# BRISBANE CITY COUNCIL

# REFERENCE SPECIFICATIONS FOR ENGINEERING WORK

# S320 LAYING OF ASPHALT

## AMENDMENT REGISTER

|  |  |  |  |
| --- | --- | --- | --- |
| Ed/Rev Number | Section Number | Description | Date |
| 1.0 |  | Original issue | Oct 2001 |
| 2.0 |  | Specification reviewed | Apr 2014 |
| 3.0 | 1.2 and 1.3 | Cross and External References Updated and Corrected | May 2016 |
| Table 3.1 | NAASRA roughness counts – Change references to pavement types to City Plan 2014 classifications |
| 4.0 | General | Document name changed from ‘Reference Specifications for Civil Engineering Work’ to ‘Reference Specifications for Engineering Work’ | Mar 2021 |
| 1.3 | References to Reference Specifications updated. |
| 3.0 | Terminology relating to kerb and channel/gutter’ updated. |
| Roughness section expanded and International Roughness Index requirements included. |
| Table 5.1 | Nominal aggregate size for Type 3 mix corrected. |
| 5.3 | Compaction temperature when Warm Mix Additive used |

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## GENERAL

### Section Content

Transport and laying of hot mix asphaltic concrete, including preparation of the base surface.

### Standards

|  |  |  |
| --- | --- | --- |
| Australian Standard | AS2891.1.2 | Methods of sampling and testing asphalt – Sampling – Coring method |
| Australian/New Zealand Standard | AS/NZS2891.2.1 | Methods of sampling and testing asphalt – Sample preparation – Mixing, quartering and conditioning of asphalt in the laboratory |
| Australian/New Zealand Standard | AS/NZS 2891.2.2 | Methods of sampling and testing asphalt – Sample preparation – Compaction of asphalt test specimens using a gyratory compactor |
| Australian/New Zealand Standard | AS/NZS2891.7.1 | Standard: Methods of sampling and testing asphalt – Determination of maximum density of asphalt – Water displacement method |
| Australian Standard | AS2891.9.2 | Determination of bulk density of compacted asphalt – Presaturation method |
| 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 | N04 | Compacted Density of Asphalt |
| Queensland Department of Transport and Main Roads | Test Method | Q303A | Preparation of asphalt core samples |
| Queensland Department of Transport and Main Roads | Test Method | Q303B | Preparation of asphalt mix from a core sample |
| Queensland Department of Transport and Main Roads | Test Method | Q306C | Compacted density of asphalt – silicone sealed |
| Queensland Department of Transport and Main Roads | Test Method | Q708B | Road roughness – surface evenness – two laser profilometer |
| Queensland Department of Transport and Main Roads | Test Method | Q708C | Road roughness – surface evenness – static level and staff |

Refer to the following Reference Specifications for Engineering Work:

|  |  |
| --- | --- |
| S110 | General Requirements |
| S120 | Quality |
| S150 | Roadworks |
| S310 | Supply of Dense Graded Asphalt |
| S330 | Sprayed Bituminous Surfacing |
| S335 | Emulsion Surfacing Treatment |
| S336 | Micro Surfacing Treatment |

## QUALITY

### Quality System

The supplier must maintain a Quality Assurance System with third party accreditation to *AS/NZS* *ISO* *9001*. The supplier must notify the Contractor or Superintendent within two days of becoming aware that process control tests relevant to the work have fallen outside the specified limits.

### Inspection

**Witness points**

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

* Materials or areas ready for tests.
* Testing including any rolling pattern trial.
* Each pavement layer placed and compacted.
* Automatic level control devices in place.
* Surfaces prepared for tack coating, priming, sealing or surfacing.
* Commencement of asphalt surfacing.

### Tests

General

Methods: Use the specified Australian Standard or Queensland Department of Transport and Main Roads (DTMR) test methods.

Testing authority: Use a testing facility registered by NATA for the test required.

Process control

Perform sampling and testing of the type and frequency necessary to adequately control the work. Comply with the minimum requirements of *Reference Specification* *S120 Quality, Clause 7.1*. *Refer annexure*.

Compliance (acceptance) tests

The Contractor or the Superintendent may carry out compliance testing using a testing laboratory registered with NATA for the particular test.

### Contractor’s Submissions

Test program

On request, submit details of the supplier's inspection and test program covering all specified properties of the materials. On request, submit details of recent test results demonstrating sustained compliance of the work and similar work with the required properties. *Refer annexure*.

Deliveries

Delivery docket: Submit a delivery docket at the time and place of delivery for each truckload of material showing:

* Empty and loaded mass of the vehicle.
* Date and time of dispatch.
* Supplier and location of mixing plant.
* Registration number of the vehicle.
* Size and type of asphalt mix.
* Class of binder.
* Temperature of load at mixing plant.
* If required, laboratory stamp or other evidence certifying compliance with the specified properties.

Laying program and rolling pattern

On request, submit laying program and rolling pattern prior to commencement of work. *Refer annexure*.

## TOLERANCES

General

Sampling frequency: In accordance with *Reference Specification S120 Quality, Clause 7.1*.

Conformance criteria: In accordance with *Reference Specification* *S120 Quality, Clause 7.2*.

Finished surface level

General: Provide a finished surface that is free draining and evenly graded between level points.

Edges abutting kerb and channel: Within + 5 mm or flush with the level of the actual lip of channel.

Crossfall: Measure crossfall between any two points more than 2 m apart transversely to the centreline. Do not depart from the corresponding design crossfall by more than 0.2% absolute. Maintain positive drainage slope towards pavement drainage system.

Primary vertical tolerance: +10 mm, -0 mm at any point on the surface layer.

Deviation from a 3 m straightedge: Maximum 5 mm except where due allowance for design shape dictates otherwise.

Horizontal surfaces

Absolute tolerance: ±50 mm, except where alignment with an existing road structure is necessary. Join new construction to the existing work in a smooth manner.

Roughness

Definition: Roughness is a measure of ride quality or smoothness of a road surface. The vertical irregularities in the longitudinal profile of a road are assessed in terms of the displacement of a standard test vehicle relative to the axle as the vehicle travels over the surface at a standard speed. Roughness is reported by either of two methods:

* The International Roughness Index (IRI) is a mathematical model of the dynamic response of a real motor vehicle travelling along a single wheel path (or wheel track) of longitudinal road profile, referred to as the quarter-car (or World Bank) model. The IRI is expressed in terms of accumulated displacement of the simulated suspension in metres per measured kilometre (m/km).
* The NAASRA Roughness Meter has been the standard mechanical device used extensively in Australia and New Zealand since the 1970’s for measuring road roughness by recording the upward movement of the rear axle of a standard station wagon relative to the vehicle’s body as the vehicle travels at a standard speed along the road being tested. A cumulative upward vertical movement of 15.2 mm corresponds to 1 NAASRA Roughness Count. NAASRA Roughness is reported as Counts/km.

Requirements: Achieve target surface roughness of the final pavement layer to within the values specified in Table 3.1. Do not exceed the maximum limits specified in Table 3.1 for new construction and pavement rehabilitation work. *Refer annexure*.

Test method: *DTMR Q708B or DTMR Q708C*.

Test lot: Minimum length 100 m, maximum length 500 m.

Table 3.1 – Roughness counts

| Road classification | Target | Maximum limit – new construction | Maximum limit – after rehabilitation |
| --- | --- | --- | --- |
| IRI | NAASRA | IRI | NAASRA | IRI | NAASRA |
| Local road | £2.7 | £70 | 4.2 | 110 | 5.0 | 130 |
| Neighbourhood road | £2.7 | £70 | 3.4 | 90 | 4.2 | 110 |
| District road | £2.3 | £60 | 3.4 | 90 | 4.2 | 110 |
| Suburban road | £2.3 | £60 | 3.4 | 90 | 4.2 | 110 |
| Primary freight access routes | £2.3 | £60 | 3.8 | 100 | 4.6 | 120 |
| Primary freight routes | £1.9 | £50 | 2.7 | 70 | 3.4 | 90 |
| Arterial road | £1.9 | £50 | 2.7 | 70 | 3.4 | 90 |
| Motorway | £1.9 | £50 | 2.7 | 70 | 3.4 | 90 |

## PREPARATION

### Cleaning

Immediately before priming or tack coating remove loose stones, dust and foreign material from the base surface or existing surfacing using a power broom or blower. Keep traffic off the cleaned surface.

### Protection

Protect adjacent surfaces (such as kerbs, driveways, etc.) during spraying of bituminous material. Protect freshly sprayed surfaces from contamination. Where required, clean adjacent surfaces or replace and make good.

### Priming And Primer Sealing

Prime or primer seal the granular base before any asphalt is placed, generally in accordance with the requirements of *Reference Specification* *S330 Sprayed Bituminous Surfacing, Clause 6.6* and *Clause 6.7*.

### Potholes

Trim to a regular shape and a uniform depth of at least 75 mm. If there are apparent signs that the pothole is a direct result of structural performance of the pavement (i.e. depression, total disintegration, etc.) investigate the cause and identify suitable depth of replacement accordingly. The depth should be selected in line with the allowable maximum thickness of the applied asphalt mix. Tack coat the edges and bottom, and patch with asphaltic concrete.

### Cold Planing

Definition: Cold planing, or profiling, is the controlled milling of pavement surfaces using a revolving drum, having spirally set teeth, incorporated in a heavy self-propelled unit.

Planning: Prepare for resurfacing by cold planing the pavement surface. Determine job requirements such as area, depth of cut, and location of services (pit covers and the like).  *Refer annexure*.

Correcting pavement shape: Take out ruts, bumps, depressions or other uneven areas of the pavement to allow a uniform thickness of the new asphalt surface to be placed.

Deteriorated asphalt surfacing: Remove old asphalt which is fatty, bleeding, ravelling, cracked or otherwise deteriorated, prior to placing new surface.

Slope and camber: If required, correct the slope or crossfall of a pavement.

Edge planing: Remove asphalt adjacent to kerb and channel or adjoining asphalt surfaces to enable asphalt to be placed without creating height differences and to produce a smooth riding pavement joint.

Texturing: Where asphalt resurfacing is to be placed in areas of high shearing stresses, such as roundabouts and intersections, cold plan to provide a well textured surface to create a strong bond to the new surface.

Edge ramps: Where the cold planed surface is open to traffic and where the change in level exceeds 30 mm, provide suitable edge ramps by placing asphalt wedges. Limit the maximum slope for longitudinal edges to 1V in 5H. Limit the maximum slope for transverse edges to 1V in 10H for low speed roads and 1V in 20H for roads with traffic speeds over 75 km/h.

### Tack Coating

Tack coat: A light application of bitumen emulsion (for example 3 parts bitumen to 2 parts water, by volume or weight) on or against existing asphalt, concrete or sealed surfaces, to promote the adhesion of subsequent asphalt layer to that surface. Select bitumen emulsion type in line with the required residual bitumen on the surface.

Timing: Apply tack coat 30 - 120 minutes before asphalt surfacing is placed. If the pavement structure consists of a number of asphalt layers and where the elapsed time exceeds 3 days between the construction of these layers, apply tack coat between the asphalt layers.

Application: Cover the surface uniformly at an application rate of 0.10 - 0.30 L/m2 of residual bitumen. Vary rate to suit the site conditions. *Refer annexure*.

## PLACING AND COMPACTION

### Preliminary Trial

Requirement: Where directed, carry out a trial of the procedure for the laying operations if the rate of laying asphalt exceeds 60 tonnes per hour. *Refer annexure*.

Trial section: Site area of not less than 1000 m2. Determine the rolling pattern and the number of roller passes to achieve an acceptable compacted layer.

Rolling pattern: Do not vary the established rolling pattern without prior approval of the Superintendent.

### Placing

Weather restrictions

Weather: Place asphalt surfacing on a pavement surface that is essentially dry and free of any surface water. Do not place asphalt during periods of heavy or continuous rain or when rain is likely to fall during the laying and compaction of asphalt.

Temperature and wind speed: Low pavement temperature and high wind speed adversely affects the compaction of thin layers of asphalt. If the pavement temperature falls below 25°C and wind speed exceeds 25 km/h, supply at least one additional roller and/or increase the asphalt discharge temperature within the specified limits.

Discharge temperatures

Discharge temperature: Temperature of asphalt at the time of discharge from the delivery vehicle into the receiving hopper of the paver. Vary the discharge temperatures to suit:

Layer thickness ≤40 mm: Maintain discharge temperature range 135 - 175°C.

Layer thickness >40 mm: Maintain discharge temperature range 125 - 175°C.

Mechanical placement

Paver operation: Commence asphalt placement immediately following discharge of the asphalt into the receiving hopper. Adjust operating speed of the paver to achieve continuous asphalt laying to the maximum practicable extent. Do not leave spreader box in contact with the previously laid asphalt for any prolonged periods whilst awaiting asphalt delivery. Do not allow asphalt to segregate or to accumulate along the sides of the receiving hopper. Achieve uniform appearance with no evidence of segregation in the finished mat.

Laying pattern: Lay the main paving runs first. Plan the placing operation to minimise the number of joints.

Layer thickness: Comply with the limits specified in Table 5.1 when selecting target thickness of each layer chosen to suit the construction process and the thickness of the compacted asphalt course.

Table 5.1 – Layer thickness limits

| Mix type | Nominal aggregate size*(1)* | Compacted layer thickness |
| --- | --- | --- |
| Structural layer | Surfacing layer |
| Minimum thickness (mm) | Maximum thickness (mm) | Minimum thickness (mm) | Maximum thickness (mm) |
| Type 1 | 5 mm | Not suitable | Not suitable | 15 | 25 |
| Type 2 | 10 mm | Not suitable | Not suitable | 30 | 40 |
| Type 3 | 14 mm | 50 | 80 | 50 | 60 |
| Type 4 | 35 mm | 70 | 100 | Not suitable | Not suitable |

*(1) Designation for a mix chosen to give an indication of the largest particle present; DTMR mixes are defined in a different way.*

Hand spreading

Execution: Take asphalt directly from the receiving hopper (or other approved location), distribute immediately into place using shovels, spread to the required loose depth using metal rake or board rakes (lutes), and roll immediately. Remove segregated large aggregates from the surface before commencing rolling.

Limitations: Confine hand spreading operations to the correction of minor surface irregularities, to work on or very close to drainage channels, to work in tapers, and to work in other areas normally inaccessible to pavers.

### Compaction

Execution

Surface preparation: Before commencing compaction, correct promptly any irregularities in line or level. Trim lane edges to a straight line.

Compaction: Compact asphalt surfacing uniformly as soon as it will support rollers without undue displacement.

Rolling temperatures: At the commencement of rolling, maintain minimum mix temperatures of 115°C (for layer thickness ≤40 mm) and 105°C (for layer thickness >40 mm). Vary the rolling temperatures to suit. Complete rolling while the mix temperature is above 95°C.

Where a warm mix asphalt additive is included in the mix design and it is proposed to use a lower temperature than that specified above, submit evidence to demonstrate the suitability of the temperature to be adopted.

Surface finish: Provide a surface uniform in appearance and free from depressions in which water can lie.

Testing

Test methods: Perform a field bulk density test for each test site using one of the following methods.

* Core sampling of the asphalt layer in accordance with *AS 2891.1.2* (dry coring), *AS 2891.9.2* *DTMR Test Methods Q303* (preparation of cored sample) and *Q306C*. *DTMR Test Method Q306B* must not be used for samples taken from areas within the pavement that are coarsely segregated or poorly compacted. *DTMR Test Method Q306C* must be used for these areas.
* In situ density measurement using a nuclear gauge (non-destructive measurement method) in accordance with *DTMR Test Method N04*. At least 6 core samples in a test lot must be taken for the purpose of field calibration and validation. For nominal layer thickness less than 50 mm, use a thin layer nuclear gauge only. *Refer annexure*.

Sample preparation: According to *AS/NZS 2891.2.1, AS/NZS 2891.2.2* or *DTMR Test Methods Q303A* and *Q303B*.

Mix maximum density: According to *AS 2891.7.1.*

Compaction standard: Achieve minimum and maximum characteristic values as specified in *Reference Specification* *S120 Quality, Clause 7.1*.

### Joints

General

Planning: Plan the placing to minimise the number of joints. Locate joints in areas of least stress, away from traffic wheel paths. Make joints that are well bonded and sealed and provide a smooth riding surface across the joint.

Hot joints: The technique is feasible when using two pavers in echelon or very short paving runs. Do not expose edges for more than 15 minutes. Form exposed edges of each spreader run while hot to a straight line with a dense face inclined between vertical and 45°. Leave the outer 100 - 200 mm of the first paver run uncompacted until the adjoining asphalt is placed. Roll over to achieve a seamless joint.

Warm joints: Lay adjoining run with the uncompacted asphalt overlapping the previously laid run by between 25 mm and 75 mm. Prior to rolling, push back the overlapping material to the line of the joint to form a ridge along the edge of the newly laid asphalt.

Cold joints: Form clean and straight joint by employing appropriate machine cutting or hand cutting methods. For long lengths, trim back joint by sawing or using a cutting wheel (trimming angle of 45° or 60°) mounted on a piece of heavy equipment such as a steel wheel roller. Jack hammering may be suitable for small areas. Apply tack coat on the cut edges before placing the adjoining asphalt.

Longitudinal joints

General: Construct a longitudinal joint parallel to the pavement centreline if the width of the pavement is such that more than one paving run is necessary.

Location: In multiple layer work, offset joints in successive layers by at least 100 mm, except for longitudinal joints on a crowned pavement. Position longitudinal joints in the wearing course to coincide with the line marking.

Transverse joints

General: Construct a transverse joint after the completion of a day’s paving operation or where a delay in the paving operation allows material temperature to fall below 90°C or where the paving operation is stopped for more than 20 minutes.

Location: Construct to a straight vertical face for the full depth of the layer, and offset in adjoining spreader runs and layer to layer by at least 2 m.

Temporary ramps

Provide temporary asphalt ramps down to the level of the adjacent road surface if traffic is required to run on the new asphalt work at the end of a day’s laying operations. Construct ramp to provide safe passage for traffic at the allowable speed limit; requirements for ramps are discussed in *Section 4.5*, Cold planing. Cut ramp back to from a transverse joint prior to laying the adjoining run.

Abutting structures

Place asphalt surfacing to match the level of abutting surfaces such as kerbs, gutters, edge strips, manholes, or adjoining pavement in the same manner as for longitudinal and transverse joints. Fill spaces left unfilled between the spreader run and abutting edges with sufficient material to the proper height before compaction. Where an existing service pit requires raising at a later date, cover the pit temporarily with a suitable separation fabric (such as hessian bags) during the spreader run. Remove separation fabric before reconstructing the service pit.

Matched junctions

General: If asphalt surfacing is to match an existing pavement, bridge deck, rail or other fixture, place the material to provide a smooth riding surface across the junction. Where necessary, remove sufficient of the existing pavement for this purpose. Where it is necessary to taper the thickness of a layer to provide a smooth riding junction, terminate the layer at a chase cut into the existing pavement 20 mm deep and 400 mm wide. Where necessary, remove coarse particles from a layer of tapering thickness using hand raking.

Tack coat: Where the thickness of the layer tapers to less than twice the nominal size of the mix, tack coat the area upon which material of such thickness is to be placed.

Surface finish

Provide a surface uniform in appearance and free from depressions.

### Defective Surfacing

Rejection

Extent: Remove areas of rejected asphalt surfacing, including defective joints and finish, to the full depth of the layer, and replace with complying surfacing.

Joints: Treat edges of remedial work as specified for cold joints.