Amendment Register

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| --- | --- | --- | --- |
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| 2.0 | 4.3 | Concrete colour modified | Feb 2015 |
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| 1.3 | Reference list expanded to show all referenced documents |
| 4.0 | General | General Title Altered to ‘Reference Specifications for Engineering Work’ | Nov 2019 |
| 2.3 | Slip resistance classification and methodology updated to current Australian Standard requirements |
| 7.1 |
| 7.6 |

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# GENERAL

## Section Content

Specified in this section: Concrete work for specialist honed concrete footpaths for those localities defined within the Infrastructure Design Planning Scheme Policy.

## Standards

|  |  |  |
| --- | --- | --- |
| ASTM International Standards | ASTM E303-93 | Standard test method for measuring surface frictional properties using the British pendulum tester |
| Australian Standard | AS 1012 | Methods of testing concrete |
| Australian Standard | AS 1379 | Specification and supply of concrete |
| Australian/New Zealand Standard | AS/NZS 1428.4.1 | Design for access and mobility – Means to assist the orientation of people with vision impairment – Tactile ground surface indicators |
| Australian Standard | AS 2758.1 | Aggregates and rock for engineering purposes-Concrete aggregates |
| Australian Standard | AS 3600 | Concrete structures |
| Australian Standard | AS 3610 | Formwork for concrete |
| Australian Standard | AS 3610 Supplement 2 | Formwork for concrete – Commentary (Supplement to AS 3610-1995) |
| Australian Standard | AS 3799 | Liquid membrane-forming curing compounds for concrete |
| Australian Standard | AS 4586 | Slip resistance classification of new pedestrian surface materials |
| Australian Standard | AS 4663 | Slip resistance measurement of existing pedestrian surfaces |
| Australian Standard | AS 4671 | Steel reinforcing materials |
| Australian Standard | AS/NZS 4680 | Hot-dip galvanized (zinc) coatings on fabricated ferrous articles |
| Australian Standard | Handbook HB 197 | n introductory guide to the slip resistance of pedestrian surface materials |
| Australian Standard | Handbook SA HB 198 | Guide to the specification and testing of slip resistance of pedestrian surfaces |
| Australian/New Zealand Standard, International Standards Organization | AS/NZS ISO 9001 | Quality management systems – Requirements |

## References

|  |  |  |  |
| --- | --- | --- | --- |
| Queensland Department of Transport and Main Roads | Test Method | Q704 | Skid resistance – portable pendulum |

Refer to the following other Brisbane City Council Reference Specification for Civil Engineering Works:

|  |  |
| --- | --- |
| S110 | General Requirements |
| S120 | Quality |
| S150 | Roadworks |

## Interpretation

Definitions

Hot weather: Surrounding outdoor shade temperature >32ºC.

# QUALITY

## Quality System

The supplier must maintain a Quality Assurance System with third party accreditation to AS/NZS ISO 9001.

## Inspection

Witness points

Give sufficient notice so that inspection may be made of the following:

* Base or subgrade before covering.
* Membrane or film underlay installed on the base or subgrade.
* Completed formwork, reinforcement and embedments fixed in place.
* Completed scabbled construction joints.
* Commencement of concrete placing.
* Surfaces or elements to be concealed in the final work before covering.
* Evaluation of the finish.

Rejection

Remove rejected concrete from the site.

## Testing

Slip resistance testing

Carry out Wet Pendulum Test slip resistance testing on path surface to AS/NZS 4586 for new surfaces and AS 4663 for existing surfaces. Testing to be undertaken with a British Pendulum test using a Slider 55 (TRL) rubber pad and recorded and presented as a BPN. Refer to Clause 7.1 of this Specification for acceptable slip resistance levels.

Skid resistance testing

Carry out Portable pendulum skid resistance tests (British Pendulum) tests on wet surfaces in accordance with ASTM E303-93 or DTMR  Q704. Skid resistance measurements to be recorded and presented as a BPN. Refer to Clause 7.1 of this Specification for acceptable skid resistance level.

## Contractor’s Submissions

Subcontractors

Concrete: Provide where requested of names and contact details of proposed ready mixed concrete suppliers, and alternative source of supply in the event of breakdown of ready mixed or site mixed supply.

Tests

Dissemination of production information: Provide evidence where requested legible copies of the reports.

Reinforcement: Provide evidence where requested either the manufacturer's certificate of compliance with the relevant standard, or an independent testing authority's test certificates demonstrating compliance.

Materials

General: Provide where requested details of proposed sources of materials.

Execution

Formwork: Provide formwork to sides, construction joints and ends. Class 3 surface finish to AS 3610.

Surface repair method: Before commencing repairs, provide where requested the proposed method.

Concrete: Provide evidence where requested proposals for mixing, placing, finishing and curing concrete including the following:

* Site storage, mixing and transport methods and equipment, if applicable.
* Addition of water at the site.
* Handling, placing, compaction and finishing methods and equipment.
* Temperature control methods.
* Curing and protection methods.
* Target strength, slump and proposed mix for each type and grade of concrete.
* High early strength cement.
* Cutting or displacing reinforcement, or cutting hardened concrete.
* Sequence and times for concrete pours, and construction joint locations.

Sawn joints: Provide evidence where requested the proposed methods, timing and sequence of saw-cutting joints.

Reinforcement changes: Provide where requested the proposed changes, if any, in the reinforcement shown on the drawings, including additional splicing.

Damaged galvanising: If repair is intended, submit proposals.

Ready mixed supply

Delivery docket: For each batch, provide where requested a docket listing the information required by AS 1379, and the following additional information:

* The concrete element or part of the works for which the concrete was ordered.
* The total amount of water added at the plant and the maximum amount permitted to be added at the site.
* The amount of water, if any, added at the site.

# Tolerances

Pavement edges: Shape new pavement surface to match existing features such as pit covers or driveways to within 5 mm.

Absolute level tolerance: ± 25 mm.

Maximum deviation relative to a 3 m straightedge: 5 mm.

Discontinuity in pavement surface levels: For pedestrian areas 1.5 mm.

Maximum deviation of edge from design alignment: 25 mm.

Width: - 0 mm, + 35 mm.

Thickness: - 5 mm, + 30 mm.

Maximum deviation from a 3 m straightedge placed on surfaces required to be straight: 10 mm.

Drainage: All surfaces must be free draining.

# MATERIALS

## Concrete

Generally

Strength: All concrete to N32.

Cement content: All mixes must contain a minimum mass of portland cement equal to 60% of the total mass of cementitious material.

Aggregates: Maximum water absorption 2.5%. Durability assessment method to be wet strength and wet/dry strength variations.

Accelerants: Maximum addition of accelerants to be 2%. To be agreed with relevant Council delegate. Provide a delivery docket where requested.

Admixtures: Do not use calcium chloride as an admixture. The total alkali contribution (measured as Na2O equivalent) of all admixtures used in mix must not exceed 0.20 kg/m3.

Plastic cracking: Design the concrete mix to minimise plastic settlement and shrinkage cracking.

Ready mixed supply

Method: Use the batch production process. Deliver in agitator trucks.

Addition of water: Obtain approval from the relevant Council delegate before adding water at site.

Elapsed delivery time: Elapsed time between the wetting of the mix and the discharge of the mix at the site must not exceed the criteria specified in *Clause 4.2* of this Specification.

## Elapsed Delivery Time

Do not exceed the following maximum elapsed times for the corresponding concrete temperatures at the time of discharge:

* Temperature <24°C: 2.0 hours.
* Temperature 24 – 27°C: 1.5 hours.
* Temperature 27 – 30°C: 1.0 hour.
* Temperature >30°C: 45 minutes.

## Concrete Type

Specialist surface concrete

Style: Terracrete

Concrete Colour: CCS Liquorice

Aggregate Mix: 90% ‘Blue Heeler’ (or demonstrated equivalent) with 10% ‘Winter Brown’ (or demonstrated equivalent).

Nominated supplier is Hanson concrete or approved equivalent.

## Concrete Thickness

Footpaths: Minimum 125 mm thick, 50 mm minimum cover to reinforcement. Refer to Brisbane City Council Standard Drawing BSD-5202 for detail.

Driveways: Minimum 180 mm thick, 50 mm minimum top cover to reinforcement as per minimum vehicle crossing Type ‘B1’ to Brisbane City Council Standard Drawings BSD-2021.

## Reinforcement

General

Extent: Provide reinforcement, including tie wires, support chairs, spacers and accessories.

Reinforcing type: Driveways – Minimum SL92 (as for minimum vehicle crossing Type ‘B1’ as per Brisbane City Council Standard Drawing BSD-2021);

Footpaths – Minimum SL72 for, or as per the design drawings.

Identification: Supply reinforcement that is readily identifiable as to grade and origin.

Dowels

Standard: To AS 4671 grade 250R.

General: Provide each dowel galvanised and in one piece, straight, with square cut ends free from burrs. Heavily grease or bitumen coat one half and fit an expansion cap to that end.

Tolerances: Location to ± half the diameter of the dowel, alignment 2 mm in 300 mm.

Fixing reinforcement

General: Secure the reinforcement against displacement by tying at intersections with either annealed iron 1.25 mm diameter (minimum) wire ties, or clips. Bend the ends of wire ties away from nearby faces of forms so that the ties do not project into the concrete cover.

Provision for concrete placement

Notice: If spacing or cover of reinforcement does not comply give notice.

Reinforcement supports

General: Use approved plastic bar-chairs. The shape of the chairs shall be such that minimum obstruction is offered to the formation of a homogenous concrete both within and around the chairs. Tubular or cylindrical chair types are not acceptable. Precast concrete or metal chairs shall not be used. Layers of reinforcement shall be separated by the use of approved bar spacers.

Supports over membranes: Prevent damage to waterproofing membranes or vapour barriers. Place a metal or plastic plate under each support to prevent puncturing.

Support spacing: Bars ≤60 diameters, fabric ≤750 mm.

# PLACING AND CURING

## Placing

General: Use placing methods that minimise plastic settlement and shrinkage cracking. Place concrete without segregation.

Placing slabs and pavements: Place concrete uniformly over the width of the slab so that the face is generally vertical and normal to the direction of placing.

Horizontal movement

Use suitable conveyors, clean chutes, troughs or pipes.

Rain

Do not expose concrete to rain before it has set, including during mixing, transport or placing.

Sequence of pours

Minimise shrinkage effect by pouring the sections of the work between construction joints in a sequence such that there will be suitable time delays between adjacent pours.

Compaction

General: Remove air bubbles and fully compact the mix.

Method: Vibrate with a poker vibrator, particularly around edges to remove all voids within the concrete. Ensure the process is monitored so that it is not done in excess otherwise coloured aggregates will not show up near surface when honed.

Vibrators: Do not allow vibrators to come into contact with partially hardened concrete, or reinforcement embedded in it. Do not use vibrators to move concrete along the forms.

Finishing operations: Use methods to provide a dense surface free from visible surface cracking. Rework concrete surface as necessary to eliminate plastic cracking after the initial set has taken place and before the commencement of curing.

Placing records

Keep on site and make available for inspection a log book recording each placement of concrete, including the following:

* Date;
* The portion of work;
* Specified grade and source of concrete;
* Slump measurements;
* Volume placed.

## Curing

General

Protection: Protect fresh concrete, during the curing period, from premature drying and from excessively hot or cold temperatures.

Note: Accelerants are generally not be used unless there is prior agreement obtained from relevant Council delegate.

Curing period: Cure continuously until the total cumulative number of days or fractions of days, during which the air temperature in contact with the concrete is above 10ºC, is at least 7 days.

Polythene sheet

Must be of sufficient strength to withstand wind and foot traffic. Do not use torn or punctured sheets. Provide laps not less than 300 mm. Seal or hold down edges and laps. Daily spray water under sheeting edges and laps. Use clear sheeting if coloured sheeting causes desiccation of the concrete.

## Protection

Loading

Notice: Give notice before loading the concrete.

Protection: Protect the concrete from damage due to premature loading, heavy shocks and excessive vibrations, particularly during the curing period.

Surface protection

Protect finished concrete surfaces from damage.

## Cement Contamination

Protection: Water contaminated with cement must not enter the drainage system of the drip zone of any tree.

Clean up: Remove any material contaminated with cement from site and dispose of in accordance with relevant legislation and standards.

# JOINTS

## General

Joint locations and setout are to comply with the requirements shown in Brisbane City Council *Standard Drawings BSD-5206 and BSD-5207*. Typically provide an isolation joint along the length of the kerb and along the length of theprivate property interface with all expansion and contraction joints are to align with the decorative joint pattern.

Contraction joints are to be cut 4-12 hours after layng of concrete.

Where the footpath is to be constructed in two stages, to allow half of the footpath to remain open for pedestrian use, a contraction joint is to be installed to coincide with the centre longitudinal sawcut of the footpath.

Spacing: Space to match service pits and other discontinuity in cross-section.

## Joint Types

Sawn joints/pattern: Pattern and depth of sawn joints as per the relevant standard drawings. Saw cut joints to 15 mm depth and 2-3 mm wide. Refer to Clause 7.3 of this Specification for detail.

Contraction or shrinkage control joints: Contraction joints to align with the decorative saw-cut pattern. Unless specified otherwise, maximum spacing in unreinforced or nominally reinforced concrete is 4 m. Wet saw cut joints 4-12 hours after finishing to at least one-third depth and 6 mm wide.

Construction joints: Locate at contraction or expansion joints. Do not relocate or eliminate construction joints, or make construction joints not shown on the drawings. This includes unplanned construction joints. Make suitable contingency plans for equipment or plant failure. Roughen and clean the hardened concrete joint surface, remove loose or soft material, free water, foreign matter and laitance. Dampen the surface just before placing the fresh concrete. Butt join the surfaces of adjoining pours. In visually important surfaces, make the joint straight and true, and free from impermissible blemishes relevant to its surface finish class.

Expansion joints: Expansion joints to align with the decorative saw-cut pattern. Unless specified otherwise, the maximum spacing in un-reinforced or nominally reinforced concrete is 12 m. Provide additional expansion joints between the concrete slab and abutting edge restraints. Form joints with full depth 10 mm closed cell close linked polyethylene foam 85-150 kg/m3 (with 10 mm removable top section) securely taped to the end form. Seal surface of joint with a suitable polyurethane sealant.

Isolation joint: A joint without keying, dowelling, or reinforcement, which imposes no restraint on movement.

# concrete surface finish

## General

Slip resistance

New/untrafficked external surfaces (<1 in 20): classified as Class ‘P5’ (>44 Mean BPN using a Slider 55 (TRL) rubber pad) to *AS 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 15 years.

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

Skid resistance

The skid resistance requirement for vehicle driveways and other vehicle trafficable areas is specified in Table 7.1. Maintain the minimum skid resistance values for the duration of the product guarantee period.

Table 7.1 - Minimum skid resistance value

|  |  |
| --- | --- |
| Location | Minimum skid resistance value\* (BPN) |
| Vehicle Driveways | 45 |
| Other Trafficable Areas# |

\* 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.

# Other trafficable areas within the verge or footpath area, including dedicated bike and declared shared paths. Does not include the dedicated road pavement or traffic lanes.

Table 7.1 – Minimum enduring skid resistance values

Level tolerance

Finish slab surfaces to finished levels, to tolerances specified in Clause3.0 of this Specification.

## Honed Concrete Surface Finish

The minimum time period between pouring concrete and honing is 7 days. This curing period ensures aggregates are not dislodged when the honing is done.

Honing Method

Grit size to achieve slip resistance as described in Clause7.1 of this Specification (inclusive of application of specified sealer).

Honing shall be undertaken prior to the decorative saw-cutting. Refer to Clause7.3 of this Specification for detail.

Note: Contraction joints shall be cut into the newly laid concrete 4-12 hours after laying of concrete and prior to honing.

Equipment: Honing shall be undertaken as a dry process grind with dust extraction. The machine used to undertake the work shall be capable of grinding heavily without use of water.

The honing machines used to undertake Council installations of honed concrete are Husqvarna 820 mm and 680 mm wide honing machines. These machines are 3-phase 32-Amp powered Triple Head Planetary action with variable speeds on both the planetary and the grinding discs. The type of machine used to undertake honing work on public footpaths should be capable of equalling the finish outcome of these machines.

Note: Footpaths and driveways are to be honed.

Concrete sealer

Apply a penetrating/impregnating concrete sealer to the surface once full curing has been achieved and honing and decorative saw cutting has been completed. Chosen sealer to be applied in accordance with manufacturers specifications. Proprietary examples of appropriate sealers include, but are not limited to the following products:

* ProGlo Professional Seal;
* Concrete Colour Systems (CCS) Streetscape Sealer;
* BASF Materseal 333

Other sealers maybe considered for approval subject to approval by the relevant Council delegate.

## Decorative Saw-cutting

Decorative saw-cutting is to be done as a dry process with a soft cut machine (with dust extraction). Cuts are to be generally to a depth of 15 mm. Width of cuts is to be 2-3 mm (generally the width of the soft cut blade).

All saw cuts shall be carried out in accordance with the pattern described in Brisbane City Council Standard Drawings BSD-5001 and BSD-5207. All cuts shall be straight and meet at the described junctions.

Decorative saw-cuts are to be discontinued at driveways, kerb ramps and in areas such as, but not limited to, bus stops where tactile indicators are required. Refer Brisbane City Council Standard Drawings BSD-5207 for detail.

## Kerb Ramps

Kerb ramps shall be plain grey concrete with a broom finish and constructed in accordance with Brisbane City Council Standard Drawing BSD-5231.

## Street Furniture

Drilling of fixing holes and points for street furniture is to be undertaken at the same time as the decorative saw cutting, prior to honing and concrete sealing of finished surface.

Installation of street furniture and associated fixings is to be delayed until after honing and concrete sealing operation has been completed.

## Tactile Ground Surface Indicators (Hazard & Directional)

The chosen tactile markers shall comply with AS/NZS 1428.4*.1*.

Style

For kerb ramp and driveway locations, tactile indicators shall be supplied and installed in accordance with Brisbane City Council Standard Drawings BSD-2021, *BSD-5206*, and BSD-5231.

For bus stop locations, tactile indicators shall be supplied and installed in accordance with Brisbane City Council Standard Drawings BSD-2101, BSD-2102, BSD-2103, BSD-2104, BSD-2105, BSD-2106, BSD-2107, BSD-2108, BSD-2109, *BSD-2110 BSD-2111 and BSD-5207*.

For directional trails (*‘Braille Trails’*), tactile indicators shall be supplied and installed in accordance with Brisbane City Council Standard Drawing BSD-5217.

Construction

Tactile indicators shall be installed in accordance with Brisbane City Council Standard Drawing BSD-5218.

Material

The tactile indicators shall be 300 mm x 300 mm x 40 mm thick cast concrete paving units, manufactured using wet cast technology.

Tolerances:

Thickness: ±2.5 mm.

Size: ±3.0 mm.

Strength

Minimum concrete compressive strength: 40 MPa

Characteristic breaking load: 5 kN

Characteristic flexural strength: 3 MPa

Breaking load and flexural strength characteristics measured at 28 days.

Sealing

The tactile indicator paving units are to be sealed utilising the same method as that of the honed concrete surface.

Colour

The tactile indicators shall be Black (CCS ‘Voodoo’ or equivalent).

Colour specifics: Oxide – Concrete Colour Systems (CCS) Voodoo 8%

 Cement – Grey

Slip resistance

The tactile indicators are to achieve minimum R12 (Oil-Wet Ramp Test) or Class ‘P5’ (Wet Pendulum Test) slip resistance rating when tested according to the methods in AS 4586.

Installation

The tactile indicator paving units are to be installed prior to sealing of the concrete.

Pit lids

Where the installation of tactile indicators is in conflict with pit lid locations, they will be assessed on a site-by-site basis.

Other surface finishes

Where the installation of tactile indicators abuts or continues to another surface type, the type and colour will be assessed on a site-by-site basis.