CONSTRUCTION SPECIFICATION FOR DEVELOPMENTS AND SUBDIVISIONS

C261 - Pavement Markings
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ORIGIN OF DOCUMENT, COPYRIGHT

This document was originally based on AUS-SPEC - Development Construction Specification C261 - Pavement Markings. Substantial parts of the original AUS-SPEC document have been deleted and replaced in the production of this Tamworth Regional Council Specification. The parts of the AUS-SPEC document that remain are still subject to the original copyright.

REVISIONS: C261 - PAVEMENT MARKINGS

<table>
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<th>CLAUSES AMENDED</th>
<th>DATE ISSUED (The new version takes effect from this date)</th>
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<tr>
<td>0</td>
<td>Original Issue</td>
<td></td>
<td>30/11/2018</td>
<td></td>
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</tbody>
</table>
GENERAL

C261.01 SCOPE

This Specification is for the setting out, supply and application of pavement marking paint, thermoplastic pavement marking material and raised pavement markers as shown on the approved design drawings.

Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in CQC-Quality Control Requirements Sub-Annexure B9.

C261.02 REFERENCE DOCUMENTS

Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

Where not otherwise specified in the relevant Tamworth Regional Council (TRC) Construction Specifications or the approved design drawings, the Constructor shall use the latest versions of the Reference documentation, including amendments and supplements, listed in the TRC Construction Specifications at the time of the Works approval.

(a) Tamworth Regional Council (TRC) Specifications

- C201 - Control of Traffic.
- C244 - Sprayed Bituminous Surfacing.
- C245 - Asphaltic Concrete.
- CQC - Quality Control Requirements

(b) Australian Standards

References in this Specification or on the approved design drawings to Australian Standards are noted by their prefix AS or AS/NZS.

- AS 1580.107.3 - Determination of wet film thickness by gauge.
- AS 1742.2 - Traffic control devices for general use.
- AS 1906.3 - Raised pavement markers (retroreflective and non-retroreflective).
- AS 2700S - Colour standards for general purposes.
- AS 4049.1 - Solvent-borne paint - For use with drop-on beads.
- AS 4049.2 - Thermoplastic road marking materials.
- AS 4049.3 - Waterborne paint - For use with drop-on beads.

(c) Roads and Maritime (RMS) Specifications

- RMS QA Specification 3359 - Profile Thermoplastic Roadmarking Material.
- RMS QA Specification 3660 - Two Part cold - applied Roadmarking Material.
- RMS QA Specification 3353 - Glass Beads.
- RMS QA Specification 3354 - Adhesives for Raised Pavement Marker Installation.

c) Other Publications

TRC Engineering Guidelines for Subdivisions and Developments.
C261.03 TYPE OF MARKINGS

Details of the various types of pavement markings and devices are generally in accordance with the requirements of AS 1742.2.

C261.04 TYPES OF MATERIALS TO BE APPLIED

The materials shall be applied as follows:

(a) Pavement Marking Paint

Permanent markings on all wearing surfaces. Temporary markings, other than on the final wearing surfaces. Traffic islands and kerbs where specified.

(b) Thermoplastic Pavement Marking Material

Permanent markings where explicitly indicated on the approved design drawings.

(c) Reflective Glass Beads

To be applied to all painted and thermoplastic markings.

(d) Raised Pavement Markers

To be installed as permanent and temporary markings as shown on the approved design drawings.

C261.05 MATERIAL QUALITY

The Constructor shall submit to the Developer’s Representative sufficient evidence that the materials meet the quality requirements, including paint, glass beads, raised pavement markers and thermoplastic material (refer Hold Points).

Only materials conforming to the requirements of the referenced Specifications and Standards shall be used.

C261.06 SETTING OUT

The Constructor shall set out the work to ensure that all markings are placed in accordance with the approved design drawings. Setting out lines are to be covered by the permanent marking so it is not visible once completed.

The locations of pavement markings shall not vary by more than 20mm from the locations shown on the approved design drawings. Where new pavement markings require a taper to transition to existing pavement markings, a minimum taper length of 15:1 shall be adopted.

C261.07 SURFACE PREPARATION

Pavement markings shall only be applied to clean dry surfaces. The Constructor shall clean the surface to ensure a satisfactory bond between the markings and wearing surface of the pavement. The surface shall be free of aggregate, dirt, gravel and any other material that may compromise adhesion.

Pavement marking shall not be carried out during wet weather or, if in the opinion of the Developer’s Representative, rain is likely to fall during, or immediately after, the process.

Where raised pavement markers are specified for pavements having a concrete wearing surface, the full area under each raised pavement marker shall be lightly scabbled to remove fine mortar material (laitance).
C261.08 PROVISION FOR TRAFFIC AND PROTECTION OF WORK

The Constructor shall provide for traffic, in accordance with C201 - Control of Traffic, while undertaking the work and shall protect the pavement markings until the material has hardened sufficiently so that traffic will not cause damage.

C261.09 MAINTENANCE OF PAVEMENT MARKINGS

The Constructor shall be responsible for the maintenance, and replacement if necessary, of raised pavement markers and all pavement marking during the duration of the Works and the Maintenance Bond Period for Developer Infrastructure Works as defined in the TRC Engineering Guidelines for Subdivisions and Developments.

PAVEMENT MARKING PAINT

C261.10 MATERIALS

Paint shall comply with the requirements of AS 4049.1 or AS 4049.3. In this Specification, the term 'paint' shall mean 'pavement marking paint'.

Glass beads shall comply with the requirements of AS 2009 for drop-on beads.

The nominated paint colours shall comply with the following reference colours in accordance with AS 2700S:

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

C261.11 MIXING OF PAINT

All paint shall be thoroughly mixed in its original container before use to produce a smooth uniform product consistent with the freshly manufactured product.

C261.12 APPLICATION OF PAINT AND BEADS

All longitudinal lines shall be sprayed by an approved self-propelled machine. The two sets of lines forming a one-way or two-way barrier line pattern shall be sprayed concurrently.

Hand spraying with the use of templates to control the pattern and shape shall be permitted for transverse lines, symbols, legends, arrows and chevrons.

The paint shall be applied uniformly and the wet film thickness shall be neither less than 0.30 mm nor more than 0.40 mm.

Glass beads shall be applied by air propulsion to the surface of all longitudinal lines at a net application rate of 0.30kg/m² immediately after application of the paint prior to a skin forming. The actual application rate shall be set to overcome any loss of beads between the bead dispenser and the sprayed line.

Glass beads shall be similarly applied to all other paint markings at a net application rate of 0.30kg/m² immediately after application of the paint.

Pavement markings shall be straight or with smooth, even curves where intended. All edges shall have a clean, sharp cut off. Any marking material applied beyond the defined edge of the marking shall be removed leaving a neat and smooth marking on the wearing surface of the pavement.
The lengths of longitudinal lines shall not vary by more than 20mm from the lengths shown in AS 1742.2. The widths of longitudinal lines shall not vary by more than 10mm from the widths shown in AS 1742.2.

The lengths and widths of transverse lines shall not vary by more than 10mm from the lengths and widths shown in AS 1742.2.

The dimensions of arrows, chevrons, painted medians, painted left turn islands and speed markings shall not vary by more than 50mm from the dimensions shown on the design plans or in AS 1742.2 as appropriate. Arrows and speed markings shall be placed square with the centreline of the traffic lane.

Waterborne pavement markings shall be applied in a two stage application process for new Sprayed Bituminous Surfacings. The second coat shall be applied after two months, but before three months after the initial markings are placed.

C261.13 FIELD TESTING

The thickness of the wet film applied to the road pavement shall be checked by the method described in AS 1580.107.3 Method B, comb gauge.

<table>
<thead>
<tr>
<th>Road Speed (km/h)</th>
<th>Line Widths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>75mm</td>
</tr>
<tr>
<td>8</td>
<td>371</td>
</tr>
<tr>
<td>13</td>
<td>603</td>
</tr>
<tr>
<td>16</td>
<td>742</td>
</tr>
</tbody>
</table>

1. Tolerance of +10% shall be permissible when measuring the above volume.

2. When two or more glass bead dispensers are to be used, each dispenser shall be checked separately to make up the totals shown.

3. Glass beads weigh approximately 1.53 grams per millilitre (ml).

Table C261.1 - Volume of glass beads (ml) required in 10 seconds of operation.
**THERMOPLASTIC PAVEMENT MARKING MATERIAL**

**C261.14 MATERIALS**

Thermoplastic pavement marking material shall comply with the requirements of AS 4049.2 or RMS QA Specification 3357.

In this Specification, the term 'thermoplastic material' shall mean 'thermoplastic pavement marking material'.

Glass beads shall be incorporated in thermoplastic material, in the proportion of 10% of the total mass, as part of the aggregate constituent and shall comply with the requirements of AS 2009, Intermix type.

Glass beads for surface application shall comply with the requirements of AS 2009, Drop-on beads.

Tack coat material shall be to the manufacturer's specification as approved by the Developer's Representative.

**C261.15 PREPARATION OF THERMOPLASTIC MATERIAL ON SITE**

For sprayed applications, the thermoplastic material shall be uniformly heated in a suitable oil bath kettle to the temperature recommended by the manufacturer. The thermoplastic material shall not be heated above the temperature recommended by the manufacturer. The thermoplastic material shall not remain molten for more than 6 hours for hydrocarbon resins and 4 hours for wood and gum resins. Should over-heating occur and/or the time expire for molten materials, then the thermoplastic material shall be discarded.

**C261.16 APPLICATION OF THERMOPLASTIC MATERIAL AND BEADS**

Where the wearing surface of the pavement is smooth or polished, a tack coat of material may be required by the TRC Representative and shall be applied in accordance with the recommendations of the thermoplastic manufacturer. The tack coat shall be applied immediately before the application of the thermoplastic material in accordance with the directions of the manufacturer of the thermoplastic material and the manufacturer of the tack coat material.

All longitudinal lines shall be sprayed by a self-propelled machine. The two sets of lines forming a one-way or two-way barrier line shall be sprayed concurrently. The thermoplastic material shall be applied uniformly and the cold film thickness shall be greater than 1.8mm.

Glass beads shall be applied by air propulsion to the surface of all longitudinal lines at a net application rate of 0.40kg/m² immediately after application of the thermoplastic material. The actual application rate shall be set to overcome any loss of beads between the bead dispenser and the sprayed line.

All transverse lines, symbols, legends and arrows shall be screeded. The screeded thermoplastic material shall be applied using a mobile applicator, with templates to control the pattern.

The thermoplastic material for transverse lines, symbols, legends and arrows shall be applied uniformly and the cold film thickness shall be 3.0mm with a tolerance of plus or minus 1.0mm. The surface finish shall be smooth.

Glass beads for other than longitudinal lines shall be uniformly applied to screeded markings at a net application rate of 0.30kg/m² immediately after application of the thermoplastic material by a method approved by the Developer’s Representative.
Pavement marking shall be straight or with smooth, even curves where intended. All edges shall have a clean, sharp cut off. Any marking material applied beyond the defined edge of the marking shall be removed leaving a neat and smooth marking on the wearing surface of the pavement.

The lengths of longitudinal lines shall not vary by more than 20mm from the lengths shown in AS 1742.2. The widths of longitudinal lines shall not vary by more than 10mm from the widths shown in AS 1742.2.

The lengths and widths of transverse lines shall not vary by more than 10mm from the lengths and widths shown in AS 1742.2.

The dimensions of arrows, chevrons, painted medians, painted left turn islands and speed markings shall not vary by more than 50mm from the dimensions shown on the approved design plans or in AS 1742.2 as appropriate. Arrows and speed markings shall be placed square with the centreline of the traffic lane.

C261.17 FIELD TESTING

The thickness of the cold film of thermoplastic material applied to the road pavement shall be checked by measurement, using a micrometer, of the thickness of thermoplastic material applied to a metal test plate.

The application rate of glass beads applied to the surface of the markings shall be checked by the method described in Annexure C261A.

The following details shall be submitted to the Developer’s Representative at least ten (10) working days prior to the commencement of pavement marking work:

- Traffic Management Arrangements;
- Materials proposed and evidence of conformance;
- Material application rates; and
- Spray Equipment and work methodologies.

PROCESS HELD: Application of Pavement Markings.

C261.18 MATERIALS

Raised pavement markers, both reflective and non-reflective, shall comply with AS 1906.3 and shall have the dimensions shown on the approved design drawings.

The adhesive used for attaching the raised pavement markers to the wearing surface shall comply with RMS QA Specification 3354.

C261.19 INSTALLATION OF RAISED PAVEMENT MARKERS

For new work, the raised pavement markers shall be installed in accordance with the approved design drawings.

Raised pavement markers shall be fixed to the wearing surface of the pavement using a hot melt bitumen adhesive or an equivalent product. The adhesive shall be freshly heated to the Manufacturer’s instructions and thoroughly mixed. The adhesive shall not be allowed to cool and be reheated prior to use.
The adhesive shall be spread uniformly over the underside of the raised pavement marker to a depth of approximately 10 mm. The raised pavement marker shall be pressed down onto the pavement surface in its correct position and shall be rotated slightly until the adhesive is squeezed out around all edges of the marker. The raised pavement marker shall not be disturbed until the adhesive has set.

On rough surfaces, such as newly laid coarse sprayed bituminous seals, and where directed by the TRC Representative, an initial pad of adhesive of diameter 20mm larger than the diameter of the base of the raised pavement marker, shall be provided. The adhesive shall be applied to fill the irregularities in the pavement surface to produce a flat, smooth surface flush with the upper stone level.

The adhesive pad shall be allowed to set. Additional adhesive shall be applied to the pavement, as described above, and then the raised pavement marker shall be pressed down onto the adhesive pad on the pavement surface to ensure good adhesion.

### HOLD POINT

The following details shall be submitted to the Developer’s Representative at least 10 working days prior to the Installation of Raised Pavement Markers:

- Traffic Management Arrangements.
- Raised Pavement Marker type and conformance.
- Adhesive type and proposed methodology.

**PROCESS HELD:** Installation of Raised Pavement Markers.

### REMOVAL OF PAVEMENT MARKINGS

**C261.20 GENERAL**

The Constructor shall remove pavement markings and other delineators (i.e. stick and stomps or raised pavement markers), no longer required or incorrectly installed by the Constructor, from the wearing surface of pavements without significant damage to the surface.

The method of removal shall be permanent. Painting over existing linemarking is not permissible.
## LIMITS AND TOLERANCES

### C261.21 SUMMARY OF LIMITS AND TOLERANCES

The limits and tolerances applicable to the various clauses of this Specification are summarised in Table C261.2 below:

<table>
<thead>
<tr>
<th>Item</th>
<th>Activity</th>
<th>Limits/Tolerances</th>
<th>Spec Clause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Location of Markings</td>
<td>± 20mm from specified location</td>
<td>C261.06</td>
</tr>
<tr>
<td></td>
<td>Location of Markings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Longitudinal Lines</td>
<td>± 20mm from lengths shown in AS 1742.2</td>
<td>C261.12</td>
</tr>
<tr>
<td></td>
<td>(a) Length</td>
<td></td>
<td>C261.16</td>
</tr>
<tr>
<td></td>
<td>(b) Width</td>
<td>± 10mm from widths shown in AS 1742.2</td>
<td>C261.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C261.16</td>
</tr>
<tr>
<td>3</td>
<td>Transverse Lines</td>
<td>± 10mm from lengths and widths shown in AS 1742.2</td>
<td>C261.12</td>
</tr>
<tr>
<td></td>
<td>(a) Length</td>
<td></td>
<td>C261.16</td>
</tr>
<tr>
<td></td>
<td>(b) Width</td>
<td></td>
<td>C261.16</td>
</tr>
<tr>
<td>4</td>
<td>Arrows, Chevrons, Painted Medians, Speed Markings etc.</td>
<td>± 50mm from the dimensions shown in AS 1742.2</td>
<td>C261.12</td>
</tr>
<tr>
<td></td>
<td>Arrows, Chevrons, Painted Medians, Speed Markings etc.</td>
<td></td>
<td>C261.16</td>
</tr>
<tr>
<td>5</td>
<td>Application of Paint</td>
<td>&gt;0.30mm, &lt;0.40mm</td>
<td>C261.12</td>
</tr>
<tr>
<td></td>
<td>(a) Film Thickness</td>
<td></td>
<td>C261.12</td>
</tr>
<tr>
<td>6</td>
<td>Application of Thermoplastic</td>
<td>2.0mm ± 0.5mm</td>
<td>C261.16</td>
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<td></td>
<td>(a) Longitudinal Lines - Cold Film Thickness</td>
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<td>C261.16</td>
</tr>
<tr>
<td></td>
<td>(b) Transverse Lines, Symbols, Arrows etc. Cold Film Thickness</td>
<td>3.5mm ± 1.5mm</td>
<td>C261.16</td>
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<tr>
<td>7</td>
<td>Glass Beads</td>
<td></td>
<td>C261.16</td>
</tr>
<tr>
<td></td>
<td>(a) Volume used for longitudinal lines (Paint)</td>
<td>0.30 kg/m² ± 10%</td>
<td>C261.12</td>
</tr>
<tr>
<td></td>
<td>(b) Volume used for other markings (Paint)</td>
<td>0.30 kg/m² ± 10%</td>
<td>C261.12</td>
</tr>
<tr>
<td></td>
<td>(c) Volume used for longitudinal lines (Thermoplastic)</td>
<td>0.40 kg/m² ± 10%</td>
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<tr>
<td></td>
<td>(d) Volume used for other markings (Thermoplastic)</td>
<td>0.40 kg/m² ± 10%</td>
<td>C261.16</td>
</tr>
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</table>

Table C261.2 - Summary of Limits and Tolerances
ANNEXURE C261A - PROCEDURE FOR MEASUREMENT OF RATE OF APPLICATION OF SPHERICAL GLASS BEADS

1. SCOPE

The following procedure shall be adopted for field measurement of the rate of application of spherical glass beads on to wet paint or thermoplastic surfaces.

2. SPHERICAL GLASS BEADS

The glass beads shall comply with AS 2009.

3. MEASUREMENT

The method of field measurement shall be as follows:

(a) Turn off the paint or thermoplastic supply valves and operate the glass bead dispenser for exactly 10 seconds allowing glass beads to run into a plastic bag or tray.

(b) Pour the glass beads from the bag or tray into a suitable measuring cylinder calibrated in millilitres to measure the volume of glass beads collected. Level but do not compact the glass beads in the cylinder.

(c) Compare the volume of glass beads collected with the correct figure given in Table C261.1.

Table C261.1 shows the correct volumes of glass beads required to give a net application rate on the marked line of approximately 0.30 kilograms per square metre for different line widths and road speeds. The glass bead volume figures given in Table C261.1 are calculated for an actual application rate of 0.34 kilograms per square metre. These figures are used for calibrating the machine because there is a loss of beads between the bead dispenser and the marked line and the volume is measured with beads not compacted. For the calibration of application rates to suit class D beads, the above table will need to be altered to 0.50kg/m2.