# Brisbane City Council

# Reference Specifications for Engineering Work

# S155 Road Pavement Markings

## Amendment Register

|  |  |  |  |
| --- | --- | --- | --- |
| Ed/Rev Number | Section Number | Description | Date |
| 1.0 |  | Original issue.Sections moved from Reference Specification for Civil Engineering Works S150 Roadworks | Apr 2014 |
| 2.0 | 1.2 | References list expanded | May 2016 |
| 3.5.2 | Road hierarchy descriptions updated |
| 3.5.9 | Reference to SEQ Water Supply and Sewerage Design and Construction Code drawing updated |
| 3.0 | 1.3 | Title of Austroads Guide to Road Design document updated to current title. | Nov 2018 |
| 3.3.1 | Allowance for waterborne paint at >600 µm thickness to be used for longitudinal lines |
| 3.5.1 | Reference to AS 1742 included. |
| 3.5.2 | Road hierarchy descriptions updated |
| 3.5.3 | Updated material type requirements for longitudinal and transverse markings. |
| ‘Bicycle Awareness Zones’ reference removed from Specification. ‘Bicycle Awareness Zones’ are no longer permitted on Brisbane City Council-controlled Roads. |
| 3.5.4 | Cold applied plastic material added to Clause. |
| Table 4.2 | Cross-references in table updated |
| 4.0 | General | General Title Altered to ‘Reference Specifications for Engineering Work’ | Nov 2019 |
| 1.2 | Reference to AS 4586 updated to latest numbering. |
| 4.2 | Slip resistance requirements for coloured pavement treatments updated to current standards.Table 4.1 removed from document. |
| 5.0 | General | Document name changed from ‘Reference Specifications for Civil Engineering Work’ to ‘Reference Specifications for Engineering Work’ | Mar 2021 |
| 1.3 | Reference to Austroads Guide updated. |
| 3.3.4 | ‘Retroreflectivity’ requirement added to Pavement marking tape clause. |
| 4.7 | Road marking colour for white lettering and symbols on coloured pavement treatments added. |
| 4.7.3 and 4.7.4 | Road marking colour for *BICYCLE SHARED ZONES* added *ON-ROAD BICYCLE LANES* and *OFF-ROAD BICYCLE FACILITIES* included. |
| 4.7.6 and 4.8.4 | *SCHOOL ZONE ENHANCED* marking type changed to *SCHOOL ZONE ENHANCED TREATMENT* to be consistent with current standards. |
| 4.7.7 and 4.8.5 | Requirements for Significant Wildlife Conservation Area (SWCA) Thresholds added. |

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## GENERAL

### Section Control

Types of road pavement marking and coloured surface treatments.

### Standards

|  |  |  |
| --- | --- | --- |
| ASTM International Standards | ASTM E303-93 (2008) | Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester |
| Australian Standard | AS 1141.41 | Methods for sampling and testing aggregates - Polished aggregate friction value – Horizontal bed machine |
| Australian/New Zealand Standard | AS/NZS 1580.205.4 | Paints and related materials - Methods of test - Application properties – Airless spraying |
| Australian Standard | AS 1742 | Manual of uniform traffic control devices |
| Australian/New Zealand Standard | AS/NZS 1906.1 | Retroreflective materials and devices for road traffic control purposes – Retroreflective sheeting |
| Australian Standard | AS 1906.3 | Retroreflective materials and devices for road traffic control purposes - Raised pavement markers (retroreflective and non-retroreflective) |
| Australian Standard | AS 2009 | Glass beads for pavement-marking materials |
| Australian Standard | AS 2700 | Colour standards for general purposes |
| Australian Standard | AS 4049.2 | Paints and related materials – Pavement marking materials – Thermoplastic pavement marking materials – For use with surface applied glass bead |
| Australian Standard | AS 4049.3 | Paints and related materials – Pavement marking materials – Waterborne paint – For use with surface applied glass beads |
| Australian/New Zealand Standard | AS/NZS 4586 | Slip resistance classification of new pedestrian surface materials |
| Australian Standard | AS 4663 | Slip resistance measurement of existing pedestrian surfaces |
| Australian Standards/CSIRO | Handbook HB197 | An introductory guide to the slip resistance of pedestrian surface materials |
| Australian/New Zealand Standard, International Standards Organization | AS/NZS ISO 9001 | Quality management systems – Requirements |

### References

Refer to the following documents:

|  |  |  |  |
| --- | --- | --- | --- |
| Queensland Department of Transport and Main Roads |  | MUTCD | Queensland Manual of Uniform Traffic Control Devices |
| Queensland Department of Transport and Main Roads |  | TC Signs | Queensland Traffic Control (TC) Signs |
| Queensland Department of Transport and Main Roads | Technical Guide |  | A guide to signing cycle networks |
| Brisbane City Council |  |  | Standard Drawings |
| Brisbane City Council | Design Manual |  | Bicycle Signage Manual |
|  | Design Manual |  | Moreton Bay Cycleway Signage Manual. |
| Austroads | Guide to Road Design | Part 6A | Paths for Walking and Cycling |
| SEQ Water Supply and Sewerage Design and Construction Code |  |  | SEQ Drinking Water Supply Drawings |

Refer to the following other Reference Specifications for Engineering Works:

|  |  |
| --- | --- |
| S110 | General Requirements |
| S120 | Quality |
| S150 | Roadworks |
| S154 | Traffic Signs and Associated Roadside Furniture |

### Defintions

Traffic control device: Any sign, signal, pavement marking or other installation placed or erected under authority of the Transport Operations (Road Use Management) Act, for the purpose of regulating, warning or guiding road users.

Pavement markings: Longitudinal lines and transverse markings.

Longitudinal lines: Centre lines, lane lines, edge lines, turn lines and continuity lines.

Transverse markings: Transverse lines, shapes and symbols.

Coloured pavement treatment: Coloured material applied asphalt or concrete pavement surface for decorative, traffic delineation or anti-skid requirements.

## QUALITY

### Generally

The Superintendent responsible for the management of the quality of work under the contract must maintain a Quality Assurance System with third party accreditation to *AS/NZS ISO 9001*.

Responsibility for preparation of an inspection and test plan may rest with the Contractor or the Superintendent. Where the Contractor is responsible for the plan, submit it to the Superintendent for approval. Where the Superintendent is responsible for the plan, submit it to the Principal for approval. *Refer annexure.*

### Inspections

Witness points

*Refer annexure*. Give sufficient notice so that inspection may be made at the following stages:

* Traffic sign locations marked.
* Pavement marking set out ready for marking.

Hold points

*Refer annexure*. Do not proceed without approval. Give sufficient notice so that inspection may be made at the following stages:

* Material compliance certificates.

### Samples

General

*Refer annexure*. Submit to the testing authority samples of the following:

* Each type of pavement marking material.
* Each type of coloured pavement treatment material.

### Contractor’s Submissions

* Pavement marking material to be used.

## LONGITUDINAL AND TRANSVERSE PAVEMENT MARKINGS

### Redundant Line Removal

Unless approved otherwise, remove redundant lines only by abrasive blasting (including water blasting) or by cold planing or grinding.

**‘Blacking out’ is not considered a removal method and is not to be used under any circumstances.**

Where the profiled depth exceeds 10 mm, overlay the affected area of road with a minimum thickness of bituminous surfacing appropriate to the road type prior to pavement marking.

### Colour

White: Equivalent to or whiter than “Y35 Off White” as defined in AS 2700.

Yellow: Equivalent to “Y14 Golden Yellow” as defined in AS 2700.

### Materials

#### Paint

General: Use paint suitable for application by airless spray equipment tested in accordance with AS 1580.205.4.

Water-borne road marking paint: A paint that conforms to the requirements of AS 4049.3 and has approval under Australian Paint Approval Scheme (APAS) Specification number 0041/5. Where applied at >600 µm wet film thickness, considered an appropriate longlife treatment for longitudinal lines.

Solvent-borne road marking paint: This form of road marking paint is not acceptable for use within the Brisbane City Council area.

#### Thermoplastic materials

A material that complies with the requirements of AS 4049.2 and has approval under Australian Paint Approval Scheme (APAS) Specification number 0041/5. Considered an appropriate longlife treatment.

#### Two-part cold applied materials

A Poly Methyl Methacrylate resin-based pavement marking material that complies with the requirements for colour, luminance and bead content of AS 4049.2. Considered an appropriate longlife treatment.

#### Pavement marking tape

A pliant self-adhesive polymer pavement marking tape (either temporary or permanent) suitable for application to bituminous coated, concrete or other surface as directed. Tape must be durable (suitable for external application under traffic loading and weathering conditions) and retain colourfastness and retroreflectivity.

#### Reflective glass beads

Requirement: Glass marking beads shall comply with the requirements of AS 2009.

Drop-on beads: Use Class ‘C’ intermix glass beads for all transverse markings and painted traffic islands/kerbs. Class ‘D’ large uniform sized glass beads to be used in all the longitudinal marking applications. Class ‘D’ beads to have adhesive coating to manufacturers requirements where used with longlife applications.

Intermix beads: Use Class ‘C’ glass beads for premixing with longlife materials. Glass beads to form minimum 20% mass of total mixture for thermoplastic material.

#### Anti-skid material

Scope of application: Apply anti-skid treatment to all transverse markings, excluding chevron markings. Apply anti-skid material to all longitudinal markings on bicycle facilities.

Anti-skid material: Crushed quartz, or other material matching or exceeding the properties of crushed quartz. The quartz must be clean, durable, non-plastic and free from adherent coatings and any foreign matter. It must be sound grained, very angular to semi angular, with particle size complying with Table 3.1.

Application: Apply anti-skid material either as a drop-on material to paint or sprayed, screeded or extruded longlife material or premixed in a preformed longlife material.

For white pavement markings: Use white (whiter than “Y35 Off White” as defined in AS 2700) crushed quartz.

For coloured pavement markings: Use a coloured anti-skid material that matches or exceeds the properties of crushed quartz, to match the finished colour of the marking.

Table 3.1 – Glass bead class to Anti-skid material size

|  |  |
| --- | --- |
| Glass Bead Class/Size | Anti-skid Material Nominal Size |
| Class ‘B’ | Not used |
| Class ‘C’ | 1-1.6 mm |
| Class ‘D’ | 1-2 mm |

#### Raised retroreflective pavement markers

Requirement: Provide reflective surfaces that are self-cleaning under normal traffic conditions.

Type: Type A1 either uni-directional or bi-directional raised retroreflective pavement markers, conforming to the requirements of AS 1906.3.

Dimension and shape: Dimensions of pavement markers to comply with AS 1906.3.

Colour in traffic situations: Uni-directional raised retroreflective pavement markers to be white, yellow, red, or green as specified on the drawings. Bi-directional raised retroreflective pavement markers to be white or yellow as specified on the drawings.

Colour to indicate fire hydrant location: Bi-directional raised retroreflective pavement markers to be blue in accordance with *SEQ Water Supply and Sewerage Design and Construction Code – Drinking Water Supply* Drawing SEQ-WAT-1300-1.

#### Raised non-retroreflective pavement markers

Type: Type B raised pavement markers, conforming to the requirements of AS 1906.3.

Dimension and shape: Circular approximately 100 mm in diameter and maximum 15 mm high, domed.

Colour: White.

#### Adhesives for raised pavement markers

Certification: Provide certificate from the adhesive manufacturer stating that the adhesive is appropriate for the application. Adhesives may be soft, hard or mid-range.

Soft adhesives: Single part bituminous based materials, applied by heating to high temperatures. This is the preferred adhesive type for application to asphalt surfaces.

Hard adhesives: Hybrid cement or two-part epoxy materials mixed and applied at ambient temperatures to manufacturer requirements.

Mid-range adhesives: Two-part urethane based materials, mixed and applied at ambient temperatures to manufacturer requirements.

#### Temporary pavement markers

Type: Temporary pavement markers shall conform to the requirements of AS 1906.3.

Colour: Body to be white or yellow, reflector to be white, yellow or red.

### Execution and Installation

#### Weather conditions

Rain and condensation: Do not carry out pavement markings when there is possibility of the freshly applied pavement markings becoming damaged by rain, fog, or condensation before they have dried or set.

Application temperatures: Do not install pavement markings when the atmospheric temperatures are below or likely to drop below 10°C for water-borne paint. The surface temperature must not drop below 7°C during the application of thermoplastic material.

#### Surface preparation

Remove all dirt, loose material and other contaminants from surfaces that are to receive pavement markings. Apply pavement markings to surfaces that are clean and dry. Additionally, remove all laitance and curing compound by mechanical wire brushing or abrasive blast cleaning, before the application of thermoplastic material to concrete surfaces.

#### Spotting

Spotting: Paint 30 mm wide by 30 mm long spot.

Longitudinal lines: Carry out spotting at 5 m intervals on straight lines and a maximum of 2 m intervals on curved lines.

Transverse markings: Carry out spotting as shown on the drawings.

Tolerances: Comply with Table 3.2.

Table 3.2 – Spotting tolerances

|  |  |
| --- | --- |
| Dimension | Tolerance |
| Distance between spots | ±300 mm |
| Lateral position of longitudinal lines: |  |
| New construction | ±40 mm |
| Reseals and asphalt overlays | ±40 mm |
| Placement of transverse markings |  |
| New construction | ±20 mm |
| Reseals and asphalt overlays | ±20 mm |

#### Applying paint

Paint temperature: Do not heat above 65°C for water-borne paint.

Painting longitudinal line: Apply paint in any longitudinal line group pattern, including glass beads and anti-skid material, in one pass of the longitudinal line application machine. Apply one coat of paint to achieve wet film thickness of 600 µm ± 25 µm for painting work involving Class ‘D’ large uniform sized glass beads.

Transverse markings: Paint using stencils, boards and hand spray equipment. Apply one coat of paint to achieve wet film thickness of 375 µm ± 25 µm.

#### Applying thermoplastic material

Primer: Use a resinous primer when thermoplastic material is applied to concrete, smooth or polished surfaces and to any surface after grinding or removal activities. Where required by the manufacturer, apply primer to other surface types to ensure adhesion of the thermoplastic material. Apply primer to the surface immediately in advance of, but concurrent with, the application of thermoplastic material. Do not thin primer. Apply at the application rate recommended by the manufacturer.

Thermoplastic material: Apply by screeding, spraying or extrusion methods, including glass beads and anti-skid material in a single uniform layer or as preformed material. Apply to pavement at a temperature between 180°C and 200°C, unless the manufacturer recommends a different temperature. Completely coat pavement surface with thermoplastic material and fill any surface voids. Apply at a rate to achieve a thickness of 2.5 mm (+ 0.5 mm - 0.0 mm) for longitudinal lines and transverse markings.

#### Applying two-part cold applied material

Apply by spraying, screeding, trowelling or extrusion methods, including glass beads and anti-skid material in a single uniform layer or as preformed material. For longitudinal lines and transverse markings, apply material at a rate to achieve a final thickness of 1.0 mm (+ 0.5 mm - 0.0 mm) for spray applications and maximum 2.5 mm ± 0.5 mm for application by screeding, trowelling or extrusion methods.

#### Applying drop-on glass beads

Application Rate: Achieve coverage of not less than the application rates shown in Table 3.3. Application rate to be strictly adhered to unless specified otherwise.

Table 3.3 – Glass bead surface application rates

|  |  |  |  |
| --- | --- | --- | --- |
| Glass Bead Class/Size | Drop-on Glass Bead Application Rate | Line Application | Marking Material |
| Class ‘B’ | Not used |
| Class ‘C’ | 325 g/m2 ± 25 g/m2 | Transverse markings | All |
| Class ‘D’ | 450 g/m2 ± 25 g/m2 | Longitudinal markings | All |

Longitudinal paint application: Incorporate Class ‘D’ glass beads uniformly in all coats of paint concurrently with the application of the paint.

Transverse paint application: Apply Class ‘C’ glass beads uniformly to all coats of paint concurrently with the application of the paint. Do not use Class ‘D’ beads for this application.

Longitudinal Thermoplastic and Two-part cold applied plastic material: Apply Class ‘D’ glass beads immediately to the surface of the fresh plastic material. Incorporate Class ‘C’ intermix beads uniformly and evenly through the thermoplastic material.

Transverse Thermoplastic and Two-part cold applied plastic material: Apply Class ‘C’ glass beads immediately to the surface of fresh plastic material. Incorporate Class ‘C’ intermix beads uniformly and evenly through the thermoplastic material.

#### Applying anti-skid material

Application rate: Where an anti-skid treatment is required, achieve coverage of not less than the application rates shown in Table 3.4.

Table 3.4 – Anti-skid material surface application rates

|  |  |  |  |
| --- | --- | --- | --- |
| Line Application | Anti-skid Material Application Rate | Marking Material | Glass Bead Class Used for Line Application |
| Transverse markings | 175 g/m2 ± 25 g/m2 | All | Class ‘C’ |
| Longitudinal markings | 250 g/m2 ± 25 g/m2 | All | Class ‘D’ |

Waterborne paint: Incorporate anti-skid material in all coats of paint concurrently with the application of the paint.

Thermoplastic material: Apply anti-skid material immediately to the molten thermoplastic material.

Two-part cold applied material: Apply the anti-skid material immediately to the fresh plastic material.

#### Applying pavement marking tape

Undertake surface preparation, tape installation and removal (where necessary) in accordance with the manufacturers’ recommendations.

#### Applying raised pavement markers

Using soft adhesive: Place adhesive pad on road surface and heat to manufacturer/supplier requirements. Place raised pavement marker directly to heated pad.

Using hard and mid-range adhesive: Butter back of marker with prepared adhesive to manufacturer/supplier requirements. Place raised pavement marker directly to road surface.

#### Alignment and finish

Protection: Protect newly placed pavement markings from damage by traffic or other causes until the paint is dry (no pickup condition) or thermoplastic material has hardened sufficiently. Use approved traffic management procedures.

Improper markings: Remove immediately from the pavement surface any drip, overspray, improper marking, and paint and thermoplastic material tracked by traffic. Use methods that minimise damage to the pavement surface (abrasive blasting is the preferred method).

Appearance: Completed pavement markings must be uniform, have clean and well defined edges without running or deformation, and conform to the dimensions shown on the drawings.

Longitudinal lines: Lines must be straight on straight alignment and a true arc on curved alignment.

Arrows and letters: Place parallel to the centre alignment of the traffic lane.

Tolerances: Conform to the values specified in Table 3.5.

Table 3.5 – Pavement marking tolerances

| Dimension | Tolerance |
| --- | --- |
| Longitudinal lines |  |
| Width of line | ±10 mm |
| Width of gap between adjacent lines | ±10 mm |
| Length of line and/or gap |  |
| New construction | ±100 mm |
| Reseals and asphalt overlays | ±300 mm |
| Lateral Placement from spotting |  |
| New construction | ±20 mm |
| Reseals and asphalt overlays | ±40 mm |
| Lateral Placement from existing line (repaints) | ±25 mm |
| Trueness of line | <15 mm in 10 m |
| Transverse markings |  |
| Dimension of transverse markings and shapes | ±20 mm |
| Placement from spotting | ±20 mm |
| Placement from existing markings | ±20 mm |
| Raised pavement markers |  |
| Lateral position |  |
| Barrier and edge line | +25 mm, -50 mm from longitudinal line |
| Broken line | ±20 mm |
| Flush medians | ±20 mm |
| Longitudinal position |  |
| New construction | ±100 mm |
| Replacement | ±300 mm |

### Installation Requirements

#### Marking dimensions and layout

Pavement markings (longitudinal lines, transverse lines, symbology, lettering, raised pavement markers and the like) should be installed as per Standard Drawings BSD-3151 to BSD-3165. Where no Brisbane City Council standard exists, refer to the *AS* *1742* and/or the Queensland MUTCD.

#### Road hierarchy

Table 3.6 – Road Hierarchy Types and Descriptions

| Hierarchy Plan Road Type | Description |
| --- | --- |
| Minor Roads |
| Local road | Has a minor road function and provides low-speed local travel and direct property access.Includes laneways as a type of local road. |
| Neighbourhood Road | Has a minor road function and carries low volumes of local traffic between local and district roads. |
| Major Roads |
| District Road | For through-traffic including local freight and public transport.Links for minor roads and local centres to suburban and arterial roads. |
| Suburban Road | Has a major road function.Connects suburbs to arterial roads (sub-arterial) and provides safe and efficient movement of moderate to high volumes of traffic of motor vehicles, including public transport and pedestrians and cyclists.Avoids conflicts between pedestrian, bicycle and motorised traffic by physically segregating different modes. |
| CBD | Street within the City Centre Neighbourhood Area and Fortitude Valley Neighbourhood Area (as defined in the Infrastructure Design Panning Scheme Policy, Chapter 5) (Figure 3.1 and 3.2). |
| Arterial Road | Has a major road function;Provides intra-city connections between principal and major regional activity centres and major employment areas both within Brisbane and in the surrounding areas.Caters for high volumes of traffic and provides bus priority on the road and at intersections.Avoids conflicts between pedestrian, bicycle and motorised traffic by physically separating pedestrian, non-motorised and motorised modes. |
| Motorways | Has a major road function;Provides for inter and intra-regional connections and directs longer distance traffic around heavily developed areas.Is a high-speed restricted access environment that is designed for the efficient and safe movement of high volumes of people and goods.Accommodates pedestrians, cyclists and motor vehicles and in some instances public transport on separated carriageways. |

|  |
| --- |
| The detail contained within this Brisbane City Council Reference specification is of a technical nature and as such is not accessible. For assistance accessing and interpreting this Reference specification please contact Council on 07 3403 8888. |

Figure 3.1 – City Centre Neighbourhood area (IDPSP Chapter 5.3)

|  |
| --- |
| The detail contained within this Brisbane City Council Reference specification is of a technical nature and as such is not accessible. For assistance accessing and interpreting this Reference specification please contact Council on 07 3403 8888. |

Figure 3.2 – Fortitude Valley Neighbourhood area (IDPSP Chapter 5.3)

A diagram of the road hierarchy concept plan is shown in Figure 3.3.

Figure 3.3 – Road hierarchy concept plan

#### Colour application

White markings: The installation of standard pavement markings (longitudinal, transverse lines and symbology) shall be white for all markings, with the following exceptions;

Yellow markings: The following pavement marking types are to be completed in yellow material:

* “No Stopping” zones (longitudinal edge lines);
* Loading, Taxi and Bus Stopping zones;
* Crosshatch markings at railway crossings to Queensland Department of Transport and Main Roads sign TC1428.

Specialist pavement markings: There are special colour requirements for the installation of bus, transit and dedicated bicycle lanes, which require a coloured pavement treatment. Coloured pavement surface treatments for a local area traffic management (LATM) schemes fulfil a critical traffic function and they are to be installed or re-instated with an appropriate system. For acceptable material and colour details, refer Section 3.2 of this Specification.

Table 3.7 – Longitudinal lines material: material application requirements

| Hierarchy Plan Road Type | Line Type | Material |
| --- | --- | --- |
| Bikeways | All Markings | Waterborne paint or Cold Applied Plastic (Spray) (Section 3.5.6) |
| Local and Neighbourhood Roads(Other than LATM schemes) | All Longitudinal Lines and Bikeway Markings | Waterborne paint |
| LATM Schemes | All Longitudinal Lines | Longlife material |
| District Access, Suburban and Arterial Roads | Centrelines on all roads | Waterborne paint or Longlife material  |
| Lane lines on Multi-Lane roads | Longlife material |
| Island outlines(Centre islands and medians) | Longlife material |
| Island outlines(Left hand splitter islands etc.) | Waterborne paint |
| Edge lines(Non-bicycle facilities) | Waterborne paint or Longlife material  |
| Edge lines(Bicycle facilities) | Waterborne paint or Cold Applied Plastic |
| Continuity lines | Longlife material |
| Primary Freight Access Routes/CBD | All Longitudinal Lines | Waterborne paint or Cold Applied Plastic |
| Primary Freight Routes | All Longitudinal Lines except Island outlines | Longlife material |
| Island outlines | Waterborne paint |
| Motorways | All Longitudinal Lines | Longlife material  |

\* Continuity lines across intersections (where required) are to be completed in a longlife material.

Table 3.8 – Transverse markings (including symbology): material application requirements

| Hierarchy Plan Road Type | Line Type | Material |
| --- | --- | --- |
| Bikeways | All Markings | Waterborne paint or Cold Applied Plastic (Spray)(Section 3.5.6) |
| Local and Neighbourhood Roads(Including LATM schemes) | All Transverse Markings | Longlife material |
| District Access, Suburban and Arterial Roads | All Transverse Markings | Longlife material |
| Primary Freight Access Routes/CBD | All Transverse Markings | Longlife material  |
| Primary Freight Routes | All Transverse Markings | Longlife material |
| Motorways | All Transverse Markings | Longlife material  |
| All Roads except LATM Schemes | Chevron markings | Waterborne paint  |
| LATM Schemes | Chevron markings | Longlife material  |

\* All transverse markings (with the exception of chevron markings) are to be treated with an anti-skid material at application.

#### Symbology and markings

Any symbology (other than bicycle facilities) not covered by the sections above shall be completed in waterborne paint or cold applied plastic.

#### Pedestrian crossings

Pedestrian (“Zebra”) crossings are to be completed to Standard Drawing BSD-3152 in a longlife material with anti-skid additives or a Type 2 Skid Resistant material as outlined in Section 4.

#### Bicycle facilities

Any markings in or along bicycle facilities are to be completed in waterborne paint or sprayed cold applied plastic material ensuring that the finished thickness of the material does not exceed 1.0 mm (+ 0.5 mm -0.0mm). Hot applied thermoplastic is not to be used for these installations.

The installation of raised retroreflective pavement markers is to be avoided in bicycle areas. Where they must be used (island tails, hydrant markers and longitudinal lines on major roads), the raised retroreflective pavement markers is to be placed out of the direct bicycle wheel path.

#### Raised retroreflective pavement markers – longitudinal markings

For longitudinal markings, raised retroreflective pavement markers are only to be used for the separation, centreline, lane and edge line markings and island tails of District Access, Suburban and Arterial Routes. Raised retroreflective pavement markers are not to be used on any other longitudinal line marking. Raised retroreflective pavement markers to be installed on longitudinal markings as shown in Standard Drawing BSD-3154.

#### Raised retroreflective pavement markers – island tails and medians

Raised retroreflective pavement markers to be used in painted island tails and medians as shown in Standard Drawings BSD-3155 and BSD-3156.

#### Fire hydrant markers

Blue raised retroreflective pavement markers are to be installed to mark fire hydrants as per the requirements of SEQ Water Service Providers Water Supply Standard Drawing SEQ-WAT-1300-1.

#### Raised retroreflective pavement markers – other locations

Raised pavement markers are not to be used on transverse markings or symbology. See bicycle requirements above.

## COLOURED PAVEMENT TREATMENTS

### General

This clause applies to coloured treatments, texturing, decorative, and high friction surfacing systems on asphalt and concrete surfaces.

### Slip Resistance

Scope: Applies to pedestrian surfaces.

Standard: Generally to AS/NZS 4586 for new surface and AS 4663 for existing surface.

Slip resistance requirements:

New/untrafficked external surfaces (<1 in 20): classified as Class ‘P5’ (>44 Mean BPN using a Slider 55 (TRL) rubber pad) to *AS/NZS 4586*.

New/untrafficked external surfaces (>1 in 20): mean BPN must be increased in accordance with Appendix A of HB197 – An introductory Guide to Slip Resistance of Pedestrian Surfaces.

Existing/trafficked external surfaces: tested to the methods in *AS 4663* and classified in accordance with HB197 – An introductory Guide to Slip Resistance of Pedestrian Surfaces.

The pavement must demonstrate characteristics in accordance with the relevant Australian Standards of a Very Low Contribution of the surface to slips when wet. The likely contamination of the surface must be considered, and the surface must maintain its slip resistance with minimal maintenance for the estimated life of 10 years.

Where the slope of the footpath is such that the minimum slip resistance for the coloured pavement treatment cannot be achieved, then an alternative treatment is to be considered. This will be determined on a site-by-site basis.

Table 4.1 – Table removed from document

### Skid Resistance

Scope: Applies to vehicular trafficked surfaces.

Definition: Skid resistance is a measure of the friction between the vehicle tyre and the paved surface. The skid resistance depends on both the micro texture of the aggregate in the surfacing, the macro texture (surface texture) of the surfacing, as well as the presence of moisture and film thickness.

Bituminous surfaces: Micro texture relates primarily to the surface texture of the individual aggregate particles, which is in turn influenced by the degree of polishing of the aggregate. The shape of and the space between the aggregate particles provides the macro texture.

Concrete surfaces: The fine aggregate particles in the mix provide the micro texture. Texturing in accordance with Reference Specification for Engineering Work S200 Concrete Clause 10.1 provides the macro texture.

Portable pendulum skid resistance tests (British Pendulum): Carry out tests on wet surfaces in accordance with Queensland Department of Transport and Main Roads Test Method Q704 or ASTME 303. The testing device measures the coefficient of friction between the road surface and a rubber slider, mounted on a pendulum. The skid resistance measurements are recorded as the BPN.

Requirement: The skid resistance requirement of an applied surface treatment is specified in Table 4.2. Maintain the minimum skid resistance values for the duration of the product guarantee period.

Table 4.2 – Minimum enduring skid resistance values

|  |  |
| --- | --- |
| Surface Treatment Type | Minimum skid resistance value*(1)* (BPN) |
| Type 1 Treatment (See 4.5) | 55 |
| Type 2 Treatment (See 4.6) | 65 |

*(1) Record measurement at the end of the defects liability period (i.e. 12* *months from the date of on maintenance acceptance). The initial skid resistance is expected to be higher than the specified minimum value to ensure achievement of the minimum enduring requirement.*

### General Requirements

Treatment locations: Thresholds at local traffic areas to visually enhance traffic control devices such as mini-roundabouts, diamond slow-ways, single lane angled slow-ways, approaches to intersections, and road humps (traffic calming device) and to visually enhance school zones or demarcation of parking area, bicycle lanes or bus lanes. Type 1 Treatment is generally used for these locations.

Type 2 Treatment is required for locations requiring high skid resistance. (e.g. accident black spots and locations with high incidence of wet weather skidding)

Visual assessment: Inspect the installed coloured treatment to assess uniformity and compliance with the minimum skid resistance requirement. Use test boards (product samples that have been tested for skid resistance and found to be satisfactory) to aid the visual assessment. Conduct visual assessment during the on-maintenance inspection.

British Pendulum tests: Undertake a minimum of 2 skid resistance tests in each treatment area. Increase test frequency as required (minimum 1 test per 100 m2 or part thereof per site in the wheel path) to delineate any non-conforming areas. If required, rectify defects. Conduct tests at the end of the defects liability period (i.e. 12 months from the date of on maintenance acceptance).

Manufacturer’s guarantee: Minimum period of 3 years against the loss of colour, stripping and delamination, and maintaining the skid resistance characteristics specified in *Clause 4.3 of this Reference Specification*. The product guarantee does not extend to defects arising from damage caused by settlement, subsidence or failure of the underlying stratum.

### Type 1 Treatment (Stencilled or Stamped/Imprinted Surfacing System)

#### General

Surfacing system: Generally a proprietary treatment approved by Brisbane City Council (Approving Authority: Manager Asset Management) that has been specifically developed for installation by trained personnel to produce a uniformly coloured, highly durable, and seamless surface finish of adequate skid resistance (on road surface) or slip resistance (on pedestrian surface). *Refer annexure*.

Approval of treatment system: Comply with one or more of the following criteria.

* The system has a minimum of 3 years of documented history of satisfactory performance/trials and or usage locally or interstate. Brisbane City Council may require further trials before approval.
* The system is approved by an internationally recognised body such as the HAPAS British Board of Agreement (BBA) for its intended purpose.
* The system has been subjected to accelerated testings for scuffing, wear and tensile adhesion in accordance with the defined tests in TRL Report 176, Appendix G, H and J respectively (or equivalent NATA certified tests) and the results are satisfactory to Brisbane City Council.

Surface preparation: Water blast the substrate to be treated to remove all oil, grease, dirt and anything foreign to the surface. Remove thermoplastic road markings. Treat joints and cracks in accordance with the manufacturer’s instructions.

#### Coating system

Base coat (colour required): Use base coat that is capable of filling voids in the asphalt and concrete surfaces.

Top coat (colour required): Incorporate uniformly the UV stable organic and/or metallic oxide pigments, graded aggregates, specialty resins and other additives such as wetting agents and super plasticisers.

Protective sealer: Provide protection against petroleum based fuels and oils as experienced on road surfaces.

#### Resin bonded aggregate system

Where a resin bonded aggregate system is used as a Type 1 Treatment; Clause 4.5 of this Reference Specification applies except that the aggregate requirements are as follows:

Aggregates requirement: Provide aggregates that are clean, dry, hard, tough, durable, moderately sharp grains of pre-coated coloured natural stone, of uniform quality, free of dust, dirt and other deleterious matter.

Grading: Not more than 5% (by weight) is retained on a 2.36 mm A.S. sieve and not more than 5% (by weight) passes a 0.6 mm A.S. sieve.

Frictional characteristic: Achieve a Polished Aggregate Friction Value (PAFV) of not less than 60 as determined by test method AS 1141.41.

### Type 2 Treatment (High Friction Surfacing System)

#### General

High Friction Surfacing system: Generally a proprietary anti skid and resin bonded aggregate system approved by Brisbane City Council (Approving Authority: Manager Asset Management) and that has been specifically developed for installation by trained personnel to produce a textured, durable surfacing of high skid resistance. *Refer annexure*.

Approval of treatment system: Comply with one or more of the following criteria.

* The system is an approved high friction surface product/method for this application under the HAPAS British Board of Agreement (BBA) or an equivalent internationally recognised body.
* The system has been subjected to accelerated testing for scuffing, wear and tensile adhesion in accordance with the defined tests in TRL Report 176, Appendix G, H and J respectively (or equivalent NATA certified tests) in accordance with the requirements detailed in Table 4.3.

Table 4.3 – Accelerated testings

| Test parameter | Requirement |
| --- | --- |
| Scuffing(*TRL 176 Appendix G*, conducted at 45 C) | Initially | Texture depth ³1.4 mm |
| After 500 wheel passes | Texture depth (mm) ³1.2 mmErosion index £3 |
| After heat ageing for 112 days at (70 ± 3)°C and 500 wheel passes | Texture depth (mm) ³1.2 mmErosion index £5 |
| Wear(*TRL 176 Appendix H*) | Initially | Texture depth ³1.4 mmBPN ³65 |
| After 100,000 wheel passes | Texture depth ³1.1 mmErosion index £ 3BPN ³65 |
| Tensile adhesion(*TRL 176 Appendix* *J*) | Stress at (–10 ± 2)°C | ³1.0 N/mm2 |
| Stress at (+20 ± 2)°C | ³0.5 N/mm2 |

Surface preparation: Treat surface vigorously by either hot chemical application or dry surface abrasive blasting (as determined by a site inspection) to remove dust laitance and other loose material. Wash and scrub the surface with a mild detergent solution to remove any remaining visible oil stains and flush with clean water. Allow surface to dry prior to surface application of the binder. Do not apply binder to surface that has been exposed to rain in the previous 48 hours when the treatment system is used in full lane/carriageway application. Suitably mask all existing utility pit covers and raised pavement markers.

Asphalt surface: Subject newly laid asphalt surface to vehicular traffic for a period of at least 6 weeks prior to surface binder application.

#### Resin binder

General: Use a certified industrial grade thermosetting two component polymer resin binder suitably pigmented to provide the necessary depth of specified colour in the finished surface coating.

Binder properties: Maintain a maximum in service time of 4 hours at an ambient surface temperature of 20°C upon mixing and application of binder to the pavement surface. Comply with Table 4.4 for other material properties.

Table 4.4 – Binder properties

|  |  |  |
| --- | --- | --- |
| Test | Parameter | Requirement |
| Tensile adhesion(*TRL 176 Appendix* J) | Stress at –10 ± 2°C | ³1.0 N/mm2 |
| Tensile adhesion(*TRL 176 Appendix J*) | Stress at 20 ± 2°C | >0.5 N/mm2 |
| Elongation at break(*BS 2782*) | 7 days at 23°C | ³30% |
| Tensile strength(*BS**2782*) | 7 days at 23°C | ³10.5 N/mm2 |

Application: Spray, brush or squeegee binder on to a dry surface at a rate to suit the surface texture and porosity. On a smooth closed textured surface the amount of binder must not be less than what is required to hold the aggregate permanently in position. Use a temperature gauge accurate to ±2°C to measure the temperature of the heated binder components to facilitate the mixing or spray application. Do not exceed the maximum temperature recommended by the manufacturer. Allow heated binders to cool prior to the application of aggregate.

#### Aggregates

Requirement: Provide aggregates that are clean, dry, hard, tough, durable, moderately sharp grains of either natural stone or calcined bauxite, of uniform quality, free of dust, dirt and other deleterious matter.

Grading: Not more than 5% (by weight) is retained on a 3.35 mm A.S. sieve and not more than 5% (by weight) passes a 1.18 mm A.S. sieve.

Frictional characteristics: Achieve a Polished Aggregate Friction Value (PAFV) of not less than 70 as determined by test method AS 1141.41.

Application: After binder application, broadcast aggregates to cover the binder uniformly and to excess, in accordance with manufacturer’s instructions. Do not roll aggregates. Upon initial curing, remove all excess aggregates by a vacuum sweeper or equivalent means.

### Colour

#### General

Colour: Produce surfacing colour to be an approximate match to the specified AS 2700 colour standard. Undertake assessment of colour matching in the test light booth in accordance with the procedure prescribed in AS/NZS 1580.601.1.

#### Local traffic area (LATM) schemes

Permitted colours for threshold treatments on pavement: Red of an approximate match to any of the AS 2700 standard colours ‘R13 Signal Red’ or ‘R14 Waratah’.

Permitted colours for border of threshold treatments on pavement: Yellow of an approximate match to any of the AS 2700 standard colours ‘Y11 Canary’ or ‘Y12 Wattle’ or ‘Y13 Vivid yellow’.

Permitted colours for top of speed platforms: Red of an approximate match to any of the AS 2700 standard colours ‘R13 Signal Red’ or ‘R14 Waratah’.

Permitted colours at median infill: Red of an approximate match to any of the AS 2700 standard colours ‘R42 Salmon Pink’ or ‘R43 Red Dust’ or ‘R52 Terracotta’.

Permitted colour for lettering: White of anequivalent to, or whiter than, the AS 2700 standard colour “Y35 Off White”.

#### On-road Bicycle lanes and Bicycle Shared Zones

Permitted colours: Green to match the preferred AS 2700 standard colour ‘G27 Homebush Green’. To accommodate different materials and varying conditions, an approximate colour match to one of the following three AS 2700 greens is permitted: ‘G27 Homebush Green’ or ‘G13 Emerald’, or ‘G16 Traffic Green’.

Permitted colour for lettering and symbols: White of anequivalent to, or whiter than, the AS 2700 standard colour “Y35 Off White”.

#### Off-road Bicycle facilities

Permitted colours – conflict zone markings: Red of an approximate match to any of the AS 2700 standard colours ‘R13 Signal Red’ or ‘R14 Waratah’ with Yellow border of an approximate match to any of the AS 2700 standard colours ‘Y11 Canary’ or ‘Y12 Wattle’ or ‘Y13 Vivid yellow’.

Permitted colours – on-surface ‘SLOW’ and ‘CAUTION’ markings: Yellow of an approximate match to any of the AS 2700 standard colours ‘Y11 Canary’ or ‘Y12 Wattle’ or ‘Y13 Vivid yellow’ with Red lettering of an approximate match to any of the AS 2700 standard colours ‘R13 Signal Red’ or ‘R14 Waratah’.

Permitted colour for lettering and symbols: White of anequivalent to, or whiter than, the AS 2700 standard colour “Y35 Off White”.

#### Bus lanes

Permitted colours: Red of an approximate match to any of the AS 2700 standard colours ‘R13 Signal Red’ or ‘R14 Waratah’.

Permitted colour for lettering: White of anequivalent to, or whiter than, the AS 2700 standard colour “Y35 Off White”.

#### School Zone Enhanced Treatment

Permitted colours: Red of an approximate match to any of the AS 2700 standard colours ‘R13 Signal Red’ or ‘R14 Waratah’.

Permitted colours for border of threshold treatments on pavement: Yellow of an approximate match to any of the AS 2700 standard colours ‘Y11 Canary’ or ‘Y12 Wattle’ or ‘Y13 Vivid yellow’.

Permitted colour for lettering: White of anequivalent to, or whiter than, the AS 2700 standard colour “Y35 Off White”.

#### Significant Wildlife Conservation Area (SWCA) Thresholds

Permitted colours: Green to match the preferred AS 2700 standard colour ‘G27 Homebush Green’. To accommodate different materials and varying conditions, an approximate colour match to one of the following three AS 2700 greens is permitted: ‘G27 Homebush Green’ or ‘G13 Emerald’, or ‘G16 Traffic Green’.

Permitted colours for border of threshold treatments on pavement: Yellow of an approximate match to any of the AS 2700 standard colours ‘Y11 Canary’ or ‘Y12 Wattle’ or ‘Y13 Vivid yellow’.

Permitted colour for lettering: White of anequivalent to, or whiter than, the AS 2700 standard colour “Y35 Off White”.

#### Decorative streetscape

Not permitted for non-traffic management purposes.

### Application Of Coloured Pavement Treatment

#### Local area traffic management (LATM) schemes (traffic calming)

The correct usage of threshold treatments is to designate a changed road environment where arterial or sub-arterial roads (typically 60km/h or greater) intersect neighbourhood or local access roads (50km/h or less). The intent is to highlight a change of speed limit or road function i.e. movement vs. access. The treatment for the entrance to an LATM consists of a threshold treatment (typically full width of road) of red with a yellow border.

Coloured pavement treatments are also used to delineate the path through a traffic management/calming device. These treatments are the same as used for a threshold treatment, namely red with a yellow border.

Some developments often have threshold treatments where they do not have a traffic management function, i.e. local access road to local access road. These treatments are not to be replaced or reinstalled.

LATM schemes are to be installed in accordance with Brisbane City Council Standard Drawings.

#### Bus lanes and transit lanes

There are special requirements for the installation of bus and transit lanes which use/require a coloured pavement treatment and normal longitudinal markings.

For the installation of bus lane markings, refer to Queensland Department of Transport and Main Roads Traffic Control drawings TC1427.

For the installation of transit lane markings, refer to Queensland Department of Transport and Main Roads Traffic Control drawing TC1244.

#### Bicycle lanes

Coloured bicycle lanes are typically used to delineate specialist bicycle facilities and lanes on the road pavement. They serve to restrict access where there are high levels of interaction between bicycles and other road users, typically at intersections. Coloured bicycle lanes are green in colour.

Associated longitudinal and transverse pavement marking types and dimensions are shown in the AS *1742*, *Queensland MUTCD* and Brisbane City Council Standard Drawings.

For typical longitudinal traffic markings, waterborne paint is preferred for these applications if the thickness tolerance for longlife material cannot be achieved.

A longlife material (other than hot applied thermoplastic) maybe used on high volume roads where excessive wear may occur. Any markings in a longlife material are not to exceed 3mm in thickness. The use of hot applied thermoplastic markings is to be avoided in areas with high bicycle use, particularly when used for bicycle lanes.

Testing has shown that hot applied thermoplastic can be hazardous to bicycles (and motorcycles) due to the potential for water build-up or ponding behind the line which has the potential to contribute to aquaplaning and the potential for low skid-resistance on the surface of the material if an anti-skid material is not applied installation.

On-road bicycle facilities are installed to Austroads Guide to Road Design: Part 6A, Standard Drawing BSD-5104 and DTMR ‘A guide to signing cycle networks’.

#### School Zone Enhanced Treatment

School Zone Enhanced Treatments are installed to alert motorist that they are entering a specialist traffic zone. The School Zone Enhanced Treatment consists of a threshold treatment (either part or full width of road) of red with a yellow border with the legend ‘SCHOOL ZONE’ written across the red section of the threshold.

School Zone Enhanced Treatments are to be installed to Standard Drawing BSD-3167.

#### Significant Wildlife Conservation Area (SWCA) Thresholds

Significant Wildlife Conservation Area (SWCA) Thresholds are be used to identify the start of signed ‘Significant Wildlife Conservation Areas’ (SWCAs). The purpose of threshold treatments is to complement the entry signs into a SWCA and shall bear the words 'WILD LIFE'.

Significant Wildlife Conservation Area (SWCA) Thresholds are to be installed as per *DTMR TC* *Sign TC2321*.

Significant Wildlife Conservation Area (SWCA) Thresholds are to be using a Type 2 Treatment (High Friction Surfacing System).

#### Pedestrian facilities

A coloured pavement treatment may be used at pedestrian facilities to show a clear path or delineation for users. These facilities include pedestrian refuges and pedestrian build-outs at crossings.

Coloured pavement treatments may also be installed to highlight or provide a contrast for pedestrian facilities, for example, a Zebra Crossing.

Pedestrian facilities are to be installed to Standard Drawing BSD-5232, BSD-5258 BSD-5259 and BSD-5260.

#### High friction surface treatments

This treatment is applied to areas or sections of a road that has a history of accidents and/or considered to have a surface with an unacceptable skid level.

While not technically a coloured pavement treatment and not performing a traffic function, these treatments are normally a different colour to the existing road surface and are often very noticeable. They are covered by the same specification as coloured pavement treatments and are often applied by the same suppliers using very similar techniques.

Care has to be taken when considering work on or near these treatments as there installation is considered a safety issue. These materials must be replaced with a like material after maintenance.

#### Installation and re-instatement – coloured pavement treatments

General Requirements

Coloured pavement treatments are only to be installed or re-instated where they serve a traffic management function or as described in this document. Examples include where they are part of a LATM or Traffic Calming Scheme, bus or bicycle lanes, a school zone or pedestrian facilities.

Threshold treatments need to be maintained where local and neighbourhood roads meet arterial, sub-arterial or district access roads as defined in the Road Hierarchy Plan for Brisbane. Treatments will also need maintenance where they delineate the path through a traffic control device or on a speed platform within a controlled area due to wear or following pavement resurfacing.

Where the treatment is to be reinstalled/reinstated, use only with the colours as described in the specification (red with yellow border).

Threshold treatments at local intersections that are clearly defined T-junctions should not require maintenance.

In cases where the threshold is at a T-junction that is not clearly defined, the threshold should be maintained as an indication of intersection priority, that is the threshold is on the terminating road. If there is any doubt, advice should be sought from Road Network officers (Transport and Traffic) for the area. Alternatively the treatment could be replaced with the appropriate intersection treatment with the installation of signage and a Give Way line.

For those cases where the threshold treatment is not to be maintained then the surface treatment should be left to wear off. If necessary, the community will need to be advised where the treatment is not being replaced.

Other Surface Materials

Where treatment is completed in material other than a surface applied material (pavers or concrete), and rehabilitation or replacement is justified, remove existing material and replace with asphalt surface and surface applied coloured treatment. Where road surface requires rehabilitation and replacement of colour surface is not justified, remove and replace with asphalt surface.

If necessary, the community will need to be advised where the treatment is not being replaced