## NOTICE

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<th>Clause Number</th>
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(PERFORMANCE BASED)
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FOREWORD

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BASE SPECIFICATION

This document is based on Specification RMS R145 Edition 4 Revision 0.
RMS SPECIFICATION D&C R145

PAVEMENT MARKING (PERFORMANCE BASED)

1 GENERAL

1.1 SCOPE

This Specification sets out the requirements for the supply and application of pavement markings for works such as:

(i) installation of markings on new roads and for revised traffic schemes;
(ii) reinstatement of markings after road works;
(iii) maintenance of markings (e.g. marking over existing markings),

using any pavement marking material of your choice which meets the required performance criteria, with the exception of solvent-borne paint.

This Specification does not cover all the requirements for markings for School Zones. For School Zones markings not covered by this Specification, contact the RMS Centre for Road Safety. For details of “Dragon’s Teeth” pavement markings at School Zones, refer to the RMS Centre for Road Safety Technical Direction TD 2009/SR02.

This Specification includes the requirements for Bus Lane and Bicycle Lane markings. For requirements for Bus Lane and Bicycle Lane surface coatings, refer to Specification RMS D&C R110 “Coloured Surface Coatings for Bus Lanes and Cycleways”.

1.2 STRUCTURE OF SPECIFICATION

This Specification includes a series of annexures and appendices that detail additional requirements.

1.2.1 (Not Used)

1.2.2 (Not Used)

1.2.3 Schedules of HOLD POINTS and Identified Records

The schedules in Annexure R145/C list the HOLD POINTS that must be observed. Refer to Specification RMS D&C Q6 for the definition of HOLD POINTS.

The records listed in Annexure R145/C are Identified Records for the purposes of RMS D&C Q6 Annexure Q/E.

1.2.4 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure R145/D and must be implemented.

In all cases where this Specification refers to the manufacturer’s recommendations, these must be included in the PROJECT QUALITY PLAN.
Notify the Nominated Authority of any proposed changes prior to their introduction. Any such information provided does not restrict you from introducing new technologies and materials.

1.2.5 (Not Used)

1.2.6 Referenced Documents

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 1234). For convenience, the full titles are given in Annexure R145/M.

1.3 DEFINITIONS

The terms “you” and “your” mean “the Contractor” and “the Contractor’s” respectively.

The following definitions apply to this Specification:

**Stripe**

That part of longitudinal linemarking comprising pavement marking material.

**Longitudinal linemarking**

All lines that are generally parallel to the traffic flow, such as centre, lane, edge, turn, continuity and transition lines and outline markings.

**Transverse lines**

All lines that are marked at right angles to the general traffic flow, such as “Stop/Give Way” lines and pedestrian crosswalk lines.

**Other markings**

All diagonal and chevron markings, messages on the pavement including symbols, words, numerals and arrows, kerb markings and markings for parking.

**Pavement marking**

All longitudinal linemarking, transverse lines and other markings used on the road pavement and kerbs for the purpose of guiding traffic, but excluding raised pavement markers, which are covered in Specification RMS D&C R142.

**Performance criteria**

A series of subjective assessments and objective values of the colour, skid resistance, retention and day and night visibility of pavement markings by which the standard of pavement markings can be evaluated.

**Skid resistance**

An estimation of the adherence quality of a wet road surface measured by the friction at a low speed of a rubber slider upon this surface. The measure BPN applies.

1.4 ACCREDITATION TO PAINTING CONTRACTORS CERTIFICATION PROGRAM

All works carried out using this Specification must be by pavement marking organisations accredited to the “Painting Contractors Certification Program” (PCCP), administered by CSIRO, under the appropriate classes from Category B “Pavement markings”, as follows:

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Long-run longitudinal pavement marking on major roads</td>
</tr>
<tr>
<td>21</td>
<td>Short to medium-run longitudinal pavement marking on minor roads</td>
</tr>
<tr>
<td>22</td>
<td>Audio tactile markings</td>
</tr>
</tbody>
</table>
Transverse pavement marking including intersection markings and messages
High friction surfacings
Pavement marking: removal

Provide evidence to the Nominated Authority that the work is carried out by a pavement marking organisation holding the appropriate PCCP accreditation.

1.5 **TYPES OF MARKINGS**

Details of the various types of pavement markings are shown on the following Appendices and Figures which are included at the back of this Specification:

- **Appendix 1**: Longitudinal Pavement Markings
- **Appendix 2**: Transverse Pavement Markings
- **Appendix 3**: Pavement Markings and Symbols for Bicycle Facilities
- **Appendix 4**: (Not Used)
- **Appendix 5**: Pavement Markings at Roundabouts

(Figures 1 to 8 are not used)

- **Figure 9**: Pavement Arrows at Intersections – Common Types (AR1, AR3(R), AR4(R))
- **Figure 10**: Pavement Arrows at Intersections – Special Types (AR2, AR7, AR8, AR9)
- **Figure 11**: Lane Change Arrows – Urban and Rural (ARU5, ARR5)
- **Figure 12**: (Not Used)
- **Figure 13**: Pavement Arrow for Use in One Way Roads
- **Figure 14**: Chevron Layout
- **Figure 15**: Pavement Marking – Median
- **Figure 16**: Pavement Marking – Left Turn Island
- **Figure 17**: Pavement Marking in Advance of Open Level Crossings
- **Figure 18**: Pavement Alphabet and Numerals
- **Figure 19**: Speed Numeral Pavement Patch
- **Figure 20**: E-TAG Pavement Marking

2 **MATERIALS**

2.1 **CHOICE OF MATERIALS**

The formulation of the pavement marking material and its application to the road pavement is your responsibility, and you may use any pavement marking material of your choice, with the exception of solvent-borne paint.

The proposed pavement marking materials must be appropriate for the pavement and traffic conditions under which they are applied and used, and must satisfy the performance criteria detailed in Clause 4 of this Specification.
Provide to the Nominated Authority a list of materials which you propose to use, and their limitations under the conditions for which they will be used under the deed, such as seasonal constraints and potential or known incompatibility with other materials.

The materials must be compatible with the other materials which they are in contact with.

### 2.2 COLOUR

All pavement markings must be in white colour, unless otherwise detailed on the Design Documentation drawings or relevant RMS D&C specifications.

### 2.3 HANDLING, STORAGE AND MIXING

The pavement marking materials must be handled, stored, combined with other products and used in accordance with each individual manufacturer’s recommendations, such as the recommended application temperatures.

### 2.4 HEAVY METAL CONTENT

Glass beads used must comply with Australian Paint Approval Scheme (APAS) Specification AP-S0042 Clause 6.2 “Heavy metal content”. Obtain evidence of compliance.

### 3 APPLICATION OF PAVEMENT MARKINGS

#### 3.1 SURFACE PREPARATION

##### 3.1.1 Responsibility for Surface Preparation

Surface preparation is, at all times, your responsibility.

##### 3.1.2 Surface Condition

The surface area to be marked must be dry and free of dirt, gravel and other loose or foreign material.

The area around the marking must also be free of dirt, gravel and other loose or foreign material to avoid tracking of such material on to newly applied markings.

Do not carry out the pavement marking work until the above conditions have been met.

##### 3.1.3 Condition of Existing Marking

When marking over existing markings, and the existing marking material is flaking or chipping, is of a type or is in such a condition that adhesion of the new marking to the road surface cannot be guaranteed for its required life, develop a suitable method of surface preparation.

##### 3.1.4 Compatibility with Existing Surface

Where a pavement marking material to be applied may be incompatible with the existing marking or surface, prepare the marking or surface suitably before applying the pavement marking material.
3.1.5 Existing Curing Compound Film

Where a curing compound has been applied to a new rigid concrete pavement surface, remove the curing compound by physical abrasive means such as grinding or blasting, from the areas where the pavement marking material is to be applied.

3.2 Application of Waterborne Paint with Large Glass Beads (Type D-HR)

3.2.1 Recommended Conditions for Application of Waterborne Paint

Recommended conditions for application of waterborne paints with large glass beads (Type D-HR) to produce markings with optimum long term performance are given in Annexure R145/F as a guide.

3.2.2 Painted Markings on New or Resurfaced Sprayed Seal Pavements

*For a single stage application which meets the performance criteria, the method described in Annexure R145/E may be suitable for use.*

3.3 Application of Profile (or Audio Tactile) Longitudinal Pavement Marking

3.3.1 Types

Profile (or audio tactile) longitudinal pavement marking may be either:

(i) raised ribs applied at a regular interval over a base strip layer of the same material (*continuous type*), or

(ii) raised ribs only, placed directly on the road surface (*discontinuous type*).

3.3.2 Assessment of Pavement Surface

Prior to the application of the marking material, carry out an assessment of the pavement surface, particularly concrete or smooth or polished pavement surfaces, to determine the need for surface or other preparation such as grinding and/or the application of a tack coat to facilitate adhesion.

3.3.3 Profile Pattern Dimensions

The profile pattern must conform to the dimensions shown in Table R145.1.
Table R145.1 – Profile Longitudinal Pavement Marking Dimensions

<table>
<thead>
<tr>
<th>Description</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height of raised ribs, proud of pavement surface (excluding surface applied beads)</td>
<td>10 ± 2 mm</td>
</tr>
<tr>
<td>Thickness of strip in between raised rib sections (if applied)</td>
<td>≤ 2 mm</td>
</tr>
<tr>
<td>Clear spacing of raised ribs (in longitudinal direction)</td>
<td>250 ± 50 mm</td>
</tr>
<tr>
<td>Length of raised ribs (in longitudinal direction)</td>
<td>60 ± 10 mm</td>
</tr>
<tr>
<td>Slope angle of raised rib lead and trail faces</td>
<td>45° (approximately)</td>
</tr>
</tbody>
</table>

Measure and record the height of the raised ribs, and the thickness of the strip in between the raised rib sections (if applied), of the profile pavement marking material applied to the road pavement with a vernier or a suitable dry film thickness gauge.

3.4 POSITION, DIMENSIONS AND TOLERANCES

HOLD POINT

Process Held: Application of pavement markings.
Submission Details: Notification that set out is complete.
Release of Hold Point: The Nominated Authority may inspect the set out prior to authorising the release of the Hold Point.

3.4.1 Position of Markings

3.4.1.1 New Installation

New installation refers to the installation of markings on new roads and for revised traffic schemes.

Set out the work such that the markings are placed in accordance with the Design Documentation drawings and/or the Figures at the back of this Specification and within the tolerances listed in Table R145.2.

3.4.1.2 Reinstatement After Road Works

Where the markings require reinstatement following pavement works carried out by others, such as reseals, apply the reinstated markings to the set out placed by others and within the tolerances listed in Table R145.2.

3.4.1.3 Maintenance

Apply markings directly over the existing markings within the tolerances listed in Table R145.2.

At locations where the existing markings are so badly worn that installation of new markings is required, set these out to achieve the correct shape and position of the markings within the tolerances listed in Table R145.2.
3.4.2 Tolerances

Comply with the tolerances shown in Table R145.2 when installing the pavement markings.

**Table R145.2 – Pavement Marking Positions, Dimensions and Tolerances**

<table>
<thead>
<tr>
<th>Position or Dimension</th>
<th>New Installation or Reinstatement (^{(3, 4)})</th>
<th>Maintenance (^{(5)})</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Longitudinal linemarking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Distance between centreline of new and old linemarking</td>
<td>N.A.</td>
<td>&lt; 15 mm</td>
</tr>
<tr>
<td>(b) Start of new stripe relative to start of old stripe</td>
<td>N.A.</td>
<td>Lesser of:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>± 5% of stripe length or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>± 100 mm</td>
</tr>
<tr>
<td>(c) Position of centreline of new linemarking</td>
<td>&lt; 50 mm from positions shown on Design Documentation drawings</td>
<td>N.A.</td>
</tr>
<tr>
<td>(d) Length of new stripe (and for maintenance: total length of new and old stripe, unless otherwise required)</td>
<td>Lengths shown in Appendix 1 ± 50 mm</td>
<td>Old stripe length ± lesser of:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5% of old stripe length or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>± 100 mm</td>
</tr>
<tr>
<td>(e) Width of new linemarking (and for maintenance: total width of new and old linemarking, unless otherwise required)</td>
<td>Widths shown in Appendix 1 ± 5 mm</td>
<td>Width of old linemarking ± 10 mm</td>
</tr>
<tr>
<td>(f) Gap between double lines</td>
<td>Gap shown in Appendix 1 ± 10 mm</td>
<td>Gap shown in Appendix 1 ± 10 mm</td>
</tr>
</tbody>
</table>

| **2. Transverse and other markings**                      |                                               |                                           |
| (a) Position of centreline of transverse marking          | < 50 mm from positions shown on Design Documentation drawings | N.A.                                      |
| (b) Length of new marking                                 | Lengths shown in Appendices 2, 3 and 5, ± 10 mm | Length of old marking ± 10 mm \(^{(1)}\) |
| (c) Width of new marking                                  | Widths shown in Appendices 2, 3 and 5, ± 10 mm | Width of old marking ± 10 mm \(^{(1)}\)    |

| **3. Markings in advance of open level crossings**        |                                               |                                           |
| (a) Length of new marking                                 | Length shown in Figure 17 ± 50 mm             | Length of old marking ± 10 mm \(^{(1)}\)  |
| (b) Width of new marking                                  | Width shown in Figure 17 ± 10 mm              | Width of old marking ± 10 mm \(^{(1)}\)   |
### Position or Dimension

<table>
<thead>
<tr>
<th>New Installation or Reinstatement (^{(3,4)})</th>
<th>Maintenance (^{(5)})</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Arrows, chevrons, marked medians, marked left turn islands, speed markings (^{(2)})</td>
<td>Dimensions shown in Figures 9 to 11, 13 to 16, and 18 to 20, ± 50 mm</td>
</tr>
<tr>
<td>(a) Each dimension</td>
<td>≤ 6 mm</td>
</tr>
</tbody>
</table>

### Notes:

1. Where the dimensions of existing markings exceed the dimensions permitted for Reinstatement, the dimensions and tolerances applicable to Reinstatement also apply to the new Maintenance markings.
2. Place arrows and speed markings square to the direction of travel.
3. For Reinstatement markings done to set out placed by others, follow the set out as much as practicable but minimising any disruption to the marking pattern to which it links.
4. For New Installation markings, set out the markings such that, at the ends, any disruption to the marking pattern to which it links is minimised.
5. The alignment of longitudinal linemarking must be a smooth and continuous apparent line when viewed in the direction of the line.

### 3.5 Reinstatement of Pavement Markings After Road Works

#### 3.5.1 Time Limits for Reinstatement

Reinstall the pavement markings as soon as possible after road works where the pavement markings have been removed or damaged, to maintain the delineation for road safety purposes.

#### 3.5.2 Use of Temporary Raised Pavement Markers

You may use temporary raised pavement markers for delineation for up to 10 days after opening to traffic, after which the pavement markings must be reinstated.

### 3.6 Redundant Pavement Markings

**Redundant pavement markings usually arise:**

- as part of traffic switches during road construction or reconstruction (involving temporary removal or masking of the markings). In most cases, a final pavement surface will be re-laid, over which permanent markings are installed;
- as a result of a pavement marking/delineation scheme being changed due to traffic and road safety considerations (involving permanent removal of the markings).
3.6.1 General

Remove or mask pavement markings which are no longer required, and leave behind a clean and undamaged pavement with surface texture, reflectivity characteristics and colour comparable to the adjacent pavement surface.

3.6.2 Use of Temporary Masking Materials

You may use black non-reflective pavement marking tapes, specially designed for the purpose, as temporary masking materials. Remove the tapes to expose the masked marking when the marking is once again required.

3.6.3 Methods of Pavement Marking Removal

Remove pavement markings in a manner that will not damage the pavement structure, surface or texture. After removal of the markings, the condition of the resulting pavement surface must be suitable for bonding of new markings.

Remove pavement markings over expansion joints on concrete pavements by methods acceptable to the RMS Representative.

3.6.4 Extent of Removal or Masking

When removing or masking longitudinal and transverse lines such as edge lines, centre lines, lane lines, holding lines, or other lines, the removal or masking must cover a minimum of 200% of the total area of existing lines; i.e. minimum 50% extra coverage on both sides of the existing lines.

When removing or masking pavement markings such as arrows, numerals, letters, or other pavement markings, the removal or masking must take the form of a rectangular area or block around such markings.

3.6.5 Repair of Damage Caused by Markings Removal

Repair, by methods acceptable to the RMS Representative, any damage to the pavement structure, pavement surface or pavement joint caused by the markings removal.

3.6.6 Time Limits for Removal of Redundant Pavement Markings

Remove, within 48 hours of application, any painted “blackout” or overlay that is applied as a temporary measure.

Remove, within 6 months of application, any pavement marking tape that is applied over existing markings as a temporary masking measure. Renew the marking tapes where they are to remain longer than 6 months after application.

3.6.7 Sequence of Removal

Where existing pavement markings are to be removed and replaced by other pavement markings, do not remove the pavement markings until adequate provision has been made to complete the installation of the replacement markings.

Remove pavement markings in such order that the markings remaining in place at any time will not be in a pattern that will mislead or misdirect road users.
3.6.8 Disposal of Removed Marking Material

Promptly remove any material deposited on the pavement resulting from the markings removal by the methods stated in the PROJECT QUALITY PLAN. On completion of the markings removal, clear the pavement surface of any residue or debris.

Do not leave any marking material that has been removed from the pavement on the Site. Dispose of marking material removed in accordance with current EPA guidelines.

3.6.9 (Not Used)

4 PERFORMANCE CRITERIA

4.1 RETROREFLECTIVITY

4.1.1 General

The dry and wet retroreflectivity of any pavement marking, when measured in accordance with AS 4049.4 Appendix K, using the MX30 instrument or an equivalent retro-reflectometer that uses 30 m geometry, must comply with the performance criteria in Clauses 4.1.2 and 4.1.3 respectively.

4.1.2 Dry Retroreflectivity

The dry retroreflectivity must be a minimum of:
(i) 250 mcd/lux/m², within the first 20 days after opening to traffic;
(ii) 200 mcd/lux/m², at between 310 and 340 days after opening to traffic;
(iii) 150 mcd/lux/m² before re-marking is required – this is the intervention level.

4.1.3 Wet Retroreflectivity

The wet retroreflectivity must be a minimum of 80 mcd/lux/m² at any time after application.

4.2 SKID RESISTANCE

The skid resistance of any pavement marking must be a minimum of 40 BPN when tested in accordance with AS 4049.4 Appendix J at any time after application.

For profile pavement markings, measure and report the skid resistance only when the profile pavement marking is of the continuous type. The skid resistance is to be measured on the flat strip in between the raised ribs.

4.3 COLOUR

4.3.1 Colour Match

When required, prepare a sample pavement marking material panel in accordance with AS 4049.4 Appendix F.
The colour of the sample must be at least an “approximate match”, as determined by unaided visual inspection in accordance with AS/NZS 1580.601.1, against the reference colours in AS 2700S, as follows:

- White: Y35
- Yellow: Y14
- Red: R62

4.3.2 Mixed Colour Markings

Where mixed colour markings are used, with different colours providing different daytime colour contrasts to deliver a message, assess each individual colour for compliance with the colour specified, and clarity of definition of the markings, both between the different colours, and between the coloured marking and the pavement, as well as the retention of the message.

4.3.3 Colour Change

When non-white colour pavement markings in the wheel path are assessed for colour change against a reference sample in accordance with AS 4049.4 Appendix G, the grey scale rating must be 3 or greater.

4.4 Luminance Factor

When white pavement markings in the wheel path are tested for the luminance factor in accordance with AS 4049.4 Appendix H, Method 2, the test marking must be lighter than Natural Colour System (NCS) swatch S 2500-N (see SS 01 91 02).

4.5 Degree of Wear

When pavement markings are tested for the degree of wear in accordance with AS 4049.4 Appendix L, the pavement marking tested must be “70% of area intact” or better, in accordance with AS 4049.4 Appendix M.

4.6 Thickness

The thickness of any non-profile pavement marking must not exceed 6 mm.

5 Sampling and Testing

Develop and provide to the Nominated Authority a robust statistical sampling plan for assessing the dry retroreflectivity performance of pavement markings, in accordance with AS 4049.5 Appendix D.

Sample and test the pavement markings for their dry retroreflectivity performance in accordance with AS 4049.5 Clause 8, within the first 20 days of opening to traffic.

Provide the results of your testing to the Nominated Authority within 10 working days of carrying out the test.
Locations where performance is regularly found to be below specification requirements may require more frequent inspections and field testing to enable more frequent maintenance, or alternative solutions provided to achieve a better performance.

6 CONFORMITY

6.1 SHAPE AND APPEARANCE

Completed markings must be uniform in appearance, texture, width and thickness and the surface must be free from unbeaded areas, traffic damage or other defects.

Markings must be straight or with smooth even curves where intended. All edges must have a clean sharp cut off.

Remove any marking material beyond the defined marking, leaving a neat marking on the wearing surface of the pavement.

6.2 PAVEMENT MARKINGS REMOVAL

Inspect areas where removal of redundant markings has been carried out, to verify that:

(i) redundant markings have been completely removed;
(ii) pavement area has been cleaned up and waste material removed from the Site;
(iii) any damage to the pavement caused by the marking removal has been repaired;
(iv) guidance provided by the delineation to road users is clear and not misleading.

6.3 NONCONFORMITY

Pavement markings which are not in accordance with this Specification and Design Documentation drawings are nonconforming and must be dealt with in accordance with the quality management system requirements and/or your PROJECT QUALITY PLAN.
ANNEXURES R145/A AND R145/B – (NOT USED)

ANNEXURE R145/C – SCHEDULES OF HOLD POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.2.3.

**C1  SCHEDULE OF HOLD POINTS**

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4</td>
<td>Set out of pavement markings.</td>
</tr>
</tbody>
</table>

**C2  SCHEDULE OF IDENTIFIED RECORDS**

The records listed below are Identified Records for the purposes of RMS D&C Q6 Annexure Q/E.

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description of Identified Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Test results of dry retroreflectivity performance.</td>
</tr>
</tbody>
</table>

**ANNEXURE R145/D – PLANNING DOCUMENTS**

Refer to Clause 1.2.4.

The following documents are a summary of documents that must be included in the PROJECT QUALITY PLAN. The requirements of this Specification and others included in the deed must be reviewed to determine additional documentation requirements.

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4</td>
<td>Evidence of accreditation to the “Painting Contractors Certification Program”.</td>
</tr>
<tr>
<td>2.1</td>
<td>List of materials proposed for use, and details of their limitations under the conditions for which they will be used, such as seasonal restrictions and compatibility with other materials.</td>
</tr>
<tr>
<td>3.6</td>
<td>Details of materials and methods for masking or removal of redundant pavement markings.</td>
</tr>
</tbody>
</table>
ANNEXURE R145/E – SINGLE STAGE DOUBLE COAT APPLICATION OF PAINTED MARKINGS ON NEW OR RESURFACED SPRAYED SEALS

The critical performance criterion for painted marking is a dry retroreflectivity of 200 mcd/lx/m² at between 310 days to 340 days after opening to traffic. To be able to meet this requirement, an initial (within 20 days after opening) dry retroreflectivity level of not less than 350 mcd/lx/m² is required. Using the method stated below, it has been shown that this initial dry retroreflectivity level can consistently be achieved.

Applying an initial primer or base coat of paint and glass beads. On the same visit, and after the primer coat is at least touch dry, apply a secondary coat of paint and glass beads directly over the primer coat. This double coat assists in overcoming some of the inherent difficulties of painted markings on new or resurfaced sprayed seals, due to its high surface texture, and the presence of aggregate precoating chemicals and volatile binder additives, and provide durability for the marking.

Based on the results of trials, a double coat of painted marking with large Type D-HR glass beads, applied through low pressure (less than 500 psi) double angled spray guns and a static bead drop system, can achieve the performance criteria. As a guide, for 14 mm sprayed seals, a wet film paint thicknesses of 600 µm and a bead drop rate of 600 g/m² may be required.
ANNEXURE R145/F – RECOMMENDED CONDITIONS FOR APPLICATION OF WATERBORNE PAINT WITH LARGE GLASS BEADS

To achieve optimum long term performance, apply waterborne paint incorporating glass beads under the following conditions:

(a) air temperature and pavement temperature > 15°C;
(b) relative humidity < 70 %;
(c) air movement > 10 km/hr (reasonable air movement);
(d) adequate protection of lines from traffic during the drying process.

Do not apply waterborne paint when relative humidity is above 85% or when air or road temperatures are below 10°C.

ANNEXURES R145/G TO R145/L – (NOT USED)
ANNEXURE R145/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.6.

**RMS Specifications**

- RMS D&C G10  Traffic Management
- RMS D&C Q6  Quality Management System (Type 6)
- RMS D&C R110  Coloured Surface Coatings for Bus Lanes and Cycleways
- RMS D&C R142  Retroreflective Raised Pavement Markers

**RMS Technical Documents**

- RMS Delineation Manual
- TD 2009/SR02  Dragon’s Teeth at School Zones (RMS Centre for Road Safety)

**Australian Standards**

- AS/NZS 1580.601.1  Paints and related materials – Methods of test – Colour – Visual comparison
- AS 1742.2  Manual of uniform traffic control devices – Traffic control devices for general use
- AS 2700S  Colour standards for general purposes – Swatches
- AS 4049  Paints and related materials – Pavement marking materials
  - AS 4049.4  High performance pavement marking systems
  - AS 4049.5  Performance assessment of pavement markings

**Australian Paint Approval Scheme (APAS) Specifications**

- AP-S0042  Glass Beads for Pavement Marking Paint

**Natural Colour System (NCS) Colour Swatches**

- NCS SS 01 91 02
APPENDICES 1 TO 5
# APPENDIX 1 – LONGITUDINAL PAVEMENT MARKINGS

<table>
<thead>
<tr>
<th>Line</th>
<th>Type</th>
<th>Pattern and Dimensions</th>
<th>Reference Section*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIVIDING LINES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dividing (Separation) line on 2 lane road</td>
<td>S1</td>
<td>3 9 3 9 0.10</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dividing (Separation) line on multi lane road</td>
<td>S6</td>
<td>9 3 9 3 0.15</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dividing (Barrier) lines (Restricted overtaking in one direction)</td>
<td>BS</td>
<td>3 9 3 9 0.10</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dividing (Barrier) lines</td>
<td>BB</td>
<td>0.10 0.10</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td></td>
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**Notes:**

(all dimensions in m unless stated otherwise)

* Section in RMS Delineation Manual
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</tr>
</thead>
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<tr>
<td>ENHANCED DIVIDING LINES #</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Dividing (Separation) line on 2 lane road</td>
<td>S3</td>
<td>3 9 3 9 0.20</td>
<td>5.2.2</td>
</tr>
<tr>
<td>Dividing (Barrier) lines (Restricted overtaking in one direction)</td>
<td>BS1</td>
<td>0.150 0.150 0.150 0.150</td>
<td>5.2.3</td>
</tr>
<tr>
<td>Dividing (Barrier) lines</td>
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<td>0.150 0.150</td>
<td>5.2.3</td>
</tr>
<tr>
<td>Dividing (Barrier) lines</td>
<td>BB2</td>
<td>0.200 0.200 0.600 0.200</td>
<td>5.2.3</td>
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</table>

Notes:
(all dimensions in m unless stated otherwise)
* Section in RMS Delineation Manual
# Use of enhanced dividing lines requires approval of GM, Traffic Management
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<th>Line</th>
<th>Type</th>
<th>Pattern and Dimensions</th>
<th>Reference Section*</th>
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</thead>
<tbody>
<tr>
<td>LANE LINES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lane line on multi lane roads including motorways and dual-carriageways</td>
<td>L1</td>
<td>3 9 3 9 0.10</td>
<td>4.6</td>
</tr>
<tr>
<td>Enhanced lane line (profile) on motorways, dual carriageways or on special locations such as bridges ²</td>
<td>L2</td>
<td>3 9 3 9 0.10</td>
<td>4.6, 5.2.5</td>
</tr>
<tr>
<td>Lane line on multi lane road</td>
<td>L3</td>
<td></td>
<td>4.6</td>
</tr>
<tr>
<td>Exit lane line on multilane roundabouts</td>
<td>L4</td>
<td>9 3 9 3 0.10</td>
<td>4.6</td>
</tr>
<tr>
<td>Defines the edge of a Bus Lane and Bus Only lane adjacent to general traffic lane</td>
<td>L6</td>
<td>35 1 35 0.10</td>
<td>4.6</td>
</tr>
<tr>
<td>Defines the edge of a Bicycle Lane adjacent to general traffic lane</td>
<td>L7</td>
<td></td>
<td>4.6</td>
</tr>
<tr>
<td>Enhanced lane line</td>
<td>L5</td>
<td></td>
<td>4.6, 5.2.4</td>
</tr>
</tbody>
</table>

Notes:

(all dimensions in m unless stated otherwise)

* Section in RMS Delineation Manual

² Use of enhanced dividing lines requires approval of GM, Traffic Management
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<th>Line Type</th>
<th>Pattern and Dimensions</th>
<th>Reference Section</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EDGE LINES</strong></td>
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</tr>
<tr>
<td>Left hand edge line on general purpose road (E1)</td>
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<td>4.7</td>
</tr>
<tr>
<td>Left hand edge line on Motorway (E2)</td>
<td></td>
<td>4.7</td>
</tr>
<tr>
<td>Right hand edge on divided carriageway (E3)</td>
<td></td>
<td>4.7</td>
</tr>
<tr>
<td>Outline of traffic island or freeway ramp gore (E4)</td>
<td></td>
<td>4.7</td>
</tr>
<tr>
<td>Outline of painted median (E5)</td>
<td></td>
<td>4.7</td>
</tr>
<tr>
<td>Line applied to incline face of median kerb (E6)</td>
<td></td>
<td>4.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Line Type</th>
<th>Pattern and Dimensions</th>
<th>Reference Section</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PROFILE LINES</strong></td>
<td></td>
<td>5.2.6</td>
</tr>
<tr>
<td>Continuity line (C1)</td>
<td></td>
<td>4.8</td>
</tr>
<tr>
<td>Turning line (T1)</td>
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<td>4.9</td>
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</table>

<table>
<thead>
<tr>
<th>Line Type</th>
<th>Pattern and Dimensions</th>
<th>Reference Section</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KERBSIDE PARKING RESTRICTION LINES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clearway line (C2)</td>
<td></td>
<td>13.2</td>
</tr>
<tr>
<td>No Stopping line (C3)</td>
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<td>13.3</td>
</tr>
</tbody>
</table>

**Notes:**
(all dimensions in m unless stated otherwise)

* Section in RMS Delineation Manual
<table>
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<tr>
<th>Line</th>
<th>Type</th>
<th>Pattern and Dimensions</th>
<th>Reference Section*</th>
</tr>
</thead>
<tbody>
<tr>
<td>BICYCLE LINES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicycle lane line</td>
<td>L7</td>
<td></td>
<td>4.10</td>
</tr>
<tr>
<td>Bicycle lane continuity line</td>
<td>C4</td>
<td></td>
<td>4.10</td>
</tr>
<tr>
<td>Bicycle separation line for off-road bike path (with restricted visibility)</td>
<td>S4</td>
<td></td>
<td>4.10</td>
</tr>
<tr>
<td>Bicycle lane separation line for off-road bike path (Straight sections)</td>
<td>S5</td>
<td></td>
<td>4.10</td>
</tr>
<tr>
<td>Bicycle edge line for off-road bike paths &amp; shared paths</td>
<td>E7</td>
<td></td>
<td>4.10</td>
</tr>
</tbody>
</table>

Notes:
(all dimensions in m unless stated otherwise)

* Section in RMS Delineation Manual
# APPENDIX 2 – TRANSVERSE PAVEMENT MARKINGS

<table>
<thead>
<tr>
<th>Line Type</th>
<th>Use</th>
<th>Dimensions (m)</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>TF</td>
<td>Stop line</td>
<td><img src="image" alt="TF Diagram" /></td>
<td>White</td>
</tr>
<tr>
<td>TF1</td>
<td>NO LONGER USED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TF2</td>
<td>NO LONGER USED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TB</td>
<td>Give Way Line (Used with signs)</td>
<td><img src="image" alt="TB Diagram" /></td>
<td>White</td>
</tr>
<tr>
<td>TB1</td>
<td>Give Way Line (Used on right side of road)</td>
<td><img src="image" alt="TB1 Diagram" /></td>
<td>White</td>
</tr>
<tr>
<td>PCW</td>
<td>Pedestrian Cross Walk Lines</td>
<td><img src="image" alt="PCW Diagram" /></td>
<td>White</td>
</tr>
<tr>
<td>PX</td>
<td>Pedestrian Crossing</td>
<td><img src="image" alt="PX Diagram" /></td>
<td>White</td>
</tr>
</tbody>
</table>

Dimensions in mm unless stated otherwise
Transverse line at a stop sign
(all dimensions in mm unless stated otherwise)

Transverse line at a stop sign with pedestrian crossing
(all dimensions in mm unless stated otherwise)

Transverse line at a give way sign
(all dimensions in mm unless stated otherwise)
Transverse lines at traffic signals

(all dimensions in mm unless stated otherwise)

Transverse lines at a stop & give way sign at a junction with gravel road.

Transverse lines at a stop & give way sign at a junction with sealed road
Transverse line at a stop & give way sign connecting road on a dual carriageways.

Transverse lines for other applications
(all dimensions in mm unless stated otherwise)

- Ferry Approach
- Opening Bridge
- One Lane Bridge
- Level Crossing with Signals and/or Gate

* 5 - 10m Ferry Gate or Signals
  3m Gate other than Ferry

- Level Crossing With Stop Sign

- Open Level Crossing
  One Lane Bridge without Stop Signs or Signals
  Give Way Sign or RLC + B Assembly

Gate or Signal

300

TF

300

TF

300

TF

300

TB  600

300

TB  600

300
Typical pedestrian crosswalk lines at an intersection with a marked foot crossing

(all dimensions in mm unless stated otherwise)

Typical pedestrian crosswalk lines at mid block marked foot crossing

(all dimensions in mm unless stated otherwise)
Transverse lines for scramble crossing

(all dimensions in mm unless stated otherwise)

Zig Zag Markings

(all dimensions in mm unless stated otherwise)
### Arrows – types, uses and shapes

<table>
<thead>
<tr>
<th>No</th>
<th>Description of requirements</th>
<th>Four lane</th>
<th>Three lane</th>
<th>Two lane</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Legal manoeuvres if lane unmarked</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Legal manoeuvres if left lane only marked</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Legal manoeuvres if right lane only marked</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Markings for two exclusive left turn lanes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Markings for two exclusive right turn lanes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Markings for shared left turn and through from lane adjacent to left turn lane</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Markings for shared right turn and through from lane adjacent to right turn lane</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Markings for shared left turn and through from lane adjacent to exclusive left turn lanes</td>
<td></td>
<td></td>
<td></td>
<td>NOT APPLICABLE</td>
</tr>
<tr>
<td>9</td>
<td>Markings for shared right turn and through from lane adjacent to exclusive right turn lanes</td>
<td></td>
<td></td>
<td></td>
<td>NOT APPLICABLE</td>
</tr>
<tr>
<td>10</td>
<td>Markings to indicate left turn prohibition (signing also required, see Clause 2.2.2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Markings to indicate right turn prohibition (signing also required, see Clause 2.2.2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**

1. Full lines indicate arrows to be marked.
2. Dotted lines indicate manoeuvres which are permitted by regulations but which need not be marked.
3. On some intersection approaches, it may be necessary to combine two or more of the marking methods shown.

*(Ref. AS 1742.2 Fig. 5.8)*
**APPENDIX 3 – PAVEMENT MARKINGS AND SYMBOLS FOR BICYCLE FACILITIES**

### Linemarking specifications

- **L7** Bicycle lane line  
  Continuous line 100 mm wide

- **C4** Bicycle lane continuity line  
  Dashed line 100 mm wide, 1000 mm long with 3000 mm gap

- **S4** Off-road path continuous separation line  
  Continuous line 100 mm wide (used on path sections with restricted visibility or at intersections)

- **S5** Off-road path broken separation line  
  Dashed line 100 mm wide, 1000 mm long with 3000 mm gap (used on straight path sections)

- **E7** Edge line for off-road bicycle paths and shared paths  
  Continuous line 100 mm wide

#### Pavement symbols for on-road use

- **Bicycle lane traffic signal pavement arrows and symbols**
  - BA-2
  - BA-3R
  - BA-3L
  - BA-4R
  - BA-4L
  - BA-6

- **Bicycle lane pavement arrows and symbols**
  - BA-1
  - BA-1
  - UA-1 to UA-6

- **Stop and Give Way lines for off-road paths**
  - **TFB** Stop line on path  
    200 mm wide
  - **TBB** Give Way line on path  
    200 mm wide, 200 mm long with 200 mm gap

#### Pavement direction arrow symbols for off-road paths

- PS-2
- PA-1
- PA-2
- PA-3R
- PA-3L
- PA-4R
- PA-4L
- PA-6

### APPENDIX 4 - (NOT USED)
### APPENDIX 5 – PAVEMENT MARKINGS AT ROUNDABOUTS

<table>
<thead>
<tr>
<th>Line Type</th>
<th>Use</th>
<th>Dimensions (m)</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(for dimensions shown * see marker spacing column)</td>
<td></td>
</tr>
<tr>
<td>L4</td>
<td>Exit lane line on multilane roundabouts</td>
<td><a href="#">Diagram</a> 9 <em>3</em> 9 <em>3</em> 0.10 0.6 0.6 0.6 0.6 0.6 0.30</td>
<td>White</td>
</tr>
<tr>
<td>TB</td>
<td>Holding Line</td>
<td><a href="#">Diagram</a> 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.30</td>
<td>White</td>
</tr>
</tbody>
</table>

**Roundabout Pavement Markings, four 2 lane entry/ exits**

![Roundabout Diagram](#)
Roundabout pavement markings, two 2 lane entry/exits with two 1 lane entry/exits

Roundabout pavement markings, four 2 lane entry/exit with one exclusive left turn lane

The painted chevrons should be replaced with concrete kerb in the future.
Roundabout pavement markings, T junction with two 2 lane and one 1 lane entry/exit

Roundabout pavement markings, dual right turn on one approach
FIGURES 9 TO 20
Notes:

1. Minimum length of arrow:
   (a) Straight ahead arrow and combined arrow = 6 m.
   (b) Turn arrow = 4 m.

2. The width of grid squares is constant at 100 mm. The height of the grid is 100 mm minimum.

Figure 9 – Intersection Arrows (Ref. AS 1742.2 Fig. 5.9)
Notes:

1. Minimum length of arrow:
   (a) Double turn arrow = 4 m.
   (b) U-turn arrow = 5 m.
   (c) Sequential turns and 45° turn arrows = 6 m.

2. The width of grid squares is constant at 100 mm. The height of the grid is 100 mm minimum.

Figure 10 – Intersection Arrows (Ref. AS 1742.2 Fig. 5.10)
Figure 11 – Lane Change Arrows (Ref. AS 1742.2 Fig. 5.11)

Figure 12 – (Not Used)
PAVEMENT ARROW FOR USE ON ONE WAY ROADS
(For Restrainment of Wrong Way Movements)

SA1

Figure 13
Figure 14

- 150 wide white continuity line
- 1000 stripes with 3000 gaps

White reflectorised chevrons

150 wide white line
Figure 15

*NOTE:

1. Angle for diagonal markings
   45° (Speeds less than 90km/h)
   30° (Speeds 90km/h or higher)
Figure 16
PAVEMENT MARKING IN ADVANCE OF OPEN LEVEL CROSSINGS

Figure 17
Note:
1. The grid width is constant at 100mm but the grid height "X" may vary.
2. The grid height $X = \frac{\text{height of letter or numeral required in mm}}{40}$

PAVEMENT ALPHABET AND NUMERALS

Figure 18
NOTES:

1. For school zones where lane lines are not marked, patch to be positioned:
   - centrally between the separation line/centre of road and edge of pavement/bitumen where a parked vehicle would not obscure any part of the patch when the zone is in effect.
   - 300mm from the separation line/centre of road where a parked vehicle would obscure any part of the patch when the zone is in effect.

For school zones and school bus stop zones where lane lines are marked, patch to be positioned centrally in each lane. Do not position a patch in the kerbside lane where a parked vehicle would obscure any part of the patch when the zone is in effect.

2. Border, white for school zone, yellow for school bus stop zone.

3. Square, yellow for school zone, white for school bus stop zone.

4. Numerals, black.

5. For installation specification, refer to School Zones.

Measurements are in mm, unless otherwise stated.

SCHOOL ZONE AND SCHOOL BUS STOP ZONE
SPEED NUMERAL PAVEMENT PATCH

Figure 19
E-TAG PAVEMENT MARKING

FIGURE 20