CAPRICORN MUNICIPAL DEVELOPMENT GUIDELINES

PAVEMENT MARKINGS

C261

CONSTRUCTION SPECIFICATION

TABLE OF CONTENTS

Keeping the Capricorn Municipal Development Guidelines up-to-date

The Capricorn Municipal Development Guidelines are living documents which reflect progress of municipal works in the Capricorn Region. To maintain a high level of currency that reflects the current municipal environment, all guidelines are periodically reviewed with new editions published and the possibility of some editions to be removed. Between the publishing of these editions, amendments may be issued. It is important that readers assure themselves they are using current guideline, which should include any amendments which may have been published since the guideline was printed. A guideline will be deemed current at the date of development approval for construction works.

GENERAL

C261.01 SCOPE

C261.01.01 The work to be executed under this Specification consists of the setting out, supply and application of pavement marking paint, thermoplastic pavement marking material, pavement marking tape and raised pavement markers as shown on the Drawings and in accordance with this Specification.

C261.01.02 Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in Annexure C261B. ***Quality***

C261.01.03 The following order of priority for interpretation of documents will apply: (Please note that reference to a Guideline or Standard, is reference to the latest version of the relevant document, unless specifically a version number is specifically stated) ***Order of Priority***

1. CMDG C261 Pavement Markings Construction Specification
2. Manual of Uniform Traffic Control Devices (MUTCD)
3. Traffic and Road Use Manual (TRUM)
4. Australian Standards

C261.02 REFERENCE DOCUMENTS

C261.02.01 Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) CMDG Specifications

C201 - Control of Traffic

(b) Australian Standards

AS 1580	-	Paints and related materials - Methods of test
AS/NZS 1580.107.3	-	Determination of wet film thickness by gauge
AS 1580.401.8	-	No-pick-up time of road marking paints
AS 1742.2	-	Manual of uniform traffic control devices - Traffic control devices for general use
AS 1742.3	-	Traffic control for works on roads
AS 1906	-	Retroreflective materials and devices for road traffic control purposes
AS 1906.3	-	Raised pavement markers (retro-reflective and non-retro-reflective).
AS/NZS 2009	-	Glass beads for road-marking materials.
AS 2700	-	Colour standards for general purposes
AS 4049.1	-	Solvent-borne paint - For use with surface applied glass beads.
AS 4049.2	-	Thermoplastic road marking materials – for use with surface applied glass beads
AS 4049.3	-	Waterborne paint - For use with surface applied glass beads.

(c) Queensland Department of Main Roads Publications

MUTCD	-	Manual of Uniform Traffic Control Devices (MUTCD)
TRUM	-	Traffic and Road Use Manual

C261.03 TYPE OF MARKINGS

C261.03.01 Details of the various types of pavement markings and devices are generally in accordance with the requirements of the MUTCD.

Standard

C261.04 TYPES OF MATERIALS TO BE APPLIED

C261.04.01 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 Drawings.

c) Pavement Marking Tape
Temporary markings on final wearing surfaces.

d) Reflective Glass Beads
To be applied to all painted and thermoplastic markings.

e) Raised Pavement Markers
To be installed as permanent and temporary markings as shown on the Drawings.

Locations for Use

C261.05 SETTING OUT

C261.05.01 The Contractor shall set out the work to ensure that all markings are placed in accordance with the Drawings.

Contractor's Responsibility

C261.05.02 The locations of pavement markings shall not vary by more than 20mm from the locations shown on the Drawings.

Tolerance

C261.06 SURFACE PREPARATION

C261.06.01 Pavement markings shall only be applied to clean dry surfaces. The Contractor shall clean the surface to ensure a satisfactory bond between the markings and wearing surface of the pavement.

Clean Dry Surface

C261.06.02 Pavement marking shall not be carried out during wet weather or, if in the opinion of the Superintendent, rain is likely to fall during the process.

Wet Weather

C261.06.03 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).

Scabbling

C261.06.04 Where pavement markers are to be placed on newly laid asphaltic surface, traffic must be either diverted or temporary markers placed until the cutter/oil levels on the wearing surface ensure a secure adhesion between the wearing surface and the pavement marker.

C261.07 PROVISION FOR TRAFFIC AND PROTECTION OF WORK

C261.07.01 The Contractor shall provide for traffic, in accordance with the Specification for CONTROL OF TRAFFIC C211, while undertaking the work and shall protect the pavement markings until the material has hardened sufficiently so that traffic will not cause damage.

Contractor's Responsibility

C261.08 MAINTENANCE OF PAVEMENT MARKINGS

C261.08.01 The Contractor shall be responsible for the maintenance, and replacement if necessary, of raised pavement markers and all pavement marking during the contract period and the contract defects liability period.

Responsibility in Contract Period

PAVEMENT MARKING PAINT

C261.09 MATERIALS

C261.09.01 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'.

Paint Quality

C261.09.02 Glass beads shall comply with the requirements of AS/NZS2009 for drop-on beads.

Glass Beads Quality`

C261.10 MIXING OF PAINT

C261.10.01 All paint shall be thoroughly mixed in its original container before use to produce a smooth uniform product consistent with the freshly manufactured product.

Uniform Product

C261.11 APPLICATION OF PAINT AND BEADS

C261.11.01 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.

Longitudinal Lines

C261.11.02 Hand spraying with the use of templates to control the pattern and shape shall be permitted for transverse lines, symbols, legends, arrows and chevrons.

Hand Spraying

C261.11.03 The paint shall be applied uniformly and the wet film thickness shall be neither less than 0.35 mm and no more than 0.40 mm.

Paint Thickness

C261.11.04 Glass beads shall be applied to the surface of all longitudinal lines at a net application rate of 0.30 kilograms per square metre immediately after application of the paint. The actual application rate shall be set to overcome any loss of beads between the bead dispenser and the sprayed line.

Beads for Longitudinal Lines

C261.11.05 Glass beads shall be similarly applied to all other paint markings at a net application rate of 0.30 kilograms per square metre immediately after application of the paint.

Beads for other Markings

C261.11.06 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.

Pavement Marking Finish

C261.11.07 The lengths of longitudinal lines shall not vary by more than 20mm from the lengths shown in the MUTCD. The widths of longitudinal lines shall not vary by more than 10mm from the widths shown in the MUTCD.

Longitudinal Line Tolerances

C261.11.08 The lengths and widths of transverse lines shall not vary by more than 10mm from the lengths and widths shown in the MUTCD

Transverse Line Tolerance

C261.11.09 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 Drawings or in the MUTCD as appropriate. Arrows and speed markings shall be placed square with the centreline of the traffic lane.

Arrows, Chevrons Tolerance

C261.11.10 Ambient conditions for applying paint with glass beads. For optimum performance and durability, incorporate glass beads under the following conditions:

Ambient Conditions

- Air and pavement temperature: > 15°C.
- Relative humidity: > 70%.
- Air movement: 10 km/hr (reasonable air movement).
- Protection of markings from traffic during the drying process.

C261.12 FIELD TESTING

C261.12.01 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.

Paint Application

C261.12.02 The application rate of glass beads applied to the surface of the markings shall be checked by the method described in Annexure C261A.

Beads Application

Table C261. 12.1 - Volume of glass beads (ml) required in 10 seconds of operation.

Road Speed km/h	Line Widths				
	80mm	100mm	120mm	150mm	200mm
8	396	495	594	742	990
13	643	804	965	1207	1698
16	791	990	1188	1484	1484

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.

THERMOPLASTIC PAVEMENT MARKING MATERIAL

C261.13 MATERIALS

C261.13.01 Thermoplastic pavement marking material shall comply with the requirements of AS 4049.2.

Thermoplastic Quality

C261.13.02 In this Specification, the term 'thermoplastic material' shall mean 'thermoplastic pavement marking material'.

Definition

C261.13.03 Glass beads shall be incorporated in thermoplastic material, in the proportion of 20 per cent of the total mass, as part of the aggregate constituent and shall comply with the requirements of AS/NZS 2009, Intermix type.

Glass Bead Proportion

C261.13.04 Glass beads for surface application shall comply with the requirements of AS/NZS 2009, Drop-on beads.

Glass Bead Quality

C261.13.05 Tack coat material shall be to the manufacturer's specification.

Tack Coat

C261.14 PREPARATION OF THERMOPLASTIC MATERIAL ON SITE

C261.14.01 Immediately before application, the thermoplastic material shall be uniformly heated in a suitable 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 six hours for hydrocarbon resins and four hours for wood and gum resins. Should over-heating occur and/or the time expires for molten materials, then the thermoplastic material shall be discarded.

Heating

C261.15 APPLICATION OF THERMOPLASTIC MATERIAL AND BEADS

C261.15.01 Where the wearing surface of the pavement is smooth or polished, a tack coat of material may be required 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.

Tack Coat Requirement

C261.15.02 All longitudinal lines shall be sprayed by a self-propelled machine approved by the Superintendent. 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 1.8mm with a tolerance of plus or minus 0.5mm.

Longitudinal Lines

C261.15.03 Glass beads shall be applied by air propulsion to the surface of all longitudinal lines at a net application rate of 0.30 kilograms per square metre 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.

Beads for Longitudinal Lines

C261.15.04 All transverse lines, symbols, legends and arrows shall be screeded. The screeded thermoplastic material shall be applied using a mobile applicator, approved by the Superintendent, and templates to control the pattern.

Screed

C261.15.05 The thermoplastic material for transverse lines, symbols, legends and arrows shall be applied uniformly and the cold film thickness shall be 1.8mm with a tolerance of plus or minus 0.5mm. The surface finish shall be smooth.

Tolerance

C261.15.06 Glass beads for other than longitudinal lines shall be uniformly applied to screeded markings at a net application rate of 0.30 kilograms per square metre immediately after application of the thermoplastic material by a method approved by the Superintendent.

Beads for Other Markings

C261.15.07 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.

Pavement Marking Finish

C261.15.08 The lengths of longitudinal lines shall not vary by more than 20mm from the lengths shown in the MUTCD. The widths of longitudinal lines shall not vary by more than 10mm from the widths shown in the MUTCD.

Longitudinal Line Tolerances

C261.15.09 The lengths and widths of transverse lines shall not vary by more than 10mm from the lengths and widths shown in the MUTCD.

Transverse Line Tolerances

C261.15.10 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 Drawings or in the MUTCD as appropriate. Arrows and speed markings shall be placed square with the centreline of the traffic lane.

Arrows, Chevrons, Tolerance

C261.16 FIELD TESTING

C261.16.01 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.

Thickness of Thermoplastic Material

C261.16.02 The application rate of glass beads applied to the surface of the markings shall be checked by the method described in Annexure C261A.

Glass Beads Application Rate

PAVEMENT MARKING TAPE

C261.17 MATERIALS

C261.17.01 Pavement marking tape shall be a strippable type of tape, such as 'Staymark - Detour Grade', or equivalent approved tape.

Brands

C261.18 APPLICATION OF PAVEMENT MARKING TAPE

C261.18.01 The method of application of pavement marking tape, including surface preparation, shall be in accordance with the manufacturer's recommendations.

Manufacturer's Recommendation

C261.19 REMOVAL OF PAVEMENT MARKING TAPE

C261.19.01 When directed by the Superintendent, the Contractor shall remove pavement marking tape in accordance with the manufacturer's recommendations.

Manufacturer's Recommendation

RAISED PAVEMENT MARKERS

C261.20 MATERIALS

C261.20.01 Raised pavement markers, both reflective and non-reflective, shall comply with AS 1906.3 and shall have the dimensions shown on the Drawings.

Standard

C261.20.02 The adhesive used for attaching the raised pavement markers to the wearing surface of the pavement will be a “hot melt” bitumen adhesive or an equivalent approved product.

Bitumen Adhesive

C261.21 INSTALLATION OF RAISED PAVEMENT MARKERS

C261.21.01 Raised pavement markers shall be fixed to the wearing surface of the pavement using a hot melt bitumen adhesive or an equivalent approved. 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.

Adhesive Quality

C261.21.02 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.

Method

C261.21.03 On rough surfaces, such as newly laid coarse sprayed bituminous seals, and where directed by the Superintendent, 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.

Rough Surfaces

REMOVAL OF PAVEMENT MARKINGS

C261.22 GENERAL

C261.22.01 The Contractor shall remove pavement markings, no longer required, from the wearing surface of pavements by grinding or other approved method without significant damage to the surface. Remove markings in blocks to avoid ghosted images.

Marking Removing – AC/Concrete

C261.22.02 Painting over the existing pavement marking is not acceptable.

C261.22.03 The Contractor shall remove pavement markings, no longer required, from the wearing surface of pavements by resurfacing with 7mm stone or other approved method without significant damage to the surface. The resurfacing area shall be undertaken as a rectangular shape to include the painted surface plus 100mm clearance/overlap.

Marking Removal - Chip Seal

C261.22.04 Painting over the existing pavement marking is not an approved method.

LIMITS AND TOLERANCES

C261.23 SUMMARY OF LIMITS AND TOLERANCES

C261.23.01 The limits and tolerances applicable to the various clauses of this Specification are summarised in Table C261. 23.1 below:

Table C261. 23.1 - Summary of Limits and Tolerances (New Work Only)

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Location of Markings**	± 20mm from specified location	C261.05
2.	**Longitudinal Lines**		C261.11
	(a) Length	± 25mm from lengths shown in the MUTCD	C261.15
	(b) Width	± 10mm from widths shown in the MUTCD	C261.11 C261.15
3.	**Transverse Lines**		
	(a) Length	± 10mm from lengths and widths	C261.11
	(b) Width	shown in the MUTCD	C261.15
4.	**Arrows, Chevrons, Painted Medians, Speed Markings etc.**	± 50mm from the dimensions shown in the MUTCD	C261.11 C261.15
5.	**Application of Paint**		
	(a) Film Thickness	>0.35mm <0.40mm	C261.11
6.	**Application of Thermoplastic**		
	(a) Longitudinal Lines - Cold Film Thickness	1.8mm ± 0.5mm	C261.15
	(b) Transverse Lines, Symbols, Arrows etc. Cold Film Thickness	3.0mm ± 1.0mm	C261.15
7.	**Glass Beads**		
	(a) Volume used in operation	0.30 kg/sq m + 10%	C261.11 C261.15

Marking tolerances table

Marking type and dimension	New installation	Maintenance
Spotting		
All markings: Documented location	± 50 mm	-
Arrows, chevrons, painted medians, painted left turn islands and speed markings: Each dimension	± 50 mm	± 50 mm of existing marking
Longitudinal linemarkings		
Width	± 5 mm	Width of existing marking ± 10 mm
Width of gap between adjacent lines	± 10 mm	± 10 mm

Marking type and dimension	**New installation**	**Maintenance**
Length	± 50 mm	Length of existing marking ± 100 mm
Distance between centreline of new and existing	-	< 15 mm
Transverse lines and other markings		
Width	± 10 mm	Width of existing marking ± 10 mm
Length	± 10 mm	Width of existing marking ± 10 mm
Raised pavement markers		
Documented location: Transverse	± 25 mm	-
Documented location: Longitudinal	± 100 mm	
From other markers in the same line for a distance of 1.5 m	± 25 mm	-
Documented direction	± 4°	-

ANNEXURE 261A

C261.24 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/NZS 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. 12.1 - Volume of glass beads (ml) required in 10 seconds of operation.

Table C261. 12.1 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. 12.1 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.

ANNEXURE 261B

C261.25 QUALITY CONTROL AND TESTING

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
MANDATORY TESTING				
Nil				
AUDIT TESTING – IF ORDERED BY COUNCIL				
Materials Supply	Material Quality - Supplier's documentary evidence and certification of:			
	- Paint	1 contract	1 per contract or change in material	AS 4049.3
	- Glass Beads	1 contract	1 per contract or change in material	AS/NZS 2009
	- Thermoplastic Material	1 contract	1 per contract or change in material	AS 4049.2
	- Raised Pavement Markers	1 contract	1 per contract or change in material	AS 1906.3
Paint Application	Wet Film Thickness	1 contract	1 per site visit or change in pressure settings	AS 1580.107.3 Method B, comb gauge
	Application Rate of Glass Beads	1 contract	1 per site visit or change in pressure settings	Annexure 261A C261.24
Thermoplastic Application	Cold Film Thickness	1 contract	1 per site visit or change in pressure settings	Measure by micrometer
	Application Rate of Glass Beads	1 contract	1 per site visit or change in pressure settings	Annexure 261A C261.24