
SECTION 722 - PAVEMENT MARKINGS – NEW SURFACINGS

- PART 722.A - GENERAL
- PART 722.B - RAISED PAVEMENT MARKERS
- PART 722.C - PAINTED PAVEMENT MARKINGS
- PART 722.D - LONGLIFE PAVEMENT MARKINGS

PART 722.A - GENERAL

722.A01 GENERAL

This section covers the requirements for materials and application of pavement markings including:

- (a) fixing of both reflective and non-reflective raised pavement markers to asphalt or sealed pavements using epoxy adhesive or hot melt bitumen adhesive;
- (b) supply and application of pavement marking paint and glass beads for new installation of longitudinal lines, intersection markings and other markings on the road surface;
- (c) supply and application of thermoplastic or cold-applied plastic material and glass beads, and pliant polymer tape for new installations of pavement markings.

722.A02 STANDARDS

The dimensions of the pavement markings shall conform to the following standards:

- (a) VicRoads' Traffic Engineering Manual, Volume 2;
- (b) the linemarking drawings included in Section IV.

722.A03 DEFINITIONS

Pavement Marking:

The term used to define all linemarking, roadmarking and raised pavement markers.

Linemarking:

The term used to define all longitudinal lines such as centre, lane, edge, turn and continuity lines.

Roadmarking:

The term used to define all transverse lines and markings applied by hand such as Stop/Give Way lines, pedestrian lines, arrows, and legends.

Raised Pavement Marker:

A device placed on a pavement which may be a:

Non Reflective Marker:

A device to provide a degree of delineation during daylight owing to the contrasting colour, reflection and profile with respect to the pavement surface. Also a device which reflects ambient light during the day-time and to a limited degree when illuminated at night.

Reflective Marker:

A device which produces an effective point source of light at normal highway viewing distances by reflecting incident light in directions close to the direction from which it came. Also a device to provide a degree of delineation during daylight owing to the contrasting colour, reflection and profile with respect to the pavement surface.

Temporary Reflective Marker:

A device performing the same function as a Reflective Marker but with an intended life of not more than 2 weeks under average traffic conditions.

722.A04 MATERIALS

Pavement marking materials shall conform to the following standards:

(a) Raised Pavement Markers

- (i) Raised pavement markers shall comply with the relevant requirements of AS 1906, Part 3.
- (ii) All raised non-reflective pavement markers shall be of the ultra hard plastic type unless otherwise specified or approved by the Superintendent.
- (iii) Temporary raised reflective pavement markers shall be at least 100 mm in width and to a height of 50 mm with reflective material on both sides and include protective covers for the reflective material.

(b) Adhesive

Epoxy adhesive shall be Standard Set or Rapid Set adhesive complying with the relevant requirements of AS 3554.

Hot melt bitumen adhesive shall comply with Section 853 - Hot Melt Bitumen Adhesive for Raised Pavement Marker Installation.

(c) Linemarking and Roadmarking Paint

Unless otherwise approved by the Superintendent, solvent-borne chlorinated rubber paint may only be substituted for water-borne for initial applications on new surfaces. All paints shall be approved under the Australian Paint Approval Scheme (APAS).

Also, for initial marking of new surfacings, paint shall comply with the requirements of AS 4049.1 for solvent-borne paint or AS/NZS 4049.3 for water-borne paint.

(d) Glass Beads

Glass beads shall be used on the markings and shall conform with the requirements for drop-on beads as described in AS/NZS 2009, except that E20 beads shall be adopted for use with 0.3 mm minimum dry film thickness linemarking applications of water-borne paint. Glass beads shall comply with size distribution requirements of Table 722.A041.

Table 722.A041 Size Distribution for Glass Beads

Sieve size µm	% Passing			% Retained
	Drop-On Glass Beads	E20 Glass Beads	Type 3 Glass Beads	Intermix Glass Beads
2.36				
2.0				
1.7			100	
1.4		100	95 - 100	
1.18		95 - 100	80 - 95	0 – 3
1.0		80 - 95	10 - 40	
0.85	100	10 - 40	0 - 5	5 – 20
0.71		0 - 5	0 - 2	
0.60	90 - 100	0 - 2		
0.42	35 - 75			65 – 95
0.30	15 - 45			
0.15	0 - 5			
0.075	0 - 1			
Pan				0 – 10

The glass beads must comply with the requirements specified in AS/NZS 2009 and Australian Paint Approval Scheme (APAS) Specification 0042. The amount of heavy metals in the beads shall not be greater than that specified in APAS Specification 0042 (refer to Section 3, Table 1, and Appendix A), a copy of which can be found at the following website: <http://www.apas.gov.au/pdfs/0042.pdf>

(e) Thermoplastic Pavement Marking Material

Thermoplastic pavement marking material used under this Contract shall comply with the requirements of AS 4049.2.

Thermoplastic pavement marking material intended for use under this Contract to provide profiled edge lining shall provide a functional service life of at least 6 years. The material shall, as a minimum, comply with the requirements of AS 4049.2.

(f) Cold-applied Plastic Pavement Marking Material

Cold-applied plastic pavement marking material used under this Contract shall be a Poly Methyl Methacrylate resin based pavement marking material conforming with the colour, luminance and bead content requirements of AS 4049.2.

(g) Pliant Polymer Pavement Marking Tape

Pliant polymer pavement marking tape intended for use under this Contract shall be approved by the Superintendent.

(h) Colour

Unless otherwise specified paint and longlife material shall be white except that they shall be yellow in snow areas and as Fairway tramline markings.

722.A05 LAYOUT OF MARKINGS

Unless otherwise specified the Contractor shall be responsible for the layout of markings in accordance with the above Standards.

Spotting marks shall conform with the VicRoads Traffic Engineering Manual Volume 2.

722.A06 POSITION OF MARKINGS

New markings shall be:

- (a) applied within the tolerances listed in Clause 722.A07; and
- (b) unless otherwise specified, set out by the Contractor in conformance with the appropriate standard required by Clause 722.A02.

722.A07 TOLERANCES ON PAVEMENT MARKINGS

- (a) The Contractor shall install new painted and longlife pavement markings so that:
 - (i) the distance between the centreline of the marking and the centreline of the set out mark is less than 30 mm; and
 - (ii) the apparent line of the markings is a smooth, continuous alignment when viewed in the direction of the line; and
 - (iii) the width of completed markings is within -10 mm, +0 mm of the specified dimensions; and
 - (iv) the length of completed stripes and blocks is within +10%, -0% of the specified length; and
 - (v) the gap between double lines is within +0-10 mm of the required 100 mm gap; and
 - (vi) the paint and bead application rates are within +50%, -0% of the specified rate.
- (b) The Contractor shall affix raised pavement markers within the following limits, unless otherwise specified:
 - (i) Markers in Line with Broken Line Segments
Transverse position within 25 mm of the centreline of the segments.
Longitudinal position within 0.5 m of the specified position.
 - (ii) Markers in a Longitudinal Group
Transverse position of the centre of each marker within 25 mm of the specified position and within 10 mm of a line joining the centres of the end markers of the group.
Longitudinal position of the end markers of the group within 0.5 m of the specified position.
Spacing of markers within the group within 50 mm of the specified spacing.
 - (iii) Markers Adjacent to Unbroken Line
Clearance to edge of line within 5 mm of that specified.
Longitudinal mismatch between markers in transverse pairs at barrier line not more than 25 mm.
Longitudinal position of markers within 0.5 m or 10% of the specified spacing, whichever is the less.
 - (iv) Orientation of Reflective Markers
Lower edge of the reflective face at 85° to 95° to the centreline of the roadway or any adjacent line.

(v) Temporary Raised Reflective Pavement Markers

Temporary raised reflective pavement markers shall be placed at the following minimum spacings on all longitudinal lane lines, except that on any curve less than 500 m in radius the spacing shall not be more than 12 metre centres:

- AADT >5,000 and freeways 12 metre centres
- AADT >1,000 and <5,000 24 metre centres
- AADT <1,000 48 metre centres

(c) The Contractor shall install thermoplastic profiled edge lining within the following limits, unless otherwise specified:

(i) Tolerances on dimension

Line width	+20mm, -5mm
Line height	+2mm, -0mm
Extrusion breadth	+10mm, -0mm
Extrusion spacing	±15mm
Extrusion shape	±25mm at any point from rectangular shape.

(ii) Tolerances on position

The distance between the centreline of the marking and the centreline of the setout mark is less than 30 mm; and

the apparent line of the markings is a smooth, continuous alignment when viewed in the direction of the line; and

the length of the completed lines is within +5%, -0% of the specified length; and

the longitudinal position of individual extrusions is within ±50mm of any previously applied profiled edge lining.

722.A08 PROTECTION OF WORK

The Contractor shall be responsible for protecting the work by an appropriate means until the work can be trafficked without being picked up and/or spread by tyres of passing traffic. If pick-up does occur, the Superintendent may direct that the spread paint or longlife be removed in a manner accepted by the Superintendent at the Contractor's cost.

722.A09 RECORDS AND REPORTING

Unless otherwise specified the Contractor shall complete and forward to the Superintendent a "Retroreflectivity Report" in a form approved by the Superintendent showing the level of retroreflectivity measured for each Job Item in Schedule 1 in accordance with the requirements of Clause 722.A14. This information shall be submitted to the Superintendent within two months of completion of the final marking on a Job Item.

722.A10 LIMIT OF WORK

Unless otherwise specified the limit of pavement marking works shall be the same as the limit of the new surfacing.

722.A11 SCOPE OF WORK

Unless otherwise specified the following works shall be undertaken as part of the lump sum and in accordance with Clause 722.A12:

- (a) Prior to resurfacing - removal of raised pavement markers and placement of temporary raised reflective pavement markers as specified on sealed pavements.
- (b) Immediate placement after surfacing of temporary reflective pavement markers on asphalt pavements including removal of protective covers and immediate removal of protective covers after surfacing of sealed pavements.
- (c) Initial reinstatement of pavement markings, including reinstatement of any adjoining pavement markings blackened but not necessarily covered by the surfacing activity, comprising:
 - (i) replacement of raised pavement markers and removal of temporary raised reflective pavement markers
 - (ii) temporary replacement of covered profiled edgelines with painted edgeline
 - (iii) reinstatement of other longlife pavement markings
 - (iv) initial coat of painted pavement markings.
- (d) Second coat of painted pavement markings covered or blackened by the surfacing, including temporarily replaced profiled edgelines.
- (e) Reinstatement of profiled edgelines temporarily replaced with two coats of paint.

Unless otherwise specified pavement marking reinstatement shall be done in the same material as the pavement marking which is being resurfaced. The reinstated pavement markings shall comply with the requirements of Clauses 722.C03 and 722.D03.

722.A12 PROGRAM

Unless otherwise specified the Contractor shall undertake pavement marking works in accordance with the following requirements:

- (a) Removal of raised pavement markers and placement of temporary raised reflective pavement markers on sealed pavements not more than 24 hours prior to resurfacing. Placement of temporary reflective pavement markers shall be part of the same operation as the removal of the raised pavement markers.
- (b) The initial coat of paint, all longlife pavement markings other than profiled edgelines and non-reflective raised pavement markers on newly surfaced pavements in accordance with the following:
 - (i) AADT >5,000 and freeways : within 24 hours of opening to traffic;
 - (ii) AADT >1,000 and <5,000 : within 3 days of opening to traffic;
 - (iii) AADT <1,000 : within 5 days of opening to traffic.
- (c) The Contractor shall apply the second coat of painted pavement markings not less than 4 weeks and not more than 8 weeks after the initial paint treatment.
- (d) Raised reflective pavement markers shall be installed no later than 1 week following the completion of the initial pavement marking.
- (e) Profiled edgelines shall be reinstated no earlier than 4 weeks and no longer than 8 weeks following the application of the second coat of the painted temporary edgeline.

722.A13 ACCEPTANCE OF WORK

Pavement marking shall comply with the specified requirements as detailed in the following clauses:

- (a) 722.A04 Materials
- (b) 722.A07 Tolerances on Pavement Marking
- (c) 722.C03 Minimum Requirements Paint
- (d) 722.D03 Minimum Requirements Longlife Markings
- (e) 722.A14 Acceptance of Retroreflectivity

Where a particular item fails to satisfy any of the above requirements the Superintendent will determine:

- (a) the extent of reduced payment for out-of-tolerance markings in accordance with the provisions of Section 1000,
or
- (b) extent of remarking or other the remedial work that is required to be carried out at the Contractor's expense.

Where removal of unsuitable pavement marking is required, the method of removal shall be approved by the Superintendent.

722.A14 ACCEPTANCE OF RETROREFLECTIVITY

Acceptance of the retroreflectivity of any line or road marking will be based on the marking achieving a minimum level of reflectivity of 200 mcd/lux/m² measured during the period between 25 and 35 days after application of the second coat and prior to the installation of profiled edgelines. The Contractor shall measure the level of retroreflectivity as part of the lump sum and, unless otherwise approved by the Superintendent, the Contractor shall use the procedure set out in Attachment A to this Section 722 – Dry Minimum Retroreflectivity Sampling Procedure.

PART 722.B - RAISED PAVEMENT MARKERS

722.B01 PLACING MARKERS

Markers shall be placed in accordance with the specifications of the manufacturers of the markers and adhesives.

Adhesive on the exposed surfaces of the marker shall be removed.

Where a new or replacement marker is not positioned correctly it shall be discarded and a new marker placed.

Markers shall be protected from traffic after placing and any marker dislodged by traffic shall be removed and replaced with a new marker.

On asphalt pavements, wherever possible, markers shall be placed clear of longitudinal or transverse joints and on all pavements markers shall be placed clear of any surface cracks or positions from which markers have been removed and the surface is damaged.

722.B02 PAVEMENT DAMAGE

Any pavement damage caused by the installation or removal of raised pavement markers included in a lump sum Job Item shall be the Contractor's responsibility. Rectification of any pavement damage to line and level shall be completed on the same day in accordance with the Superintendent's requirements.

On sections of road on which the Contractor has been directed to replace or remove raised pavement markers, the Contractor shall also repair damage to the pavement caused by the loss of pavement markers unless otherwise specified.

PART 722.C - PAINTED PAVEMENT MARKINGS**722.C01 GENERAL**

Linemarking shall be applied by a self propelled machine, and stencils shall be used with all roadmarking.

Completed markings shall be uniform in appearance from all angles of observation, texture, width and thickness and the surface shall be free from streaks, overlaps, unbeaded areas, tyre marks or other defects. Edges and cut-offs should be neat and sharp, and there shall be no visible run-off, overspray, dribbles, splash or spillage on to the surrounding area, or on to parked or passing vehicles. The Contractor shall be responsible for the cost of removal of paint from such vehicles.

Glass beads shall be applied to the paint to produce a uniform properly bonded coverage over the whole painted surface. Glass beads shall be applied to all markings.

The Contractor shall be responsible for any spillage on to the surrounding area, and cost of any remedial action required.

722.C02 NEW MARKINGS

All markings are to set out be in accordance with the dimensions and spacings as required by the appropriate standard in Clause 722.A02.

HP Painting shall not commence until the Superintendent has inspected the set out and given consent to proceed, unless an exemption has been granted in writing by the Superintendent.

New markings shall receive two applications of paint as specified in Clause 722.C03. The second application shall be applied between 4 and 8 weeks after the initial application.

722.C03 MINIMUM REQUIREMENTS

The minimum requirements for paint and glass beads shall be as shown in Table 722.C031.

Table 722.C031 – Minimum Requirements – Paint and Glass Beads

	Paint Water-borne or Solvent-borne ⁽¹⁾	Glass Beads ⁽²⁾
Linemarking		
New Markings (initial application only)	0.3 mm minimum dry film thickness	Drop-on
Remarking (including second application on new markings)		
M, A and B Roads	0.3 mm minimum dry film thickness	E20
C Roads	0.2 mm minimum dry film thickness	Drop-on
Roads without MABC classification		
Roadmarking		
All Marking	0.3 mm minimum dry film thickness	Drop-on
⁽¹⁾ The minimum dry paint film thickness specified above shall be the end product thickness measured on a 200 mm x 100 mm sheet metal test plate without beads.		
⁽²⁾ A minimum of 250 g/m ² shall be retained in the painted marking for each application.		

PART 722.D - LONGLIFE PAVEMENT MARKINGS**722.D01 GENERAL**

Longlife pavement marking materials shall be prepared and used in accordance with the manufacturer's specification.

All linemarking shall be applied using a self-propelled ride-on machine except Statcon centre-lines or unless otherwise specified or approved by the Superintendent.

Glass beads shall be applied to all plastic markings. Glass beads shall be sprinkled or sprayed on to the plastic material while it is in a fluid state immediately after it has been applied to the pavement. The surface beads shall be distributed to give a uniform coverage over the whole surface of the plastic material.

Completed markings shall be uniform in appearance, texture, width and thickness and the surface shall be free from blisters, air bubbles, tears, lumps, streaks, overlaps, unbeaded areas, tyre marks or other defects. Edges and cut-offs shall be neat and sharp, and there shall be no visible run-off, overspray, dribbles, splash or spillage on to the surrounding area, or on to parked or passing vehicles. The Contractor shall be responsible for the cost of removal of pavement marking material from such vehicles.

722.D02 NEW MARKINGS

All markings are to set out in accordance with the dimensions and spacings as required by the appropriate standard in Clause 722.A02.

HP Application of material shall not commence until the Superintendent has inspected the set out and given consent to proceed, unless an exemption has been granted in writing by the Superintendent.

722.D03 MINIMUM REQUIREMENTS

The minimum requirements of longlife materials and glass beads shall be as shown in Table 722.D031. The Contractor shall allow for any extra material required when placing on coarse chip seals.

Table 722.D031 – Minimum Requirements – Longlife and Glass Beads

Material	Applied Minimum Thickness, Glass Bead and Other Requirements
Thermoplastic	
sprayed markings	2.0 mm minimum thickness with a minimum of 250 g/m ² of drop-on glass beads retained on the marking surface
extruded line markings	2.0 mm minimum thickness on longitudinal lines with intermix beads intermixed and a minimum of 250 g/m ² of drop-on glass beads retained on the marking surface
extruded road markings ⁽¹⁾	3.0 mm minimum thickness on intersections with intermix beads intermixed and a minimum of 250 g/m ² of drop-on glass beads retained on the marking surface
preformed markings	2.3 mm with a minimum skidding resistance value of 45 BPN (British Pendulum Number)
profiled edge lining ⁽¹⁾	8.0 mm minimum thickness with a minimum of 250 g/m ² of drop-on glass beads retained on the marking surface

Table 722.D031 continued on next page

Table 722.D031 (continued)

Material	Applied Minimum Thickness, Glass Bead and Other Requirements
Cold-applied Plastic	
sprayed line markings ⁽²⁾	1.0 mm minimum thickness for longitudinal line markings only with a minimum of 250 g/m ² of E20 glass beads retained in and on the marking surface
sprayed road markings ⁽²⁾	2.0 mm minimum thickness for all roadmarkings with intermix beads intermixed and a minimum of 250 g/m ² of drop-on glass beads retained on the marking surface
trowelled, screeded, or extruded markings ⁽¹⁾	2.0 mm minimum thickness with intermix beads intermixed and a minimum of 250 g/m ² drop-on glass beads retained on the marking surface
Pliant Polymer Tape	as supplied
⁽¹⁾ The minimum thickness specified shall be the height above the upper road surface level including glass beads. ⁽²⁾ The minimum thickness specified shall be the height of the cold-applied plastic material between the glass beads on a metal test plate. ⁽³⁾ All other thicknesses shall be as measured on a metal test plate including glass beads.	

722.D04 SPECIAL REQUIREMENTS FOR PROFILED EDGE LINING

The Contractor shall carry out remedial work to rectify defective sections of profiled edge linings where:

- (a) profiled edge linings were not installed to specified dimensions, or distorted in shape or lost shape due to wear, such that the height of individual extrusions is less than 8 mm above the top of adjacent road surface aggregate particles, over more than 10% of the profiled edge lining job item, or
- (b) profiled edge linings have shattered or no longer adhere to the road surface over more than 1% of the profiled edge lining job item, or
- (c) profiled edge linings have shattered or no longer adhere to the road surface over a continuous length exceeding 5 metres.

DRY MINIMUM RETROFLECTIVITY SAMPLING PROCEDURE**1. Lot Selection and Sampling Points****(a) Intersections (Signalised)**

The Contractor shall provide a listing of signalised intersections for each road section for testing. The superintendent shall select two intersections for the Contractor to test. These intersections shall represent a lot made up of a maximum of ten intersections per road section that have been remarked within 30 days of each other.

All Other Road Markings (excluding keep clears, yellow hatching and yellow pedestrian walkways).

The Contractor shall test 20% of all other individual road markings for each road section that have been remarked within 30 days of each other.

Each keep clear shall have readings taken between 30 and 35 days over 20% of the maintained/installed area.

Each yellow hatching shall have readings taken between 30 and 35 days over 20% of the maintained / installed area.

Each yellow pedestrian walkway shall have readings taken between 30 and 35 days over 20% of the maintained / installed area.

(b) Longitudinal Linemarking

The Contractor shall provide the superintendent with readings from sampling points that have been remarked within 30 days of each other as follows:

Painted or longlife sections of carriageway comprising the following distances:

METROPOLITAN REGIONS

0 – 2 km – 2 readings

Each additional 2 km or part thereof – 2 readings --- Inner Metropolitan Area

Each additional 5 km or part thereof – 2 readings --- Outer Metropolitan Area

RURAL REGIONS

0 – 2 km – 2 readings

Each additional 2 km or part thereof – 2 readings --- Built Up Areas Major Rural Towns

Each additional 10 km or part thereof – 2 readings

2. Number of Measurements Per Sampling Point**(a) Intersections (Signalised)**

Six readings shall be taken on each approach. At least 2 readings shall be in the wheel path on the stop bar or pedestrian walk lines, at least 2 readings shall be on the edge/lane lines and 2 readings on lane arrows if applicable. These 6 readings shall be averaged and that shall be the representative value for that approach. Results are to be submitted for all intersection approaches.

All Other Road Markings (excluding keep clears, yellow hatching and yellow pedestrian walkways)

Statcon Markings: At least 4 readings shall be taken in the wheel path on the stop bar or give way bar and 2 readings on the centre line, at least 4 readings in the wheel path on statcon holding bars.

Arrows: At least 3 readings shall be taken on each arrow (one reading on wheel path on arrow head).

Other Markings: The Contractor shall test 20% of all other individual road markings for each road section that have been remarked within 30 days of each other.

The readings for each marking shall be averaged and that shall be the representative value for that marking.

The values for each marking shall be averaged and that shall be the representative value for the maintained / installed works.

(b) Longitudinal Linemarking

For single carriageways: Three readings shall be taken in the direction of travel at each sampling point on edge lines, these readings shall be averaged and the value shall be the representative value for the edge line. Three readings shall be taken on centre/lane lines in both directions of travel at each sampling point, the readings in each direction of travel shall be averaged and the lower directional value shall be the representative value for the line.

For dual carriageways: Three readings shall be taken in the direction of travel on edge lines and centre / lane lines at each sampling point, the readings for each line shall be averaged and the value shall be the representative value for the line. Where the dual carriageway is divided by a solid centre line or double barrier line, three readings shall be taken in both directions of travel at each sampling point, the readings in each direction of travel shall be averaged and the lower directional value shall be the representative value for the line.

Line Averages: Each line is to have an averaged reflectivity reading.

Sampling Point: Cross section of roadway up to 10 metres in length of which all lines on cross section are to have readings taken. The sampling point shall be marked and numbered in yellow paint adjacent to an edge or centre line.

The Retroreflectometer and Calibration, shall be of a type approved by the Superintendent.

The sample point spread sheet, shall be of a type approved by the Superintendent.