

Roads

Master Specification

RD-LM-C1 Application of Pavement Marking

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RD-LM-C1 Application Of Pavement Marking

1 General

1.1 This Part specifies the requirements for the application of pavement marking.

Term	Definition
Line Marking	All longitudinal lines.
Maintenance Repainting	The supply and application of a single coat of paint to a previously painted surface.
New Work	The supply and application of pavement marking to an unmarked surface or the modification of existing markings.
Pavement Marking	The supply and application of line marking, road marking, pavement bars and raised pavement markers.
PCCP	Painting Contractors Certification Program (refer www.apas.gov.au/pccp).
Road Marking	Transverse lines, arrows, symbols, chevrons, diagonals, messages and traffic island and median kerbing.

1.2 Other terms must be as defined in the DPTI Pavement Marking Manual, available from: <https://www.dpti.sa.gov.au/standards/tass>.

2 Quality Requirements

2.1 The Contractor must prepare and implement a Quality Plan that includes detailed procedures for:

- ensuring that the plant, processes and personnel used to apply pavement marking comply with the specified certification requirements and are capable of delivering the quality of marking required;
- controlling the quality of materials used;
- verifying that materials have been applied at the specified application rates; and
- verifying that the field performance meets specified requirements.

2.2 If not submitted beforehand, the procedures must be submitted at least 28 days prior to the commencement of site work.

2.3 Provision of the procedures listed in this Clause shall constitute a **Hold Point**.

3 Contractor Accreditation

3.1 The work must be undertaken by a company that has PCCP accreditation appropriate for the type of work being undertaken in accordance with Table RD-LM-C1 3-1.

Table RD-LM-C1 3-1 PCCP Accreditation

Class	Accreditation Class Description	Materials	Sub-class
21	Long-run longitudinal pavement marking on major roads	Paint	Class 20-1
22	Short to medium-run longitudinal pavement marking on minor roads	Paint	Class 21-1
23	Pavement marking; Car park	Paint	Class 22-1
24	Transverse pavement marking including intersections & messaging	Thermoplastic	Class 24-2
		Multi-component / CAP	Class 24-3
		Non-skid Paint	Class 24-4
25	Raised Pavement Marker / Pavement Bar Installation		Class 25-1
26	High Friction Surfacing	Coloured Bus / Cycle Lanes	Class 26-2
27	Pavement marking; Removal		Class 27-1

4 Materials

- 4.1 All pavement marking materials must comply with RD-LM-S1 "Materials for Pavement Marking".

5 Application of Pavement Marking

General

- 5.1 Markings must be as detailed on the Drawings and in accordance with the DPTI Pavement Marking Manual.
- 5.2 The application of pavement marking to the road surface must only take place under the following conditions:
- a) when the surface is dry and free from foreign matter (e.g. oil, loose material, sealing aggregate, etc.);
 - b) at air temperatures $>10^{\circ}\text{C}$; and
 - c) when relative humidity is $<85\%$.
- 5.3 Subject to prior approval, the manufacturer's written recommendations must be used if at variance with these criteria. All data must be recorded in the daily diary.
- 5.4 The Contractor must undertake mechanical or hand brooming if the first condition above cannot be achieved by use of a surface cleaning apparatus incorporated in the line marking machine.

Protection of Work

- 5.5 Until full curing of the pavement marking has been achieved, the Contractor must ensure that all work is protected from traffic damage by the use of cones and signs in accordance with AS 1742.3, Clause 3.9.1.
- 5.6 If "pick-up" is evident the Contractor must obliterate any "re-distributed" material caused by vehicles passing over uncured work by removing and / or covering the "re-distributed" material with a treatment of appropriate colour and type to match the existing road surface.
- 5.7 The Contractor must reapply pavement marking damaged by vehicles passing over uncured work.
- 5.8 Longitudinal line marking must be considered damaged where the initial retroreflectivity measured within 10 days of application using a calibrated low angle retroreflectometer using 30 metre geometry is below $240 \text{ mcd/m}^2/\text{lx}$.

Spotting Alignment

- 5.9 For new work, the Contractor must carry out spotting prior to the application of all pavement markings. Following spotting, the Contractor must give 24 hours' notice before any pavement marking is applied.
- 5.10 Provision of the above notice shall constitute a **Hold Point**.

Paint Application - General

- 5.11 Unless specified otherwise, longitudinal line work in rural areas must be undertaken with a Class A line marking machine. Longitudinal line marking in the metropolitan area must be undertaken with a Class A line marking machine if practicable, otherwise a Class B line marking machine must be used. Refer to the PCCP for details of Class A and Class B line marking machines.
- 5.12 Hand spraying with the use of templates to control the pattern and shape will be allowed for transverse lines, chevrons, diagonals, pavement messages, symbols and traffic island and median kerbing.

- 5.13 Where two coats of paint are to be applied for separation lines on carriageways with two-way traffic, the coats must be applied in opposite directions. Paint for separation lines on carriageways with one-way traffic and all edge lines must be applied in the direction of traffic.
- 5.14 Where two coats of paint are to be applied, the first coat must be adequately cured prior to the application of the second coat. All paint and beads must be evenly applied to the markings.
- 5.15 The time and date of installation of regulatory lines must be recorded and the Contractor must forward this information within 5 working days.

Longitudinal Paint Systems

- 5.16 The longitudinal paint system must be as described in Table RD-LM-C1 5-1:

Table RD-LM-C1 5-1 Longitudinal Paint System

Treatment	Materials	Typical Application
Standard	Paint and Type B high retroreflectivity drop on beads (traditionally referred to as “virgin”, “pristine” or “high refractive index” beads).	Roads where standard performance and limited wet weather reflectivity is acceptable.
Large Beads	Paint and Type D-HR large beads.	High traffic volume roads where enhanced performance and wet weather retroreflectivity is required. This treatment will typically halve maintenance requirements.
Large Bead / Glass Anti-Skid Mix	Paint and Type D-HR large bead / glass anti-skid mix.	High traffic volume roads where enhanced performance and wet weather retroreflectivity is required and skid resistance must be provided on a smooth road surface. This treatment will typically halve maintenance requirements.

- 5.17 Large beads and / or the Large Bead / Glass Anti-Skid Mix must be used when specified by the Principal.

Transverse “Non-Skid” Marking Systems

- 5.18 The transverse paint system must be as described in Table RD-LM-C1 5-2:

Table RD-LM-C1 5-2 Transverse Paint System

Treatment	Materials	Typical Application
Standard	Premixed paint and crushed quartz.	Roads and intersections where skid resistance is required but no retroreflectivity.
High performance Multi Component	2 part cold applied material, aggregate and Type D-HR large beads with an adhesion coating.	High traffic volume roads and intersections with a large number of heavy vehicles where enhanced performance and dry and wet weather retroreflectivity is required. This treatment will typically have a 5 year life span.
High Performance Pre-Form Thermoplastic	Thermoplastic material and anti- skid mixture containing Type C Intermix glass beads and crushed glass.	High traffic volume roads and intersections where enhanced performance and retroreflectivity is required. This treatment will typically have a 5 year life span.

- 5.19 High performance markings must be used when specified by the Principal.

Longitudinal Paint Application (PCCP Class 20-1 and 21-1)

New Work

- a) Standard Treatment.
 - b) Two coats of paint must be applied during the same site visit.
- 5.20 Large Beads and Large Bead / Glass Anti-Skid Treatment
- 5.21 Two coats of paint must be applied. The first coat must be the Standard Treatment and the second coat the Large Bead Treatment.
- 5.22 Two coats of paint must be applied together with a concurrent application of beads. The first coat must be fully cured prior to the application of the second coat. The timing of the application of paint must comply with any requirements specified by the Principal.
- 5.23 Until installation of the separation line, the Contractor must maintain appropriate signing in accordance with AS 1742 (e.g. T3-12 "No lines do not overtake unless safe") and PC-SM1 "Traffic & Pedestrian Management".

Maintenance Repainting

- 5.24 One coat of the specified paint treatment must be applied together with a concurrent application of glass beads.

Transverse "non-skid" paint application (PCCP Class 24-4)

New Work

- 5.25 Two coats of pre-mixed paint and crushed quartz must be applied during the same site visit. The first coat must be fully cured prior to the application of the second coat.

Maintenance Repainting

- 5.26 One coat of pre-mixed paint and crushed quartz must be applied.

Transverse high Performance pavement marking application

- 5.27 **Multi Component** (PCCP Class 24-3) consists of a 2 part cold applied pavement marking material applied according to the manufacturer's recommendations and comprising:
- a) a base coat;
 - b) aggregate;
 - c) a top coat to encapsulate the aggregate; and
 - d) type D-HR beads with an adhesion coating.
- 5.28 The aggregate and beads must be applied while the material is fluid to ensure embedment and must be evenly distributed to provide a complete coverage.
- 5.29 **Pre-Form Thermoplastic Pavement Marking** (PCCP Class 24-2) consists of pre-formed thermoplastic pavement marking material applied according to the manufacturer's recommendations. An anti-skid mixture containing Type C Intermix glass beads and crushed glass must be applied immediately after heating while the material is still liquid. The mixture must be evenly distributed to provide a complete coverage of the surface of the thermoplastic.

Coloured Pavement Surfacing Application (PCCP Class 26-2)

- 5.30 Coloured pavement surfacings are for use on pavement designated as bus or cycle lanes.
- 5.31 **Multi Component** consists of a suitably pigmented 2 part cold applied pavement marking material applied according to the manufacturer's recommendations and comprising:
- a) a base coat;

- b) aggregate; and
 - c) a top coat to encapsulate the aggregate.
- 5.32 The aggregate must be applied while the material is fluid to ensure embedment and must be evenly distributed to provide a complete coverage.
- 5.33 **Pigmented Binder System** consists of a 2 or more component thermosetting resin suitably pigmented to provide the necessary depth of specified colour in the finished surface coating and the application of coloured aggregate. The aggregate must be applied while the material is fluid to ensure embedment and must be evenly distributed to provide a complete coverage of the treated area.

Kerb Treatment

New Work

- 5.34 The concrete surface of the kerb must be dry and adequately cured prior to the application of paint, and any curing agents used must be removed by an appropriate means. The paint must be applied in one or more coats to achieve the specified minimum dry thickness. Glass beads must be applied to the final coat immediately following the application of paint to ensure embedment and retention.

Maintenance Repainting

- 5.35 The Contractor must remove and dispose of any lifting or flaking paint coatings, rubbish, grass and vegetation to achieve a sound surface prior the application of paint. Repainting must consist of a single application of paint to achieve the specified minimum dry film thickness. Glass beads must be applied immediately following the application of paint to ensure embedment and retention. The Contractor must ensure that "over-spray" does not cause paint contamination to adjacent surfaces.

Glass Bead and Glass Bead / Anti-Skid Application

- 5.36 All beads and bead / anti-skid mix must be applied using a method that ensures uniform cover and retention to the surface of the marking, and minimal wastage of material. The Contractor must ensure excessive application of material, which may present a hazard for road users, does not occur. Glass beads and glass bead / anti-skid mix must be applied immediately following application of pavement marking material to ensure embedment and retention.

Pavement Marking Application Rates

- 5.37 Pavement marking and additives must be applied in accordance with Table RD-LM-C1 5-3.
- 5.38 Written verification of all application rates must be provided, vide Clause 12 "Verification Requirements and Records".

Table RD-LM-C1 5-3 Pavement Marking Application

Item To Be Treated	Paint			Additive	
	Type	Colour	Film Thickness	Type	Rate
Longitudinal Lines Standard Beads	Waterborne pavement marking	White	Wet 300 – 375 um.	Type B High Retroreflectivity Drop-on Glass Beads	Min. Retained 275 g/m ²
Longitudinal Lines Large Beads	Waterborne pavement marking	White	Wet 600 um.	Type D-HR Large wet weather Glass Beads	Min. Retained 500 g/m ²
Longitudinal Lines Large Bead / Glass anti-skid mix	Waterborne pavement marking	White	Wet 600 um.	Type D-HR Large wet weather Glass Bead and 1 mm – 2 mm crushed glass mix	Min. Retained 750 g/m ² Mix Ratio 70:30

Item To Be Treated	Paint		Additive		
Pavement messages, symbols, chevrons, diagonals & transverse lines	Waterborne pavement marking	White	Dry 250 – 350 um.	Premixed with Crushed Quartz	Min. 0.50 kg/L
Pavement messages, symbols, chevrons, merge arrows, diagonals & transverse lines	High Performance Multi Component	White Yellow	Base coat 1mm Top coat 0.5 mm	1-3 mm aggregate Type D-HR Large wet weather Glass Beads with adhesion coating	400 gm/m ² 400 gm/m ²
	High Performance Pre-Form Thermoplastic	White Yellow	Pre-Form Thickness 2.5 mm ± 0.5 mm	Type C Intermix Glass Bead and 1 mm – 2 mm crushed glass mix	1.60 Kg/m ² retained Mix Ratio 70:30
Bus and Cycle Lanes	Multi Component	Various	Base coat 1 mm Top coat 0.5 mm	1-3 mm aggregate	1.50 Kg/m ²
	Pigmented Binder	Various	Binder Uniform thickness to provide adhesion to aggregate and substrate	1-3 mm aggregate	Complete coverage of treated area
Traffic island and median kerbing	Latex exterior flat or low gloss	White	New: dry 60 – 90 um. Maintenance: dry 40 – 60 um.	Type B High Retroreflectivity Drop-on Glass Beads	Min. Retained 275 g/m ²
Pavement bars	Latex exterior flat or low gloss	Yellow	New: dry 60 – 90 um. Maintenance: dry 40 – 60 um.	Type B High Retroreflectivity Drop-on Glass Beads	Min. Retained 275 g/m ²
Clearway markings	Waterborne pavement marking	Yellow	Wet 300 – 375 um.	Type B High Retroreflectivity Drop-on Glass Beads	Min. Retained 275 g/m ²
No standing zones	Waterborne pavement marking	Yellow	Wet 300 – 375 um.	Type B High Retroreflectivity Drop-on Glass Beads	Min. Retained 275 g/m ²
Blacking-out	Waterborne pavement marking	Black	Dry 250 – 350 um.	Premixed with Crushed Quartz	Min. 0.50 kg/L
Rail crossing box hatchings	Waterborne pavement marking	Yellow	Dry 250 – 350 um.	Premixed with Crushed Quartz	Min. 0.50 kg/L

Placement of Markings

5.39 For maintenance repainting, the existing road markings must be repainted to restore the original size, shape and line pattern. Pavement marking must be placed on the road surface in correct position within the following tolerances specified in Table RD-LM-C1 5-4.

Table RD-LM-C1 5-4 Placement of Markings

	New Work	Maintenance Repainting
Spotting		
Line marking	+ - 50 mm of pavement / seal centre or to surveyed design strings	-
Road marking	+ - 50 mm of drawing dimensions and control lines	-
Road marking	+ - 25 mm in relation to "spotting"	Areas must not be less than existing shape and size and not more than 10 mm greater than the existing all round (i.e. 0, + 10 mm).
Line Marking		
Edgeline distance from centreline	+ - 25 mm	-
Resultant lane width	+ - 50 mm	-
Lateral deviation from "spotting"	+ - 25 mm	-
Stripe width	+ 10, - 0 mm	+ 10, - 0 mm
Stripe length, less than 12 m	+ 150, - 0 mm	+ 150, - 0 mm
Stripe length, greater than 12 m	+ 300, - 0 mm	+ 300, - 0 mm
Module length, 12 m	+ 150, - 0 mm	+ 150, - 0 mm
Module length, greater than 12 m	+ 300, - 0 mm	+ 300, - 0 mm
"New over old" line placement (lateral)	-	< 10 mm
"New over old" line placement (longitudinal)	-	+ 150, - 0 mm

No Overtaking Zones

- 5.40 The Contractor must accurately locate the extent of no overtaking zones from the Drawings prior to the commencement of works. To locate zones the Contractor must use a calibrated, precise vehicle mounted measuring device capable of measuring to 1 m accuracy. If any discrepancies are identified the Contractor must provide immediate notification. Under no circumstances must the Contractor install new or modify existing installations.

Removal of Pavement Markings (PCCP Class 27-1)

- 5.41 Removal of pavement marking must be undertaken so as to not adversely affect the skid resistance, texture depth, susceptibility to ponding and appearance of the road surface. The Contractor must obtain approval of the proposed removal method prior to undertaking the removal. Any materials produced by removal activity must be immediately collected and removed from site and disposed of in an environmentally acceptable manner.

Transition Between Existing and New Work

- 5.42 This sub-clause applies where a change of lane width after resealing works or road reconstruction results in a miss-match of an edge line. Where this occurs, the Contractor must ensure that the edge lines transition smoothly between the old and new work. Unless specified otherwise, a transition treatment must be made as indicated in Figure RD-LM-C1 5-1. The existing edge line and RRPMS must be removed from the existing pavement and the new edge line must transition between the old and new work on the existing pavement. The transitional line marking treatment must not be applied to new pavement work.

Figure RD-LM-C1 5-1 Edge line Mismatch Treatment

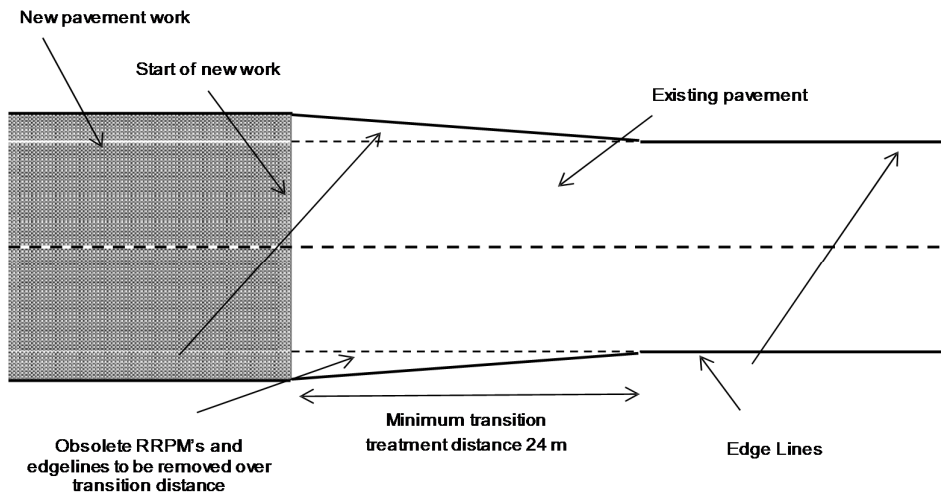


Figure 5.16
Edge line Mismatch Treatment

6 Raised Pavement Markers (PCCP Class 25-1)

- 6.1 Installation of raised pavement markers must be in accordance with the DPTI Pavement Marking Manual if there are no drawings applicable. Markers must be placed to a tolerance of ± 25 mm.
- 6.2 Adhesive must be two-part epoxy or hot melt used in accordance with the manufacturer's instructions and applied evenly over the whole contact surface area of the marker so that a bead of adhesive forms around the perimeter when the marker is pressed onto the road surface during installation.
- 6.3 If removal of raised pavement markers is required, the Contractor must remove the marker and adhesive in such a way that minimum damage is caused to the road surface. Any damage to a wearing surface must be repaired by an approved method. Markers removed from the road must be collected and disposed of.

7 Pavement Bars (PCCP Class 25-1)

- 7.1 Installation must be carried out such that the pavement bars are placed true to the locations indicated on the Drawings. Bars must be placed to a tolerance of ± 25 mm. Pavement bars must be treated with a paint / bead application in one or more coats to achieve the specified paint and glass bead application rates.
- 7.2 Adhesive must be two part epoxy or hot melt used in accordance with the manufacturer's instructions and applied evenly over the whole contact surface area of the bar so that a bead of adhesive forms around the perimeter when the bar is pressed onto the road surface during installation.
- 7.3 If removal of pavement bars is required, the Contractor must remove the bar and adhesive in such a way that minimum damage is caused to the road surface. Remaining adhesive deposits must be removed to surface level to give a textured surface finish. The bar must be disposed of appropriately and any surface damage repaired. The method of repair must be subject to prior approval.
- 7.4 If maintenance repainting of pavement bars is required, bars must be treated with a paint/bead application to achieve the specified paint and glass bead application rates. Precautions must be taken to avoid "overspray" and damage by traffic whilst drying.

8 Retroreflectivity

- 8.1 The measurement of retroreflectivity, as referenced in TP 950, must be carried out using a low angle retroreflectometer using 30 metre geometry calibrated to a nationally recognised reference standard.

If the retroreflectivity at any test location should fall below the value shown in Table RD-LM-C1 8-1, the affected area, as defined in TP 950, must have the pavement marking re-applied.

Table RD-LM-C1 8-1 Retroreflectivity

Retroreflectivity			
Annual Average Daily Traffic Estimates (AADTE) >10 000 vehicles per day			
Days of Wear	10 to 20	160 to 180	360 to 380
Retroreflectivity, mcd/m ² /lx	240	165	No requirement specified
AADTE 4 000 to 10 000 vehicles per day			
Days of Wear	10 to 20	160 to 180	360 to 380
Retroreflectivity, mcd/m ² /lx	240	175	No requirement specified
AADTE 1 000 to 4 000 vehicles per day			
Days of Wear	10 to 20	160 to 180	360 to 380
Retroreflectivity, mcd/m ² /lx	240	220	No requirement specified
AADTE <1 000 vehicles per day			
Days of Wear	10 to 20	160 to 180	360 to 380
Retroreflectivity, mcd/m ² /lx	265	235	225

9 Skid Resistance

- 9.1 Skid resistance for transverse marking must be greater than 45 BPN, until at least the issue of the Final Certificate, when measured in accordance with TP344 or TP345. If the skid resistance is below 45 BPN the Contractor must re-apply pavement marking to the affected area.

Test Procedures

- 9.2 The Contractor must use the following test procedures (refer https://www.dpti.sa.gov.au/contractor_documents) to verify conformance with the Specification:

Table RD-LM-C1 9-1 Test Procedures

Test	Test Procedure
Determination of Skid Resistance with the Grip Tester	TP344
Operation of a British Pendulum Portable Skid Tester	TP345
Determination of Retroreflectivity of Pavement Markings	TP907

10 Hold Points

- 10.1 The following is a summary of Hold Points referenced in this Part:

Document Ref.	Hold Point	Response Time
2	Submission of Procedures (if not submitted beforehand)	7 working days
5.3	Following spotting and prior to application of pavement marking paint	1 working day

11 Verification Requirements and Records

Test records

- 11.1 The Contractor must undertake the testing specified in this Clause and supply written evidence of compliance with the lot package.

Table RD-LM-C1 11-1 Verification requirements

Document Ref.	Subject	Property	Procedure	Frequency	Acceptance Limits
5.1	Application conditions	Measurement of temperature and relative humidity	Contractor to provide	Every work session.	Air temperature > 10°C. Relative humidity < 85%.
5.13	All pavement marking applications	Material application rate	Contractor to provide evidence through materials consumption and area	Every work session.	As per Table 5.4

Other Records

11.2 The Contractor must supply the following records:

Table RD-LM-C1 11-2 Verification records

Document Ref.	Subject	Record To Be Provided
5.4	Regulatory lines	Time and date of installation of regulatory lines
Part RD-LM-S1	Materials	Records referred to in Clause RD-LM-S1.13

12 Measurement

- 12.1 A line pattern will be measured as though it is a continuous line (i.e. the measurement will be the sum of the painted and unpainted dimensions).
- 12.2 A Barrier Line will be measured as though it is a single line.
- 12.3 Pavement marking which involves a 2-coat paint system will be measured as though it is a single coat (i.e. the quantity shown in any schedule is the actual measurement of the marking on the pavement surface).