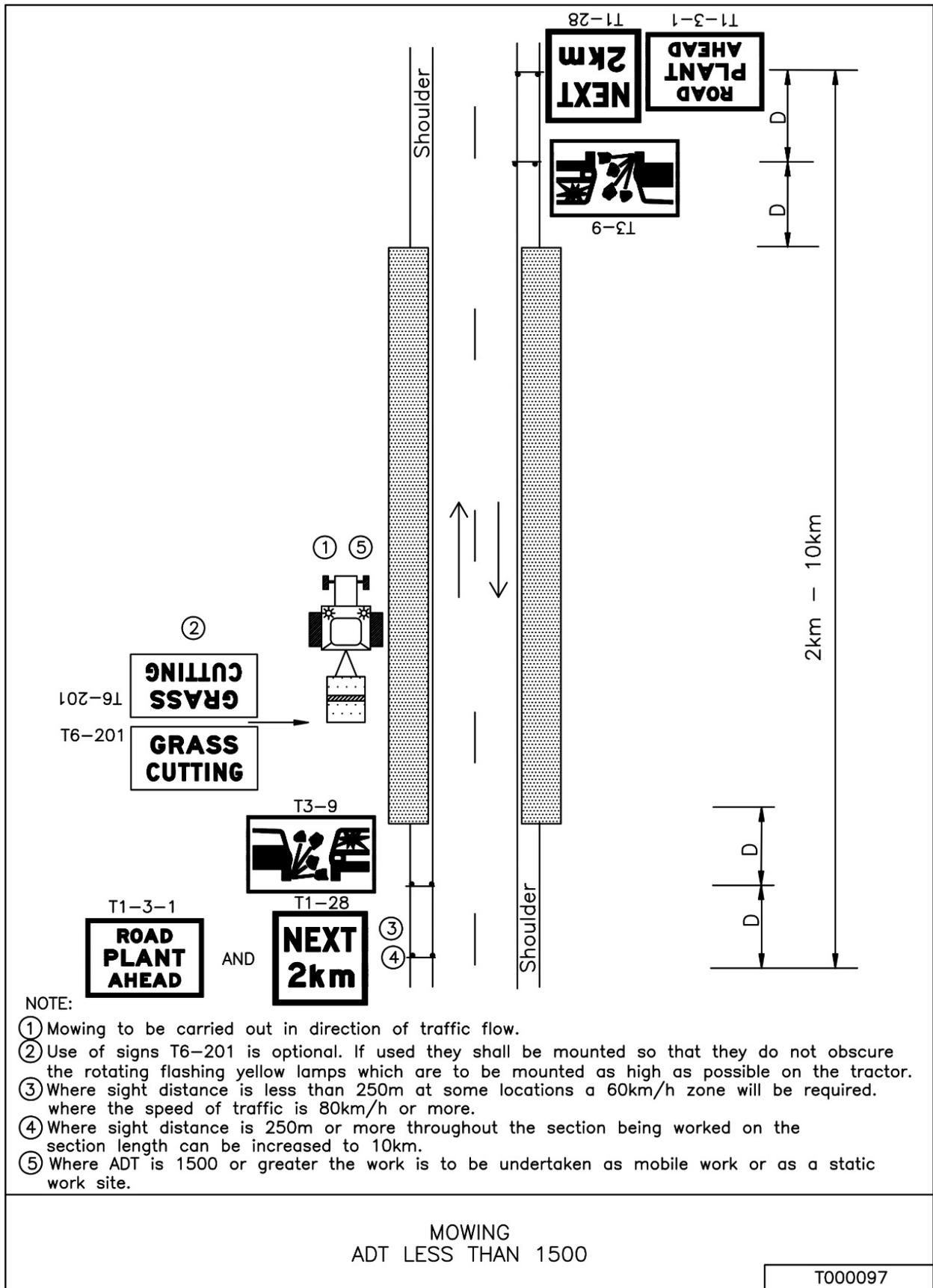
TCP 94



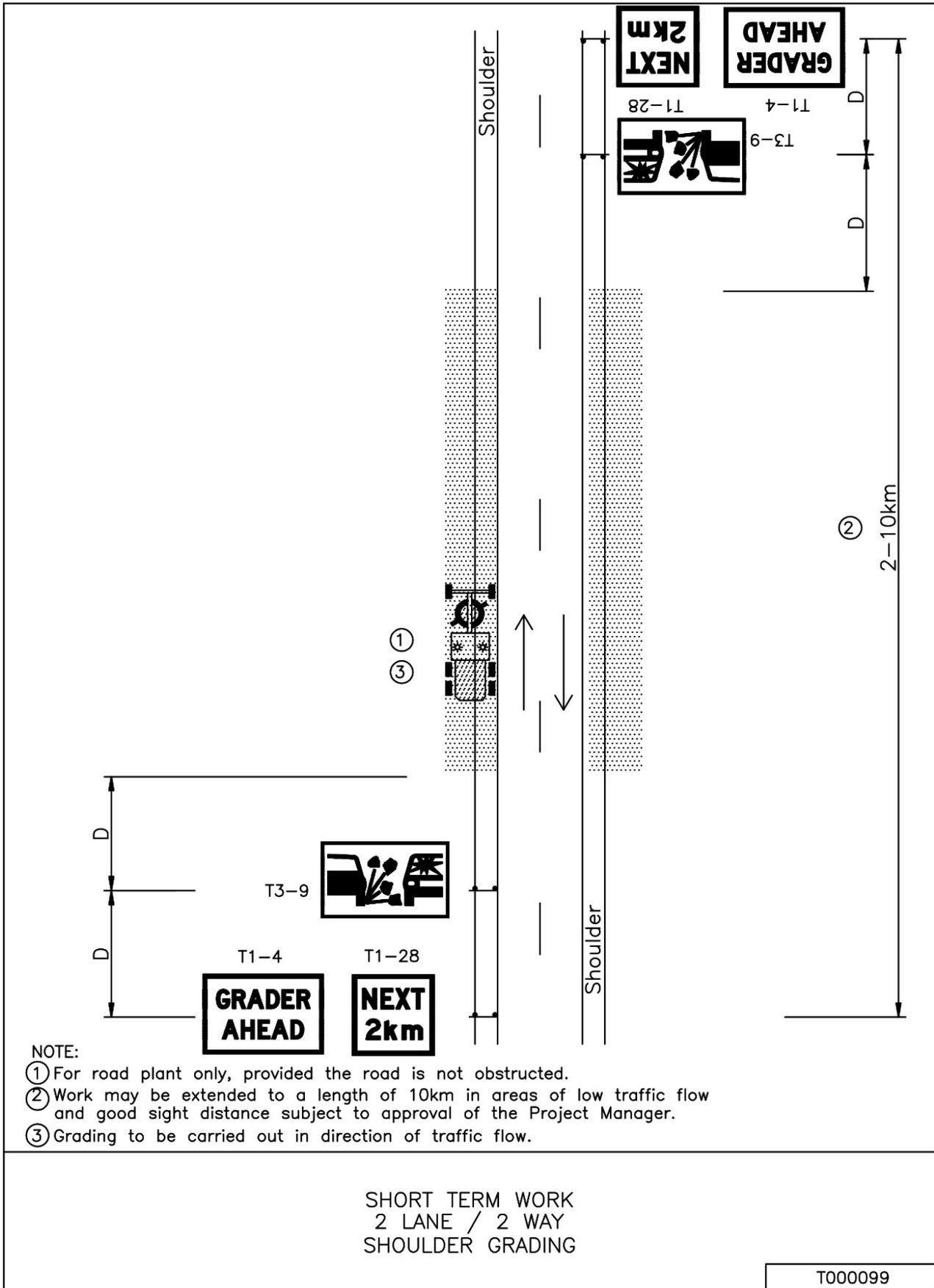
TCP 95



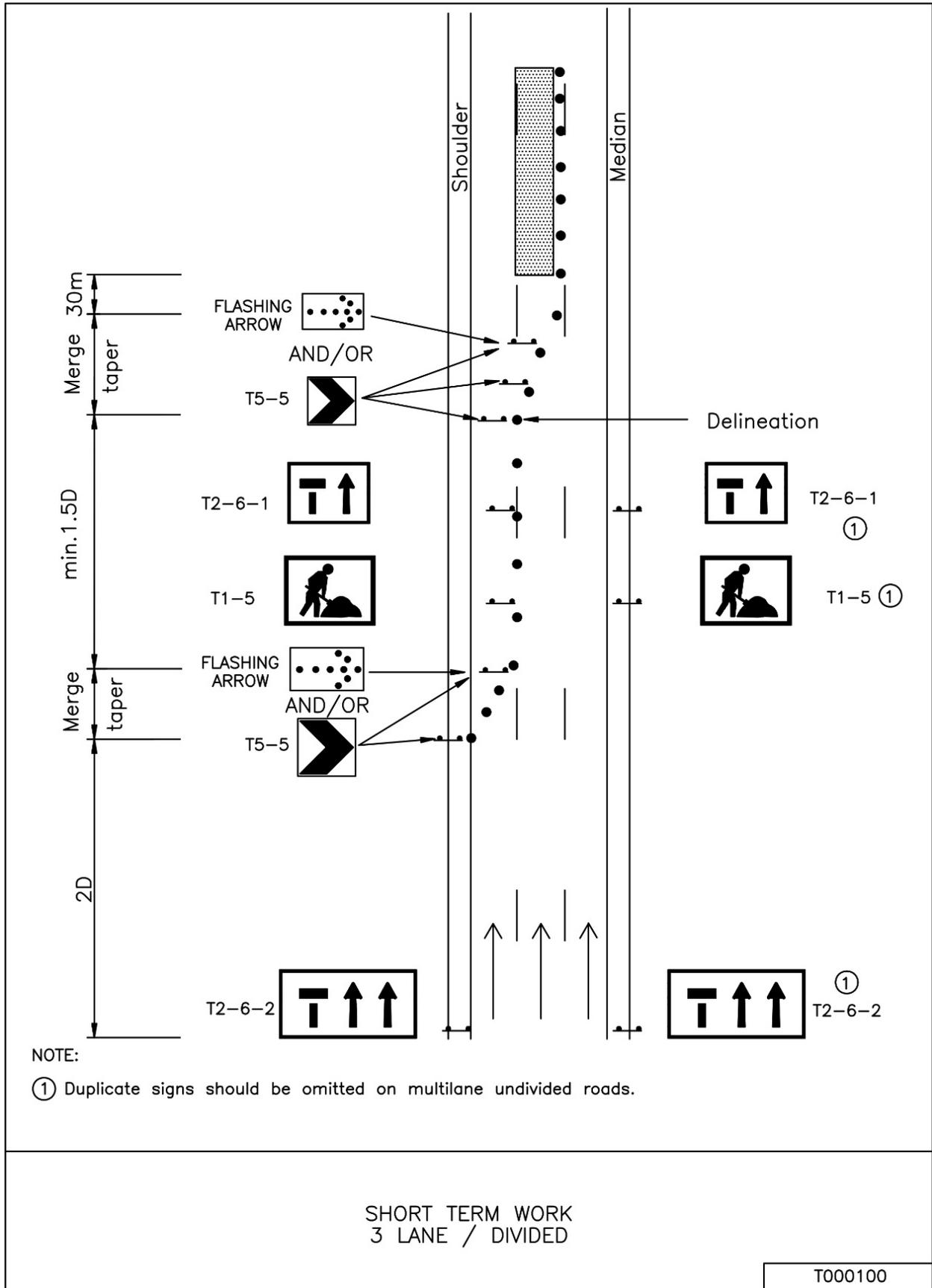
TCP 97



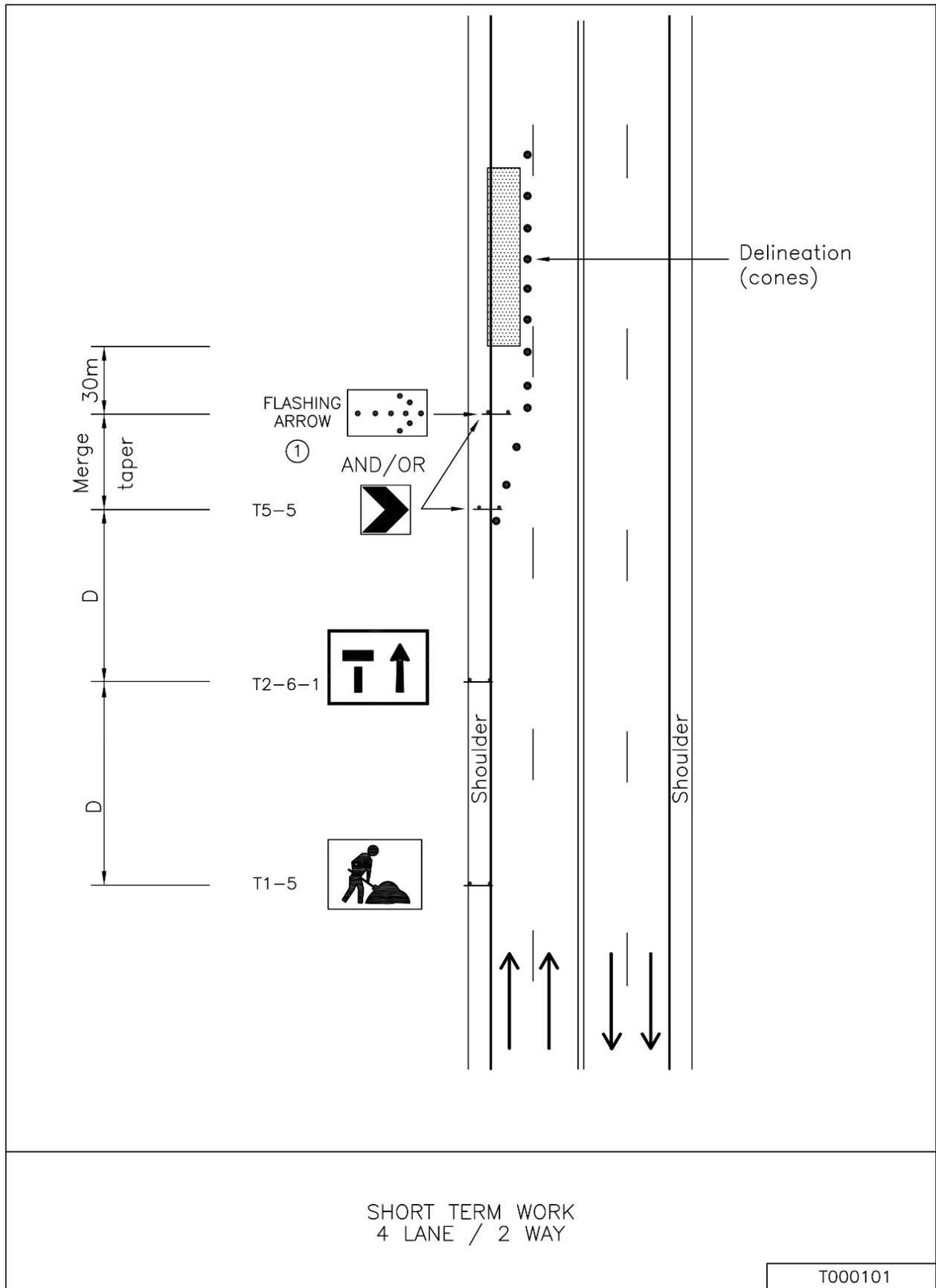
TCP 99



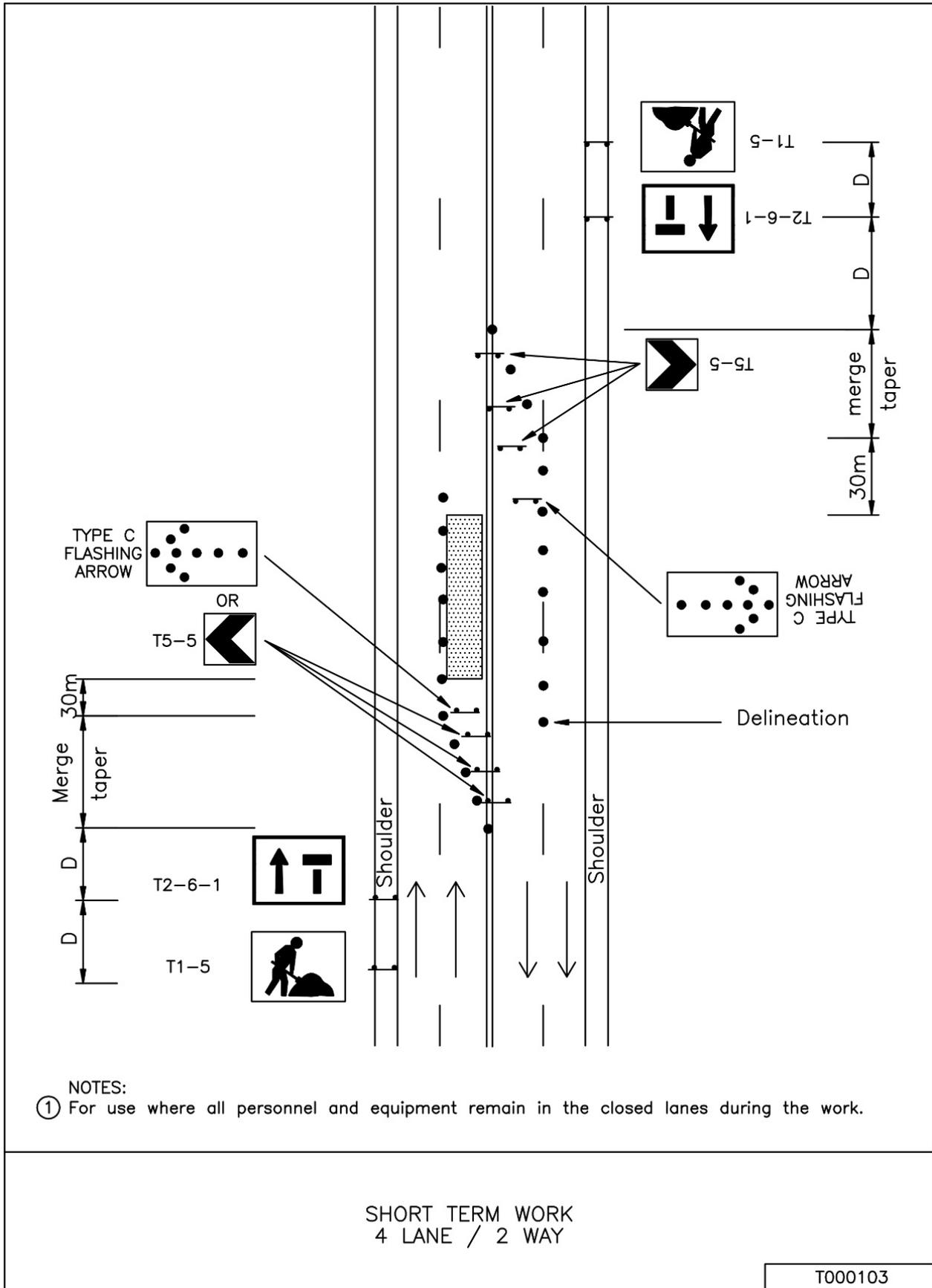
TCP 100



TCP 101

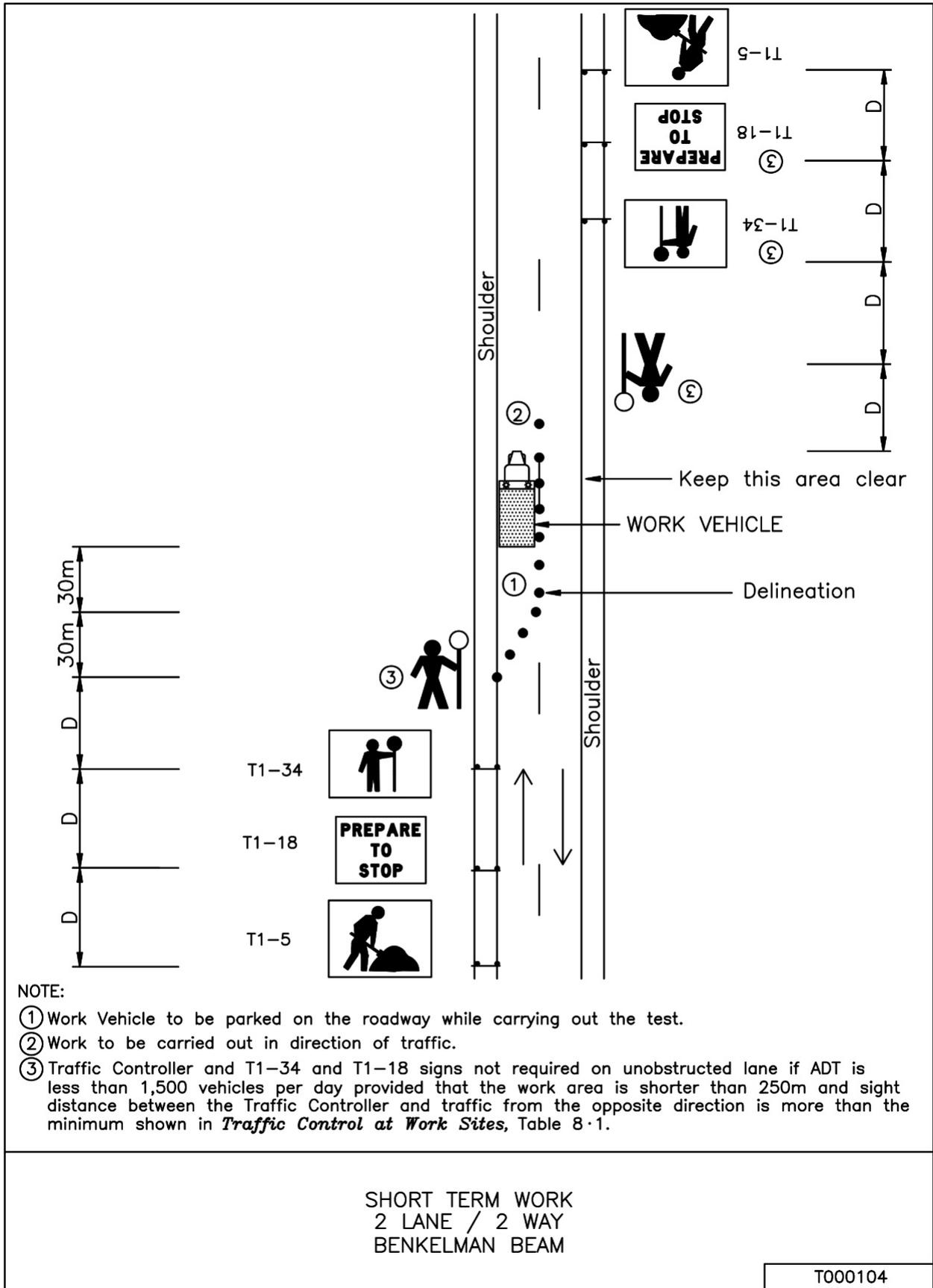


TCP 103

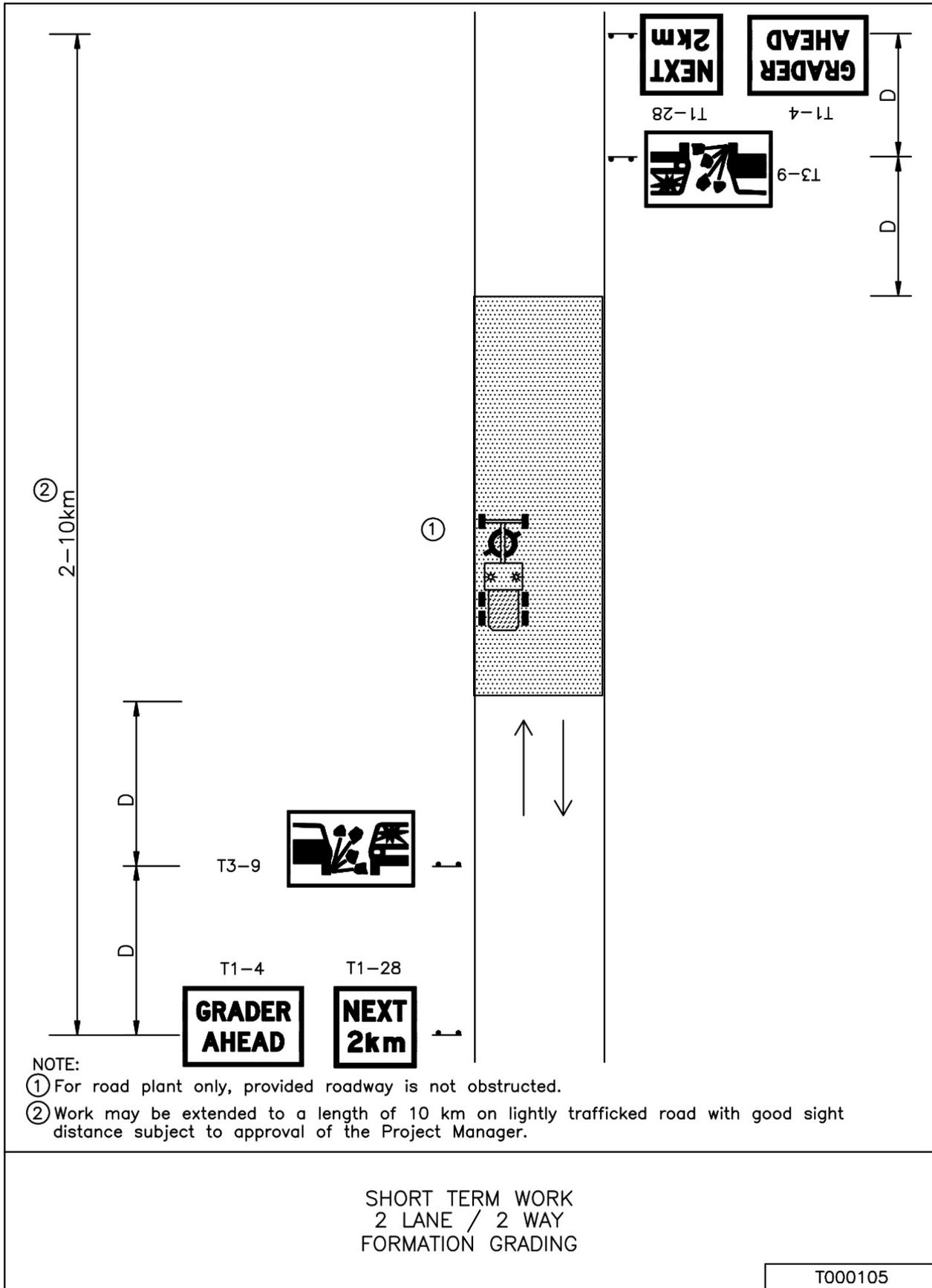


- NOTES:
- ① For use where all personnel and equipment remain in the closed lanes during the work.

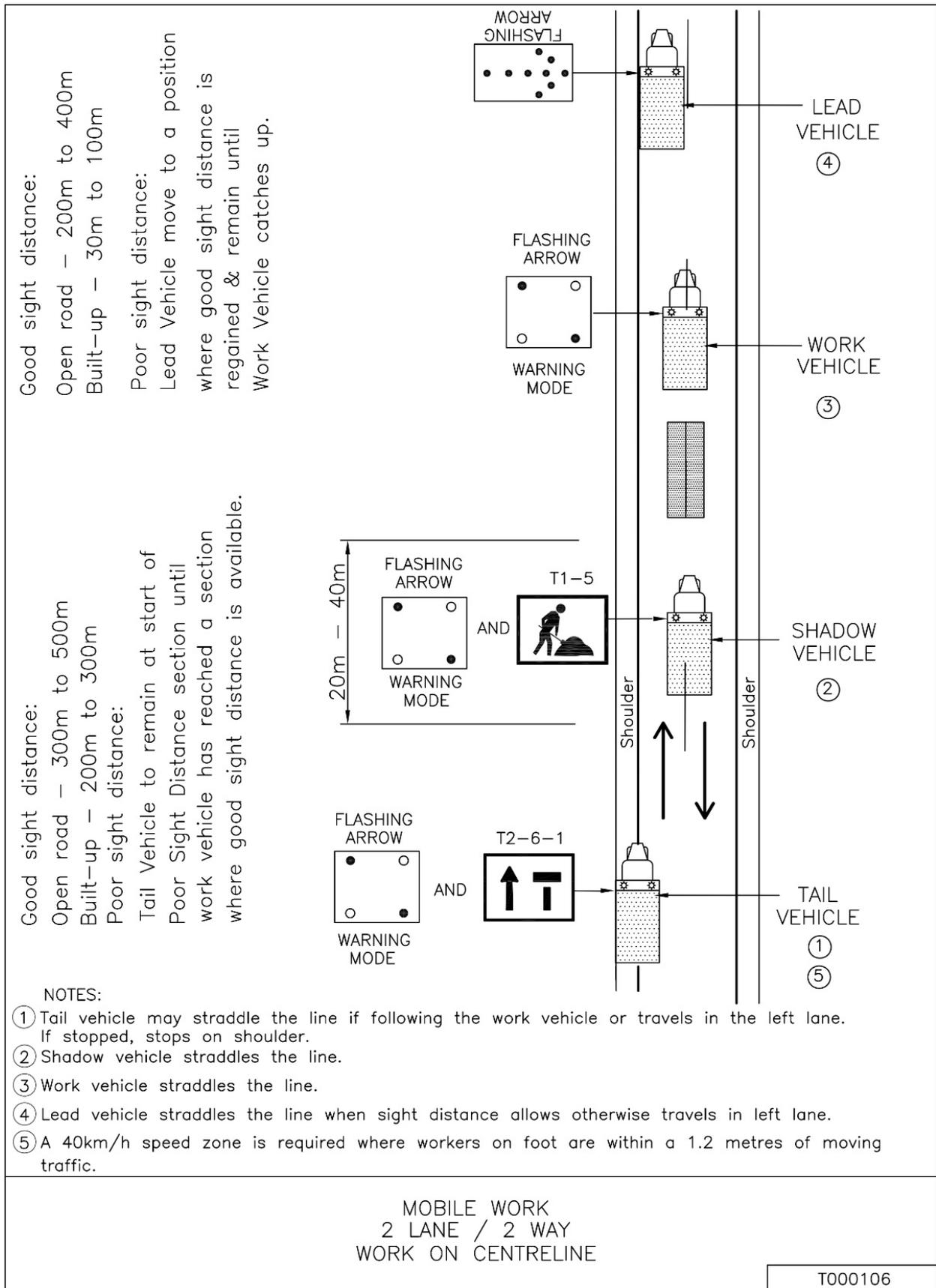
TCP 104



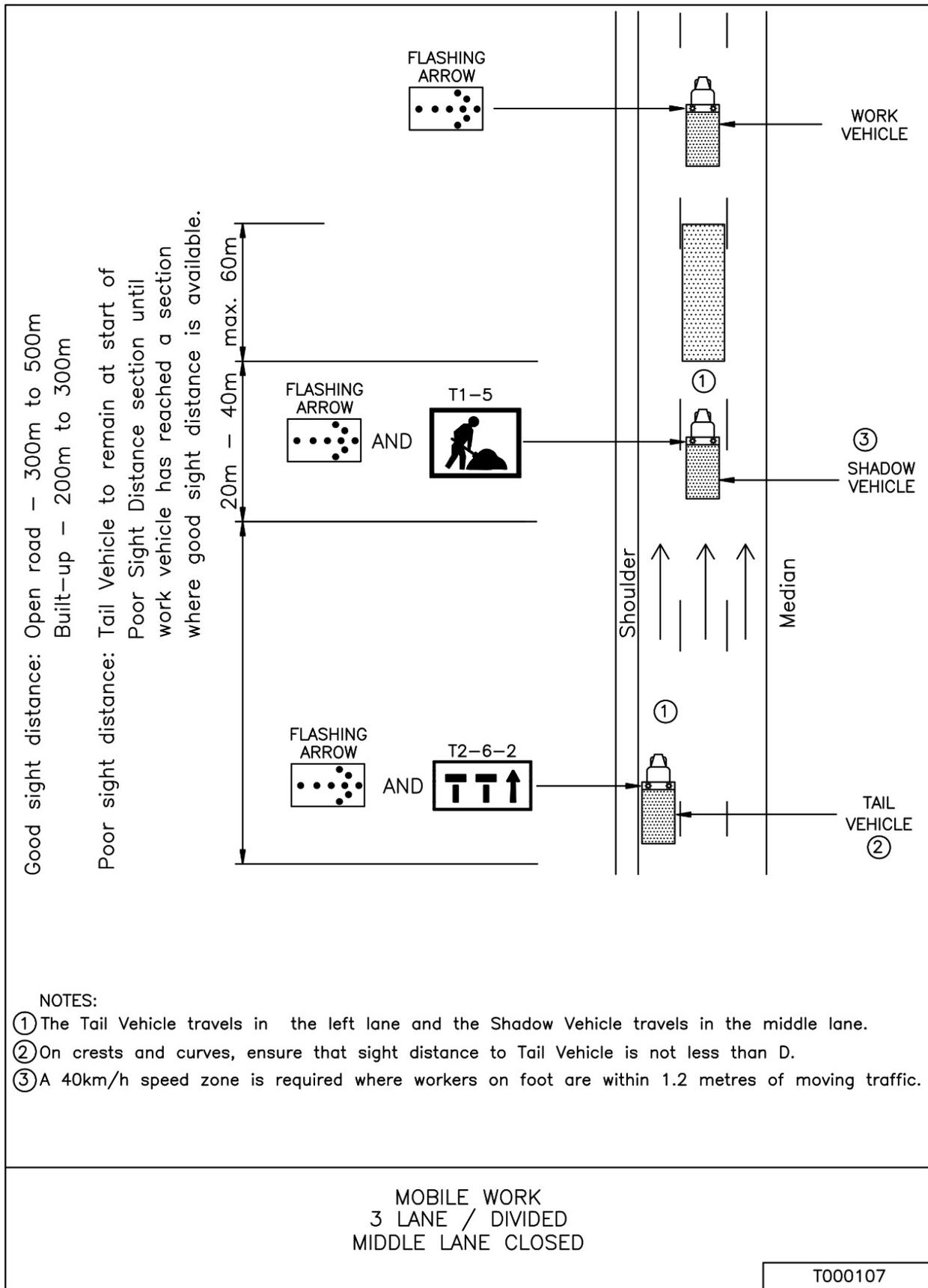
TCP 105



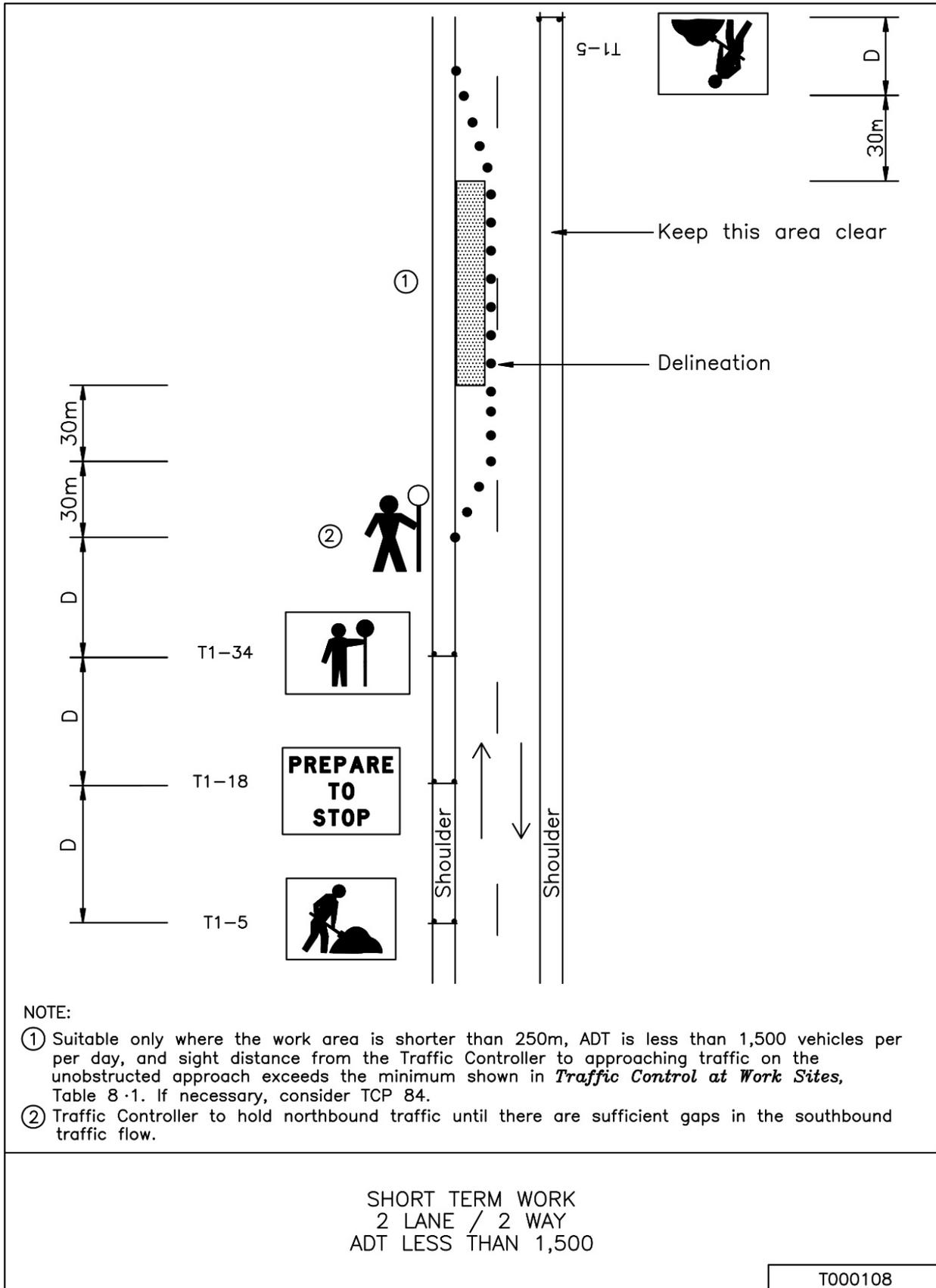
TCP 106



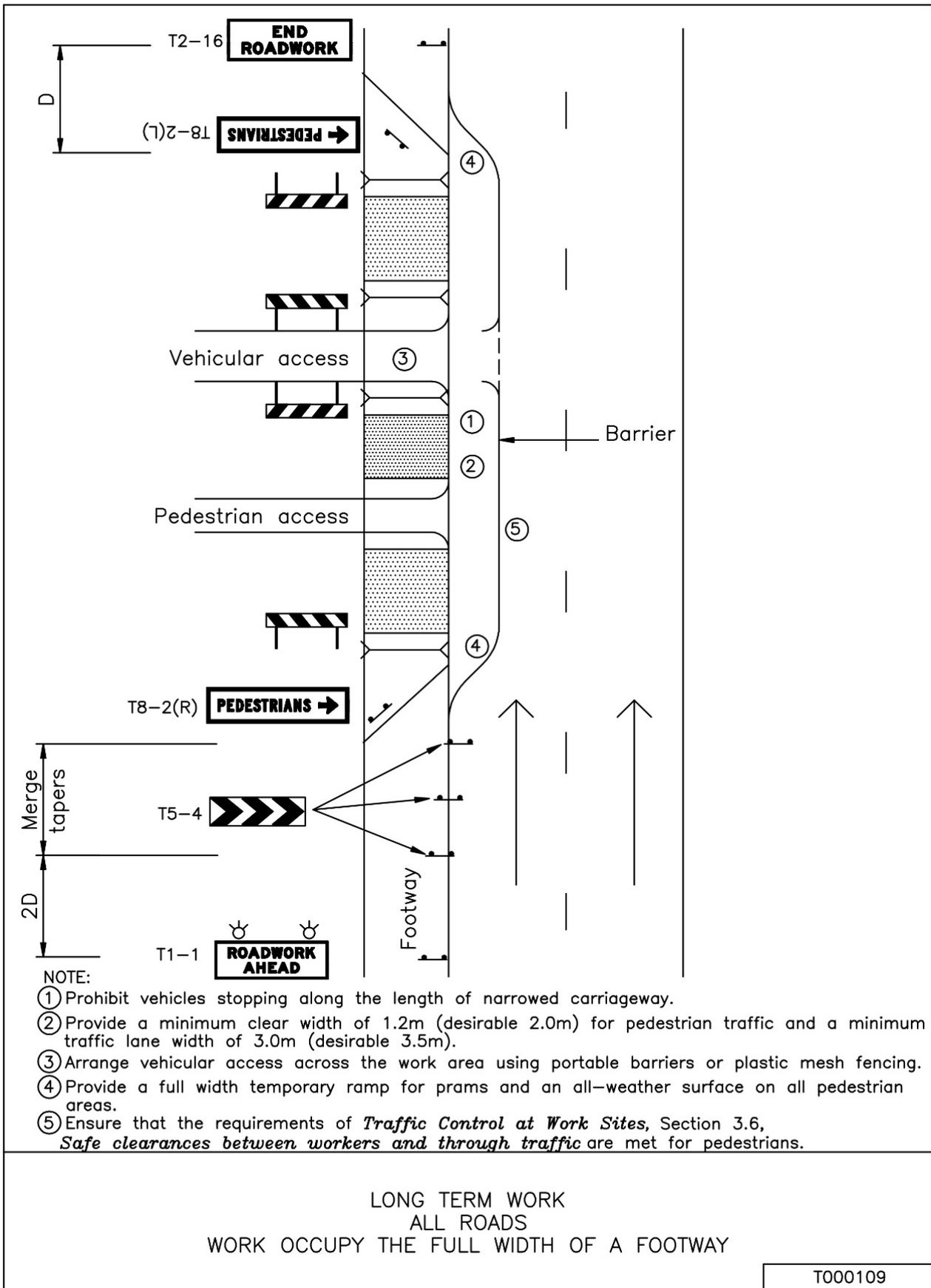
TCP 107



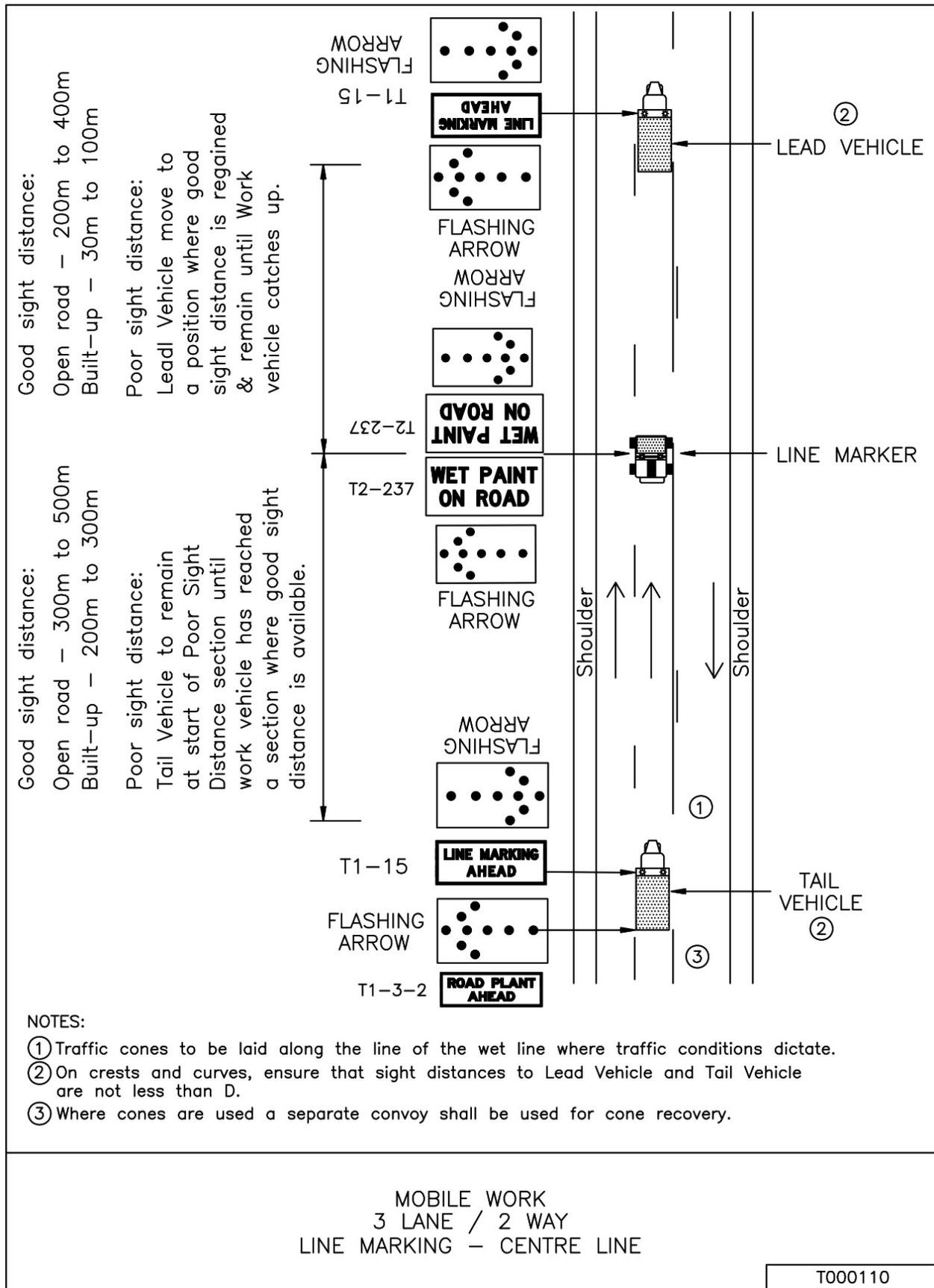
TCP 108



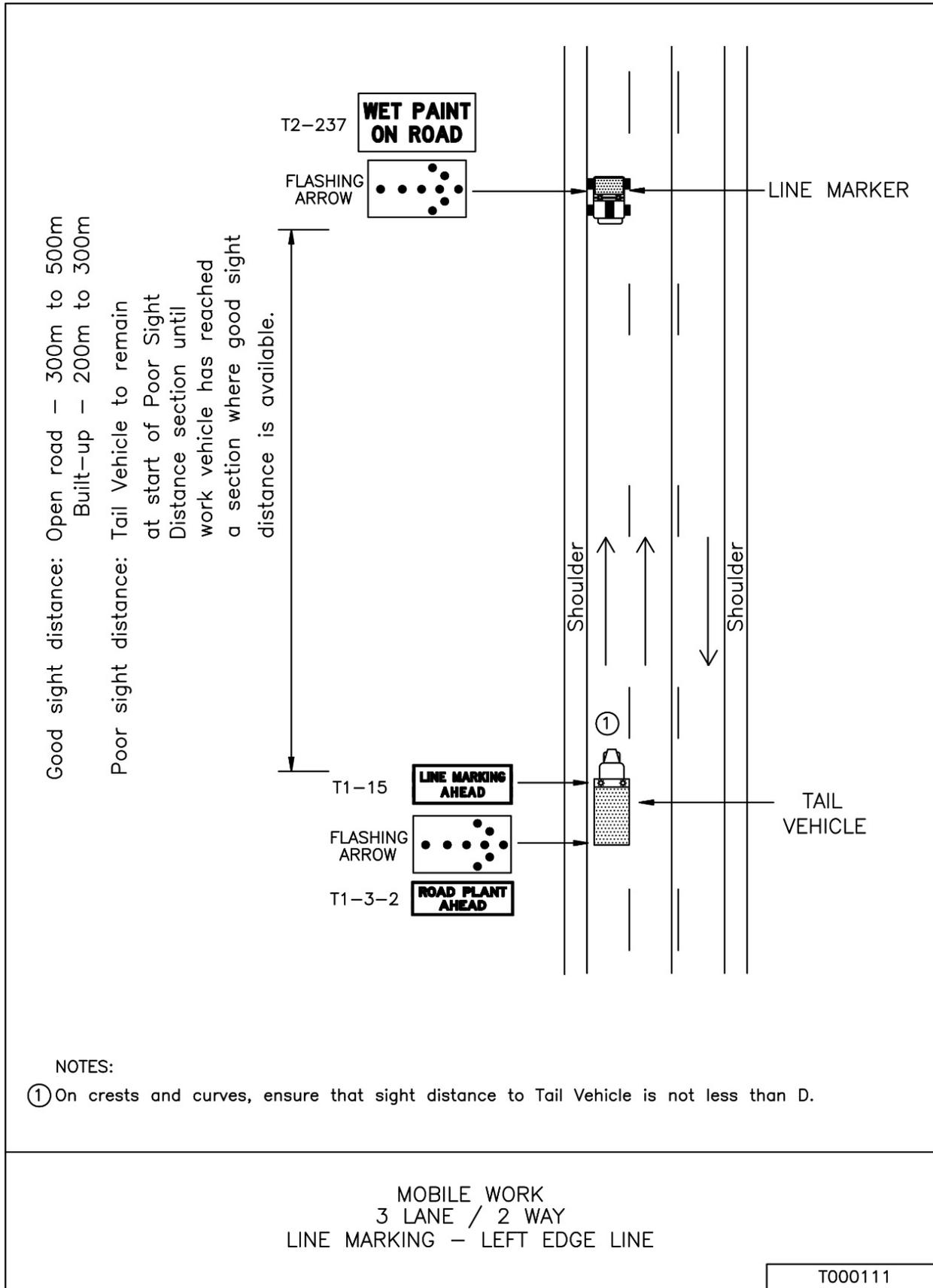
TCP 109



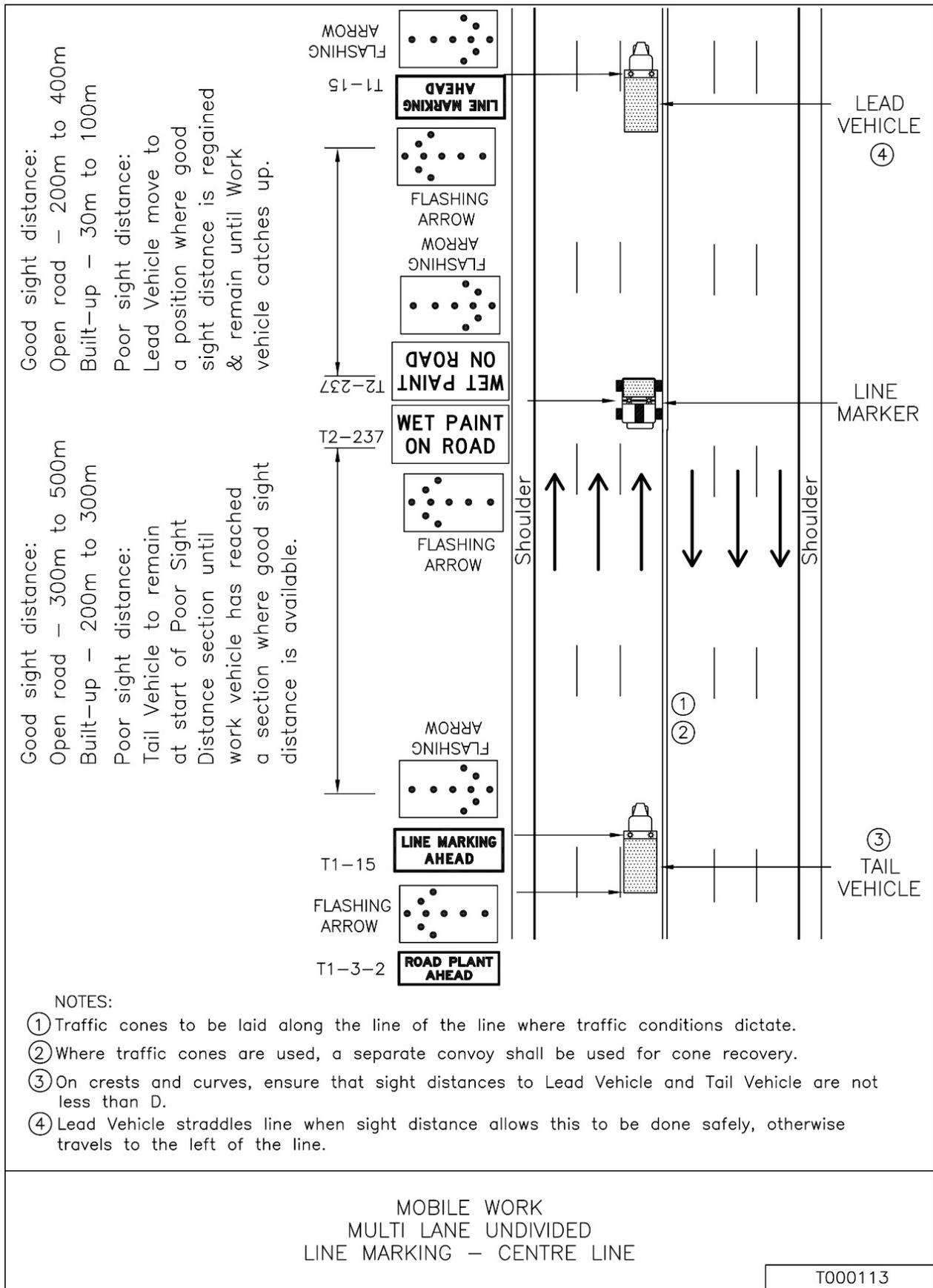
TCP 110



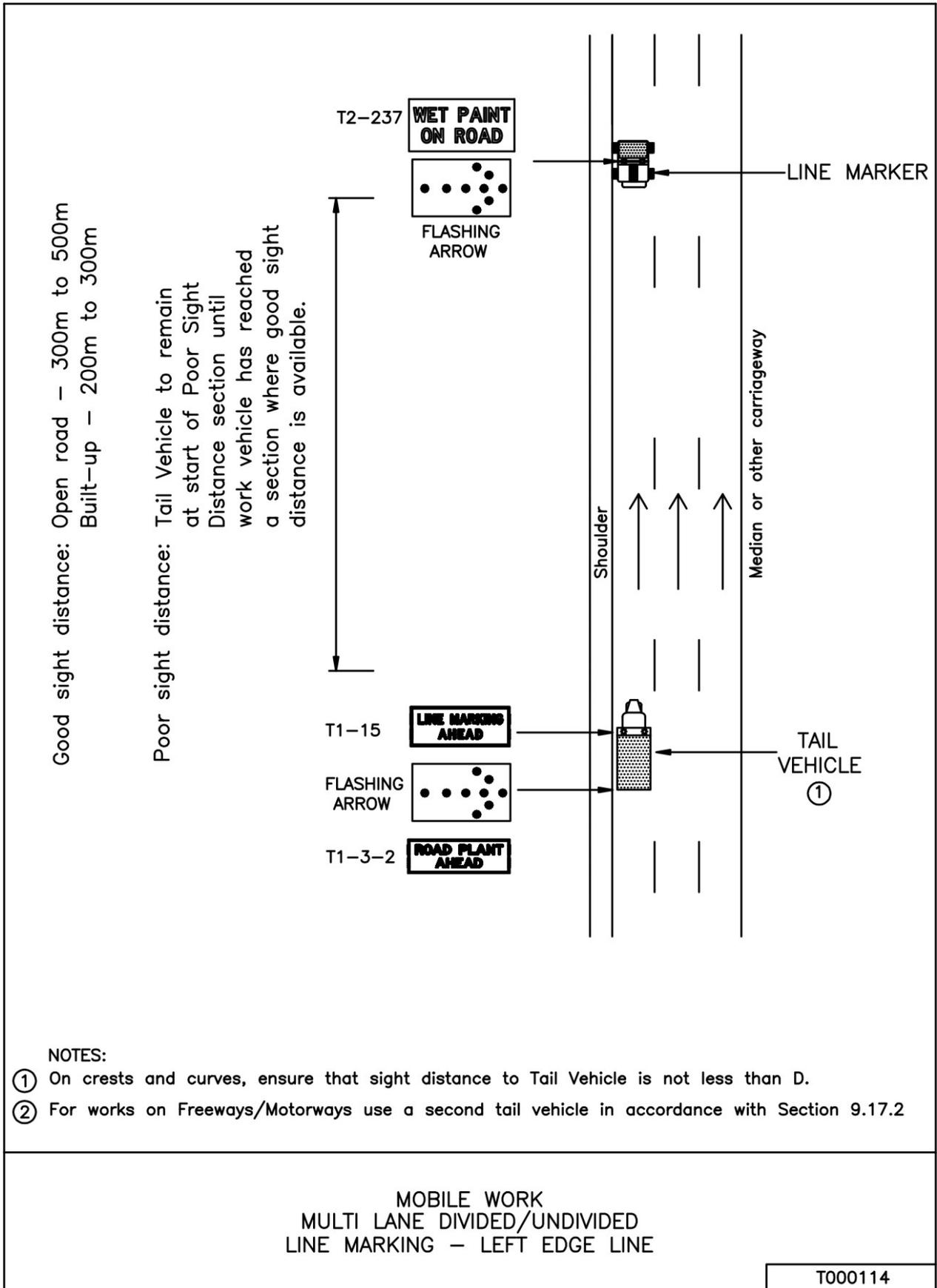
TCP 111



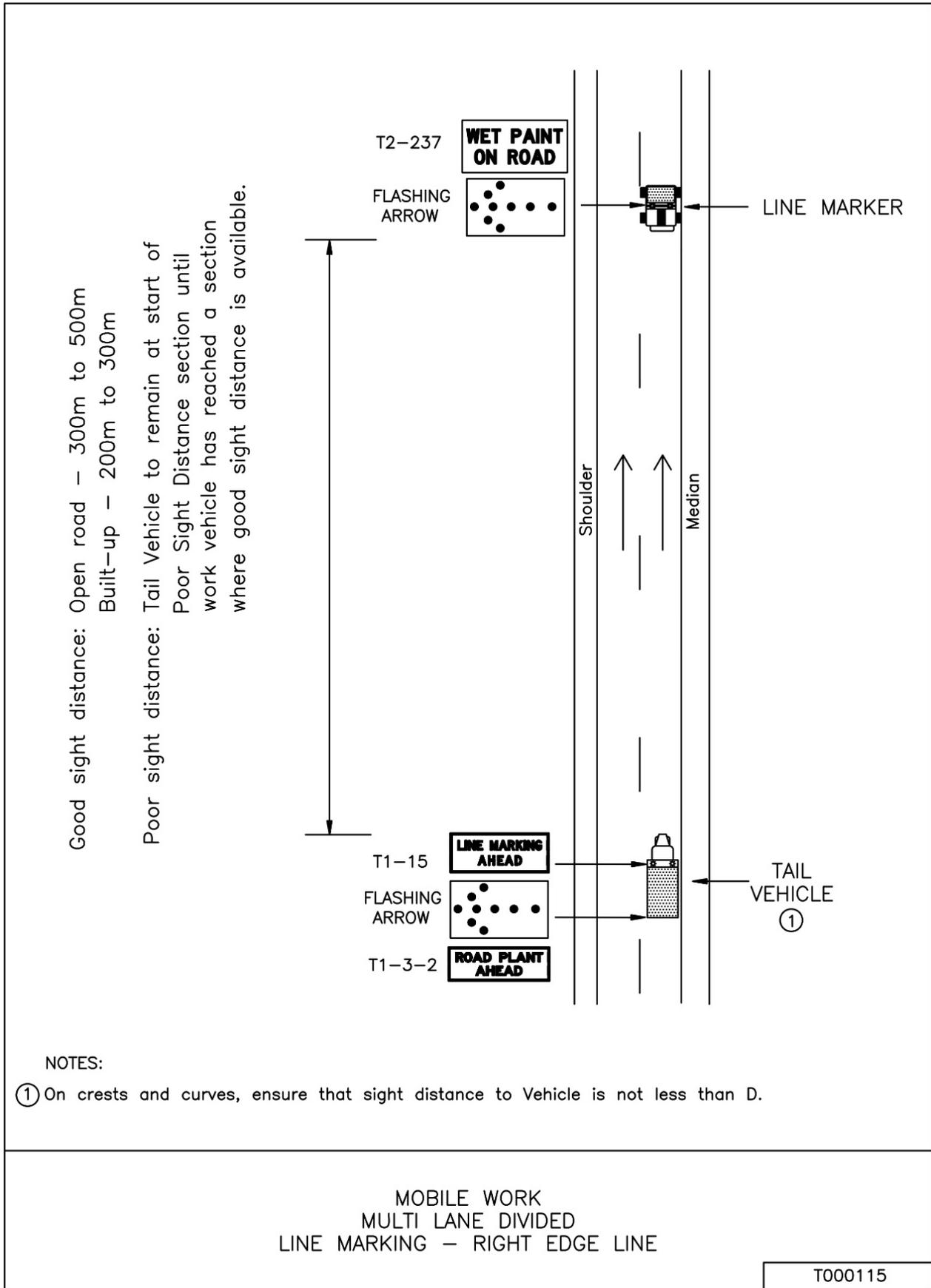
TCP 113



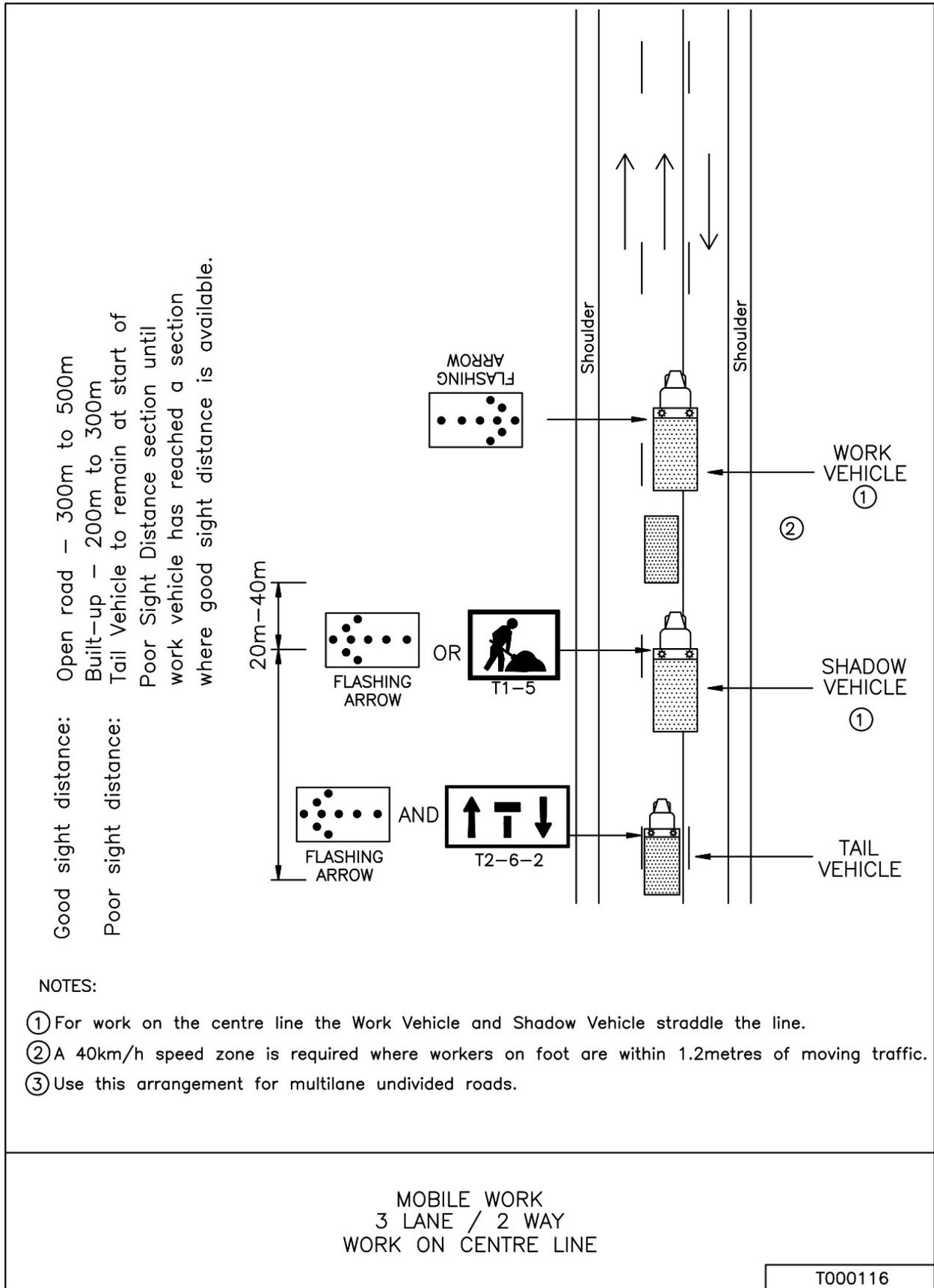
TCP 114



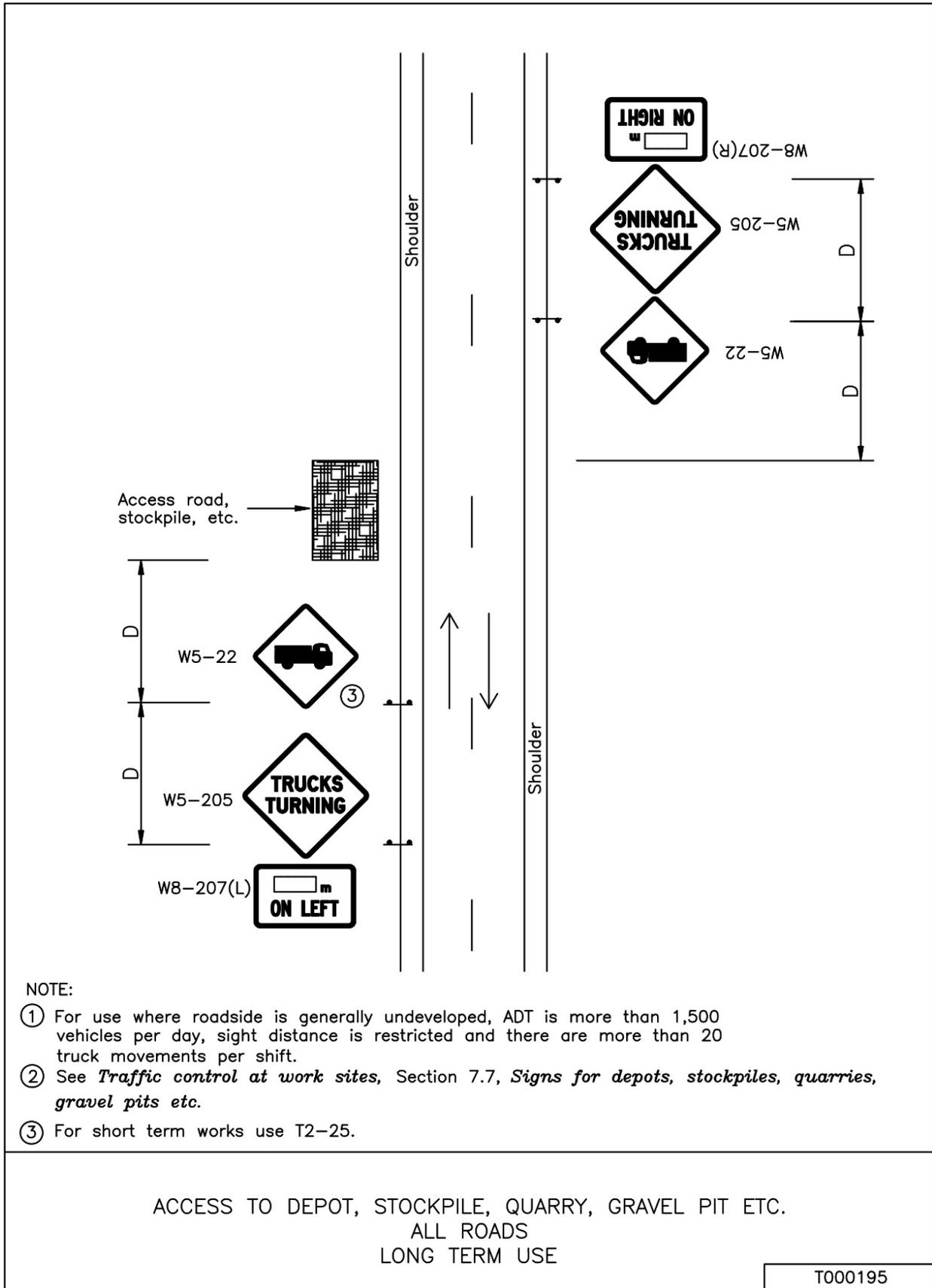
TCP 115



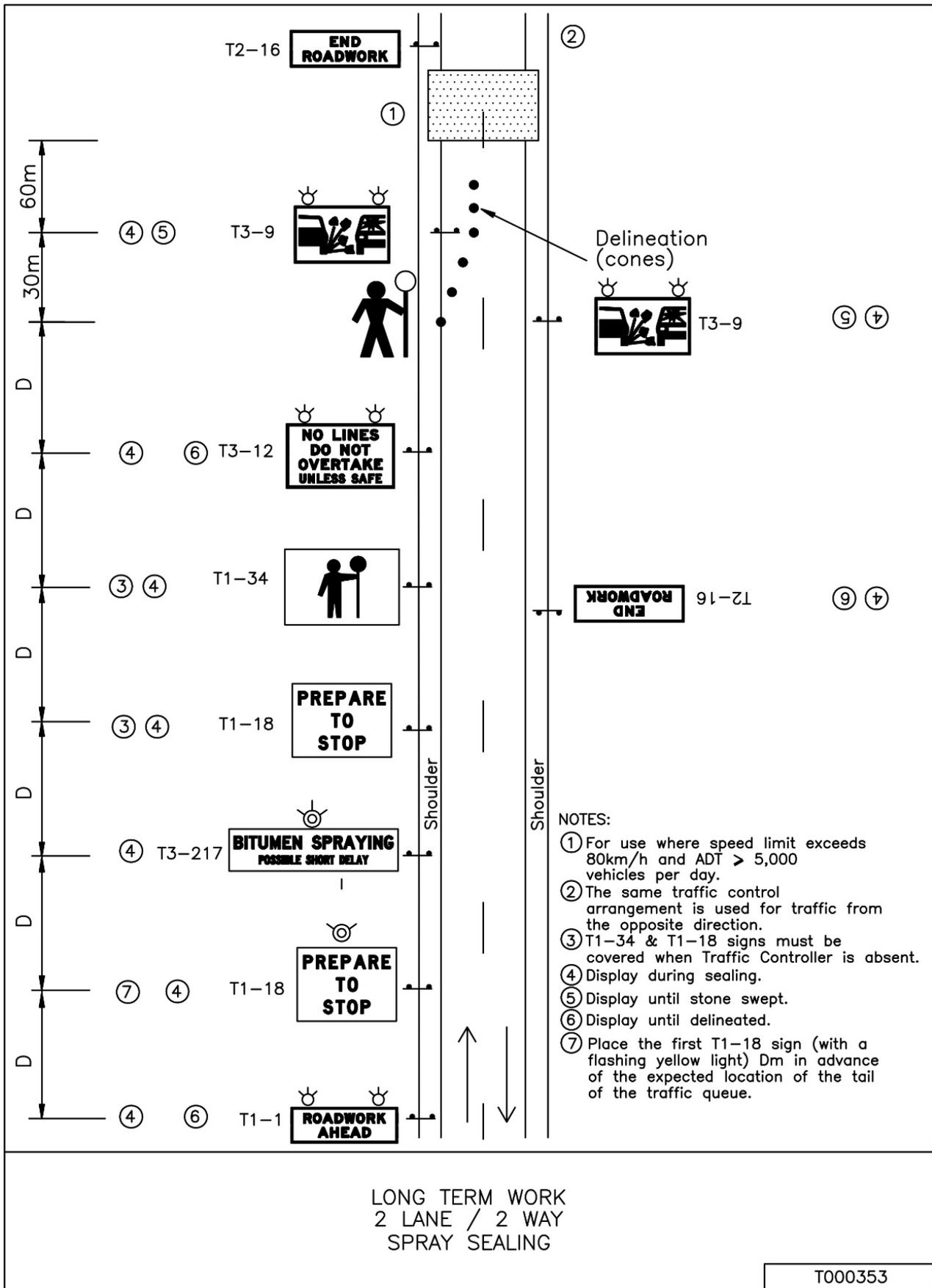
TCP 116



TCP 195

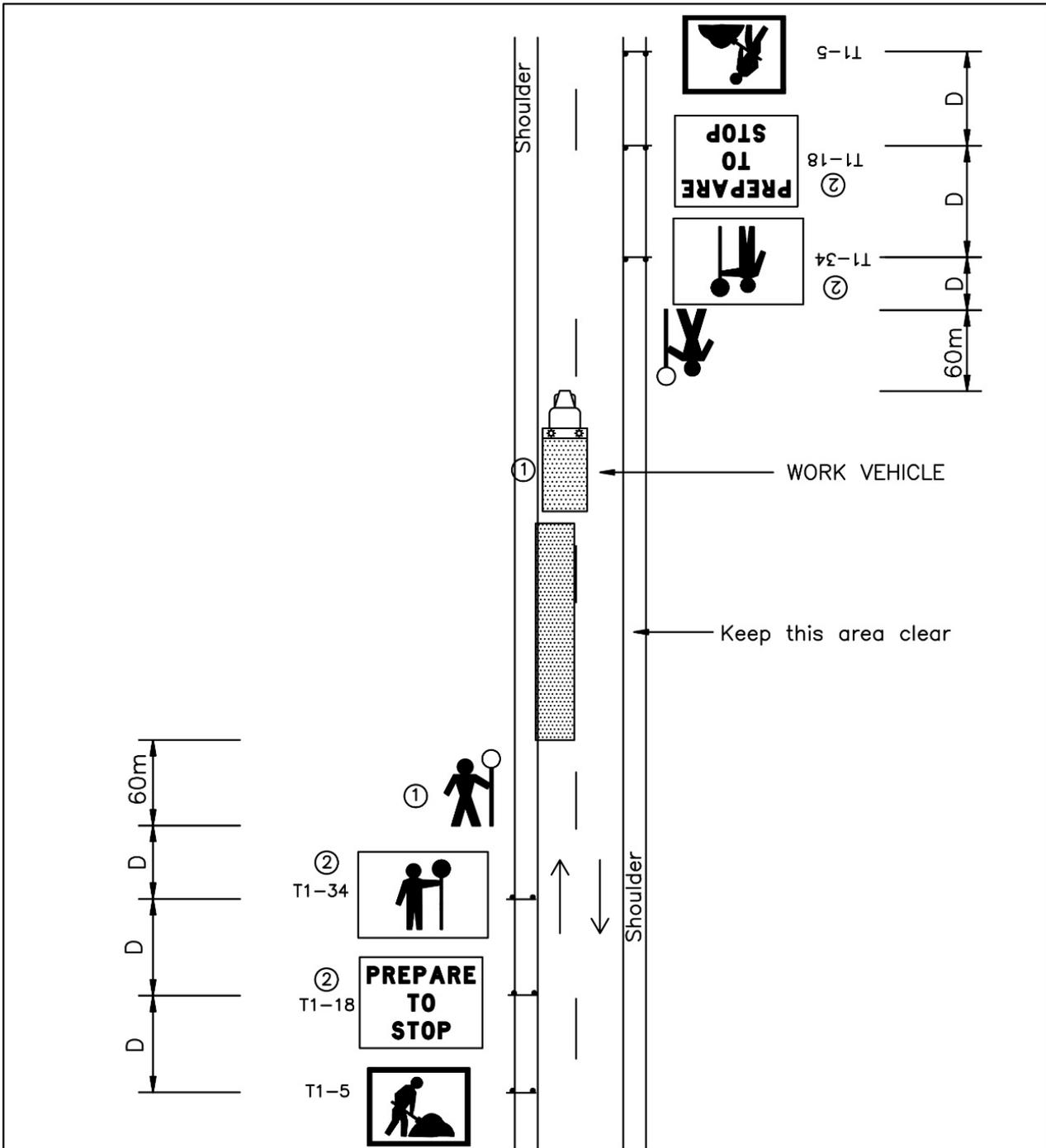


TCP 353



- 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 T1-34 & T1-18 signs must be covered when Traffic Controller is absent.
 - ④ Display during sealing.
 - ⑤ Display until stone swept.
 - 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.

TCP 437



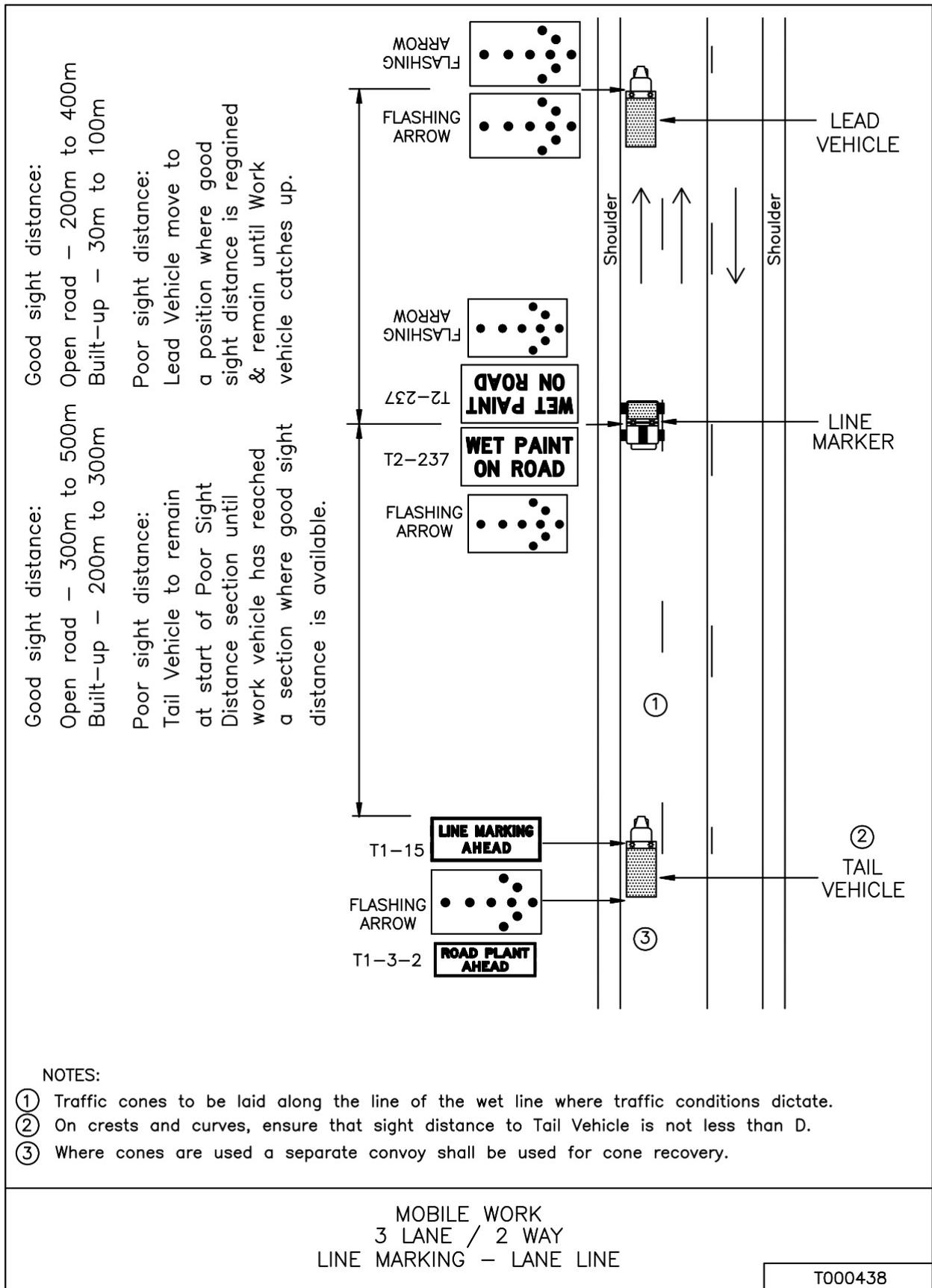
NOTE:

- 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, T1-34 and T1-18 signs must be covered while Traffic Controller is absent.

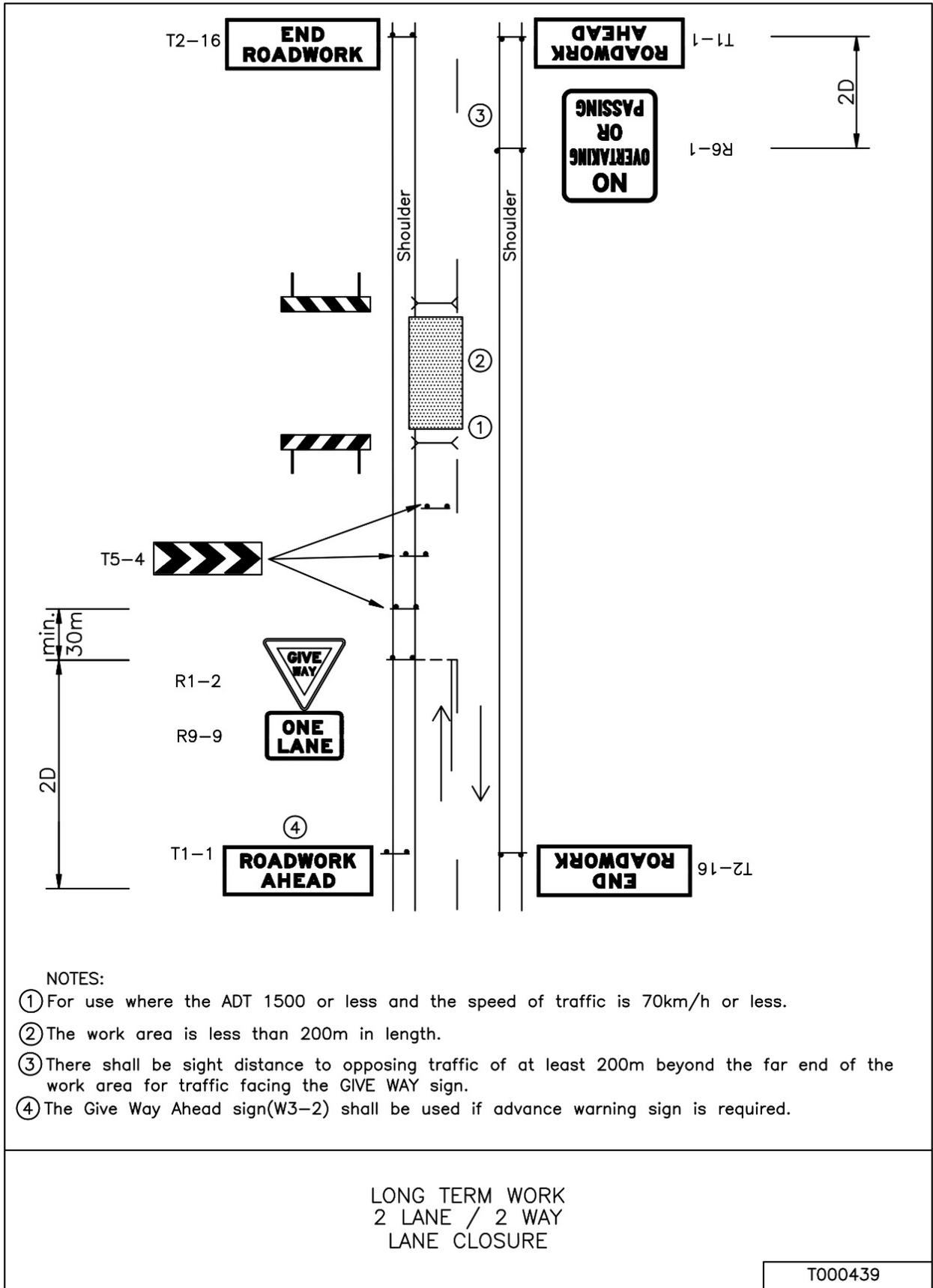
SHORT TERM WORK
 2 LANE / 2 WAY
 ADT ≥ 1500

T000437

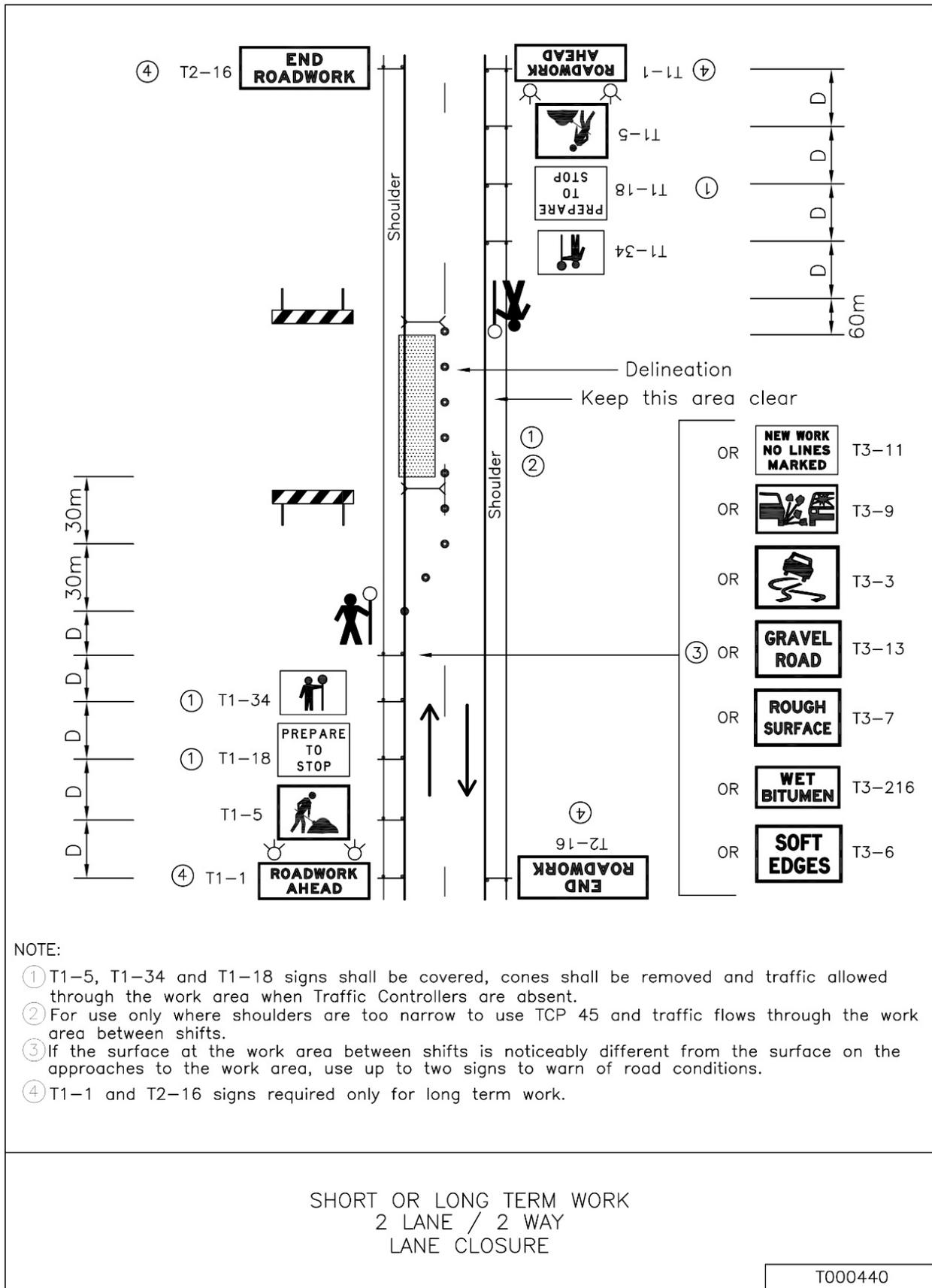
TCP 438



TCP 439



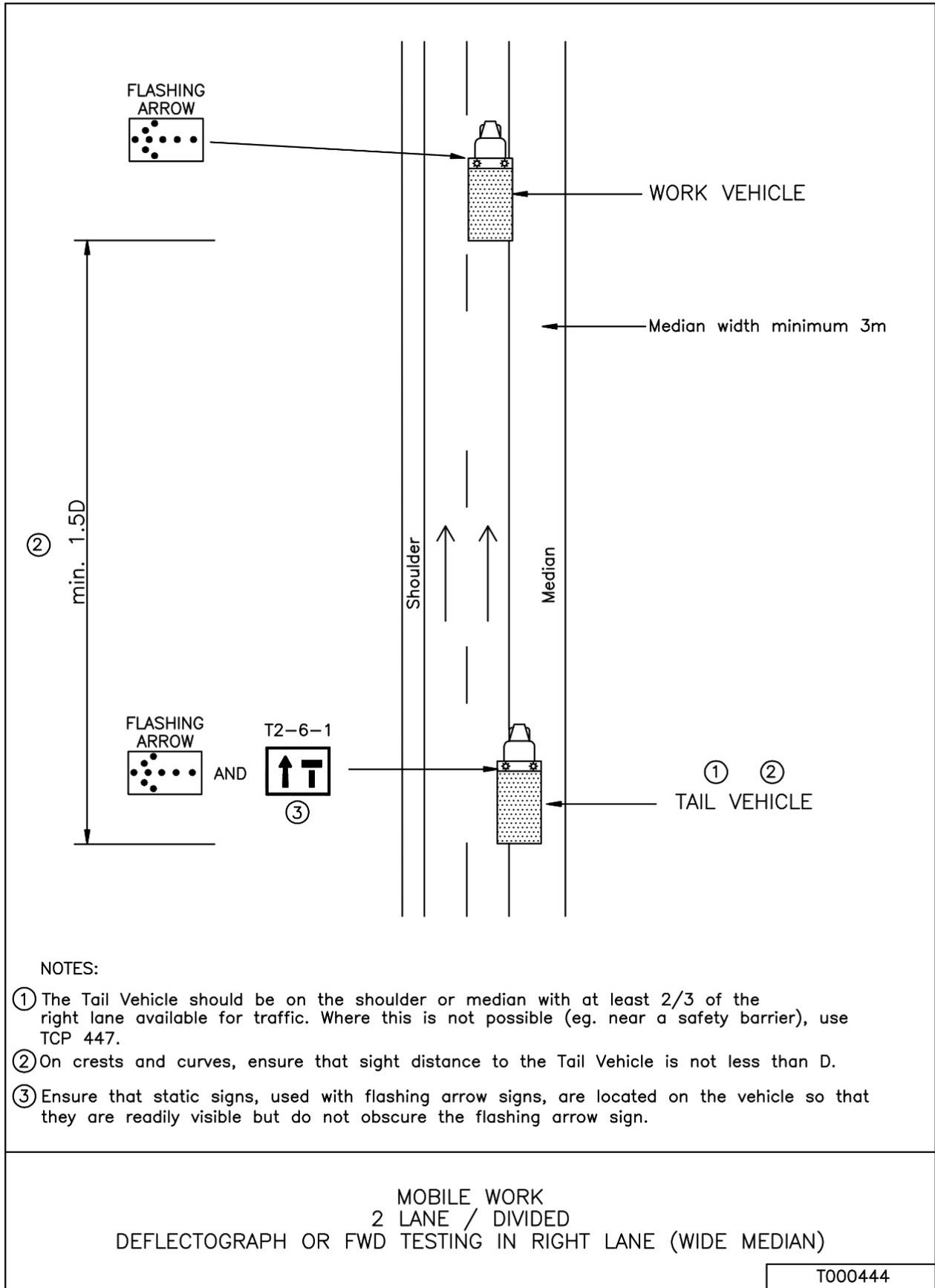
TCP 440



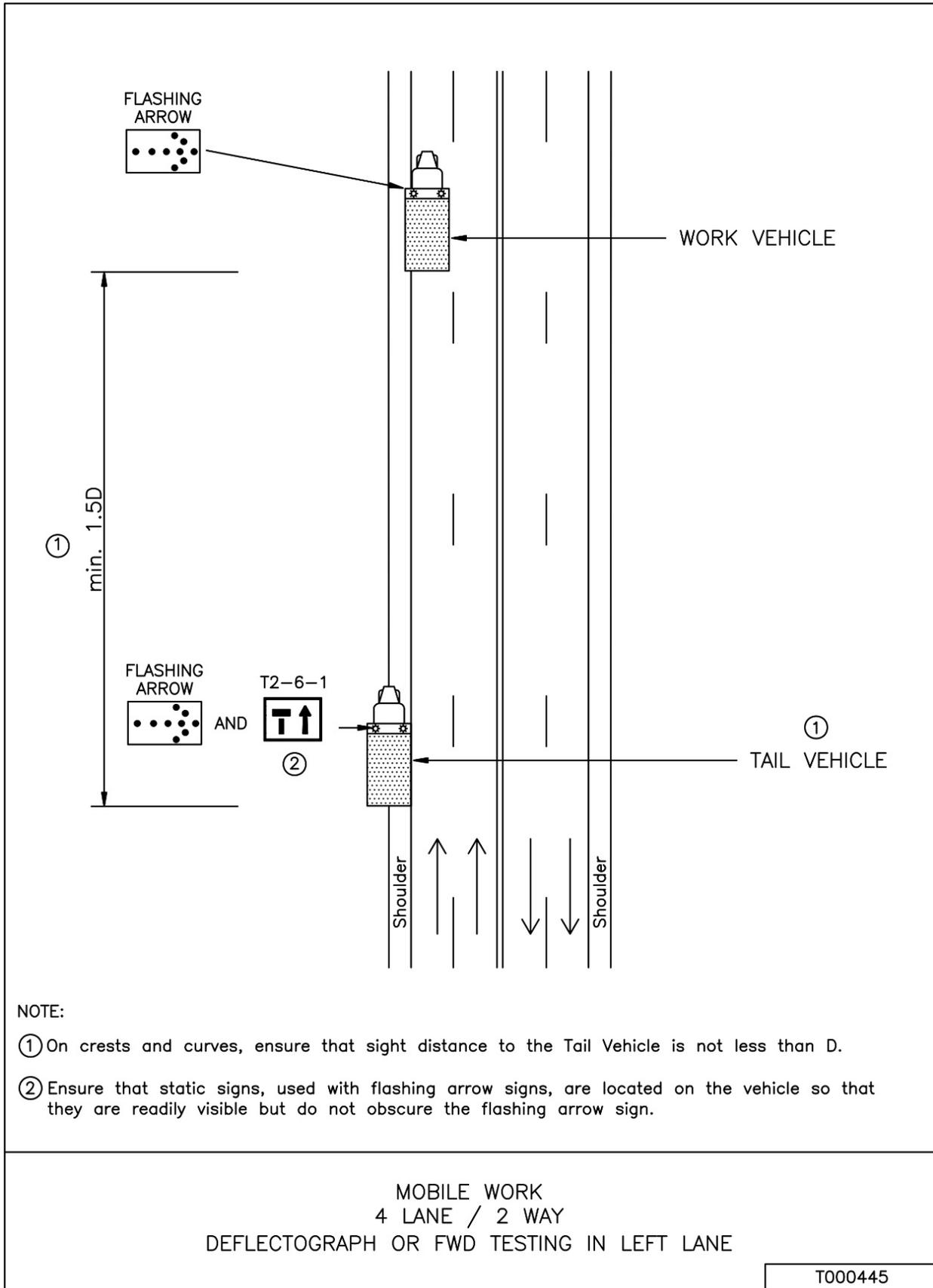
NOTE:

- ① T1-5, T1-34 and T1-18 signs shall be covered, cones shall be removed and traffic allowed through the work area when Traffic Controllers are absent.
- ② For use only where shoulders are too narrow to use TCP 45 and traffic flows through the work area between shifts.
- ③ 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.
- ④ T1-1 and T2-16 signs required only for long term work.

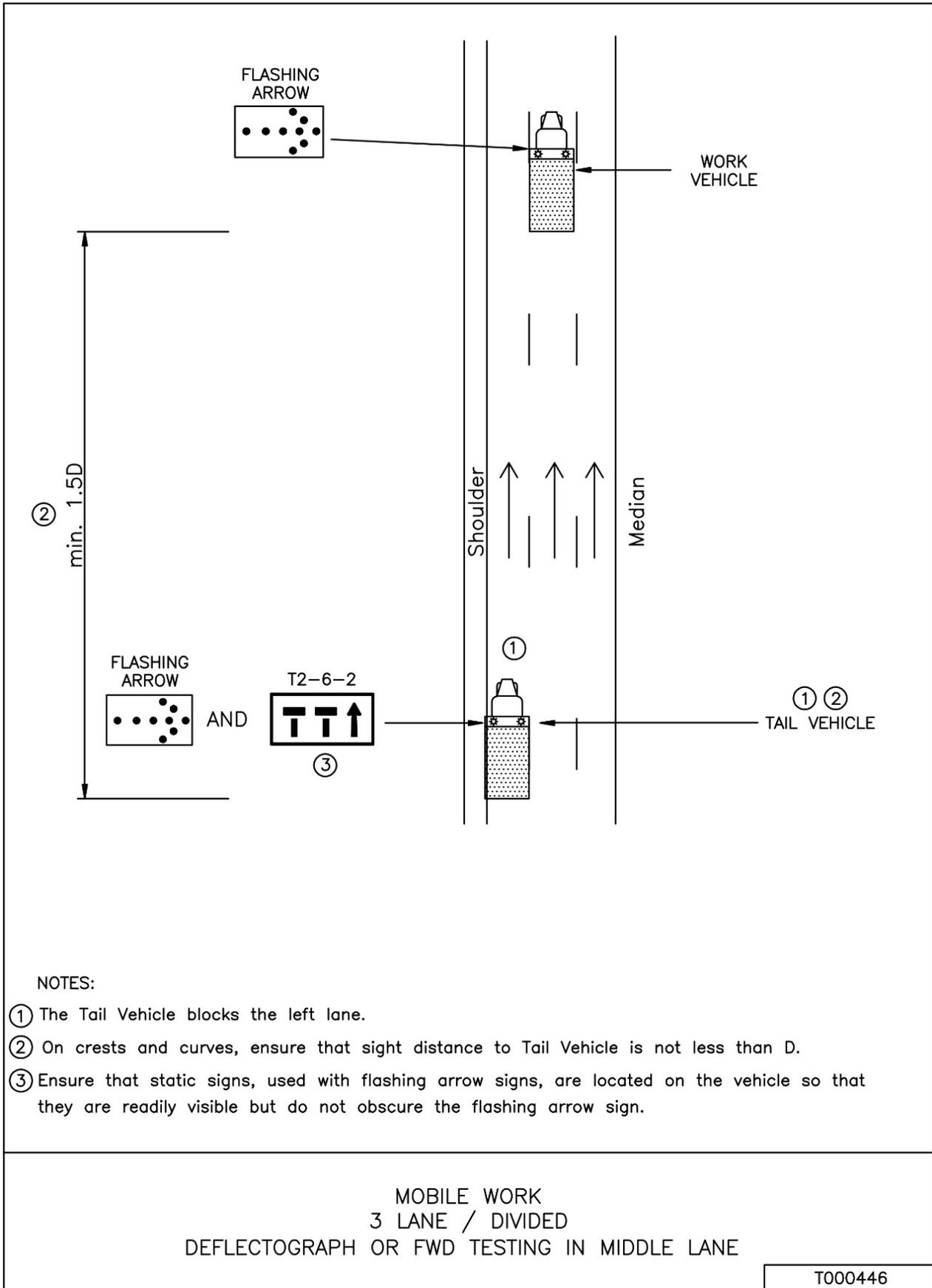
TCP 444



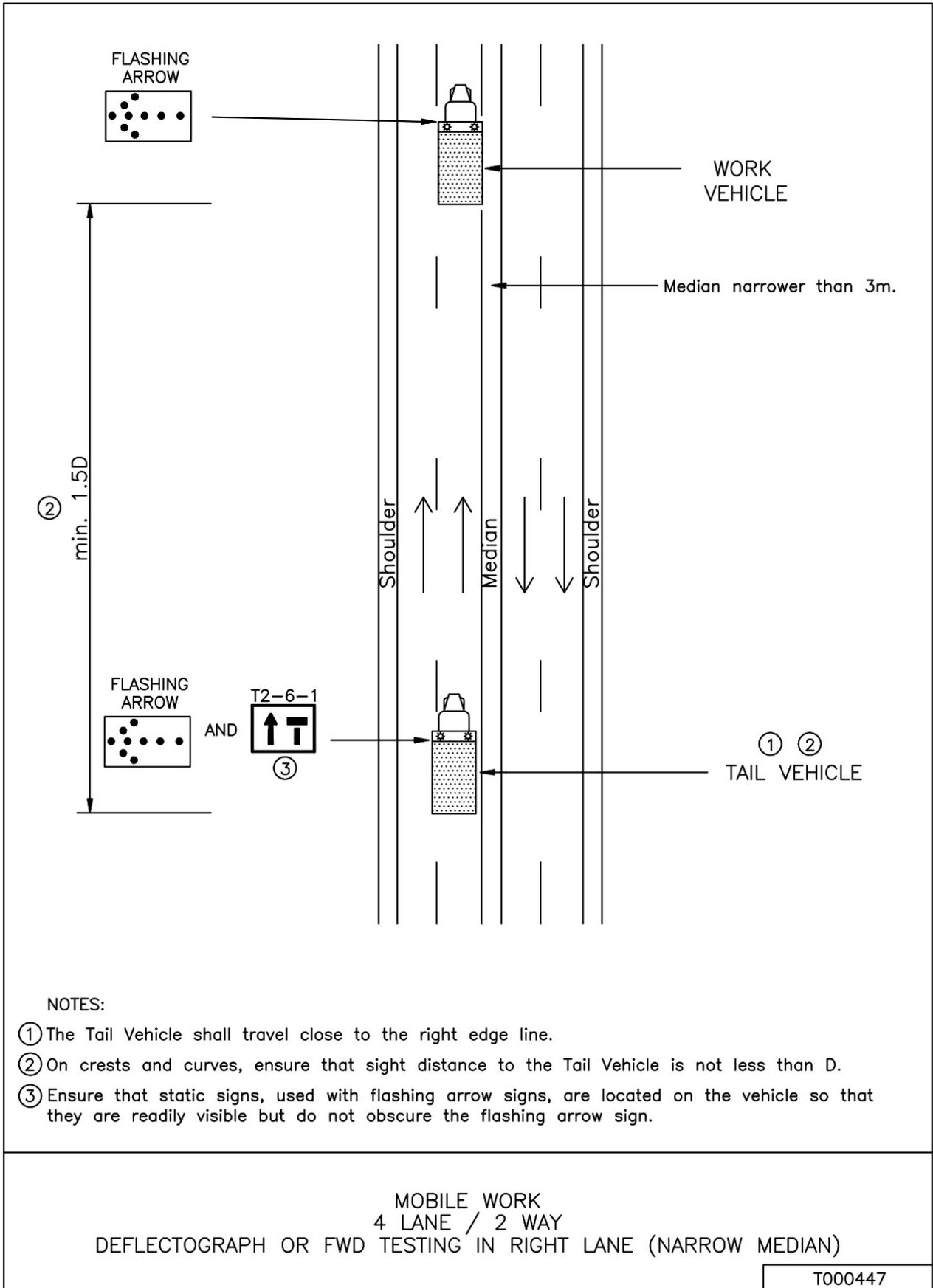
TCP 445



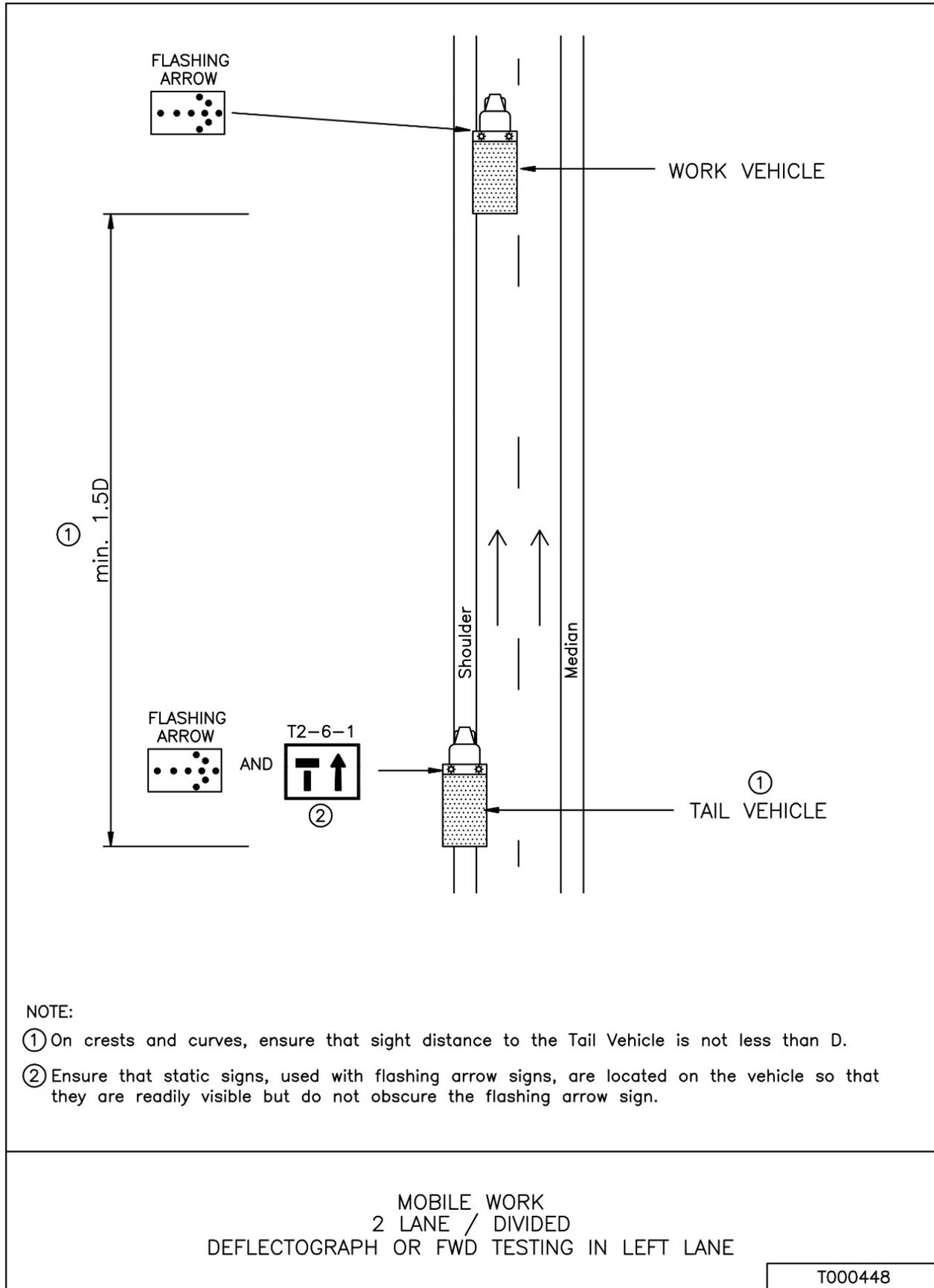
TCP 446



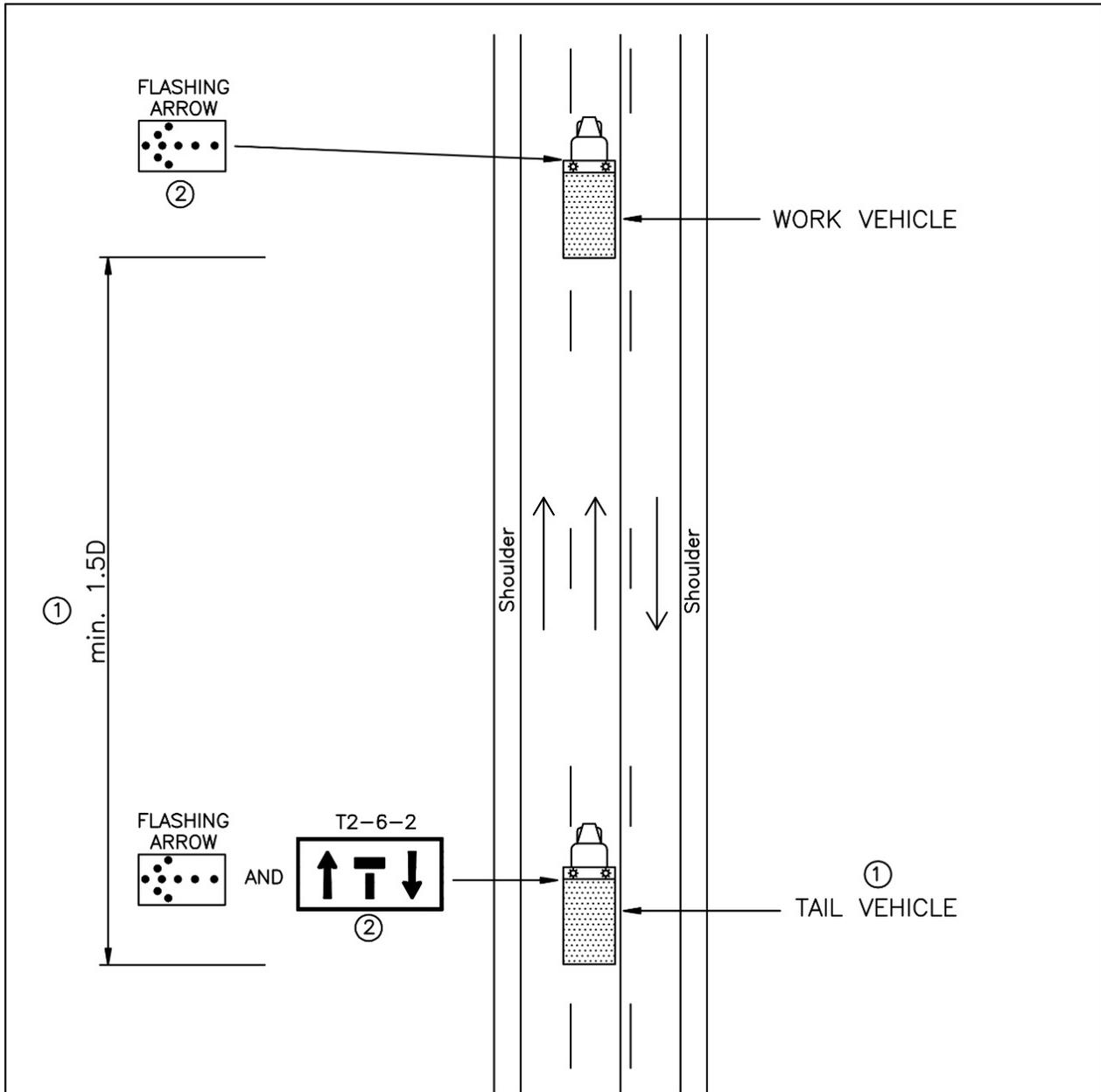
TCP 447



TCP 448



TCP 449



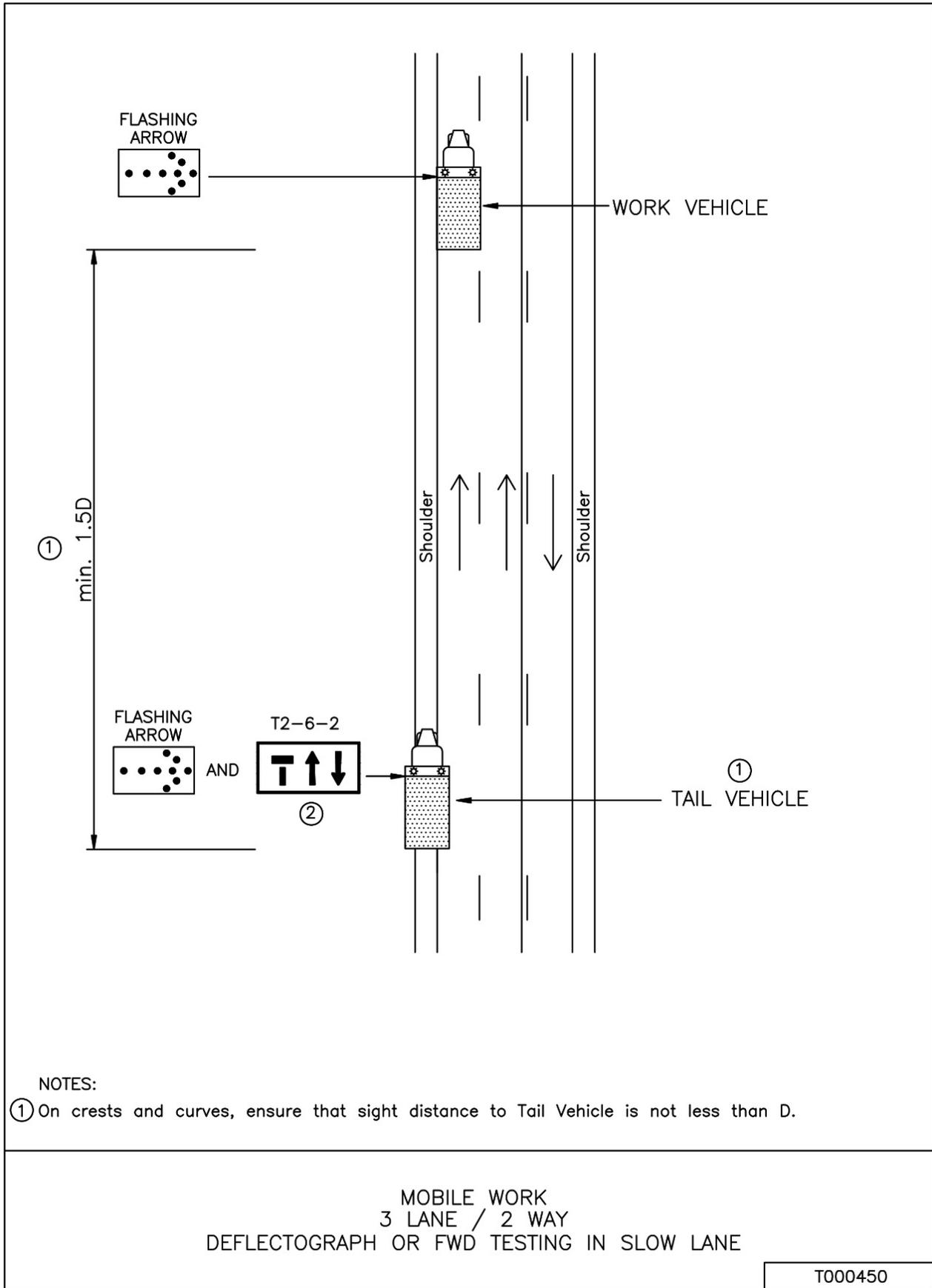
NOTES:

- ① On crests and curves, ensure that sight distance to Tail Vehicle is not less than D.
- ② 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.

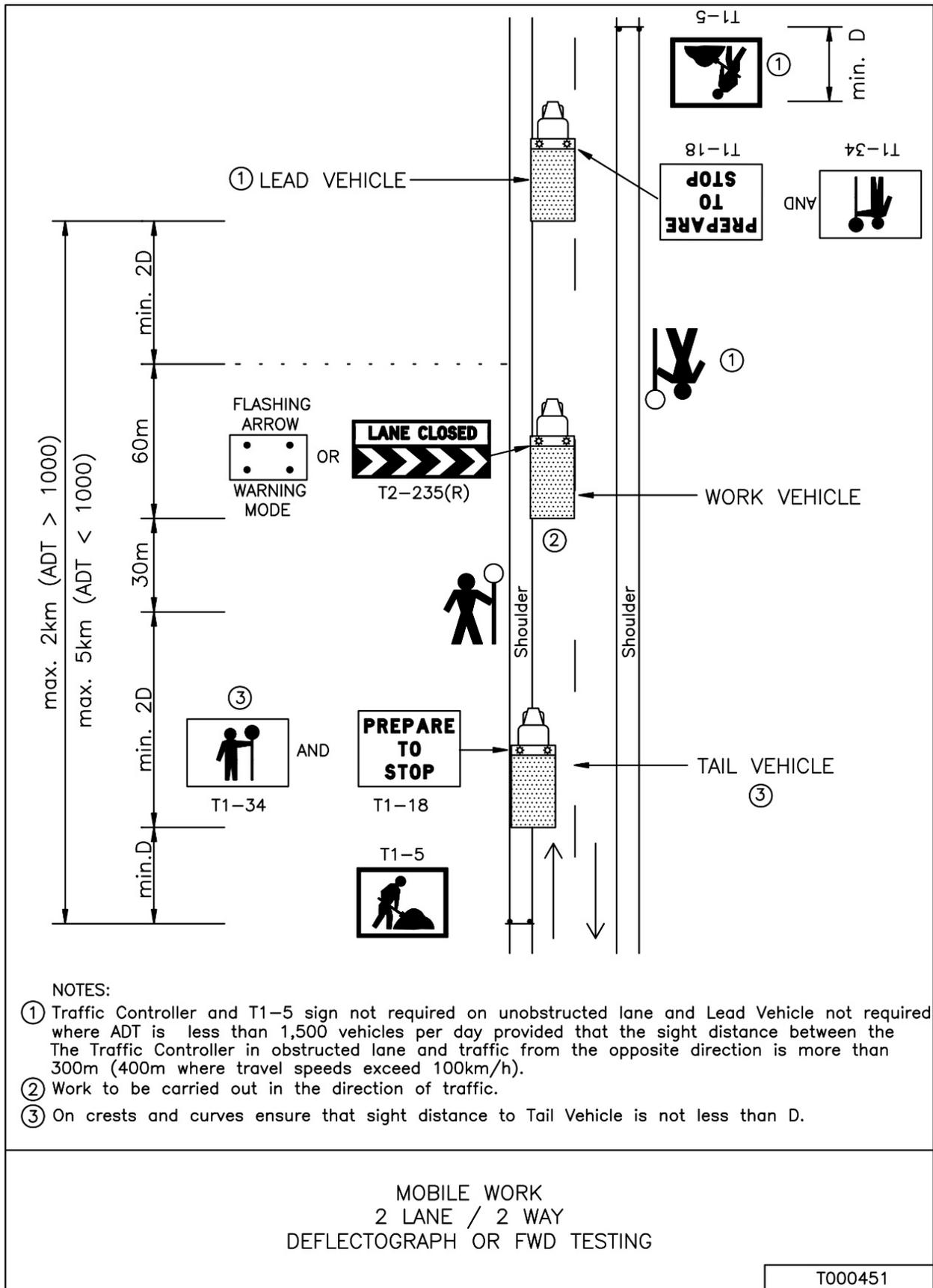
MOBILE WORK
3 LANE / 2 WAY
DEFLECTOGRAPH OR FWD TESTING IN OVERTAKING LANE

T000449

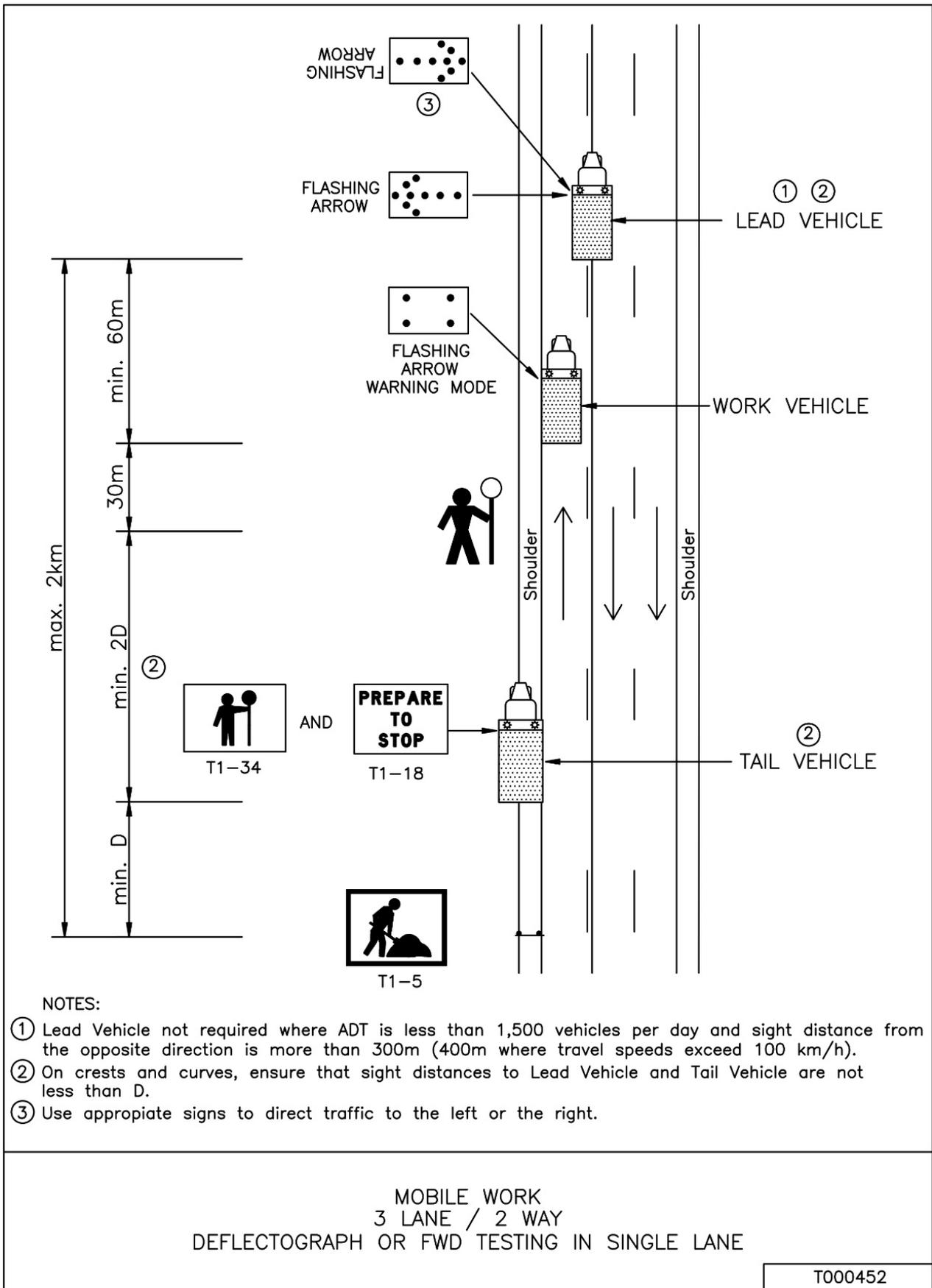
TCP 450



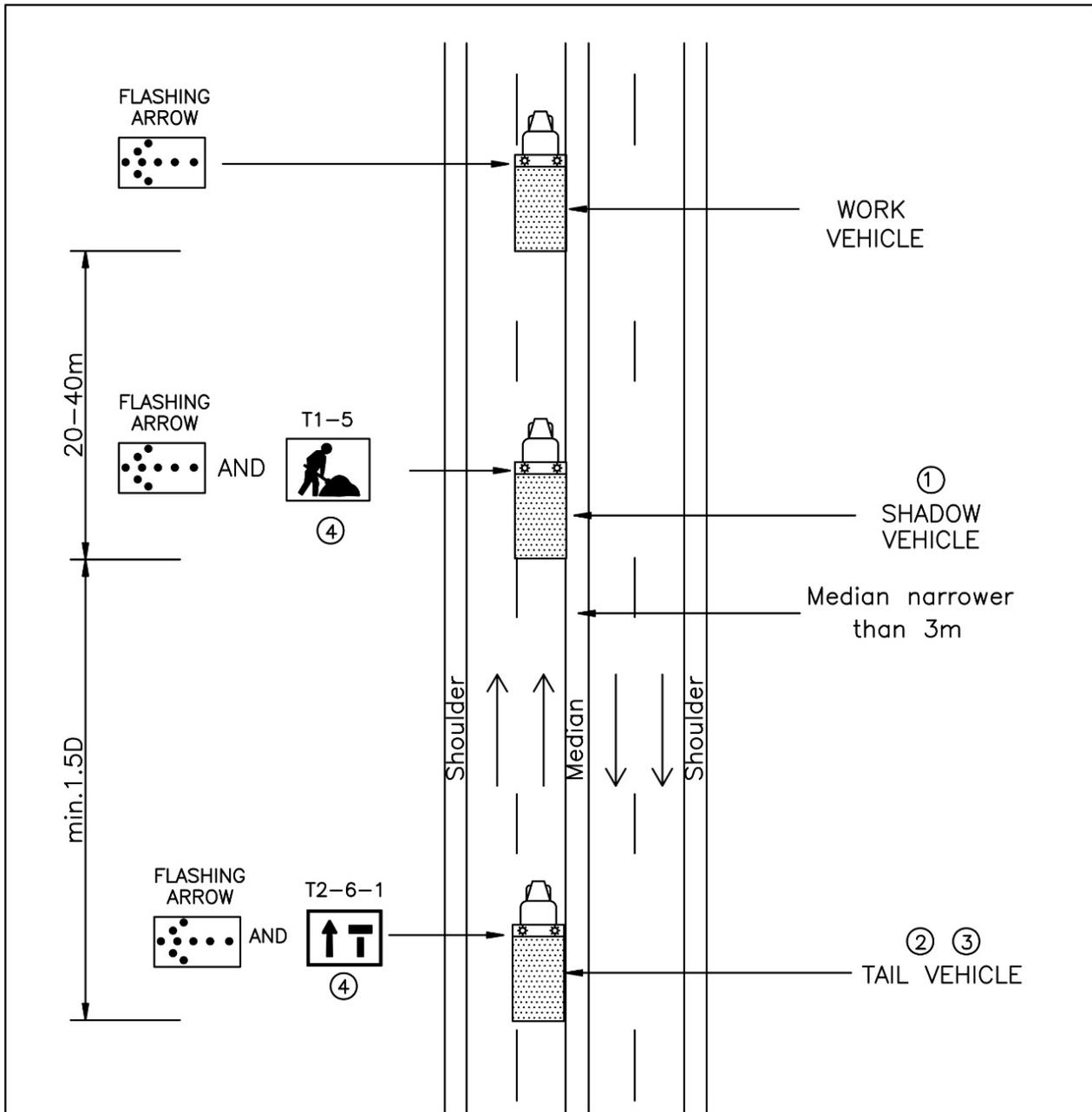
TCP 451



TCP 452



TCP 453



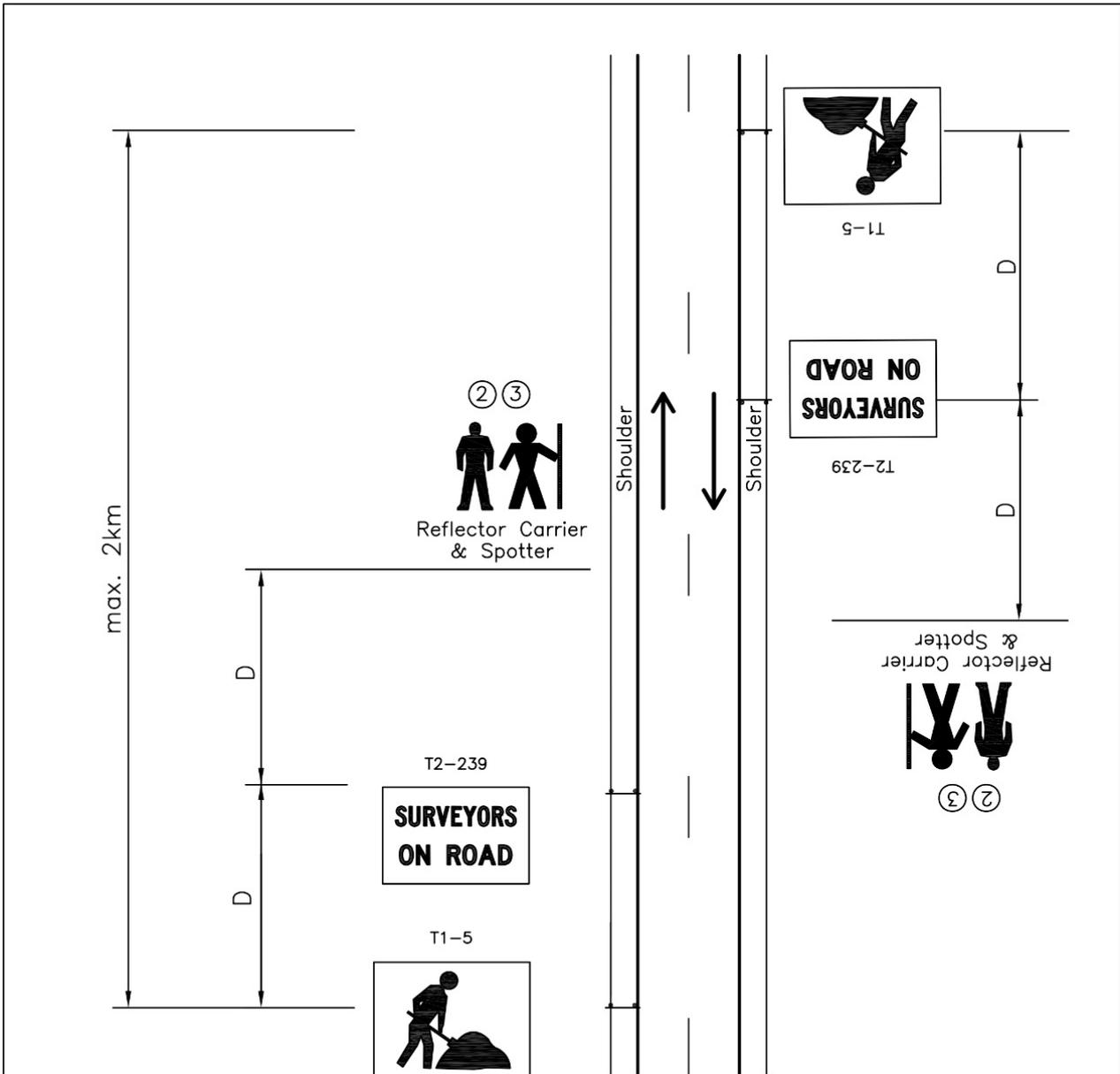
NOTES:

- 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 D.
- 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
BENKELMAN BEAM TESTING IN RIGHT LANE

T000453

TCP 459



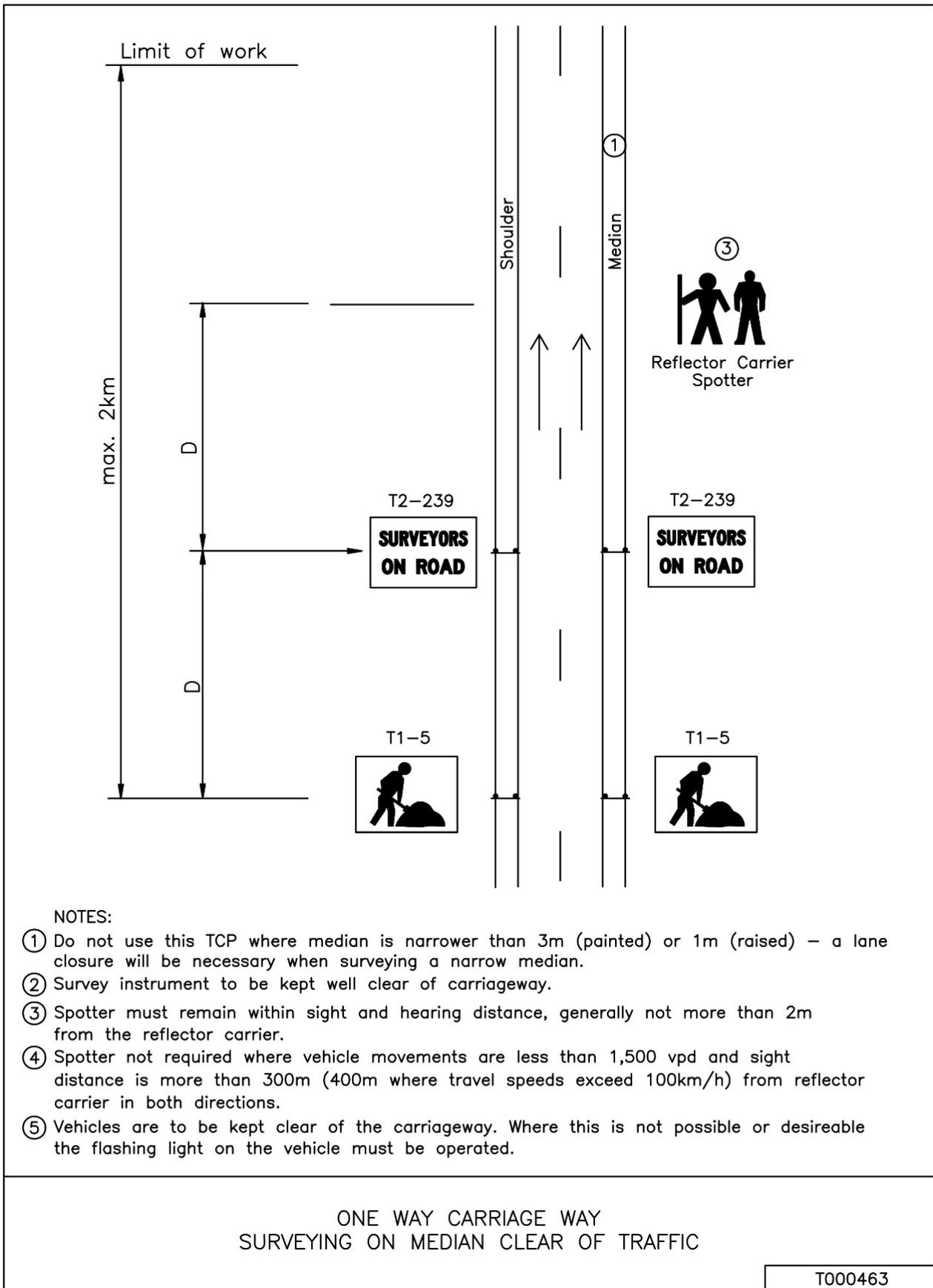
NOTES:

- ① Survey instrument to be kept well clear of carriageway.
- ② Spotter must remain within sight and hearing distance, generally not more than 2m from the reflector carrier.
- ③ For shoulder surveying the spotter 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 desirable the flashing light on the vehicle must be operated.

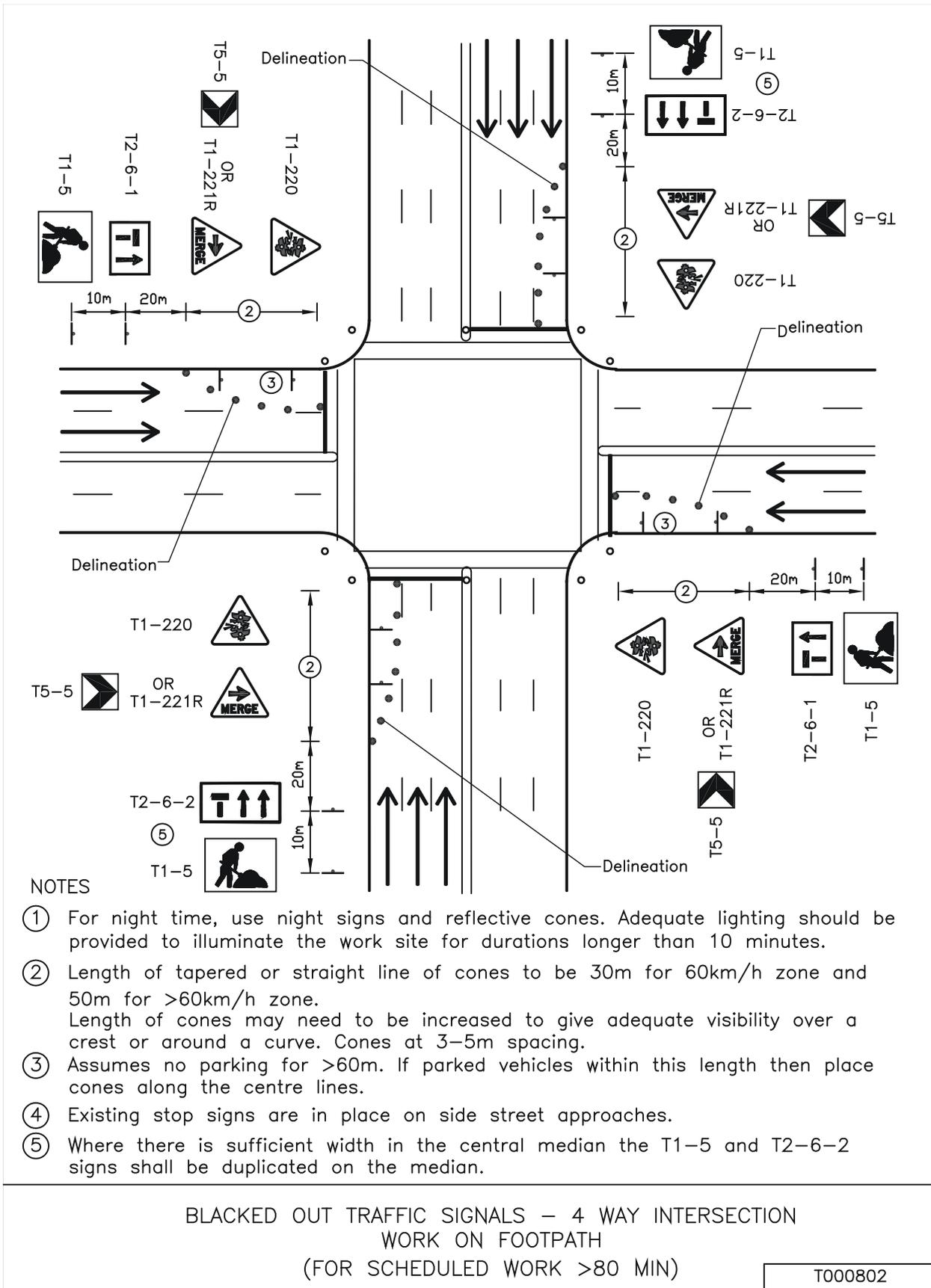
2 WAY CARRIAGEWAY
 SURVEYING SHOULDER ON BOTH SIDES (CLEAR OF TRAFFIC)
 SURVEYING CENTRELINE OR ON CARRIAGEWAY

T000459

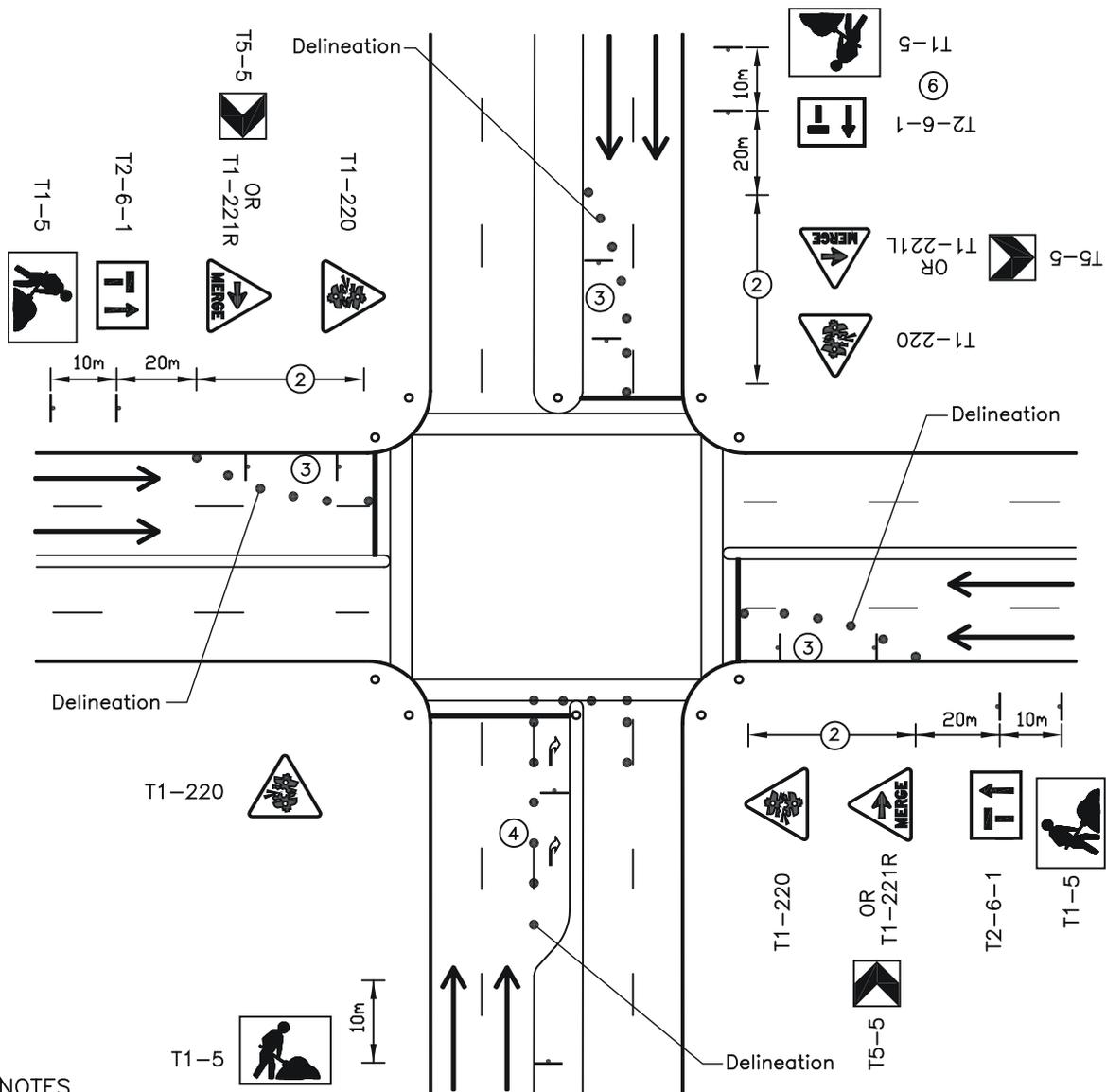
TCP 463



TCP 802



TCP 803



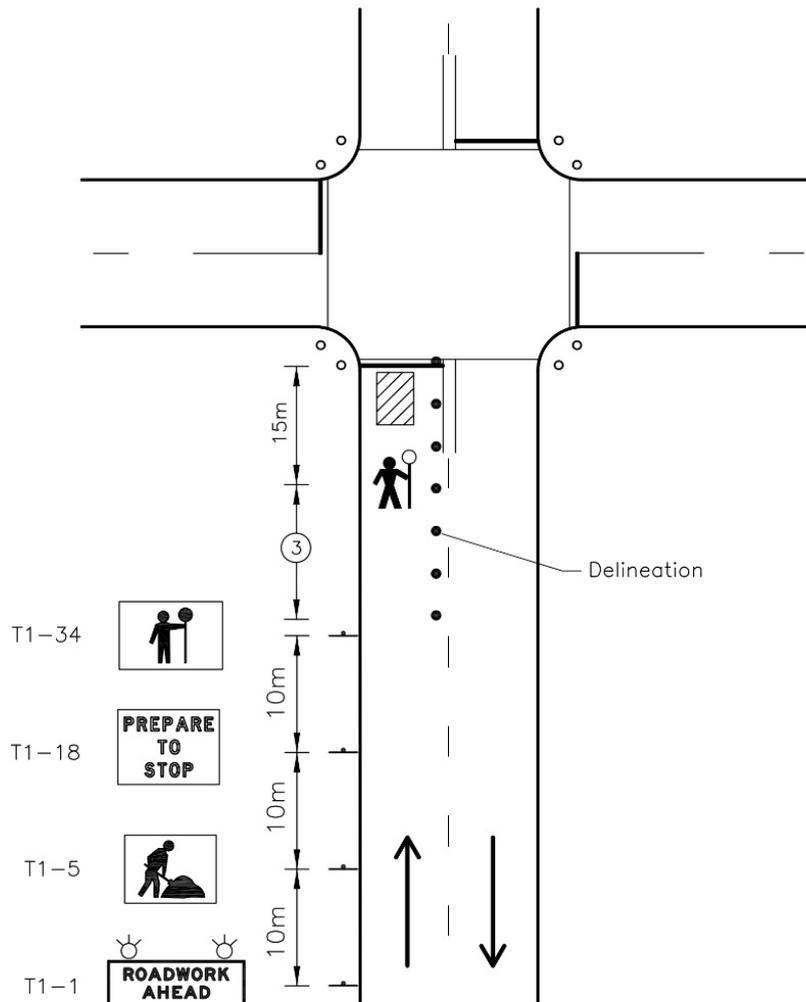
NOTES

- 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 804



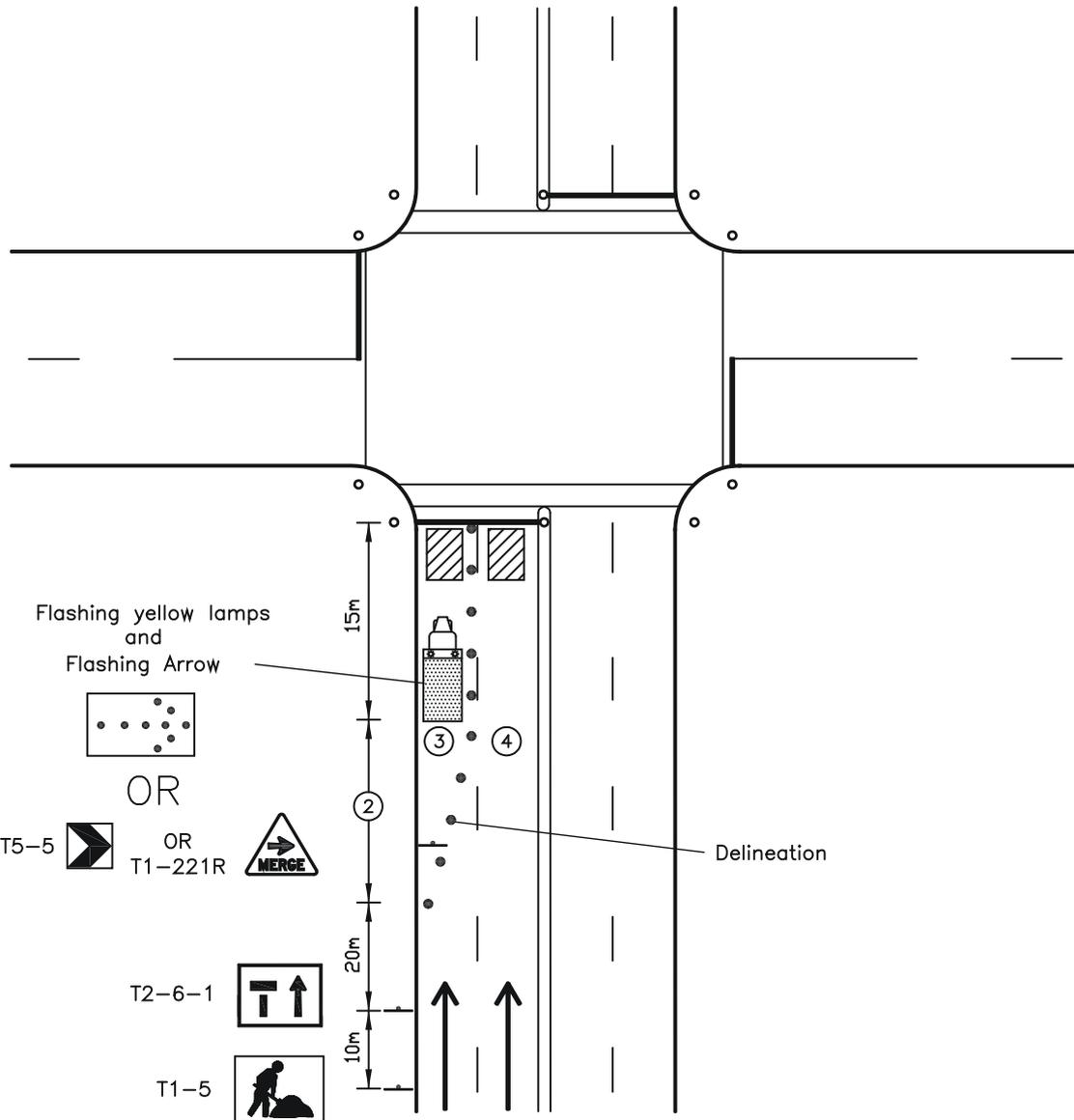
NOTES

- 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 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 805



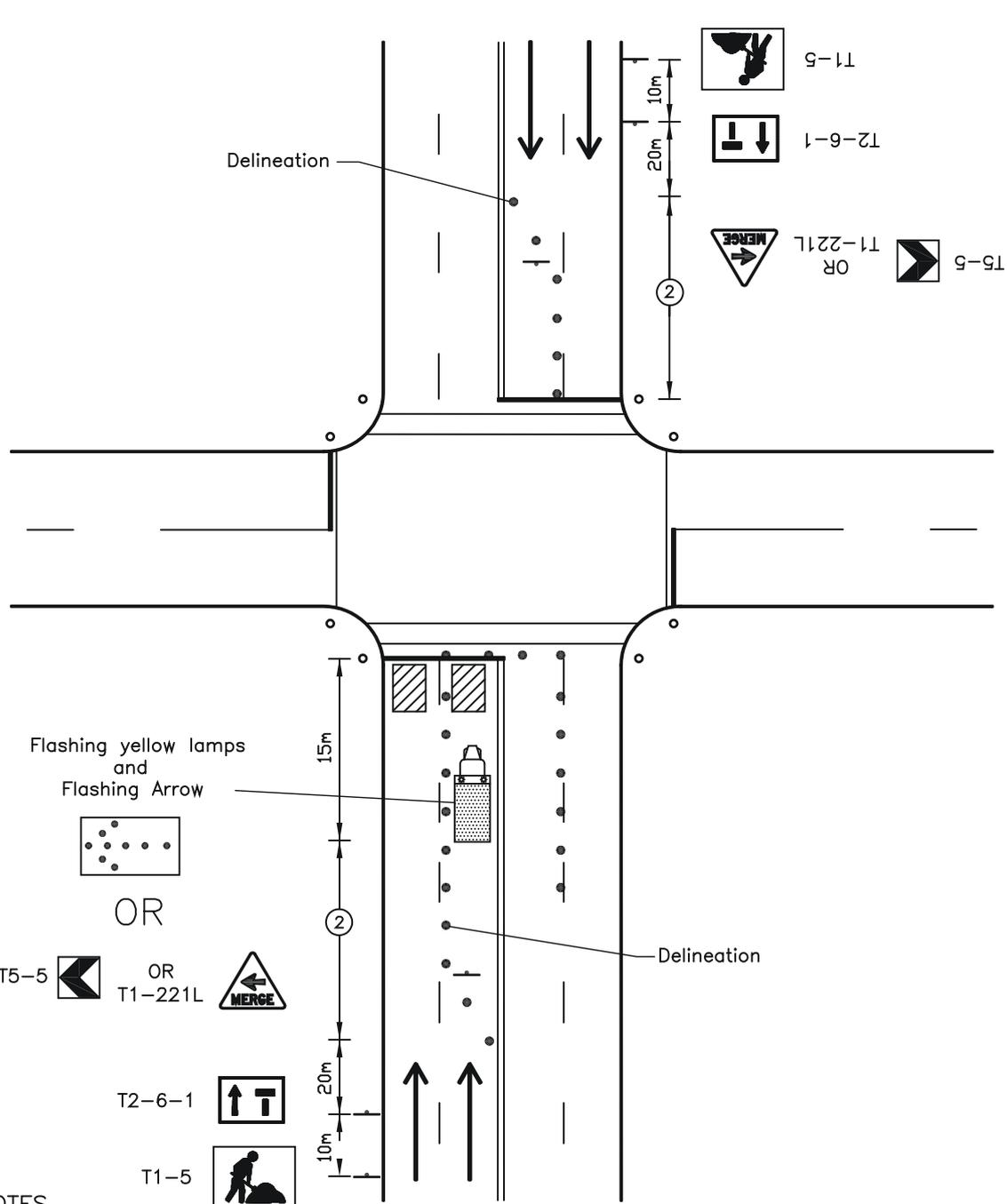
NOTES

- 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.
- 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 805A



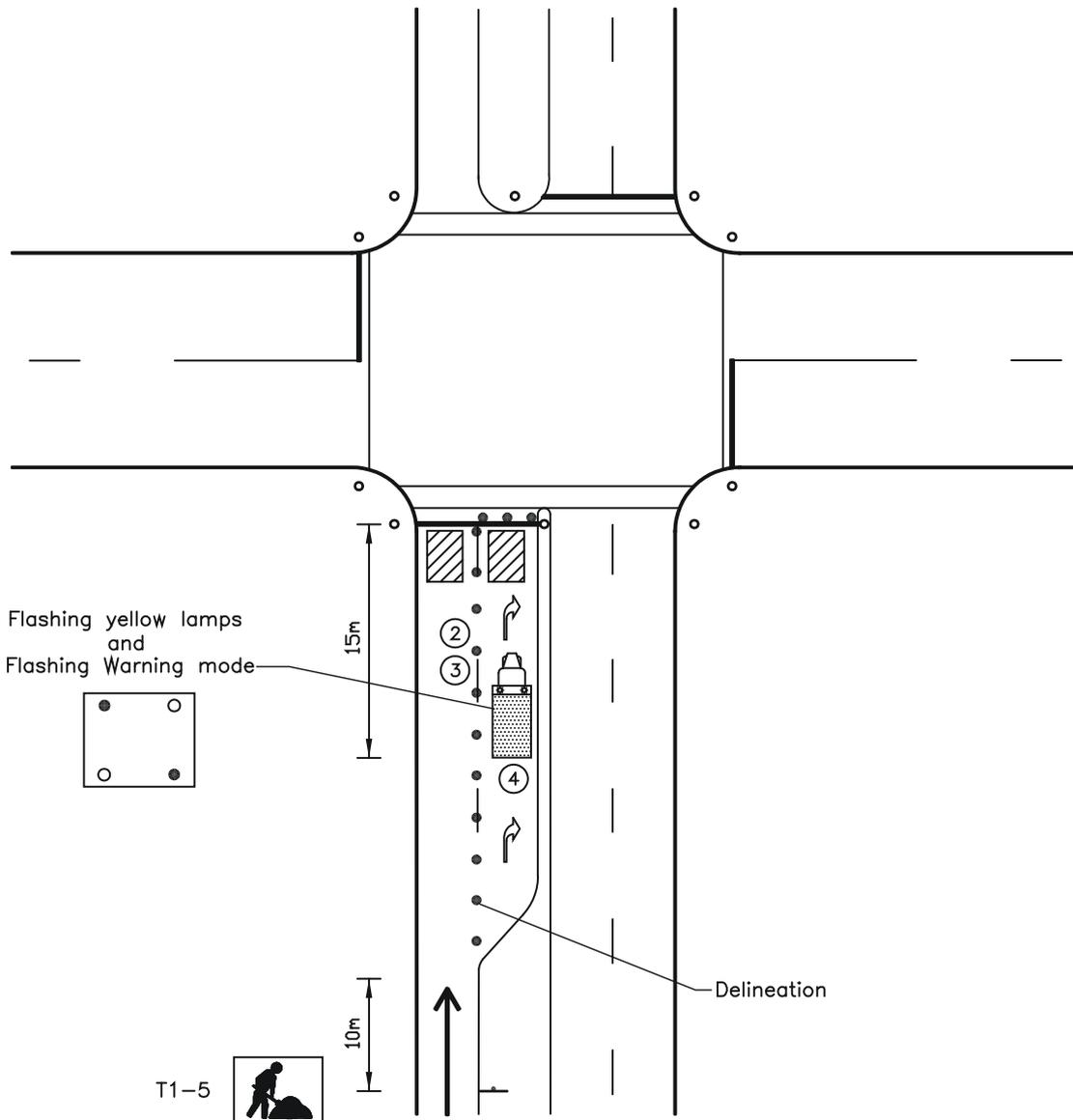
NOTES

- 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 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 806



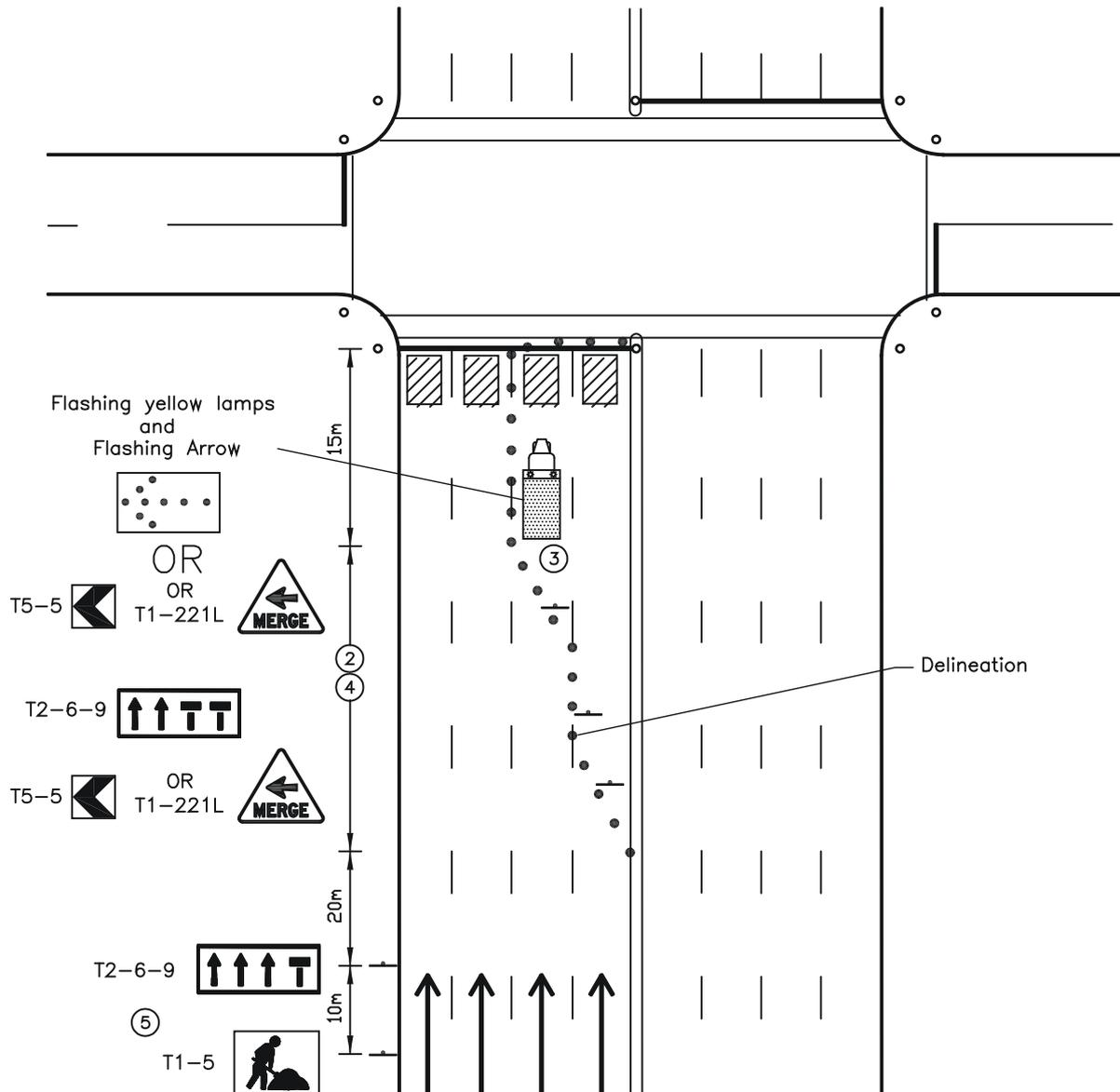
NOTES

- 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 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 <math>< 1.2\text{m}</math>, same treatment as TCP 805A should be used, i.e. closing off lane in opposite direction.

LOOP CUTTING – RIGHT TURN BAY

T000806

TCP 807



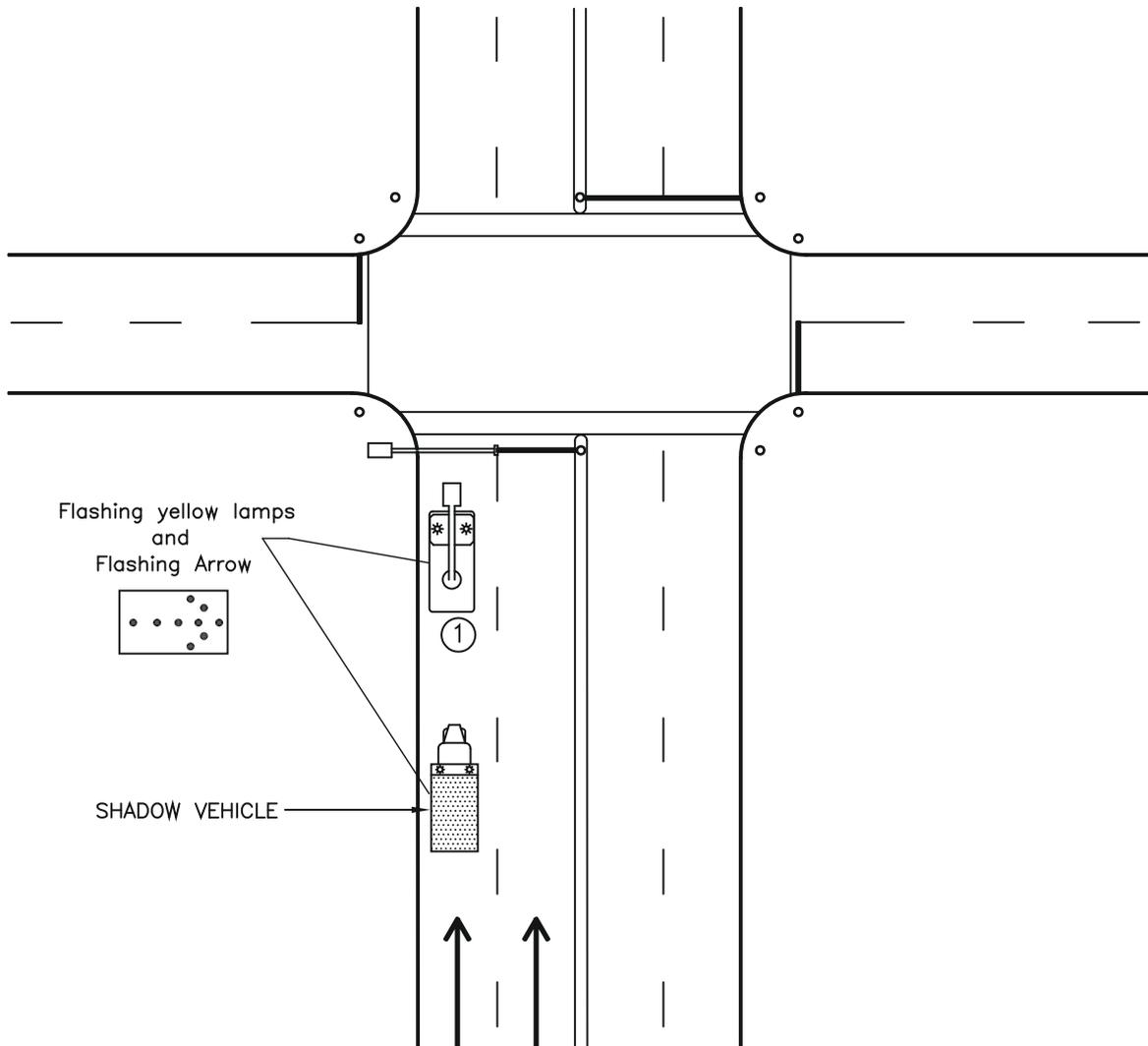
NOTES

- 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 809



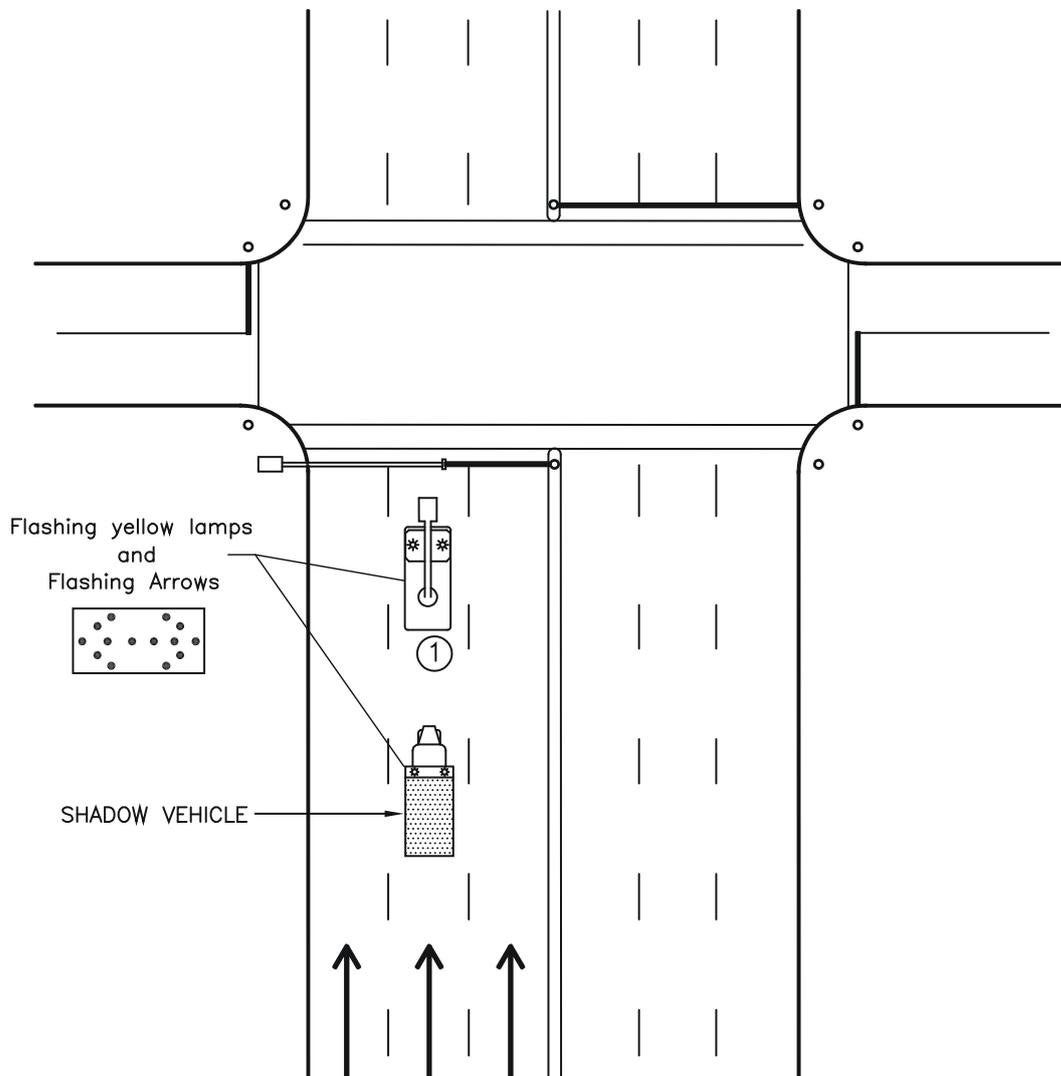
NOTES

- ① EPV and shadow vehicle fitted with flashing arrow and flashing yellow lamps.

EPV-KERBSIDE LANE-MAST ARM ON APPROACH
<80MIN WORK

T000809

TCP 810



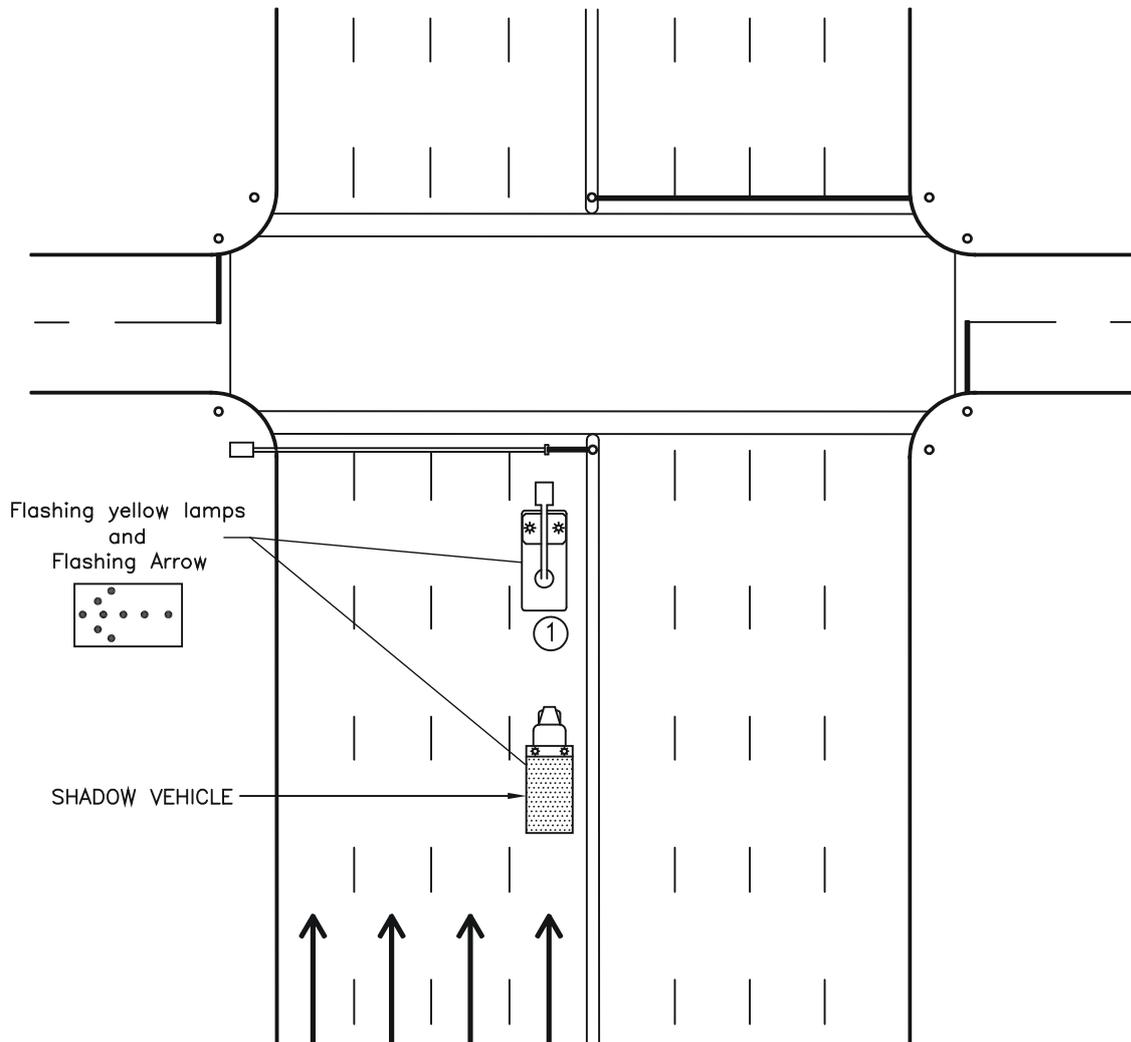
NOTES

- ① EPV and shadow vehicle fitted with flashing arrows and flashing yellow lamps.

EPV-CENTRE LANE-MAST ARM ON APPROACH
<80MIN WORK

T000810

TCP 811



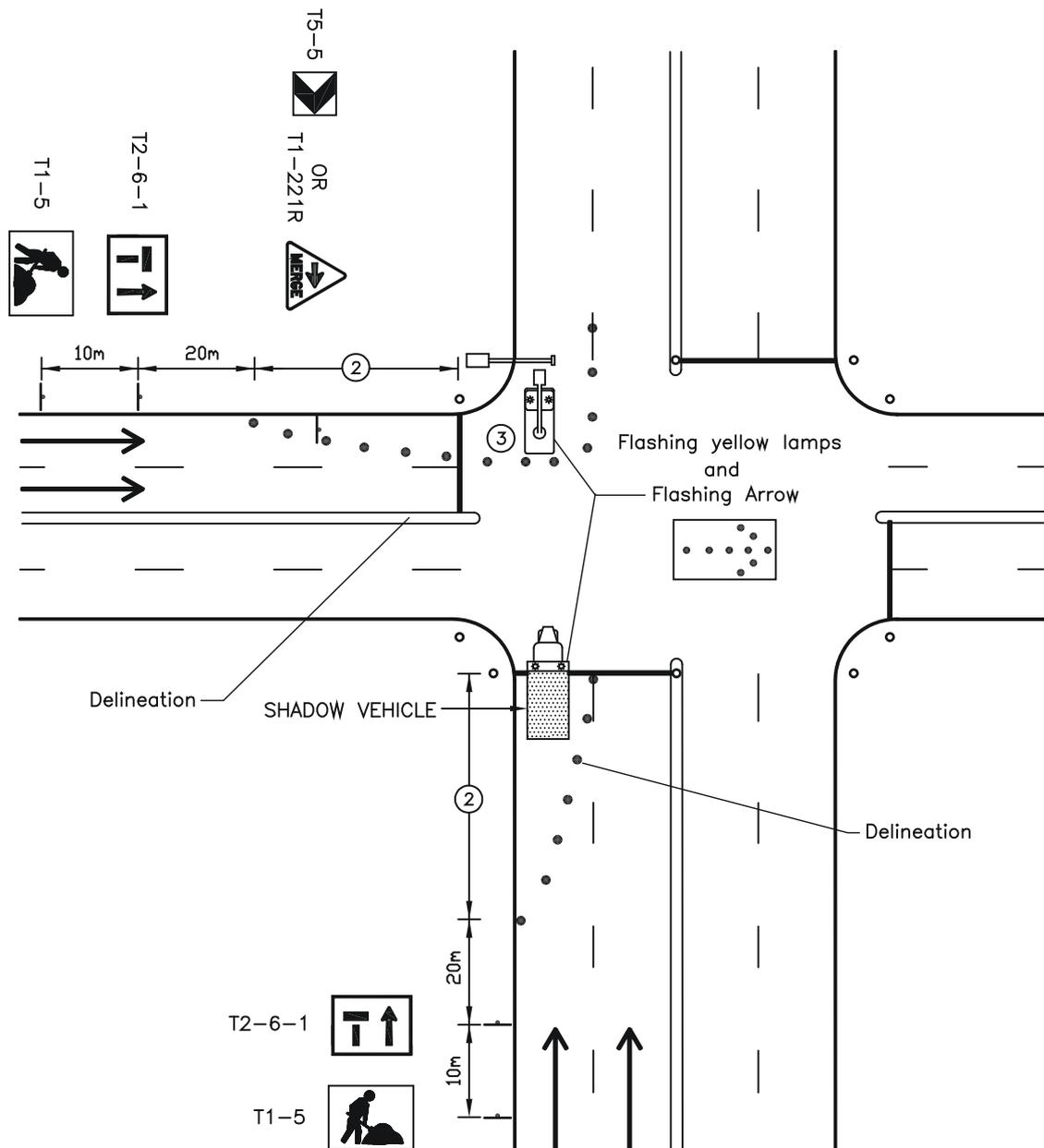
NOTES

- ① EPV and shadow vehicle fitted with flashing arrow and flashing yellow lamps.

EPV-MULTI LANE-MAST ARM ON APPROACH
<80MIN WORK

T00811

TCP 812



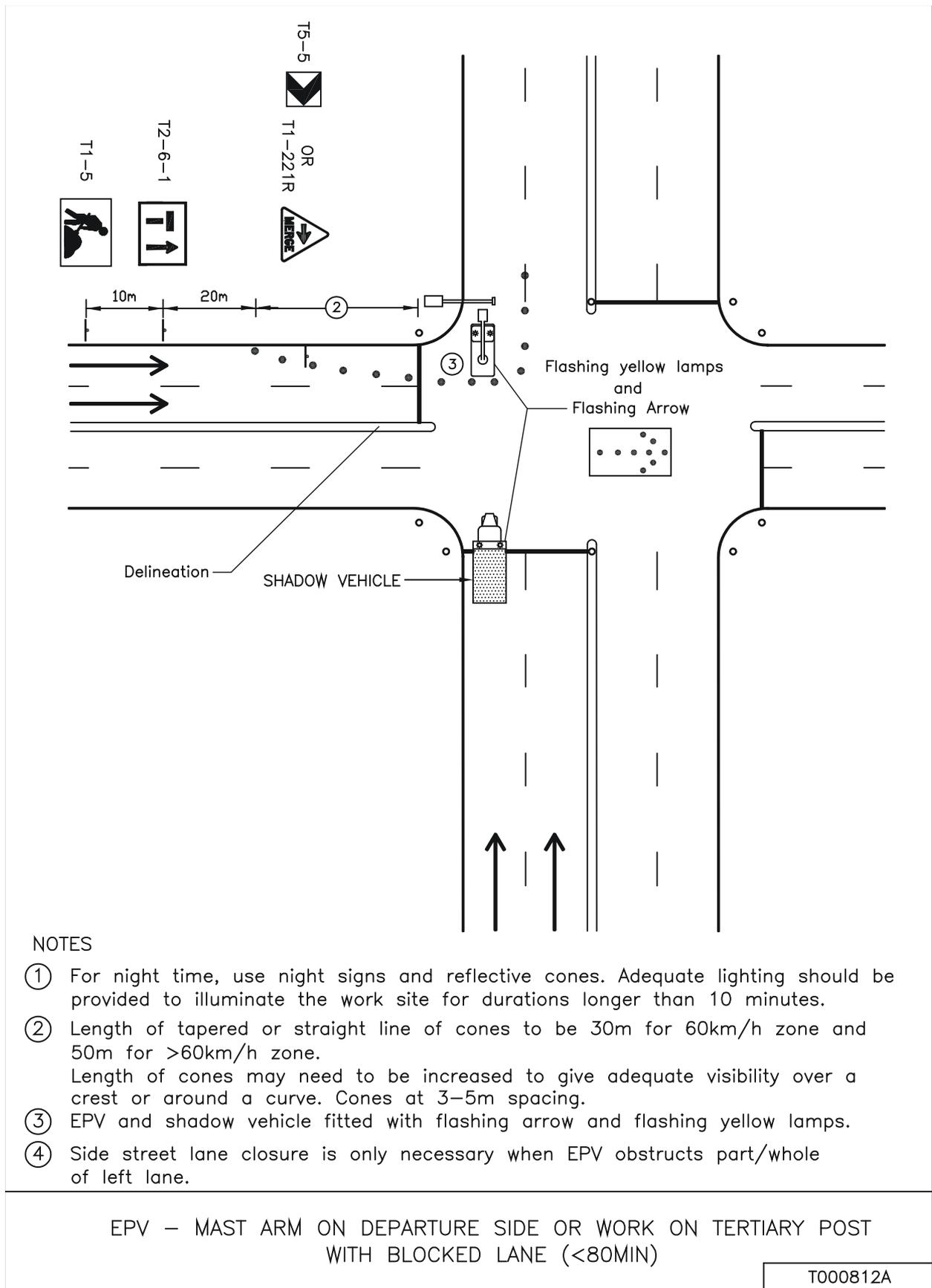
NOTES

- 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.

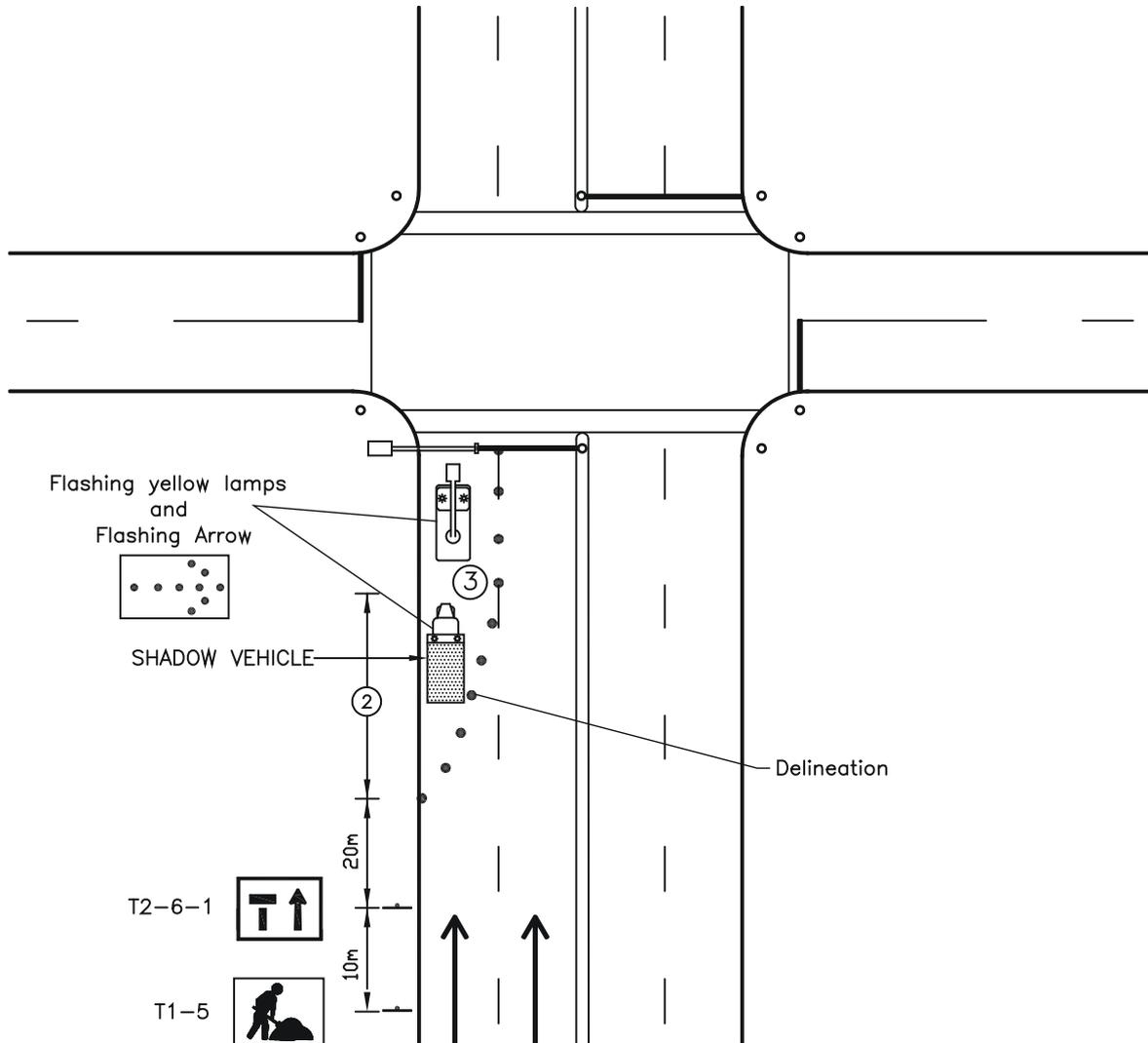
EPV – MAST ARM ON DEPARTURE SIDE OR WORK ON TERTIARY POST WITH BLOCKED LANE (>80MIN)

T000812

TCP 812A



TCP 813



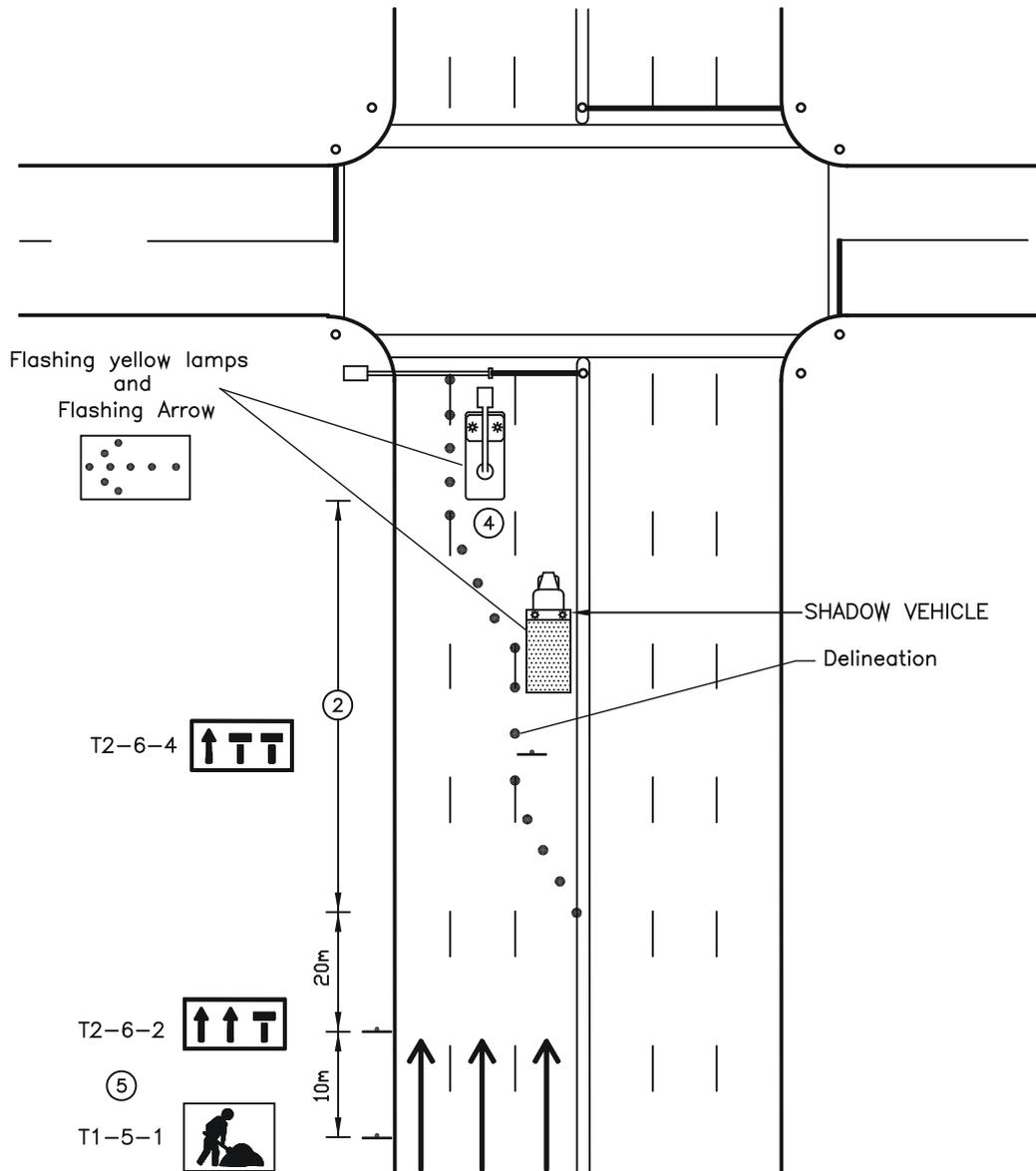
NOTES

- 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 814



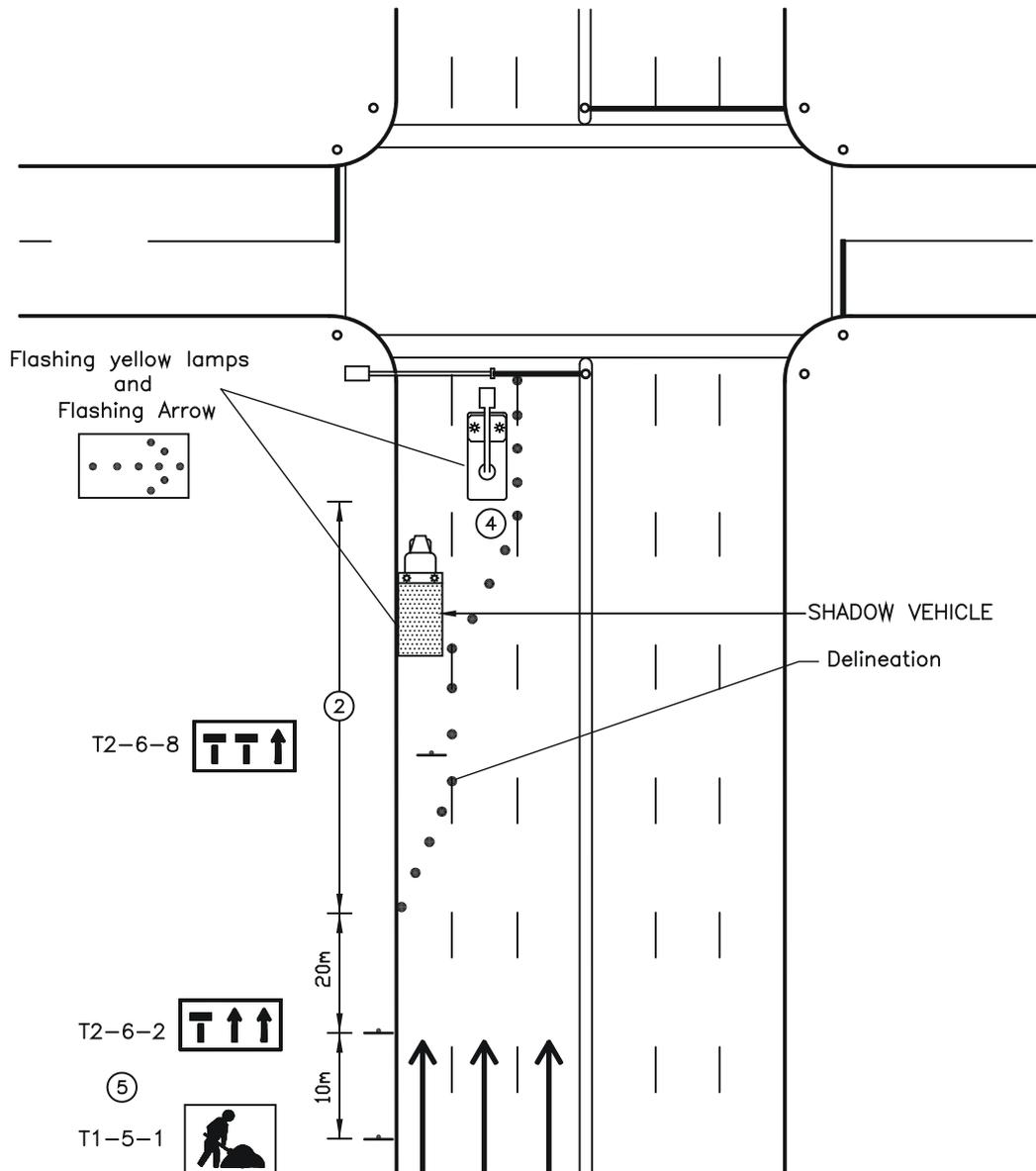
NOTES

- 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 814A



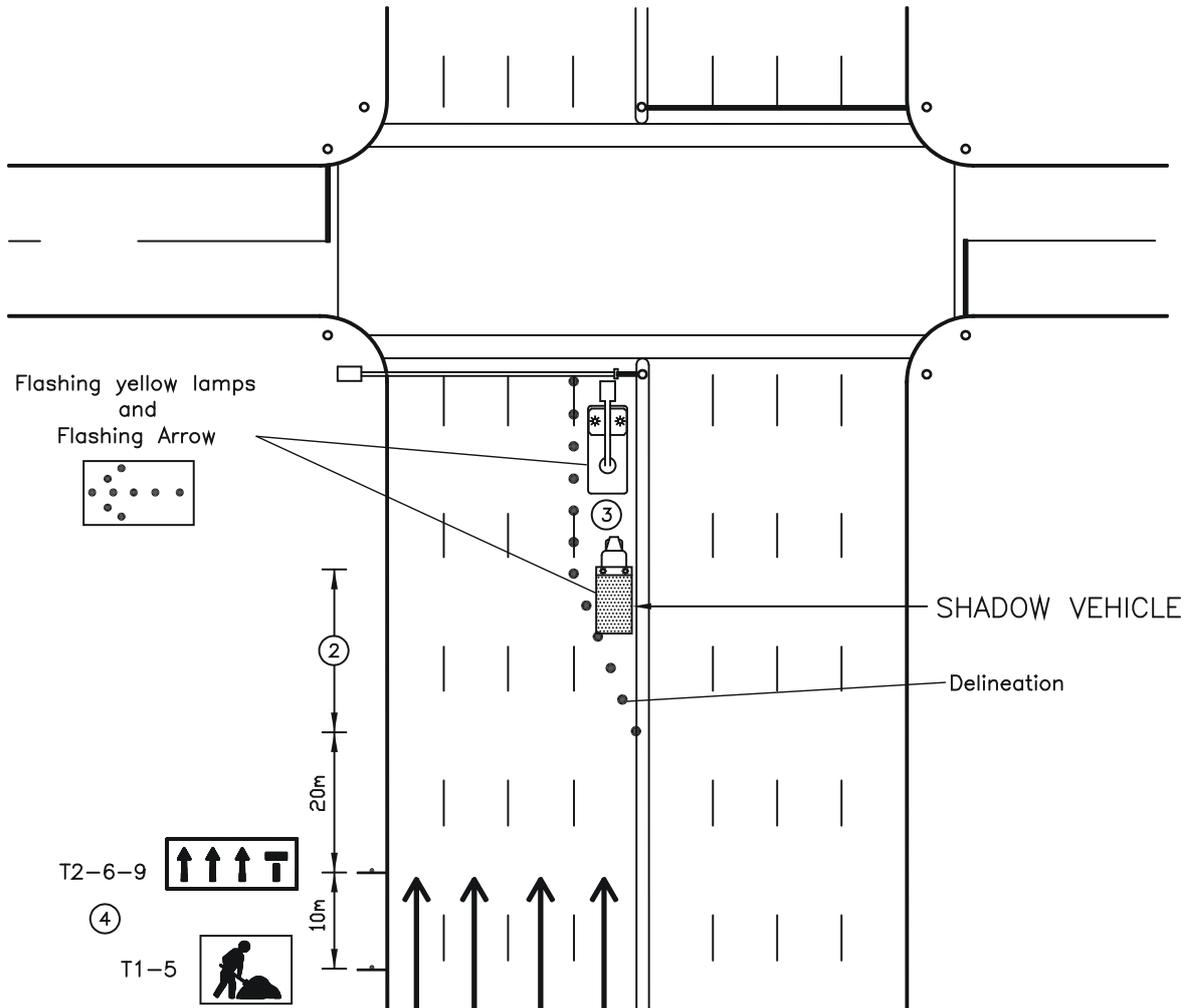
NOTES

- 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 815



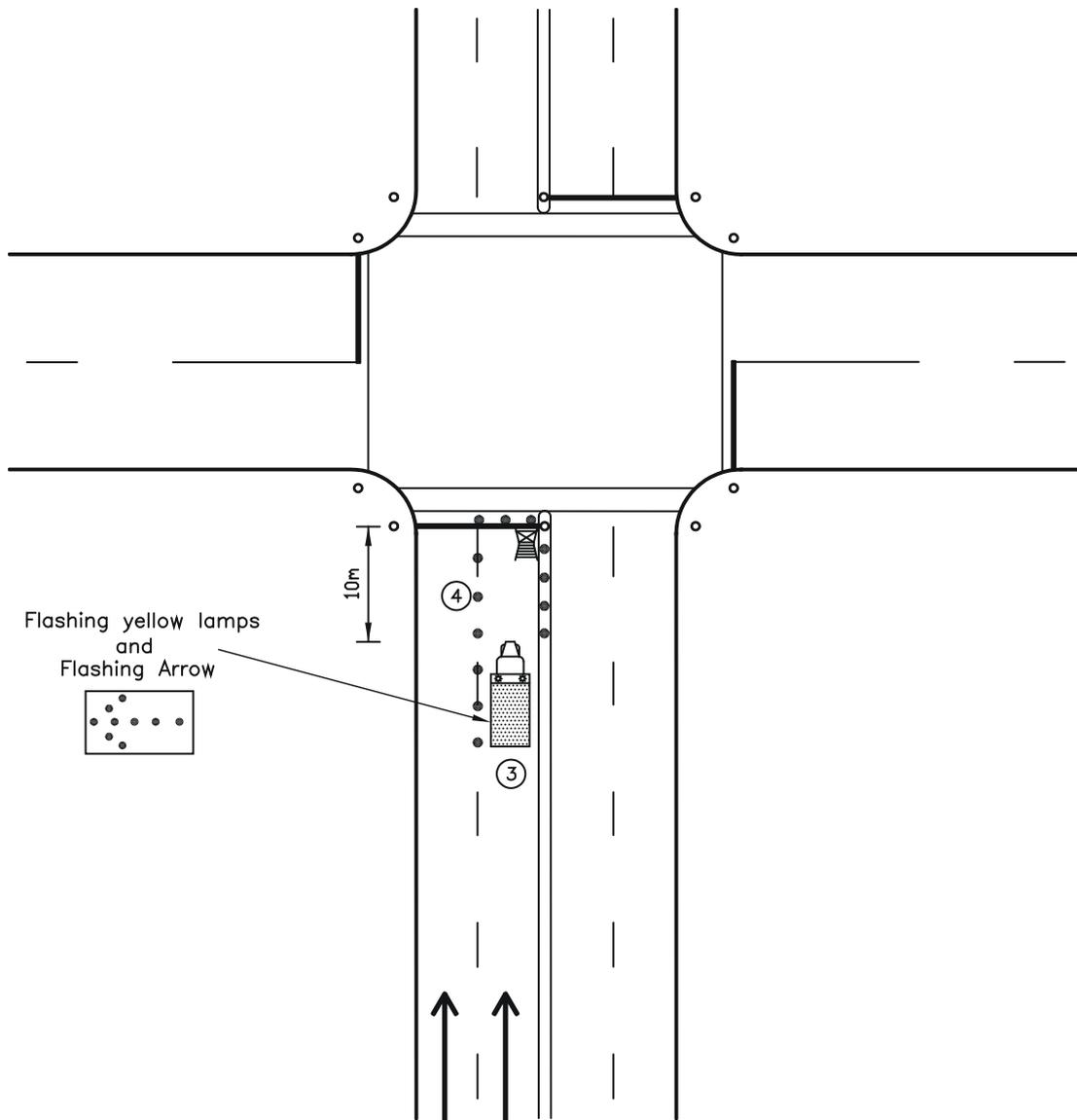
NOTES

- 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 816



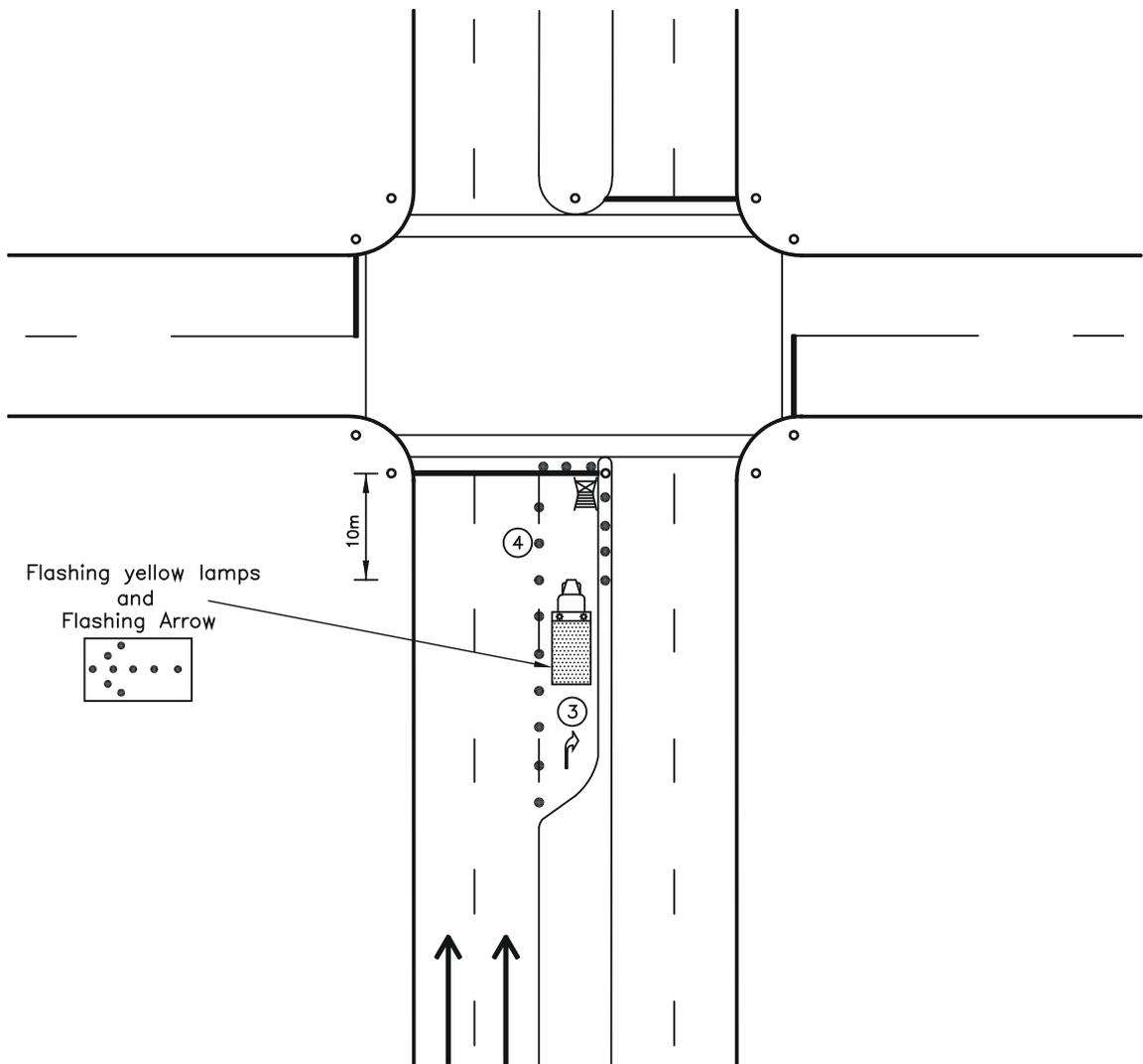
NOTES

- 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 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 817



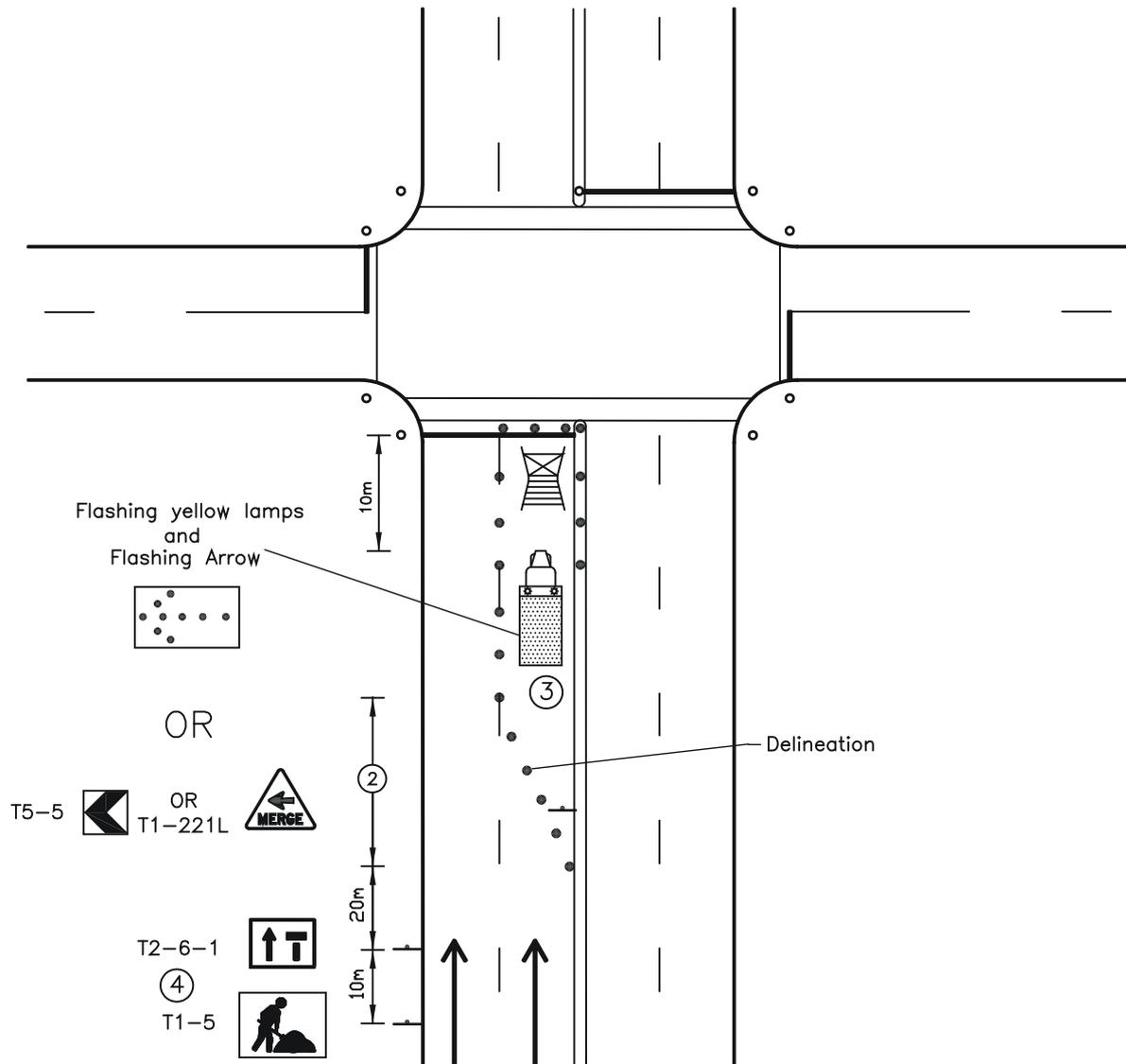
NOTES

- 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 818



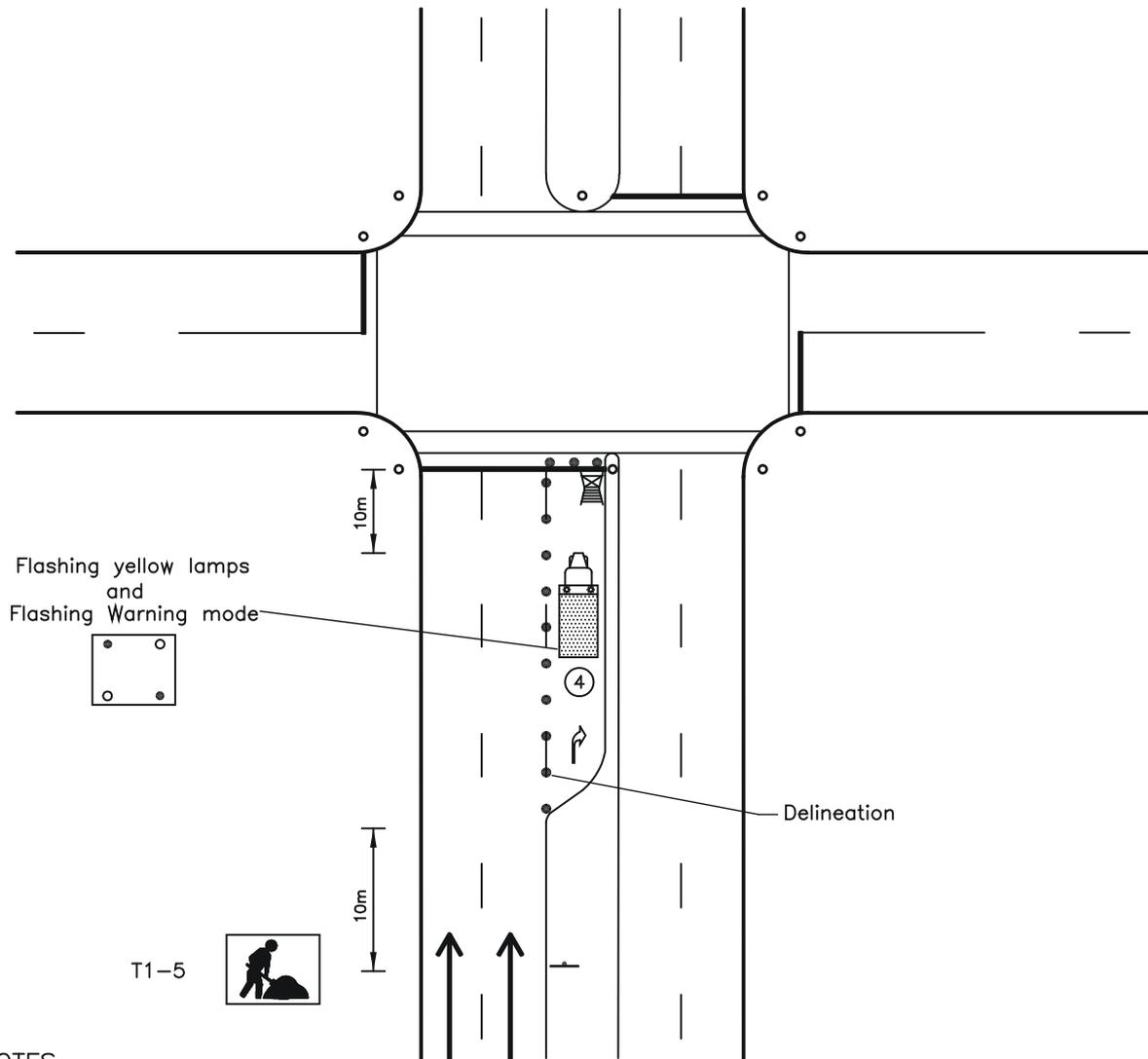
NOTES

- 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 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 819



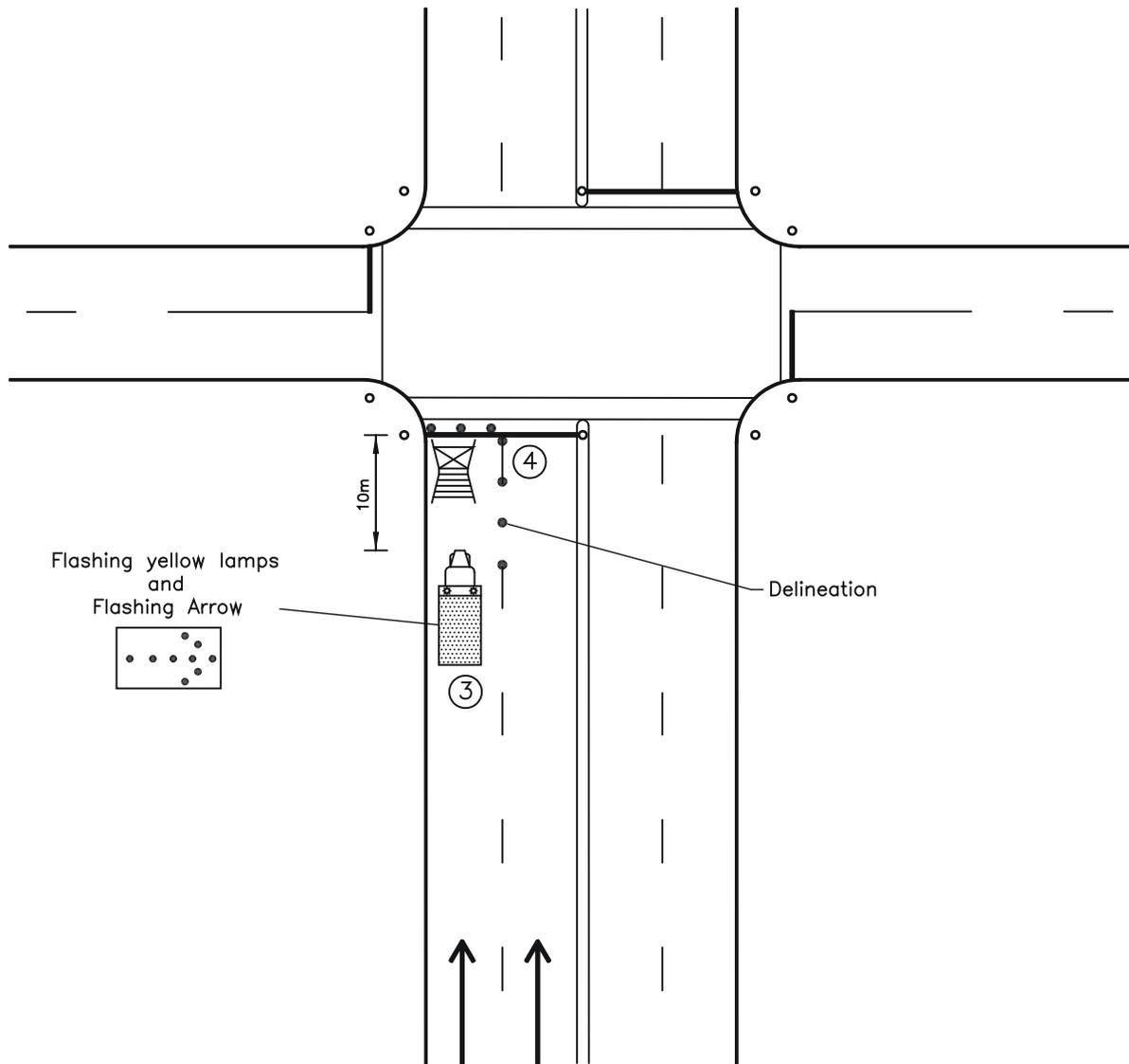
NOTES

- 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 820



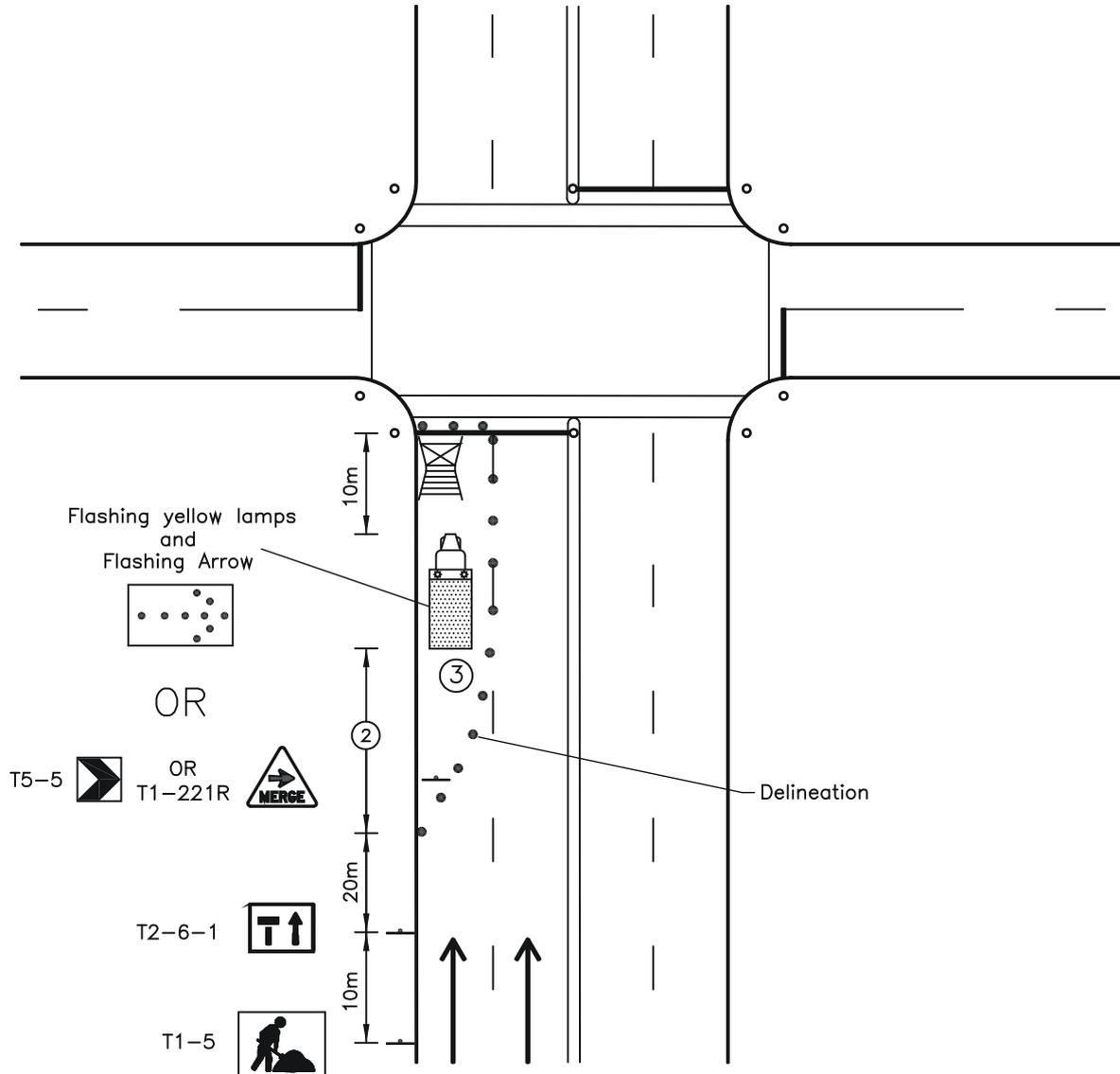
NOTES

- 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 821



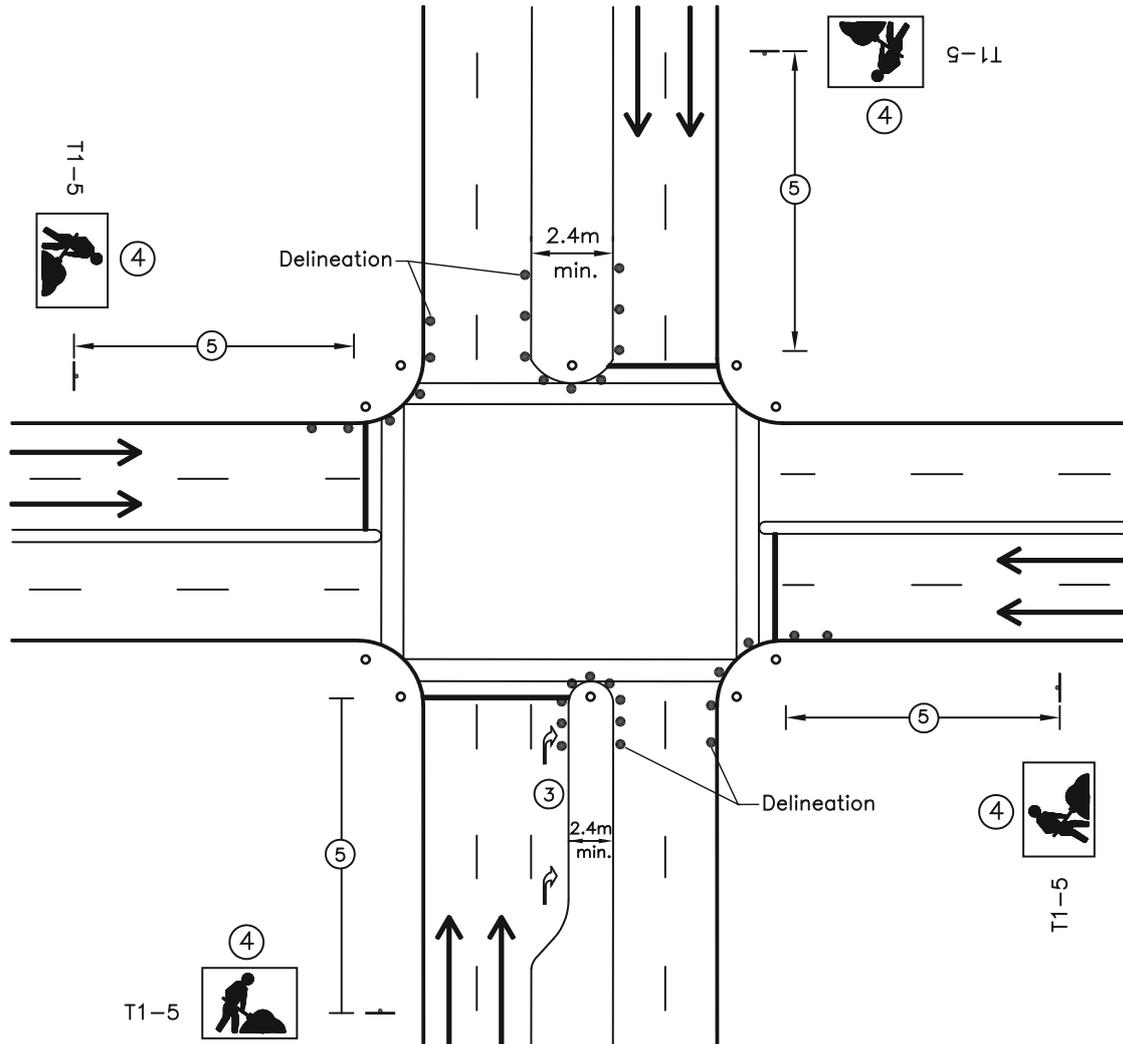
NOTES

- 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)

T00821

TCP 822



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.

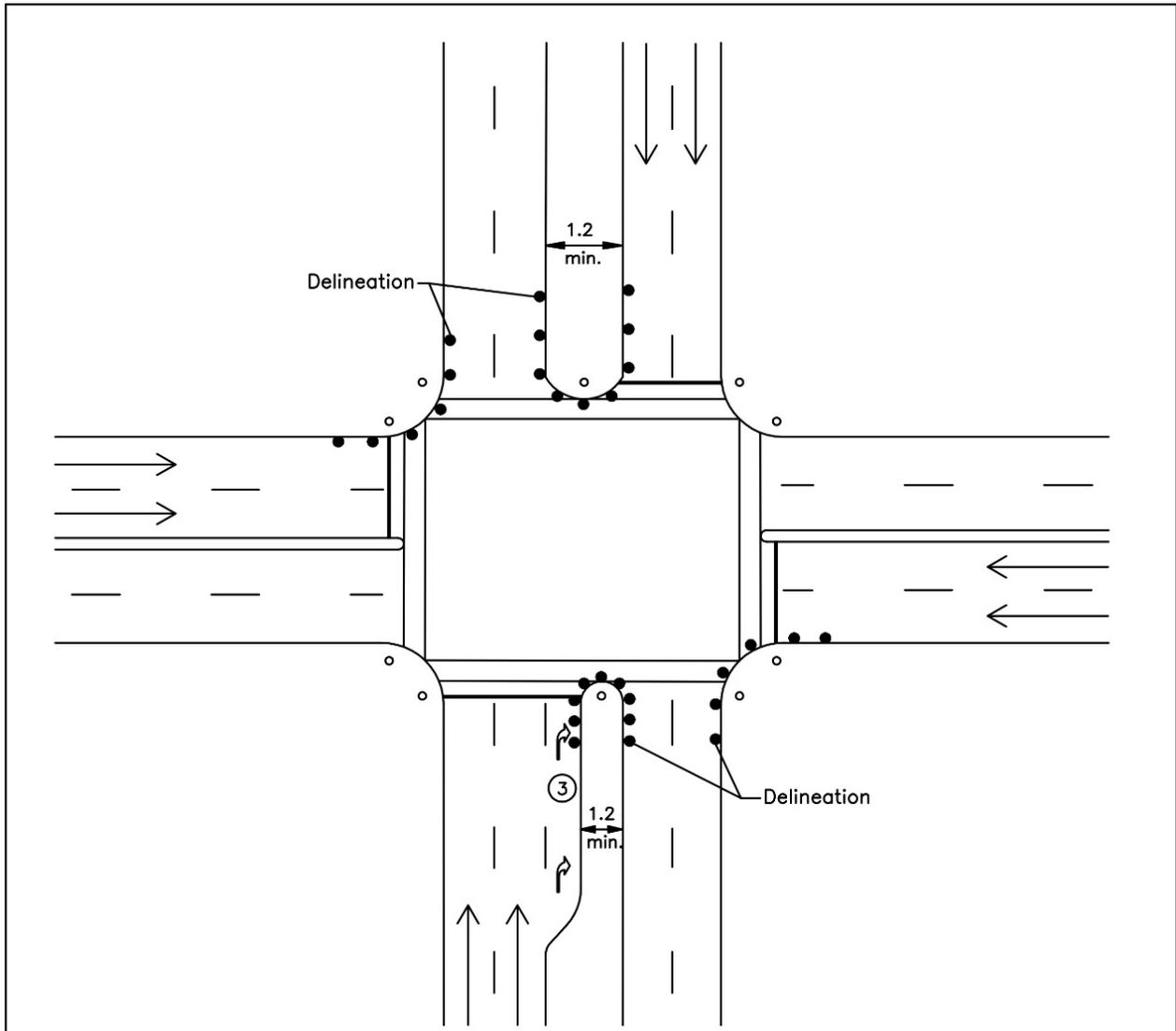
For Routine Maintenance (No Lane Blocked)

- 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 822A



NOTES

For Short Term Traffic Signal Emergency Maintenance (≤ 10 Minutes)

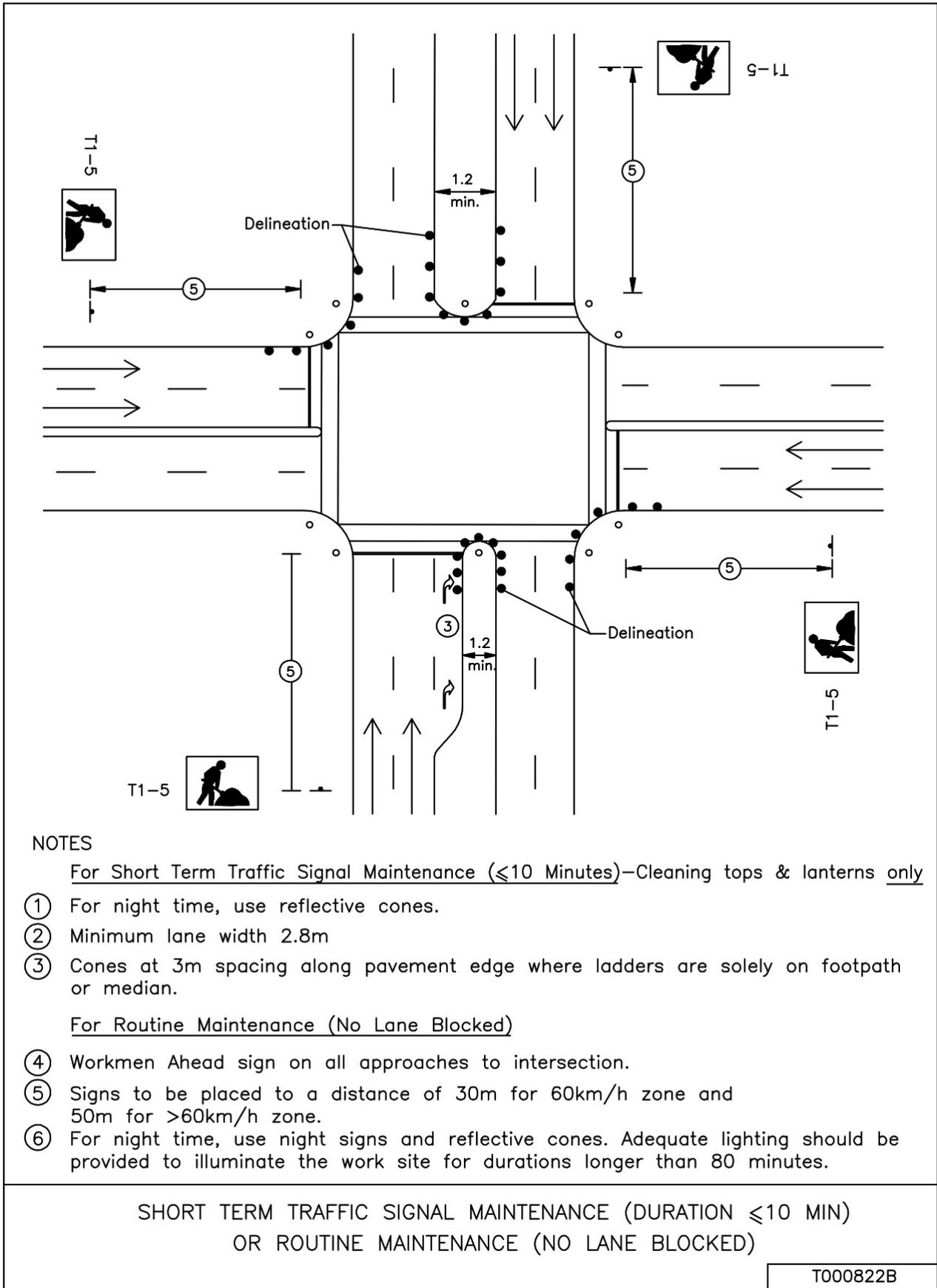
Single Lamp replacement/Push button repair/PT inspection

- 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 or where one foot of ladder is resting in travel lane.

SHORT TERM TRAFFIC SIGNAL EMERGENCY MAINTENANCE (DURATION ≤ 10 MIN)

T000822A

TCP 822B



NOTES

For Short Term Traffic Signal Maintenance (≤ 10 Minutes)—Cleaning tops & lanterns only

- 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.

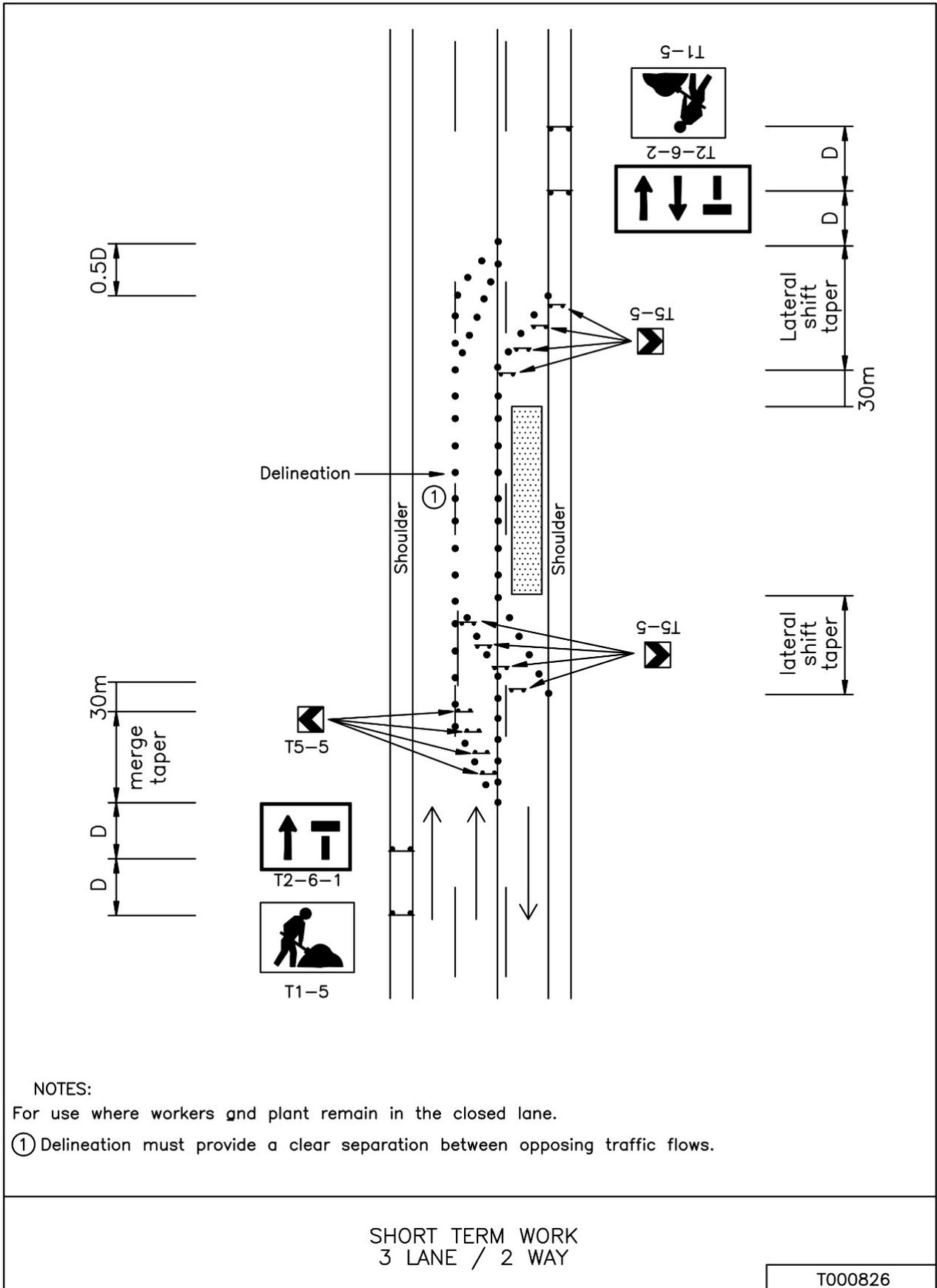
For Routine Maintenance (No Lane Blocked)

- 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.

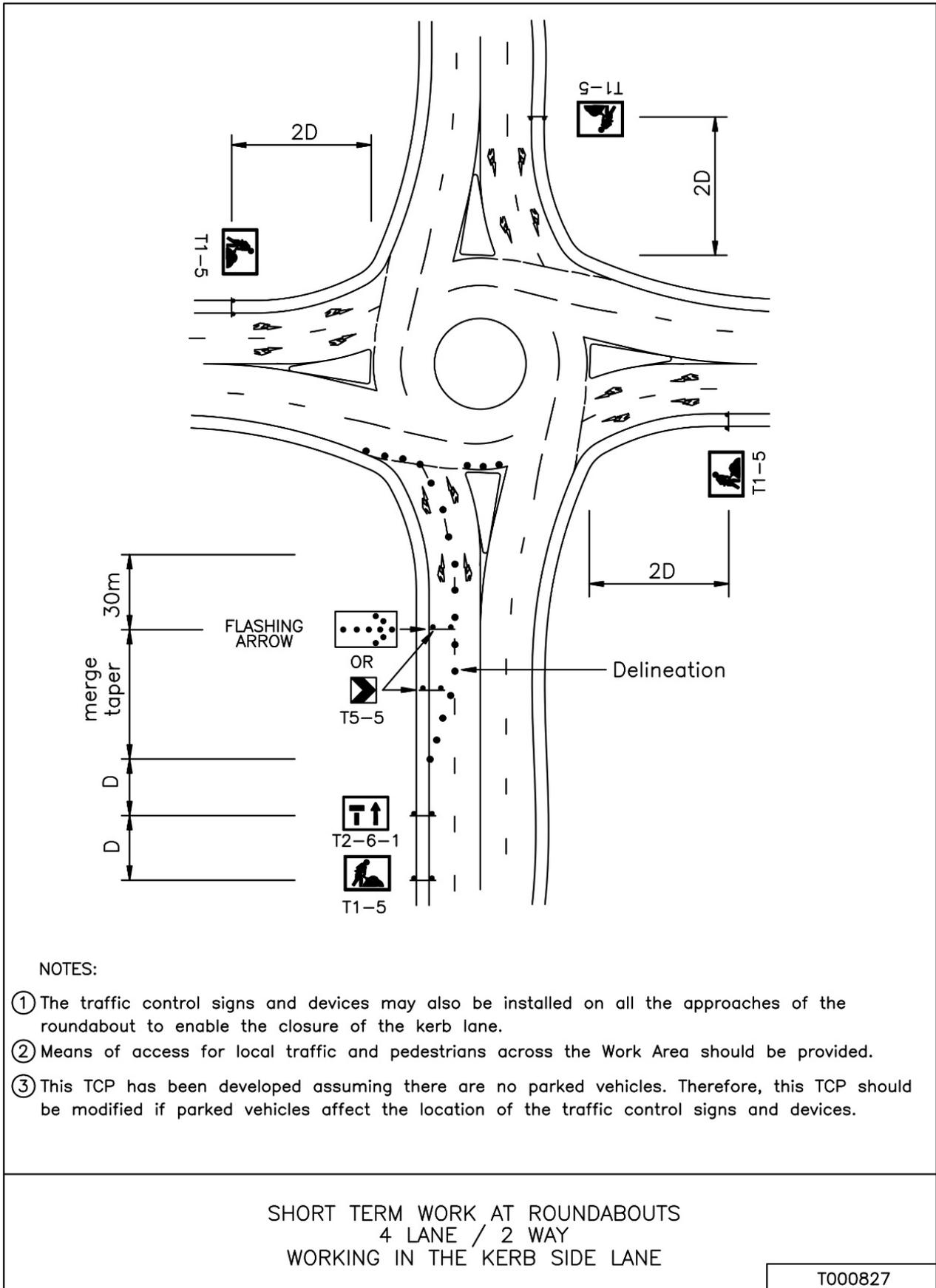
SHORT TERM TRAFFIC SIGNAL MAINTENANCE (DURATION ≤ 10 MIN)
OR ROUTINE MAINTENANCE (NO LANE BLOCKED)

T000822B

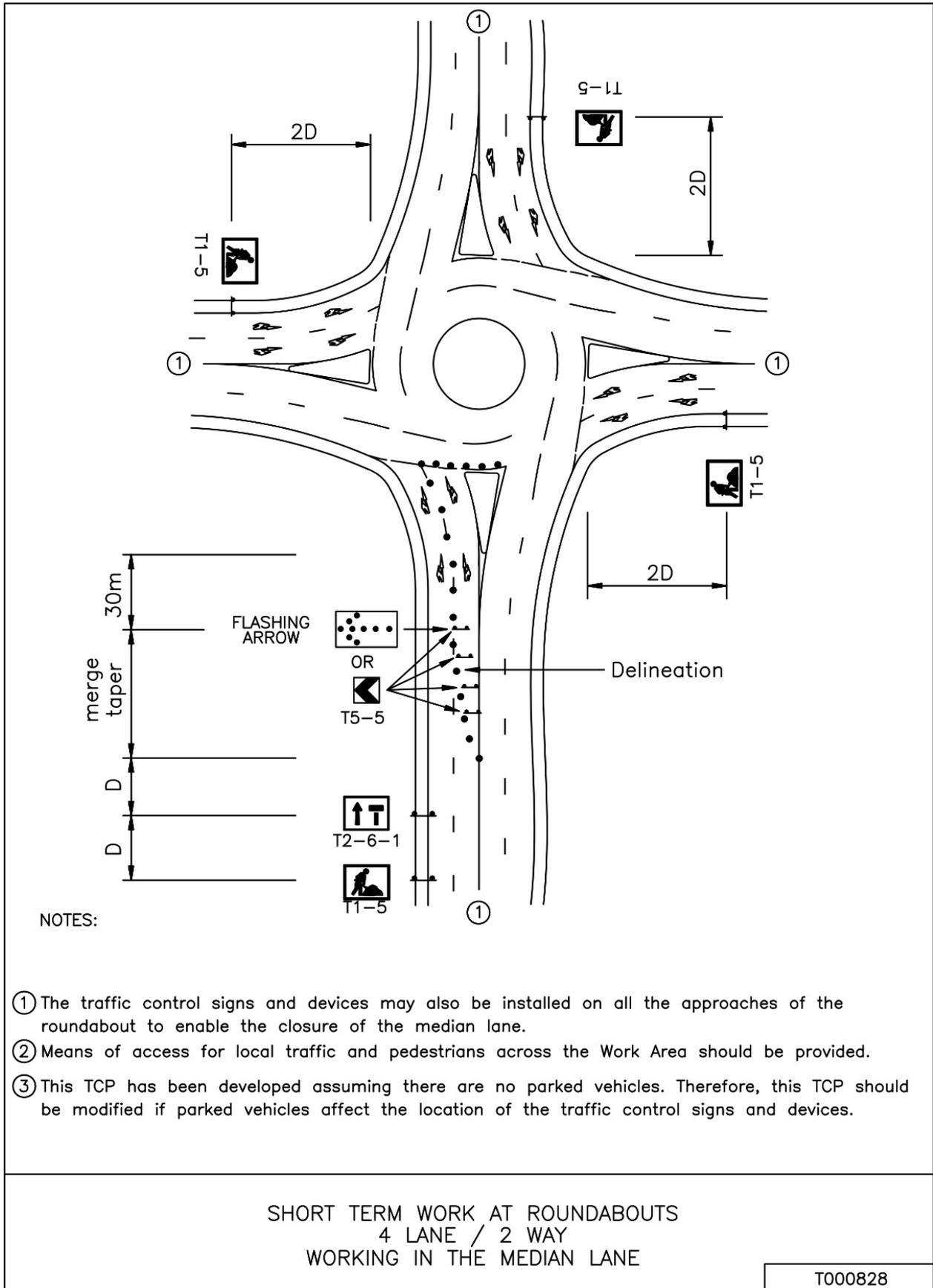
TCP 826



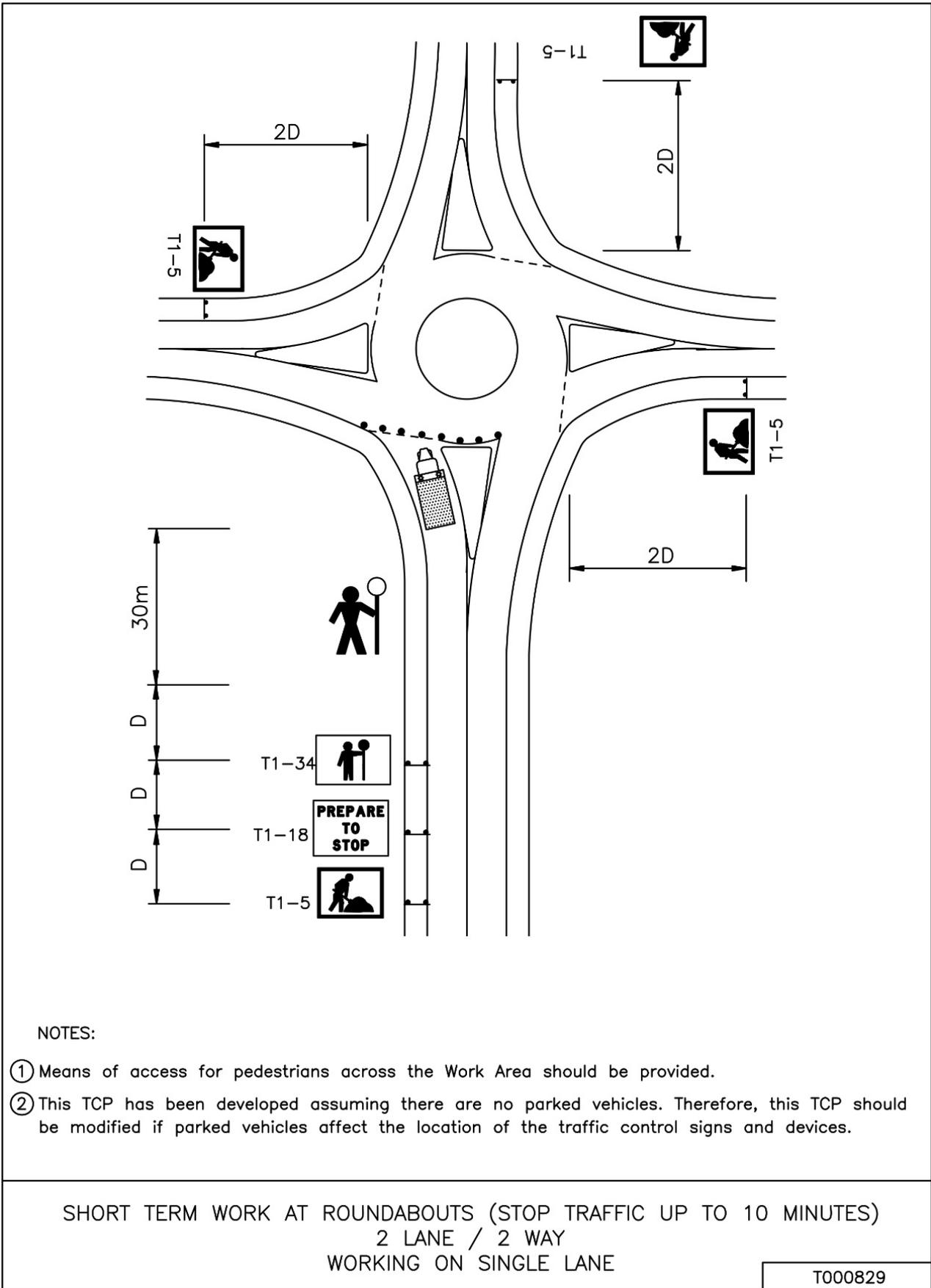
TCP 827



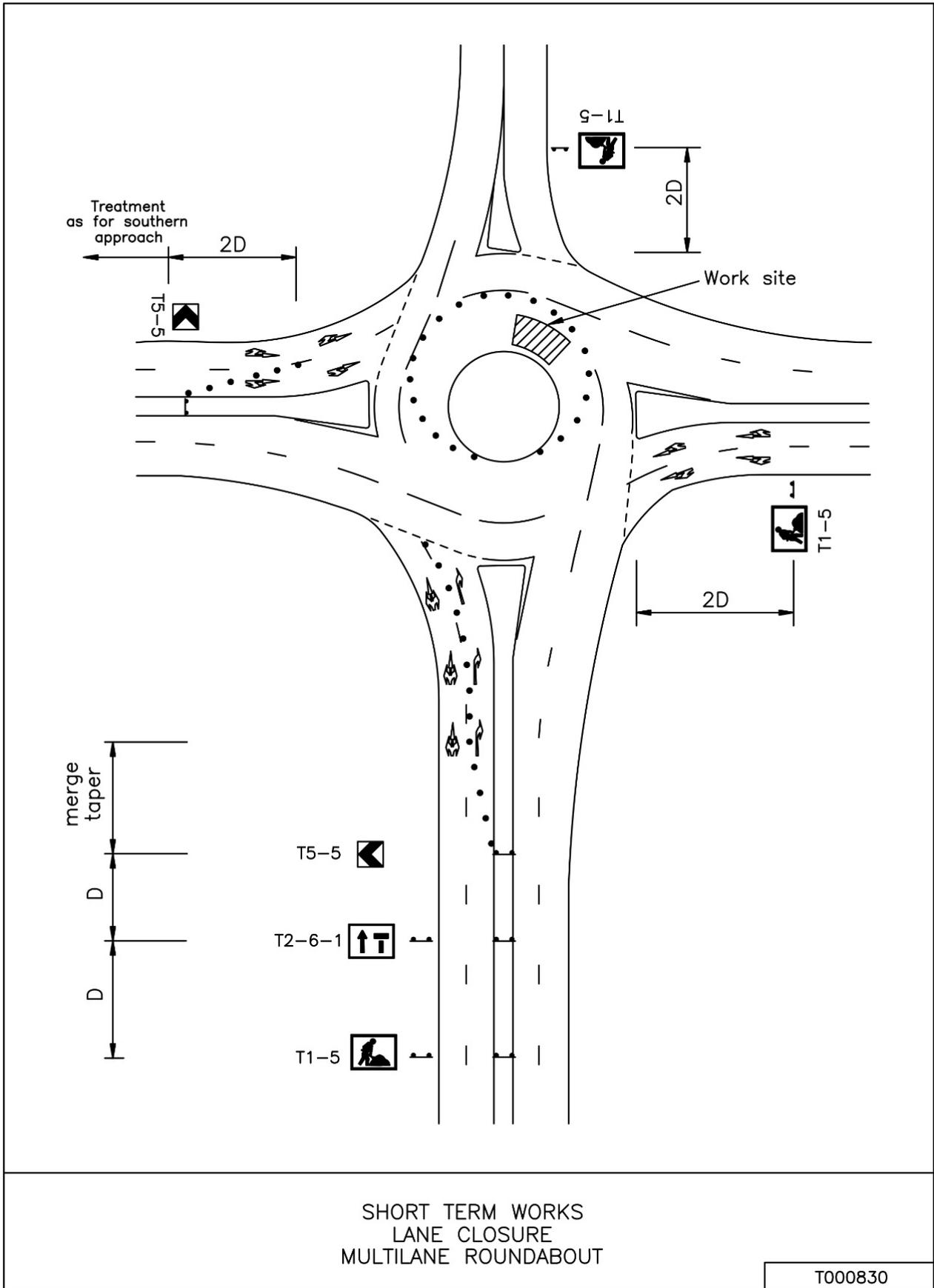
TCP 828



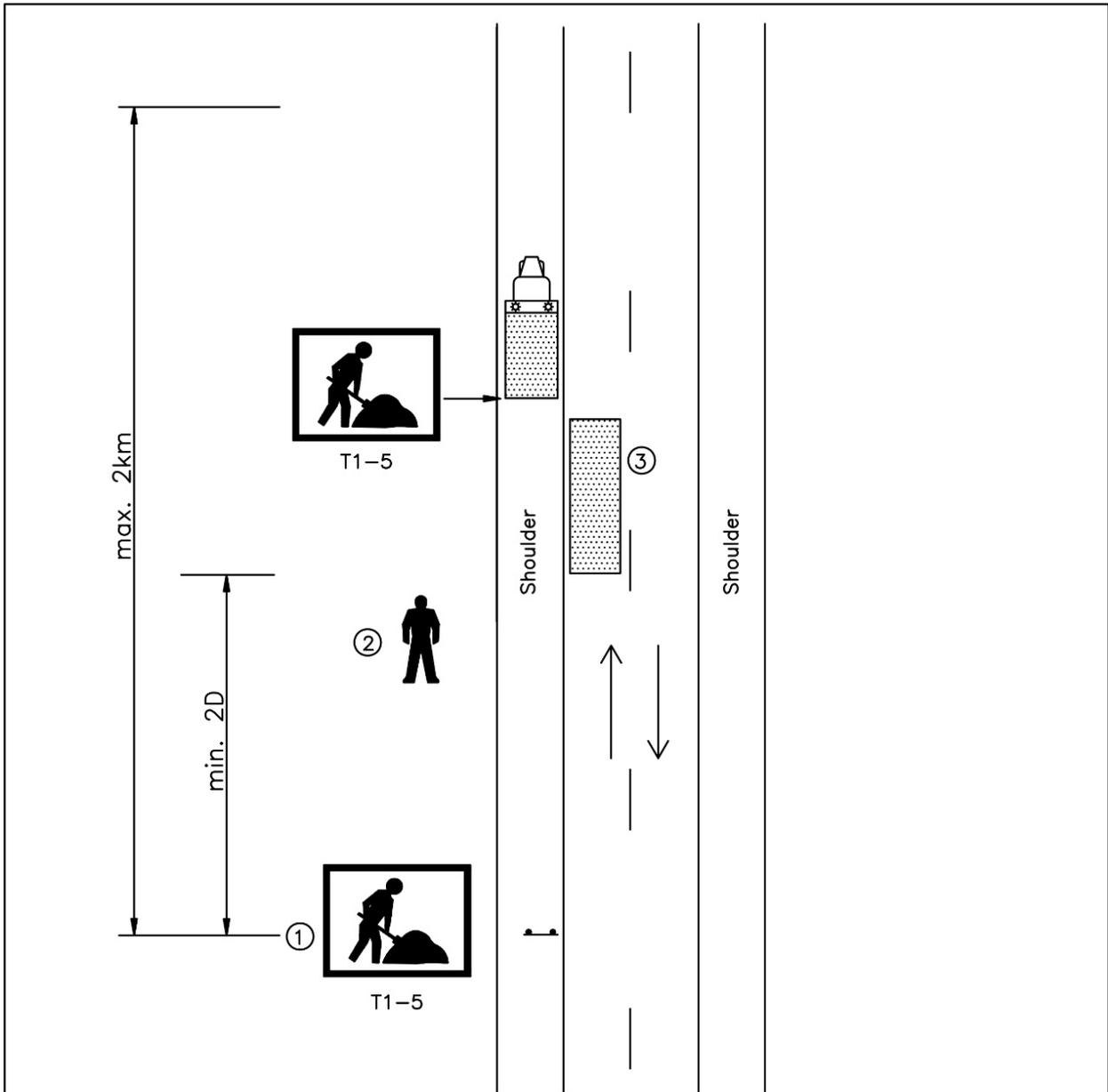
TCP 829



TCP 830



TCP 831



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. To 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

Appendix E Inspection checklists and forms

This Appendix contains examples of inspection checklists and forms to be used at traffic control sites. The forms may be modified to suit local requirements provided that the basic information is retained.

Traffic control at work sites safety inspection checklist

Date:		Time:	
Inspector:		PWZTMP Cert №	
Roads and Maritime office/contractor:			
Site supervisor:			
TCP number:		TCP Modified: Y/N	
Road/Bridge name:		Location:	
Type of work:			
Duration of work:	days	Time/s of work:	
Road configuration:			
Rate in the following manner:			
✓ Acceptable	X Not Acceptable	N/A Not Applicable	

Guidance notes:

- Detailed Inspections using this checklist shall only be undertaken by personnel qualified in Prepare Work Zone Traffic Management
- Report to the Site Office or most senior person and attend site induction or be escorted
- Desk-top “Audit”. Review paperwork and discuss site conditions, to complete Column 1. Check items against TCP and associated documents
- Site Inspection. Conduct site verification inspection, discussing issues with random site workers/ operators, to complete Column 2 – what you see on site
- Complete your report on site, where possible
- If you able to make a copy of the report on site, leave a copy with the supervisors
- Forward an additional copy to the engineer
- For contractor sites, forward an electronic copy to Manager Contractor Safety, Roads and Maritime WHS division.

No	Conditions	TCWS Section	Rating	
			1	2
1	TCP			
1.1	Does the work require a: - A TMP ? A TCP ? A VMP ? (See 12 below.) A PMP ?	G10		
1.2	Are all required plans approved ?	4.3		
1.3	Is the approved TCP on site ?	4.4.1/2		
1.4	Have signs and devices been set out as in the TCP ?	4.4.1/2		
1.5	If modifications have been made are they approved and marked on the TCP ?	4.5		
1.6	Has a TCWS Appendix D Risk Assessment (RA) been done and been attached to the TCP ?	App D		
1.7	Does the RA cover the risks associated with the work site ?			
1.8	Does the RA cover current risks; including 'out of hours' work ?			
1.9	Is the TCP relevant for the works in progress ?	4.4.2		
1.10	Has a Road Occupancy Licence been issued and is it being complied with ?	G11		
1.11	Are the requirements implemented for safe clearances to workers and pedestrians and traffic approach speeds ?	3.6 9.3		
1.12	Other			
COMMENTS ITEM 1				
2	Roadwork speed zones (RSZ)1			
2.1	Has the RSZ zone been authorised ?	8.2.6		
2.2	Is a copy of the SZA form held on site ?	8.2.6		
2.2	Has the SZA form been sent to local Police ?	8.2.6(a)		
2.3	Are records being kept of the times of RSZ installation ?	8.2.7		
2.4	Where a RSZ is in place, is the limit appropriate for the works being undertaken ?	8.2.3		
2.5	Is the speed limit/s operating within the approved times ?	8.2.6		
2.6	Is the length of the speed zone as per TCWS ?	8.2.4(b)		
2.7	Are Advanced Speed Warning Signs used appropriately ?	8.2.5(a)		

No	Conditions	TCWS Section	Rating	
			1	2
4.2	Has consideration been given to the use of a portable traffic control device instead of a traffic controller?:			
4.3	Are the correct number of TCs being used?	8.1.3		
4.4	Have TC Certificates been sighted and the No's recorded?	G10		
4.5	Is TCs high visibility clothing in good repair?	8.1.1(a)		
4.6	Are all TCs displaying the Road Authority's logo and <i>Authorised Traffic Controller</i> ?	8.1.1(c)		
4.7	Is the traffic speed restricted to a max of 60 km/h ?	8.1.1(d)		
4.8	Is the sight distance to approaching traffic 1.5D or greater?	8.1.1(e)		
4.9	Do TCs have a clear escape route?	8.1.4		
4.10	Has provision been made to prevent end of queue accidents?	8.1.1(e)		
4.11	Are TCs able to communicate with each other (line of sight, two way radios, additional TCs) ?	8.1.1(f) 3.5.7		
4.12	Are the PREPARE TO STOP (T1-18) and Traffic Controller Ahead (T1-34) signs correctly displayed?	8.1.1(a); 8.1.4		
4.13	Are the above signs covered or removed when not required?	8.1.4		
4.14	Are they controlling traffic in accordance with <i>Instructions to Traffic Controllers</i> ?	8.1.4		
4.15	If TCs are being used for night work: - are they wearing approved clothing ? are they safely lit and visible ? do they have correct communication ? are they using lighted wands ?	8.1.5		
4.16	Other			
COMMENTS ITEM 4				
5	Portable traffic signals (PTS)			
5.1	Are PTS being used?			
5.2	Are the PTS formally approved for use? (This may be included on the TCP approval.)	4.4.3, 10.5		
5.3	Are the PTS being used marked as complying with Roads and Maritime Specification TSI-SP-049?	10.2		
5.4	Are the PTS correctly registered?			
5.5	Is the approach speed of traffic reduced to 60 km/h or less?	10.7.2		
5.6	Is minimum sight distance of 150 metres provided?	10.7.3		

No	Conditions	TCWS Section	Rating	
			1	2
7.3	Are there less than 4 words per screen and no more than 2 screens on display ?	3.2.8		
7.4	Is the sign located in a safe position ?			
7.5	Is the VMS fitted with flashing blue and red lights ? If yes have them switched off/removed.			
7.6	Other			
COMMENTS ITEM 7				
8	Safety barriers			
8.1	Are safety barriers installed correctly ?	9.6		
8.2	Have the correct barriers been installed ?	9.6 & 3.3.7		
8.3	Where barrier sections are used as Safety Barriers, are they in compliance with AS3845 ?	9.6		
8.4	Where non rigid barrier systems are used as safety barriers, is work behind the barrier prohibited from the deflection zone ?	9.6.5		
8.5	Are water filled safety barrier elements full of water ?			
8.6	Is the safety barrier erected as designed (incorporating end protection) ?	9.6.1		
8.7	Has the approach speed of traffic been reduced to the barrier design rating ?			
8.8	Other			
COMMENTS ITEM 8				
9	Signs and devices			
9.1	Are all signs and devices in good condition ?	4.4.1		
9.2	Are the signs clearly visible and not affected by other signs, plant items, vegetation, shade, light glare etc. ?	3.1.1		
9.3	Are sign faces in compliance with AS1742.3 and have Class 400 retroreflective material ?	3.2.1		
9.4	Are the correct sign sizes being used ?	3.2.2		

No	Conditions	TCWS Section	Rating	
			1	2
9.5	Are signs duplicated, where required ?	3.2.4		
9.6	Are signs erected at the correct height and position ?	3.2.8		
9.7	Are the signs erected to give the correct sight distance ?	3.2.8		
9.8	Are signs displayed on frangible mounts ?	3.2.7		
9.9	Are barrier boards sighted at right angles to the flow of traffic ?	3.3.1		
9.10	Are there any contradictory or superfluous signs, devices or markings?	4.3.2		
9.11	Have the needs of pedestrians been provided for ?	9.3		
9.12	Have the needs of cyclists been provided for ?	9.4		
9.13	Are all property accesses to the site controlled ?	9.7		
9.14	Are all cones and bollards installed at the correct spacing ?	5.2.2		
9.15	Are the correct sized cones and bollards being used ?	3.3.3		
9.16	Where tapers are used, have they been identified as <i>lateral shift</i> or <i>merge</i> tapers and are they the correct length ?	5.2 Table 5.2		
9.17	Where there are 3 lanes of traffic or more in one direction and two lanes are closed, are the separate merge tapers of the correct length ?	5.2.9		
9.18	Are the 2 tapers separated by at least 1.5 D ?	5.2.9		
9.19	Where work is beyond a crest or curve, has the taper been set up before the crest or curve ?			
9.20	Where temporary pavement marking and markers are used, do they comply with the requirements of TCWS Manual ?	3.3.6		
9.21	Other			
COMMENTS ITEM 9				
10	End-of queue			
10.1	Has the potential for end of queue accidents been considered and appropriate action taken ?	3.5.7(a)		
10.2	Has an assessment of expected queue length been undertaken/documentated ?	3.5.7(b)		
10.3	Has protection been provided where the end-of-queue is likely to be within D of the first downstream PTS sign ?	3.5.7(c)		
10.4	Is a sight distance between approaching motorists and the end-of-queue, being maintained at greater than 2D (open road areas) and 1.5D (built up areas) ?	3.5.7(c)		

No	Conditions	TCWS Section	Rating	
			1	2
10.5	Where the first PTS sign is more than 4D from the control point, are <i>repeater signs</i> placed at intervals of not more than 4D ?	3.5.7(c)		
10.6	Is the traffic queue monitored at all times during the course of the work ?	3.5.7(b)		
10.7	Other.			
COMMENTS ITEM 10				
11	Workers on foot near plant			
11.1	Have workers working within 3 metres of plant been trained/briefed/tool-boxed on requirements of TCWS and Roads and Maritime TIP Sheet ?	9.23		
11.2	Where workers are working close to revolving plant, are satisfactory risk controls in place ?	9.23		
11.3	Has a VMP been developed where the conditions listed in TCWS occur on site ?	9.23.1		
11.4	Are lookout persons being used near reversing plant or delivery vehicles ?	9.23		
11.5	Other			
COMMENTS ITEM 11				
12	Works Traffic (VMPs)			
12.1	Have acceleration and deceleration lanes been provided ?	7.2		
12.2	Are U turns being undertaken safely ?	7.3		
12.3	Are reversing movements being undertaken safely ?	7.3		
12.4	Are signs provided for stock pile sites etc. ?	7.7		
12.5	Are median crossovers being used correctly ?	7.8		
12.6	Has a VMP been approved and provided ? Written VMP shall be prepared in 100km/h zones.	7.5;7.6 9.23.1		
12.7	Does the person authorising the VMP have traffic control qualifications ? If so, what qualifications ?			

No	Conditions	TCWS Section	Rating	
			1	2
12.8	Have access and egress to the site been safely provided ?	7.2		
12.9	Are delivery vehicles required to report to a designated location/person ? Is it happening on site ?	9.23		
12.10	Other			
COMMENTS ITEM 12				
13	Miscellaneous			
13.1	For intermittent work are all requirements met ?	9.1.2		
13.2	Where a lookout person is used, are all requirements being met ?	9.1.2		
13.3	For mobile work are all requirements being met ?	9.17		
13.4	If the work is conducted at night are all requirements being met ?	9.2		
13.5	Where travelling plant or vehicles travel slower than 20 km/h below the normal road speed limit, do they comply with the requirements of TCWS ?	9.1.3, 9.1.10		
13.6	Other			
COMMENTS ITEM 13				
ADDITIONAL COMMENTS				
Signed (Inspector).....				

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	
Approval №								
Temp speed – time operational	To		To		To		To	
Approval №								
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	1		2		3		4	
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:

Emergency incident management checklist

The following actions are common to most emergency road-related incidents.

Before leaving depot	
<input type="checkbox"/>	Staff PPE needs.
<input type="checkbox"/>	Emergency incident response equipment/ supplies
<input type="checkbox"/>	Heavy equipment needs.
<input type="checkbox"/>	Incident response plans (IRPs).
<input type="checkbox"/>	Motorist detour handouts (where available).
Arrival on site	
<input type="checkbox"/>	<p>Assess dangers present:</p> <ul style="list-style-type: none"> • Electricity line(s) down • Fire/potential explosion • Hazardous material/substance spill • Traffic related risks • Crash victims and responders • Leaking fuel or gas • Any other potential hazards.
<input type="checkbox"/>	Report to senior police officer and receive incident briefing
<input type="checkbox"/>	<p>Provide initial situation report (SITREP) to Transport Management Centre (TMC) or Roads and Maritime field traffic manager.</p> <p>Advise TMC or the field traffic manager of the planned traffic management arrangements (ie lane closure, road closure and detour or contra flow).</p>
<input type="checkbox"/>	<p>Implement lane closure(s) or road closure(s) and traffic diversion(s), where required to relieve police of traffic control duties and secure the incident scene.</p> <p>Note: if there are no police on scene or managing traffic it can be necessary to immediately proceed to implementing the traffic control by:</p> <ul style="list-style-type: none"> • Initially stopping the response vehicle on the shoulder or in the travel lane if safe with all flashing lights on and immediately begin warning (with safety) approaching traffic to slow down. Where possible, the vehicle and workers should be located to achieve a minimum sight distance of 2.5 D to approaching traffic. • Set up appropriate TCP to use traffic controllers to stop traffic (advance signs at appropriate locations). • Set up advanced warning signs (ie TRAFFIC ACCIDENT AHEAD, PREPARE TO STOP, TRAFFIC HAZARD) in advance of the anticipated end of the traffic queues, to provide adequate warning to approaching traffic that a traffic queue ahead can exist. The length of the traffic queue and the location of appropriate warning signs will require periodic monitoring. • Consider implementing additional traffic controller for end of queue management. • Ensure implemented traffic control complies with this manual and AS1742;3 as soon as practical.
<input type="checkbox"/>	Provide liaison staff at incident (police/ emergency service) forward command post.

Subsequent actions (once established on site)	
<input type="checkbox"/>	Secure and maintain emergency services site access.
<input type="checkbox"/>	Ongoing monitoring and adjustment (if required) of the 'end of queue' management.
<input type="checkbox"/>	Assess suitability of road closure and diversion route(s).
<input type="checkbox"/>	Ascertain emergency services reasons for full road closures (where necessary).
<input type="checkbox"/>	Determine if a lane can be opened to traffic under alternate/contra-flow arrangements.
<input type="checkbox"/>	Activate available portable or permanent variable message sign (VMS) units to support incident.
<input type="checkbox"/>	Open/close 'fixed' detour signage (where available).
<input type="checkbox"/>	Ascertain duration of incident (if possible).
<input type="checkbox"/>	Provide regular SITREPs to TMC/field traffic manager every 30 minutes or when there is a significant change on site.
<input type="checkbox"/>	Manage emergency vehicles to ensure trafficable lanes remain available.
<input type="checkbox"/>	Assist police with scene management issues as required.
<input type="checkbox"/>	Provide detour handouts to motorists (where available).
<input type="checkbox"/>	Ensure compliance of traffic control plan and devices in accordance with TCAWS manual (AS1742.3).
Other considerations	
<input type="checkbox"/>	Monitor staff welfare and provide relief to staff at protracted incidents.
<input type="checkbox"/>	Report any injuries or near miss incidents to supervisor.
<input type="checkbox"/>	Coordinate salvage and clean-up operations.
<input type="checkbox"/>	Confirm Fire & Rescue NSW (FRNSW) Hazmat attending if hazardous material/substance spill incident.
<input type="checkbox"/>	Confirm police crash investigation unit (CIU)/crime scene attending if fatal/life threatening incident.
<input type="checkbox"/>	Provide the field traffic manager or TMC media unit with photos of the incident (Note: not appropriate for incident involving fatalities).

Assess additional resource requirements:	
<input type="checkbox"/>	Additional staff.
<input type="checkbox"/>	Heavy machinery or equipment.
<input type="checkbox"/>	Fixed/portable VMS.
<input type="checkbox"/>	Traffic control equipment.
<input type="checkbox"/>	Portable light towers.
<input type="checkbox"/>	Absorbent material for spillages
Assess need for additional support agencies:	
<input type="checkbox"/>	Other Roads and Maritime works depots.
<input type="checkbox"/>	Other local government authorities.
<input type="checkbox"/>	Interstate road authorities.
<input type="checkbox"/>	Private traffic control companies
Administrative actions	
<input type="checkbox"/>	Maintain incident log and SITREPs to TMC/field traffic manager
<input type="checkbox"/>	Obtain a police incident 'event number'.
<input type="checkbox"/>	Record details of Roads and Maritime and council personnel and resources in attendance.
<input type="checkbox"/>	Regularly review requirements for site personnel/resources.
<input type="checkbox"/>	Arrange internal incident de-brief (where necessary).



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Customer feedback

Roads and Maritime

Locked Bag 928

North Sydney NSW 2059

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