



**ACT**  
Government

# LINE MARKING 11

MUNICIPAL  
INFRASTRUCTURE  
TECHNICAL  
SPECIFICATION  
**11 - LINE MARKING**

Transport Canberra and  
City Services

July 2019



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# 1 PAVEMENT MARKING

## 1.1 General

Pavement markings: To AS 1742.2.

### 1.1.1 Responsibilities

#### 1.1.1.1 Objectives

Requirement: To specify requirements for pavement marking systems:

#### 1.1.1.2 Precedence

Where any document except legislation or the *Territory Plan* issued in conjunction with this Specification includes technical requirements that conflict with this Design Standard the requirements of this Specification take precedence.

### 1.1.2 Cross references

General: The following documents are related to this Specification:

#### 1.1.2.1 Legislation

Road Transport (General) Act

Road Transport (Safety and Traffic Management) Act

Road Transport (Mass, Dimensions and Loading) Act

Road Transport (Safety and Traffic Management) Regulation

Territory Plan and related Codes

Public Roads Act

#### 1.1.2.2 Specifications

Requirement: Conform to the following:

MITS 00 Preliminaries

MITS 01 Roadwork

#### 1.1.2.3 Design Standards

General: The following Design Standards are related to this Specification:

MIS 13 Traffic Control Devices

ACT Standard Drawings (ACTSD) - as referenced through this Specification.

#### 1.1.2.4 TCCS Reference Documents

General: The following TCCS reference documents are related to this Specification:

Reference document 7 Operational acceptance submissions

Reference document 8 Works As Executed quality records

Reference document 9 Final Acceptance submissions

Reference document 11 Drafting Standard for Civil and Landscape works

### 1.1.3 Referenced documents

#### 1.1.3.1 Standards

General: The following documents are incorporated into this Specification by reference:

AS 1141	Methods for sampling and testing aggregates
AS 1289	Methods of testing soils for engineering purposes
AS 1289.2.1.4	Soil moisture content tests - Determination of the moisture content of a soil - Microwave-oven drying method (subsidiary method)
AS 1580	Paints and related materials—Methods of test
AS 1580.107.3	Determination of wet film thickness by gauge
AS/NZS 1580.401.8	No-pick-up time of road marking paints
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	Glass beads for pavement - marking materials
AS 2700	Colour Standards for general purposes
AS 4049	Paints and related materials - Pavement marking materials
AS 4049.1	Solvent-borne paint - For use with surface applied glass beads
AS 4049.2	Thermoplastic pavement marking materials - For use with surface applied glass beads
AS 4049.3	Waterborne paint - For use with surface applied glass beads
AS 4049.4	High performance pavement marking systems

#### Roads and Maritime Services (NSW)

RMS QA Specification DCM R141-2011 Pavement Marking

RMS Technical Direction Prequalified Retroreflective Raised Pavement Markers

RMS QA Specification R145 Pavement Marking (Performance Based)

American Society for Testing and Materials

ASTM D3335-2009 Standard test method for low concentrations of lead, cadmium, and cobalt in paint by atomic absorption spectroscopy

### 1.1.4 Interpretation

#### 1.1.4.1 Abbreviations

General: For the purposes of this Specification the following abbreviations apply:

<b>Paint</b>	In this work section implies 'waterborne pavement marking paint'.
<b>Thermoplastic material:</b>	In this work section implies 'thermoplastic pavement marking material'.
<b>RMS:</b>	NSW Roads and Maritime Services

**TCCS:** Transport Canberra and City Services.

#### **1.1.4.2 Definitions**

General: For the purposes of this Specification the definitions given below apply:

**Authorised Person:** Person or body responsible for administering the works contract. May include Principals Authorised Persons, Superintendent's Representatives or any other parties in accordance with the works contract

**Durability:** The ability of the marking to resist wear and deterioration, and the longevity of the marking.

**Frictional resistance:** An estimation of adherence quality on a wet pavement surface as measured by friction between the surface and the friction equipment. The abbreviation SRN (Skid Resistance Number) is used to describe the value. The BPN (British Pendulum Number) is the nearest whole number to the SRN value.

**Longitudinal linemarking:** All lines that are generally parallel to the traffic flow - barrier, parking, merge, path, dividing, edge and lane lines as shown on ACTSD-3501.

**Long-life material:** Pavement marking materials of high durability suitable for high traffic volumes and severe wear conditions which provide long term performance, including thermoplastic and two part cold applied materials.

**Other markings:** All diagonal and chevron markings on the pavement, symbols, words, numerals and arrows, kerb markings and markings for parking including any other marking not included above.

**Pavement markers:** The term used for Retroreflective Raised Pavement Markers.

**Pavement marking:** All longitudinal linemarking, transverse lines, coloured surface coatings, raised pavement markers and other markings placed on the road to control traffic movement or parking.

**Reflectivity value:** The average of five reflectometer readings taken in close proximity at any particular test site.

**Reproducibility of equipment:** The ability of devices to produce identical readings at relatively the same point.

**Retroreflective Raised Pavement Markers (RRPM):** Markers applied directly to the substrate by means of a suitable adhesive which provide a point source of reflected or internal light when illuminated by vehicle headlights when viewed at normal night time viewing angles by vehicle drivers. There may be some delineation during daylight hours due to their contrasting colour, reflection and profile with respect to the pavement surface.

**Retroreflectivity:** The reflectivity provided by solid glass beads, expressed in millicandelas per lux per square metre (mcd/lux/m<sup>2</sup>) as measured by a retroreflectometer approved and witnessed on site by the Authorised Person.

**Stripe:** That part of longitudinal linemarking comprising pavement marking material.

**Substrate :** Existing road or path surface to which the pavement marking, surface coating or raised pavement marker is to be applied or affixed.

**Surface coating:** Coloured material comprising aggregate and resin based binders applied to the surface of the road or path pavement.

**Transverse lines:** All lines that are marked at right angles to the general traffic flow, such as Stop, Give Way and pedestrian crosswalk lines.

## 1.1.5 Submissions

### 1.1.5.1 General

Submissions: To the Authorised Person's approval.

Approvals: Submit Principal Approved Laboratory or equivalent Approval Scheme and other specified materials certification; conform to **Hold points and witness points**.

Drawings: Prepare drawings and other documentation including asset sheets to record extent and constitution of final works in accordance with *TCCS Reference document 8* and submit electronic TCD documentation in accordance with *TCCS Reference document 11*.

## 1.1.6 Hold points and witness points

### 1.1.6.1 Notice

General: Give written notice so that the documented inspection and submissions may be made in accordance with the **Hold point table** and the **Witness point table**.

**Table 11-1 Hold point table**

Item	Clause title	Requirement	Notice for inspection	Release by
<b>Approval of materials for use</b>				
<b>11.1</b>	Complying materials proposed for use.	Submit a signed verification statement and compliance documentation	7 days prior to scheduled work commencement	Authorised Person
<b>11.2</b>	Non-complying materials proposed for use.	Submit details of proposed materials with documentation supporting its use.	7 days prior to scheduled work commencement	Authorised Person
<b>Long life materials</b>				
<b>11.3</b>	Details of proposed long life material	The manufacturer's technical data for the LLM proposed for use together with written evidence from a Principal Approved Laboratory or equivalent scheme that the material complies with the requirements of this Specification	7 days prior to scheduled marking including material samples if requested	Authorised Person



Item	Clause title	Requirement	Notice for inspection	Release by
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#### Glass beads

11.4	Details of proposed glass beads	Submission of the manufacturer's technical data for the glass beads proposed for use together with written evidence from a Principal Approved Laboratory or equivalent scheme that the glass beads comply with the requirements of this Specification.	7 days prior to scheduled use of glass beads including material samples if requested	Authorised Person
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#### Raised pavement markers

11.5	Details of proposed raised pavement markers	Details of raised pavement markers specified for use in the contract works, together with full technical details of the adhesive proposed for use, and written evidence from a Principal Approved Laboratory or equivalent scheme that the adhesive materials comply with the requirements of this Specification. Refer to <i>RMS Technical Direction TD 2015/01 Prequalified Retroreflective Raised Pavement Markers</i>	7 days prior to scheduled application of raised pavement markers including material samples if requested	Authorised Person
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#### Surface preparation

11.6	Surface preparation for pavement marking	Notification that the road surface and/or existing pavement markings will be prepared on site	2 working days prior to scheduled pavement marking commencement	Authorised Person
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#### Positioning of markings

11.7	Set out of pavement marking	Notification that the pavement marking works will be marked out on site	2 working days prior to scheduled pavement marking commencement	Authorised Person
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#### Removal of redundant markings, Eradication of pavement markings

11.8	Eradication of pavement markings	Identification of all markings to be eradicated have been marked out on site.	1 working day prior to scheduled work commencement	Authorised Person
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Item	Clause title	Requirement	Notice for inspection	Release by
11.9	Removal of raised pavement markers	Submit written procedure on their method of raised pavement marker removal and proposed method of pavement rectification	2 working days prior to scheduled work commencement	Authorised Person

#### Removal of redundant markings, Masking of existing markings

11.10	Use of "Blackout" material	Submission of the manufacturer's documentation on the material / method intended for use and details of the areas proposed for use of the material / procedure.	5 working days prior to scheduled work commencement	Authorised Person
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#### Non conforming work

11.11	Non conforming work rectification	Submission of a non-conformance report and acceptance of the disposition by the Authorised Person.	To be included on the non-conformance report	Authorised Person
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**Table 11-2 Witness point table**

Item	Clause title	Requirement	Notice for inspection	Release by
<b>Reflectivity testing</b>				
11.1	Reflectivity conformance	Confirmation of reflectivity testing on site	2 working days prior to scheduled testing commencement	Authorised Person

## 1.2 Pre-construction planning

### 1.2.1 General

#### 1.2.1.1 Traffic management

General: Take all necessary steps to avoid or minimise delays and inconvenience to all users of the road reserve or open space area during the course of the work but without compromise to the safety of the employees and the public or quality of the works.

Plan: Submit a Temporary Traffic Management Plan for approval in conformance with *MITS 01 Traffic Management*.

## 1.3 Materials

### 1.3.1 Approval of materials for use

Complying materials documentation: A statement verifying that materials meet the requirements shall be submitted prior to their proposed use. The statement shall include documentation verifying that the materials comply with the requirements of this specification. The documentation shall be from a Principal Approved Laboratory or equivalent Approval Scheme. Such documentation shall be valid for tests conducted no more than thirty six (36) months previously. This is a **HOLD POINT**.

Non-complying materials documentation: Where a material proposed for use does not comply with this specification or composition or manufacturers specified application rates vary from those referred to within this specification, samples of the materials shall be submitted prior to their proposed use. The samples shall be submitted together with a statement verifying the materials compliance and/or non compliance with the requirements of this specification, the manufacturer's recommendations for application, application rates, previous history of use, details of wet and dry retro reflectivity, luminance, skid resistance, durability, degree of wear previous test results, related Material Safety Data Sheets and, thickness for preformed thermo plastics. This is a **HOLD POINT**.

### 1.3.2 Colour of lines, other markings and surface coatings

Requirement: The colours of pavement markings described in this specification shall comply with the following as defined in AS2700:

Pavement Marking:

White	Whiter than Y35 Off White
Yellow	Within the range and including: Y12 Wattle - Y14 Golden Yellow
Blue	B21 Ultramarine Blue

Surface coating:

Red	Within the range and including: R53 Redgum - R54 Raspberry - R62 Venetian Red
Green	Within the range and including: G13 Emerald - G23 Shamrock

Blackout:

Black	No lighter than 642 Night (or B64 Charcoal)
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Approved 'Blackout' material shall be applied with an approved non slip aggregate.

### 1.3.3 Pavement marking paint

Requirement: Waterborne paint shall conform to the requirements of AS 4049.3 *Waterborne paint – For use with surface applied glass beads*.

### 1.3.4 Long life materials

#### 1.3.4.1 General

Requirement: The materials proposed for use for thermoplastic and two component cold applied marking materials will require the approval of the Authorised Person. This is a **HOLD POINT**.

A minimum 2 year warranty on materials and workmanship (i.e. delaminating due to poor application) of all applied long life material shall be provided. This does not include spatial cracking due to wearing course movement.

The contractor is to identify any specific areas of concern in their tender submission (Refer to **Surface preparation, Surfaces with existing markings and Coloured surface coatings, Delamination and ravelling**).

The Contractor, in consultation with their material supplier(s), will need to guarantee that materials issues, such as compatibility, have been resolved and that the application will satisfy the long term performance requirements.

#### 1.3.4.2 Thermoplastic markings

Requirement: Thermoplastic long-life materials (LLMs) shall conform to the following:

- > Non Profile Pavement Marking including preformed, screeded, extruded and spray applied shall conform to the requirements of *AS 4049.2*.
- > Profile Pavement Marking shall conform to the requirements of *RMS D&C Specification 3359*.

#### 1.3.4.3 Two component cold applied marking materials

Requirement: Two component Cold Applied Pavement Marking Materials shall comply with the requirements of *RMS D&C Specification 3360*.

### 1.3.5 Glass beads

#### 1.3.5.1 General

Requirement:

- > Reflective Glass Drop on Beads shall comply with the requirements of *AS 2009*.
- > Glass beads used for “drop-on” applications shall comply with the requirements of *RMS D&C Specification 3353*.

Submission of documentation certifying conformance with the requirements is a **HOLD POINT**.

#### 1.3.5.2 Allowable heavy metal content

Requirement: The heavy metal content for glass beads shall be in accordance with the **Allowable heavy metal content for glass beads table**.

**Table 11-3 Allowable heavy metal content for glass beads table**

Heavy Metal	Requirement
Antimony (Sb) Lead (Pb) Mercury (Hg)	Not greater than 50ppm each element
Arsenic (As) Cadmium (as the oxide) (Cdo) Chromium (tri-valent) (Cr <sub>2</sub> O <sub>3</sub> )	Not greater than 10ppm each element

### 1.3.6 Raised pavement markers

Requirement: Demonstration of conformance to the following is a **HOLD POINT**:

- > Raised Pavement Markers may be used to assist in the delineation of the pavement marking and shall be of an approved type meeting the requirements of *AS 1906.3* and shall be those specified in *RMS Technical Direction Prequalified Retroreflective Raised Pavement Markers*.
- > Retroreflective markers shall have an initial retro reflectivity value as shown in *TD 2015/01* as measured by an approved laboratory in accordance with *AS 1906.3*. They will meet the dimensions specified in *RMS D&C Specification R142*.
- > Adhesives for Raised Pavement Marker installation shall comply with the requirements of *AS 3354*.
- > Comply with *RMS TD 2015/1 prequalified retroreflective raised pavement markers*.

## 1.4 Pavement marking execution

### 1.4.1 Surface preparation

#### 1.4.1.1 General

Requirement: Pavement markings shall only be applied to sound, clean and dry surfaces. Surface preparation shall, at all times be the responsibility of the Contractor.

Substrate: The area to be marked shall be dry and free of dirt, incompatible or flaking marking material, or other loose or foreign material. The area around the marking shall also be free of dirt, gravel and other loose or foreign material so that tracking of such material on to the new marking is avoided.

Remediation: If any of these conditions are not met, maintenance, reinstatement or installation of new markings shall be delayed until the surface is dried or the offending material removed.

This is a **HOLD POINT**

#### 1.4.1.2 Surfaces with existing markings

Requirement: New pavement markings shall not be applied over pavement markings of a different type unless approved by the Authorised Person. Where a pavement marking material is to be applied to a surface where it may be incompatible with the existing marking or surface, the surface shall be suitably treated.

Concrete substrates: Where a curing compound has been applied to a concrete surface, the curing compound shall be removed from the areas where the pavement marking material is to be applied if adhesion of the marking material will be affected. All concrete surfaces shall be primed in accordance with the pavement marking material manufacturer's specifications for surface treatment of concrete and the Contractor shall obtain agreement in writing of the Authorised Person to the proposed method of surface preparation and its extent.

Unsound substrates: Where the existing material is not sound, is of a type, or is in such a condition that adhesion of the new material to the pavement surface cannot be guaranteed for the required life of the marking, the Contractor shall obtain the agreement in writing from the Authorised Person to the proposed method of surface preparation and its extent. The cost of such work shall be borne by the Contractor.

Tape markings: For preparation of surfaces containing existing tape markings refer to **Removal of Tape Markings**.

#### 1.4.1.3 Surfaces for surface coatings

Requirement: Surfaces to which surface coatings are to be applied should be prepared to maximise adhesion of the coating. The cleanliness and suitability of the surface should be assessed against criteria documented by the source of the technology, and, if necessary, the surface cleaned and primed.

Priming: Any Priming material applied to the pavement surface must be protected from contamination and trafficking prior to application of the binder.

Substrate condition: Surface preparation should be in accordance with *RMS D&C Specification R110* and the associated Guide Notes and, where a Coloured Surface Coating material is to be applied to a surface where it may be incompatible with the existing surface due to the condition of the surface, and such adhesion of the new material to the pavement surface cannot be guaranteed for the required life of the marking, the Contractor shall obtain the agreement in writing from the Authorised Person for the proposed method of surface preparation or replacement including its extent. The cost of such work shall

be borne by the Contractor. Unsuitable areas must be notified to the Authorised Person at the time of tendering.

## **1.4.2 Positioning of markings**

### **1.4.2.1 General**

Requirement: All markings shall be set out and applied within the tolerances as listed in the **Pavement marking dimension and thickness tolerances table** and as detailed on the relevant ACTSD or the approved TCD drawings supplied. Conform to *MITS 00 Preliminaries*.

Non-conformance: The Contractor shall, without additional cost to the Principal, remove and replace any markings which are deemed not to comply with the requirements of ACTSD, this specification or the approved Traffic Control Device Plans.

This is a **HOLD POINT**.

### **1.4.2.2 Maintenance**

Set out: Pavement marking material shall be applied directly over the existing marking alignment unless they are so badly worn that a new set out is required. Where it is deemed that the need for such set out is required, the cost of such set out and associated temporary traffic management shall be borne by the Contractor.

Existing marking tape: Where the existing pavement marking material is marking tape, this material shall be treated in accordance with **Removal of redundant markings, Masking of existing markings** prior to the installation of the new markings.

Where the existing markings differ from the ACTSD or approved TCD drawings, the contractor shall remove or mask the existing affected pavement marking in accordance with **Removal of redundant markings** and **Surface preparation**.

### **1.4.2.3 New installation and reinstatement**

Layout: The position of all longitudinal markings except symbols and legends shall be defined by a line of painted spots of a 50mm maximum diameter at a maximum of 10 metres apart (short sections and sections on curves should be spaced no greater than 5 metres apart for clarity).

Marking details: Hooks are to be used to mark the start and finish of each type of line except for Hold and Stop Lines. Each line is to be marked with the line code in 150mm high lettering adjacent to the set-out. Upon completion of spotting, the Contractor shall advise the Authorised Person, and a joint checking procedure shall be undertaken prior to application of final markings.

Temporary markers: For reinstatement of pavement markings after resurfacing, temporary raised pavement markers (TRPMs) may be placed on top of the line to be reinstated prior to resurfacing at a spacing not greater than that for raised pavement markers and used to position the new marking.

### 1.4.3 Provision for traffic

Requirement: Conform to *MITS 01 Traffic Management*.

Works protection: The Contractor shall provide for traffic management in accordance with the requirements of *AS 1742* and *AS 1743* while undertaking the work and any set out required and shall protect the pavement markings until the material has hardened sufficiently so that traffic will not cause damage or dislodge the glass beads.

Temporary traffic arrangements: Details of Temporary Traffic Management (TTM) Plans shall be submitted to the Authorised Person for endorsement prior to submission for approval by the Road Authority for each situation. The Contractor shall obtain approval from the Road Authority for all necessary temporary traffic management prior to commencing any work. The traffic management used on site must comply with the approved details. The Authorised Person shall have the right to remove any personnel and equipment from site that do not comply with the approved details.

Costs: All costs associated with traffic management including the preparation and submission of TTM Plans to the Road Authority shall be allowed for by the Contractor.

Timing: The approval of TTM Plans by the Road Authority may take up to seven working days to process. The Contractor must allow for this lead time in his works program scheduling.

Traffic controllers: All personnel involved in traffic management shall be fully trained and be able to demonstrate their competency by holding relevant RMS traffic controller cards. Traffic controllers shall be clearly identified on site and shall carry their card on their person while engaged in traffic control.

### 1.4.4 Pavement marking

#### 1.4.4.1 General

Requirement: The completed markings shall be uniform in appearance, texture, width and thickness and the surface shall be free from unbeaded areas, traffic damage or other defects. Markings shall be straight or with smooth even curves where intended. All edges shall have a clean sharp cut off.

Method: All longitudinal lines shall be applied using a self propelled machine unless otherwise authorised by the Road Authority. The two sets of lines forming a one way or two way barrier line pattern shall be applied concurrently.

Non-conformance: Any marking material beyond the defined marking shall be removed at the contractor's cost, leaving a neat marking on the wearing surface of the pavement.

#### 1.4.4.2 Colour

Requirement: All pavement markings shall be applied in the following colours

Longitudinal Lines:

- > All Longitudinal lines shall be white, unless otherwise specified in the ACTSD or the approved Traffic Control Device (TCD) drawings.

Reflective Raised Pavement Markers:

- > Colour appropriate to the location of the marking in accordance with *ACTSD-3501* and *ACTSD-3503*, unless specified otherwise on the Approved TCD drawings.



## Transverse Lines and Other Markings

- > All Transverse Lines and Other Markings including chevrons (excluding accessible parking bay chevrons), words, numerals, arrows and symbols shall be white, unless otherwise specified in the ACTSD or the approved TCD drawings
- > Accessible Parking Bay (including accessible parking bay chevrons), Bus Stop, Taxi Ranks, Loading Zone and Keep Clear Markings shall be yellow unless otherwise specified in the ACTSD or the approved TCD drawings.
- > Access for pavement symbol shall be white on a blue patch.

## Surface coatings:

- > Coloured surface coatings shall be Red for bus lanes and Green for bicycle lanes, unless otherwise specified on the approved TCD drawings or within the contract documentation for the specific project.

### 1.4.4.3 Installation requirements

Requirement: All pavement markings shall be applied as follows:

## Longitudinal lines:

- > All painted longitudinal linemarking is to be applied in waterborne paint. All paint shall be applied uniformly.

## Raised Pavement Markers:

- > Raised Pavement Markers shall be installed in accordance with ACTSD.
- > Markers requiring to be offset from a line shall be offset by 80mm measured from the edge of the line nearest the marker position, to the edge of the marker nearest the line

## Transverse Lines and Other Markings:

- > The shape and dimensions of lateral lines and other markings shall be in accordance with ACTSD.
- > Hand spraying with the use of a template to control the pattern and shape of the marking is allowed for transverse and other markings

## Surface coatings:

- > Surface coatings are to be applied in accordance with the approved TCD drawings and **Coloured surface coatings**.

### 1.4.5 Pavement marking paint

General: Due to initial incompatibility problems between precoat on reseals and new asphalt and the new paint markings, waterborne paint markings should not be applied on new pavement surfaces as follows:

- > 7 to 21 days for reseals using water based precoat
- > 10 to 21 days for reseals using petroleum based precoat
- > 10 to 21 days for asphalt surfaces

As a guide, the recommended conditions for the application of waterborne paints with large glass beads to ensure good long term performance are given in *RMS QA Specification 145 Pavement Marking Annexure F*.

All materials are to be applied as per manufacturers' specifications. The contractor is to specify any non-conformance in their tender submission.

#### 1.4.6 Thermoplastic markings (non-profile)

Allowed use:

- > Sprayed, extruded or preformed thermoplastic may be used for longitudinal, transverse and other pavement markings and shall be applied with a uniform cross section.
- > Screeded, thermoplastic may be used for transverse lines and other markings only.

Application:

- > Screeded, sprayed or extruded thermoplastic material shall be applied using a suitable applicator and templates to control the pattern.
- > Preformed thermoplastic material, upon approval for use, shall be applied to the pavement surface by melting onto the pavement surface after the application of a tack coat, if required, and in accordance with the manufacturer's recommendations
- > The application rates of thermoplastic material (non profile) shall be as specified in the **Thermoplastic material (Non-profile) application rates table**

Substrate: For screeded, sprayed or extruded thermoplastic material where the surface of the pavement is concrete or is smooth or is polished, a tack coat shall be applied in accordance with the manufacturer's recommendations.

**Table 11-4 Thermoplastic material (Non-profile) application rates table**

Material	Longitudinal linemarking	Transverse lines and other markings	
		Screeded, Sprayed or Extruded Thermoplastic	Preformed Thermoplastic
Thermoplastic cold film thickness	$\geq 1.5\text{mm}$	$3.0\text{mm} \pm 0.5\text{mm}$	-
Thermoplastic thickness	-	-	$2.5\text{mm} \pm 0.5\text{mm}$

The application rates of thermoplastic material (non profile) specified in the above table excludes surface applied glass beads and non slip aggregates.

#### 1.4.7 Application of profile (or audio tactile) longitudinal pavement marking

Allowed use: Profile (or audio tactile) longitudinal pavement markings may be either:

- > Raised ribs applied at a regular interval over a base strip layer of the same material (continuous type), or
- > Raised ribs only, placed directly on the pavement surface (discontinuous type)

Prior to the application of the marking material, carry out an assessment of the pavement surface, particularly concrete or smooth or polished pavement surfaces, to determine the need for surface or other preparation such as grinding and/or the application of tack coat to facilitate adhesion.

The profile pattern must conform to the dimensions shown in the **Dimension Detail for Profile Longitudinal Pavement Marking table**

Substrate: Where the surface of the pavement is concrete or is smooth or polished, a tack coat shall be applied in accordance with the manufacturer's recommendations prior to the application of the profile material.

**Table 11-5 Dimension detail for profile longitudinal pavement marking table**

Property	Tolerance
Height of raised ribs proud of the pavement surface	10mm ± 2mm
Thickness of base line joining rib sections	<= 2mm
Spacing of raised ribs along line	250mm ± 50mm
Length of raised ribs along line	60mm ± 10mm
Slope angle of raised rib leading and trailing faces	45° (approximately)

#### 1.4.8 Cold applied plastic

General: Due to initial incompatibility problems between precoat on reseals and new asphalt and the new paint markings, cold applied plastic markings should not be applied on new pavement surfaces as follows:

10 to 21 days for reseals using petroleum based precoat

21 days for asphalt surfaces

Allowed use:

- > Sprayed two part cold applied plastic materials may be used for longitudinal linemarking.
- > Trowelled, screeded, sprayed, roll-on or extruded two part cold applied plastic materials may be used for transverse lines and other pavement markings.

Substrate: Where the surface of the pavement is concrete or is smooth or polished, a primer shall be applied in accordance with the manufacturer's recommendations

Application: The application rates for the material shall be as specified in the **Two part cold applied pavement marking material application rates table**.

**Table 11-6 Two part cold applied pavement marking material application rates table**

Material	Transverse Lines and Other Markings	
	Trowelled, Screeded or Extruded	Sprayed or Rolled
Dry Cold Applied Plastic thickness	>=2.0mm ± 0.20mm	>=1.0mm ± 0.1mm

#### 1.4.9

### 1.4.10 Glass beads

Requirements:

- > For surface applications to waterborne pavement marking materials for longitudinal lines shall comply with *AS2009 Class "D-HR" beads*. In addition, the refractivity index shall be either greater than 1.55 or virgin glass with a refractivity index greater than 1.50.
- > For surface applications to all Long Life Material (LLM) pavement marking materials shall be adhesive coated.
- > Glass beads must be coated with a compatible coupling agent to form an improved adhesive bond with thermoplastic or two part cold applied pavement marking material

Application: Glass beads shall be applied uniformly to all markings and shall be applied over the whole surface of the marking in such a manner as to produce a uniform, properly bonded coverage.

Excess material: All excess pavement marking materials remaining on the pavement surface shall be collected and disposed of in a manner acceptable to the Environmental regulator.

### 1.4.11 Retroreflective raised pavement markers (RRPM) and solar markers

Requirement: Markers must be fixed with adhesive to the wearing surface of the pavement in accordance with the recommendations of the marker and the adhesive manufacturers.

Application:

- > The markers are to be applied in accordance with the ACTSD or approved TCD drawings. Raised pavement markers shall be fixed using adhesives which comply with *AS 3354*.
- > Two component adhesives shall be freshly mixed and shall not have started to gel prior to use.
- > Bituminous adhesives shall be applied at the correct temperature as specified in the manufacturer's recommendations.
- > Adhesive shall fill all irregularities in the pavement surface and shall be applied in such a way that the contact area between the marker and the pavement surface is completely covered.
- > The thickness of the adhesive shall be 2 to 5mm thick, as measured from the marker base to the highest point of the roughened pavement.
- > The marker shall be pressed down onto the adhesive covered surface in the correct position, rotated slightly until the adhesive is squeezed out around all edges of the marker up to 30mm from the edge.
- > The marker must not be disturbed until the adhesive has completely set. Care shall be taken to ensure that excess adhesive is not applied to areas outside of those defined above.
- > Installation of raised pavement markers shall not be carried out whilst the pavement is damp, during wet weather, or if rain is likely to fall during the application process.

Substrate: Where the surface of the pavement is concrete the surface of the concrete shall be abraded prior to application of the adhesive and an adhesive approved by the Road Authority shall be used to adhere the marker to the surface.

Maintenance work: Markers which are to be replaced shall be those which have debonded from the pavement surface or which are deemed to be ineffective during a night assessment by two inspectors using the headlights of a standard passenger vehicle on low beam.

**Table 11-7 Allowed Raised Pavement Marker types**

RRPM Type	Description
WU	Uni-direction reflective white
YU	Uni-direction reflective yellow
RU	Uni-direction reflective red
GU	Uni-direction reflective green
GU Solar	Uni-direction solar green
WB	Bi-direction reflective white
YB	Bi-direction reflective yellow
BB	Bi- direction reflective blue

## 1.4.12 Surface coatings

### 1.4.12.1 General

Requirement: Coloured surface coatings should be applied to achieve:

- > Uniform application of binder and aggregate in accordance with the nominated design with adequate adhesion to the underlying surface;
- > Complete cover with aggregate particles over the whole of the treated area; and
- > An effective bond between binder and aggregate.

Application: In accordance with *RMS D&C Specification R110* and the relevant Guide Notes.

### 1.4.12.2 Pavement temperature and weather conditions

Requirement: The application process should take into account the increase in cure time of the resin binder with decrease in temperature. The use of accelerators/catalysts and heat to increase curing rate must be strictly in accordance with the binder manufacturer's recommendations.

Records: Ambient air and pavement temperatures should be measured and recorded at regular intervals during conduct of the work. For this purpose a suitable thermometer or temperature gauge, accurate to  $\pm 2^{\circ}\text{C}$ , must be used and time intervals between temperatures measurements must not exceed two hours. In the case of urethanes, a wet/dry bulb hygrometer must be used to report the dew-point or relative humidity.

Temperature measurement: If the work is performed in daylight hours and the pavement is partly in sun and partly in shade, the cooler shade temperature will determine the cure of the whole work, so the shade temperature must be monitored. Pavement temperature shall be in accordance with the manufacturers' specification for the application of material.

Application: Must not be carried out on a damp or wet pavement, when rain appears imminent or during high winds or dust storms.

#### 1.4.12.3 Binder

Application:

- > The binder must be applied in a uniform thickness and at a rate in accordance with the nominated design. The work area must be treated in a suitable number of lots.
- > Low viscosity (<3 Pa.s) binders such as acrylics require an additional application after the aggregate is broadcast.

Verification: After each application of binder to each lot, the quantity of material used must be checked against the area covered and any necessary adjustments made to ensure that the specified or agreed rate of application is maintained in subsequent applications.

#### 1.4.12.4 Aggregate

Requirement: Aggregate must be applied at a uniform rate and adequately embedded in the binder. The aggregate must be dry at the time of application.

Trafficking: After the application of the binder and aggregate, a period of at least the minimum time recommended by the binder supplier, or such longer period as may be necessary for the binder to cure, must elapse before the area is opened to traffic. During this curing period, traffic must be kept off the treated surface.

Coverage: Any bare or insufficiently covered areas must be re-covered as necessary to give a uniform and complete surface coverage within the specified time.

Verification: After the application of aggregate to each lot, the quantity of material used must be checked against the area covered and any necessary adjustments made to ensure that the specified or agreed rate of application is maintained in subsequent applications.

### 1.4.13 Acceptance of dimensions and thickness

Acceptable limits: Conform to the **Pavement marking dimension and thickness tolerances table** for acceptable limits of departure from the dimensions and thicknesses specified.

**Table 11-8 Pavement marking dimension and thickness tolerances table**

Dimension	Maintenance Pavement marking (Note 1)	Reinstatement and installation
<b>Longitudinal linemarking</b>		
<b>Distance between centreline of new and old marking</b>	< 15mm	
<b>Location of new longitudinal linemarking</b>		< 50mm from the locations shown in the ACTSD or Specification.
<b>Width of new linemarking (and for maintenance: total width of new and old linemarking, unless directed otherwise)</b>	Widths shown in the ACTSD for line shapes and sizes +10mm / - 0mm	Widths shown in the ACTSD for line shapes and sizes +10mm / - 0mm
<b>Length of new stripe (and for maintenance: total length of new and old stripe unless otherwise directed)</b>	The lesser of:- +10 / - 0% of old stripe or old stripe length + 200mm / - 0mm	Lengths shown in the ACTSD or approved TCD Drawings for line shapes and sizes +100mm / - 0mm

Dimension	Maintenance Pavement marking (Note 1)	Reinstatement and installation
<b>Start of new stripe relative to start of old stripe</b>	The lesser of:- + 0% / -10% of stripe length or old stripe length + 0mm / - 200mm	
<b>Gap between double lines</b>	100mm +20mm / - 0mm	100mm +20mm / - 0mm
<b>Raised Pavement Markers</b>	Longitudinal displacement $\pm$ 20mm from that specified in the ACTSD unless otherwise directed by the Road Authority. Lateral displacement $\pm$ 10mm from that specified in the ACTSD unless otherwise directed by the Road Authority. Directional $\pm$ 4°.	Longitudinal and lateral displacement $\pm$ 20mm from that specified in the ACTSD. Directional $\pm$ 4°.

#### Transverse lines and other markings (Refer Notes 2 and 3)

<b>(a) Width of new marking</b>	Width of old marking + 20mm / - 0mm Also refer Note 2.	Widths in the ACTSD for line shapes and sizes +20mm / - 0mm. Refer Note 3
<b>(b) Length of new marking</b>	Length of old marking +20mm / - 0mm Also refer Note 2	Lengths shown in the ACTSD for line shapes and sizes + 20mm / - 0mm

#### Maximum thickness of pavement markings other than profile pavement marking

	$\leq$ 6mm thickness unless otherwise directed by the Road Authority.	As per dimensions shown in tables for each product
<b>Surface coatings</b>		
	$\leq$ 6mm thickness unless otherwise directed by the Road Authority.	Length as specified $\pm$ 100mm. Width +10mm / - 0mm

Notes to Table 11-8:

1. The apparent line of longitudinal linemarking shall have a smooth and continuous alignment when viewed in the direction of travel along the line.
2. Where the existing markings exceed the dimensions permitted for Reinstatement, the dimensions for the new Maintenance markings shall not increase the deviation from the dimension permitted for Reinstatement, unless otherwise directed by the Road Authority.
3. Arrows and speed markings shall be placed square to the direction of travel except in the case of oblique arrows which shall be installed in accordance with ACTSD-3520.
4. Localised deviations in minimum line width due to poor pavement conditions may be accepted by the Authorised Person.

## 1.4.14 Removal of redundant markings

### 1.4.14.1 Eradication of pavement markings

Requirements:

- > The Contractor shall check the extent of eradication with the Authorised Person and all markings to be eradicated shall be clearly identified with red paint prior to the commencement of eradication.

This is a **HOLD POINT**.

- > Any markings incorrectly eradicated shall be remarked by the Contractor at no extra cost to the Principal.
- > Abrasive materials shall not be allowed to accumulate on any position of the works area open to any mode of transport.
- > The Contractor shall clean up and remove from the works area all materials and debris from their operations and leave the roadway clear for use by the public.
- > Hydro-blasting, grinding, scraping or other eradication activity shall not continue after the markings have been removed and any excessive damage to the pavement shall be repaired to the satisfaction of the Authorised Person at no additional cost to the Principal.
- > Do not leave any marking material that has been removed from the pavement on the Site. Dispose of removed marking material in accordance with current EPA guidelines.

Work method:

- > The eradication of pavement markings shall be carried out by hydro-blasting techniques. Grinding or resurfacing may be permitted with the approval of the Authorised Person.
- > All numerals, letters, symbols, and arrows will be marked or removed in such a way to avoid any possible confusion of motorists in wet conditions i.e. pavement messages shall be squared up and gaps between letters, symbols and zebra crossing bars also treated with the same eradication method.
- > The eradication of, or removal of pliant polymer markings shall be carried out by grinding or hydro-blasting. Removal by burning will not be allowed.
- > Removal of markings shall be carried out until at least ninety eight percent of the original area of each pavement marking has been removed unless approved by the Authorised Person. Any marking remaining shall not be concentrated in any one or two places of the original marking.
- > Appropriate TTM signage and installation of TRPMs shall be provided when the permanent pavement marking is not marked within the same work shift as the eradication.
- > Unless approved by the Authorised Person all TB, TB1, SL1 and SL2 lines shall be reinstated with 48 hours of eradication.

Extent: The Contractor shall eradicate the nominated pavement marking as specified on the drawings regardless of the colour, number of coats, type and age of the paint or pliant polymer marking.

### 1.4.14.2 Removal of raised pavement markers

Requirements:

- > Where raised pavement markers are to be removed from the wearing surface of the pavement, the remaining adhesive shall be removed and the pavement shall be repaired so that it is clean, smooth, flush and has a surface colour and texture comparable to the adjacent pavement surface.
- > The Contractor shall provide a written procedure on their method of raised pavement marker removal and proposed method of pavement rectification 48hrs prior to removal.

This is a **HOLD POINT**.



#### 1.4.14.3 Masking of existing markings

Requirement:

- > Masking of existing markings shall not be undertaken unless directed by the Authorised Person as a temporary measure. The Authorised Person may permit masking within non-trafficable areas i.e. painted island and painted medians.
- > Where directed the Contractor shall mask (or remove) pavement markings no longer required from the wearing surface of pavements to leave a clean, undamaged pavement with a surface texture and colour comparable to the adjacent pavement surface.
- > Sand shall not be used on the pavement open to any modes of transport open to the public, or in locations which may cause a hazard.
- > 'Blackout' will only be permitted if carried out by the use of a material with a colour and texture matched to the adjacent pavement surface and which minimises the possibility of misleading drivers under daylight/darkness and wet/dry conditions. The 'Blackout' treatment must be equal to or better than mechanically stripping the old marking. All pavement marking tape shall be removed before 'Blackout' may be used.
- > Approved 'Blackout' material shall be applied with an approved non slip aggregate.
- > The Contractor shall obtain approval from the Authorised Person for the method of masking (or removal) of the lines including any 'Blackout' treatment prior to any operations being carried out.
- > Do not leave any marking material that has been removed from the pavement on the Site. Dispose of removed marking material in accordance with current EPA guidelines.

This is a **HOLD POINT**.

Work method:

- > The masking (or removal) of existing Tape Markings which are no longer required from the wearing surface shall be undertaken in accordance with the guidelines in the **Guideline for new pavement marking over existing tape markings table**, without the remarking requirement.
- > Where a "Partial removal" is used (i.e. some material is left on the surface) the previously marked area shall be remarked with a two component cold applied long life materials of a colour comparable to the existing pavement surface, in accordance with the manufacture's recommendations. The new marking shall be "squared off" such that the original marking configuration is no longer visible.
- > Any pavement marking materials removed from the pavement surface shall be collected and disposed of in a manner acceptable to the appropriate Environmental regulator.
- > The removal or treatment of existing tape markings where new markings are to be installed directly over existing markings is covered in **Removal of Tape Markings**.

## 1.4.15 Removal of tape markings

Requirements:

- > All existing pavement marking tape which is to be directly re-marked is to be removed or treated, prior to installation of the new pavement marking material, in accordance with the following guideline in the **Guideline for new pavement marking over existing tape markings table**, as directed by the Authorised Person.
- > The guideline describes the process to be used when undertaking new pavement marking over existing tape markings. These assessments should be jointly carried out by the Authorised Person and the Contractor prior to the commencement of any new pavement marking works.

**Table 11-9 Guideline for new pavement marking over existing tape markings table**

Condition of pavement under existing marking	Pavement resurfacing expected within 2 years	Pavement resurfacing expected after 2 years	Comments
<b>Asphalt surface in good condition</b> (i.e. minor or no cracking, ravelling, or bitumen hardening)	Grind off all tape marking (i.e. Full Removal) and remark in PAINT	Grind off all tape marking (i.e. full removal) and remark in LLM	Depressions resulting from grinding must be less than 2mm. This limit can be increased to 5mm provided that a feathered edge (max 1:20) is used (as measured by a 1.2m or 3m straight edge)
<b>Asphalt surface in poor condition</b> (i.e. as evidenced by significant cracking, ravelling, or bitumen hardening)	Remove any loose tape (i.e. Partial removal), and remark with PAINT directly over existing marking	Remove any loose tape (i.e. Partial removal), apply 2 component cold applied marking material (or approved bituminous product) to fill any local depressions over 5mm deep, and remark with two component cold applied plastic LLM	The removal of loose (i.e. flaky or peeling) tape is to be undertaken by manual means, or by a machine which can achieve this objective without damaging the pavement surface
<b>Sealed surface in good condition</b> (i.e. minor or no cracking, stripping, or binder hardening)	Remove any loose tape (i.e. Partial removal), and remark with PAINT directly over existing marking	Remove any loose tape (i.e. Partial Removal), apply 2 component cold applied marking material (or approved bituminous product) to fill any local depressions over 5mm deep, and remark with two component cold applied plastic LLM	The removal of loose (i.e. flaky or peeling) tape is to be undertaken by manual means, or by a machine which can achieve this objective without damaging the pavement surface.
<b>Sealed surface in poor condition</b> (i.e. as evidenced by significant cracking, stripping, or binder hardening)	Remove any loose tape (i.e. Partial removal), and remark with PAINT directly over existing marking	Remove any loose tape (i.e. Partial Removal), apply 2 component cold applied marking material (or approved bituminous product) to fill any local depressions over 5mm deep, and remark with two component cold applied plastic LLM	The removal of loose (i.e. flaky or peeling) tape is to be undertaken by manual means, or by a machine which can achieve this objective without damaging the pavement surface.

## 1.5 Inspection, sampling and testing

### 1.5.1 Testing

Inspection and Testing: To MITS 00B Quality Construction.

### 1.5.2 Retroreflective raised pavement markers (RRPM)

#### 1.5.2.1 New installation and complete replacement

Requirements:

- > Retroreflective Raised pavement markers will be tested for effectiveness and functionality.
  - A marker is defined as effective if it is retained on the pavement surface.
  - The retroreflective element of a marker is defined as functional if it satisfies the values specified in AS 1906.3.
- > No more than three consecutive markers shall be ineffective.
- > All retroreflective raised pavement markers must be effective for 30 days after installation.
- > A minimum of 95% of raised pavement markers must be effective for contract duration including the defect liability period after the installation.

Notes on functionality requirements:

- > Retroreflectivity may be measured with a suitable raised pavement marker retroreflectometer which is calibrated and operated according to the manufacturer's recommendations.
- > A subjective indication of the functionality of a retroreflective raised pavement marker is that it can be seen clearly by the driver to retro reflect at a distance of 60 metres when illuminated at night by the low beam of standard car headlights.

#### 1.5.2.2 Partial replacement

Requirements:

- > Retroreflective raised pavement markers:
  - To be tested for effectiveness and functionality.
  - Must be effective for 30 days after installation with no more than three consecutive retroreflective markers shall be ineffective
  - A minimum of 95% of the number of raised pavement markers originally placed must be effective for contract duration and defect liability period after the replacement.

## 1.5.3 Coloured surface coatings

### 1.5.3.1 Frequency and test timing

Requirements:

- > All materials used in the work must be sampled and tested to verify conformity to the requirements of this Specification.
- > The Contractor must nominate the proposed testing frequency which must not be less than that specified in the **Guideline for new pavement marking over existing tape markings table**. Where a minimum frequency is not specified, the Authorised Person must nominate an appropriate frequency.
- > Binder thickness may be measured during application. All other tests including *RMS D&C T231* must be performed between 1 month and the end of the defects liability period.

### 1.5.3.2 Surface texture

Requirements:

- > The surface texture of the coloured surface coating must be measured in accordance with *RMS D&C T240* or *RMS D&C T192*.
- > The frequency of testing must be in accordance with the **Guideline for new pavement marking over existing tape markings table**
- > Throughout the defects liability period, the surface texture must be a minimum of 0.6 mm.

### 1.5.3.3 Frictional characteristics

Requirements:

- > When subjected to simulated trafficking in accordance with the requirements of *AS 1141.41* and assessed for frictional properties in accordance with the requirements of *AS 1141.42*, the Polished Aggregate Friction Value (PAFV) test, the PAFV of a system panel prepared with the same materials, at the same thickness and by the same techniques as proposed for the works, must not be less than the minimum value specified in *RMS D&C R110*.
- > If the proposed coloured surface coating includes a second coat of binder to be applied over the aggregate, the system panel for PAFV must be prepared the same.
- > For aggregates which are not rolled after broadcasting and are held by a thermosetting binder there shall be no requirement to form a mosaic by hand and the requirements of *AS 1141.42 7.2(b)* does not apply.

The frictional characteristics of the coloured surface coating must be determined in accordance with the *RMS D&C T231*.

### 1.5.3.4 Delamination and ravelling

Requirements:

- > Throughout the contract and defects liability periods unless noted otherwise, all delamination and ravelling must be rectified.
- > At any time during the maintenance period, the area of the work which has delaminated or ravelled must not exceed 1% in any square metre and 0.1% of the total area of the work.

### 1.5.3.5 Colour

#### Requirements:

- > Approximate match of colour in this Specification must be determined in accordance with *AS/NZS 1580.601.1*.
- > Throughout the contract and defects liability periods, the colour of the surfacing must remain recognisably red or green and be an approximate match to the initial colour.
- > If the assessment or measurement is performed on an area cleaned for the purpose of assessment, the whole of the work must be so cleaned.

Colour verification: If the Contractor and the Authorised Person disagree on colour assessment by the specified method of approximate match, an instrument such as a Minolta chromameter (CIE 1931, D65/45/0) or approved equal shall be used for assessment and the colour of the surfacing must be within the approximate rectangular colour space with CIE (x,y) coordinates as follows:

Colour (Initial): The initial colour must be defined within an approximate trapezoidal colour space with the coordinates:

Red	(0.47,0.38)	(0.56,0.37)	(0.45,0.32)	(0.54,0.32)
Green	(0.32,0.50)	(0.33,0.38)	(0.30,0.36)	(0.19,0.41)

Colour (During and at the end of the defects period): The colour must be defined within an approximate trapezoidal colour space with the coordinates:

Red	(0.45,0.38)	(0.56,0.37)	(0.42,0.33)	(0.54,0.32)
The Y value, brightness or reflectance, must lie within the limits 6-15.				
Green	(0.32,0.50)	(0.33,0.38)	(0.30,0.35)	(0.19,0.41)

The Y value, brightness or reflectance, must lie within the limits 8-19.

### 1.5.4 Reflectivity testing

#### Requirements:

- > All testing shall be at the Contractors expense and is to be included in the contract sums / rates.
- > The pavement marking reflectivity is to be provided by application of solid glass beads to the pavement markings, expressed in millicandelas per lux per square metre (mcd/lux/m<sup>2</sup>) as measured by an MX30 retroreflectometer or approved equivalent.
- > All pavement markings shall be applied in such a manner that 80% of representative test sites do not have less than the specified reflectivity values shown in the **Pavement marking reflectivity and friction testing requirements table**.
- > Any markings where the reflectivity value is between 80% and 100% of the specified value will be subject to additional reflectivity testing at additional points as specified and witnessed by the Authorised Person, at the contractor's expense. These sections will be required to be remarked, unless 80% of the reflectivity values, from this further testing as specified and witnessed by the Authorised Person, equals or exceeds the specified reflectivity values. This is a **WITNESS POINT**.
- > All sections where representative test sites are less than 80% of the specified reflectivity values shown in the **Pavement marking reflectivity and friction testing requirements table** shall be remarked at the contractors expense, until 80% of the reflectivity values, from further testing as specified by the Authorised Person, equals or exceeds the specified reflectivity value.

This is a **WITNESS POINT**.

#### Dry Testing:

- > To be performed within six weeks of the pavement markings application, but no sooner than three weeks and shall be tested at the frequency specified in *MITS 00B Quality Construciton*. The Authorised Person may reduce the frequency of the reflectivity testing if the application is proven to exceed dry reflectivity requirements.
- > The locations of all representative test sites and reading locations are to be easily identifiable on site using a method that is approved by the Authorised Person.
- > The Authorised Person shall witness and confirm the reflectivity test results on the site.
- > Each representative test site shall include five readings taken within close proximity of each other (i.e. approx. 1m apart). The average of these five readings will represent the reflectivity value for that representative test site.

#### Wet Testing:

- > The locations of all representative test sites and reading locations are to be easily identifiable on site using a method that is approved by the Authorised Person and shall be tested at a frequency nominated by the Authorised Person.
- > Test sites shall be selected so as to avoid any areas of poor drainage or those which are susceptible to ponding. The test sites shall as near as practicable to the locations selected for dry testing.
- > 1 L of fresh water shall be poured onto the pavement surface from a height of approximately 500 mm, to cover a marking length of approximately 400 mm, ensuring that the operation is completed within 5 seconds.
- > Testing to be undertaken immediately 60±3 seconds after water has been poured onto the pavement surface with the reflectometer.
- > Measurements shall simulate the viewing direction of road and path users, with readings taken in both directions on centre lines.
- > The readings at each location shall be averaged to determine the retroreflectivity for a site.

Records: The contractor shall provide a report to the Authorised Person that includes a clear description of the locations of all representative test sites and shall include all reflectivity readings and reflectivity values associated with the test sites.

### 1.5.5 Friction testing

#### Requirement:

- > All testing must be at the frequency specified by the Authorised Person. Contractors expense will be nominated as a provisional quantity.
- > Friction testing to be undertaken on wearing courses and seals where the final aggregate application is 10mm or smaller.
- > The skid resistance of pavement markings shall be as specified in the **Pavement marking reflectivity and friction testing requirements table** and shall be measured by a laboratory (in bPNs), which is registered for skid resistance testing with the National Association of Testing Authorities.
- > Skid resistance testing shall be arranged by the Contractor, and carried out on markings within the critical paths of the pavement at locations identified by the Authorised Person. These will generally include markings within intersections involving hold and stop lines, arrows, zebra crossings, transverse bars, pavement messages, coloured surface coatings, and other markings identified in the **Pavement marking reflectivity and friction testing requirements table**.

## Testing:

- > Is to be performed within six weeks of the pavement markings application, but no sooner than three weeks and shall be tested at the frequency specified by the Authorised Person.
- > The locations of all tests are to be easily identifiable on site using a method that is approved by the Authorised Person.
- > Testing on coloured surface coatings must be performed 2 to 4 weeks after the coating was applied.
- > The frequency of testing for transverse marking will be specified by the Authorised Person (generally 1 test per 15m<sup>2</sup>).
- > The frequency of testing for coloured surface coatings will be specified by the Authorised Person (generally 2 tests per 50m<sup>2</sup>).

Records: The Contractor shall provide a report to the Authorised Person that includes a clear description of the locations of all test sites identified by the Authorised Person, and shall include all applicable friction test results and the original copies of the Principal Approved Laboratories or equivalent scheme test certificates.

The Authorised Person may waive friction testing based on the provision of conforming test results no older than 24 months for the same material combination on similar wearing courses following a joint site inspection of the application.

**Table 11-10 Pavement marking reflectivity and friction testing requirements table**

ACT Linetype	Description	Dry Reflectivity (mcd/lux/m <sup>2</sup> )	Friction (bpn)
<b>BARRIER LINES</b>			
B1	BARRIER LINE	350	-
BS	CROSSING IS PERMITTED IN ONE DIRECTION	350	-
BB	CROSSING IS NOT PERMITTED	350	-
<b>PARKING LINES</b>			
P1	PARKING BAY BARRIER LINE	-	-
P2	SPECIAL USE SPACE (RESERVED PARKING LINE, KEEP CLEAR, ACCESSIBLE PARKING BAYS, LOADING ZONES)	100	45
P3	SPECIAL SPACE USE (BUS BAYS, LOADING ZONES AND TAXI RANKS)	100	45
P4	PARKING BAY	-	-

ACT Linetype	Description	Dry Reflectivity (mcd/lux/m <sup>2</sup> )	Friction (bpn)
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#### MERGE LINES

M1	MERGE AND DIVERGE SITUATIONS, LONG TAPERS, ACCELERATION & DECELERATION TAPERS	250	45
M2	TYPICALLY USED TO THE LEFT OF AN M1 LINE AT A CYCLE STAND UP LANE OR WHERE APPROVED BY THE ROAD AUTHORITY TO PROVIDE GUIDANCE THROUGH SIGNALISED INTERSECTIONS	250	45

#### PATH LINES

B2T	BARRIER LINE (TACTILE MARKING)	White – 250 Yellow – 100	45
SP1	PATH SEPARATION LINE AND PATH EDGE LINE		45
SP2	PATH SEPARATION LINE		45
TB2	CONTROLLED INTERSECTION		45
TB3	GIVE WAY LINE CONTROLLED INTERSECTION		45
SC2	STOP LINE CONTROLLED INTERSECTION		45

#### DIVIDING LINES

S1-24	RURAL ROADS	350	-
S1-12	ALL OTHER ROADS	350	-
SLL	LOCAL ROADS WHERE RRPM DELINEATION IS NOT REQUIRED	350	-
S6	RURAL ROAD CENTRELINE OR SPECIAL USE AT INTERSECTIONS (ONLY TO BE USED WHERE APPROVED BY THE ROAD AUTHORITY)	350	-

#### EDGE LINES

E1	EDGE LINE LEFT HAND SIDE	350	-
E3	DIVIDED ROAD RIGHT HAND SIDE	350	-

#### LANE LINES

L1	RURAL ROADS & SUB-ARTERIALS	350	-
L4	EXIT LINE ON ROUNDABOUT	250	45
L8	ARTERIALS	350	-
L9	ARTERIALS SPECIAL CONDITIONS	350	-



ACT Linetype	Description	Dry Reflectivity (mcd/lux/m <sup>2</sup> )	Friction (bpn)
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#### TRANSVERSE LINES

T1	TURN LINE	250	45
TB	GIVE WAY AT CONTROLLED INTERSECTIONS	250	45
TB1	CONTROLLED INTERSECTIONS, SHORT TAPERS	250	45
SL1	STOP LINE AT TRAFFIC SIGNALS AND SCHOOL CROSSINGS	250	45
TF	STOP LINE AT PRIORITY INTERSECTIONS	250	45
RS	RUMBLE STRIP – SPEED REDUCTION MEASURE (ONLY TO BE USED WHERE APPROVED BY THE ROAD AUTHORITY)	250	45
E6	WHITE GORE	250	-
PCW	PEDESTRIAN CROSS WALK LINE	250	45
TBC	TRANSVERSE BICYCLE CROSSING	250	45
RHM	ROAD HUMP MARKERS	250	45
PX	ZEBRA CROSSING STRIPES	250	45
-	CHEVRON MARKINGS IN TRAFFIC LANES	250	45
-	OTHER MARKINGS AND MESSAGES – WHITE	250	45
	OTHER MARKINGS AND MESSAGES – YELLOW	100	45
-	OTHER MARKINGS AND MESSAGES – BLUE	N/A	45
-	COLOURED SURFACE COATING	N/A	55
	BLACKOUT	N/A	45

Notes to Table 11-11:

1. Wet reflectivity must be a minimum of 80 mcd/lux/m<sup>2</sup> at any time after application.
2. An approved glass bead and non slip aggregate mix shall be applied to all markings with friction testing requirements.

## 1.6 Completion

### 1.6.1.1 Submissions

Work as Executed Records: To *MITS 00B Quality Requirements*.

## 2 MEASUREMENT AND PAYMENT

### 2.1 Measurement

#### 2.1.1.1 General

Payments made to the Bill of Quantities: To *MIT 00A General requirements*, this Specification, the drawings and **Pay items**.

#### 2.1.1.2 Methodology

The following methodology will be applied for measurement and payment:

- > Allow for all work, materials, testing and quality assurance requirements in each Pay Item.
- > Additional pay items may be required for alternative colour markings.

### 2.2 Pay items

**Table 11-11 Pay items table**

Item No	Pay items	Unit of measurement	Activities / scope
11.1	Eradication of Redundant Pavement marking	Lump Sum	<p>This pay item shall include all costs associated with the removal and eradication of all redundant pavement marking in accordance with the traffic control plans</p> <p>Progress payments shall be made on a pro-rata basis of work performed as part of this pay item, having due regard to the duration of the Contract.</p> <p>This item shall include the eradication of all existing pavement marking necessary for the works even if the marking is not detailed on the drawings.</p>
11.2	Set Out of Pavement Marking	Lump Sum	<p>This pay item shall include all costs associated with the setting out of the work of all pavement marking in accordance with the Authorised Traffic Control Devices Plans(s)</p> <p>The contractor shall allow for the adjustment of pavement marking set out as directed by the Superintendent regardless of the extent or number of times that the set out needs to be adjusted. The contractor shall supply all temporary traffic management, paint, string lines and other devices required to set out the works to the Superintendents approval.</p>
11.3	Paint – Longitudinal Lines	per linear metre. (Discontinuous lines are measures as gross length)	<p>The pay item shall include all costs associated with the supply and application of all material, including line width, length and gaps as specified on the drawings. RRPM(s) are not included in the linear metre cost and are included at <b>Pay Item 11.10</b>. A separate pay item shall be included in the Contract for each line type.</p> <ul style="list-style-type: none"> <li>11.3.1 Barrier Line (B1)</li> <li>11.3.2 Barrier Line (BS)</li> <li>11.3.3 Barrier Line (BB)</li> <li>11.3.4 Parking Line (P1)</li> <li>11.3.5 Parking Line (P2)</li> </ul>

Item No	Pay items	Unit of measurement	Activities / scope
			11.3.6 Parking Line (P3) 11.3.7 Parking Line (P4) 11.3.8 Dividing Line (S1-24) 11.3.9 Dividing Line (S1-12) 11.3.10 Dividing Line (SLL) 11.3.11 Dividing Line (S6) 11.3.12 Edge Line (E1) 11.3.13 Edge Line (E3) 11.3.14 Lane Line (L1) 11.3.15 Lane Line (L8) 11.3.16 Path Line (SP1) 11.3.17 Path Line (SP2)
<b>11.4</b>	Paint – Symbols, Legends, Arrows, Chevrons, Traffic Islands and Kerbs	per square metre.	<p>The area of the painted surface shall be determined by direct measurement of the markings as applied. RRPM(s) are not included in the linear metre cost and are included at <b>Pay Item 11.10</b>.</p> <p>This pay item shall include all costs associated with the supply and application of all material.</p> <p>A separate pay item shall be included in the Contract for each marking type.</p> 11.4.1 White Gore (E6) 11.4.2 Chevron 11.4.3 Coloured Surface Coating per approved marking. 11.4.4 Access Symbol Pavement Marking 11.4.5 Bicycle Pavement Marking (Cycle, 1.8m x 1.1m) 11.4.6 Bicycle Pavement Marking (Cyclist, 1.3m x 1.0m) 11.4.7 Bicycle Pavement Marking (Cyclist, 1.0m x 0.85m) 11.4.8 Pedestrian Pavement Marking (Walker 1.5m x 0.6m) 11.4.9 Pedestrian Pavement Marking (Walker 1.0m x 0.6m) 11.4.10 Arrow Path Marking 11.4.11 Pavement Arrow (A10) 11.4.12 Sharrow Pavement Marking (Large, 1.0m x 1.0m) 11.4.13 Sharrow Pavement Marking (Multi and 2 arrows) 11.4.14 Equestrian Symbol Path Marking 11.4.15 Lettering “LANE” 11.4.16 Lettering “END” 11.4.17 Lettering “ONLY” path 11.4.18 Lettering “AHEAD” path 11.4.19 Slow Approach Path Patches(Series of 3)

Item No	Pay items	Unit of measurement	Activities / scope
11.5	Paint - Transverse Lines	per linear metre.	<p>The pay item shall include all costs associated with the supply and application of all material, including line width, length and gaps as specified on the drawings.</p> <p>A separate pay item shall be included in the Contract for each line type.</p> <ul style="list-style-type: none"> <li>11.5.1 Controlled Intersection (TB2)</li> <li>11.5.2 Give Way Line (TB3)</li> <li>11.5.3 Stop Line (SC2)</li> </ul>
11.6	Paint - Long Life Material (LLM) - Longitudinal Lines	per linear metre. (Discontinuous lines are measured as gross length)	<p>This pay item shall include all costs associated with the supply and application of all material and tack coating where necessary as specified on the drawings. RRPM(s) are not included in the linear metre cost and are included at <b>Pay Item 11.10</b>.</p> <p>A separate pay item shall be included in the Contract for each line type.</p> <ul style="list-style-type: none"> <li>11.6.1 Barrier Line (B1)</li> <li>11.6.2 Barrier Line (BS)</li> <li>11.6.3 Barrier Line (BB)</li> <li>11.6.4 Parking Line (P3)</li> <li>11.6.5 Merge Line (M1)</li> <li>11.6.6 Merge Line (M2)</li> <li>11.6.7 Edgeline (E1)</li> <li>11.6.8 Edgeline (E3)</li> <li>11.6.9 Lane Line (L4)</li> <li>11.6.10 Lane Line (L9)</li> <li>11.6.11 Turn Line (T1)</li> <li>11.6.12 Barrier Line (B2T)</li> </ul>
11.7	Long Life Material (LLM) - Transverse Lines	per linear metre.	<p>This pay item shall include all costs associated with the supply and application of all materials and tack coating where necessary.</p> <p>A separate pay item shall be included in the Contract for each marking type.</p> <ul style="list-style-type: none"> <li>11.7.1 Turn Line (T1)</li> <li>11.7.2 Give Way Line (TB)</li> <li>11.7.3 Short Taper (TB1)</li> <li>11.7.4 Stop Line (SL1)</li> <li>11.7.5 Stop Line (TF)</li> <li>11.7.6 Pedestrian Crosswalk Line (PCW)</li> <li>11.7.7 Transverse Bicycle Crossing (TBC)</li> <li>11.7.8 Road Hump Marking (RHM)</li> </ul> <p>Road Hump Markings are measured transversely inclusive of keys.</p>

Item No	Pay items	Unit of measurement	Activities / scope
<b>11.8</b>	Long Life Material (LLM) - Symbols, Legends and Arrows	per approved marking.	<p>This pay item shall include all costs associated with the supply and application of all materials and tack coating where necessary.</p> <p>A separate pay item shall be included in the Contract for each marking type.</p> <ul style="list-style-type: none"> <li>11.8.1 Pavement Arrow (A1)</li> <li>11.8.2 Pavement Arrow (A2)</li> <li>11.8.3 Pavement Arrow (A3)</li> <li>11.8.4 Pavement Arrow (A4)</li> <li>11.8.5 Pavement Arrow (A5)</li> <li>11.8.6 Pavement Arrow (A6)</li> <li>11.8.7 Pavement Arrow (A7)</li> <li>11.8.8 Pavement Arrow (A8)</li> <li>11.8.9 Pavement Arrow (A9)</li> <li>11.8.10 Pavement Arrow (A10)</li> <li>11.8.11 Arrow Path Marking</li> <li>11.8.12 Sharrow Pavement Marking (Large, 1.0m x 1.0m)</li> <li>11.8.13 Sharrow Pavement Marking (Multi and 2 arrows)</li> <li>11.8.14 Lettering "FORM ONE LANE"</li> <li>11.8.15 Lettering "ONLY"</li> <li>11.8.16 Lettering "KEEP CLEAR"</li> <li>11.8.17 Lettering "BUS STOP"</li> <li>11.8.18 Lettering "TAXI ONLY"</li> <li>11.8.19 Lettering "MOTORCYCLE PARKING"</li> <li>11.8.20 Lettering "LOADING ZONE"</li> <li>11.8.21 Lettering "LANE"</li> <li>11.8.22 Lettering "END"</li> <li>11.8.23 Lettering "AHEAD"</li> <li>11.8.24 Lettering "GIVE WAY AHEAD"</li> <li>11.8.25 Bicycle Pavement Marking (Cycle, 1.8m x 1.1m)</li> <li>11.8.26 Bicycle Pavement Marking (Cyclist, 1.3m x 1.0m)</li> <li>11.8.27 Bicycle Pavement Marking (Cyclist, 1.0m x 0.85m)</li> <li>11.8.28 Pedestrian Pavement Marking (Walker 1.5m x 0.6m)</li> <li>11.8.29 Pedestrian Pavement Marking (Walker 1.0m x 0.6m)</li> <li>11.8.30 Equestrian Symbol Road Marking</li> <li>11.8.31 Slow Approach Road Patches (Series of 3)</li> <li>11.8.32 "ON-STREET" Street Without Paths Pavement Patch</li> </ul>
<b>11.9</b>	Long Life Material (LLM) - Symbols, Legends and Arrows	per square metre.	<p>This pay item shall include all costs associated with the supply and application of all materials and tack coating where necessary.</p> <p>A separate pay item shall be included in the Contract for each marking type.</p> <ul style="list-style-type: none"> <li>11.9.1 Coloured Surface Coating</li> <li>11.9.2 Zebra Crossing (PX)</li> <li>11.9.3 Rumble Strip (RS)</li> </ul>

Item No	Pay items	Unit of measurement	Activities / scope
<b>11.10</b>	Installation of Retroreflective Raised Pavement Markers (RRPM)	per retroreflective raised pavement marker.	<p>This pay item shall be inclusive of the cost of surface preparation and all costs associated with the supply and installation of the uni-directional or bidirectional marker regardless of colour.</p> <p>A separate pay item shall be included in the Contract for each retroreflective raised pavement marker type.</p> <p>11.10.1 RRPM</p> <p>11.10.2 RRPM solar</p>
<b>11.11</b>	Friction Testing	Provisional Sum item	<p>This pay item shall be inclusive of all costs associated with skid resistance testing. The contractor shall supply all temporary traffic management and other devices required to the Superintendents approval.</p> <ul style="list-style-type: none"> <li>&gt; The frequency of testing for transverse marking will be specified by the Authorised Person (generally 1 test per 15m<sup>2</sup>).</li> <li>&gt; The frequency of testing for coloured surface coatings will be specified by the Authorised Person (generally 2 tests per 50m<sup>2</sup>).</li> </ul>



Transport Canberra and  
City Services

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