

SPECIFICATION 604

PAVEMENT MARKING

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SPECIFICATION 604

PAVEMENT MARKING

REVISION REGISTER

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SPECIFICATION 604

PAVEMENT MARKING

GENERAL

604.01 SCOPE

1. The work under this specification provides the minimum requirements for the supply, installation and maintenance of road pavement markings and raised pavement markers.

604.02 REFERENCES

1. Australian Standards, MAIN ROADS Western Australia Standards and MAIN ROADS Western Australia Test Methods are referred to in abbreviated form (e.g. AS 1234, MRS 67-08-43 or WA 123). For convenience, the full titles are given below:

Australian Standards

AS 1742	Manual of Uniform Traffic Control Devices.
AS 1906.3	Retro-reflective Materials and Devices for Road Traffic Control Purposes – Raised Pavement Markers (Retro-reflective and Non-Retro-reflective).
AS 2009	Glass Beads for Pavement Marking Materials.
AS 2341	Methods of Testing Bitumen and Related Road-making Products
AS 2700	Colour Standard for General Purpose
AS 3554	Adhesives – Epoxy – For Raised Pavement Market Installation.
AS 4049.1	Paints and Related Materials – Road Marking Materials Pt 1 – Solvent-Borne Paint – For Use with Drop-On Beads.
AS 4049.2	Paints and Related Materials – Road Marking Materials Pt 2 – Thermoplastic Road Marking Materials.

Other Standards

Australian Paint Approval Scheme Specification, Government Paint Committee – P-41/5

American Society for Testing and Materials

ASTM C430	Fineness of Hydraulic Cement
ASTM D5	Penetration of Bituminous Materials
ASTM D36	Softening Point of Bitumen
ASTM D92	Flash & Fire Points by Cleveland Open Cup
ASTM D2171	Viscosity of Asphalts by Vacuum Capillary Viscometer

- ASTM D2669 Apparent Viscosity of Petroleum Waxes Compounded with Additives (Hot Melt)
- ASTM D3407 Joint Sealants, Hot Poured for Concrete & Asphalt Pavements

MAIN ROADS Standards

- 67-08-40 Survey & Mapping Standard
- 71-06-1398 Heavy Metal Concentration of Glass Beads

MAIN ROADS Test Methods

- WA 841.1 Luminance of Pavement Markings

MAIN ROADS Specifications

Specification 201 QUALITY SYSTEMS

604.03 – 604.05 NOT USED

PRODUCTS AND MATERIALS

604.06 PERMANENT ROAD PAVEMENT MARKINGS

604.06.01 GENERAL

1. Road pavement marking shall consist of:
 - a) painting longitudinal road markings using white and/or yellow road marking paint. ***Painting***
 - b) the installation of longitudinal lines, transverse lines and other markings (ie; holding lines, turn arrows, chevron pavement markings), using a long life thermoplastic or cold applied plastic material. ***Thermo-plastic***
 - c) the installation of Raised Retro-reflective Pavement Markers. ***Pavement Markers***
2. The installation of longitudinal road markings and the installation of transverse lines and other markings, shall include the application of drop-on glass beads to the wet paint, thermoplastic or cold applied plastic, to provide night time retroreflectivity, unless otherwise specified in the Contract. ***Glass Beads***
3. The work shall also include spotting or setting out the alignment of the lines and markings to ensure that all road markings are applied to the road surface at their correct locations. ***Setting Out***

604.06.02 SUPPLY OF MATERIALS

1. All materials required to complete the works shall be supplied and delivered by the Contractor.

604.07 LONGITUDINAL ROAD MARKING PAINT TECHNICAL SPECIFICATION

604.07.01 GENERAL

1. Water borne road marking paint shall be used for all longitudinal road marking and shall be an APAS approved product which complies with APAS Specification GPC-P-41/5. **Water Borne Paint**
2. Solvent based paint shall not be used for longitudinal road marking without the prior approval of Main Roads. Where approved and specified, it shall be in accordance with AS 4049.1. **Solvent Based Paint**
3. The paint shall be lead free. **Lead Free**
4. The paint shall be suitable for application by air assisted and airless road pavement line marking machines without the addition of thinning liquids. **Suitability**
5. The paint shall be suitable for application to both unpainted and previously painted road surfaces consisting of aggregate chip seals and bituminous concrete (asphalt).
6. The paint shall be suitable for the receipt of reflective glass beads immediately after application to the road surface and shall be capable of retaining the glass beads under traffic.
7. The Contractor shall be responsible for the legal disposal of empty paint containers. The Contractor should note that some Local Government rubbish tips may not accept empty paint containers and other arrangements shall be made for disposal. **Disposal of Containers**

604.08 THERMOPLASTIC TECHNICAL SPECIFICATION

604.08.01 GENERAL

1. Thermoplastic road marking material shall consist of aggregate, pigment, binder, glass beads and extenders, capable of being softened by heating and hardened by cooling. **Constituents**
2. Thermoplastic road marking material shall comply with AS 4049.2.
3. Thermoplastic used for audio tactile pavement markings shall comply with AS 4049.2 but modified as follows **Audio Tactile Markings**
 - a) Softening Point: When determined in accordance with AS 2341.18, the softening point shall be not less than 95°C.
 - b) Cold Flow: When determined in accordance with AS 4049.2, Appendix J the cold flow shall be no more than 5% at 40°C.
 - c) Skid Resistance: When tested in accordance with AS 4049.2 Appendices L and M at any time up to 3,000,000 vehicle passes the skid resistance value of beaded unprofiled base material shall be not less than 50.

- d) Retro-reflectivity: When tested in accordance with AS 4049.2 Appendices L and N at any time up to 3,000,000 vehicle passes the retroreflectivity of a beaded line of the unprofiled base material shall be greater than 100mcd/lux/m².

604.09 COLD APPLIED PLASTIC TECHNICAL SPECIFICATION

604.09.01 ROAD MARKING MATERIAL

1. Cold applied plastic road marking material shall be a road marking material conforming with the following requirements of AS 4049.2 :

- a) Clause 5.1 - Colour,
- b) Clause 5.2 - Luminance and
- c) Clause 7 - Field Testing.

604.09.02 NO-PICK-UP TIME

1. The material shall have a maximum no-pick-up time of 60 minutes.

604.10 GLASS BEADS TECHNICAL SPECIFICATION

1. Glass beads including intermix and larger sized beads shall conform to the requirements of AS 2009 and Main Roads Standard 71-06-1398.

604.11 TEMPORARY ROAD MARKING TAPE

1. Temporary Retro-reflective Road Marking Tape shall be either 3M Scotchlane Detour grade or Visatech or a similar strippable type approved by the Superintendent

604.12 RAISED PAVEMENT MARKERS TECHNICAL SPECIFICATION

604.12.01 RAISED PAVEMENT MARKERS

1. Retro-flective raised pavement markers shall comply with AS 1906.3.

Retro-reflective Markers

604.12.02 ADHESIVE FOR RAISED PAVEMENT MARKERS

1. Hot Melt Adhesive

- a) The properties of hot melt adhesive and its constituent components shall be in accordance with Table 604B1 in Annexure 604B.

Properties

- b) Prior to application hot melt adhesive shall be heated to, and maintained at a temperature within the range of 205°C – 215°C. Hot melt adhesive heated above 215°C shall be rejected and replaced at the Contractors expense. **Temperature**
2. Epoxy Adhesive
- a) Epoxy adhesive shall be in accordance with AS 3554, with the exception of the failure stress quoted for wet hardened concrete in Table 4, Section 6 of the standard.

604.12.03 COMPONENT PROPERTIES

1. The asphalt properties of Filler Free Material and Filler Properties shall be in accordance with Table 604B2 and Table 604B3 respectively in Annexure 604B.

604.12.04 TEMPORARY PAVEMENT MARKERS

1. Temporary pavement markers shall be either Swarovski Mini – star art.3091/22/001, or Road Marking Supplies Standup Temporary Raised Pavement Marker, Stimsonite Temporary Chip-seal, or similar as approved by the Superintendent.

604.13 – 604.29 NOT USED

APPLICATION

604.30 PAVEMENT MARKING APPLICATION

604.30.1 GENERAL

1. The Contractor shall be responsible for any costs for damage to property, equipment or the road surface caused by the work including any costs associated with the repair of vehicles damaged as a result of driving on or close to newly applied road markings at no cost to the Principal. **Contractors Responsibility**
2. Road marking materials shall not be applied during wet weather, or when the road pavement is wet or when adverse weather conditions may prevail during the work. **Adverse Weather**
3. The road surface shall be dry and air blasted prior to application of road marking material. **Surface Dry**
4. Foreign material such as parts of tyres, rubbish and animal carcasses unable to be removed by air blasting shall also be removed from the road surface prior to application of road markings. **Clean Surface**
5. The Contractor shall take all necessary precautions to protect newly applied road markings until such time as the road markings are able to resist damage from traffic. Any road marking damaged by traffic prior to drying or setting, shall be rectified by the Contractor at no cost to the Principal. **Remedial Works**

6. Where an error occurs in the placement of any road marking, the error shall be corrected by the Contractor at no cost to the Principal. **Errors**

604.31 LONGITUDINAL PERMANENT LINE MARKING

604.31.01 GENERAL

1. Longitudinal line marking consists of applying paint or thermoplastic longitudinal road markings on roads using white and yellow road marking paint including the application of drop-on glass beads to the wet paint or thermoplastic to provide night time retroreflectivity.

604.31.02 SPOTTING & SETTING OUT

1 Longitudinal line marking shall be set out in accordance with AS 1742, Main Roads Standard Drawings as listed in Annexure 604C and the Contract drawings. **Setting Out**

2. All spotting shall be undertaken in accordance with Main Roads' Survey & Mapping Standard 67-08-40, titled "Spotting In Preparation For Longitudinal Line Marking Of Roads". Overtaking barriers shall be set out in accordance with AS 1742. **Spotting & Overtaking Barriers**

604.31.03 EQUIPMENT FOR LONGITUDINAL LINE MARKING

1. Longitudinal line marking machinery shall be capable of preparing the road surface, applying the road marking paint or thermoplastic to achieve the required dry film thickness and applying the drop-on glass beads in accordance with the requirements of this specification. **Machinery**

2. Longitudinal line marking machinery shall be fitted with automatic pattern control, and shall be capable of applying lines up to and adjacent to traffic islands and kerbing and of marking a set of two lines forming a one-way or two-way barrier line concurrently. **Automatic Pattern Control**

3. All road marking vehicles shall have been tested and calibrated to achieve the required rates of application of road marking materials. **Tested & Calibrated**

604.31.04 DANGEROUS GOODS APPROVED VEHICLES

1. The Contractor shall obtain any required Western Australian Dangerous Goods approvals for its equipment prior to commencing work. **Approvals**

604.31.05 STORAGE FACILITIES

1. The Contractor shall obtain appropriate Western Australian Dangerous Goods approvals, where necessary, for the proposed storage facilities for all road marking materials. **Dangerous Goods Approvals**

604.31.06 LONGITUDINAL ROAD MARKING PATTERN AND LOCATION

1. The longitudinal road marking pattern types and their locations shall be as shown in the drawings. Longitudinal line markings shall be set out in accordance with AS 1742 and the contract drawings. Main Roads longitudinal line types and dimensions are as shown in Drawing 9931-0198.

Patterns, & Locations

604.31.07 LOCATION AND PATTERN TOLERANCES

1. The following tolerances shall be used for painting new road markings:

Tolerances

- | | |
|---|-----------------|
| a) Maximum deviation from straightness | 5mm in 2000mm |
| b) Maximum deviation from correct alignment or position | ± 15mm |
| c) Width of road marking | - 0mm
+ 10mm |
| d) Longitudinal start painting position | ± 100mm |
| e) Length of marking segment | ± 100mm |
| f) Spacing between marking segments | ± 100mm |
| g) Double line gap | - 0mm
+ 10mm |

604.31.08 APPLICATION OF ROAD MARKING PAINT

1. The paint shall be uniformly applied to achieve the minimum dry film thickness as specified in the Contract and as shown in the table at Annexure 604C.

Paint Thickness

2. All edges of the painted line shall be clean sharp cut, free of dusting or splattering. Dusting is the when the paint vaporises before it reaches the road and forms a cloud of paint and splattering is when the paint bounces off the road surface as droplets.

Paint Edges

604.31.09 APPLICATION OF THERMOPLASTIC

Thermo-plastic

1. Thermoplastic shall be applied in accordance with AS 4049.2 and the manufacturer's instructions and to the dimensions and thickness as shown in Drawings 201131-0039 and 201131-0040.

604.31.10 GLASS BEADS

1. Drop-on glass beads shall be applied to the surface of the road marking paint as shown in the table at Annexure 604C. **Application Rate for Paint**
2. Drop on glass beads shall be applied to all thermoplastic and cold applied plastic pavement markings at the rate of 300gms/m² **Application Rate for Thermo-plastic**
3. The drop-on glass beads shall be applied immediately after the application of the paint using suitable equipment to ensure that the beads are adequately absorbed, and spread evenly across the painted surface. **Timing**

604.32 TRANSVERSE LINES & OTHER PAVEMENT MARKINGS

604.32.01 GENERAL

1. Holding lines, turn arrows, chevron road markings and others shall be applied using long-life thermoplastic road marking material, or cold applied plastic material. The material shall be applied in accordance with the manufacturer's specifications. **Types**
2. For markings where a long life material is not required, the markings shall be applied using road marking paint in accordance with Clause 604.32.

604.32.02 SETTING OUT

1. Road markings shall be set out in accordance with AS 1742, Main Roads Standard Drawings listed at Annexure 604 D and the Contract Drawings.
2. Setting out for reinstatement of obliterated markings shall be transitioned to tie-in to existing markings without abrupt changes in direction.

604.32.04 GLASS BEADS

1. Drop-on glass beads shall be applied to all Thermoplastic and Cold Applied Plastic pavement markings at the rate of 300gms/m². **Glass Beads**

604.32.05 THERMOPLASTIC

1. Thermoplastic shall be applied in accordance with AS 4049.2 and the manufacturer's specification. **Thermo-plastic**
2. The applied dry film thickness of thermoplastic laid by spray, screed or extrusion shall be 2.5mm ± 0.5mm. **Application Thickness**

604.32.06 COLD APPLIED PLASTIC

1. Cold applied plastic shall be applied in accordance with the manufacturer's specifications.

**Cold
Applied
Plastic
Application
Thickness**

2. The applied dry film thickness of cold plastic laid by trowelling, screeding or extruding shall be 2.5mm ± 0.5mm.

604.32.07 TEMPORARY ROAD MARKING TAPE

1. Temporary road marking tape shall be applied in accordance with the manufacturer's specifications, including specifications for surface preparation.

**Road
Marking
Tape**

604.32.08 STENCILS

1. The Contractor shall supply and maintain all templates and stencils required to complete the works.

Stencils

Tolerances

604.32.09 TOLERANCES

1. The following tolerances shall apply to the application of road marking materials:

- a) length and spacing of holding lines, arrows, numerals and letters ± 10mm
- b) width and positioning of holding lines, arrows, numerals and letters ± 5mm
- c) length and spacing of longitudinal lines ± 50mm
- d) width and positioning of longitudinal lines ± 5mm
- e) spacing between marking segments ± 50mm
- f) double line gap - 0mm
+ 10mm

2. Markings not meeting the above tolerances shall be rectified at no cost to the Principal.

**Raised
Pavement
Markers**

604.33 RAISED PAVEMENT MARKERS

604.33.01 INSTALLATION

1. Adhesive shall be applied to the sealed surface such that the thickness of the applied adhesive is within + 3mm and + 7mm of the sealed road surface level. Raised pavement markers shall be fixed to the adhesive within five (5) seconds of the adhesive being applied.

Adhesive

2. The lateral spread of adhesive after a raised pavement marker is fixed shall be within + 10mm and + 20mm of the outside extremities of the base of the marker. Raised pavement markers shall be aligned such that the retroreflective surfaces of the marker are angled between 85° to 95° to the direction of oncoming traffic.

**Spread of
Adhesive**

3. The type, colour, spacing and location of markers shall be as stated below and in accordance with the drawings and as shown in the drawings as listed in Annexure 604D. **Type, Colour, Spacing**

- a) single sided white on lane lines
- b) single sided red on left edge line
- c) single sided yellow on right edge line
- d) double sided yellow on barrier lines

4. The lateral divergence of raised pavement markers shall be within ± 5 mm. The longitudinal spacing of raised pavement markers shall be within ± 150 mm. **Lateral Divergence**

5. Excess materials shall be disposed of at an authorised disposal site.

604.33.02 REMOVAL

1. Where required, raised pavement markers shall be removed by breaking the bond between the adhesive, the road surface and the base of the raised pavement marker. **Breaking Bond**

2. Excess materials shall be disposed of at an authorised disposal site.

604.33.03 EQUIPMENT FOR DISPENSING OF HOT MELT ADHESIVE

1. Equipment to heat and dispense hot melt adhesive shall be fitted with a thermostatic temperature control device capable of maintaining the hot melt adhesive between the temperature range of 205°C – 215°C. **Temperature Control**

604.34 REPAIR TO ROAD SURFACE

Repairs to Road Surface

604.34.01 GENERAL

1. Where damage to the road surface occurs during the raised pavement marker removal process the resulting divot shall be repaired by the Contractor at no cost to the Principal. **Damage**

2. All divots caused by the removal of the raised pavement markers on aggregate seal surfaces or greater than 10mm deep on asphalt surfaces, and no larger than the area of the raised pavement marker itself, shall be filled with either hot melt adhesive or epoxy adhesive to the level of the surrounding pavement to a tolerance of ± 3 mm. Divots shall only be filled when the surface of the divot is clean and completely dry. Air blasting equipment shall be used to clean every deep divot.

3. Any divots of greater size or depth than in clause 604.34.01.2 above, or where any disturbance of the pavement basecourse occurs, shall be repaired as for potholes.

604.35 TEMPORARY PAVEMENT MARKERS

Temporary Pavement Markers

604.35.01 GENERAL

1. To assist the management of traffic, temporary pavement markers shall be installed on all areas of cold planed, asphalt or spray seal surfaced prior to the areas being temporarily opened to traffic.
2. Temporary raised pavement markers shall be regarded as incidental to the control of traffic, and shall be removed and replaced with permanent markers as soon as the final road surface is completed and ready to receive the permanent markers. Where temporary markers are used to delineate traffic lanes and directions pending installation of permanent markings, they should be offset from the final alignment sufficiently to allow permanent markings to be installed without hindrance prior to the removal of the temporary markers.
3. Temporary markers shall be placed at 12m centres and in accordance with the colours as specified at Clause 604.33.01.
4. Temporary pavement markers shall be aligned such that the retroreflective surfaces of the marker are angled between 85 to 95 degrees to the direction of oncoming traffic.
5. Subject to Clause 604.35.01.2 above, the lateral divergence of temporary pavement markers shall be within $\pm 10\text{mm}$. The longitudinal spacing of temporary pavement markers shall be within $\pm 150\text{mm}$.
6. Excess materials shall be disposed of at an authorised disposal site.

Traffic Management

Temporary Markers to be Replaced

Placement & Colour

Alignment

Lateral Divergence

604.36 COVERING AND REMOVING EXISTING ROAD MARKINGS

604.36.01 PAINTING OVER

1. This method shall not be used to cover road markings

Paint Over not permitted

604.36.02 OVERSPRAY

Overspray

1. For aggregate seal pavement surfaces, existing road line and pavement markings no longer required shall be concealed by the application of a cutback bitumen and 5 mm crushed aggregate overspray. This method is not generally used for asphalt surfaces.
2. For longitudinal line markings the overspray shall be sufficiently wide to cover the entire marking. For other pavement markings the overspray area shall be the minimum rectangular area required to cover the existing marking. The overspray shall be aligned parallel to the road centre line.
3. The timing of this treatment shall be coordinated with the commissioning of the new works and application of new pavement markings to minimise the impact on road users.

Width & Alignment

Timing

4. The binder shall be a cutback bitumen blend comprising 90% Class 170 bitumen and 10% medium curing cutting oil sprayed at an application rate of 1.0 litre/m². **Bitumen**

5. The cover material shall be 5 mm crushed aggregate applied at a rate of 120 m²/m³, and should match as far as possible the colour of the surrounding pavement surface. **Cover Material**

604.36.03 GRINDING **Grinding**

1. Road markings shall be removed by grinding such that the road marking is removed without damage to the underlying road pavement.

2. Damage to the seal surface shall be repaired by the Contractor at no cost to the Principal. **Damage**

3. Road markings ground off shall not be discernable.

4. Ground off material shall be disposed of by the Contractor at an authorised disposal site **Disposal of Material**

604.36.04 PLANE AND RESEAL **Plane & Reseal**

1. Road marking designated in the Contract shall be removed by planing and resurfacing of a predetermined area. All such works shall be undertaken in accordance with Main Roads Standards – Planing 7700/13/07 and Asphalt 7700/13/02.

2. All loose material shall be disposed of by the Contractor at an authorised disposal site.

604.36.05 SANDBLASTING **Sand-blasting**

1. Road markings designated in the Contract shall be removed by wet sandblasting such that the road marking is removed without damage to the underlying road pavement.

2. If so directed by the Superintendent, the Contractor shall apply paint to the discoloured surface in accordance with Clause 604.36.01 above to make the treated area indiscernible to traffic

3. Damage to the seal surface shall be repaired by the Contractor at no cost to the Principal.

4. Road markings ground off shall not be discernable.

5. Ground off material and blast sand shall be disposed of by the Contractor at an authorised disposal site.

6. In trafficked areas, signs warning approaching traffic of the hazard and the need to close windows, must be placed during work activities

604.36.07 TEMPORARY ROAD MARKING TAPE AND LONG LIFE MATERIAL

**Temporary
Tape**

1. Temporary road marking tape and long life material whether of a preformed, extruded, spray or screeded type shall be removed in accordance with the Manufacturer instructions. Where no Manufacturer instructions exist, the markings shall be removed in a manner agreed in prior consultation between the Superintendent and the Contractor.

Removal

604.37 – 604.50 NOT USED

MAINTENANCE

604.51 MAINTENANCE OF ROAD PAVEMENT MARKING

1. All materials and application processes used for the maintenance of existing road pavement markings shall comply with this Specification.
2. The level of service of Longitudinal Lines, Transverse Lines, Other Markings and Retroreflective Raised Pavement Markers shall not fall below the minimum Performance Criteria given in clauses 604.52 and 604.53.

PERFORMANCE CRITERIA

604.52 LONGITUDINAL LINES, TRANSVERSE LINES & OTHER MARKINGS

604.52.01 COLOUR

1. White markings shall be whiter in appearance than the colour “Y35 Off White” as specified in AS 2700.
2. Yellow markings shall be equivalent to “Y12 Wattle” or “Y15 Golden Yellow” as specified in AS 2700, or any colour which falls between these colours.

604.52.02 RETROREFLECTIVITY

1. The retroreflectivity of any marking or 300m segment of a longitudinal line must exceed the following when measured in dry conditions in accordance with AS 4049.2 or AS 4049.3.
 - a) 100 mcd/lx.m² for white markings
 - b) 70 mcd/lx.m² for yellow markings

604.52.03 LUMINANCE

1. The luminance factor must exceed the following when measured in accordance with Main Roads Test Method WA 841.1:
 - a) 40% for white markings
 - b) 30% for yellow markings

604.52.04 SKID RESISTANCE

1. The average skid resistance value (SRV) must be greater than 45 when measured in accordance with AS 4049.2.

604.52.05 THICKNESS

1. Except where specified for tactile purposes, the thickness of road marking material shall not exceed 5mm.

604.52.06 REPLACEMENT OF MARKINGS

1. In order to provide a uniform visual guide to the road user, all longitudinal lines within a 300m segment shall be replaced where the length of defective line exceeds:
 - (a) 36m continuous or 25% of total on any 300m lane length on curves and barrier lines or
 - (b) 72m continuous or 50% of total on any 300m lane length on straights
2. For transverse lines and other markings, the whole marking shall be replaced where more than 25% of the marking is defective.

604.53 RAISED RETROREFLECTIVE PAVEMENT MARKERS

604.53.01 SAFETY

1. Markers shall not shatter or detach in a manner which constitutes a hazard to the road user.

604.53.02 RETROREFLECTIVITY

1. When measured in accordance with AS 1906.3 (1992) Appendix A at an observation angle of 0.2α and an entrance angle of 0α the CIL value for any marker shall be greater than:
 - a) White markers 10mcd/lx
 - b) Yellow markers 6mcd/lx
 - c) Red markers 3mcd/lx

604.53.03 REPLACEMENT OF RAISED PAVEMENT MARKERS

1. In order to provide a uniform visual guide to the road user, all markers within a 300m segment must be replaced where the length of defective markers exceeds:

- a) 36m continuous or 25% of the total on any 300m lane length on curves or barrier lines or
- b) 72m continuous or 50% of the total on any 300m lane length on straights.

604.54 - 604.80 NOT USED

AS BUILT AND HANDOVER REQUIREMENTS

604.81 – 604.90 NOT USED

CONTRACT SPECIFIC REQUIREMENTS

604.91 – 604.99 NOT USED

ANNEXURE 604A

HOLD POINTS

- 1. The following Hold Points shall apply to this Contract:

Desired Action	Release of Hold Point by Superintendent
Application of road markings	After setting out, and immediately prior to the application of road markings

(NOTE: Add further Hold Points as necessary, and delete this note)

ANNEXURE 604B

RAISED PAVEMENT MARKERS

TABLE 604.B1 ADHESIVE PROPERTIES OF HOT MELT ADHESIVES

Property	Min.	Max.	Method
Softening Point, °F	210	230	ASTM D 36
Penetration	8	16	ASTM D 5
Flow, inches	-	0.2	ASTM D 3407
Heat Stability Flow, inches	-	0.2	
Viscosity, 400°F, Poises	-	75	ASTM D 2669
Flash Point, C.O.C., °F	550	-	ASTM D 92
Recommended Pouring Temperature, °F	400	425	
Shelf Life, years	-	2	

TABLE 604.B2 ASPHALT PROPERTIES OF FILLER FREE MATERIAL

Property	Min.	Max.	Method
Penetration	8	16	ASTM D 5
Viscosity, 275°F	12	100	ASTM D 2171
Viscosity Ratio, 275°F	-	2.2	

TABLE 604.B3 FILLER PROPERTIES

Property	Min.	Max.	Method
Filler Content, % by weight	65	75	
Filler Fineness, % passing			ASTM C 430
No 200	85		
No 100	100		

ANNEXURE 604C

ROAD MARKING PAINT AND GLASS BEAD APPLICATION RATES

PAINT TYPE	COMMENTS	DRY FILM THICKNESS (Minimum)	GLASS BEAD TYPE	GLASS BEAD APPLICATION RATE
SOLVENT (Prior Approval Required)	Maintain existing marking	200µm	Standard (AS 2009)	300g/m ² +/- 50g/m ²
	Install new marking	300µm	Standard (AS 2009)	300g/m ² +/- 50g/m ²
WATER BORNE	Maintain existing marking	200µm	Standard (AS 2009)	300g/m ² +/- 50g/m ²
	Install new marking	300µm	Standard (AS 2009)	300g/m ² +/- 50g/m ²
	Maintain existing marking	320µm	Type D (AS 2009)	500g/m ² +/- 50g/m ²
	Install new marking (Asphalt)	320µm	Type D (AS 2009)	500g/m ² +/- 50g/m ²
	Install new marking (Aggregate)	400µm	Type D (AS 2009)	500g/m ² +/- 50g/m ²

(NOTES: 1. Prior approval is required for the use of solvent based paints.

Delete the paint types not required.

Delete this note.)

ANNEXURE 604D

STANDARD PAVEMENT MARKING DRAWINGS

The following Main Roads Standard Pavement Marking drawings are available on the Main Roads web site, www.mainroads.wa.gov.au

Drawing No.	Description
9531-2010	Pavement Arrows Construction Detail

SPECIFICATION 604 GUIDANCE NOTES

DELETE THESE GUIDANCE NOTES FROM FINAL DOCUMENT AFTER USING FOR REFERENCE

All edits to downloaded TDP documents shall be tracked (most word processing software allows this to be done automatically). Deletions shall be struck through e.g. ~~example~~. Insertions shall be in italics e.g. *example*. If **all** information relating to a clause is deleted then the clause number should be retained and the words "**NOT USED**" should be inserted.

The proposed documents with tracked changes shall be submitted to the Project Manager for review, prior to printing the final batch of documents. When this final printing is carried out, the tracked changes option is to be **turned off**.

The Custodian of this specification is the Traffic Engineering Standards Manager.

1. HOLD POINTS (Annexure 604A)

All Hold Points for Pavement Marking shall be nominated in Annexure 604A in addition to the Hold Point after the setting out and prior to the application of the road marking.

2. MATERIAL TYPES

All material types shall be nominated in the Contract, i.e. thermoplastic, cold applied plastic, etc.

Notes:

- 2.1 Water Borne paint shall be used for all longitudinal and other road marking.
- 2.2 Solvent Based paint shall **ONLY** be used in specific instances and with prior approval of the Project Manager. Delete the paint types not required.

3. MATERIAL COMPLIANCE

The Contract Quality Plan shall make provision for verification of material compliance with this Specification.

4. RESPONSE TIMES

The Contract shall nominate minimum response times for the installation or modification to pavement markings.

5. REMOVAL OF EXISTING PAVEMENT MARKINGS (Clause 604.36)

Where existing pavement markings are to be removed or covered, the Contract shall specify the required method to be used. Inapplicable methods should be deleted and marked "NOT USED".

Notes:

1. In all instances where removal or cover of existing pavement markings is required, permanent removal by overlay of the road pavement is the preferred option as it provides a new surface for the new markings without compromising safety. Unless there is a concentration of pavement markings in one area, i.e. a marked pedestrian crossing, it can be an expensive option however this must be assessed against the safety implications of an alternative method of removal. Other methods of removal or cover are listed in 604.36. When choosing an alternative method of pavement marking removal or cover the following points should be considered:

- a) Is the removal/cover temporary or permanent?
- b) Will the chosen method achieve the desired result in both the short and long term without excessive maintenance?
- c) Will the safety of road traffic be compromised, i.e. will the resultant surface still display old markings which could be misleading to traffic?

2. It should be noted that the painting over of existing road markings is considered to be a very short term and temporary measure.

3. The Overspray method is generally used for aggregate seals only.

6. SPOTTING & OVERTAKING BARRIERS

6.1 It is essential that prior to any longitudinal road marking taking place, the road is spotted in accordance with the approved methodology as set out in Clause 604.31.02.2. The marking of overtaking barriers must also be undertaken prior to any longitudinal road marking commencing. It is essential that the overtaking barriers are marked out by a Main Roads accredited person.

CONTRACT SPECIFIC REQUIREMENTS TO ADD OR DELETE

The following clauses are to be placed under the CONTRACT SPECIFIC REQUIREMENTS as required.

(NONE AT THIS TIME)

SPECIFICATION AMENDMENT CHECKLIST

Specification Name: No: **604** Revision No: _____ Title: **PAVEMENT MARKING**

Project Manager: Name: _____ Signature _____ Date: _____

Checked By: Name: _____ Signature: _____ Date: _____

Contract No: _____ Contract Description: _____

ITEM	DESCRIPTION	SIGN OFF
<i>Note: All changes/amendments must be shown in Tracked Change mode until approved.</i>		
1.	Project Manager has reviewed Specification and identified Additions and Amendments.	
2.	CONTRACT SPECIFIC REQUIREMENTS addressed? – Contract specific materials/products/clauses added? (Refer Specification Guidance Notes for guidance).	
3.	Any unlisted Materials/Products proposed and approved by the Project Manager? – if “Yes” provide details at 15.	
4.	Standard Clauses amended? – MUST SEEK approval from MCP.	
5.	Clause deletions shown as ‘NOT USED’.	
6.	Appropriate INSPECTION & TESTING parameters included in Spec 201 (Test Methods, Minimum Testing Frequencies verified).	
7.	ANNEXURES completed (Refer Specification Guidance Notes).	
8.	HANDOVER and AS BUILT requirements addressed.	
9.	Main Roads QS has approved changes to SMM .	
10.	Project Manager certifies completed Specification reflects intent of the design.	
11.	Completed Specification – independent verification arranged by Project Manager	
12.	Project Manager’s review completed.	
13.	SPECIFICATION GUIDANCE NOTES deleted.	
14.	TABLE OF CONTENTS updated.	
15.	Supporting information prepared and submitted to Project Manager.	
Further action necessary:		

Signed: _____ (*Project Manager*) Date: _____