6 Signs and devices

6.1 General

This Section must be used to determine the use and placement of TTM signs and devices at Transport work sites by persons qualified with PWZTMP or ITCP as applicable. The Section includes defining the clearances and spacing for signs and devices as well as the sequence of installation and removal.

The devices in this Section include:

- Portable traffic control devices (PTCDs);
- Safety barriers;
- Traffic guidance and delineation devices; and
- Other safety devices.

In relation to this Section the following must not be used:

- Isolated or non-continuous safety barrier units;
- Barrier boards parallel to the direction of traffic flow; and
- Any other traffic control device that is not authorised for use.

For authorising the use of an unaccepted traffic control device see Section 2.8 Departures from this Technical Manual.

6.2 Clearances and spacing of signs and devices

6.2.1 Edge clearances for delineating devices and temporary safety barriers

Clearances between the edge of traffic lane and delineating devices or a road safety barrier system must be in accordance with Table 6-1. Clearances must be measured to the traffic side edge of delineating devices or barrier. This edge must also be the line from which clearances to the work area are measured for the purpose of determining treatments.

Where barrier shape includes feet, the clearance must be measured from the edge of the foot on the traffic side. Containment fences marking the limit of work area must be placed as specified in Section 6.8.3 Plastic containment tapes and fences.

Where it is not possible to achieve the edge clearances shown in Table 6-1, then alternatives must be determined based on a documented risk assessment and detailed in the TMP as per Section 2.8 Departures from this Technical Manual.

See Figure 6-1 and Figure 6-2 for further information.

Table 6-1. Edge clearances

<table>
<thead>
<tr>
<th>Edge of traffic lane to:</th>
<th>Edge clearances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line of traffic cones or bollards</td>
<td>• 0.5 m for traffic speeds less than 65 km/h</td>
</tr>
<tr>
<td></td>
<td>• 1.0 m for traffic speeds greater than 65 km/h</td>
</tr>
<tr>
<td>Barrier boards, temporary guide posts or</td>
<td>1.0 m</td>
</tr>
<tr>
<td>temporary hazard markers</td>
<td></td>
</tr>
</tbody>
</table>
### 6.2.2 Use of delineating devices on kerbs

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

Temporary kerbing used for delineation of the roadway on detours and side-tracks must be clearly delineated with red delineators on the left side and white on the right (two-way roadway) or yellow on the right (one-way roadway). Additional information relating to the use of temporary kerbing can be found in Section 6.8.5 Temporary kerbs.

### 6.2.3 Use of temporary safety barriers on kerbs

Where a kerb is traversed directly prior to impact with a temporary safety barrier, roll and pitch are developed which affect the interaction of the vehicle with the barrier, increasing the risk of the vehicle mounting the barrier.

Where installation of a temporary safety barrier is required behind a kerb the barrier must be installed:

- Greater than 1.5 m behind the kerb, to allow an errant vehicle to stabilise before striking the barrier; or
- Within 0.2 m of the kerb so that an errant vehicle has not had adequate time to develop significant pitch and/or roll.

Where temporary safety barriers are required to be installed behind kerbs on roads with a posted speed limit of 75 km/h a risk assessment must be performed to determine the most appropriate barrier position and detailed within the TMP.

### 6.2.4 Placement and clearances of registered plant or devices

This Section applies to registered plant or trailer mounted devices that are left unattended for a period of time on the road-side during roadworks, such as lighting towers and VMS. The plant and devices captured within this section generally have a physical size and mass such that they are not frangible and if positioned inappropriately can pose a potential road safety hazard.
Prior to placement of the plant or device, a site-specific risk assessment must be undertaken by the persons responsible for the work site to identify, assess and manage the risks associated with deployment. The risk assessment should consider:

- Location of specific hazards such as traffic, utilities, culverts, medians or embankments;
- Risks introduced as a result of the placement or operation of the device;
- Parking and removal of plant or device; and
- If the items be unloaded and loaded onto floats or rigid trucks.

When determining the placement and clearances, the plant or device must be located:

- In a lawful parking location i.e. not on a footpath;
- Behind a Transport accepted safety barrier or outside of the clear zone in accordance with Austroads *Guide to Road Design Part 6: Roadside Design, Safety and Barriers*;
- No less than the safe sight distance from an intersection, merge point, exit ramp, traffic control signal or sharp curves;
- In a position where road user sight lines are not obstructed;
- To provide for the safe movements of all road users, including cyclists, pedestrians (inclusive of mobility and vision impaired pedestrians) and heavy vehicles including wide loads;
- Where safe stopping sight distance to pedestrians at crossing points (e.g. refuges, pedestrian crossings, signalised intersections) are not obstructed; and
- Where adequate delineation can be provided such as bollards, traffic cones or temporary linemarking so that road users can perceive the location of the device at night or in low visibility.

When a device cannot be protected by a barrier or cannot be placed outside of the clear zone, the devices or vehicle must be positioned as far away from the edge of the traffic lane as is practical. If these requirements cannot be achieved, the departures process in *Section 2.8 Departures from this Technical Manual* must be followed to ensure that the safest possible location is determined for all road users.

Additional issues that should be considered when locating plant or devices include:

- Positioning relative to curves—avoid locating the device, plant item or other vehicle on the outside a curve;
- Avoid locating where vehicles are laterally moving or weaving across traffic lanes (i.e. at the end of merge or in the merge run out area); and
- The deflection zone of the relevant barrier systems
- When a device, plant item or other vehicle is being located behind a crash barrier. Adequate lateral separation should be provided between the back of the barrier and the device, plant item or vehicle to ensure that the performance of the system is not compromised.

Additional information specific to the placement of Variable Message Signs is contained in *Section 6.9.1 Variable message signs (portable)*.

### 6.2.5 Spacing of cones and bollards

Cones and bollards are used to define the traffic path past or through work areas (refer to *Section 6.8 Traffic guidance and delineation devices* for further information on types, sizes and uses of cones and bollards).
Maximum spacing of cones and bollards must be in accordance with *Table 6-2*. Where traffic volumes are high or other conditions warrant it, consideration should be given to reducing the spacing of cones to as close as 1 m to prevent traffic taking a wrong turn through cones or bollards.

### Table 6-2. Required maximum spacing of cones and bollards

<table>
<thead>
<tr>
<th>Purpose and usage</th>
<th>Speed zone of device location km/h</th>
<th>Maximum spacing m</th>
</tr>
</thead>
<tbody>
<tr>
<td>On approach to a traffic controller position (centreline or edge line)</td>
<td>All cases</td>
<td>4</td>
</tr>
</tbody>
</table>
| Merge tapers | 55 to 75  
greater than 76 | 9  
12 |
| Lateral shift tapers | 55 to 75  
greater than 76 | 12  
18 |
| Protecting freshly painted lines | 56 to 75  
greater than 75 | 24  
60* |
| All other purposes | less than or equal to 55  
56 to 75  
greater than 76 | 4  
12  
18 |

*Note* to *Table 6-2*: This spacing should be:
- Reduced on curves or crests or if the row of cones is not clearly defined at night.
- Extended to 60 m where the length of the line of cones or bollards exceeds 1 km but is not adjacent to locations where there are workers on foot.

### 6.2.6 Spacing of signs

Signs must be spaced in accordance with *Table 6-3*. The value of ‘Dimension D’ is used to determine the placement of signs, see *Section 7.3 Dimension D* for determining ‘Dimension D’.

### Table 6-3. Sign spacing requirements

<table>
<thead>
<tr>
<th>Number of signs</th>
<th>Approach speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>less than 65 km/h</td>
</tr>
<tr>
<td>One advanced sign</td>
<td>D</td>
</tr>
<tr>
<td>Multiple advanced signs</td>
<td>D</td>
</tr>
</tbody>
</table>

Where there is more than one advance sign position, the advance sign nearest the work area must be placed D from the beginning of the taper area or diversion and other advance sign positions at successive spacing of D further in advance of the work area.

Tolerances for positioning on signs and devices is detailed in *Section 7.10.3 Tolerances on positioning of signs and devices*.
6.3 Maintaining temporary signs and devices

Work site temporary signs and devices need to be consistently maintained with particular attention given to the following:

- Signs and devices displayed must remain appropriate for changing circumstances during the work;
- Signs which are not required between shifts must be covered;
- Sign placement, including covers must be checked after weather events;
- Signs and devices must be in good condition;
- Damaged or disfigured signs in the work environment must be replaced as soon as possible, especially if the warnings displayed are not clear;
- Signs and devices erected before they are required must be covered by a suitable, opaque material in accordance with AS 1742.3. A suitable material may be WF 200 woven polypropylene material. The cover must be removed immediately prior to the commencement of work;
  
  **Note:** Covering signs with hessian material does not sufficiently inhibit the sign's retroreflective performance and should not be used. Additionally, dark coloured and plastic materials may cause overheating or excessive moisture build-up and therefore damage to the sign.
- If used at night, signs and devices must be inspected at night (see Appendix E – Inspection checklists and tools).
- Signs must not display conflicting messages; and
- Temporary signs displays must not be altered or changed by adhering non-approved materials to the sign face. For example, roadwork speed zones must not be altered by using tape or any other similar material.

The condition of signs must be checked prior to installation and as a part of regular TTM inspections. See Section 8.1 Work site inspections, reviews and audits.

6.4 Sequence for installation and removal of signs and devices

6.4.1 General

The sequence for installation and removal of signs and devices must be considered in the TMP and documented on the TGS or another site document such as a SWMS. The installation and removal of signs and devices must:

- Be undertaken in accordance with the procedures shown on the TGS or other document;
- Be planned to be in the direction of normal traffic flow;
- Not require workers to cross roads or carriageways on foot; and
- Be undertaken with a work vehicle with a flashing arrow or rotating or flashing light(s) is positioned between the workers and approaching traffic.

Special consideration must be given for the removal of signs on central medians and barriers on multi-lane divided carriageways, i.e. a site-specific TGS or use of a work convoy etc.
6.4.2 Installation

Before work commences, signs and devices at the work site must be installed in a sequence that is safe and efficient. After the work area has been located, via the use of a GPS, survey, landmarks, side streets or chainage, setting up a site to install signs and devices should be in accordance with the general procedures described below:

2-lane, 2-way roads

For 2-lane, 2-way roads, installation should occur in the following order:
1. Install termination signs (if no side roads).
2. Install on side streets.
3. Install in the non-working lane (unaffected direction).
4. Install in the working lane (affected direction).

*Figure 6-3* provides an example sign installation sequence for a 2-lane, 2-way road.

![Figure 6-3. Example sign installation sequence for a 2-lane, 2-way road](Image)

Multi-lane roads

For multi-lane roads, installation should occur in the following order:
1. Install signs and devices for the non-working lane (un-affected direction).
2. Install signs and devices for the working lane (affected direction).

Special consideration must be given to the installation of signs on central medians and barriers on multi-lane divided carriageways. In such cases, a site-specific TGS or use of a convoy may be required.

*Figure 6-4* provides an example sign installation sequence for a multi-lane road.

![Figure 6-4](Image)
A different implementation sequence may needed for site specific circumstances, e.g. install End Roadwork and reinstate the existing permanent speed limit first.

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

For long-term or recurring short-term sites, consideration should be given to marking the desired location of each sign or device on the road for easy placement.

6.4.3 Removal

Removal of traffic control signs and devices should be undertaken in the reverse order of installation, progressing from the work area out toward the approaches. On motorway type carriageways, the removal of signs can be difficult in this sequence, in which case, signs should be removed in the same order that they were installed. The work vehicle should be positioned between the workers and approaching traffic when removing signs in this manner.

When removing delineation devices, such as cones, bollards or barrier boards used to close a lane, an advanced warning vehicle should be used to warn road users of workers on foot and a work vehicle must also be positioned between the workers and approaching traffic.

A work vehicle must only proceed in a forward direction towards approaching traffic along the closed roadway if it is determined by the PWZTMP or ITCP qualified person that it is safe to do so. This should not occur at night time where it may create motorist confusion or distraction, such as headlight glare.

6.4.4 High risk sites

At sites where it is deemed too difficult or unsafe to install and remove control signs and devices in accordance with the above general principles, special arrangements to complement the above general principles must be adopted to maintain worker safety. These arrangements must be documented as part of the TMP and the relevant TGS or SWMS, and mitigation measures incorporated into the work practice that is adopted. This may mean that signs are removed in the same order that they were erected to allow the work vehicle with a rotating or flashing light(s) and flashing, to move in the direction of normal traffic flow when use of the travel lane is the only alternative.
6.5 Traffic control signs

6.5.1 General

Standard TTM signs must be used wherever one suitable for the purpose exists. All existing signs can be found in the Traffic Signs Register. Where a suitable standard traffic sign does not exist, the process detailed in Section 2.8.2 Use of unapproved signs must be followed.

Signs referred to in this Technical Manual follow the naming and numbering conventions of AS 1742.1, which is summarised in Table 6-4.

Table 6-4. Sign naming and numbering convention

<table>
<thead>
<tr>
<th>Class</th>
<th>Function in TTM</th>
<th>TTM Sign example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory sign (R)</td>
<td>To regulate the movement of traffic by indicating when or where a legal requirement applies, failure to comply constitutes an offence.</td>
<td>STOP HERE ON RED SIGNAL (R6-6)</td>
</tr>
<tr>
<td>Warning sign (W)</td>
<td>To warn road users of unexpected or hazardous conditions on or adjacent to the road.</td>
<td>Traffic Lights symbolic (W3-3)</td>
</tr>
<tr>
<td>Direction sign (G)</td>
<td>To inform and advise road users of directions or non-regulatory traffic instructions.</td>
<td>Speed limit AHEAD sign (G9-79)</td>
</tr>
<tr>
<td>Temporary signs (T)</td>
<td>To control, warn and guide road users safety through, around or past work sites on roads and footpaths and to warn and advise of other temporary hazardous conditions that could endanger road users.</td>
<td>ROADWORK AHEAD (T1–1)</td>
</tr>
</tbody>
</table>

Where, due to regulatory requirements, NSW is required to have a variation to the design of an Australian Standard sign, an ‘n’ following the sign number will be included. Examples include:

- Speed Limit ROADWORK (R4-212n) sign;
- SHOULDER CLOSED (T2-19n) sign; and
- ONE LANE (R9-9n) sign.

6.5.2 Types of signs

Examples of traffic control signs grouped into broad categories, are provided in Table 6-5.

Table 6-5. Examples of signs used for a typical category

<table>
<thead>
<tr>
<th>Category</th>
<th>Example signs</th>
<th>Sign number</th>
</tr>
</thead>
</table>
| Work site approaches and departures | ROADWORK AHEAD  
GRADER AHEAD  
END ROADWORK | T1-1  
T1-4  
T2-16 |
| Regulatory control of traffic     | Speed limit ROADWORK  
PREPARE TO STOP  
STOP HERE ON RED SIGNAL | R4-212n  
T1-18  
R6-6 |
Signs must be designed and manufactured in accordance with AS 1743. Details of each letter must be as shown in AS 1742.2. The retroreflective material used on signs must be Class 400 or Class 400T material complying with AS 1906.1.

### 6.5.3 Sign sizes

Individual signs are available in two main sizes, known as ‘A size’ or ‘B size’ with ‘C size’ and ‘D size’ available as larger options. The dimensions of the sign sizes vary depending on the sign.

Conditions for use of the different sign sizes are provided in Table 6-6. The TGS designer is responsible for selecting sign sizes and therefore must ensure that they are shown on the TGS.

<table>
<thead>
<tr>
<th>Sign Size</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A size</strong></td>
<td>Must be used when any of the following conditions are met:</td>
</tr>
<tr>
<td></td>
<td>• Directed at pedestrians or cyclists;</td>
</tr>
<tr>
<td></td>
<td>• The lateral offset of the sign from the travel path is less than 4.5 m; or</td>
</tr>
<tr>
<td></td>
<td>• The lateral offset of the sign from the travel path is between 4.5 m and 8 m and the posted speed is less than 95 km/h.</td>
</tr>
<tr>
<td><strong>B size</strong></td>
<td>Must be used when any of the following conditions are met:</td>
</tr>
<tr>
<td></td>
<td>• The conditions for A size signs are exceeded;</td>
</tr>
<tr>
<td></td>
<td>• The sign is a roadwork speed zone sign used on roads where the existing permanent speed limit is greater than 55 km/h;</td>
</tr>
<tr>
<td></td>
<td>• The relevant A size sign is less than 1 m² in area and traffic speeds are greater than 65 km/h;</td>
</tr>
<tr>
<td></td>
<td>• On motorway type roads for added emphasis of the onset of works, detours or closures; or</td>
</tr>
<tr>
<td></td>
<td>• For display of any other critical safety messages</td>
</tr>
</tbody>
</table>
### Sign Size

<table>
<thead>
<tr>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>C size and D size</td>
</tr>
<tr>
<td>Must be used when any of the following conditions are met:</td>
</tr>
<tr>
<td>• The sign is a roadwork speed zone sign used on motorway type roads, multi-lane roads, or higher speed roads;</td>
</tr>
<tr>
<td>• There is considered to be a need to emphasise the message; or</td>
</tr>
<tr>
<td>• There is excessive lateral offset of the sign.</td>
</tr>
</tbody>
</table>

**Note:** Details of standard sign sizes are contained in Transport electronic Traffic Signs Register and AS 1742.1.

### 6.5.4 Sign mounting

The method of mounting signs must consider the duration of display, the placement location and frequency of removal or covering. Signs may be mounted in frames or on posts; however at all times the signs must:

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

For ease of installation and removal, signs mounted in frames are the preference for works taking less than two weeks. Signs required for works which will be in progress for less than two weeks may be erected in a permanent manner if it is considered to be justified.

Signs continuously required for works, which will be in progress for longer than two weeks, should be installed on posts in a permanent manner.

*Table 6-7* provides the requirements for frame and post mounted signs.

### Table 6-7. Frame and post-mounted sign requirements

<table>
<thead>
<tr>
<th>Sign mount</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs mounted in frames</td>
<td>When using frames to mount signs they must be quick and easy to install as well as easy to handle, transport and store. When in a frame, the minimum height to the lower edge of the sign should be 200 mm. For requirements specifically associated with frame mountings of multi-message signage, see <em>Section 6.5.8 Multi-message signs</em>.</td>
</tr>
</tbody>
</table>
| Signs mounted on posts            | When signs are mounted on posts, the locations of any underground utilities must be determined prior to installation. The ability to install signs on posts may be restricted:  
• In narrow cuttings;  
• Where underground utilities are located;  
• Behind safety barriers where off-sets might be too great; or  
• Where it is undesirable to damage the asset for installing.  
When installed in open road situations, the underside of the sign must be at least 1.5 m above the level of the nearest edge of the travelled path. When installed on a kerb or footpath, the underside of the sign must be at least 2.2 m above the level of the nearest edge of the travelled path to reduce impact on vulnerable road users or interference from parked vehicles. |
6.5.5 Sign placement

Placement of signs must be arranged so that they are prominently displayed to traffic and will command attention. Signs must be properly displayed at all times and within the line of sight of the intended road user. Regulatory and detour signs must be located nearest to the travel edge of the lane. Signs must not:

- Be obscured from view such as vegetation or parked cars;
- Obscure other devices from the line of sight of road users;
- Create a hazard to road workers and road users (see Section 4.4 Providing for specific road users for additional provisions for specific road users);
- Be a hazard that deflects traffic into an undesirable path; or
- Restrict sight distance for drivers entering from side roads or streets, or private driveways.

The visibility of a sign can be affected by shade, the direction of the sunlight, and background conditions including lighting and oncoming headlights.

Where installed, signs must be oriented to ensure adequate line of sight for approaching road users (see Figure 6-5):

- On the outside of a curve, the sign face must be at 90 degrees, or “normal to traffic”;
- On a straight, the sign face must be angled at approximately 95 degrees away from oncoming traffic; and
- On the inside of a curve, the sign face must be angled at approximately 95 degrees away from oncoming traffic at 200 m preceding the sign.
Signs must be placed in accordance with Table 6-8.

Table 6-8. Sign placement provisions

<table>
<thead>
<tr>
<th>Placement of signs</th>
<th>Provision</th>
</tr>
</thead>
</table>
| For short term works | Signs mounted on portable supports used for short-term operation must be located as follows:  
  * In open road areas*—on the road shoulder a minimum of 1 m clear of the travelled way.  
  * In built up areas*—behind the kerb if visible to oncoming traffic and not obstructing vulnerable road users or on the pavement, as near as practicable to the kerb, provided the sign is not obscured by parked vehicles and without obstructing moving traffic. |
# Placement of signs

<table>
<thead>
<tr>
<th>Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For long term works</strong></td>
</tr>
<tr>
<td>Signs mounted on posts used for long-term operation must be located as follows:</td>
</tr>
<tr>
<td>• <em>In open road areas or roads without kerbing</em>—signs should be placed clear of the outer edge of the shoulder and, where possible, at least 2 m clear of the travelled path, whichever is the greater clearance.</td>
</tr>
<tr>
<td>• <em>In built up areas or roads with kerbing</em>—signs should be placed at a minimum of 300 mm clear distance behind the kerb.</td>
</tr>
<tr>
<td>All signs mounted on posts should be mounted at heights specified in Section 6.5.4 Sign mounting.</td>
</tr>
</tbody>
</table>

## 6.5.6 Duplication of signs

Consideration should be given to duplicating signs as a measure to improve worker and road user safety when developing a TMP and TGS. Where practical, signs should be located on both sides of the roadway for undivided roads, or on the left hand side and on the median for divided roads where there is sufficient median width.

Signs should be duplicated:

- On multilane roads with volumes of 10,000 vpd or greater;
- For lane status signs (T2-6-1, T2-6-2 etc.) regardless of vpd;
- On the outside of left hand curves where the sign is seen on approach to the work area;
- On medians of dual carriageways where parked vehicles or other objects obscure kerb side/footpath signs; and
- At other locations where conditions are such that duplicate signs improves safety and guidance as identified in the TMP or risk assessment.

Duplication of signs should not be used, where:

- It will introduce potential safety risks during installation;
- It will be necessary to cross the road on foot carrying signs;
- The shoulder is too narrow to position the signs or to park the work vehicle; or
- The duplicated signs have too large a lateral offset as to not be obvious to motorists e.g. on a six lane, two way undivided road.

The decision to not duplicate signs in accordance with the above provisions must be documented in the TMP.

On multi-lane roads where there is no room for duplicate signs on medians, consideration should be given to placing supplementary signs on the left hand side.

Details of duplication of speed zone signs are contained within the speed zones Section 4.5.5 Implementation.

## 6.5.7 Dual sign arrangements

Dual sign arrangements are two independent signs displayed together at one position either side by side, as shown in Figure 6-6 or 'stacked', as shown in Figure 6-7. Dual sign arrangements may be used, provided all of the following conditions are met:

- The size of both signs, including the legend, size of symbol or area occupied by the legend is unchanged from the standard sign;
- The lateral offset meets the requirements of Section 6.2.6 Spacing of signs; and
- Where used in a dual sign arrangement, regulatory or detour signs must be located nearest to the travel edge of the lane.

![Figure 6-6. Side-by-side dual sign arrangements](image)

![Figure 6-7. Stacked dual sign arrangements](image)

### 6.5.8 Multi-message signs

#### 6.5.8.1 General

Multi-message signs (MMS) are two or more logically related signs displayed within one mounting frame. For Transport roadwork, MMS may be used, provided both of the following conditions are met:

- The existing permanent speed limit is less than 65 km/h; and
- The MMS frame has the dimensions shown in either Figure 6-10 or Figure 6-11.

Additionally, an MMS must not:

- Be used on multi-lane carriageways;
- Contain messages that are not relevant to the works being performed; or
- Contain empty panels (empty voids).

MMS should not be used where the lateral offset of the sign is close to allowable limits, due to insufficient time for drivers to fully read and comprehend the message being displayed. Examples of typical MMS use and layouts are contained in Figure 6-8 and Figure 6-9.
6.5.8.2 Frame and sign sizes

*Figure 6-10* and *Figure 6-11* show the two permitted sizes of multi message sign frames.

![Figure 6-10. Three sign MMS frame](image)

![Figure 6-11. Dual sign MMS frame](image)
Table 6-9 shows the permitted MMS dimensions and sizes.

### Table 6-9. Permitted MMS sign dimensions and sizes

<table>
<thead>
<tr>
<th>Sign dimension (mm)</th>
<th>Sign Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>600 x 600</td>
<td>M-A</td>
</tr>
<tr>
<td>1200 x 300</td>
<td>M-B</td>
</tr>
<tr>
<td>1200 x 600</td>
<td>M-C</td>
</tr>
<tr>
<td>600 x 900</td>
<td>M-D</td>
</tr>
</tbody>
</table>

#### 6.5.8.3 Combinations

When determining the combination of signs to be used in an MMS frame, the following conditions must be met:

- No more than one regulatory sign is used per MMS frame;
- The regulatory sign must be located in the top position of the frame, closest to the traffic;
- There must not be more than two signs consisting of words only;
- When using two 600 mm x 600 mm signs, at least one 600 mm x 600 mm panel must contain a symbolic sign;
- All signs are placed horizontally;
- A blank retroreflective yellow panel must be placed within any unused panel of the frame; and
- Signs that are not published in the [Traffic Signs Register](#) for MMS use must not be used.

*Figure 6-12 to Figure 6-26* are examples of possible MMS combinations.
Figure 6-12. Sign numbers: TM1 and GM9-79

Figure 6-13. Sign numbers: TM1-1 and RM4-212n

Figure 6-14. Sign numbers: TM1-32 and RM2-66n-L

Figure 6-15. Sign numbers: RM2-66n-R and TM1-32

Figure 6-16. Sign numbers: RM2-11 and RM4-212n

Figure 6-17. Sign numbers: RM2-7 and RM4-212n

Figure 6-18. Sign numbers: TM1-3-1 and TM1-28

Figure 6-19. Sign numbers: TM2-17 and RM4-1

Figure 6-20. Sign numbers: TM1-5, TM1-18 and TM1-100

Figure 6-21. Sign numbers: TM1-5, TM1-3-1 and TM1-100
6.5.9 Requirements for specific signs

Table 6-10 provides the requirements and conditions of use of specific TTM signs. During aftercare arrangements, when not in use, or the relevant work is not being performed, the signs must be covered or removed.

Table 6-10. Requirements and conditions of use for specific TTM signs

<table>
<thead>
<tr>
<th>Sign</th>
<th>Conditions</th>
<th>Notes</th>
</tr>
</thead>
</table>
| Workers symbolic (T1-5)     | Must be used where worker on foot will be visibly working adjacent to traffic. | The sign must be:  
  - Covered or removed where there are no workers on foot; and  
  - Used with the NEXT 2km (T1-28) sign at frequently changing work areas. |
| PREPARE TO STOP (T1-18)     | Must be used where traffic is required to stop at a PTCD or traffic controller. | The sign must be used with the relevant PTCD warning sign or traffic control sign. |
| Trucks symbolic (W5-22)     | Must be used where roadworks generate greater than 20 truck turning movements per day. | The sign (T2-25) is restricted to short term work only. These signs may be used in conjunction with __ m ON LEFT/RIGHT (W8-207). |
| Trucks symbolic (T2-25)     |                                                                             |                                                                      |
### Sign Conditions Notes

<table>
<thead>
<tr>
<th>Sign</th>
<th>Conditions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROAD PLANT AHEAD (T1-3-1)</td>
<td></td>
<td>The sign must be used with the NEXT 2km (T1-28) sign for frequently changing work areas. 2 km may be increased to 10 km for shoulder grading and mowing in open road areas and for maintenance grading on unsealed roads.</td>
</tr>
<tr>
<td>GRADER AHEAD (T1-4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 6-11 provides the requirements and conditions of use of specific TTM signs that may remain uncovered during aftercare arrangements. The signs must be used where the stated conditions apply.*

**Table 6-11. Requirements and conditions of use for specific aftercare TTM signs**

<table>
<thead>
<tr>
<th>Sign</th>
<th>Conditions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROADWORK AHEAD (T1–1) or (T1-31)</td>
<td></td>
<td>The signs may be used:</td>
</tr>
<tr>
<td>BRIDGEWORK AHEAD (T1-2)</td>
<td></td>
<td>• With the NEXT 2km (T1-28) sign for frequently changing work areas; and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Short-term works where additional advance warning is warranted.</td>
</tr>
<tr>
<td>ROADWORK X km AHEAD (T1–16)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRIDGEWORK X km AHEAD (T1-29)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Must be used where:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The approach speed is greater than 85 km/h; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sight distance is less than 150 m.</td>
<td></td>
</tr>
<tr>
<td>ROADWORK ON SIDE ROAD (T1-25)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Must be used in advance of an intersection to warn of the relevant activities on the side road where there is insufficient distance on that road to provide the required warning.</td>
<td></td>
</tr>
<tr>
<td>SIDE ROAD CLOSED (T1-32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRAFFIC HAZARD (T1–10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STOP HERE ON RED SIGNAL (R6-6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Must be used:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Where traffic is required to stop in compliance with a PTS (placed 6 m in advance of the PTS); and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• With the SIGNALS AHEAD (T1-30 or W3-3) sign.</td>
<td></td>
</tr>
</tbody>
</table>
### Signpostings of roadwork speed zones

In accordance with Section 4.5 Speed zones, roadwork speed zones must be implemented to assist in managing the risk to road users or road workers where there is a hazard on or surrounding the road. When designing a TGS that includes a roadworks speed zone the following requirements must be followed:

<table>
<thead>
<tr>
<th>Sign</th>
<th>Conditions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>END ROADWORK (T2–16) or (T2-17)</td>
<td>Must be:</td>
<td>The T2-16 sign is preferred wherever space available as the site allows it to be used</td>
</tr>
<tr>
<td></td>
<td>• Placed at a distance D from the work site to indicate that normal traffic conditions have resumed when ROADWORK AHEAD (T1-1) or ROADWORK X KM AHEAD (T1-16) signs are used; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Placed adjacent to or after any signs indicating the reinstatement of an existing permanent speed limit.</td>
<td></td>
</tr>
<tr>
<td>Slippery symbolic (T3-3)</td>
<td>Must be installed to warn motorists of conditions which make a roadway surface temporarily hazardous.</td>
<td>On long work sites these signs should be repeated at intervals of not more than 500 m</td>
</tr>
<tr>
<td>SOFT EDGES (T3-6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROUGH SURFACE (T3-7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRAVEL ROAD (T3-13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loose stones symbolic (T3-9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOOSE SURFACE (T3-14)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO LINES DO NOT OVERTAKE UNLESS SAFE (T3-12)</td>
<td>Must be used in a 2-lane, 2-way road when:</td>
<td>• T3-12 may be used where overtaking would normally be permitted in an oncoming traffic lane.</td>
</tr>
<tr>
<td>NO LINES DO NOT OVERTAKE (TM3-12-1n)</td>
<td>• Lines have been removed; or</td>
<td>• TM3-12-1n must be used where barrier lines would normally be installed and overtaking is not permitted.</td>
</tr>
<tr>
<td>NEW WORK NO LINES MARKED (T3-11)</td>
<td>• A new seal has been installed.</td>
<td>• Must not be used where there is an unacceptable risk of collision due to oncoming traffic. In such cases, T3-12 or TM3-12n as applicable must be used.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Roadworks speed zone signs used on roads where the existing permanent speed limit is greater than 55 km/h, must be at least ‘B’ size. On motorway type roads, multi-lane roads, or higher speed roads, ‘C’ size signs may be erected;

• When a roadworks speed zone is introduced, speed limit signs or markings (see requirements below) and advisory speed limit signs in the zone which show conflicting speeds, must be covered or removed;

• When erected, roadwork speed limit restriction signs must be:
  ° Located within 5 m of the edge of the outer travel lane; and
  ° Clearly visible to traffic. In urban areas the location of the sign may be adjusted to avoid parked vehicles, other signs or obstructions.

• Where there are multiple work crews within a job site or over a length of road, separate zones may be needed for each work area in order to avoid an excessively long and restrictive speed zone. This will be relevant where 30 km/h speed zones have been installed to support the safety of workers on foot in a particular location within a work site. The minimum lengths stated in Section 4.5.6 Minimum length zones may be used as a guide when designing the TGS in this instance; and

• For long-term work, in place for longer than four weeks, the existing speed limit pavement numerals should be removed in accordance with Section 6.8.8 Removal of pavement markings and markers. Pavement markings for roadworks speed zones are typically not installed.

Table 6-12 provides the requirements and conditions for use of specific roadwork speed limit signs, that must be used in accordance with the stated conditions.

Table 6-12. Requirements and conditions of use of specific roadwork signs

<table>
<thead>
<tr>
<th>Sign</th>
<th>Condition’s</th>
<th>Notes</th>
</tr>
</thead>
</table>
| Speed limit AHEAD (G9-79) sign            | Speed Limit AHEAD signs must be erected where the speed of traffic on the approach to the temporary speed zone is 35 km/h or more than the temporary limit. The Speed Limit AHEAD signs must be located 2D in advance of the initial roadworks speed zone (R4-212n) signs. | Speed limit ahead signs should only be used when it is essential to provide motorists with information that is not otherwise evident, or where the reduction in speed is significant. Speed Limit AHEAD signs should also be considered for use:
  • Where there is insufficient sight distance;
  • On downhill approaches;
  • Where, under normal driving expectations, the change in speed zone is not apparent to road users; and
  • In complex roadside environments where there is competing signage or factors such that the speed zone change might not be apparent to road users |
| Speed Limit ROADWORK (R4-212n) sign      | At the start of a roadworks speed zone, Speed Limit ROADWORK signs must be erected on both sides of the carriageway. Repeater signs must be erected on the left side of the carriageway at a maximum spacing of 500 m. They must also be erected where traffic enters from a side road within a roadworks speed zone. | Where this is not possible a second sign must be erected 0.5D from the start of the zone. |
### 6.6 Portable traffic control devices

#### 6.6.1 General

A portable traffic control device (PTCD) is a device designed to manually control traffic. A PTCD is designed to reduce risk to traffic control personnel by enabling use and control of the device via a remote, enabling the operator to be located outside of the live lane of traffic. PTCDs may include but are not limited to PTS and boom barriers.

In accordance with Section 5.4 Traffic control, a PTCD must be used instead of a manual traffic controller for all work sites under traffic control when the existing permanent speed limit is above 45km/h. The decision to not use a PTCD must be documented in the TMP and must be considered in associated risk assessments.

When developing a TMP, or selecting or designing a TGS for the use of a PTCD, the relevant qualified person must consider:

- Queue length estimates;
- Expected traffic flows;
- Operational efficiency of the device and the expected delay and queue lengths; and
- Any lost time associated with use for e.g. lowering of boom.

*Appendix B – Device use requirements* provides additional requirements in relation to the use, installation, operation and removal of accepted PTCD types. The requirements provided for these devices must be read in conjunction with relevant specifications and manufacturer’s instructions.

#### 6.6.2 Delegation and approval

Prior to the use of a PTCD, the appropriate approval must be sought and granted.

Before using a PTS, two approvals are required:

- Type approval of the equipment as per the relevant Usage Procedure for the PTS device; and
- Approval from the relevant delegated representative.
Within Transport, a person at or above the level of section manager within Transport has the delegated authority to approve the installation of the PTS.

Other Road Authorities in NSW (i.e. Councils) have delegated authority to use PTS in specific situations. No other delegated authority has been given to other agencies or persons. This means that public utility authorities and contractors working on public streets have no delegated authority to use PTS and will need to apply to Transport for authorisation to do so.

No delegation is required for the installation of a portable boom barrier; however before using a portable boom barrier, two approvals are required:

- Either a Transport Infrastructure Product Evaluation Scheme (‘TIPES’) certification or type approval as per the relevant Usage Procedure for the device; and
- Project approval for use on each job.

### 6.6.3 Type 2 (automatic) portable traffic signal (PTS) systems

The type 2 PTS, also known as automatic PTS can be controlled under vehicle actuated or fixed time operational modes. A type 2 (automatic) PTS can also be controlled manually by a traffic controller using a remote control.

Type 2 PTS may be used for traffic control applications lasting up to three months. For sites where work will continue for longer periods, without the location of the work site changing, a risk assessment and feasibility analysis must be carried out to determine whether the extended use of portable signals is acceptable or whether a temporary signal installation should be provided. This risk assessment and feasibility analysis must be submitted to Traffic Engineering Services for review and the concurrence of the Director Traffic Engineering Services obtained for the use of the portable signals for an extended period.

A type 2 PTS must be used in accordance with Appendix B.2 Usage procedure: Type 2 (automatic) portable traffic signal systems.

### 6.6.4 Type 1 (manual) portable traffic signal (PTS) systems

The Type 1 PTS is a compact portable system that is manually controlled by a traffic controller using a remote control. A Type 1 PTS may be used with or without the addition of a boom arm. Where used:

- Type 1 (manual) PTS devices must have type approval in accordance with Transport Specification TSI-SP-059 Type 1 Portable Traffic Signals.
- Type 1 (manual) PTS devices with a boom arm (Type 1 PTS-B) must have type approval in accordance with Transport Specification TSI-SP-081 Type 1 Portable Traffic Signal with Boom Barrier.

Type 1 PTS or Type 1 PTS-B may be used when controlling a single-lane of traffic where either shuttle flow or plant crossing control is required.

Type 1 PTS and Type 1 PTS-B must not:

- Be installed on multi-lane carriageways; or
- Be installed for work sites where the traffic speed in the work zone is greater than 65 km/h.
All Type 1 PTS and Type 1 PTS-B must be used in accordance with Appendix B.3 Usage procedure: Type 1 (manual) portable traffic signal systems.

### 6.6.5 Portable boom barriers

A portable boom barrier is controlled by a traffic controller using a remote control. A portable boom barrier is an alternative to other devices such as PTS. Portable boom barriers are required to have either a Transport Infrastructure Product Evaluation Scheme (‘TIPES’) certification or Transport type approval. At the time of publication of this Technical Manual, a Transport specification for portable boom barriers is not available.

Portable boom barriers are not suitable in all traffic environments, but may be suitable for locations where there are sufficient gaps in traffic to safely lower the boom.

Portable boom barriers may be installed when controlling a single-lane of traffic in a single direction. **Note:** Two portable boom barriers may be used when controlling a single-lane in opposite directions for either shuttle flow or plant crossing control situations.

Portable boom barriers must not:

- Be installed on multi-lane carriageways; or
- Be installed for work sites where the traffic speed in the work zone is greater than 65 km/h.

A portable boom barrier must be used in accordance with Appendix B.4 Usage procedure: portable boom barriers.

### 6.7 Temporary safety barriers

#### 6.7.1 General

Work zone temporary safety barriers are used at work sites to prevent vehicles encroaching on work areas and to ensure the safety of the workers from errant vehicles.

Work zone temporary safety barrier products must be accepted for use by Transport. Accepted safety barriers have been assessed and conform to the requirements of AS 3845. Unless the barrier, including attachment, has been tested and accepted, devices such as signage, lighting posts, screens or work platforms must not be attached to temporary safety barriers.

The use of safety barriers during temporary works should be considered as part of the project TMP and risk assessment. The Austroads Guide to Road Design Part 6: Roadside Design, Safety and Barriers provides detailed guidelines for analysing risks, severity and design of safety barriers on temporary roads and detours as well as for the protection of workers in defined work areas adjacent to traffic.

It should be noted that barriers are an introduced obstruction. When the reason for their inclusion in the road side environment no longer exists, the barriers should be removed as soon as practicable. Barriers must only be used for their intended purpose, since they can present a hazard in the work area or work site if used otherwise. If temporary safety barriers are proposed to be used such that they are not placed parallel to traffic, Road Design must be consulted to determine minimum lengths and placement angle in relation to passing traffic so that the risk of injury is minimised if the barrier is inadvertently struck.

For long-term, complex or high risk projects, advice should be sought from Road Design for barrier selection and design.
6.7.2 Use of temporary safety barriers

Work zone temporary safety barriers must be installed in accordance with their acceptance conditions and manufacturer’s requirements. This ensures in-field performance during impact is as expected based on crash testing undertaken. The list of accepted work zone temporary safety barriers systems and their acceptance conditions can be found on the Transport Safety Barrier Products website.

Additional information is provided in Section 6.2.1 Edge clearances for delineating devices and temporary safety barriers for clearance requirements and restrictions on installing safety barriers on kerbs.

Temporary safety barriers may be used:

- To separate opposing traffic streams where there are potentially hazardous conflicts, such as the risk of head-on collisions;
- Where there are excavations or hazardous fixed objects close to the travelled way;
- Where there is inadequate separation from temporary foot paths or bicycle paths; or
- Where there are embankments within the vicinity of works.

Temporary safety barriers are not delineation devices and therefore must not be used alone for the purposes of delineation. However, they may be used to assist delineation, provided other signs and devices, such as cones or bollards are also in place.

When determining the appropriate temporary safety barrier for use, the dynamic deflection and working width relevant to the barrier type must be considered, and an exclusion zone delineated to ensure workers do not access these areas.

Dynamic deflection is the largest transverse deflection of a road safety barrier system during an actual crash or during a full-scale impact test (i.e. the amount the road safety barrier deflects from its initial position during impact (see Figure 6-27)).

An exclusion zone is the area behind the barriers that must be maintained as being clear of materials, workers or plant considerate of the dynamic deflection.
See Section 6.2.1 Edge clearances for delineating devices and temporary safety barriers for details on clearances, placement and location of barriers.

Where work zone temporary safety barriers are designed for use as part of a work site, a Temporary Safety Barrier Design Statement should be completed and included in the TMP. A Temporary Safety Barrier Design Statement should include:

- Location and direction barriers;
- Barrier type and specific design requirements;
- Terminals required;
- Transitions, including overlap requirements of different systems;
- Installation sequence; and
- Any relevant diagrams to assist the installation of the design.

The Temporary Barrier Design Statement should also include the ability for persons installing or inspecting to sign off that the barrier system is in accordance with the Design Statement. A Temporary Barrier Design Statement template is provided in Appendix A.2.4 Temporary barrier design statement for this purpose.

### 6.7.3 Mobile safety barriers

Mobile safety barriers are a portable barrier system attached to a prime mover and are designed to provide protection to workers in both static and dynamic work environments.

A barrier trailer, when deployed correctly, aims to absorb the impact and deflect a vehicle which has left the intended path and entered the work site. The purpose of the mobile barrier is to protect the road workers behind it whilst maintaining the safety of the road user.

In a static environment, mobile safety barriers provide an additional form of work site protection.

When used for dynamic work, the portable temporary barrier system is designed to take the place of the work vehicle and the shadow vehicle within the work convoy (see Figure 6-28).
Mobile safety barriers must only be used when all of the following conditions are met:

- The mobile safety barrier is accepted for use by Transport;
  
  Note: At the time of publication of this Technical Manual, the only accepted mobile safety barrier is “Mobile Barrier Truck – MBT-1”.

- The temporary speed limit is less than 85 km/h;

- The exclusion zone behind the barrier is a minimum of 0.4 m;

- When deployed parallel to direction of traffic; and

- When a crash tested truck-mounted attenuator (TMA) is used as a tail vehicle.

Mobile safety barriers must not be used:

- As a work platform or with attachments such as lifting equipment or working platform; or

- With any additional attachments for the purpose of undertaking work on a work site.

Mobile safety barriers must comply with Transport Specification R132 and with Transport’s Acceptance Conditions – Mobile Barriers MBT-1.

Example of work site layout for use in static and dynamic work sites are provided in Appendix D – Work type layout examples.

6.8 Traffic guidance and delineation devices

6.8.1 General

Delineators used at or near works on roads must meet the requirements of AS/NZS 1906.2 for either the sheeting or discrete device type. Delineators made from orientation-sensitive material must be made and installed in accordance with the manufacturer’s recommended orientation for optimum performance. Delineators must be used in accordance with AS 1742.2 and Delineation guide.

6.8.2 Barrier boards

For use as traffic guidance devices, barrier boards must:

- Comply with Transport QA Specification 3385;

- Alternate diagonal stripes of black and retroreflective yellow, terminating in yellow at each end as illustrated in Figure 6-29;
• Have diagonal stripes aligned to face down;
• Be placed at right angles to traffic flow;
• Be placed at a maximum spacing of 100 m; and
• Be secured so that they are not moved or blown over by winds or pressure from heavy vehicles.

Where barrier boards are placed facing traffic, the bars need to be consistently pointing in the same direction. The bars on the barrier board must point down toward the side that vehicles are required to pass. For example, traffic is required to pass to the right of the barrier board as shown in Figure 6-29.

Barrier boards must not:
• Be used as delineation devices;
• Be placed parallel to the direction of traffic flow. This ensures maximum visibility of the barrier board and prevents it from becoming a spearing hazard if struck by an out-of-control vehicle; and
• Be used adjacent to a pedestrian or cyclist path of travel so as to not become a tripping or falling hazard.

6.8.3 Plastic containment tapes and fences

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

When installed, containment tape and fencing must:
• Be supported by posts;
• Have posts installed at maximum spacing of 5 m;
• Ensure horizontal deflection of the tape or fence material does not exceed 0.5 m from the nominal line of the tape or fencing as a result of wind, air turbulence from passing traffic or minor impacts; and
• Be monitored and maintained as they can become a hazard to traffic if poorly maintained, especially in windy conditions.

Plastic containment tapes and fences must not:
• Be used as temporary safety barriers; or
• Act as delineation devices when used adjacent to traffic.
Containment fences or delineation should be used behind safety barriers to delineate and prevent workers entering the exclusion zone behind the temporary safety barrier. See Section 6.7 Temporary safety barriers for further information.

Additional conditions of use of containment tapes and fences are provided in Table 6-13.

Table 6-13. Conditions of use of containment tapes and fences

<table>
<thead>
<tr>
<th>Containment type</th>
<th>Conditions of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Containment tapes</td>
<td>Containment tapes may be used to contain workers on foot and plant within the safe workplace boundary established at the particular work site. Where used, tapes must be 100 mm wide with alternate stripes of contrasting colour and supported on posts approximately 1 m high such that the height of the tape above the ground is never less than 800 mm. Tapes must not be used for pedestrian containment adjacent to traffic.</td>
</tr>
<tr>
<td>Plastic mesh fencing</td>
<td>Plastic mesh fencing may be used for excluding pedestrians from a work area and for the containment of workers on foot and plant. When in use, plastic mesh fencing must comprise a flexible orange mesh approximately 1 m high. When in use, the top of the fence must not be less than 800 mm above the ground. When used for containment from the travelled way, the clearance requirements of Section 4.3.4 Minimum clearances of workers to traffic must be met.</td>
</tr>
</tbody>
</table>

6.8.4 Traffic cones and temporary bollards

Traffic cones and temporary bollards may be used to define the traffic path past or through the work area. Cones and temporary bollards must not be used as a substitute for barrier boards and signs at either end of the work.

Traffic cones and temporary bollards must comply with Transport QA Specification 3352 Fluorescent Plastic Traffic Cones. Traffic cones and temporary bollards must have a white horizontal retroreflective band of Class 400 material that are:

- 150 mm wide on 450 mm traffic cones; or
- 250 mm wide on the traffic cones and temporary bollards higher than 450 mm.

Traffic cones and temporary bollards must be used on works in accordance with the conditions provided in Table 6-14.

Table 6-14. Traffic cone and temporary bollard conditions of use

<table>
<thead>
<tr>
<th>Cone or bollard size</th>
<th>Conditions of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Cones and bollards must only be used while work is in progress (day or night) where workers are in attendance to reinstate any of the cones and bollards dislodged by traffic or wind. Cones or bollards may be used on long-term unattended works provided they are securely fixed to the pavement or weighted to provide adequate stability. The requirements for spacing of cones and bollards are provided in Table 6-2.</td>
</tr>
<tr>
<td>300 mm cones</td>
<td>300 mm traffic cones must not be used.</td>
</tr>
</tbody>
</table>
Cone or bollard size | Conditions of use
--- | ---
Small (450 mm) cones | 450 mm traffic cones may be used for most built-up and open road applications including footpaths, shared paths and bicycle paths provided traffic speeds are less than 75 km/h.

Standard (700 mm) cones | 700 mm traffic cones must be used in locations where traffic speeds are greater than 75 km/h. 
**Note:** 700 mm traffic cones may also be used on lower speed roads.

Large (900 mm) cones | 900 mm traffic cones may be used:
- On high speed to high volume roads instead of standard size cones, e.g. expressway type roads; or
- On any work site where increased visibility is required or as a means to provide additional delineation. 
**Note:** 900 mm traffic cones may also be used on lower speed roads.

Temporary bollards (min 900 mm) | Temporary bollards must be:
- At least 900 mm high and 100 mm in diameter;
- Made from fluorescent red or orange material; and
- Resilient to impact. 
**Note:** Temporary bollards may also be used on any speed roads.

### 6.8.5 Temporary kerbs

Temporary kerbing may be used to form temporary medians, traffic islands, pavement edges, or as a temporary lane divider in appropriate situations during long term works.

When used temporary kerbing must be:
- Yellow in colour;
- Not greater than 150 mm in height;
- Secured to the pavement;
- A continuous line at least 150 mm wide as seen by approaching traffic; and
- Clearly delineated in accordance with *Section 6.2.2 Use of delineating devices on kerbs*.

### 6.8.6 Roadworks temporary guideposts

Roadworks temporary guideposts with delineators may be installed to provide a single continuous line defining the travelled path.

Where used for delineation and at a minimum, roadworks temporary guideposts must be used as follows:
- For delineation of the travel path through or past the work site as an alternative to traffic cones or bollards, guideposts must have yellow delineators and must be placed on both sides of the roadway; or
- For delineation of the roadway on detours and side-tracks, guideposts must have red delineators on the left side and white on the right for a two-way roadway, or yellow on the right (one-way roadway).

Roadworks temporary guideposts with delineators must be installed in accordance with AS 1742.2.

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

Pavement markings on temporary roadways and detours must be of a similar standard to that in use at either end of the adjoining sections of road. Where the adjoining road is delineated with edge lines, temporary roadworks must be similarly marked with an edge line.

Pavement markings and markers used at temporary work sites generally comprise:
- Barrier, lane and edge lines;
- Turning arrows; or
- Raised retroreflective pavement markers (temporary or permanent).

Where, during or at the conclusion of pavement-surfacing works, a section of roadway is to be left for a period of time without linemarking, temporary raised pavement markers should be used to provide delineation at the dividing or lane lines. Application of the pavement markings must take place as soon as practicable.

Where temporary linemarking, i.e. linemarking not in its final location, is required on the final wearing surface, or adjacent pavement, pavement marking tape should be used. Where used pavement marking tape must meet the performance requirements of Transport QA Specification R145 Pavement Marking (Performance Based).

Where it is determined that any temporary pavement marking or marker has become ineffective, remarking and/or replacement must be undertaken as soon as practicable.

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

Where existing pavement markings are required after the temporary works, these may be masked over with suitable black tapes where they exhibit similar characteristics to the existing pavement colour and surface finish, during the works period. This may be a suitable consideration where limited traffic impact is expected, to limit the chance of dislodgement by traffic. Otherwise, permanent removal must be undertaken and agreement must be received from the asset owner in accordance with Section 6.8.8 Removal of pavement markings and markers.

On long-term works raised retroreflective pavement markers complying with Transport QA Specification R142 Retroreflective Raised Pavement Markers, may be used in conjunction with temporary pavement markings. The spacing and application must be as specified in Transport QA Specification R142 Retroreflective Raised Pavement Markers.

Pavement markings and retroreflective markers should be considered in conjunction with the placement of other delineation devices, and must be used where temporary safety barriers are used, to ensure road users are safely directed through the site without conflicting messages.

All pavement markings must be retroreflective in accordance with Transport QA Specification R145 Pavement Marking (Performance Based).

6.8.8 Removal of pavement markings and markers

All redundant pavement markings and raised pavement markers that will not be required must be immediately removed in such a way as to leave a clean, undamaged pavement with a surface texture, reflectivity characteristics and colour comparable to the adjacent pavement surface.

Blacking out of redundant pavement markings with paint is not permitted and must not occur.
Where existing pavement markings are to be removed and replaced by other pavement markings, removal must not begin until adequate provisions have been made to complete the installation of the replacement markings. Pavement markings must be removed so that the markings that remain in place at any time will not be in a pattern that will mislead or misdirect road users. Reinstatement of the pavement markings must take place as soon as possible.

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

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

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

### 6.9 Illuminated warning devices

#### 6.9.1 Variable message signs (portable)

A portable variable message sign (VMS) is an electronically powered on-road sign used for traffic management or driver information applications. All portable VMS used on a Transport work site must meet the requirements of AS 4852.2 *Variable Message Signs, Part 2 Portable Signs*. Where portable VMS are to be used at or near a work site to carry warning or other messages relating to the works, this Section must be applied. If a conflict exists between requirements in this Section and AS 4852.2, then AS 4852.2 must be applied.

Where a VMS is used, the rationale for use must be documented in the TMP and / or risk assessment. The risk assessment should:

- Include identification, assessment and management of risks introduced to road users and the workers who install and maintain the VMS; and
- Consider the risks associated with the proposed VMS location such as proximity to traffic, overhead electricity lines, and positioning them near culverts, medians or steep embankments.

The inclusion of VMS at a work site must be shown on the approved TGS. *Table 6-15* provides the conditions of use that apply in relation to the display of portable VMSs.

<table>
<thead>
<tr>
<th>Display type</th>
<th>Conditions of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>When a VMS is used, it must meet the following conditions:</td>
</tr>
<tr>
<td></td>
<td>• The VMS display must be levelled;</td>
</tr>
<tr>
<td></td>
<td>• The visual lighting intensity of the VMS display must not generate a distraction or blinding risk for road users, particularly at night;</td>
</tr>
<tr>
<td></td>
<td>• Complementary messages must only be placed on a VMS when a flashing arrow sign is utilised;</td>
</tr>
<tr>
<td></td>
<td>• When on-site, the VMS display must always be displaying a sign or message. Where there is no relevant sign or message to be displayed, the messages shown “Report Traffic Incident” with “131 700” as alternating messages as shown in <em>Figure 6-30</em> should be used as the default messages. Otherwise, the VMS must be switched off; and</td>
</tr>
</tbody>
</table>

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Transport for NSW

UNCONTROLLED WHEN PRINTED
<table>
<thead>
<tr>
<th>Display type</th>
<th>Conditions of use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• If there is a malfunction with the VMS the display must be rotated at 90 degrees or folded down until such time as it can be removed. In these circumstances, consideration should be given to placing additional delineation to highlight the presence of the out of service VMS.</td>
</tr>
<tr>
<td>Displaying</td>
<td>A VMS may be used to display a static sign under the following conditions:</td>
</tr>
<tr>
<td>signs</td>
<td>• Where a VMS will display a sign detailed in the Traffic Signs Register, the VMS must:</td>
</tr>
<tr>
<td></td>
<td>o Display a reasonable likeness (i.e. a faithful representation) to the static sign in accordance with the NSW Road Rules; and</td>
</tr>
<tr>
<td></td>
<td>o Be, at a minimum, displayed at the required size in accordance with this Technical Manual and the relevant Sign Design Plan provided in the Traffic Signs Register.</td>
</tr>
<tr>
<td></td>
<td>• Where a VMS is used to replace a regulatory sign or a lane status sign, the VMS must display the message continuously and not alternating with another message or flashing;</td>
</tr>
<tr>
<td></td>
<td>• All signs in Traffic Signs Register requiring red, or red/black on white must be similarly displayed as red or red/black on white on the VMS, unless the reversal of colour (red/white on black) has been permitted under Schedule 2 or Schedule 3 of the NSW Road Rules; and</td>
</tr>
<tr>
<td></td>
<td>• VMS sign colours may be reversed for speed signs, no left, right or U-turn signs. All other signs that are displayed on a portable VMS must be of reasonable likeness to the corresponding sign given in Schedule 2 and Schedule 3 of the NSW Road Rules, including but not limited to colours.</td>
</tr>
<tr>
<td>Displaying</td>
<td>• The content of new and revised messages must be approved in accordance with standard procedures for each road authority. Refer to Austroads Guide to Traffic Management (AGTM) Part 10: Traffic Control and Communication Devices and Transport Supplement to AGTM Part 10;</td>
</tr>
<tr>
<td>messages</td>
<td>• Messages must comprise not more than four words or numbers on any one screen;</td>
</tr>
<tr>
<td></td>
<td>• Letter forms and legend height must be adequate to be comfortably read by drivers at the prevailing approach speed of traffic;</td>
</tr>
<tr>
<td></td>
<td>• There must not be more than two separate screens in any alternating series of screens;</td>
</tr>
<tr>
<td></td>
<td>• Where there are alternating screens, the 'on' time of each screen must be 0.6 + 0.1 second per word or number, and the total time required to read the message on both screens must be taken into account when determining message length and letter height;</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> A procedure for determining letter sizes for signs is provided in AS 1742.2. The letter series which most nearly match the on-screen fonts should be used in the calculations. It is recommended that the calculated letter height be doubled for this purpose.</td>
</tr>
<tr>
<td></td>
<td>• Symbols must not be used unless they replicate an existing static sign or have been tested for comprehension in their on-screen format, i.e. taking into account distortions due to pixel size limitations;</td>
</tr>
<tr>
<td></td>
<td>• Messages must be relevant to the nature and phase of the work in progress and must be changed or switched off when they are not relevant;</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> Other variable message signs near roadworks sites displaying unrelated messages must be switched off.</td>
</tr>
<tr>
<td></td>
<td>• Messages must be complementary to other signs, or warning or delineating devices required by this Technical Manual. The nature and positioning of the messages must not detract from those signs or devices.</td>
</tr>
</tbody>
</table>
All VMS must be located and installed in accordance with Section 6.2.4 Placement and clearances of registered plant or devices.

In addition to the requirements of Section 6.2.4 Placement and clearances of registered plant or devices, portable VMS must be:

- Placed on a road where there is adequate time for the driver to view and comprehend the message. A greater distance is required for multiple message screens and higher traffic speeds;
- Driven into position in the same direction as traffic, so that the trailer lights and reflectors are seen by on-coming vehicles;
- Placed at least 300 m from the nearest permanent VMS;
- Positioned so that the display is clear of the envelope of passing vehicles (particularly heavy vehicles);
- Be clearly visible at all times, with reflective material delineating the outer extremities;
- Anchored to prevent it moving under wind loading; and
- Risk assessed to determine if additional delineation is required, taking into account factors such as lateral offset from the edgeline, road alignment, horizontal and vertical, speed zone, road environment and the adequacy of the delineation on the trailer body/sign face.

The positioning of VMS must always be verified by the project team or delivery partner as being appropriate. Appendix E – Inspection checklists and tools and forms contains a checklist that is a broad summary of the major items for consideration in locating and placing of portable VMSs.

### 6.9.2 Illuminated flashing arrow signs

Illuminated flashing arrow signs (FAS) are signs which comprise a matrix of lamps or LED aspects in the form of an arrow that is flashed in a cyclic manner to either the left or right, indicating the direction in which approaching vehicles are to pass. Flashing arrow signs are intended to be applied primarily where a lane is closed or a diversion of traffic is required, typically on a multi-lane carriageway.

Illuminated flashing arrow signs must comply with Transport Specification TSI-SP-060 Illuminated Flashing Arrow Signs and the relevant Australian Standards. General operating instructions are provided in this Section and Appendix B.
Illuminated FAS must only be vehicle-mounted (rear mounted or cab mounted), incorporated into VMS, or a stand-alone sign. Appendix B.5 Usage procedure: illuminated flashing arrow signs provides additional relevant requirements in relation to their use, installation, operation, signage and removal. The requirements provided for these devices must be read in conjunction with relevant specifications and manufacturer’s instructions.

Additional vehicle mounted beacons or lamps that might cause a risk or confusion to road users whilst the flashing arrow sign is operating should be switched off.

6.9.3 Traffic warning (roadwork) lamps—flashing yellow lamps

Vehicle-mounted warning devices must be displayed as follows:

- A single (1) rotating or flashing yellow lamp for emergency or other infrequent use on a vehicle not normally used for roadworks purposes, or for use on a plant item or an inspection vehicle; or
- A pair (2) of rotating or flashing yellow lamps for use on vehicles (e.g. patrol trucks) so that at least one and preferably both lamps are visible from any direction.

The conditions of use for flashing yellow lamps are provided in Table 6-16.

Table 6-16. Conditions of use of flashing yellow lamps

<table>
<thead>
<tr>
<th>Display type</th>
<th>Conditions of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unidirectional flashing yellow lamps</td>
<td>Are used to draw attention to a particular sign. Where used, they must be mounted above the sign. They may be mounted on barrier boards indicating the ends of work areas. They must not be used to delineate a path through a work site because of the confusing light pattern which a series of such lamps can produce. They may also be used to highlight safety barrier end treatments.</td>
</tr>
<tr>
<td>Rotating or flashing yellow lamps</td>
<td>Must be used to draw attention to work vehicles and plant to which they are attached or to draw attention to signs in difficult light conditions or in high volume locations.</td>
</tr>
<tr>
<td>LED light bars or beacons</td>
<td>May be used if it can be shown that their on-time performance in each flash cycle is equal to or longer than that of the rotating or flashing lamp.</td>
</tr>
</tbody>
</table>

6.10 Truck and trailer-mounted attenuators

6.10.1 Description

A truck and trailer-mounted attenuator (TMA) is a combination of host vehicle and Impact Attenuator Unit (IAU), mounted on or towed by the host vehicle. The IAU is a mobile crash cushion safety device, used as an advance warning device on approach to work sites to provide for increased road user safety if struck. The primary purpose of an IAU is to reduce the impact for errant road users and should not be used as the sole protection method for work sites from unexpected vehicle impacts.

For use on Transport roads, TMAs must be of an accepted Transport supplier.

6.10.2 Usage policy

TMAs must be used on the roads at the listed localities provided in Table 6-17. If a section of the road listed below, or work type on the section of road listed below does not have a risk profile that justifies the need for a TMA, this must be captured in the relevant TMP as a departure in accordance with Section 2.8 Departures from this Technical Manual.
Table 6-17. Roads at localities where TMAs are required

<table>
<thead>
<tr>
<th>State road name</th>
<th>Route number</th>
<th>Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacific Motorway</td>
<td>M1</td>
<td>Wahroonga to Beresfield</td>
</tr>
<tr>
<td>Princes Motorway</td>
<td>M1</td>
<td>Waterfall to Yallah</td>
</tr>
<tr>
<td>Eastern Distributor</td>
<td>M1</td>
<td>Entire</td>
</tr>
<tr>
<td>Western Distributor</td>
<td>A4</td>
<td>Entire</td>
</tr>
<tr>
<td>Hume Motorway</td>
<td>M31</td>
<td>Casula to Sutton Forrest</td>
</tr>
<tr>
<td>Hunter Expressway</td>
<td>M15</td>
<td>Entire</td>
</tr>
<tr>
<td>Westlink</td>
<td>M7</td>
<td>Entire</td>
</tr>
<tr>
<td>Western Motorway</td>
<td>M4</td>
<td>Entire</td>
</tr>
<tr>
<td>The Hills Motorway</td>
<td>M2</td>
<td>Entire</td>
</tr>
<tr>
<td>South Western Motorway</td>
<td>M5</td>
<td>Entire</td>
</tr>
<tr>
<td>NorthConnex</td>
<td>No route number</td>
<td>Entire</td>
</tr>
<tr>
<td>WestConnex</td>
<td>M8, M5, M4</td>
<td>Entire</td>
</tr>
<tr>
<td>Lane Cove Tunnel</td>
<td>A1, M2</td>
<td>Entire</td>
</tr>
<tr>
<td>Sydney Harbour Tunnel</td>
<td>M1</td>
<td>Entire</td>
</tr>
<tr>
<td>Sydney Harbour Bridge</td>
<td>No route number</td>
<td>Entire</td>
</tr>
</tbody>
</table>

TMAs are not required where one or more of the following are in place:
- Road closure;
- Contraflow; or
- Work is behind temporary safety barriers.

TMAs are recommended to be used when the posted speed limit exceeds 85 km/h and traffic volumes exceed 20,000 vpd. Additionally, TMAs may also be used in other instances.

The need for a TMA must be determined in the TMP and the site specific risk assessment. Factors that should be considered when determining if a TMA is required include:
- Work type and activity;
- Speed of approaching traffic;
- Location of work, including sight distances;
- Crash history at location of work;
- Posted and temporary speed limits;
- Number of carriageways;
- If the location is a nominated heavy vehicle route; and
- Volume of heavy vehicle movements.
6.10.3 Operation

The operational requirements of a TMA are as follows:

- The TMA must be set-up and installed, operated and disassembled in accordance with the manufacturer’s instructions. The requirements of this document in relation to TMAs are additional to the manufacturer’s instructions, and in the case of discrepancy, this document prevails;
- The host vehicle must be staffed by at least one qualified operator (see Section 6.10.6 TMA Operator);
- All occupants of the host vehicle must be harnessed while the attenuator is lowered;
- The TMA must be located between 100 m and 200 m to the work area during dynamic work, including the roll ahead distance (see Figure 6-31);
- The TMA must not be lowered when people are in the immediate vicinity of the attenuator;
- When used as an advance warning vehicle (motorway application) and when in environments with narrow shoulders and reduced edge clearances (if the advance warning vehicle cannot achieve the required 0.5 m clearance from edge line), the TMA must be located outside the traffic lane;
- When used as a shadow vehicle (protected by the tail vehicle) for the protection of workers on foot or small plant items, must follow no less than 40 m behind in the work lane (see Figure 6-32); and
- Consideration should be given to switching off any vehicle mounted beacons that might cause a risk or confusion to road users whilst flashing arrow sign is operating.

![Figure 6-31. TMA layout—dynamic work](image-url)
6.10.4 Host vehicle features

The host vehicle must:

- Have at least two dedicated flashing warning lights, usually amber in colour;
- Have a rear overhang of 6.5 m minimum;
- Be at least 15 tonnes GVM;
- Be a single cab truck, with automatic transmission;
- Be fitted with automatic impact brakes (AIB);
- Be fitted with a variable message sign (VMS);
- Be fitted with rear facing CCTV cameras; and
- Be fitted with a Type C flashing arrow board.

6.10.5 Signage

Signage on a VMS that is attached to a TMA must be in accordance with Section 6.9.1 Variable message signs (portable).

Advance warning signage should follow the guidance provided in Figure 6-31 and Figure 6-32.

For static work sites, advance warning signage must be installed on all approaches to the work area. For dynamic works, an advance warning vehicle must be in place on all approaches to the work area.

6.10.6 TMA Operator

The operator of the TMA must:

- Hold a current and valid heavy vehicle licence of suitable class to operate the TMA host vehicle;
- Hold a current Implement Traffic Control Plan qualification;
- Have successfully completed the national unit of competency RIIRTM301D (operate a truck or trailer-mounted attenuator) with evidence of completion;
- Have successfully completed training in the relevant business/divisional requirements; and
- Have been inducted into the relevant or site-specific SWMS for operation of TMAs at roadwork sites.
6.11 Temporary portable rumble strips

6.11.1 Description

Temporary portable rumble strips (TPRS) are portable traffic devices placed in a traffic lane perpendicular to the direction of travel. TPRS provide a visual, audible and tactile warning to alert road users of changed conditions.

When used in conjunction with other traffic control signs and devices, TPRS have been found to increase positive road user behaviour in terms of increased compliance at a work site.

The decision to use a TPRS must be considered as part of the risk assessment and documented in the TMP.

TPRS are not suitable in all traffic environments and the decision to use a TPRS must consider:

- Volumes and proportion of heavy vehicles which influence the lateral and rotational movement of the TPRS;
- Maintaining safe travel paths for vulnerable road users;
- Vertical (grade) and horizontal (curves) alignment of road which influence longitudinal, lateral and rotational movement of TPRS;
- Road alignment to ensure clear sight distance of D to the TPRS is maintained; and
- Proximity of residential buildings or other noise sensitive land uses due to noise associated with the TPRS.

A TGS, which includes TPRS, must be designed in accordance with the above considerations. Only TPRS accepted by Transport products must be used. At the time of publication, this includes:

“RoadQuake Modular F1791001 or Folding F1791003”

TPRS from the above manufacturer must be yellow in colour.

Other TPRS devices not listed above may be used following approval from the Director of Traffic Engineering Services via Traffic.Engineering@transport.nsw.gov.au.

6.11.2 Usage policy

TPRS may be installed in locations characterised by all of the following:

- Where the speed zone is less than 65 km/h; and
- On concrete, asphalt or sealed roads.

TPRS must not be installed:

- On multi-lane carriageways, except where all of the above conditions have been met;
- For work sites where the speed zone in the work zone is greater than 65 km/h; or
- On wet, unsealed, freshly sealed, or heavily rutted roads.

To protect oncoming traffic from the risk of swerving behaviour, TPRS must be placed in one of the following methods:

1. Where traffic is reduced to and controlled within a single lane (see Figure 6-34); or
2. On a 2-lane 2-way road a temporary median kerb with delineators is installed on the centreline for a minimum distance of D prior to the first strip in each array (see Figure 6-35).
Loose materials such as gravel and debris on the road surface must be removed prior to installation. The carriageways near and around the work site that are being controlled by TPRS should remain clean and clear of dirt and construction debris. Debris and other construction waste that have dislodged from passing vehicles onto the carriageway/s should be regularly monitored and removed.

TPRS must be installed in the form of arrays. An array is a series of three rumble strips with 3 m spacing between each rumble strip as shown in Figure 6-33.

![Figure 6-33. Temporary portable rumble strip (TPRS) typical array arrangement](image)

TPRS must be used in accordance with Appendix B.6 Usage procedure: temporary portable rumble strips. The requirements provided for these devices must be read in conjunction with relevant specifications and manufacturer’s instructions (see Figure 6-34).
Figure 6-34. TPRS layout—single lane

Figure 6-35. TPRS layout—porta-boom