Master Specification
Part RD-LM-S1

Materials for Pavement Marking

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Government of South Australia
Department for Infrastructure and Transport

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Contents

RD-LM-S1 Materials for Pavement Marking

1 General

a) This Master Specification Part sets out the requirements for the supply of road pavement marking materials including:

i) the documentation requirements, as set out in section 2;

ii) the requirements for paint, as set out in section 3;

iii) the requirements for quartz for non-skid pavement markings, as set out in section 4;

iv) the requirements for glass beads, as set out in section 5;

v) the requirements for crushed glass anti-skid mix, as set out in section 6;

vi) the requirements for high performance pavement marking, as set out in section 7;

vii) the requirements for coloured pavement surfacings, as set out in section 8;

viii) the requirement for raised pavement markers, as set out in section 9;

ix) the requirements for sheet materials, as set out in section 10;

x) the requirements for adhesives, as set out in section 11;

xi) the requirements for pavement bars, as set out in section 12;

xii) the requirements for temporary pavement marking materials, as set out in section 13;

xiii) the records requirements, as set out in section 14; and

xiv) the verification requirements and records, as set out in section 15.

b) The materials for pavement marking must comply with the Reference Documents, including:

i) APAS Specification AP-S0042 Glass Beads (and Glass Particles) - For use in and with Pavement Marking Materials (available from: https://vs.csiro.au/apas/specifications/);

ii) AP-S0041/5 Pavement Marking Material - Water-borne Paint;

iii) AS 1012 Methods of testing concrete;

iv) AS 1289.2.1.4 Methods of testing soils for engineering purposes, Method 2.1.4: Soil moisture content tests - Determination of the moisture content of a soil - Microwave-oven drying method (subsidiary method);

v) AS 1379 Specification and supply of concrete;

vi) AS/NZS 1580.601.1 Paints and related materials - Methods of test, Method 601.1: Colour - Visual comparison;

vii) AS 1742.3 Manual of uniform traffic control devices, Part 3: Traffic control for works on roads;

viii) AS/NZS 1906.3 Retroreflective materials and devices for road traffic control purposes, Part 3: Raised pavement markers (retroreflective and non-retroreflective);

ix) AS/NZS 2009 Glass beads for pavement-marking materials;

x) AS 2700 Colour standards for general purposes;

xi) AS 3600 Concrete structures;

xii) AS 3610 Formwork for concrete;

xiii) AS 3972 General purpose and blended cements;

xiv) AS 4049 Paints and related materials - Pavement marking materials;

xv) AS 4049.3 Paints and related materials - Pavement marking materials, Part 3: Waterborne paint - For use with surface applied glass beads;

xvi) CIA Recommended Practice Z9 Curing of Concrete, Appendix A; and

xvii) Department Test Procedure TP134 Particle Size Distribution - Standard Method of Analysis by Sieving (available from: https://dit.sa.gov.au/standards/test_procedures).

2 Documentation

2.1 Construction Documentation

In addition to the requirements of PC-CN3 “Construction Management”, the Construction Documentation must include:

a) approval of adhesives for fixing of raised pavement markers and pavement bars from the manufacturer, as required by section 11;

b) details of alternative materials, as required by section 12.4b);

c) information supplied by the recycled pavement bar manufacturer on the likely service life of the recycled pavement bar, as required by section 12.5d);

d) details of the manufacturer’s recommended paint product which is compatible with the recycled pavement bar surface, as required by section 12.5f); and

e) details of the method and application of temporary line marking tape required in section 13.2.

2.2 Quality Management Records

In addition to the requirements of PC-QA1 “Quality Management Requirements” or PC-QA2 “Quality Management Requirements for Major Projects” (as applicable), the Quality Management Records must include:

a) concrete flexural strength test records as required by section 12.2.2b);

b) record of consignments and associated documentation, as required by section 14; and

c) verification requirements and records, as required by section 15.

3 Paint

3.1 General

a) The Contractor must ensure that pavement marking paint is compliant with AP-S0041/5 Pavement Marking Material - Water-borne Paint.

b) The Contractor must ensure that the pavement marking paints appear on the Department Approved Products List or are otherwise submitted for approval in accordance with PC-CN3 “Construction Management”.

3.2 Colour

The Contractor must ensure that the pavement marking paint colour complies with Table RD-LM-S1 3-1 and Table RD-LM-S1 3-2.

Table RD-LM-S1 3-1 Paint colour compliance

Colour	
White	Luminance factor of >80% and colour whiter than Y35 of AS 2700 Colour standards for general purposes, when measured in accordance with AS 4049.3 Paints and related materials - Pavement marking materials, Part 3: Waterborne paint - For use with surface applied glass beads
Black	Luminance factor of <5%, when measured in accordance with AS 4049.3 Paints and related materials - Pavement marking materials, Part 3: Waterborne paint - For use with surface applied glass beads
Yellow	Luminance factor of 45 - 50%, when measured in accordance with AS 4049.3 Paints and related materials - Pavement marking materials, Part 3: Waterborne paint - For use with surface applied glass beads. The chromaticity coordinates must lie within the colour/luminance space defined by the coordinates shown in Table RD-LM-S1 3-2
Blue	Luminance factor of 12 -15%, when measured in accordance with AS 4049.3 Paints and related materials - Pavement marking materials, Part 3: Waterborne paint - For use with surface applied glass beads

Table RD-LM-S1 3-2 Yellow colour space(1)

Point	X	Y
1	0.531	0.468
2	0.477	0.433
3	0.427	0.483
4	0.465	0.534

Table notes:
(1) Chromaticity coordinates CIE standard illuminant D65, instrument configuration 45/0, 2°observer.

4 Skid resistant additives

4.1 General

a) The requirements of section 4 applies where skid resistant additives are used for non-skid pavement markings.

b) The Contractor must ensure that all skid resistant additives material is clean, sound, hard, durable, non-plastic and free from adherent coatings and any foreign matter.

4.2 Colour

The Contractor must ensure that the skid resistant additives supplied pursuant to this Master Specification Part is whiter than 'Y35 off white' as determined by:

a) filling a cylindrical container of minimum diameter 50 mm and minimum depth of 20 mm with skid resistant additives;

b) screeding off the surface; and

c) comparing the skid resistant additives against an AS 2700 Colour standards for general purposes colour swatch.

4.3 Packaging

The Contractor must ensure that the skid resistant additive is packaged so as to prevent damage during transportation and handling, and to ensure that contamination does not occur.

5 Glass beads

a) The Contractor must ensure that all glass beads comply with:

i) AS/NZS 2009 Glass beads for pavement-marking materials; and

ii) APAS Specification AP-S0042 Glass Beads (and Glass Particles) - For use in and with Pavement Marking Materials.

b) In addition to the requirements set out in section 5a), the Contractor must ensure that Type B beads (drop-on) comply with the properties defined in AS/NZS 2009 Glass beads for pavement-marking materials, with an additional high performance retroreflectivity requirement requiring the delivery of a minimum 450 mcd/m2/lx when tested in accordance with a modified Appendix M of AS/NZS 2009 Glass beads for pavement-marking materials modified as follows:

i) Section M4 Apparatus Clause a) Dry film thickness of paint will be 200 -250 µm;

ii) Section M5 Procedure Clause b) Weigh 24 ± 0.5 grams of beads; and

iii) Section M5 Procedure Clause e) Wet Film thickness of paint will be 375 ± 25 µm.

c) The chemical properties of the glass beads must not exceed the lower of:

i) any applicable limits specified at Law (including EPA waste fill classification, or other criteria deemed appropriate for the source of the materials and the proposed use); and

ii) the values in Clause 8 Table 1 of APAS Specification AP-S0042 Glass Beads (and Glass Particles) - For use in and with Pavement Marking Materials.

6 Crushed glass anti-skid mix

a) The Contractor must ensure that anti-skid mixtures consist of glass beads and crushed glass in the ratio of 70:30.

b) The Contractor must ensure that glass used in anti-skid mixtures is:

i) crushed to a cubic shape;

ii) contains no sign of glass shards; and

iii) has a particle size of 1 mm to 2 mm.

7 High performance pavement marking

a) The Contractor must ensure that high performance pavement marking materials are used where greater durability than that provided by waterborne paint is required, including intersection marking and messages.

b) The Contractor must ensure that high performance pavement marking products are in accordance with AS 4049 Paints and related materials - Pavement marking materials. (as applicable)

c) The Contractor must ensure that the high performance pavement marking materials appear on the Department Approved Products List or are otherwise submitted to the Principal for approval in accordance with PC-CN3 “Construction Management”.

d) The Contractor must ensure that all high performance pavement markings are white or yellow to the requirements in accordance with AS 4049 Paints and related materials - Pavement marking materials.

8 Coloured pavement surfacings

a) The Contractor must ensure that coloured pavement surfacings, such as that used for dedicated bus and cycle lanes, be in accordance with AS 4049 Paints and related materials - Pavement marking materials.

b) The Contractor must ensure that the coloured pavement surfacings appear on the Department Approved Products List or are otherwise submitted to the Principal for approval in accordance with PC-CN3 “Construction Management”.

c) The Contractor must ensure that coloured pavement surfacings for specific pavement purpose are a commercial match to AS 2700 Colour standards for general purposes colours as set out in Table RD-LM-S1 8-1.

Table RD-LM-S1 8-1 Colour pavement surfacing requirements

Pavement purpose	Colour(1)
Bus lanes	Signal red, R13
Cycle lanes	Emerald, G13
Pedestrian crossings, pavement bars, clearway markings, no standing zones, rail crossing box hatching	Golden yellow, Y14
Accessible boarding indicator patch (station platforms)	Ultramarine, B21
Dedicated parking patch for people with disabilities	Ultramarine, B21
Traffic island and median kerbing	White, Y35

Table notes:

(1) Colours as set out in AS 2700 Colour standards for general purposes.

9 Raised pavement markers

a) The Contractor must ensure that raised pavement markers comply with class C as specified in AS/NZS 1906.3 Retroreflective materials and devices for road traffic control purposes, Part 3: Raised pavement markers (retroreflective and non-retroreflective).

b) Non reflective raised pavement markers must not be ceramic.

10 Sheet materials

The Contractor must ensure that the road marking sheet materials are Principal approved pliant polymers appearing on the Department Approved Products List or are otherwise submitted to the Principal for approval in accordance with PC-CN3 “Construction Management”.

11 Adhesives

Adhesives for fixing of raised pavement markers and pavement bars must be as approved in writing by the raised pavement marker or pavement bar manufacturer, with details of the adhesives and evidence of manufacturer approval submitted as part of the Construction Documentation.

12 Pavement bars

12.1 General

a) The Contractor must ensure that Size B pavement bars (for use where the 85th percentile speed is less than 75 km/h) have a 50 mm maximum height and comply with the dimensions shown on Appendix 1: Pavement bar.

b) The Contractor must ensure that Size B pavement bars are either:

i) manufactured from fibre reinforced concrete and comply with section 12.2.1; or

ii) a recycled bar complying with section 12.2.8.

12.2 Concrete pavement bars

12.2.1 General

a) The Contractor must ensure that concrete for pavement bars is supplied in accordance with AS 1379 Specification and supply of concrete, as amended or supplemented by this Master Specification Part.

b) The Contractor must ensure that concrete for pavement bars is strength Grade S32.

c) Concrete for pavement bars must be placed and compacted in accordance with AS 3600 Concrete structures, as amended or supplemented by this Master Specification Part.

12.2.2 Sampling and testing

a) The Contractor must ensure that sampling and testing of pavement bars comply with AS 1012 Methods of testing concrete.

b) The Contractor must ensure that:

i) 2 standard specimens made concurrently form a sample for compressive strength testing;

ii) 3 standard specimens made concurrently form a sample for flexural strength testing; and

iii) test results form part of the Quality Management Records.

c) Test specimens for flexural strength testing must be standard specimens and must be made and treated in accordance with AS 1012.8 Methods of testing concrete, Part 8 Method for making and curing concrete (Method 8.1 to 8.4).

d) Any assessment of compressive strength must be undertaken without the addition of fibre reinforcement. Flexural strength tests must be undertaken with fibre reinforcement.

12.2.3 Curing of specimens

a) The Contractor must ensure that concrete for pavement bars is cured in accordance with AS 3600 Concrete structures, as amended or supplemented by this Master Specification Part.

b) The Contractor must ensure that the surface is maintained in moist condition as required by AS 3600 Concrete structures, with:

i) concrete containing Portland cement conforming to AS 3972 General purpose and blended cements must be moist cured for 7 days; and

ii) concrete containing blended cements conforming to AS 3972 General purpose and blended cements must be moist cured for 14 days.

c) The Contractor must ensure that 2 additional compressive strength samples per 100 units must be prepared when steam curing is used. These specimens must be initially treated and steam cured as per CIA Recommended Practice Z9 Curing of Concrete, Appendix A.

d) Subsequent to steam curing pursuant to section 12.2.3c), the Contractor must ensure that the specimens are subjected to the same curing procedures adopted for the unit they represent, and the Contractor must make provision for such curing of the specimens at the Site.

e) Testing of the additional compressive strength test specimens required by section 12.2.3d) must be carried out at the completion of the total curing cycle.

12.2.4 Flexural strength and fibre cohesive capability of a sample

a) The Contractor must ensure that the composite concrete flexural strength with fibre complies with the requirements specified in section 12.4.

b) Where a specimen has failed when tested in accordance with section 12.2.2c), the upper rollers of the flexural test apparatus must be advanced a further 40 mm and released. For

acceptance of the failure, the fractured pieces of concrete must remain firmly held together by the fibre.

12.2.5 Fibre reinforcement

Reinforcing fibre must be Caricrete, fibre size various tex, fibre length 75 mm (Order Code KU10100) or an approved alternative. The amount of fibre in the mix must be a minimum of 0.3% by mass.

12.2.6 Surface finish

a) The Contractor must ensure that concrete surfaces of the pavement bars are finished so as to achieve the specified dimensions, texture and surface finish as required by this Master Specification Part. The surface finish must be class 3 in accordance with AS 3610 Formwork for concrete.

b) The Contractor must ensure that the bottom surface of the pavement bar has an exposed aggregate finish free of laitance for bonding purposes.

12.2.7 Painting of concrete pavement bars

a) Pavement bars must be painted with 2 coats of low gloss acrylic “Golden Yellow” paint, as defined in AS 2700 Colour standards for general purposes to a total dry film thickness of 60 mm.

b) A coating of glass beads must be added to each coat of paint whilst it is still wet to ensure embedment.

c) The Contractor must ensure that the paints used for painting concrete pavement bars are products appearing on the Department Approved Products List or are otherwise submitted for approval in accordance with PC-CN3 “Construction Management”.

12.2.8 Recycled pavement bars

The Contractor must ensure that the recycled pavement bars are products appearing on the Department Approved Products List or are otherwise submitted for approval in accordance with PC-CN3 “Construction Management”, with the Contractor submitting:

a) results of recognised tests or other suitable documentation (in order to support the requirements of this section 12);

b) disposal instructions for the recycled pavement bars;

c) a guarantee or warranty statement of the life expectancy of the recycled pavement bars in relation to colour fastness and structural integrity of the material; and

d) evidence demonstrating satisfactory physical properties, proven durability and fixing method.

12.3 Manufacturing or recycled pavement bars

a) The Contractor must ensure that recycled pavement bars are manufactured from recyclable materials and materials that resist permanent deformation.

b) The Contractor must ensure that recycled pavement bars are manufactured so that they resist breaking under impact from traffic, or if breaks do occur, sections of the bar do not detach and create the possibility of damage to vehicles or road users.

c) The Contractor must ensure that materials used in recycled pavement bars are not subject to becoming more brittle, or otherwise deteriorate structurally.

12.4 Compressive and flexural strength

a) The Contractor must ensure that pavement bars have a minimum compressive strength of 32 MPa and a minimum flexural strength of 4.5 MPa.

b) Where the Contractor proposes to use pavement bars that do not meet the strength requirements set out in section 12.4a) but which do possess a memory characteristic allowing

the pavement bar material to regain its shape after deformation, the Contractor must submit details of any proposed alternative materials in the Construction Documentation for the Principal's approval.

12.5 Recycled pavement bar colour

a) The Contractor must ensure that recycled pavement bars are manufactured either yellow in colour or capable of accepting and retaining paint. The yellow colour must be colour "Golden Yellow", as defined in AS2700 Colour standards for general purposes.

b) The Contractor must ensure that each recycled pavement bar has a colour match rating of 3 when compared to the "Golden Yellow" colour, as determined in accordance with AS 1580.601.1 Paints and related materials - Methods of test, Method 601.1: Colour - Visual comparison.

c) The Contractor must ensure that pavement bars that are manufactured yellow and do not require painting are capable of retaining their colour when exposed to weather conditions.

d) Where recycled pavement bars are being supplied, the Contractor must provide as part of the Construction Documentation, information supplied by the recycled pavement bar manufacturer on the likely service life of the recycled pavement bar prior to painting that pavement bar.

e) Recycled pavement bars are not required to be retroreflective if used on roads which have any level of road lighting.

f) Where the manufacturer has nominated a paint product which is compatible with the recycled pavement bar surface and which will minimise discolouration due to wear or the accumulation of road grime, the Contractor must submit details of that recommended paint product in the Construction Documentation.

12.6 Performance requirements

a) The Contractor must ensure that recycled pavement bar surfaces have a smooth surface and are not capable of causing damage to vehicle tyres. They must exhibit self-cleaning properties whereby the recycled pavement bar will retain its yellow colour and minimise discolouration due to wear or the accumulation of road grime.

b) The Contractor must ensure that the underside of the recycled pavement bars are sufficiently rough enough to permit a good bond between the pavement bar and the adhesive used. The bottom surface of the pavement bar must be flat so that it can rest firmly on a hard flat surface without rocking when a load is alternately applied to each end.

12.7 Fixing methods

a) The Contractor must ensure that recycled pavement bars are capable of being fixed to the road surface by the use of adhesives.

b) The Contractor must ensure that recycled pavement bars are not fixed to the road surface by the use of mechanical fixings.

c) The Contractor must use a suitable adhesive agent in accordance with the manufacturer's requirements.

13 Temporary pavement marking materials

13.1 Temporary retroreflective raised pavement markers

The Contractor must ensure that temporary retroreflective raised pavement markers are sufficiently robust to survive under traffic until permanent markings are installed, in accordance with AS 1742.3 Manual of uniform traffic control devices, Part 3: Traffic control for works on roads.

13.2 Temporary line marking tape

Details of the method and application of temporary line marking tape must be detailed in the Construction Documentation.

14 Records

Traceability is required for all pavement marking materials supplied pursuant to this Master Specification Part. The Contractor must submit a record of consignments and associated documentation for all pavement marking materials as part of the Quality Management Records. The documentation must provide details including:

a) product name;

b) product description;

c) batch no.;

d) date of manufacture; and

e) evidence that the pavement marking material complies with the requirements of this Master Specification Part.

15 Verification requirements and records

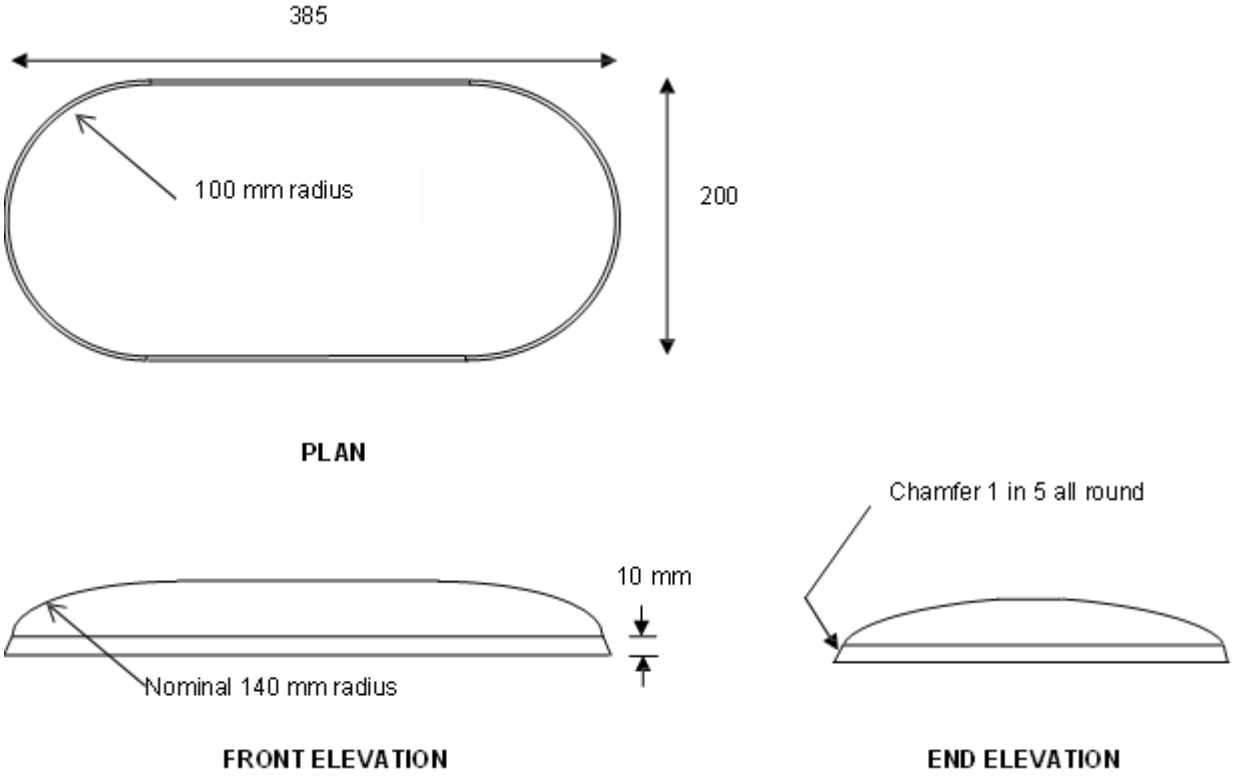
The Contractor must supply written verification as part of the Quality Management Records that the requirements listed in Table RD-LM-S1 15-1 have been complied with:

Table RD-LM-S1 15-1 Verification requirements

Section reference	Subject	Procedure	Frequency	Record to be provided
4	Skid resistant additives for non-skid paint	AS2700 Colour standards for general purposes “whiter than Y35” and TP134 Particle Size Distribution - Standard Method of Analysis by Sieving	Each consignment	Record of supply stating compliance to Master Specification Part
5	Glass beads	AS/NZS 2009 Glass beads for pavement-marking materials and APAS Specification AP-S0042 Glass Beads (and Glass Particles) - For use in and with Pavement Marking Materials	Each consignment	Record of supply stating compliance to AS/NZS 2009 Glass beads for pavement-marking materials and APAS Specification AP-S0042 Glass Beads (and Glass Particles) - For use in and with Pavement Marking Materials for Type D-HR, Type C or Type B High Performance Retroreflectivity glass beads
9	Raised pavement markers	AS/NZS 1906.3 Retroreflective materials and devices for road traffic control purposes, Part 3: Raised pavement markers (retroreflective and non-retroreflective)	Each batch	Record of supply stating compliance to AS/NZS 1906.3 Retroreflective materials and devices for road traffic control purposes, Part 3: Raised pavement markers (retroreflective and non-retroreflective) and class of material
11	Adhesives		Per Project	Written approval of raised pavement marker or pavement bar manufacturer
12	Pavement bars		Per Project	Record of supply stating compliance to Master Specification Part

16 Appendix 1: Pavement bar

Figure 16-1 Pavement bars plan, front elevation and elevation views



NOTE:

Not to scale

All dimensions in millimetres

Size B Bars 50 mm nominal height