

## 4 Inputs to a traffic management plan

### 4.1 General

When developing a traffic management plan, the following principles must be taken into account to ensure the safety of road workers and road users:

- Type of work being performed;
- Temporary works design principles;
- Providing for specific road users;
- Speed zones;
- End-of-queue management; and
- Credibility of work sites.

Detailed considerations of these principles when developing a TMP are provided in the following Sections.

### 4.2 Types of work

#### 4.2.1 General

In this Technical Manual, work is classified by duration and activity. The terms used in this Technical Manual to classify work by duration are short-term work and long-term work. The terms used in this Technical Manual to classify work by activity are static work and dynamic work.

*Table 4-1* provides a summary of the permitted relationships between static, dynamic, short and long term work.

Table 4-1. Relationships between work types

	Short term	Long term
Static work	✓	✓
Dynamic work	✓	✗

#### 4.2.2 Short-term work

Short-term work applies to traffic management when work does not exceed the duration of a single shift and the work site is continuously attended. Examples include activities such as maintenance of freeway safety barriers, linemarking or installation of treatments such as raised pavement markers or audio tactile linemarking.

With all short-term work, roadway conditions must be returned to normal, without traffic control or after-care provisions, when work has been completed.

Short term work must be performed as either static work or dynamic work.

### 4.2.3 Long-term work

Long-term work applies when work is performed over a duration greater than one shift and traffic management is used between shifts. For long-term work, a traffic guidance scheme might need to operate both day and night with the work site left unattended. Long-term work must be arranged and undertaken in accordance with the relevant requirements of static work.

Long term work must only be performed as static work.

### 4.2.4 Static work

Static work is classified as work that is completed at a fixed site for a period of time with TTM. Static work sites may involve complex traffic arrangements and are often established so that a site can be left unattended during or between work shifts. The use of a static work site must be a risk based decision, where the risk of setting up static controls is considered against the protection provided by those controls.

Static work might include the use of lane closures, roadwork speed zones, changes to linemarking, detours, shoulder closures etc. and often with some form of traffic control.

The length of a static work site may range from 100 m to many kilometres of work area. If traffic is to be stopped for any duration at a static work site, then the length of the work site should be considered in the TMP in relation to risk (particularly end-of-queue).

Static work must be performed as either short-term work or long-term work. For information on designing a TGS for static work see [Section 7.7 Designing a TGS: Static work](#).

### 4.2.5 Dynamic work

Dynamic work is classified as work that is short in duration and moves along a length of roadway. Dynamic work is classified into three sub-categories:

- *Frequently changing work*—regularly moves between successive locations, either in or outside of a traffic lane where minimal warning is required to advise road users of the presence of workers;
- *Continuous work (previously known as mobile work)*—progressively moving in vehicles along the roadway; or
- *Intermittent work*—work which is undertaken on travel lanes, in gaps in traffic, and requires no adjustment that affects road users on the roadway.

Dynamic work may be completed:

- In a lane, on an edge line or on a shoulder; or
- On a verge, median or footpath.

Depending on the activity, dynamic work may involve:

- Workers only;
- Plant only; or
- A combination of both.

See [Section 7.8 Designing a TGS: Dynamic work](#) for examples and further details of dynamic work.

Dynamic work must be performed as short-term work only. For information on designing a TGS for dynamic work see [Section 7.8 Designing a TGS: Dynamic work](#).

### 4.2.6 Risk Management through work type selection

In all instances, the work type that enables the highest order control through the hierarchy of controls must be selected. Most often for long term works, this is the selection of a static site protected by a detour or safety barriers. It is recognised however that the selection and set up of static methods for short term work can in itself generate an increased level of risk (e.g. by exposing workers to traffic for longer periods during the setup of the site than the time required to perform the work). In these instances, a dynamic work method may be selected, however the worker protection must always be prioritised in accordance with the hierarchy of controls framework shown in *Figure 4-1*.

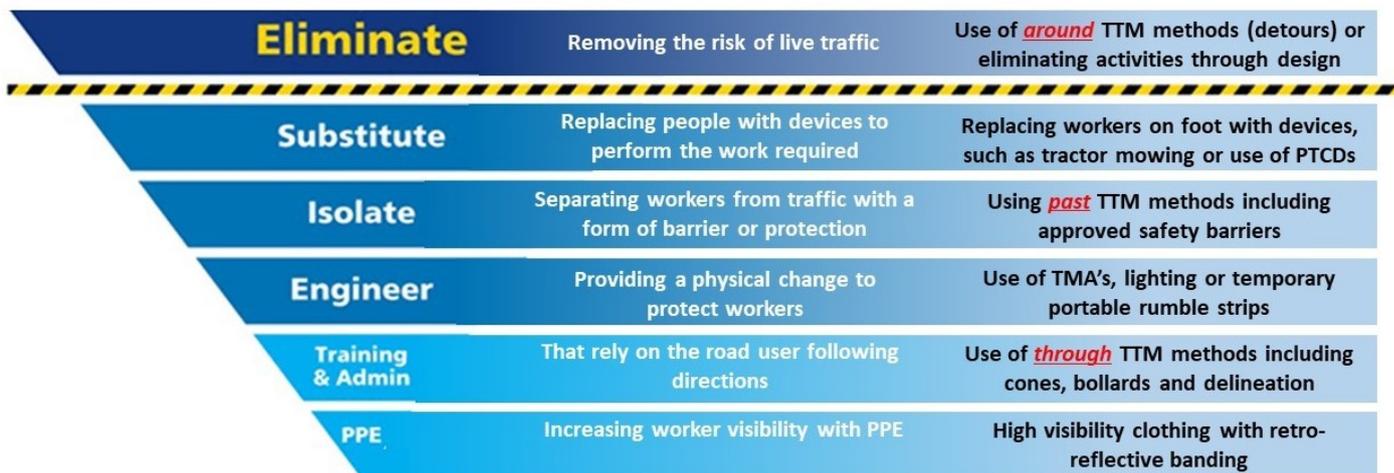


Figure 4-1. Hierarchy of controls framework

## 4.3 Temporary works design principles

### 4.3.1 General

When designing a TMP, appropriate temporary design principles must be used to ensure a safe road environment for road workers and road users. In some instances, these principles will align with the permanent road design standards.

### 4.3.2 Lane widths

The minimum width for lanes carrying traffic around, past or through a work site must be in accordance with *Table 4-2*. Lane widths should also consider accommodating the turn paths of large vehicles expected to negotiate the work site.

Table 4-2. Minimum lane widths

Speed of traffic (km/h)	Minimum lane width (m)
Less than 65 km/h	3.0
Greater than 65 km/h	3.5
Curve with radius less than 250 m	Curve widening of 0.5 m per lane
Shuttle flow with active control	3.5

**Note to Table 4-2:** Where existing lane widths are narrower than those specified in the table above, the lane widths may be maintained. However the TMP must document provisions for turning paths, sight distances and vulnerable road users.

Where fixed vertical obstructions such as fences or safety barriers are restricting the available shoulder width, consideration should be given to increasing lane widths to accommodate larger vehicles.

See [Section 4.4.5 Heavy vehicles](#) for additional information regarding lane width considerations for heavy vehicles.

### 4.3.3 Clear zones

A clear zone is the area adjacent to the traffic lane that should be kept free from features that would be potentially hazardous to errant vehicles. The clear zone should be kept free of non-frangible hazards where economically and environmentally possible. Alternatively, hazards within the clear zone should be treated to make them safe or be shielded by a safety barrier.

In order to have a manageable risk assessment process, it is necessary to define an area beside the road that will envelop the majority of hazards that are of interest. This entails defining a width from the nearest through travel lane within which the risk of all hazards should be assessed. Ideally from a roadside safety perspective, this area should be clear of all hazards; hence the term “clear zone”.

The clear zone is a compromise between the recovery area for every errant vehicle, the cost of providing that area and the probability of an errant vehicle encountering a hazard.

### 4.3.4 Minimum clearances of workers to traffic

Work must be planned and designed to provide maximum achievable clearances to workers on foot and plant.

When performing static work, the minimum allowable clearance of 1.5 m must be maintained at all times between workers on foot, plant and traffic. Additionally, the controls provided in [Section 4.3.5 Protection of work area](#) must be implemented.

When performing dynamic work, the minimum allowable clearance of 1.5 m should be maintained at all times between workers on foot, plant and traffic. When it is determined that a safer outcome can be achieved by workers undertaking an activity within 1.5 m the following must be demonstrated:

- A site or activity specific risk assessment must be completed, demonstrating that the hierarchy of controls is applied and all higher order controls have been considered;
- Site specific controls for works, including the minimum controls detailed in [Section 4.3.5 Protection of work area](#), have been determined and detailed in the traffic management plan; and
- Work specific minimum controls, detailed in [Section 7.8 Designing a TGS: Dynamic work](#) have been determined and detailed in the traffic management plan.

### 4.3.5 Protection of work area

In accordance with [Section 4.3.4 Minimum clearances of workers to traffic](#), all work areas should be distanced as far away from through traffic as possible via the use of “around” or “past” traffic management methods. Where work is required to be performed near traffic, [Table 4-3](#) provides the mandatory and recommended controls for the protection of a work area.

Table 4-3. Mandatory and recommended controls for protection of a work area

Distance of work area to traffic	Mandatory and recommended controls			
	Mandatory/ recommended	Long term work (greater than 4 weeks)	Long term work (less than 4 weeks)	*Continuous and frequently changing work
Closer than 1.5 m	Mandatory controls	Temporary safety barrier	<ul style="list-style-type: none"> <li>Delineation of work area</li> <li>Speed zone of 45 km/h or less</li> </ul>	<ul style="list-style-type: none"> <li>Speed zone of 45 km/h or less</li> <li>Shadow vehicle</li> </ul>
	Recommended controls	Speed zone of 85 km/h or less	<ul style="list-style-type: none"> <li>Speed zone of 35 km/h or less</li> <li>Temporary safety barrier</li> </ul>	<ul style="list-style-type: none"> <li>Delineation of work area</li> <li>Speed zone of 35 km/h or less</li> </ul>
Between 1.5 m and 3 m	Mandatory controls	<ul style="list-style-type: none"> <li>Temporary safety barrier where speed zone is greater than 75 km/h</li> <li>Speed zone of 65 km/h or less where no temporary safety barrier is used</li> </ul>	<ul style="list-style-type: none"> <li>Delineation of work area</li> <li>Speed zone of 65 km/h or less</li> </ul>	<ul style="list-style-type: none"> <li>Speed zone of 65 km/h or less</li> <li>Shadow vehicle</li> </ul>
	Recommended controls	<ul style="list-style-type: none"> <li>Delineation of work area</li> <li>Temporary safety barrier where speed zone 85 km/hr or less</li> </ul>	Temporary safety barrier	<ul style="list-style-type: none"> <li>Delineation of work area</li> <li>Speed zone of 55 km/h or less</li> </ul>
Between 3 m and 6 m	Mandatory controls	Speed zone of 85 km/h or less where there is no safety barrier	<ul style="list-style-type: none"> <li>Delineation of work area</li> <li>Speed zone of 85 km/h or less where there is no safety barrier</li> </ul>	Speed zone of 85 km/h or less
	Recommended controls	Temporary safety barriers	Temporary safety barrier	<ul style="list-style-type: none"> <li>Delineation of work area</li> <li>Speed zone of 65 km/h or less</li> </ul>
Greater than 6m	Mandatory controls	Worker symbolic (T1-5) sign when workers are visible to road users	Worker symbolic (T1-5) sign when workers are visible to road users	As per <u>Section 7.8</u> .
	Recommended controls	<ul style="list-style-type: none"> <li>Delineation of work area</li> <li>Temporary safety barriers</li> </ul>	<ul style="list-style-type: none"> <li>Delineation of work area</li> </ul>	Delineation of work site

**Notes\* to Table 4-3:**

1. Minimum controls for intermittent work are provided in Section 7.8.5.1 Minimum controls for intermittent work.
2. All work sites protected by an approved temporary safety barrier must meet the requirements of Section 6.7 Temporary safety barriers.
3. Where a temporary safety barrier is not installed, work site delineation should be provided by way of cones, bollards or similar in accordance with Section 6.8 Traffic guidance and delineation devices.
4. If there is a risk of workers, plant or equipment encroaching into the through lane of traffic, containment fencing in accordance with Table 6-13 should be installed.
5. In addition to the controls detailed in Table 4-3, signage must be installed for the relevant works in accordance with Section 6 Signs and devices.

When determining the distance between a work area and traffic, the distance must be based on the location of the closest workers or object to the edge of a travel lane (the lane line), including bicycle lanes.

The edge of the traffic lane is the outside limit of the traffic lane, usually defined by an edge line or the kerb. If there is no edge line or kerb on the road (i.e. such as a rural road) then the edge of the traffic lane would be edge of the sealed pavement for a sealed road or the drainage swale for an unsealed road.

#### **4.3.6 Sight distances**

Suitable sight distances enable road users to perceive and react to a hazardous situation on the road ahead resulting in safer and more efficient traffic management. When designing a TMP, the PWZTMP qualified person must ensure adequate sight distance is maintained at all times along the alignment including at intersections and accesses. The following sight distance checks should be considered:

- Stopping Sight Distance (SSD);
- Safe Intersection Sight Distance (SISD);
- Overtaking Sight Distance;
- Intermediate Sight Distance;
- Approach Sight Distance (ASD); and
- Pedestrian Sight Distance.

Detailed steps and calculations associated with assigning appropriate sight distances are described in detail in Austroads *Guide to Road Design Part 3 and Part 4a*. Advice on sight distance can also be provided by road design and traffic engineering.

Sight distances must be maintained to all safety elements of the work site including but not limited to:

- Traffic control devices;
- Queued vehicles;
- Signs and delineation;
- Site access and egress points;
- Intersections;
- Private and commercial accesses;
- Merge tapers;

- Work vehicles; and
- Pedestrian, cyclist and other vulnerable road user paths and crossing points.

Best practice is to provide as much sight distance as possible, while considering drivers perception of the upcoming hazards, however it is often restricted by the following:

- Road geometry including horizontal and vertical curves in road;
- Environmental factors such as:
  - Weather;
  - Vegetation; and
  - Time of day.
- Road user factors including:
  - Traffic queues;
  - Types of road users; e.g. over-dimensional vehicles, motorcyclists; and
  - Road user behaviour such as vehicles closely following each other.
- Local site features, both temporary and permanent, including the presence of the following located in the median or on the roadside:
  - Safety barriers and kerbs;
  - Signs;
  - Street furniture including, landscaping and fencing;
  - Steep cuttings;
  - Parked vehicles;
  - Railway crossings; and
  - Bridges.

It is important to note that stopping sight distances of heavy vehicles varies from that of general road users. Information regarding stopping sight distance for vehicles can be found in the [Performance-Based Standards Scheme – Network Classification Guidelines](#).

Additional sight distance requirements are provided in [Section 7.8.5.2 Sight distances for intermittent work](#).

#### **4.3.7 Traffic staging plans**

Traffic staging plans (TSPs) are typically road design drawings that show how traffic passes safely around, past or through the work area during various stages of a roadwork project.

A qualified road designer must design the horizontal and vertical alignment of the temporary roadway. In addition and where detailed, a PWZTMP qualified person must design the layout for the temporary signage and delineation. These activities may be completed by two people or one person with both qualifications. Accordingly, the alignment and layout must be signed off under road designer and PWZTMP competencies.

The TSP and any supporting TGS must show the alignment, signage and delineation, and allow for easy installation and checking. As such, it may be necessary that the TSP be separated from other staging plans, such as a construction staging drawings.

A TSP must show the following details (where applicable):

- Lane configurations on existing and new (temporary and permanent) pavements;
- Intersection layouts and temporary traffic signals arrangements;
- All existing and temporary traffic signage, delineation and pavement markings;
- Footways and cycle ways;
- Bus stop locations;
- Work areas;
- Construction site ingress and egress locations including acceleration and deceleration lanes (or shoulders);
- Access to local properties and side roads;
- Temporary street lighting;
- Temporary barriers; and
- Chainages.

Other factors that should be considered (that may form part of a staging construction design) when designing the TSP include:

- Temporary pavement design;
- Temporary drainage design, including erosion and sedimentation control;
- Longitudinal and cross-section plans of temporary alignment;
- Utilities and their impact on staging; and
- Temporary retaining structures.

#### **4.3.8 Detours**

A detour must be carefully planned at the TMP stage such that:

- The alternative route is capable of accommodating all classes of vehicles that are to be detoured in terms of mass, height or width of structures;
- Stakeholders, such as the local council and police, are informed and concur with the proposed detour;
- Local residents are consulted and informed in a timely manner; and
- Consent is obtained for local and regional roads from the relevant local council in accordance with the Heavy Vehicle National Laws.

The following additional aspects should be considered when planning a detour:

- Lane widths;
- Geometric design of intersections and their capability to accommodate the vehicles that are being detoured (for example, B-double sweep paths and small roundabouts);
- Existing intersection controls and priority relative to the proposed route (i.e. will Give Way or Stop sign control be in conflict with the detour route);

- Existing traffic flows and turning movements;
- Vulnerable road user movements and existing facilities;
- Land use along the detour route and the need to manage any environmental impact (i.e. noise); and
- Sensitive land uses along the detour route. For example, aged care facilities, child care centres etc.

Further information regarding TGS design considerations for detours is contained in [Section 7.7.2.3 Detours](#).

## 4.4 Providing for specific road users

### 4.4.1 General

During the development of a TMP, the needs of specific road users must be understood and managed for the extent of the works. The locations of need, travel paths and desire lines must be factored into the development of the TMP to ensure safety and access is maintained.

Specific groups to be assessed include:

- Vulnerable road users including:
  - Pedestrians;
  - Cyclists;
  - Motorcyclists; and
  - Users of scooters and other similar devices/vehicles.
- Heavy vehicles, including oversize overmass vehicles.

When it is identified that TTM arrangements may affect any of the above groups, paths and routes must be maintained in an acceptable and hazard-free condition at all times. Restriction or closure of routes, accesses or desire lines must be determined via appropriate consultation and approval.

### 4.4.2 Pedestrians

It is essential to understand the type, need and access required for pedestrians affected by the works. Pedestrians include high risk pedestrians which are at greater risk to hazard such as persons with a disability, the elderly and children.

Information that should be obtained includes:

- Existing pedestrian paths within and adjacent to the project boundaries, e.g. desire lines, key routes, attractors, destinations or linked trips;
- Pedestrian accident history;
- Surrounding land use, including access needs to businesses, schools, pubs or community facilities;
- Expected numbers and types of pedestrians; and
- Pedestrian accessibility requirements e.g. shopping trolleys, prams, motorised or non-motorised wheelchairs or walking frames.

The TMP must ensure pedestrian needs are addressed, including:

- Specific requirements for high risk pedestrians e.g. persons with a disability (particularly with vision or hearing impairment), children or elderly; and
- Provision of additional signage, guidance (e.g. pedestrian fencing) and protection (e.g. crash barriers and crash cushions) in high risk locations.

Additionally, the TMP must determine the need for a road safety audit.

Generally, pedestrians will take the most direct route possible. At work sites where it has been necessary to introduce temporary arrangements for pedestrians, movement patterns of pedestrians must be observed, especially during the first week, and necessary changes made to ensure that pedestrians are able to move safely. 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 TMP.

Key considerations when planning for pedestrians are provided in [Table 4-4](#).

Table 4-4. Planning considerations for pedestrians

Consideration	Requirement
Defining the work area	<p>The work area must be clearly defined by using an appropriate fencing. Where pedestrians have been diverted onto an existing roadway, the pedestrian path must be separated from vehicular traffic by a mesh fence as a minimum, provided that there is sufficient width for the anticipated pedestrian volumes, storage and flow directions.</p> <p>Where these conditions cannot be met, a safety barrier or an alternative pedestrian path must be provided or the work site redesigned to pass a road safety audit based on pedestrian access.</p> <p>Pedestrians must be separated from any trenches or the trenches covered with appropriate plates until backfilled.</p>
Reversed traffic direction	<p>Special safety requirements may be needed where traffic is required to travel temporarily in the wrong direction, at a detour, crossover or other location. In particular:</p> <ul style="list-style-type: none"> <li>• Containment fences may be required to control the crossing point;</li> <li>• Personnel may need to be positioned to guide and assist the pedestrians; or</li> <li>• LOOK BOTH WAYS, TWO-WAY TRAFFIC (T8-5) signs may be required, especially where one carriageway of a divided road is closed. The signs must be placed on both sides of the open carriageway facing pedestrians.</li> </ul>
Footpaths	<p>Temporary footpaths must provide a clear path of travel and must be:</p> <ul style="list-style-type: none"> <li>• Adequately signposted to indicate the direction of the footway;</li> <li>• Of all weather standard including ramps over gutters that can have water velocities above 1 m/s;</li> <li>• Of equivalent material and performance to the adjacent footpaths and not pose a trip hazard for the range of pedestrians; and</li> <li>• At local constrictions, not less than 1 m width. Elsewhere a width of at least 2 m must be provided and any additional width to aid stopping sight distance to all road users.</li> </ul> <p>Care should be given to maintain good conditions and widths at points of concentration of pedestrians, such as in front of shops, schools at bus stops, light-rail stops, storage islands, medians and refuges.</p>

Consideration	Requirement
Pedestrian crossings	<p>Care should be given to maintaining pedestrian crossing facilities and associated signs during the works. If access to existing crossings cannot be maintained, alternative facilities as near as possible to the established crossing and (to at least the same standard) must be provided. 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.</p> <p>Pedestrians must be prevented from crossing, where:</p> <ul style="list-style-type: none"> <li>• Medians, refuges or other physical devices separate lanes of traffic flowing in the same direction;</li> <li>• Traffic speeds are higher or the drivers will not be alerted to pedestrians;</li> <li>• There is insufficient safe congregation space; or</li> <li>• Stopping sight distance is not available to all road users.</li> </ul> <p>In these circumstances active control must be implemented, using one of the following:</p> <ul style="list-style-type: none"> <li>• Pedestrian-actuated traffic signals;</li> <li>• Use of portable traffic control device; or</li> <li>• Direct pedestrians through a chicane so that they face the direction of oncoming traffic with the required stopping sight distance before stepping on to the traffic lanes.</li> </ul>
Lighting and security	<p>Where it is necessary to temporarily divert pedestrians, the path must:</p> <ul style="list-style-type: none"> <li>• Have lighting provided for pedestrian crossings; and</li> <li>• Have all security risk areas identified and controls implemented to manage this risk. This may include provision of additional lighting, security cameras or change of design to eliminate high potential locations.</li> </ul>

### 4.4.3 Cyclists

Transport 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 must be identified and determined during development of the TMP. Considerations should generally include:

- Existing volumes of cyclists;
- Existing cyclist facilities;
- Available width and alignments;
- Traffic speeds and volumes;
- Duration of work;
- Surface material and condition;
- Environmental effects; and
- Costs.

The TMP must detail and allow for relocation of any impacted existing cycle facilities. Where facilities previously existed, the provision of a smooth shoulder, with a minimum width of 1.2 m (2 m required if adjacent to traffic lane with speeds above 60 km/h) and regular sweeping of the riding surface is required. Consideration should be given to increasing the width of the cycle path if site based factors such as steep grades or vegetation are present.

Cyclists will take the most direct route possible. At work sites where it has been necessary to introduce temporary arrangements for cyclists, movement patterns of cyclists must be observed, especially during the first week, and necessary changes made to ensure that cyclists are able to move safely. 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 TMP.

*Table 4-5* provides considerations that should be applied when planning for works in relation to cyclists.

Table 4-5. Considerations when planning for works impacting cyclists

Type	Considerations
General principles	<ul style="list-style-type: none"> <li>• On down-grades, cyclists can travel at speeds of up to 50 km/h and surfaces must be able to be ridden on safely at this speed;</li> <li>• Many cycles have no suspension making rough surfaces unpleasant and potentially dangerous to travel on;</li> <li>• Provision should be made to ‘feather’ the edges of temporary surfaces to remove any hazardous edges;</li> <li>• Roadworks signs should be placed above the head height of cyclists; and</li> <li>• Signs and devices should be placed so that they do not force cyclists away from safe travel paths.</li> </ul>
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.
Lighting of work sites	<p>Where works affecting cycle ways are carried out for a period exceeding one day, the works must be made sufficiently visible for night time travel. That is, cyclists must be able to observe site conditions under low ambient light, including temporary access paths, and take appropriate action.</p> <p>In addition, as a general principle, lighting on temporary access paths should not be less than the existing level on the original path.</p>

#### 4.4.4 Motorcyclists

Motorcycles (and mopeds) travelling through work sites require additional consideration, particularly in terms of the road surface provided. When designing a TMP, it should be considered that motorcycles do not handle in the same way as cars, they are less stable than other vehicles on loose and slippery surfaces and are unable to brake heavily on curves.

Signage for the site must adequately identify road surfaces that are different to that on the approach. Particular hazards to motorcyclists include unsealed surfaces, some painted road markings when wet, unexpected sections of wet roads and loose gravel, especially in areas where braking and turning is required.

*Table 4-6* provides considerations that should be applied when planning for works in relation to motorcyclists.

Table 4-6. Considerations when planning for works impacting motorcyclists

Consideration	Requirement
Road surfaces	<p>Surface changes can be critical to motorcycle stability and so, surface changes must be signposted well in advance so that a motorcyclist is not forced to take rapid or unexpected evasive action. This may include:</p> <ul style="list-style-type: none"> <li>• Use of the GRAVEL ROAD (T3-13) sign where sections of sealed roads are temporarily reduced to gravel;</li> <li>• Use of the Slippery symbolic (T3-3) sign to indicate a wet surface; or</li> <li>• Use of appropriate signage, such as Temporary Portable Rumble Strip Ahead Symbolic (T5-210n) sign or Boom Barrier AHEAD (T1-272n) <b>sign</b> to warn of specific changes.</li> </ul>
Grooved roads	<p>Milling of roads prior to resurfacing can present a hazard to motorcyclists. Where road surfaces are grooved, CYCLE HAZARD GROOVED ROAD (T2-207n) signs must 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.</p>
Other hazards	<ul style="list-style-type: none"> <li>• Materials, installation and maintenance of steel plates used to cover excavations must comply with Transport QA Specification M209, Road Openings and Restoration.</li> <li>• Water which drains from roadworks, should not run across traffic lanes to a depth greater than 5 mm.</li> </ul>

#### 4.4.5 Heavy vehicles

Transport is committed to providing safe and efficient access for heavy vehicle operation in delivering freight.

OSOM loads may travel on the road network under Notice with a gross mass up to 115 tonne and dimensions up to 5 m wide, 5 m high and 30 m long. OSOM vehicles may have a trailer axle ground contact width up to 4.6 m. Transport has no visibility of when, where or the frequency of vehicles operating under notice, so work sites must cater for these dimensions as a minimum if work is carried out on an identified heavy vehicle route (see [NSW OSOM Load Carrying Vehicles Network Map](#)). Vehicles that exceed any of the above mass or dimension limits are required to obtain a permit via the National Heavy Vehicle Regulator.

When developing a TMP, the considerations provided in [Table 4-7](#) for heavy vehicles such as OSOM and Restricted Access Vehicles (RAV) accessing the network under notice or permit, must be identified and detailed in the TMP.

Table 4-7. Heavy vehicle TMP provisions

Consideration	Detail
Number and type of vehicles	Number and percentage of different types of heavy vehicles, time of day access requirements.
Vehicle clearances	<ul style="list-style-type: none"> <li>• Length, mass, height and width of vehicles expected to pass through the site;</li> <li>• Minimum ground contact height required for vehicles; and</li> <li>• Turning path and sight distance requirements.</li> </ul>

Consideration	Detail
Access through site	<ul style="list-style-type: none"> <li>• Identification of alternate routes around work site nominated if vehicle cannot be accommodated through the site;</li> <li>• Works designed so that the installation of temporary barriers, contra flow arrangements and falsework structures do not significantly affect the movement of heavy vehicles; and</li> <li>• Location and placement for emergency stopping/pull over bays within long work sites that will accommodate long vehicles.</li> </ul>
For higher volumes of OSOM vehicles	<ul style="list-style-type: none"> <li>• Ensure Livetraffic.com.au is updated to show the works and any relevant information relating to OSOM access;</li> <li>• Provide a site contact name and contact details to the Transport Road Access Management unit to assist OSOM operators in negotiating the work site;</li> <li>• Where high volumes of heavy vehicles are expected, additional safety measures such as traffic control and VMS boards should be provided to give advanced warning to OSOM loads of the upcoming works; and</li> <li>• Provision of OSOM pullover areas prior to the works.</li> </ul>

Heavy vehicles between 3.5 m to 6 m wide are accompanied by at least one escort vehicle. Escort vehicles function as a warning to other road users of an approaching oversize load. Loads in excess of 6 m wide and/or 40 m long are accompanied by NSW Police escorts.

Escort drivers must not conduct traffic management functions (aside from leading or following their OSOM vehicle) while travelling through a work site that is under independent traffic management and control. As such escort vehicle drivers must not assist in managing other road users to facilitate access of an OSOM load through a work site. This requirement does not apply to Police when acting as an escort.

Pilot vehicles which are operating in accordance with the TMP for the particular work site are permitted to manage other road users to facilitate access of an OSOM load through the particular work site.

When developing a TMP, the project location should be identified on the [Restricted Vehicle Access Maps and Lists](#) to determine if the project will be within any approved routes and network restrictions for use by heavy vehicles. The interactive RAV maps provide details on the roads and zones approved for the following heavy vehicle combinations when selecting the corresponding option, including:

- 4.6 m high vehicle routes;
- B-doubles routes; and
- Road Train Routes.

The published maps are the legally enforceable network in NSW. Freight Branch (email [roadfreight@rms.nsw.gov.au](mailto:roadfreight@rms.nsw.gov.au)) can provide support and advice regarding types of vehicles under Notice or permits to access the network.

Where a work site impacts on the dimensions of the existing road environment, by reducing lane width or introducing temporary safety barriers, Live Traffic must be used to notify road users, including heavy vehicle operators, of the work sites. As a minimum the information on Live Traffic should include details of any OSOM restrictions and a site contact and all information provided should be clear, concise and relevant.

For assistance of advice regarding OSOM routes, site provisions or to assist in sending communications about works to the heavy vehicle industry, the Transport OSOM Access Manager can be contacted on 1300 656 371.

## 4.5 Speed zones

### 4.5.1 General

Roadwork speed zones are used to assist in managing the risk to road workers or road users in case of a hazard on or surrounding the road. This may include, but is not limited to the following:

- Where traffic travels past or through a work site or where workers are undertaking activities in or adjacent to the road way;
- During an accident or an emergency;
- During situations of reduced visibility;
- Where loose material or stones are on the road surface, e.g. during spray sealing works;
- Where there is a reduction in quality of the road surface condition, including where vertical or horizontal alignment is inconsistent with the adjacent length of road;
- When traffic is diverted onto an opposing carriageway, detour or side-track;
- When controlling traffic in accordance with Section 5.4 Traffic control;
- Where road users are required to travel adjacent to excavations; and
- On bridges, for reasons of structural safety need a reduction in the impact loading caused by traffic.

### 4.5.2 Selection

When determining the need for a roadwork speed zone, the PWZTMP qualified person must ensure the selected speed zone is:

- Credible;
- Placed in accordance with the requirements of this Section;
- Placed to maximise the effectiveness of the road environment, i.e. topography and geometry;
- Not used alone, but used with other signs or devices as dictated by and in response to the site-specific conditions;
- Within the minimum length needed for the protection of workers and the travelling public;
- Not used in the place of more effective means of traffic control, but to complement such controls; and
- Only used for the duration of the need, and not used while work is not being undertaken or when road conditions have resumed to their normal operation.

The following factors should be considered when selecting the roadwork speed limit:

- Number and degree of vehicular and pedestrian and other vulnerable road user conflicts;
- Type and extent of the work in progress;
- Characteristics of the road;
- Proximity of workers to passing traffic; and
- Number and type of work vehicles entering or leaving the road.

Roadwork speed zones must be selected in accordance with the conditions provided below, and can be supported by using appropriate signs and devices according to the criteria provided in Table 4-8.

Table 4-8. Selection criteria of roadwork speed zones

Speed zone	Selection Criteria
80 km/h	<p>The speed limit must be reduced to 80 km/h where:</p> <ul style="list-style-type: none"> <li>Workers on foot, or operating plant, are between 3 m and 6 m of a traffic lane with no intervening physical barrier;</li> <li>There are changed traffic conditions on the site such as, reduction in the number or width of lanes and varying surfaces; or</li> <li>A transition zone is required in 110 km/h zones where a 60 km/h or a 40 km/h roadwork speed zone is used and the use of a Speed Limit AHEAD (G9-79) sign is considered inadequate.</li> </ul>
70 km/h	<p>The speed limit may be reduced to 70 km/h where:</p> <ul style="list-style-type: none"> <li>A Variable Speed Limit Signage is in place;</li> <li>Integrated Speed Limit and Lane Use Signs (ISLUS) are in place; or</li> <li>VMS are used to display regulatory speed zone signage.</li> </ul>
60 km/h	<p>The speed limit must be reduced to 60 km/h where:</p> <ul style="list-style-type: none"> <li>Workers on foot, or operating plant, are between 1.5 m and 3 m of traffic with no intervening physical barrier;</li> <li>Traffic control is used;</li> <li>There is frequent interaction between work vehicles and through traffic;</li> <li>There is a reduced standard of alignment due to the works; or</li> <li>There is a loose surface such as gravel or a newly sprayed bitumen seal.</li> </ul>
40 km/h	<p>The speed limit must be reduced to 40 km/h where:</p> <ul style="list-style-type: none"> <li>Workers on foot, or operating plant, are closer than 1.5 m to traffic with no intervening physical barrier;</li> <li>There is a severe change in the alignment considering the surrounding speed environment; or</li> <li>A bridge deck has an inconsistent surface or there might be structural damage to the bridge by vehicles travelling at higher speeds.</li> </ul>
30 km/h	<p>Traffic should be reduced to 30 km/h where:</p> <ul style="list-style-type: none"> <li>Workers on foot, or operating plant, are closer than 1.5 m to traffic with no intervening physical barrier;</li> <li>The existing posted speed limit of a road is 45 km/h or less; or</li> <li>It has been identified by divisional procedures.</li> </ul>

### 4.5.3 Criteria for use

Priority must be given to providing safe clearances between workers and traffic through the use of other controls, rather than installing a speed limit of less than 45 km/h.

A 40 km/h roadwork speed zone should not be left in place for extended periods of aftercare, such as over a weekend. The extended use of 40 km/h roadwork zones when the work site is clear of active workers diminishes the credibility of work sites, leading to increased rates of non-compliance.

A 40km/h speed zone may be implemented at an unattended work site for more than 24 hours, provided the one-up manager to the PWZTMP qualified person or Project Manager has reviewed and approved the plan to do so. This approval must be specifically documented in the relevant TMP and TGS. Otherwise, a 40 km/h must not remain in place when the work site is not active or unattended.

A 30 km/h temporary speed zone is an additional measure to protect workers on foot in close proximity to live traffic only, and must not be used as a justification to reduce any other TTM requirement that is stipulated in this Technical Manual. As such, all temporary traffic management must be designed to comply with a temporary speed limit of 40 km/h or above.

The following conditions must be met prior to approval and implementation of a 30 km/h speed zone:

- The length of zone must not be less than 100 m or exceed 200 m;
- The speed zone must only be implemented while workers on foot or plant are active within 1.5 m and clearly visible to road users; and
- A higher temporary speed must be reinstated during any period of inactivity, such as during lunch or other breaks.

A 30km/h speed zone must not be left in place for any period of aftercare.

It is critical for these requirements to be met, to maintain the credibility of work sites and to support the efficacy of this additional measure for protecting workers on foot. It is recognised that the slower the speed limit, the less compliant road users often become unless an immediate risk is obvious. See [Section 4.7 Credibility of work sites](#).

#### 4.5.4 Duration

Signs showing roadwork speed limits (such as R4-212n) must only be displayed when the speed zone authorisation (SZA) applies and for the duration of the need. The duration of need is typically:

- While active works are underway and the site is attended; or
- While warranted by changed road conditions.

Outside of restriction and need, roadwork speed limit signs must be removed or covered appropriately.

#### 4.5.5 Implementation

When implementing a temporary speed zones the conditions in [Table 4-9](#) must be met:

Table 4-9. Speed zone implementation conditions

Aspect	Condition
At the start of zones	Roadwork Speed Limit (R4-212n) signs are to be erected on both sides of the carriageway. Where this is not possible a second sign is to be erected 0.5D from the start of the zone.
Repeater signs	Repeater signs (R4-212n) must be erected 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 a distance no greater than D from the work site, a Speed Limit (R4-1) sign must be installed showing the pre-existing speed limit prior to or adjacent to the End Roadwork (T2-16 or T2-17) sign.
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, must be covered or removed.

Aspect	Condition
Sign size	Roadwork Speed Limit (such as R4-212n) signs used on all roads where the existing limit is 60 km/h or more are to be at least 'B' size.
Erection of signs	Roadwork speed restriction signs must be erected: <ul style="list-style-type: none"> <li>• Within 5 m of the edge of the outer travel lane; and</li> <li>• Be clearly visible to traffic.</li> </ul>

Roadwork speed zones less than 65 km/h must be located such that the zone commences no closer than 100 m before the start of the work at:

- The start of the taper area;
- The traffic diversion; or
- The traffic control position (see *Figure 4-2*).

Where 100 m cannot be achieved, a roadwork Speed Limit AHEAD (G9-79) sign must be installed to advise road users of speed reduction and allow sufficient time for speed to be reduced before the reduced speed limit.

Speed zones of less than 45 km/h must be restricted to an area or areas immediately adjacent to road workers. The roadwork speed zone must end at least 50 m past the site where people are working and must not extend greater than 500 m (see *Figure 4-3*).

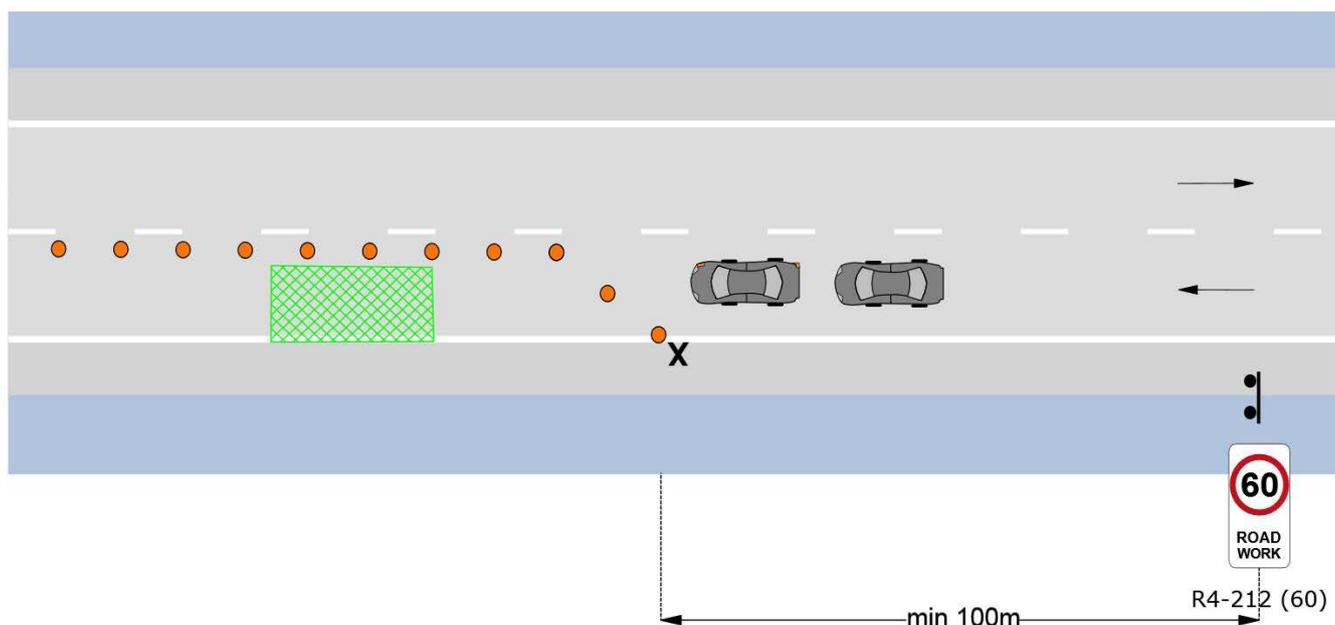


Figure 4-2. Speed zone commencement location

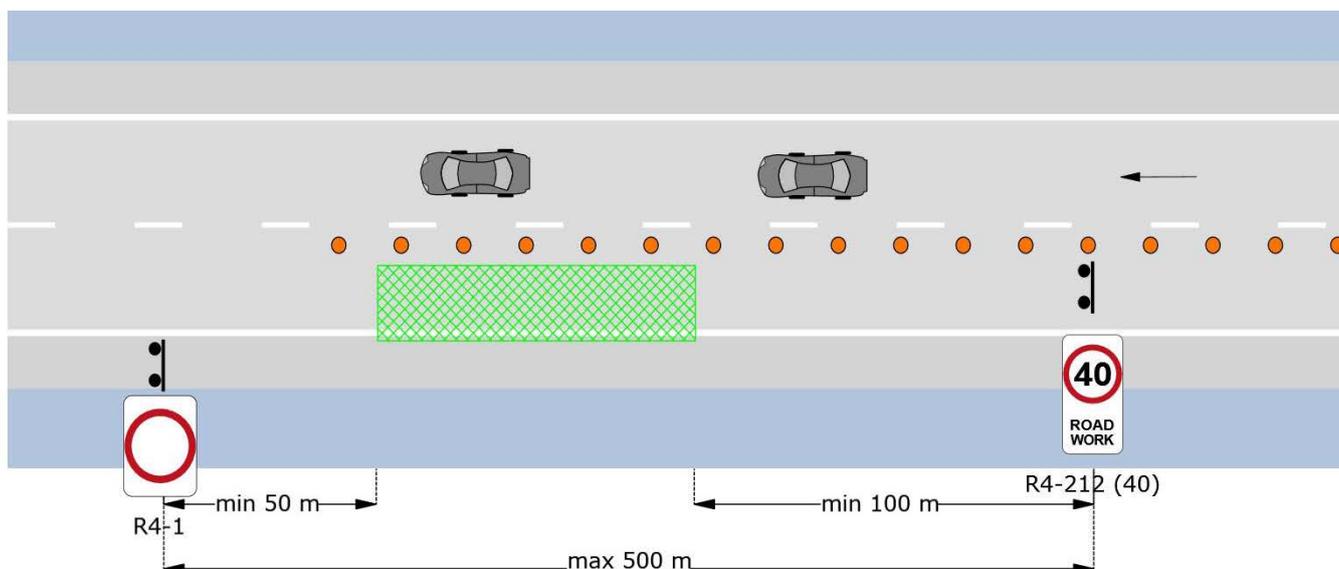


Figure 4-3. Minimum length zones

**Note to Figure 4-3:** In urban areas the location of the roadwork speed zone may be adjusted so that signs can be erected clear of parked vehicles, other signs or obstructions.

Roadworks speed zones may be offset so that there is a different speed restriction for opposing directions of traffic. An offset speed zone may be used:

- To reduce the length of speed restriction leaving the work site;
- Where a speed zone is extended in one direction 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 changed traffic condition, but is not needed for traffic flow in the opposite direction; or
- Where work is underway on the shoulder which does not affect traffic in the opposing traffic lane.

#### 4.5.6 Minimum length zones

Temporary speed zones at work sites are significantly more effective if they appear reasonable to drivers (see also Section 4.7 Credibility of work sites). The lengths of roadworks speed zones must be in accordance with Table 4-10.

Table 4-10. Length of roadworks speed zones

Roadwork Speed Zone	Minimum length	Maximum length
less than 35 km/h	150 m	200 m
40 km/h	150 m	500 m
60 km/h	150 m	Not specified*
70 km/h	200 m	Not specified*
80 km/h	500 m	Not specified*
80 km/h transition zones	300 m	Not specified*

**Note\* to Table 4-10:** For traffic safety, there is no maximum length specified however for longer lengths, additional controls to manage traffic speed should be considered, for example use of pilot vehicles.

It must be noted that increasing the length of reduced temporary speed zone without reason may cause adverse road user behaviours, as drivers may return to the normal speed limit if they see no reason to slow down.

#### 4.5.7 Strategies for achieving speed zone compliance

In addition to a reduced speed limit, the following devices or techniques should be considered to assist with driver speed compliance:

- PTCs;
- Pilot vehicles;
- Additional or oversized signs;
- Duplication of signs;
- Variable message signs;
- Electronic speed display signs (such as a variable speed limit sign (VSLS) or radar assisted speed sign (RASS));
- Narrowing of lanes using bollards or cones;
- Chicanes;
- Temporary portable rumble strips (TPRS);
- Flashing lights on signs;
- Thermoplastic tape or similar laid either longitudinally in zig zags or transversely to act as gentle 'speed humps'; or
- VMS advance warning vehicle.

#### 4.5.8 Approval of roadwork speed zones

Authorisation must be provided by an appropriately delegated officer under item 1.30 of the Transport Delegations, Part C2 Road Network and Operations Delegations, before a speed limit sign is installed, displayed, altered or removed on any State road.

For work undertaken on State roads, councils and private contractors must seek the authorisation of Transport to erect roadwork speed limit (R4-212n) signs.

For work undertaken on regional roads, before a speed limit sign is installed, displayed, altered or removed, authorisation must be carried out in accordance with Item 13 of Transport's Delegation to Councils – Regulation of Traffic (dated 31 October 2011), which states the following

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

- *Authorisation of the use of the 'Roadwork Speed Limit' (R4-212n) sign must be carried out by council or a sub-delegate holding a current Prepare Work Zone Traffic Management Plan accreditation issued by the Authority*
- *The nearest Transport office 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’ (R4-212n) sign is to be for more than six working days:*

- *Authorisation of the use of the ‘Roadwork Speed Limit’ (R4-212n) sign must be carried out by council or a sub-delegate holding a current Prepare Work Zone Traffic Management Plan accreditation issued by the Authority*
- *The nearest Transport office 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.*

## **4.5.9 Speed enforcement at roadwork sites**

### **4.5.9.1 General**

Compliance with roadwork speed limits is critical to effectively managing the safety of road workers and road users at roadwork sites. Police speed enforcement is a method that may be used to improve compliance.

Early communications and planning with police is crucial to providing an environment conducive to safe and effective police speed enforcement operations. As such, provision of suitable areas for police operations should be considered during the development and construction phases of projects and when planning maintenance activities.

During the development, delivery and maintenance stages of a project, the project team must consider the use of police speed enforcement as part of their risk management approach.

The planning of police speed enforcement is typically split in to three phases:

- *Phase 1—early site investigation;*
- *Phase 2—planning for police speed enforcement; and*
- *Phase 3—operational engagement of police.*

### **4.5.9.2 Phase 1: Early site investigation**

The risks presented by speeding drivers to the safety of road workers and road users on the roadwork site must be assessed for all roadwork projects during TMP development.

The traffic speed and crash history data obtained as part of the development of the TTM strategy and plan must be reviewed to determine if there are any existing speed related issues within the project area. This data forms a basis for early police engagement and highlight high risk areas to be dealt through appropriate TTM planning.

Potential projects requiring police involvement include:

- Long-term work located on high volume and/or high speed traffic routes;
- High-risk short-term work such as:
  - Where traffic barriers cannot be used to separate workers from adjacent traffic and work site safety depends on a lateral separation distance and reduced traffic speed; or
  - Where there is limited sight distance, complex traffic arrangements, or other factors requiring a high level of speed compliance.

When it has been identified that there is the potential for non-compliance with roadworks speed zones, which presents an unacceptable risk to the safety of road workers and road users, the project representative must begin planning for police speed enforcement.

### **4.5.9.3 Phase 2: Planning for police speed enforcement**

The objectives of Phase 2 are to:

- Raise awareness of the project and the potential need for police assistance;
- Ensure the work site can accommodate police enforcement operations in a safe and effective manner; and
- Ensure that the work site speed zones are lawful and enforceable.

This phase should normally occur during the development stage of a project and involves initial engagement with police, review ongoing data collection to monitor speed compliance and the identification of the work site requirements to support police enforcement.

#### **Initial police engagement**

The project representative must engage the police to alert them of the safety risk of road workers and road users as identified in the early site investigation. The appropriate contact details to be used for police engagement should be determined by contacting the Manager, Regional Operations (in the respective region).

Police are most likely to provide speed enforcement operations if they are confident it will be effective, the speed zone is appropriately sign posted and lawfully enforceable and the operation can be carried out within a safe operating environment that complies with their standard operating procedures.

Engaging the police early in the project is important as it creates an opportunity to:

- Describe the project and any existing conditions that affect speed compliance and safety;
- Identify and plan the work site to accommodate police speed enforcement;
- Identify data collection parameters to support a request for police involvement;
- Identify site conditions that can impact on their operations; and
- Alert them to the potential need for police speed enforcement.

Police may not commit to speed enforcement at this stage; however, this consultation can be used to obtain an in-principle agreement with the police for speed enforcement during the project delivery when the need arises, provided the work site can provide sufficient supporting data.

The type and quantity of supporting data to be collected should be confirmed with police during the initial engagement process.

#### **Work site requirements**

To enable police to undertake speed enforcement on roadwork sites, project teams must ensure that:

- Roadwork speed zones are implemented in accordance with this document;
- Speed Zone Authorisation (SZA) has been issued for the speed zone in operation and the documentation is available to police;
- Location reference points of start and end of roadwork speed zones are documented; and
- Roadwork speed zones are long enough for practical enforcement.

The following considerations must be implemented in each stage of the traffic management plan in order to create an environment for safe and effective police speed enforcement:

- Appropriately sized areas for positioning police vehicles, for example, wide shoulders or breakdown bays or pull-over bays for OSOM vehicles;
- Appropriately located areas for positioning police vehicles with unobscured line of sight to approaching traffic which allow safe departure and acceleration when conducting mobile intercept operations;
- Ability for police to pull over offending vehicles with sufficient length to accommodate the longest vehicle type (access under notice) that police may pull over. This may include provision of:
  - Sufficient shoulder width; or
  - Regular (every 500 m) breakdown bays.
- Suitable shoulder and breakdown bay surfaces.

These considerations along with any other work site requirements should be confirmed with police during the initial engagement process.

#### **4.5.9.4 Phase 3: Operational engagement of police**

##### **Police engagement for speed enforcement**

The appropriate contact details to be used for police engagement should be determined by contacting the Manager, Regional Operations (in the respective region).

At the site meeting between the project representative and police, the project representative must:

- Provide an overview of the project;
- Provide a copy of the SZA for the speed zone;
- Provide details of speed zone locations, dates and start and end times of speed zones;
- Provide evidence of speed non-compliance and any other supporting data requested during the initial engagement;
- Request confirmation of the type and quantity of data to be collected to support enforcement activities;
- Demonstrate that any work site requirements for police speed enforcement have been met;
- Provide information about activities that can impact on police operations, for example, construction vehicle movements; and
- Maintain a record of the meeting.

The project representative must then request for speed enforcement operations to be undertaken within the work site on an agreed schedule. In certain situations a ‘user pay’ arrangement in accordance with NSW Police Force user pay policing services guidelines may need to be agreed upon.

As police speed enforcement operations are not always available for the entire time road workers are on-site, police enforcement then becomes an additional control to complement existing control measures determined through risk assessment and the application of the hierarchy of controls framework.

## Ongoing data collection

Police speed enforcement data must be continuously collected throughout the duration of the project to monitor the effectiveness of the traffic management plan and the police speed enforcement when in place. This data allows police to focus their enforcement operation around the particular times of day/s of the week when the risk to road workers and road users is most significant.

This data may be used to monitor speed compliance and can be used as evidence when deciding if ongoing police speed enforcement will be requested in future discussions with police.

## Ongoing communications with police

Regular communication (such as a recurring meeting) between project representatives and police must be scheduled throughout the delivery and/or maintenance stage of the project to keep police informed. The meetings must:

- Discuss site conditions that impact police operations;
- Provide a project schedule of works to police informing them of planned changes to the road configuration that affect their speed enforcement operations;
- Discuss user pay arrangements where applicable;
- Discuss the outcomes from the previous police speed enforcement operations;
- Discuss the data that has been collected and determine if police speed enforcement is still warranted; and
- Agree on a future police speed enforcement schedule.

## Responsibilities

While Transport project representatives work with police to design site conditions conducive to police speed enforcement/presence, police are responsible for their own management of risks associated with their activities. The method of police speed enforcement is to be determined by the police.

### 4.5.10 Records and inspections

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

- Written authorisation of the installation from Transport, or council or its sub-delegate. The sub-delegate's Prepare a Work Zone Traffic Management Plan certificate number must be shown;
- Reference points or location of the roadwork speed zone;
- The installation time and date;
- The speed displayed;
- Location of repeater signs;
- Location of advanced warning signs; and
- The removal time and date.

This information must be kept for at least seven years as it can be required as evidence for litigation purposes including speeding prosecutions or accident compensation claims.

Application and completion for roadwork speed limit authorisation and occupancy licences must be lodged via Transport's [Road Occupancy Licence website](#).

For long term projects, copies of the approved forms can be forwarded to the police station nearest to the appropriate sections of road by the project manager and a record of this should be kept on site.

Roadwork speed zones must be regularly inspected as part of daily inspections carried out by an Implement Traffic Control Plans or Prepare Work Zone TMP qualified person who was not involved in the physical implementation of the signage. These inspections should be carried out before work starts, during the works and pre-closedown of the site and completed in accordance with Section 8.1 Work site inspections, reviews and audits.

In accordance with Section 8.2 Record keeping of TTM documentation, roadwork speed zones must be inspected and associated documentation examined on a regular basis. The ITCP qualified person must 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 be given to keeping photographic records of signs and their locations. Any issues or breaches should be recorded in daily diaries.

## 4.6 End-of-queue management

### 4.6.1 General

End-of-queue management strategies must be provided when:

- Traffic is planned to be stopped;
- Queues are expected to be generated; or
- The TMP or risk assessment identifies there is a potential for end-of-queue collisions.

Wherever traffic is required to slow significantly or stop, particularly at active traffic control positions, 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.

The risk of end-of-queue collisions is increased:

- Where sight distance to the end of the queue for approaching traffic is likely to be less than 2D (open road areas) or 1.5D (built-up areas);
- Where queues are unexpected, for instance on rural highways, and can be due to the lack of attention 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;
- On high speed roads such as motorways, particularly when lane closures are introduced; and
- At night or in adverse weather conditions.

### 4.6.2 Assessment of expected queue length

Anticipated queue lengths must be estimated and documented prior to stopping traffic. Factors that influence queue lengths include:

- Expected hourly traffic volumes at the time of the work;
- Expected delays at each phase of the work;
- Number of traffic lanes closed or affected;
- Traffic composition, such as percentage of heavy vehicles;

- Predicted distances or gaps between stopped vehicles—drivers in rural areas tend to leave greater gaps than those in urban environments;
- Known special events;
- Terrain at the site; and
- Road alignment (horizontal and vertical).

Traffic queues must be monitored at all times to ensure that queue lengths do not extend back beyond the limits of the advance warning signs.

At work sites where longer than normal delays can be expected, such as the laying of bridge beams, additional planning may be required which is beyond the scope of this Technical Manual. When required, this additional planning must be included in the preparation of the TMP and site-specific or activity-specific risk assessment to identify the risks associated with such long delays, and be completed in consultation with relevant divisions of Transport, emergency services and other relevant stakeholders.

### 4.6.3 Procedure for reducing end-of-queue collisions

As required by Section 5.4 Traffic control, when traffic is being controlled, a PREPARE TO STOP (T1-18) sign must be installed and the traffic controller operating the PTDC or STOP/SLOW bat or an observer with the ability to communicate to the traffic controller, must be able to maintain visibility to the end of the queue.

Additional advance warning or other mitigation measures should be implemented, depending on the speed of traffic and sight distance to the end of the queue, to alert road users of the changed road conditions and to avoid end-of-queue collisions. Where applicable, this may include extending the length of a sign posted roadwork speed zone, where the queue length extends beyond the originally established zone, and provided the zone is self-regulating.

The use of such devices and techniques must be documented in the TMP or risk assessment and included on the approved TGS.

Where significant queues are expected to form, active monitoring of the queue must be undertaken as the primary control. In addition, at least one the following end-of-queue protection strategies must be used:

- Where the maximum queue length can be predicted in advance, the primary PREPARE TO STOP sign must be located such that the distance from this sign to the end of the queue is never likely to be less than  $D$ , see Figure 4-4. 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 be 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 must be maintained.

- Under the immediate direction of an ITCP qualified person, a traffic controller may be employed to move the PREPARE TO STOP (T1-18) sign and the ROADWORK AHEAD (T1-1) sign as necessary to maintain their minimum required distance in advance of the end-of-queue.
- A portable traffic signal (flashing amber) may also be added, at each location of the PREPARE TO STOP sign to alert road users of the approaching work site.

Provided the conditions of Section 5.4.2 Traffic control types are met and a 60 km/h temporary speed zone is implemented, a traffic controller displaying the SLOW sign at each location of the PREPARE TO STOP sign, may be substituted for a portable traffic signal.

All other advance and position signs required for the work must be located at the distances shown in *Figure 4-4* from the start of the work area.

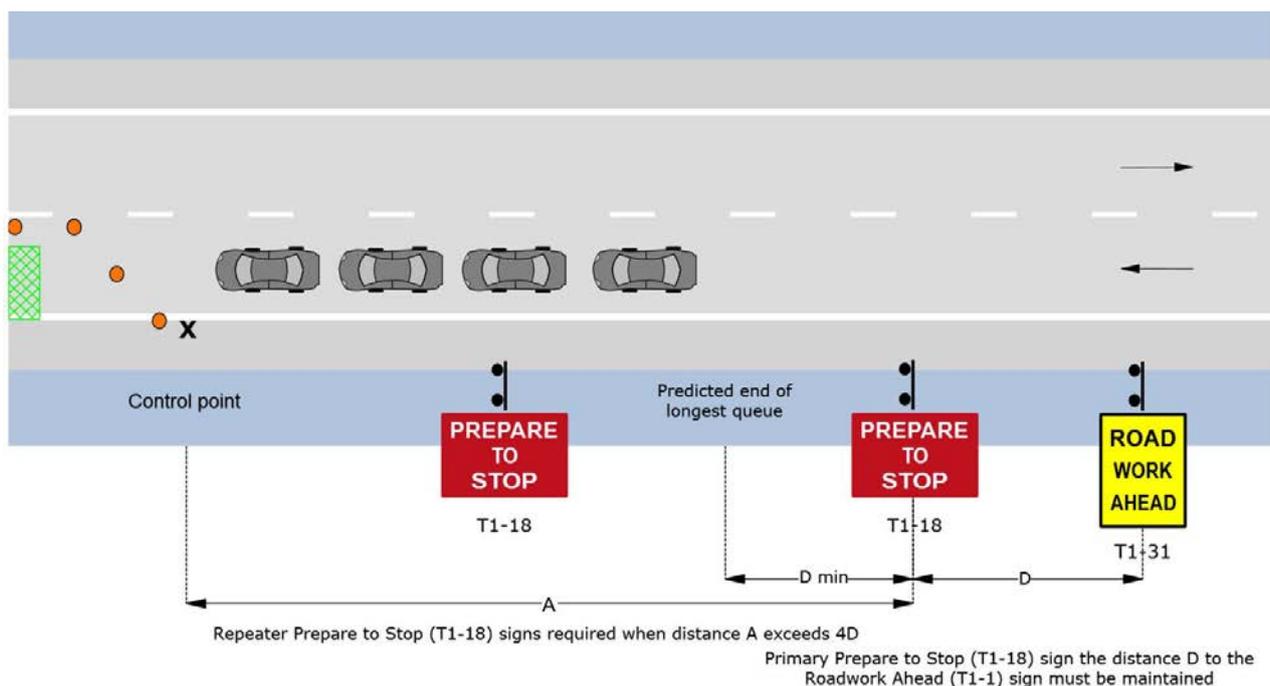


Figure 4-4. Avoiding end-of-queue collisions example

## 4.7 Credibility of work sites

### 4.7.1 General

Research has shown that drivers do not perceive roadwork zones as hazardous unless they can see active workers or machinery. In a survey undertaken by the Centre for Accident Research and Road Safety, Queensland, road users stated that the credibility of work zones is undermined by the lack of activity drivers see, particularly when a speed reduction is in place, or having to slow for a speed reduction that is perceived to be unrealistic. It was reported that not only does this lead to speeding, but it can also lead to driver frustration and other unsafe behaviour, such as tailgating, which generates risk for the road workers and road users.

It has also been demonstrated that drivers become complacent to roadwork signage when it is misused, left out or not appropriate for the works. This includes irrelevant roadwork signage left out during aftercare or the use of PREPARE TO STOP (T1-18) or traffic controller symbolic (T1-34) sign while the traffic control is not present. Not only does this affect the credibility of the work site, it can lessen the efficacy of the signs when next encountered by the drivers.

### 4.7.2 Enhancing work site credibility

The study reported that controls most likely to affect driving speed through a work zone were visibility of police, presence of workers on the road and protection of workers by barriers. To ensure credibility of Transport roadwork sites, it is important to consider the following in the TTM planning phase:

- Only reduce speed limits where required to ensure worker or road user safety;
- Reinstate speed limits when work is not occurring;
- Minimise delays to road users;

- Ensure temporary signage and road marking are clear and do not cause confusion;
- Remove or cover temporary signs that are not relevant;
- Provide ongoing road user information and education programs; and
- Engage with police to develop an enforcement strategy through the site.

### **4.7.3 Improving public awareness**

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

- Transport for NSW website;
- Approved social media;
- Community consultation sessions;
- Conducting campaigns with the police to reinforce responsible behaviour on the roads especially at work sites;
- Additional VMS / static signs near work sites;
- Presenting road safety visuals and posters in public Transport offices, particularly Service NSW centres;
- Advertising the times and duration of planned works on various mediums e.g. such as radio or newspaper;
- Explaining detour options;
- Signs that thank drivers for their cooperation; and
- Communication about the road user or community safety benefits of the work being completed and contact details for enquiries or feedback.