Use of Temporary Portable Rumble Strips in single lane operation

Summary:
Temporary Portable Rumble Strips (TPRS) are a portable traffic device designed to alert road users to a change in conditions at a work site by providing a visual, audio and tactile warning to drivers. This Technical Direction provides the operational requirements for the use of TPRS in NSW. The use of TPRS is permitted in a single lane when the speed limit is ≤ 60km/h. Otherwise, TPRS must not be used.

Purpose
This Technical Direction provides the operational requirements for Temporary Portable Rumble Strips (TPRS) and must be read in conjunction with the following documents:
- Manufacturers specifications

Approvals:

<table>
<thead>
<tr>
<th>Owner:</th>
<th>Review Date:</th>
<th>03 October 2021</th>
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<tbody>
<tr>
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Summary of Use

<table>
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<th>Considerations</th>
<th>Requirements</th>
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<td>Lane approach configuration</td>
<td>Traffic must be controlled within a single lane</td>
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<tr>
<td>Operation</td>
<td>For use within an active work site (cannot be left unattended)</td>
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<td>Speed zone at work site</td>
<td>&lt; 65km/h</td>
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Background

Temporary Portable Rumble Strips (TPRS) are portable traffic devices placed in a traffic lane perpendicular to the direction of travel. TPRS provide a visual, audio and tactile warning to alert road users of changed conditions. When used in conjunction with other traffic control signs and devices, TPRS has been found to increase positive road user behaviour in terms of increased compliance at a worksite.

This Technical Direction permits the use of TPRS at Roads and Maritime road and bridge works as an option to support increased safety, subject to conditions in this document and manufacturer’s guidelines being met.

Specification

There is currently no specification for TPRS. Current TPRS devices approved for use are:

1. RoadQuake Modular F1791001 or Folding F1791003

Products used from the above manufacturer must be yellow in colour.

Other TPRS devices not listed here may be used with the approval of the Director of Traffic Engineering Services.
Planning for use

TPRS are not suitable for use at all road work sites. When determining if TPRS are appropriate, the following factors must be considered:

<table>
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<th>Factor</th>
<th>Consideration</th>
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| Traffic                 | - Higher traffic volumes and higher proportions of heavy vehicles will increase longitudinal, lateral and rotational movement of installed TPRS, requiring greater instances of rectification  
- Use of TPRS can impact on driver behaviours, such as harsh braking and swerving, particularly in areas of known speed zone non-compliance or higher preceding speed zones  
- Appropriate and safe installation and removal must be achievable |
| Pedestrian and Cyclists | - Safe travel paths must be maintained for pedestrians and cyclists when TPRS are installed                                                                 |
| Alignment               | - Appropriate and safe installation and removal must be achievable considering the alignment of the specific location  
- The vertical alignment (or grade) of the location can impact the amount of longitudinal, lateral and rotational movement of installed TPRS  
- TPRS should not be used on horizontal curves, as the force and angle of vehicles could move TPRS to the outside of the curve  
- Alignment should be considered to ensure clear sight distance of D to the TPRS is achieved |
| Proximity to workers on foot | - Swerving behaviours have been documented during use of TPRS, so they must not be placed adjacent to or in close proximity to workers on foot |
| Proximity of residential buildings | - Consideration should be given to noise impacts to nearby residential buildings when used during night works |

Developing documentation

Once the above considerations have been addressed and it has been determined that TPRS are to be used, it must be documented in the Traffic Management Plan (TMP) and supporting risk assessments. The TPRS must also be shown on the site specific Traffic Control Plan (TCP) that is developed to support the TMP for the worksite.

It has been demonstrated that the use of multiple TPRS in the form of “arrays” assist in managing speed through the work site. An “array” is a series of 3 rumble strips with 3 metre spacing's between each rumble strip.
When determining placement and location of TPRS the competent designer of the TCP should consider the following:

- If the length of the work area is greater than 200 m, or there is an interrupted line of sight between each end of the work area, then intermediate TPRS arrays and their associated signing may be installed at intervals of not less than 100 m.:

**NOTE** Two or more arrays is preferred if the length of the work area permits, however one array of TPRS may be used.

- Adequate allowances are made for safety buffer between a TPRS array and work area; a length of 20 to 30 m is sufficient. Workers must not be located adjacent to an array of TPRS where the risk of swerving vehicles could result in workers being struck;

- TPRS array’s should be placed at least four seconds of travel time after a driver decision point, driver action point, or another TPRS array; and

- If TPRS are to be used where cyclists are directed to travel through the work site, a minimum 1 m shoulder adjacent to the TPRS should be provided, or other alternate safe provisions made.

Example layouts for the use of TPRS in shuttle flow and merge lane closure scenarios are included in Appendix A of this Technical Direction. All TCPs must be developed by a competent person in accordance with RMS Traffic Control at Work Sites Manual.

If there is any discrepancy between the manufacturer’s guidelines and the requirements of this Technical Direction, the requirements of this Technical Direction will prevail.

**Signage**

Warning signs must be installed to alert drivers to the use of TPRS. When the TPRS are not in operation, these signs must be covered or removed. TPRS must be used with the following signage:

- A Speed Hump Ahead (T5-210) warning sign installed at distance D before the first rumble strip. The distance may be increased to 1.5D – 2D when there is poor compliance or adverse driver behaviours, such as excessive speed or harsh braking; and

- A Speed Hump (T5-211) warning sign placed next to the first strip at a TPRS array.

Example layouts for the use of TPRS in shuttle flow and merge lane closure scenarios are included in Appendix A of this Technical Direction. Refer to TCWS for the definition of distance D.

A Variable Message Sign (VMS) may be used to further alert drivers about TPRS if adverse driver behaviour is identified. The addition of VMS should be considered as part of the development of the TMP and included by the designer as part of the TCP.
Installation and Operation

Equipment Installation

The installation of TPRS must be in accordance with the manufacturer’s instructions. Appropriate manual handling techniques should be used in the installation, removal and transportation of the TPRS, and separate TCP may be required for these activities.

TPRS may be installed:

- Where the speed zone is 65 km/h or less; and
- Where traffic is confined to a single lane; and
- On concrete, asphalt or sealed roads.

If one or more of the above conditions are not met, then TPRS must not be installed.

TPRS must not be installed on unsealed, freshly sealed, or heavily rutted roads. Loose materials such as gravel and debris from road surface must be removed prior to installation. In addition, TPRS must:

- Be visible to an approaching road user for at least a distance of D metres; and
- Have sufficient lighting provided to each array. During night work, floodlighting must be provided to ensure each array is sufficiently visible to road users.

TPRS should:

- Be installed on a dry surface. TPRS should not be used when the surface is wet as this increases skid and movement of the TPRS; and
- Extend across at least 90% of the lane width where safe passage for cyclists can also be achieved.

Equipment Operation

Where TPRS are deployed, regular monitoring must be undertaken to monitor movement and identify adverse driving behaviour such as heavy braking or swerving on approach or around the TPRS. If adverse driving behaviour is identified, consideration should be given to introducing additional controls or removal of the TPRS. Additional controls may include increasing the TPRS sign’s advance warning distance, or in the event of swerving behaviour, the installation of additional control devices such as cones, temporary kerbing or bollards, factoring in possible oversized vehicles.

When the work site is unattended or a speed limit of greater than 65km/h is reinstated, TPRS must be removed and associated signs (T5-210, T5-211) removed or covered up.

Movement

TPRS are not secured to the road surface and as such, movement of the devices can occur. Factors influencing the degree of movement include type of road surface, grade, traffic composition and volume.

Regular inspections for TPRS movement must be carried out during operation. Inspections should be completed more frequently when using TPRS at a work area for the first time, when being used on grades, or under high volumes of traffic with a higher proportion of heavy vehicles.

Maximum movement tolerance for TPRS is provided below, and if movement exceeds this, or if a rumble strip becomes disconnected, it must be rectified immediately. To assist in identifying the extent of
movement, a method of determining placement should be employed, such as using a chalk mark or aligning with a fixed object to indicate where the TPRS were placed.

The frequency of remediation of displaced or disconnected strips must be monitored and risk-assessed. If it is determined that the frequency and risk of remediation exceeds the benefit gained by the use of the TPRS, the TPRS must be removed.

**Maximum Movement Tolerance for TPRS**

### Longitudinal movement (direction of travel)

![Diagram showing maximum longitudinal movement tolerance](image)

### Lateral movement (sideways)

![Diagram showing maximum lateral movement tolerance](image)

### Skewing / Rotation

![Diagram showing maximum skewing/rotation tolerance](image)
Appendix A – Recommended layout for use of TPRS

Shuttle Flow
Merge lane closure
Technical Direction – Use of Temporary Portable Rumble Strips in single lane operation

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