COFFS HARBOUR CITY COUNCIL

DEVELOPMENT SPECIFICATION
DESIGN

1191 Pavement markings

Version 1 ***01 January 2009***

1191 PAVEMENTS MARKINGS

1 SCOPE AND GENERAL

1.1 SCOPE

The work to be executed under this worksection 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 worksection.

1.2 APPLICATION

This worksection shall not override any applicable State or Local Government legislation and shall be read in conjunction with AS 1742.3 and the Roads and Traffic Authority (NSW) RTA QA Specification DCM R141 Pavement Marking (or equivalent document in other states).

This worksection does not cover Cold Applied Plastics (CAP) although their use throughout Australia is quite common as a long life product. For details of application and installation refer to the manufacturer's specifications.

1.3 QUALITY

Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are given in 0161 *Quality (Construction)*.

1.4 REFERENCED DOCUMENTS

The following documents referred to in this worksection shall be deemed as the latest edition of the Australian Standards, including amendments and supplements.

Worksections

0161 Quality (Construction)

1101 Control of traffic

Standards

AS 1580	Paints and related materials—Methods of test
AS 1580.107.3	Determination of wet film thickness by gauge
AS 1742	Manual of uniform traffic control devices
AS 1742.2	Traffic control devices for general use
AS 1742.3	Traffic control devices for works on roads
AS 1906	Retroreflective materials and devices for road traffic control purposes
AS 1906.3	Raised pavement markers (retroreflective and non–retroreflective)
AS/NZS 2009	Glass beads for pavement-marking materials
AS 4049	Paints and related materials—Road marking materials
AS 4049.2	Thermoplastic road marking materials
AS/NZS 4049	Paints and related materials—Road marking materials
AS/NZS 4049.3	Waterborne paint—For use with drop-on beads

Other publications

Roads and Traffic Authority (NSW)

RTA QA Specification DCM R141 Pavement Marking

1.5 TYPE OF PAVEMENT MARKINGS AND DEVICES

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

1.6 TYPES OF MATERIALS TO BE APPLIED

The materials shall be applied as follows:

- Pavement marking paint: Permanent markings on all wearing surfaces. Temporary markings, other than on the final wearing surfaces. Traffic islands and kerbs where specified.
- Thermoplastic pavement marking material: Permanent markings where explicitly indicated on the Drawings.
- Pavement marking tape: Temporary markings on final wearing surfaces.
- Reflective glass beads: To be applied to all painted and thermoplastic markings.
- Raised pavement markers: To be installed as permanent and temporary markings as shown on the Drawings.
- Cold applied plastics: To be installed in accordance with manufacturer's specification.

1.7 MATERIAL QUALITY

The Contractor shall submit to the Superintendent NATA Registered Laboratory Test Reports, at least seven days before work is scheduled to commence, on the quality of the materials, including paint, glass beads, raised pavement markers and thermoplastic material proposed for use. Only materials conforming to the requirements of the referenced worksections/Standards shall be used.

1.8 SETTING OUT

The Contractor shall set out the work to ensure that all markings are placed in accordance with the Drawings. The locations of pavement markings shall not vary by more than 20 mm from the locations shown on the Drawings.

1.9 SURFACE PREPARATION

Clean dry surface
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.

Wet weather
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 (unless otherwise directed).

Scabbling of concrete
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).

1.10 PROVISION FOR TRAFFIC AND PROTECTION OF WORK

The Contractor shall provide for traffic, in accordance with 1101 *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.

1.11 MAINTENANCE OF PAVEMENT MARKINGS

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.

2 PAINT MARKING

2.1 MATERIALS

Paint
Paint shall comply with the requirements of AS 4049.3 and any State Road Authority specifications (where applicable) as directed by the Superintendent. In this worksection, the term 'paint' shall mean 'pavement marking paint'.

Glass beads
Glass beads shall comply with the requirements of AS 2009. Other materials may be used if approved by the Superintendent.

2.2 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.

2.3 APPLICATION OF PAINT AND BEADS

Paint thickness

The paint shall be applied uniformly and the dry film thickness shall be a minimum of 0.20 mm for class B beads, or 0.30 mm for class D beads.

Longitudinal lines

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 (unless otherwise directed by the superintendant).

The lengths of longitudinal lines shall conform to any applicable local or state requirements and not vary by more than +20 mm –0 mm from the lengths shown in AS 1742.2.

The widths of longitudinal lines shall not vary by more than +10 mm –0 mm from the widths shown in AS 1742.2.

Beads for Longitudinal Lines

Class B glass beads shall be applied to the surface of all longitudinal lines at a min application rate of 0.50kg/m^2 immediately after the 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.

Transverse lines

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

Arrows, chevrons and other markings

The dimensions of arrows, chevrons, painted medians, painted left turn islands and speed markings shall conform to any applicable local or state requirements and shall not vary by more than 50 mm from the dimensions shown on the Drawings or in AS 1742.2 as appropriate.

Arrows and speed markings shall be placed square with the centreline of the traffic lane.

Hand spraying

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

Beads for other markings

Class B glass beads shall be similarly applied to all other paint markings at a min application rate of 0.30kg/ m^2 immediately after application of the paint by a method approved by the Superintendent.

Class D glass beads shall be similarly applied to all other markings at a min application rate off 0.5 kg/m^2.

Pavement marking finish

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.

2.4 FIELD TESTING

Paint application

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.

Beads application

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

3 THERMOPLASTIC MARKING

3.1 MATERIALS

Thermoplastic

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

Definition

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

Glass bead proportion

Glass beads shall be incorporated in thermoplastic material, in the proportion of a min 20% of the total mass, as part of the aggregate constituent and shall comply with the requirements of AS 2009, Intermix type class C beads with 20–30% by mass wet weather beads.

Glass beads

Glass beads for surface application shall comply with the requirements of AS 2009, class B 'Drop-on beads' or class D 'wet weather beads'.

Glass beads of class D wet weather beads intended for use with thermoplastic applications shall be supplied with a proprietary adhesive coating and shall be clearly labelled on the packaging.

Tack coat

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

3.2 PREPARATION OF THERMOPLASTIC MATERIAL ON SITE

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 expire for molten materials, then the thermoplastic material shall be discarded.

3.3 APPLICATION OF THERMOPLASTIC MATERIAL AND BEADS

Tack coat

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

Longitudinal lines

All longitudinal lines shall be sprayed (or extruded in the case of profiled markings) 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 3.0 mm with a tolerance of plus or minus 0.5 mm. The lengths of longitudinal lines shall not vary by more than 20 mm from the lengths shown in AS 1742.2. The widths of longitudinal lines shall not vary by more than 10 mm from the widths shown in AS 1742.2.

Beads for longitudinal lines

Class B glass beads shall be applied by air propulsion or gravity fed to the surface of all longitudinal lines at a net application rate of 0.30kg/m^2 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.

Class D glass beads shall be applied at a min rate of 0.5kg/m^2.

Transverse lines, symbols, legends and arrows

The thermoplastic material for transverse lines, symbols, legends and arrows shall be applied uniformly and the cold film thickness shall be 3.5 mm with a tolerance of plus or minus 0.5 mm. The surface finish shall be smooth.

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

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

Dimensions of arrows, chevrons, tolerance

The dimensions of arrows, chevrons, painted medians, painted left turn islands and speed markings shall conform to any applicable local or state requirements and not vary by more than 50 mm from the dimensions shown on the Drawings or in AS 1742.2 as appropriate.

Arrows and speed markings shall be placed square with the centreline of the traffic lane.

Beads for other than longitudinal lines

Class B glass beads for other than longitudinal lines shall be uniformly applied to screeded markings at a min application rate of 0.30 kg/m^2 immediately after application of the thermoplastic material by a method approved by the Superintendent.

Class D glass beads shall be applied at a min application rate of 0.50kg/m^2.

Pavement marking finish

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.

3.4 FIELD TESTING

Thickness of thermoplastic material

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.

Glass beads application rate

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

4 PAVEMENT MARKING TAPE

4.1 MATERIALS

Pavement marking tape shall be a strippable type of tape approved by the Superintendent.

4.2 APPLICATION OF PAVEMENT MARKING TAPE

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

4.3 REMOVAL OF PAVEMENT MARKING TAPE

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

5 RAISED PAVEMENT MARKERS

5.1 MATERIALS

Markers

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

Adhesive

The adhesive used for attaching the raised pavement markers to the wearing surface of the pavement shall be a hot melt bitumen adhesive or an equivalent product approved by the Superintendent.

5.2 INSTALLATION OF RAISED PAVEMENT MARKERS

Adhesive

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

Heating and mixing

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.

Application of adhesive to marker

The adhesive shall be spread uniformly over the underside of the raised pavement marker to a depth of approximately 10 mm.

Adhesion of marker to pavement

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.

Adhesion to rough surfaces

On rough surfaces, such as newly laid coarse sprayed bituminous seals, and where directed by the Superintendent, an initial pad of adhesive of diameter 20 mm 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.

6 REMOVAL OF REDUNDANT MARKINGS

The Contractor shall remove pavement markings, no longer required, from the wearing surface of pavements without significant damage to the surface.

The removal of markings shall be performed in a 'block type manner, so as to avoid 'ghosted' images.

Blacking out of markings should only be used as a temporary measure and complete removal should occur within 48 hours.

The method of removal shall be approved by the Superintendent before commencement of the work.

7 LIMITS AND TOLERANCES

The limits and tolerances applicable to the various clauses of this worksection are summarised in **Table 7.1 Summary of limits and tolerances**

Activity	**Limits/Tolerances**	**Worksection Clause Reference**
Location of Markings	±20 mm from specified location	**Setting out**
Longitudinal Lines		
- Length	+20 mm from lengths shown in AS 1742.3	**Application of paint and beads & Application of thermoplastic material and beads**
- Width	+10 mm (except for double barrier lines where the gap between lines must not decrease) from widths shown in AS 1742.3	**Application of paint and beads & Application of thermoplastic material and beads**
Transverse lines		

- Length - Width	±10 mm from lengths and widths shown in AS 1742.3	**Application of paint and beads & Application of thermoplastic material and beads**
Arrows, chevrons, painted medians, speed markings etc.	±50 mm from the dimensions shown in AS 1742.3	**Application of paint and beads & Application of thermoplastic material and beads**
Application of paint		
- Film thickness	Depends on the beads to be used: for class B beads—min 0.2 mm dry film; for class D beads—min 0.3 mm dry film	**Application of paint and beads**
Application of thermoplastic		
- Longitudinal lines—Cold Film Thickness	3.0 mm ±0.5 mm	**Application of thermoplastic material and beads**
- Transverse Lines, Symbols, Arrows etc. Cold film thickness	3.5 mm ±1.5 mm	**Application of thermoplastic material and beads**
Glass beads		
- Volume used in operation	Min class B—0.30 kg/m^2 Min class D—0.50 kg/m^2	**Application of paint and beads & Application of thermoplastic material and beads**

8 MEASUREMENT AND PAYMENT

8.1 MEASUREMENT

Payment shall be made for all activities associated with completing the work detailed in this Worksection on a schedule of rates basis in accordance with Pay Items 11911.1 to 1191.6.

A lump sum price for any of these items shall not be accepted.

If any item, for which a quantity of work is listed in the Schedule of Rates, has not been priced by the Contractor, it shall be understood that due allowance has been made in other items for the cost of the item which has not been priced.

No additional payment shall be made for maintenance and replacement of pavement markers in accordance with **Maintenance of pavement markings**.

Provision for traffic is measured and paid in accordance with this worksection and not 1101 *Control of traffic*.

8.2 PAY ITEMS

1191.1 Pavement marking paint—longitudinal lines

The unit of measurement shall be per line pattern kilometre (including any gaps).

The area shall be calculated from the specified width (excluding tolerances) and the actual application length measured along the centre line of the longitudinal line.

The schedule rate shall cover all costs associated with the setting out of the work, the supply and application of the paint and beads and provision for traffic control.

1191.2 Pavement marking paint—Transverse lines, symbols, legends, arrows, chevrons, traffic islands and kerbs

The units of measurement shall be as follows:

- 1191.2(1) Transverse lines — Lineal metres
- 1191.2(2) Arrow — Each
- 1191.2(3) Symbols — Each
- 1191.2(4) Chevrons — Square metres
- 1191.2(5) Kerbs — Metres
- 1191.2(6) Traffic Islands — Square metres
- 1191.2(7) Legends — Each or square metres

The area of the painted surface shall be determined by direct measurement of the markings as applied.

The schedule rate shall cover all costs associated with the setting out of the work, the supply and application of all material and the provision for traffic control.

1191.3 Thermoplastic pavement marking material—Longitudinal lines

The unit of measurement shall be per line pattern kilometre (including any gaps).

The area shall be calculated from the specified width (excluding tolerances) and the actual application length measured along the centre line of the longitudinal line.

The schedule rate shall cover all costs associated with the setting out of the work, tack coating where necessary, the supply and application of the thermoplastic material and beads and provision for traffic.

1191.4 Thermoplastic pavement marking material—transverse lines, symbols, legends and arrows

The unit of measurement shall be as per schedule below:

- 1191.4(1) Transverse lines — Lineal metres
- 1191.4(2) Arrow — Each
- 1191.4(3) Symbols — Each
- 1191.4(4) Chevrons — Square metres
- 1191.4(5) Kerbs — Metres
- 1191.4(6) Traffic Islands — Square metres
- 1191.4(7) Legends — Each or square metres

The surface area of the thermoplastic material applied shall be determined by direct measurement of the markings as applied (as above).

The schedule rate shall cover all costs associated with the setting out of the work, tack coating where necessary, the supply and application of all material and the provision for traffic.

1191.5 Raised pavement markers (all applications)

The unit of measurement shall be ‘each’ raised pavement marker installed.

The schedule rate shall cover all costs associated with the setting out of the work, the supply and application of all material including the provision of an initial pad of adhesive when required on rough surfaces and the provision for traffic.

1191.6 Removal of pavement markings

The unit of measurement shall be metres squared.

The schedule rate shall cover all costs associated with removal and disposal.

9 ANNEXURE A

9.1 MEASUREMENT OF APPLICATION RATE OF SPHERICAL GLASS BEADS

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.

Spherical glass beads

The glass beads shall comply with AS 2009.

Measurement

The method of field measurement shall be as follows:

- 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.
- 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.
- Compare the volume of glass beads collected with the correct figure given in Table A1.

Table A1 shows the correct volumes of glass beads required to give a net application rate on the marked line of approximately 0.30 kg/m^2 for different line widths and road speeds.

The glass bead volume figures given in Table A1 are calculated for an actual application rate of 0.34 kg/m^2 . 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, Table A1 will need to be altered to 0.50 kg/m^2 .

Table A1 Volume of glass beads (ml) required in 10 seconds of operation

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

Notes:
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.

10 ANNEXURE B

10.1 TYPES OF GLASS BEADS

Class A beads (premix)

Class A beads are mixed into road-marking material by the manufacturer prior to application, and are intended to provide retroreflectivity throughout the life of the marking. These beads are to be mixed at a rate of not less than 30% by mass.

Class B beads (drop-on)

Class B glass beads are applied under gravity or pressure as a surface application to a wet film of pavement marking to provide initial retroreflectivity.

These beads should be applied on a smooth substrate.

A nominal rate of 270–300 g/m^2 may be appropriate, while a coarse surface substrate usually requires a higher application rate to achieve the required level of retroreflectivity.

These beads have a moisture-proof coating to facilitate flow and reduce the risk of ‘caking’’

Class C beads (intermix)

Class C beads are mixed into thermoplastic road-marking material by the manufacturer prior to application, and are intended to provide retroreflectivity throughout the life of the marking.

They should be intermixed at a rate of not less than 20% by mass.

Class C beads may also be used for surface applications to a wet film of pavement marking to provide initial retroreflectivity. They should be applied on a smooth substrate. A nominal rate of 350 g/m^2 may be appropriate, while a coarse surface substrate usually requires a higher rate of application to achieve the required level of retroreflectivity. These beads are not moisture-proof coated, and, if used for surface applications, could ‘cake’ during handling.

Class D beads (large wet-weather beads)

Class D glass beads are applied under gravity or pressure as a surface application to a wet film of pavement marking to provide initial retroreflectivity.

They should be applied on a smooth substrate.

A nominal rate of 500 g/m^2 may be appropriate, while a coarse surface substrate usually requires a higher rate of application to achieve the required level of retroreflectivity.

These beads have no moisture-proof coating and are, therefore, also suitable for intermixing into thermoplastic road-marking material to provide retroreflectivity in both dry and wet conditions, throughout the life of the marking. They should be intermixed at a rate of not less than 20% by mass.