## 7 Traffic guidance schemes

### 7.1 General

This Section must be used by those with PWZTMP and ITCP qualifications to develop, select and implement a traffic guidance scheme (TGS). It covers:

- Principles of a TGS, including components of a work site and application of Dimension D;
- Selection, design and implementation of a TGS; and
- Finalisation and record keeping of a TGS.

Prior to the selection or development of a TGS, the person responsible for the works must confirm the type/s of TTM work to be undertaken safely. The two types of work are:

- Static work; and
- Dynamic work.

Often, a combination of work types may be needed. For example, a dynamic work TGS may be used to set up a static work site.

Factors that influence the work type selection include, but are not limited to:

- Duration of works;
- Location of works, e.g. in the traffic lane or shoulder;
- Clearances to traffic;
- Existing posted speed limits;
- Traffic volumes;
- Other nearby or associated works;
- Available sight distance; and
- Workers on foot requirements.

After the TTM work type/s has been established, the controls can be determined and a TGS selected or developed.

As detailed in Section 7.5 Selecting a TGS, a qualified person must determine if a suitable TGS for the TTM work exists in an approved TGS library. If no Generic TGSs can be made Site Suitable, a Site Specific TGS must be designed in accordance with Sections 7.6 Designing a TGS: General principles, 7.7 Designing a TGS: Static work or 7.8 Designing a TGS: Dynamic work.

### 7.2 Types of TGS

A TGS, previously known as a traffic control plan (TCP), is a detailed layout of temporary signs and devices that communicate the TTM arrangement around, past or through a work site or temporary hazard. Table 7-1 provides a description of the different types of TGS used in this document.
### Table 7-1. TGS types and descriptions

<table>
<thead>
<tr>
<th>TGS type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generic</strong></td>
<td>A Generic TGS is a TGS that has not been approved for use on-site and has no specific location information. A Generic TGS is a planning tool and should only exist within a TGS library, see Section 7.12 TGS records held by a work group for their own operating environment and work activities (such as a District Works Depot). A series of generic TGSs may be included in a TGS library. A generic TGS must not be used and implemented unless a copy has been made and the copy has had appropriate details added and verified as Site Suitable or modified to be Site Specific (if required) and approved for use by an appropriately qualified person. See Section 7.5 Selecting a TGS. All Generic TGS must be designed by a PWZTMP qualified person and endorsed prior to being added to the TGS library. When designing a Generic TGS, the principles of this Technical Manual must be followed. The work type layouts provided in Appendix D – Work type layout examples are for information only and are not Generic TGS. They may be used to aid the design of Generic TGSs, but must not be selected and used at a work site without review and amendment.</td>
</tr>
</tbody>
</table>
| **Site Suitable** | A Site Suitable TGS is a copy of a Generic TGS that has been determined suitable for a location and / or works. In order for a TGS to be considered Site Suitable, the following provisions apply:  
- The Generic TGS must have been selected by a PWZTMP or an ITCP qualified person using the defined selection procedure, see Section 7.5 Selecting a TGS;  
- A PWZTMP or ITCP qualified person must confirm the selected Generic TGS is appropriate for use for the road environment and the work activity at that site; and  
- The TGS to be specified does not require modifications beyond the tolerances detailed in Section 7.10.3 Tolerances on positioning of signs and devices.  
When a Site Suitable TGS is selected, a TGS verification of the site must be conducted by a PWZTMP qualified person and mandatory information outlined in Section 7.4 Information required on a TGS must be added prior to the TGS being approved for use, see Section 7.12 TGS records.  
A Site Suitable TGS is only valid for the time period of works specified on the TGS. |
| **Site Specific** | A Site Specific TGS is produced by a PWZTMP qualified person and may be either:  
- A new TGS designed specifically for a project site location on the road and for a particular work activity; or  
- A copy of a Generic TGS that has been modified outside the tolerances of Section 7.4 Information required on a TGS to suit the specific location or work requirements.  
When a Site Specific TGS is designed, a TGS verification of the site must be conducted by a PWZTMP qualified person and mandatory information outlined in Section 7.4 Information required on a TGS must be added prior to the TGS being approved for use, see Section 7.12 TGS records.  
A Site Specific TGS is only valid for the time period of works specified on the TGS. A Site Specific TGS may be added to the TGS library as per Section 7.12 TGS records, if it is determined appropriate for future re-use activities. |
7.3 Dimension D

Dimension D is a measure of distance in metres. It is used to determine taper lengths, the position of signs and devices and for determining sight distances along the road so that road users have sufficient time to absorb the roadwork specific messages, understand the changed traffic conditions and take necessary actions.

Dimension D is calculated by expressing the speed in metres for the zone preceding to where the Dimension D will be applied, this may be either the existing posted speed or a reduced roadwork speed limit.

For example Dimension D in Figure 7-1 below is:

- 110 m for the yellow shaded area;
- 80 m for the blue shaded area; and
- 60 m for the pink shaded area.

The existing posted speed limit may be used to determine Dimension D throughout the work site, provided the PWZTMP qualified person has determined that there is higher risk of poor driver compliance with speed zones and where space allows.

![Figure 7-1. Example calculation of Dimension D](image)

The Dimension D to be used on a work site must be determined by the PWZTMP qualified person and must be specified on the relevant TGS.

Where required by site-specific constraints, the application of Dimension D may be varied through the departures process provided in Section 2.8 Departures from this Technical Manual.

An example showing application of Dimension D in a 60 km/h roadwork zone with a preceding 80 km/h zone is given in Table 7-2.
### Table 7-2. Dimension D calculation based on speed zone

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Dimension D required</th>
<th>Dimension D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension D</td>
<td>Dimension D calculated as 80 m</td>
<td></td>
</tr>
<tr>
<td>For determining sight distance to</td>
<td>Traffic controller must be able to see 1.5 D or greater to the oncoming traffic</td>
<td>80 m x 1.5 1.5D = 120 m</td>
</tr>
<tr>
<td>a PTCD or manual traffic controller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For determining sight distance to end-of-queue</td>
<td>Sight distance to the end-of-queue for approaching traffic must be calculated at</td>
<td>greater than 66 km/h 80 m x 2 2D = 160 m  less than 65 km/h 80 m x 1.5 1.5D = 120 m</td>
</tr>
<tr>
<td></td>
<td>2D for speeds greater than 66 km/h and 1.5D for speed zones of less than 65 km/h</td>
<td></td>
</tr>
<tr>
<td>For determining sign spacing</td>
<td>Distance between signs must be calculated as follows:</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Single sign</strong>: 2D for speeds greater than 66 km/h and 1D for speed zones of less</td>
<td></td>
</tr>
<tr>
<td></td>
<td>65 km/h</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Multiple signs</strong>: 1D for all speed zones</td>
<td></td>
</tr>
<tr>
<td>For determining taper lengths</td>
<td>See <a href="#">Section 7.6.2.2 Tapers</a></td>
<td></td>
</tr>
<tr>
<td>For distance between tapers on multi-lane</td>
<td>A distance of 1.5D should be applied</td>
<td>80 m x 1.5 1.5D = 120 m</td>
</tr>
<tr>
<td>roads</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 7.4 Information required on a TGS

#### 7.4.1 General

All TGS must include the following information:

- Project name and the time period that works will be performed;
- Types and location of permanent signs and traffic signals (where applicable);
- Types, locations and clearance requirements of all:
  - Temporary signs; and
  - Traffic control locations and devices including details of determined safe location and escape routes for traffic controllers, where applicable.
- Predicted end-of-queue lengths;
- Location and names of roads and intersecting roads;
• Location reference markers, in order to assist recreating the layout in case of incident. Location reference markers must be recorded for temporary speed zone locations;

• Notes, as per Section 7.4.2 Notes on a TGS;

• Dimension D applied;

• Frequency of “shift” TTM inspections in accordance with Section 8.1.4 Shift TTM inspections; and

• Sign-off section for the designer and approver including an issue and review date.

Where applicable, the below details should also be included on the TGS:

• Installation and removal order of temporary signs and traffic control devices, (this may also be captured in relevant SWMSs).

• Locations of temporary safety barrier systems including terminals;

• Exclusion zone required for the temporary safety barrier system and details of delineation of zones and maintenance during works;

• Existing footways and cycle ways;

• Location of site access gates;

• Location and access provisions for local properties and/or car parking access;

• Temporary pavement markings and delineation devices required;

• Locations of temporary street lighting;

• Time and date, the designer completed the TGS verification as required by Section 7.9.1 TGS verification;

• Locations of emergency or breakdown lanes; and

• Existing pavement markings including a note of which require covering/removal.

This information must be included on, or attached to the TGS. This may be as information on the front of the TGS, as detail on the rear of the TGS, as an attachment to the TGS or a combination of methods. Appendix C – Example TGS provides an example of a completed TGS with details and notes as per this Section.

7.4.2 Notes on a TGS

Notes must be applied to approved site suitable or site specific TGSs, to detail any specific procedures that need to be communicated to the:

• Implementer—for installing or removing the TGS;

• Person responsible—for inspecting and monitoring the operation of the TGS;

• Traffic controller—for the operation of the TGS; or

• Workers—utilising the TGS.

Notes are created by either the ITCP or PWZTMP qualified person and provide additional information to the TGS or reinforcement of key critical safety messages.

The non-exhaustive list below provides some examples of notes that may be included on TGS:

• “Shadow vehicle or TGS No xxx must be used to set out this TGS (installation/dismantle);”

• “Observer must be utilised when installing this TGS;”
• “Ensure all radios are switched to the appropriate channel and frequency, and are in working order”; “Size X signs must be used”;
• “Signs X must be duplicated”;
• “Contradictory signs must be covered”;
• “Where there is not enough lateral clearance, reduce speed to X km/h”;
• “Access and exit points for site/delivery vehicles must be via X”;
• “Containment fence or tape to be used to delineate exclusion zones”;
• “All personnel, plant and equipment to maintain a minimum of X m from traffic”;
• “A variable message sign (truck or trailer mounted) may replace ‘Roadwork Ahead’ or ‘Roadwork Ahead 1 km sign/s (ensure clear of edge line)”;
• “All signs that are no longer required must be covered or removed when not in use, e.g. between shifts or during meal breaks”.

7.5 Selecting a TGS

7.5.1 General

A Generic TGS that has been developed in accordance with Section 7.6 Designing a TGS: General principles and 7.7 Designing a TGS: Static work, or 7.7.4 Through TTM methods, may be selected by a person who is either ITCP or PWZTMP qualified (see Figure 7-2) to be site suitable. The qualified person must then assess whether the Generic TGS will:

• Be suitable for the road environment and TTM activity and if so, confirm the Generic TGS as a Site Suitable TGS in accordance with Section 7.9 TGS confirmation and approval; and

• Require modifications in excess of the tolerances detailed in Section 7.10.3 Tolerances on positioning of signs and devices.

• If modifications are required, then a PWZTMP qualified person must design a Site Specific TGS.

To appropriately select and assess a generic TGS the PWZTMP or ITCP qualified person must:

• Obtain a copy of the relevant TMP;

• Determine the category of work to be undertaken (short term / long term, static / dynamic);

• Use an approved selection procedure; and

• Identify, assess and mitigate site-specific conditions and risks within the parameters of the selection procedure and the tolerances outlined in Section 7.10.3 Tolerances on positioning of signs and devices.
Figure 7-2. TGS selection flow chart
Notes Figure 7-2:
1. Selection procedure must be developed in accordance with Section 7.5.2 TGS Selection Procedure
2. Tolerances must be in accordance with Section 7.10.3 Tolerances on positioning of signs and devices
3. TGS Verification must be completed in accordance with Section 7.9 TGS confirmation and approval

7.5.2 TGS Selection Procedure

A selection procedure must be prepared and endorsed by a PWZTMP qualified person to accompany a generic TGS Library. The selection procedure must define the factors or inputs to be used to determine whether a generic TGS is suitable or not. When using the generic TGS Library to select a site suitable TGS, the PWZTMP or ITCP qualified person must:

- Reference the TMP under which the TGS will be implemented; and
- Ensure that the generic TGS has been reviewed and approved within the previous 12-month period. See Section 7.11.1 Generic TGS review and Section 7.9 TGS confirmation and approval for review and approval of a TGS.

A selection procedure should consider factors such as the:

- Activity to be undertaken;
- Type of work being planned, i.e. static or dynamic work;
- Type of road i.e. a one-way or two-way road and single versus divided carriageway;
- Number of lanes;
- Road environment, for example rural/urban;
- Posted speed limit and approach speeds of traffic;
- Time of day, for example whether the TGS is suitable for day work, night work or both;
- Traffic volumes; and
- Where the work site is located within the road corridor, for example on shoulder or in lane.

If a TGS does not exist in the generic library that can be selected as Site Suitable, a Site Specific TGS must be designed in accordance with Section 7.6 Designing a TGS: General principles and Section 7.7 Designing a TGS: Static work, or Section 7.7.4 Through TTM methods.

7.5.3 Confirming a Site Suitable TGS

After a Generic TGS has been identified as being suitable for the works using the selection procedure, the PWZTMP or ITCP qualified person must make a copy of the relevant Generic TGS. This copy will become the Site Suitable TGS after the below information has been added to it:

- Distance D;
- Details of modifications within the tolerances outlined in Section 7.10.3 Tolerances on positioning of signs and devices;
- Location information; and
- Signature and date of approval date of the selected TGS.

Once the site suitable TGS has been created, it must be confirmed and approved in accordance with Section 7.9 TGS confirmation and approval before it is implemented in the field.
7.6 Designing a TGS: General principles

7.6.1 General

This Section provides the general principles for designing a TGS.

There are two types of TGS that may be designed by a PWZTMP qualified person. These include:

- Generic TGS; and
- Site Specific TGS.

All TGSs must be designed and approved by a PWZTMP qualified person and prepared in accordance with this manual. Key principles for designing a TGS include:

- Ensure the risks and controls detailed in the TMP are addressed;
- Eliminate risks SFAIRP;
- Provide protection SFAIRP to workers and the work site, including:
  - Separating the work area from the route of vehicles wherever possible; and
  - Prioritising the use of PTCDs rather than a manual traffic controller.
- The needs of all road users is provided for e.g. pedestrians, cyclists, school children etc., including:
  - Avoiding the need to slow and/or stop traffic wherever possible.
  - The use of a pilot vehicle is considered;
- Only accepted signs and devices are used, including condition signs where the road surface at the work area is sufficiently different from the approach roads and may be hazardous to traffic;
- Preparing a separate TGS for each stage of the work; and
- TGSs are drawn to scale to ensure geometric standards are achieved and implemented.

To ensure a TGS is easily understood, all TGSs should be produced electronically with hand drawn TGSs only produced in extenuating circumstances.

7.6.2 Components of the work site

The work site is the length of road, made up of five smaller areas as shown in Figure 7-3 below, which includes the area where the work is being undertaken and any additional length of road used for traffic control including signs, tapers, traffic lights and other devices.
7.6.2.1 Advanced warning

Advanced warning for work sites must be installed to communicate to road users that there are changes to the road conditions ahead. Advanced warning may be required to notify road users of:

- Traffic hazards;
- Speed reductions;
- Workers on foot;
- Stopped traffic; or
- Changes to lane configurations.

Most work sites will require advance warning signage to be included on the TGS with spacing in accordance with Section 6.2.6 Spacing of signs.

Advance warning signs are not required in the following situations:

- Where the work is sufficiently remote from a roadway that no action is required of road users;
- Where the work is undertaken as intermittent work i.e. in gaps in traffic, in either open road or built-up areas or takes less than five minutes;
- 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; or
- On unsealed roads.

7.6.2.2 Tapers

The following types of approach tapers may be used (see Figure 7-4, Figure 7-5 and Figure 7-6):

- **Traffic control taper**—where there is a PTCD or traffic controller prior to a single lane. Cones or bollards must be placed at 4 m spacing in advance of the traffic control position, either along the centre line, edge line or both as dictated by the TGS.
- **Lateral shift taper**—where traffic is required to shift laterally without conflict with another traffic stream.
- **Merge taper**—where one lane of traffic is required to merge into another.
Recommended taper lengths are provided in Table 7-3. Taper lengths should be increased at locations with poor sight distances or speed compliance, and supported by a site-specific risk assessment and documented in the TMP.

Figure 7-4. Traffic control taper with Type 1 PTS

Figure 7-5. Lateral shift taper
Recommended taper lengths are provided in Table 7-3. Taper lengths should be increased at locations with poor sight distances or speed compliance, and supported by a site-specific risk assessment and documented in the TMP.

Table 7-3. Recommended taper lengths

<table>
<thead>
<tr>
<th>Existing permanent speed limit (km/h)</th>
<th>Traffic control taper</th>
<th>Lateral shift taper</th>
<th>Merge taper</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 or less</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>46 to 55</td>
<td>15</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>56 to 65</td>
<td>30</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>66 to 75</td>
<td>N/A</td>
<td>70</td>
<td>115</td>
</tr>
<tr>
<td>76 to 85</td>
<td>N/A</td>
<td>80</td>
<td>130</td>
</tr>
<tr>
<td>86 to 95</td>
<td>N/A</td>
<td>90</td>
<td>145</td>
</tr>
<tr>
<td>96 to 105</td>
<td>N/A</td>
<td>100</td>
<td>160</td>
</tr>
<tr>
<td>Greater than 105</td>
<td>N/A</td>
<td>110</td>
<td>180</td>
</tr>
</tbody>
</table>

When installing multiple tapers, the distance between each taper must be in accordance with Table 7-4.
Table 7-4. Minimum taper lengths

<table>
<thead>
<tr>
<th>Existing permanent speed limit (km/h)</th>
<th>Distance between tapers (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 or less</td>
<td>10</td>
</tr>
<tr>
<td>46 to 55</td>
<td>25</td>
</tr>
<tr>
<td>56 to 65</td>
<td>70</td>
</tr>
<tr>
<td>greater than 66 - 75</td>
<td>1.5D</td>
</tr>
</tbody>
</table>

7.6.2.3 Safety buffer

A safety buffer is the unoccupied space between the taper and work areas, and allows for a driver of an errant vehicle to correct, slow or stop before entering the work area. When designing a TGS, a space of no less than 30 m must be provided prior to the work area for the safety buffer.

Safety buffers are not required on departure, however if road users are able approach the work area from either end, a safety buffer must be provided at both ends of the work area.

Roadworks and storage of vehicles, plant, equipment and stockpiled materials must not occur in safety buffers. Road workers must not occupy the safety buffer area except when accessing the work area.

7.6.2.4 Work areas

The work area is the space required for the immediate work to be competed. Work areas must be set up in accordance with this manual and, where possible, work vehicles within a work area must be parked so that:

- They are clear of the minimum clearances described in Section 4.3.4 Minimum clearances of workers to traffic and Section 4.3.5 Protection of work area;
- Workers are not required to enter the minimum clearances to access tools and stores from the side of the vehicle; and
- The work vehicle provides a shield to workers from the path of errant vehicles.

7.6.2.5 Termination area

Provision of appropriate termination signage is critical to ensure road users are aware that the roadwork or changed conditions are no longer present and normal road conditions are reinstated.

Where a ROADWORK AHEAD sign is installed, END ROADWORK (T2–16) or (T2-17) termination sign must be located D from the last point of the work area where people are working and displayed adjacent to or after any signs indicating the reinstatement of the existing permanent speed limit. The SPEED LIMIT (R4-1) symbolic sign must be placed no further than 50 m past the work area.

It is important to note that if the termination signs are placed at a distance too great from the work area, driver compliance may reduce and road user complacency for work sites may increase.

7.6.3 Traffic control types

Traffic control must be design in accordance with Section 5.4 Traffic control portable traffic control devices (PTCDs) must be used when the existing permanent speed limit is above 45 km/h for all work sites under traffic control. This requirement is not applicable to instances and environments of emergency response.
A manual traffic controller may be used instead of a device provided all of the following conditions are met:

- The use of a PTCD does not provide the safest outcome, SFAIRP;
- The decision to use a manual traffic controller instead of a PTCD is documented as part of the TMP and site specific risk assessment; and
- Approval is granted by the one-up manager to the PWZTMP person approving the TMP.

For all traffic control types, four cones placed at 4 m spacing must be located immediately preceding the location of the traffic control (see Figure 7-4).

### 7.6.4 End-of-queue

In addition to the TMP requirements provided in Section 4.6 End-of-queue management, if work is planned to stop traffic, the TGS designer must assess the likely maximum queue length, through a consideration of:

- Expected delay in minutes;
- Peak hourly traffic volumes at the time of the work;
- The type or mix of traffic; and

**Note:** Heavy vehicles are longer than light vehicles and therefore affect the calculation of maximum queue length.

- The gap between stopped vehicles.

**Note:** In rural environments the gap is generally longer than that of an urban road environment.

If the TGS is planned to stop traffic, the TGS designer must ensure that signs and spacing specified on the TGS are appropriate for all queue lengths up to the maximum design queue length plus thirty per cent (30%) to allow for anomalies, such as 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.

Expected queue lengths must be determined and detailed on the TGS. Procedures should be put in place where the predicted maximum queue length will be exceeded. This may include increasing gap between signs, extra signs or preparing to be able to release traffic to ease the congestion in the queue.

### 7.6.5 Pilot vehicles

A pilot vehicle is a work vehicle used to guide traffic by controlling the desired path and to manage speed through the work area. A pilot vehicle must:

- Only act as a pilot vehicle specifically for the function of the work site;
- Have the function of the pilot vehicle documented in the TMP and in the relevant TGS prior to a pilot vehicle operating on a work site;
- Be operated by a person as either Traffic Controller or Implement Traffic Control Plans and appropriately licenced to operate the relevant vehicle; and
- Be a car, utility or truck; however the vehicle must not be heavily loaded or towing;
- Have two rotating or flashing yellow lamps, an effective two-way radio, headlights and tail lights; and
- Have a PILOT VEHICLE DO NOT OVERTAKE (T6-5) sign instructing traffic to follow it but not pass it.

When in use, a PILOT VEHICLE IN USE (T6-6) sign must also be installed at an appropriate distance in advance of where the pilot vehicle operates.

A pilot vehicle should be used to guide traffic through a work area when:

- Traffic needs to follow a particular path through the site which might not be obvious to road users;
• There is low compliance with the reduced speed limit, for example, switching traffic onto a new carriageway or releasing traffic after a full closure;

• Part of the work area is out of view of the supervisor, work gang and the traffic controller;

• The traffic speed has been reduced to less than 45 km/h due to an increased risk to workers (see Section 4.5 Speed zones); or

• Traffic speed is kept low to minimise damage to the work, i.e. a newly laid seal.

### 7.6.6 Workers on foot

When work activities require workers on foot, the minimum clearances outlined in Section 4.3.4 Minimum clearances of workers to traffic must be maintained at all times. In addition, in accordance with Section 4.5 Speed zones, a 30 km/h speed zone should be installed where workers are closer than 1.5 m to moving traffic.

Additionally, to give maximum protection to workers on foot where temporary safety barriers cannot be provided:

- Work area delineation should be provided where possible;
- Work vehicles should be placed to shield workers from the path of errant vehicles; and
- Work vehicles and shadow vehicles should be positioned in line with the boundary of work area which is more exposed to traffic;

When attending parked work vehicles, access should be 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.

### 7.7 Designing a TGS: Static work

#### 7.7.1 General

When designing a TGS for static works, the size and position of the work area must enable the work site to be managed effectively for the safety of road workers and road users. The size and position might not be consistent for the whole duration of work depending on changes in project tasks or location. When designing a TGS for static works:

- Temporary speed limits must be in accordance with Section 4.5 Speed zones and be limited to the immediate times and locations required;

- Sign placement must be in accordance with Section 6.5.5 Sign placement with signs that are not immediately relevant, removed or covered;

- Lane widths must be in accordance with Section 4.3.2 Lane widths; and

Protection of the work area must be in accordance with Section 4.3.5 Protection of work area.

When designing a TGS for a static work site, the work area must be designed to provide for:

- Access and egress of workers, plant and equipment;

- Storage areas for materials and equipment;

- Safe sight distances for signage, traffic control devices and the work area; and

- Fixed work areas, which must be marked by barrier boards or delineation devices where applicable.

For a long term static work site, a number of TGS may be needed in addition to the use of staging plans.
7.7.2  Around TTM methods

7.7.2.1  General

Around traffic management strategies include detours, road closures or the use of crossovers protected by a separated median. Around TTM methods provide the highest level of worker protection as the risk of live traffic is removed. Around TTM strategies should be considered wherever possible. Prior to the implementation of any of these strategies, approvals must have been gained with appropriate road authority and emergency service consultation and notification prior to installing the treatment.

7.7.2.2  Road closures

A road closure involves the complete closure of all trafficable lanes to all road users to ensure the safety of road workers and road users whilst works are underway. For a full road closure to be undertaken, it must have been identified and approved as part of the TMP. When designing a TGS for a road closure:

- The ROAD CLOSED (T2-4) sign must be used in conjunction with barrier boards at the start of the site to prohibit general road user access;
- Speed zones must be reduced approaching the closure;
- The number of traffic lanes should be progressively reduced on approach to the closure. For example, on a two-lane one-way road, on approach to the closure, the left lane should be closed before the right lane;
- If an approach or exit lane is closed at an intersection, the corresponding approach or exit lane on the opposite side of the intersection must also be closed;
- Traffic control vehicles may be used to physically obstruct access to closed roads to supplement delineation devices if delineation devices alone are insufficient;
- If a motorway exit is temporarily closed, closure signs must be installed in advance of:
  o The previous exit if traffic is detoured through said previous exit; or
  o The closed exit if traffic is detoured through the next exit.
- Closures at on and off-ramps must be reinforced with a line of traffic cones at appropriate site distance from the work area. The traffic cones should be placed in a continuous line or chicaned to slow road users, assist in re-enforcing the closure and define work vehicle entry points. Traffic cones must be placed 1 m apart to stop road users from driving through, and advance warning signs are provided as detailed above.

Where access to properties is affected by the road closure, the following treatments should be considered:

- Provision of an alternative access point for residents and commercial businesses;
- Provision for local traffic to travel through the work area with a delineated path or guidance from a traffic controller. A LOCAL TRAFFIC ONLY sign should be erected beside the access point as applicable. Large gaps should not be left between delineation devices (e.g. traffic cones) at access points to avoid general traffic passing through by mistake or intentionally; or
- Allow pedestrian access only. Local residents will need to park elsewhere during this time.

Where road closures are utilised with detours required, detours should be installed in accordance with Section 7.7.2.3 Detours.

Figure 7-7 provides an example layout of a detour and full road closure scenario.
7.7.2.3 Detours

When designing a TGS for a static work site that utilises an around method, sufficient advanced warning signs and information to advise road users of the changed conditions must be provided. This includes the following:

- A Worker symbolic sign must be placed on the left side of the roadway in advance of the work area if road workers are visible to traffic; and

- A DETOUR AHEAD sign (or VMS) must be placed to give advance warning of an approaching route to detour around a work area. The first detour marker must be placed no more than 100 m past the DETOUR AHEAD sign (or VMS). Detour markers are mounted horizontally with the arrow either vertically upward, at 45 degrees upwards to the left or right, or horizontally to the left or right.

The advance warning area is critical to the success of an around traffic management strategy to reduce the risk of confusion to road users. Repeated information may assist road users to navigate their way safely and effectively to their intended destinations.

7.7.2.4 Side tracks and crossovers

When designing a TGS that includes a sidetrack or a crossover the following provisions apply (see Figure 7-8 for an example layout with side track):

- Approval must be sought from the maintaining authority to use any side track, cross over or detour;

- The pavement must be of sufficient structural strength to carry the loads and traffic volumes expected;
• The pavement on detours must be monitored to ensure that any damage is quickly rectified;
• The width of a detour and its alignment must be adequate for the expected traffic types and volumes;
• Provision must be made for vulnerable road users and high risk pedestrians and public transport;
• Access must be provided for local traffic;
• Delineation must be provided on the alternate route as appropriate, and may include but is not limited to:
  ◦ Linemarking;
  ◦ Temporary guide posts;
  ◦ Retro-reflective pavement markers (RRPMs), and
  ◦ Signposting.
• Signposting must be clear and adequate; and
• DETOUR AHEAD (T1-6) signs must be used to give advance warning of any detours.

Additionally, the establishment of long-term sidetracks must undergo a detailed design and review process.

7.7.3 Past TTM methods

7.7.3.1 General
Where it is not possible to move traffic around a work area, the following forms of traffic past methods must be considered:
• Lane closure and lateral shift; or
• Protection of work site via accepted safety barriers as per Section 6.7 Temporary safety barriers.
7.7.3.2 Closing a lane

When closing a traffic lane, signs and devices should be installed and removed in accordance with Section 6.4 Sequence for installation and removal of signs and devices, see also Figure 7-9. When closing off a lane, work must progress in the direction of traffic flow, starting at the farthest point from the job. The vehicle housing the traffic cones, with warning lights and hazard operating must commence at the start of the taper and progressively place the layout in the direction of traffic flow until the taper is completed. The vehicle, and any workers on foot, must be protected by a shadow vehicle during installation of the lane closure.

A minimum of two temporary hazard markers (T5-4 or T5-5) per closed lane must be used. Cones or bollards must also be used to create a taper to close the lane and define the travel path if traffic is to be merged into an adjacent lane, shifted laterally or be directed by a PTCD or a traffic controller past the work area. On high speed roads or multi-lane roads, consideration must also be given to using a flashing arrow sign in addition to, or in place of, the temporary hazard markers.

If temporary delineation is needed on both sides of the vehicle path at a taper, hazard markers must only be used on the side that is primarily guiding traffic away from the most significant obstruction or other hazard. Hazard markers on both sides of a traffic path must not be placed as this can cause confusing patterns of delineation. Cones should be placed on the lane line between the end of the taper and the work area and on the other side of the travel path in accordance with Section 6.2.5 Spacing of cones and bollards and Section 7.6.2.2 Tapers.

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.

Figure 7-9. Example layout—static: lane closure, 2-lane/2-way (formerly TCP 41)

Additional examples of lane closures are provided in Appendix D – Work type layout examples.
7.7.3.3 Closing a shoulder

When closing a shoulder, a minimum of two temporary hazard marker spaced at 20 m centres and 20 m in advance of the work area, both at 1 m off the edge line. A barrier board should be placed at the beginning and end of the work area. In addition a SHOULDER CLOSED (T2-19n) must be placed D in advance of the first temporary hazard marker (T5-4 or T5-5), (see also Figure 7-10).

Consideration must be given to cyclists, buses, resident’s vehicle, parking and any other road user that may utilise the shoulder in this area, see Section 4.4 Providing for specific road users.

7.7.3.4 Single lane operation

Single lane operation may be used on two-way two-lane roads with a very low traffic volume and appropriate sight distance. GIVE WAY (R1-2) and ONE LANE (R9-9n) sign assembly must 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 and no traffic controller is provided (see Figure 7-11). This is appropriate for work when:

- The traffic volume is 100 vpd or less and the traffic speed is less than 75 km/h;
- Each entry to the work area is visible from the other;
- The work area is less than 100 m long; or
- There is sight distance to opposing traffic of at least 300 m beyond the far end of the work area for traffic facing the GIVE WAY/ONE LANE assembly sign.

NO OVERTAKING OR PASSING (R6-1) sign must be erected at the start of the single lane for traffic in the opposite direction. See also Section 6.5.9 Requirements for specific signs.
7.7.3.5 Additional requirements for dual carriageway and multi-lane roads

When working on a central lane or in the median between carriageways there must be adequate lateral separation between workers on foot or plant from the opposing traffic flow. The lateral separation requirements in Section 4.3.4 Minimum clearances of workers to traffic should be applied as a minimum and in some situations an increased lateral separation may be required due to site-specific risks. The required lateral separation can be achieved by variety of means such as detouring the opposing traffic flow, providing a temporary barrier with a containment fence (for workers) or for shorter duration works by closing the opposing traffic lane.

Where a traffic lane is to be closed, the TGS must include:

- Appropriate lane status (T2-6-1 or T2-6-2) signs;
- A minimum of two temporary hazard markers (T5-4 or T5-5) or a flashing arrow sign must be used if traffic is merged into an adjacent lane; and
- A TMA is to be utilised as part of the lane closure, where required by Section 6.10 Truck and trailer-mounted attenuators (TMA).

Where work is undertaken on a multi-lane dual carriageway:

- Signs and devices, excluding pavement arrows, must be placed on both sides of the carriageway, where practical, in accordance with Section 6.5.6 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, see Figure 7-12; and
- Site access is established in accordance with Section 5.2.3.2 Designing site access on multi-lane roads or high speed environments, where required.
7.7.4 Through TTM methods

7.7.4.1 General

All static work sites that cannot have around or past controls applied must seek to ensure the highest order of available treatments are designed into the TGS, so as to reduce the potential for vehicles entering the work area erroneously. This should include speed reductions and delineation installed in accordance with Section 4.3.5 Protection of work area to reduce the risk of incidents between road workers and traffic.

7.7.4.2 Working at traffic signals

For short duration low impact works such as emergency fault repairs or routine maintenance, traffic controls need to be quickly set up and dismantled while still being effective in directing traffic past or through work areas. These types of works may be best managed by developing a suite of generic TGS that can be selected from, customised and implemented at various locations as site suitable TGS.

For the longer term or more major works such as pavement resurfacing, signal reconstructions or the construction of new traffic signals, site-specific TGS should be developed for each location and in some cases for each stage of work at the intersection.

In addition to the planning requirements in Section 5.3.3 Working at or close to traffic signals the following applies to designing a TGS for work at these locations:

- Any traffic control arrangements that will affect the operation of traffic signals or require them to be flashed yellow must be approved as part of the road occupancy licence. The Transport Management Centre (TMC) implements these approved changes to signal operation upon request during the implementation of the TGS;
• If working at or in close proximity to signals and alternate traffic control is needed, the signals must be flashed yellow and traffic control implemented on all approaches of the intersection prior to the use of a PTCD or STOP/SLOW bat;

• If turn restrictions or detours are necessary, in addition to the requirements of Section 7.7.2 Around TTM methods the following must be considered:
  ◦ The impact that additional traffic has on the operation (phasing) of any traffic signals on the alternative route; and
  ◦ The impact that any lane closures, particularly turn lanes has on signal operation (phasing) and intersection efficiency.

• Contact the TMC if real-time adjustments are needed to the operation (phasing) of traffic signals or adjacent signals during roadworks;

• Inform road users in advance of proposed works by advertising, for example using VMS roadside noticeboard advertising, letter drops or press releases; and

• Ensure that adequate provision is made for pedestrians and mobility aid users if it is necessary to turn off pedestrian signals or close a pedestrian crossing at intersection traffic signals.

Where lane closures are needed, the requirements of Section 7.7.3.2 Closing a lane must be applied.

Figure 7-13 provides an example layout of working at traffic signals with lane closure.

7.7.4.3 Excavations

Special consideration for the safety of both workers and traffic must be given while traffic flow is adjacent to excavations.

A temporary safety barrier must be installed where traffic travels beside an open excavation, deeper than 0.5 m and within 3 m of the travel path or edge line. When traffic is greater than 3 m of the excavation, the requirement for a temporary safety barrier should be considered during development of the TMP and risk assessment.

A temporary safety barrier must also be installed where the excavation depth exceeds 200 mm, and when the following applies:

• The excavation remains open longer than two weeks; and

• 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; or
9 m for 100 km/h or faster approach speed.

Temporary safety barriers installed must be in addition to barriers for excavation fall protection of road workers and road users.

When the adjacent lane is not under traffic control, excavations shallower than 0.5 m and within 3 m of the travel path or edge line must be defined by:

- Plastic mesh fencing;
- Barrier boards perpendicular to the traffic flow; or
- Cones, bollards or similar delineation.

Additional controls or mitigation measures as identified in the TMP or risk assessment must also be installed, e.g. temporary safety barriers.

If the project manager considers that compliance with these requirements is not practical or warranted, a more thorough risk analysis must be made, based on Austroads *Guide to Road Design Part 6: Roadside Design, Safety and Barriers*, and an application for a departure be submitted in accordance with Section 2.8 Departures from this Technical Manual.

In planning and carrying out works, priority must be given to backfilling all excavations near traffic as soon as practicable.

### 7.7.4.4 Bituminous works

Bituminous works or other pavement surfacing works may be conducted under active traffic conditions or when the work area has been cleared 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. This interruption to traffic should be kept to a minimum by careful planning and execution of the work. Such planning and control of the work also assists in the safe completion of the work.

The local community should be notified in advance of planned bitumen sealing works especially on busy roads.

The project manager must 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 no longer than 10 minutes. In such cases, the following should be determined:

- Widths and lengths of area to be treated;
- Timing to avoid peak traffic periods;
- Whether to introduce side tracks or detours; and
- Temporary closure of intersecting roads.

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

For signs at sprayed sealing works, the four stages that should be considered are:

- Before sealing begins;
- During the sealing operations;
- Until the last loose stones are removed; and
- Until the appropriate linemarking and road markings are fully restored.

See Figure 7-14 for signage examples.
Where sealing works are undertaken in areas where the existing permanent speed limit is greater than 55 km/h, a 60 km/h roadwork speed zone must be installed and remain in place until the number of loose aggregate particles falls to the specified level.

![Figure 7-14. Example layout—bituminous works](image)

### 7.7.5 Aftercare

Plans must be in place to ensure that traffic can proceed around, past or through a work site safely when workers are not present. This is typically referred to as *aftercare* traffic management. This includes periods outside normal working hours in either day or night when there are interruptions to the continuity of the work.

A separate TGS must be designed when aftercare is required at the work site, with the following applicable provisions (see *Figure 7-15* for an example layout):

- The TGS must include details of the requirements to manage traffic around, past or through the work site outside normal working hours or when workers are not present at the site. This includes the removal or covering of any signs that are not applicable, particularly temporary work site speed limits;
- Unless the risk assessment of the work site indicates otherwise, the work site speed limit should be returned to normal if safe or, if not possible, be no more than 20 km/h below the existing permanent speed limit, having regard to the work site conditions (e.g. rough or slippery unsealed road surface, loose aggregate from bituminous works, or excavations close to the roadway); and
- Inspections of the site should be undertaken in accordance with *Section 8.1 Work site inspections, reviews and audits*.

As part of preparing the work site to be left unattended, the actions shown in *Table 7-5* should be considered.
### Table 7-5. Aftercare considerations and actions

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of site</td>
<td>Reduce the extents of the work site as much as possible by reducing the length of the work zone and removing/ reducing any width restrictions.</td>
</tr>
<tr>
<td>Temporary speed limits</td>
<td>If temporary speed limits have been installed, the design should consider whether these need to remain in place or whether a higher speed zone or the existing permanent speed limit can be reinstated (any changes to a different temporary speed limit must be approved).</td>
</tr>
<tr>
<td>Unsafe conditions</td>
<td>Identification of potential unsafe conditions, e.g. loose material on the road surface, poor quality or confusing delineation, plant parked incorrectly, with mitigation measures implemented.</td>
</tr>
<tr>
<td>Signs</td>
<td>TTM signs need to remain in place and serviceable while the site is not attended. Check that all signs are ballasted for windy conditions, reasonably level, mounted at the correct height and positioned correctly.</td>
</tr>
<tr>
<td>Delineation</td>
<td>Check that all delineation devices are clean, positioned correctly, and adequately ballasted, e.g. double weighted bollards.</td>
</tr>
</tbody>
</table>

![Figure 7-15. Example layout—aftercare](image-url)
7.8 Designing a TGS: Dynamic work

7.8.1 General

Dynamic work involves the carrying out of a work activity as one of the following:

- **Frequently changing work**—regularly moves between successive locations, either within or outside of a traffic lane where minimal warning is required to advise road users of the presence of workers;
- **Continuous work**—progressively moving in vehicles along the roadway, either wholly within, or wholly outside of a traffic lane; 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.

The general principles that must be applied when developing a TGS for dynamic works are provided in Table 7-6.
### Table 7-6. Principles for the design of a TGS for dynamic works

<table>
<thead>
<tr>
<th>TGS principles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Work site layout</strong></td>
</tr>
<tr>
<td>• The work area should be designed to allow for movement of road workers, equipment, materials and vehicles, including sufficient waiting and storage space for TTM component.</td>
</tr>
<tr>
<td>• The size and position of the work area should enable the work site to be managed effectively for the safety of road workers and road users.</td>
</tr>
<tr>
<td>• The size and position may change during works depending on project tasks or location.</td>
</tr>
<tr>
<td><strong>Sight distance</strong></td>
</tr>
<tr>
<td>Sight distance allows a driver to see the work, react, and take required action to avoid a collision. Sight distance must:</td>
</tr>
<tr>
<td>• Be determined in accordance with Section 4.3.6 Sight distances; and</td>
</tr>
<tr>
<td>• Be appropriate for traffic composition (e.g. PBS vehicles see Section 4.4.5 Heavy vehicles)</td>
</tr>
<tr>
<td><strong>Traffic volume</strong></td>
</tr>
<tr>
<td>• Predicted end-of-queue lengths must be determined and a strategy must be documented in the TGS when higher than anticipated traffic volumes occur.</td>
</tr>
<tr>
<td>• Unless unavoidable and essential, work should not be undertaken during peak times or special events that can influence traffic volumes.</td>
</tr>
<tr>
<td><strong>Road users</strong></td>
</tr>
<tr>
<td>When undertaking dynamic work, access provision must be maintained for impacted road users, e.g. users of foot paths or bicycle lanes must have access to safe alternatives</td>
</tr>
<tr>
<td><strong>Speed</strong></td>
</tr>
<tr>
<td>• The TGS must ensure that the appropriate speed zoning is in place for the dynamic work to be performed safely.</td>
</tr>
<tr>
<td>• If speeding vehicles are predicted or noticed in the area, additional consideration should be given to advanced warning signs.</td>
</tr>
<tr>
<td><strong>Vehicle placement</strong></td>
</tr>
<tr>
<td>Dynamic works must be planned so that work vehicles do not need to straddle an edge line, and the placement of the work vehicles does not put at risk vulnerable road users.</td>
</tr>
<tr>
<td><strong>Access to medians and verges</strong></td>
</tr>
<tr>
<td>• Safe access and egress from medians and verges must be determined when planning dynamic work.</td>
</tr>
<tr>
<td>• The road alignment and potential for vehicles to run-off onto median and verge should be considered when planning dynamic work in the median or verge.</td>
</tr>
<tr>
<td><strong>Contingency</strong></td>
</tr>
<tr>
<td>When performing dynamic work, a contingency plan must be developed if work cannot be completed as planned.</td>
</tr>
</tbody>
</table>

#### 7.8.2 Work convoys

Work convoys, as a whole or select convoy vehicles, might be required when undertaking dynamic work. The need for a convoy or otherwise is influenced by factors such as:

- Lane and shoulder widths;
- Geometric alignment—horizontal and vertical alignment;
- Sight distance;
- Grade of road;
- Traffic volume;
- Speed of traffic;
- Number of traffic lanes;
- Traffic composition (i.e. proportion of heavy vehicles);
- Road user behaviour;
- Traffic movements—such as weaving traffic; and
- Workers on foot.

Where used, a works convoy must be made up of the vehicles in Table 7-7, as applicable, for the relevant road situation (Figure 7-16 shows a typical layout of a works convoy).

**Table 7-7. Vehicles and their function in a convoy**

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Role and function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead vehicle</td>
<td>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:</td>
</tr>
<tr>
<td></td>
<td>• Warnings oncoming road users of the work;</td>
</tr>
<tr>
<td></td>
<td>• Alert following workers early to any impending danger from oncoming traffic; and</td>
</tr>
<tr>
<td></td>
<td>• Shield workers and the work vehicle from approaching traffic.</td>
</tr>
<tr>
<td>Work vehicle</td>
<td>A ‘work vehicle’ is the vehicle or item of plant which undertakes the work, e.g. a linemarking machine, or supports the workers on foot behind it.</td>
</tr>
<tr>
<td>Shadow vehicle</td>
<td>A ‘shadow vehicle’ follows closely behind the work area as the work progresses. Its main purpose is to shield the work vehicle and/or workers on foot from traffic.</td>
</tr>
<tr>
<td></td>
<td>This vehicle must travel at 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.</td>
</tr>
<tr>
<td>Tail vehicle</td>
<td>A ‘tail vehicle’ follows some distance behind the work area. The main functions of a tail vehicle are to:</td>
</tr>
<tr>
<td></td>
<td>• Warn following road users of the work;</td>
</tr>
<tr>
<td></td>
<td>• Divert traffic past the work area; and</td>
</tr>
<tr>
<td></td>
<td>• Enable the driver to alert workers of any impending danger.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> A second tail vehicle is required on motorway type roads.</td>
</tr>
<tr>
<td>Advance warning vehicle</td>
<td>An ‘advance warning vehicle’ should be positioned approximately 1 km behind the work convoy to give advance warning to following road users.</td>
</tr>
<tr>
<td></td>
<td>• All signs and warning devices must be mounted on moving vehicles in the convoy; and</td>
</tr>
<tr>
<td></td>
<td>• All vehicles and plant items in the works convoy, other than minor plant items, must have a flashing arrow sign fitted.</td>
</tr>
<tr>
<td></td>
<td>An advance warning vehicle is not required for speed zones of less than 65 km/h with 2D sight distance.</td>
</tr>
</tbody>
</table>
7.8.3 Frequently changing work

Frequently changing work involves regular movement between successive locations, either within or outside of a traffic lane where minimal warning is required to advise road users of the presence of workers. For frequently changing work to be conducted, the following criteria must be met:

- When conducted within a traffic lane:
  - Speed limit of less than 65 km/h; and
  - Maximum work period at any one location is 20 mins or up to 1 hour if traffic volumes are less than 40 vph.

- Work conducted in median or verge:
  - Sight distance that meets the criteria outlined in Table 7-9 (or minimum sight distance to oncoming traffic 50 m not in traffic lane);
  - Speed limit of less than 75 km/h; and
  - 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; or
- 1 hour at traffic volumes 40 vph or less.

Where the above criteria cannot be met the site must be set up as a static work site or completed as another suitable dynamic work type.

Frequently changing work may permit the short term partial closure of a road without advanced warning where 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 control is required; and
- Traffic volumes are less than 20 vpd or there is room for two-way traffic past the work area.

Examples include:

<table>
<thead>
<tr>
<th>Work outside a traffic lane</th>
<th>Work within a traffic lane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pit cleaning or repair;</td>
<td>Pavement marker laying other than on dividing lines; or</td>
</tr>
<tr>
<td>Litter collection;</td>
<td>Pavement testing.</td>
</tr>
<tr>
<td>Tree pruning or planting;</td>
<td></td>
</tr>
<tr>
<td>Road signs or street furniture maintenance; or</td>
<td></td>
</tr>
<tr>
<td>Street light maintenance.</td>
<td></td>
</tr>
</tbody>
</table>

### 7.8.3.1 Minimum controls for frequently changing work

When undertaking frequently changing work the following minimum controls apply:

- A shadow vehicle or works convoy must be deployed to protect worker on foot or plant;
- All work vehicles must have at least one operating rotating or flashing yellow light on the work vehicle when work is being completed or the work vehicle is parked that is:
  - Not obscured by overhanging vegetation or a raised truck body; and
  - Visible for at least 150 m in a speed zone less than 65 km/h or 250 m elsewhere.
- Sight distance that meets the requirements of *Table 7-9*; and
- A contingency plan is in place so that work in progress can be abandoned immediately without risk to workers or traffic.

In addition, the following signage must be displayed:

- Signs up to 2 km in advance of each work position or item of moving plant. The distance between advance signs for opposing directions of travel must not exceed 2 km at any time and the location of such signs must 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 must be used in conjunction with NEXT 2km (T1-28) and must be placed beside:
  - Workers symbolic (T1-5) where there are workers on foot; or
  - ROAD PLANT AHEAD (T1-3-1) where moving road plant only will be encountered.
- Where the work is repetitive and is undertaken within a designated length of up to 2 km, signs, such as WORKERS (symbolic) (T1-5) with NEXT 2KM (T1-28) or similar must be placed in advance of the work. Where this work is undertaken as a frequently changing work area, the advance signs must be progressively relocated so that in opposing directions they are never more than 2 km apart.
Where signs and devices are mounted on the vehicles or road plant they must be visible and conspicuous to road users at all times, see also Figure 7-17.

Figure 7-17. Example layout—frequently changing work

7.8.3.2 Additional requirements: Roads with less than 1500 vpd

Some works may be conducted as frequently changing work without the use of a works convoy or shadow vehicle provided all of the following conditions are met:

- Traffic volume is less than 1500 vpd;
- The minimum sight distance for following traffic is 1.5D;
- No more than two pieces of plant are operating within sight distance of each other;
- Posted speed limit is less than 85km/h; and
- At least 1.5m is maintained from live traffic.

Typically these activities include:

- Maintenance grading and resheeting of the traffic lanes on unsealed roads; or
- Shoulder grading on sealed or unsealed roads.

When undertaking frequently changing work without the use of a shadow vehicle, works may be undertaken within a road length of up to 10 km under the following conditions:

- Subsections of 2 km or less must be created and all signs must be installed 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;
- If sight distance to the vehicle-mounted warning sign on the works vehicle or plant is greater than 250 m throughout the section of road, ROADWORK NEXT __km (T1-24) must be placed at each end of the section.
- If the sight distance is less than 250 m at any point within the section:
GRADER AHEAD (T1-4) or ROAD PLANT AHEAD (T1-3-1) together with NEXT 2km (T1-28) signs must be used on each approach to the section to cover the road length. These signs must be placed at least 100 m in advance of the start of any windrow; and

- If the speed of traffic is greater than 75 km/h, a temporary speed zone of less than 65 km/h must also be implemented, see Section 4.5 Speed zones.

Road condition signs must be placed at locations where the freshly graded surface has loose material that has become a hazard. Where required, one or more of the following must be installed depending on the nature of the hazard:

- Slippery symbolic (T3-3);
- SOFT EDGES (T3-6);
- ROUGH SURFACE (T3-7);
- GRAVEL ROAD (T3-13);
- Loose stones symbolic (T3-9); or
- LOOSE SURFACE (T3-14).

Additional information for specific activities are detailed in Table 7-8.

Table 7-8. Additional information for specific activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street sweeping</td>
<td>When undertaking works, the street sweeper must operate in a forward direction and not need to reverse for an extended distance. In addition, the sweeper may use a flashing arrow sign to direct traffic to one side of the vehicle if it is safe to do so.</td>
</tr>
<tr>
<td>Maintenance grading and resheeting</td>
<td>Wherever practicably, grading on the right side of the road against oncoming traffic should be avoided. Maintenance grading and resheeting may be carried out either with or without leaving a windrow. Work done without leaving a windrow normally involves use of either a windrow eliminator or a second grader in tandem. Where graded or resheeting material cannot be traversed by traffic, the grader blade should be raised from time to time to create a gap in the material or windrow so that traffic can overtake the grader.</td>
</tr>
</tbody>
</table>
7.8.3.3 Additional requirements: Work on a verge, median or footway

Access to verges, medians or footways must be carefully planned as it may involve works vehicles to manoeuvre in a manner that is unexpected by road users. Access to medians must be in accordance with Section 5.2 Providing safe movements for works traffic.

Median and verge mowing, tilling, seeding and weed spraying, works on a footpath and garden maintenance may be carried out without a shadow vehicle, subject to a risk assessment, the work is short term work and all of the listed conditions being met:

- Where there are no workers on foot, the relationship between speed limit and clearance to edge of traffic lane must be as follows:
  - Clearance of at least 1.5 m for speed limits greater than 85 km/h; or
  - Clearance of less than 1.5 m are permitted for speed limits less than 85 km/h, however plant items must not encroach onto the traffic lane.

- Where there are workers on foot:
  - The clearances detailed in Section 4.3.4 Minimum clearances of workers to traffic must be maintained; and
  - Where works will require workers on foot at one location for periods longer than 20mins, cones or bollards, must be placed along the kerb line or edge of traffic lane if no kerb exists.
7.8.3.4 Additional requirements: Slow moving plant

Plant that moves along the roadway that cannot travel within 20 km/h of the posted speed limit may be moved using the principles of a ‘frequently changing work site’ in a traffic lane using one of the following actions:

- Put in place a TGS 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;
- The plant item travels on the road shoulder or verge using gaps in traffic to pass obstructions and does not straddle the edge line; or
- Use a pilot vehicle or convoy of vehicles in accordance with the below.

Where required to pilot slow moving plant items travelling on the road, the following provisions apply:

- At least one pilot vehicle must travel behind the plant item;
- Up to three plant items may be guided in the one group using one or two pilot vehicles as prescribed above, provided a distance of 60 m to 80 m is maintained between the plant items;
- Where the sight distance is:
  - Less than 2D, the pilot must travel at the same speed as the plant item, and must be at a distance of approximately 2D behind the plant item;
  - Between 1D and 2D, the pilot must stop on the shoulder and must be completely clear of the travel lane until the plant item has moved a maximum of 6D ahead. The pilot may then travel at normal speeds to a point near the plant item and stop on the shoulder once again;
  - Less than 1D, a second pilot vehicle must 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 pilot 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 pilot vehicle must continue to operate as described above.
- The plant items must pull over periodically to allow traffic to pass so that the queue of traffic following does not exceed 12 vehicles.

In addition to the requirements of Section 7.6.5 Pilot vehicles, the PILOT VEHICLE DO NOT OVERTAKE (T6-5) sign must be replaced with ROAD PLANT AHEAD (T1-3-1) sign.

Where the above conditions cannot be met, plant should be floated between sites.

7.8.4 Continuous work

Continuous work is defined as work which entails vehicles moving along the roadway continually. Continuous work may be conducted with plant only, or with workers on foot, but must be completed either wholly within, or wholly outside of a traffic lane.

Examples include:

<table>
<thead>
<tr>
<th>Plant only activities</th>
<th>Worker on foot activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Linemarking;</td>
<td>• Linemarking removal;</td>
</tr>
<tr>
<td>• Pavement testing;</td>
<td>• Pavement edge or pot hole patching; or</td>
</tr>
<tr>
<td>• Pavement sweeping;</td>
<td>• Raised pavement marker installations.</td>
</tr>
<tr>
<td>• Low speed inspections</td>
<td></td>
</tr>
<tr>
<td>• Snow clearing/spreading grit;</td>
<td></td>
</tr>
</tbody>
</table>
7.8.4.1 Minimum controls for continuous work

When undertaking continuous work (see Figure 7-19), the following minimum controls apply:

- All work vehicles must have at least one operating rotating or flashing yellow light on the work vehicle when work is being completed or the work vehicle is parked that is:
  - Not obscured by overhanging vegetation or a raised truck body; and
  - Visible for at least 150 m in a speed zone less than 65 km/h or 250 m elsewhere. Sight distance that meets the requirements of Table 7-9;

- All vehicles must stay wholly within or wholly outside of a travel lane; and

- If travelling more than 20 km/h below the posted speed limit, be protected by a works convoy as detailed in Section 7.8.2 Work convoys.

In addition, vehicles may:

- Use a flashing arrow sign to direct traffic to one side of the vehicle provided 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 must be flashed; and

- Require supplementary vehicle mounted signs such as:
  - WET PAINT ON ROAD (T2-237n) or
  - ROAD PLANT AHEAD (T1-3-2).

![Figure 7-19. Example layout—continuous work]
7.8.4.2 Additional requirements: Advanced warning

Advance warning vehicles should be positioned in the same lane as the work vehicle. However, for work near the centre of a multi-lane undivided road or 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.

Vehicles providing advance warning must travel at the following convoy spacing:

- Where sight distance is greater than 2D:
  - 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; and
  - 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 less than 65 km/h.

- Where sight distance is less than 2D:
  - The lead vehicle must 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; and
  - The tail vehicle must 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.

7.8.4.3 Additional requirements: Work on two-way roads

Wherever practicable, following traffic must 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 safely pass to the right do not exist the work must be stopped periodically by pulling off the traffic lane and allowing following traffic to pass.

Traffic must not be directed to completely cross a dividing line into the path of oncoming traffic. Additionally, traffic must not be directed to cross a freshly marked line if that would result in the marking being damaged.

7.8.4.4 Additional requirements: Work on motorway type roads

A second tail vehicle must be provided for work on motorway type roads. The two vehicles must 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.

The second vehicle in the convoy or any other vehicles occupying a travel lane in a motorway environment must be fitted with a truck mounted crash attenuator (TMA). See Section 6.10 Truck and trailer-mounted attenuators (TMA) for specific requirements for the operation of a TMA.

7.8.5 Intermittent work

Intermittent work does not require any adjustments that affect road users on the roadway. For intermittent work to be performed in a live traffic lane, work must be performed within safe gaps in traffic.

Intermittent work is only permitted as a work type when all of the following criteria are met:

- Sight distances in Table 7-9 are achieved;
- Work can be performed within gaps in traffic; and
- Traffic is not obstructed.
The duration of intermittent work must not exceed:

- **5 minutes**—if works are within 1.5 m of the live traffic lane;
- **20 minutes**—if works are in the shoulder or greater than 1.5 m from the live traffic lane; or
- **60 minutes**—if works are wholly within a verge, median or footway.

Intermittent work must not include:

- Speed limit changes;
- Tapers;
- Traffic control, i.e. use of traffic control devices or manual traffic controllers;
- Aftercare signs;
- Redirection of vulnerable road users; or
- Lane width or alignment adjustments.

Work must be treated as a frequently changing or static work areas where there will be two or more intermittent locations within a space of 2 km or less worked simultaneously.

Examples of intermittent work are pot hole patching, edge repair, seal or patch spotting, road inspections, removal of dead animals or debris, or litter collection etc., see Figure 7-20.

In addition to the TGS requirements in Section 7.4 Information required on a TGS, where applicable, when designing a TGS for intermittent work, the following information must be provided:

- A contingency plan so that work in progress can be abandoned immediately without risk to workers or traffic;
- Sight distances available for the work location; and
- Whether a lookout person is required to warn workers on foot of the approach of any vehicles whose speed or size might constitute a safety threat.

### 7.8.5.1 Minimum controls for intermittent work

When undertaking intermittent work, the following minimum controls apply:

- All work vehicles must have at least one operating rotating or flashing yellow light on the work vehicle when work is being completed or the work vehicle is parked that is:
  - Not obscured by overhanging vegetation or a raised truck body; and
  - Visible for at least 150 m in a speed zone less than 65 km/h or 250 m elsewhere. Sight distance that meets the requirements of Table 7-9.
- All road workers, materials and plant have the ability to quickly and safely move on or off the roadway in a short period;
- A contingency plan, so that work in progress can be abandoned immediately without risk to workers or traffic;
- Sight distances outlined in Section 7.8.5.2 Sight distances for intermittent work; and
- Where works involve workers on foot or small items of plant working within 3 m of a traffic lane, the Worker symbolic (T1-5) sign and/or ROAD PLANT AHEAD (T1-3-1) sign must be displayed.

When work is undertaken with a lookout person, the following provisions apply:

- There must be no approaching traffic for at least a minimum distance as shown in Table 7-9 for the designated approach speed, i.e. approximately equivalent to 10 seconds travel time or 3D;
The lookout person must have good eyesight and must be fully instructed in the lookout persons’ duties; and

The lookout person must remain within sight and hearing distance of the worker(s) (generally within 2 m).

Where the distances shown in Table 7-9 cannot be achieved, an advance lookout person should be used. This advance lookout person should be within sight distance of the first lookout person or within radio contact if sight distance is not possible.

![Figure 7-20. Intermittent work](image)

### 7.8.5.2 Sight distances for intermittent work

When undertaking intermittent work, the need for a lookout person will be dependent on the sight distance available at the location. Sight distances, detailed in Table 7-9 must be maintained at all times.

#### Table 7-9. Minimum sight distances for intermittent work

<table>
<thead>
<tr>
<th>Approach speed (D) km/h</th>
<th>Minimum sight distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With a lookout person (3D)</td>
</tr>
<tr>
<td>less than 20</td>
<td>60</td>
</tr>
<tr>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td>40</td>
<td>120</td>
</tr>
<tr>
<td>50</td>
<td>150</td>
</tr>
<tr>
<td>60</td>
<td>180</td>
</tr>
</tbody>
</table>
### 7.9 TGS confirmation and approval

#### 7.9.1 TGS verification

After a TGS is selected or designed it must be approved as being appropriate for use at the work site. Site confirmation must be undertaken via the completion of the TGS verification.

A TGS verification must be undertaken to confirm the selected or designed TGS is fit for purpose. A TGS verification must be completed in accordance with Section 8.1.2 TGS verification by an ITCP or PWZTMP qualified person. TGS verification must include an inspection of the work site where the TGS will be implemented.

#### 7.9.2 TGS approval

The PWZTMP qualified person who has designed or modified the relevant TGS must approve the TGS for use. Approval of the TGS must include:

- Review of the relevant TMP, risk assessment and associated TTM specific documentation;
- Design, redesign or modification of the TGS must be in accordance with the requirements of this Technical Manual; and
- Confirmation that the TGS provides the relevant information for the ITCP person to safely implement on-site.

The PWZTMP qualified person must seek approval from the one up manager if the TGS:

- Includes a non-standard or unaccepted sign or device;
- Includes any departures from the requirements of this manual; or
- If a manual traffic controller is proposed for use.

<table>
<thead>
<tr>
<th>Approach speed (D) km/h</th>
<th>Minimum sight distance (m)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With a lookout person (3D)</td>
<td>Without a lookout person (6D)</td>
</tr>
<tr>
<td>70</td>
<td>210</td>
<td>420</td>
</tr>
<tr>
<td>80</td>
<td>240</td>
<td>480</td>
</tr>
<tr>
<td>90</td>
<td>270</td>
<td>540</td>
</tr>
<tr>
<td>100</td>
<td>300</td>
<td>600</td>
</tr>
<tr>
<td>110</td>
<td>330</td>
<td>660</td>
</tr>
</tbody>
</table>
The TGS must include separate sign-off sections for the designer and approver. The sign-off sections must contain sections to capture the relevant persons:

- Full name;
- Role;
- Division / organisation;
- Qualification number;
- Signature; and
- Date.

### 7.10 Implementing a TGS

#### 7.10.1 General

A TGS must be installed, maintained and removed in a planned and safe manner. The implementation of a TGS must only be undertaken by an ITCP qualified person.

Before work begins, the ITCP qualified person must confirm that:

- The TGS has been selected, designed or modified and approved in accordance with this Technical Manual;
- Appropriate approvals have been given for road occupancy, speed zone authorisation, PTCD or use of manual traffic controllers;
- Copies of the relevant TMP, associated risks assessments and other relevant documents are obtained;
- Adequate materials (i.e. sign covers) are available to cover signs that are not needed; and
- All signs and devices on the TGS are available, are of correct size and are in good condition. Sufficient additional devices should be available to allow for any on-site adjustments or, modifications and contingencies including:
  - additional cones;
  - repeater signs;
  - additional signs for end-of-queue management;
  - covering of existing conflicting signage;
  - covering of signs not needed for afterhours TGS; and
  - Incident/emergency signage.

*Note: Modifications and adjustments to a TGS must be undertaken by an appropriately qualified person and must be in accordance with this Technical Manual.*

#### 7.10.2 Implementing a TGS

The sequence of implementation should be determined as part of the TMP, and detailed on the TGS or SWMS, rather than being determined on-site.

The general procedure for setting up a site should be in accordance with *Section 6.4 Sequence for installation and removal of signs and devices*. A different implementation sequence may need to be adopted to address any site specific circumstances.
The ITCP qualified person must ensure that the TGS is implemented as approved, with any minor adjustments completed in accordance with Section 7.10.3 Tolerances on positioning of signs and devices, are recorded on the TGS and a signed copy is available on-site.

Any anomalies or inconsistencies found in the TGSs being used must be recorded and reported back to the TGS designer who is PWZTMP qualified.

If it is identified that risk will be generated through the implementation of a TGS that requires modification outside of the tolerances, then the site must be made safe and an updated TGS must be provided by a PWZTMP qualified person as soon as practicable. Where the TMP and TGS cannot be suitably adjusted or modified, the ITCP qualified person must advise the project manager that they are not appropriate, so that the works are postponed until a new site specific TGS is designed.

Once implemented, the appropriate inspection in accordance with Section 8.1 Work site inspections, reviews and audits must be completed.

### 7.10.3 Tolerances on positioning of signs and devices

Local constraints might not allow signs and devices to be placed exactly in accordance with the designed and approved TGS.

Where a specific distance is provided for the longitudinal positioning of signs or devices with respect to other items or features, the tolerances provided in Table 7-10 may be applied.

<table>
<thead>
<tr>
<th>Tolerance</th>
<th>Positioning of signs, length of tapers or markings</th>
<th>Spacing of delineating devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>10% less than the distances or lengths given</td>
<td>Nil</td>
</tr>
<tr>
<td>Maximum</td>
<td>25% more than the distances or lengths given</td>
<td>10% more than the spacing shown</td>
</tr>
</tbody>
</table>

These tolerances must not be applied where a distance, length or spacing is already given in the text or a figure as a maximum, a minimum or a range on a TGS. They may need to be exceeded where road features such as intersections or median openings intervene with approval from the TGS designer who is PWZTMP qualified.

Any sign location changes must be marked and initialled on the TGS held on site, with the name of the person making the changes shown.

### 7.10.4 Modifying a TGS

Modifications to a Site Specific TGS must be approved by a person holding the PWZTMP qualification, and must be supported by a TMP or risk assessment to ensure all TGSs consider and mitigate identified site-specific conditions and risks.

The ITCP qualified person may vary the positioning of signs and devices provided the requirements of Section 7.10.3 Tolerances on positioning of signs and devices are met.

If it is identified that risk will be generated through the implementation of a TGS that requires modification outside of the tolerances, then works must be stopped (including the implementation of the TGS), the site must be made safe and an updated TGS must be provided by a PWZTMP qualified person prior to works recommencing.
7.10.5 Monitoring activities

In accordance with Section 8.1 Work site inspections, reviews and audits, initial and regular inspections must be completed.

Appendix E – Inspection checklists and tools, provides a checklist that may be appropriate for this purpose.

7.11 TGS review

7.11.1 Generic TGS review

Generic TGSs must be reviewed by a PWZTMP qualified person every 12 months so that they remain appropriate. Once reviewed the date and details of the PWZTMP person must be updated on the TGS to ensure persons selecting can confirm currency.

7.11.2 Site Suitable and Site specific TGS review

All active Site Specific and Site Suitable TGSs must be reviewed as part of the weekly inspections detailed in Section 8.1 Work site inspections, reviews and audits.

A Site Specific or Site Suitable TGS must only be used for the duration of the work activity noted on the TGS. If the work activity is intended to be longer than 12 months, then the TGS must be formally reviewed by a PWZTMP qualified person at least every 12 months and issued with the review date and the details of the PWZTMP qualified person undertaking the review, and recorded on the TGS.

7.12 TGS records

All implemented TGSs must be recorded and stored in accordance with Section 8.2 Record keeping of TTM documentation.