B6: Roadways

Construction
# Table of Contents

6.1 **Scope** .................................................................................................................. 1

6.2 **Standards and Guidelines** ................................................................................... 1

6.3 **Materials** .............................................................................................................. 4

6.3.1 Base and Subbase Materials ................................................................................ 4

6.3.2 Asphalt Concrete .................................................................................................. 4

6.3.2.1 Sustainable Materials in Asphalt .................................................................. 4

6.3.2.2 Asphalt Concrete Warm Mix Asphalt ......................................................... 5

6.3.3 Stone Setts ............................................................................................................ 5

6.3.3.1 Mortar for Stone Setts .................................................................................. 6

6.3.3.2 Use of Latex Admix for Stone Setts .............................................................. 6

6.3.4 Unit Pavers ........................................................................................................... 6

6.3.4.1 Fired Clay Paving Units .............................................................................. 6

6.3.4.2 Concrete Paving Units .................................................................................. 7

6.3.4.3 Bedding Sand ................................................................................................ 8

6.3.4.4 Jointing Sand ................................................................................................ 9

6.3.4.5 Expansion Jointing ....................................................................................... 9

6.3.4.6 Bedding Mortar for Pavers .......................................................................... 9

6.3.5 Concrete ............................................................................................................... 10

6.3.6 Paint for Asphalt ................................................................................................ 10

6.3.7 Inlaid Thermoplastic Paint ................................................................................. 10

6.3.8 Recycled Material ............................................................................................... 10

6.3.9 Sampling and Testing of Course Material .......................................................... 10

6.3.10 Sampling and Testing of Bedding Mix ............................................................... 10

6.4 **Construction** ....................................................................................................... 12

6.4.1 Road Classification ............................................................................................... 12

6.4.1.1 Medium to Heavy Traffic ......................................................................... 12

6.4.1.2 Light to Medium Traffic .......................................................................... 12

6.4.2 Preparation of Sub-grade ................................................................................... 12

6.4.3 Preparation of Base Course Layers ................................................................... 12

6.4.4 Flexible Road Pavement ...................................................................................... 13

6.4.4.1 Flexible Road Pavement Structure, Material Types and Minimum Layer Thicknesses .................................................. 13

6.4.4.2 Reinstatement of Flexible Road Pavement .................................................. 13

6.4.5 Rigid Road Pavement .......................................................................................... 13

6.4.5.1 Rigid Road Pavement Structure, Material Types and Minimum Layer Thicknesses .................................................. 13

6.4.5.2 Reinstatement of Rigid Road Pavement ....................................................... 13

6.4.5.3 Concrete Road Pavement Joints ................................................................... 13

6.4.5.3.1 Longitudinal Construction Joints ............................................................... 13

6.4.5.3.2 Transverse Construction Joints ................................................................. 14

6.4.5.3.3 Transverse Expansion Joints ................................................................. 14

6.4.5.3.4 Transverse Contraction Joints ................................................................. 14

6.4.5.3.5 Longitudinal Contraction Joints ............................................................... 14

6.4.5.3.6 Sawn Contraction Joints ........................................................................... 14

6.4.5.3.7 Joint Tolerances ....................................................................................... 15

6.4.5.3.8 Joint Sealing ............................................................................................. 15

Version 4: June 2016
6.4.6 Construction of Stone Roads ................................................................. 15
6.4.6.1 Laying of Stone Setts in General ....................................................... 16
6.4.6.2 Quality Control on Site ...................................................................... 17
6.4.7 Construction of Roads with Unit Pavers ............................................. 17
6.4.7.1 Sub-grade Preparation ...................................................................... 17
6.4.7.2 Sub base ............................................................................................ 17
6.4.7.3 Base .................................................................................................... 17
6.4.7.4 Edge Restraints ................................................................................ 17
6.4.7.5 Sand Bedding Course ........................................................................ 17
6.4.7.6 Laying Paving Units .......................................................................... 17
6.4.7.7 Bedding Compaction ........................................................................ 18
6.4.7.8 Filling Joints ....................................................................................... 18
6.4.7.9 Opening to Traffic ............................................................................ 19
6.4.8 Construction of Road Threshold ............................................................ 19
6.4.9 Stamped Asphalt .................................................................................... 20
6.4.10 Paint for Asphalt .................................................................................. 20
6.4.11 Inlaid Thermoplastic Paint ................................................................. 20
6.4.11.1 Surface Imprinting ........................................................................... 20
6.4.11.2 Installation and Bonding of Pre-formed Thermoplastic Panels ...... 20
6.4.12 Special Requirements ........................................................................ 21
6.4.13 Trench Cut for Installation of Services & Temporary Road Restorations Works .......... 21
6.4.14 Permanent Restoration of Roadworks ............................................... 22
6.4.15 Dry Rolled Concrete / Sandstone Ballast ............................................ 22
6.4.16 Site Testing Equipment ....................................................................... 22

6.5 Quality ........................................................................................................ 23
6.5.1 Hold and Witness Points for Flexible Pavement ................................. 23
6.5.2 Hold and Witness Points for Rigid Pavement ...................................... 25
6.5.3 Hold and Witness Points for Unit Pavers/Stone Setts ......................... 26
6.5.4 Limits and Tolerances .......................................................................... 27
6.5.4.1 Unit Pavers Roads ............................................................................ 27
6.5.4.2 Stone Sett Roads ............................................................................. 28
6.1 Scope

The works covered by this Section of the Specification comprise the construction of flexible and rigid road pavements.

Preparation for, and placement of, the various road pavement layers and general provisions for inspection, testing or other aspects of the road work shall comply with this section of the specification as applicable.

6.2 Standards and Guidelines

Unless stated otherwise in this specification, in the drawings or elsewhere in the documents, work shall comply with the current edition of the relevant Australian Standards and/or RMS Standards.

Any variations or ambiguity between this Specification, Australian Standards and other relevant documents shall be referred to the City’s Representative for approval before proceeding with the work.

The following table indicates the Australian Standards and RMS Standards applicable to this section. This table is not exhaustive and may not include all standards which may apply to the work to be undertaken.

| Sydney Street Technical Specification Part B12. Road Opening and Restoration | AS1289, AS2891 Methods of testing soils for engineering purposes; |
| AS1289, AS2891 Methods of testing soils for engineering purposes; |
| AS2881, AS1141 Methods of testing for asphalt mix aggregates; |
| AS1160 Bitumen Emulsions for pavement construction and Maintenance; |
| RMS QA 3051 Granular Base and Subbase materials; |
| RMS QA 3071 Selected Material in Formation; |
| RMS QA 3152 Aggregates for Asphalt; |
| RMS QA 3153 Reclaimed Asphalt Pavement Materials; |
| RMS QA 3154 Recycled glass aggregates; |
| RMS QA 3201 Concrete for Maintenance; |
| RMS QA 3204 Joint Fillers for Concrete Pavement and Structures; |
| RMS QA 3211 Cement, Binders, and Fillers |
| RMS QA 3051 Granular base and subbase materials |
RMS T116                    Recycled stone aggregates;

RMS R106                    Sprayed Bituminous Surfacing (with Cutback Bitumen);
RMS R83                     Jointed Concrete Base;
RMS R116                    Asphalt (Dense Graded and Open Graded);
RMS T160                    Benkelman Beam Deflection Test;
AS 4455                    Masonry units and segmental pavers;
AS 4456.1                  Masonry units and segmental pavers - Methods of test
                            - Sampling for compliance testing;
AS 4456.2                  Masonry units and segmental pavers - Methods of test
                            - Assessment of mean and standard deviation;
AS/NZS 4456.5              Masonry units and segmental pavers - Methods of test
                            - Determining breaking load of segmental paving units;
AS/NZS 4456.9              Masonry units and segmental pavers - Methods of test
                            - Determining abrasion resistance;
AS/NZS 4456.10             Masonry units and segmental pavers - Methods of test
                            - Determining resistance to salt attack;
AS/NZS 4456.13             Masonry units and segmental pavers - Methods of test
                            Determining pitting due to lime particles;
AS/NZS 3661.1              Slip resistance of pedestrian surfaces – Requirements;
AS 3972                    Portland and Blended Cement;
AS 1672.1                  Limes and limestones - Limes for building;
AS 3582.1                  Supplementary cementitious materials for use with
                            portland and blended cement – Fly ash;
AS 2758.1                  Aggregates and rock for engineering purposes -
                            Concrete aggregates;
AS 1478.1                  Chemical admixtures for concrete, mortar and grout -
                            Admixtures for concrete;
AS 1428.2                  Design for access and mobility – Enhanced additional
                            requirements – Buildings and facilities;
AS 1428.4                  Design for access and mobility - Tactile ground
                            surface indicators for the orientation of people with
                            vision impairment; and
Sydney Street Technical Specifications
B6. Roadways

BSEN

British Standard: Pigments for the colouring of building materials based on cement and/or lime. Specifications and methods of test.
6.3 Materials

6.3.1 Base and Subbase Materials

Coarse and fine aggregate components of the Base and Subbase materials shall comply with *RMS QA Specification 3051 Granular Base and Subbase Materials for Surfaced Road Pavements*.

DGB20 and DGS40 materials shall comply with *AS1289.3.6.1* and *AS1289.3.6.3* respectively.

Concrete Pavement Base Course materials shall comply with *AS2758.1* provided percentage SO3 by mass, shall not exceed 0.1%.

6.3.2 Asphalt Concrete

Asphalt concrete shall be supplied, laid, sprayed and compacted in accordance to *AUS-SPEC 1144 Asphalt(Roadways)*. *RMS QA Specification R116 Heavy Duty Dense Graded Asphalt Concrete* should only be used with the consent of City Representative.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Property</th>
<th>Acceptance Criteria</th>
<th>Reference document</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course aggregates</td>
<td>Flakiness Index</td>
<td>35% maximum</td>
<td>As 2758.5, AS1141-15</td>
</tr>
<tr>
<td></td>
<td>Wet Strength (10% fines)</td>
<td>150 KN minimum</td>
<td>As 2758.5, AS1141-22</td>
</tr>
<tr>
<td></td>
<td>Los Angeles Abrasion</td>
<td>30% maximum</td>
<td>As 2758.5, AS1141-23</td>
</tr>
<tr>
<td></td>
<td>PAF Value</td>
<td>45 minimum</td>
<td>AS1141-40 AS1141-42</td>
</tr>
<tr>
<td>Fine aggregates</td>
<td>All passing 4.75mm sieve</td>
<td>Clean, hard, durable and free from clay or organic matter</td>
<td>RMS 3152</td>
</tr>
<tr>
<td>Binder Class 170 or Class 320 or PMB</td>
<td>All relevant properties pertaining to Hot mix AC</td>
<td>Marshall mix design</td>
<td>AS 2008-2013 and RMS 3252 for PMB</td>
</tr>
</tbody>
</table>

6.3.2.1 Sustainable Materials in Asphalt

The City prefers and encourages the use of recommended AAPA Reclaim Asphalt Pavement (RAP), and the use of Warm mix application, composition of:

- 30% RAP for basecourses with the use of "a bitumen binder one class softer than otherwise specified which will compensate for the influence of hardened binder in the RAP, and produce asphalt mixes of comparable stiffness, fatigue resistance and deformation

- 15% RAP for wearing courses and applications that will experience high shear forces with the City’s approval.

Further reduction in application temperatures is preferred and encouraged, and the City will consider semi-warm mix use in suitable applications.

Process temperatures provided by the European Asphalt Pavement Association (EAPA) define:

- Hot mix ranging from ~120-190°C;
- Warm mix ranging from ~100-140°C;
- Semi warm mix ranging from ~70-100°C; and
- Cold mix as unheated/ambient (~20°C).

Service Providers should design the RAP replacement in accordance with AS 2150:2005- Hot mix asphalt - A guide to good practice (where relevant), and AS2758.5:2009- Aggregates and rock for engineering purposes - Coarse asphalt aggregates. The Service Provider should also note that the City expects Service Providers to ensure adequate conditions for this replacement are met (i.e. that installation is varied where needed as a result of material replacement). For example changes to installation may include extending application time or varying compaction rates. The final material must comply with the performance specifications outlined elsewhere in this and associated documents.

6.3.2.2 Asphalt Concrete Warm Mix Asphalt

Warm mix asphalt technologies allow the producers of asphalt pavement material to lower the temperatures at which the material can be mixed, placed, and compacted on the road. Reductions of 10 to 20°C have been documented. Such drastic reductions have the obvious benefits of cutting fuel consumption and decreasing the production of greenhouse gases which is one of the key visions of the City.

Warm mix asphalt shall be manufactured with the aid of appropriate additives so that the workability and durability of the asphalt mix remains intact. The quality of the warm mix asphalt must meet the current Australian Standard.

6.3.3 Stone Setts

Where stone setts are to be used, roadway porphyry stones are to be used unless otherwise nominated by the City’s Representative. Types of stone setts such as cobblestones/setts, sawn pavers and random stone-crazy pavers will be specified in the approved plan. The porphyry stone setts must comply with the following properties as a minimum:

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>2555kg/m³</td>
</tr>
<tr>
<td>Water absorption</td>
<td>0.65% ~1.00%</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>200~221Mpa</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>22.5MPa</td>
</tr>
<tr>
<td>Skip/Slip Resistance</td>
<td>69</td>
</tr>
</tbody>
</table>

Tolerances
### 6.3.3.1 Mortar for Stone Setts

Portland cement, siliceous course sand free from clay and organic material and pure uncontaminated drinkable water are to be used to prepare mortar paste for stone setts. The mortar bed for stone setts shall be no more than 30mm and shall have sufficient moisture for compaction and curing. Use machine mix mortar with 1 part of cement and 4 part of sand. Allow curing for 21 days.

### 6.3.3.2 Use of Latex Admix for Stone Setts

The City recommends the use of a latex mortar admixture such as Laticrete or equivalent. All products are to be approved by the City’s Representative before use.

### 6.3.4 Unit Pavers

Where unit pavers are to be used for segmental pavement construction, the details shall be submitted to the City’s Representative for approval. Testing results, from a nominated NATA registered laboratory, shall comply with the requirements of AS4455.

Types of unit pavers such as precast concrete paving, tactile paving, and porphyry stone paving and porphyry setts paving or other types will be specified in the approved plan.

#### 6.3.4.1 Fired Clay Paving Units

Clay segmental pavers shall comply with the requirements of AS 4455. Recycled pavers may be used provided they meet all the criteria.

Refer to 6.2 Standards and Guidelines for sampling, measurement of breaking load, resistance to salt attack, pitting due to lime and determination of slip/skid and abrasive resistance.

Refer to Table 6.3.4-1 for dimensional tolerances, characteristic breaking load, slip/skid and abrasive resistance and flexural strength.

**Samples**

Submit two samples of each different type and/or source of paving for approval by the City’s Representative prior to ordering. Samples have to be indicative of the paver to be supplied for each different type of paving.

<table>
<thead>
<tr>
<th>i) Split Paving Plan</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>≤700mm =</td>
<td>±8mm</td>
<td></td>
</tr>
<tr>
<td>≥700mm =</td>
<td>±12mm</td>
<td></td>
</tr>
<tr>
<td>ii) Split/Riven Paving Thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤600mm =</td>
<td>±15mm</td>
<td></td>
</tr>
<tr>
<td>&gt;600mm =</td>
<td>±20mm</td>
<td></td>
</tr>
</tbody>
</table>

The samples of porphyry stone setts and the test results must be submitted to the City’s Representative for approval.
The net area of any paving sample shall not be less than 75% of the gross plan area. For the purpose of sampling, a lot is defined as maximum 1,000m² of paving in gross plan area for each paver type and/or manufacturer.

**Surface Coatings**
Surface coatings shall not be applied to clay paving units without the prior written approval of the City’s Representative.

**Appearance**
Clay paving units shall be sound, firm, dense, free of distortion, dimensionally stable and consistent, with a smooth upper surface and with unrumpled units having unbroken arises, chamfered or radiused as specified evenly all round. Units which exhibit cracking, bloating or are considered by the City’s Representative to be excessively porous, brittle or friable shall be liable to rejection. Paving unit colours shall fall within the colour range of the approved sample units over the full area of the pavement.

**Laying Pattern**
Unless otherwise specified by the City’s Representative, concrete pavers for road pavements shall be placed in accordance with the drawing and specification and shall be in accordance with the requirements for the appropriate road application as shown in Table 6.3.4-1.

6.3.4.2 Concrete Paving Units
The materials and manufacture of concrete paving units shall comply with the requirements of AS 4455. Recycled pavers may be used provided they meet all the criteria.

Refer to 6.2 Standards and Guidelines for sampling, measurement of breaking load, flexural strength and determination of tactile indicator tiles, slip/skid and abrasive resistance.

Refer to Table 6.3.4-1 for dimensional tolerances, characteristic of breaking load, slip/skid and abrasive resistance and flexural strength.

**Samples**
Submit two samples of each different type and/or source of paving for approval by the City’s Representative prior to ordering. Samples have to be indicative of the paver to be supplied for each different type of paving.

The net area of any paving sample shall not be less than 75% of the gross plan area. For the purpose of sampling, a lot is defined as maximum 1,000m² of paving in gross plan area for each paver type and/or manufacturer.

**Surface Coatings**
Surface coatings shall not be applied to concrete paving units without the prior written approval of the City’s Representative.

**Appearance**
Concrete paving units shall be sound, firm, dense, dimensionally stable and consistent, with a smooth unblemished upper surface and with unrumpled units having unbroken arises, chamfer or radius as specified evenly all round. Units which exhibit cracking, “boniness” or are considered by the City’s Representative to be excessively porous, brittle or friable shall be liable to rejection.
Paving unit colours shall be uniform and shall match that of approved sample units over the full area of the pavement.

**Production**

Paving units shall be mechanically vibrated in separate moulds and retained within the mould for 24 hours before stripping. Concrete shall be constantly cured.

**Laying Pattern**

Unless otherwise specified by the City’s Representative, concrete pavers for road pavements shall be placed in accordance with the drawing and specification and shall be in accordance with the requirements for the appropriate road application as shown in Table 6.3.4-1.

---

**Table 6.3.4-1**

<table>
<thead>
<tr>
<th>Application</th>
<th>Characteristic breaking load (ii) (KN)</th>
<th>Characteristic flexural strength (MPa)</th>
<th>Min Thickness (mm)</th>
<th>Dimensional deviations (Category from AS4455)</th>
<th>Slip resistance (coefficient of friction)</th>
<th>Abrasion resistance (mean abrasion index)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads - Traffic Categories</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light to Medium</td>
<td>5</td>
<td>3</td>
<td>80</td>
<td>DPB2</td>
<td>0.4</td>
<td>5</td>
</tr>
<tr>
<td>Medium to Heavy</td>
<td>5</td>
<td>3</td>
<td>80</td>
<td>DPB2</td>
<td>0.4</td>
<td>5</td>
</tr>
<tr>
<td>Industrial Pavements (i)</td>
<td>10</td>
<td>4</td>
<td>80</td>
<td>DPB3</td>
<td>0.4</td>
<td>7</td>
</tr>
</tbody>
</table>

Notes on Table 6.3.4-1

(i) The resultant joint width is a combination of paver dimensional deviation and laying procedures.

(ii) At 28 days for concrete paving units.

---

**6.3.4.3 Bedding Sand**

Bedding material shall be clean washed sand of a grading complying with the limits prescribed in Table 6.3.4.3-1 below:

---

**Table: 6.3.4.3-1**

<table>
<thead>
<tr>
<th>AS Sieve Size (mm)</th>
<th>Percentage Passing by Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.500</td>
<td>100</td>
</tr>
<tr>
<td>4.750</td>
<td>95-100</td>
</tr>
<tr>
<td>2.360</td>
<td>80-100</td>
</tr>
</tbody>
</table>
### 6.3.4.4 Jointing Sand

Material for filling unbound joints shall be sand of a grading complying with the limits given in Table 6.3.4.4-1 below:

<table>
<thead>
<tr>
<th>AS Sieve Size (mm)</th>
<th>Percentage Passing by Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.360</td>
<td>100</td>
</tr>
<tr>
<td>1.180</td>
<td>90-100</td>
</tr>
<tr>
<td>0.600</td>
<td>60-90</td>
</tr>
<tr>
<td>0.300</td>
<td>30-60</td>
</tr>
<tr>
<td>0.150</td>
<td>15-30</td>
</tr>
<tr>
<td>0.075</td>
<td>5-10</td>
</tr>
</tbody>
</table>

Jointing sand shall be free of deleterious quantities of soluble salts and other contaminants which would cause surface staining. Sand used for bedding is not suitable for joint filling.

### 6.3.4.5 Expansion Jointing

Expansion joint material shall be 10mm thick self-expanding cork filler complying with the requirements of the standard specification unless specified otherwise by the City’s Representative.
6.3.4.6 Bedding Mortar for Pavers

All mortar for the pavers is to comply with AS3700 Masonry Structures and is to be a 4:1 (river sand) cement (dry mix). The minimum compressive strength of the mortar mix shall be no less than 3.0MPa and no greater than 5.0MPa at 7 days.

6.3.5 Concrete

Refer to Section B3 Concrete Works.

6.3.6 Paint for Asphalt

The paint for asphalt shall be a cement modified, acrylic polymer and aggregate blend developed specifically for use over asphalt.

The paint shall have superior adhesion, flexibility and abrasion resistance as well as chemical resistance. Conforming to the following characteristics;

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Test Specification</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solids by Volume</td>
<td>ASTM D-2697</td>
<td>66.8%</td>
</tr>
<tr>
<td>Solids by Weight</td>
<td>ASTM D-2369</td>
<td>80.1%</td>
</tr>
<tr>
<td>Density</td>
<td>ASTM D-1475</td>
<td>1.75 kg/l</td>
</tr>
<tr>
<td>Flash Point</td>
<td>ASTM D-3278</td>
<td>&gt;93°C</td>
</tr>
<tr>
<td>Percentage Pigment (by weight including cement)</td>
<td>ASTM D-3723</td>
<td>62 +/- 2%</td>
</tr>
<tr>
<td>Sheen</td>
<td>ASTM D-523</td>
<td>&lt;3 @ 85°</td>
</tr>
</tbody>
</table>

6.3.7 Inlayed Thermoplastic Paint

The inlayed thermoplastic paint shall be performed in the specified colour and pattern. The thermoplastic material shall have a thickness of 2.3mm, and consist of colour pigmented plastic film with imbedded reflective glass spheres, uniformly distributed throughout the entire cross sectional area.

6.3.8 Recycled Material

For recycled materials specifications refer to clause 6.3.2.1.

6.3.9 Sampling and Testing of Course Material

Materials for soil, coarse aggregates and fine aggregates shall comply with Australian Standard AS1141. All tests shall be conducted by NATA accredited testing authority. Testing shall be carried out in accordance with AS2891.

6.3.10 Sampling and Testing of Bedding Mix

Trial mixes of mortar bedding material must be carried out and tested before the commencement of works to adequately select a mix that meets the strength requirement. Strength testing reports must be provided to the City’s Representative for approval.
A slurry mix is to be applied on top of this bedding, with a latex additive before laying of pavers to increase bond and compressive strength.
6.4 Construction

6.4.1 Road Classification

6.4.1.1 Medium to Heavy Traffic

The City considers medium to heavy traffic to be:
- 15,000 – 25,000 vpd (vehicles per day);
- 500 – 1,500 hvpd (heavy vehicles per day);
- 60km/hr – 80km/hr speed limit; and
- Roads with design traffic equal to or exceeding $10^7$ Equivalent Standard Axle (ESA).

6.4.1.2 Light to Medium Traffic

The City considers light to medium traffic to be:
- < 15,000 vpd (vehicles per day);
- < 500 hvpd (heavy vehicles per day);
- ≤ 60km/hr speed limit; and
- Roads with design traffic less than $10^7$ ESAs.

6.4.2 Preparation of Sub-grade

Refer to 2.6.5 in Section B2 Earthworks for preparation of sub-grade.

6.4.3 Preparation of Base Course Layers

Preparation of base course layers shall comply with RMS R71 Construction of Unbound and Modified Pavement Course. Where base course are specified to be bound such as cement stabilised the works shall comply with RMS R73 Construction of Plant Mixed Heavily Bound Pavement Course.

**NOTE:** Bound or stabilised materials are not to be used unless authorised by the City’s Representative and supported by calculation of additional asphalt concrete layer thickness to address reflective cracking. Both bound and unbound pavement courses shall comply with the compaction requirements as per the table below:

<table>
<thead>
<tr>
<th>Compaction Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>DGS 40 Subbase</td>
</tr>
<tr>
<td>DGB 20 Base</td>
</tr>
</tbody>
</table>
6.4.4 Flexible Road Pavement

6.4.4.1 Flexible Road Pavement Structure, Material Types and Minimum Layer Thicknesses

For new road construction works refer to standard drawings for detail.

6.4.4.2 Reinstatement of Flexible Road Pavement

Reinstatement of asphalt road pavement shall match the existing layer thicknesses or those specified on the standard drawing, whichever is thicker. Reinstall asphalt surface to the original level or the level on the approved design drawing or as directed by the City’s Representative.

6.4.5 Rigid Road Pavement

The concrete shall be supplied, placed, compacted and tested as described in Section B3 Concrete Works. Note, A/C material supply and placement to comply with flexible pavement as outlined above.

6.4.5.1 Rigid Road Pavement Structure, Material Types and Minimum Layer Thicknesses

For new road constructions refer to standard drawings for detail.

6.4.5.2 Reinstatement of Rigid Road Pavement

Reinstatement of concrete road pavement shall match the existing layer thicknesses or those specified on the standard drawing, whichever is thicker. Reinstall concrete surface to the original level or the level on the approved design drawing or as directed by the City’s Representative.

Epoxy grout steel dowels into the adjacent concrete and provide reinforcement to prevent the reinstated concrete from subsidising or cracking. Refer to standard drawings for details.

6.4.5.3 Concrete Road Pavement Joints

Joints shall be constructed and located as detailed on the drawings. Joints shall be straight and plumb. Unless otherwise detailed on the drawings transverse expansion and contraction joints shall be normal to the longitudinal joints, and continuous from edge to edge of the pavement throughout all paving slabs that are connected in a single paved area. Where kerbs are cast as part of the paving slab, joints of the same type shall continue through the kerb sections on the same alignment as those in the paving slab.

6.4.5.3.1 Longitudinal Construction Joints

Longitudinal construction joints shall be provided at the locations shown on the drawings or where directed by the City’s Representative. There will normally be no more than one longitudinal joint along each road segment. The joints shall be parallel to the kerb line and formed by laying and compacting the concrete up to a solid bulkhead. Joint sealer shall be silicone sealant, preformed elastomeric strips or preformed self-expanding cork strips as detailed on standard drawings. Galvanised N12 dowels, 600mm long at 500mm centres, are to be centrally placed perpendicular to joint. The top surface of longitudinal construction joints shall be smooth across the joint.
6.4.5.3.2 Transverse Construction Joints

Transverse construction joints shall be provided only at a discontinuity in the placement of concrete determined by the Service Providers operations. Transverse construction joints shall be constructed square to the kerb line and formed by either timber formwork or by cutting the previously placed concrete back to form an even, fully compacted vertical face up to which the new concrete can be abutted. Galvanised N12 dowels, 600mm long at 500mm centres, are to be centrally placed perpendicular to joint. All cut material and any loose material on this face shall be removed. The top surface of transverse construction joints shall be smooth across the joint.

6.4.5.3.3 Transverse Expansion Joints

Transverse expansion joints are to be formed at approximately 45m spacings and laid square to both gutter and/or longitudinal construction joint. The joints are to be formed with galvanised R20, 600mm long bars at 450mm centres, capped and with a bond breaking compound at one end and an AF X10125 Ableflex Joint Board, complying with RMS 3204, and joint sealant installed in accordance with Specification RMS R83 or otherwise approved by the City’s Representative.

6.4.5.3.4 Transverse Contraction Joints

Transverse contraction joints shall be constructed normal to the control line and to the dimensions and details shown on the drawings. Where necessary, the joint may be skewed to a maximum 1 in 12 to accommodate construction joints and slab anchors. Bays between transverse expansion joints shall be divided into 3 separate bays by saw-cuts at 15m spacings. The saw-cuts shall be 45mm deep, or one third of the slab thickness and cut square to both the kerb line and the longitudinal construction joint.

6.4.5.3.5 Longitudinal Contraction Joints

Longitudinal contraction joints shall be constructed continuously along the centreline of non-reinforced rigid pavement. Saw cut the joints on the concrete to an adequate depth. The depth should be typically, one third the depth of the slab. The sawing should be done late enough to avoid ravelling of the new concrete, but soon enough so that random cracking does not begin to occur. Fill the saw-cut joints with backing rod and seal.

6.4.5.3.6 Sawn Contraction Joints

Sawn contraction joints shall be constructed by cutting a groove in the hardened concrete. If uncontrolled cracking of concrete occurs, concrete placing shall be suspended. Saw cuts shall be at least 45mm deep or such greater depth as is detailed on the drawings and of uniform width in the range 3-5mm for the full depth of the cut. The line of the transverse contraction joint shall be without any discontinuities. No edge shall deviate from a three metre straight edge by more than 10mm. The surface of the transverse contraction joint shall not exhibit more than 5mm of vertical or horizontal edge ravelling. The length of edge ravelling shall not be more than 300mm in any 1m length of joint on each edge. Saw debris shall be washed from the joint and pavement immediately after sawing.

The time of sawing shall be varied between 6 and 24 hours after initial paving, depending on existing and anticipated weather conditions, and shall be such as to prevent uncontrolled cracking.
of the pavement. Sawing of the joints shall commence as early as possible, commensurate with the concrete having hardened sufficiently to permit cutting the concrete without excessive chipping, spalling or tearing. The sawn faces or joints will be inspected for undercutting or washing of the concrete due to early sawing. If this action is sufficiently deep to cause structural weakness or excessive cleaning difficulty, the sawing operation shall be delayed, and resumed as soon as the sawing can be continued without damaging the concrete slab. Nevertheless, all sawing will be completed no later than 24 hours after placement of the concrete. The joints shall be sawn, if the concrete is sufficiently hard, in the sequence of the concrete placement, initially at every fourth joint, then at the intermediate intervals.

Before sawing a joint, the concrete shall be examined closely for cracks, and the joint shall not be sawn if a crack has occurred near the location chosen for a joint. Discontinue sawing if a crack develops ahead of the saw cut. Immediately after each joint is sawn, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint, and the joint caulked with plastic or rubber tubing or suitable “tee” shaped extrusion which will remain in place and prevent the entry of foreign material into the joint.

6.4.5.3.7 Joint Tolerances

The line of joints in the concrete base shall not deviate from a three metre straight edge placed along the joint by more than 10mm. The distance between kerb and longitudinal construction joints shall not vary by more than 100mm over the length of the joint, unless approved by the City’s Representative.

6.4.5.3.8 Joint Sealing

All concrete base joints are to be sealed in accordance with Specification RMS R83.

6.4.6 Construction of Stone Roads

Prior to installation of stone setts, the Service Provider must note the following:

- The boundaries of all four sides of stone setts paving need to be tied into the base;
- Concrete gutter poured separately to reinforced base on which stone setts are laid must be reinforced to limit movement;
- Stone setts have to be laid in bays which contain joints;
- Curing should be minimum 14 days for the slab and 21 days for the cobbles/setts;
- Low shrinkage concrete has to be used for slab;
- Only the area that is capable of being done within the time limits of the materials (mortar or grout) is to prepared;
- Grout is to be installed full depth;
- A steel plate is to be used to ensure that curing occurs before traffic loading is reintroduced;
- Coloured oxide is to be used to eliminate colour variance;
- A minimum joint thickness of not less than 10mm has to be used; and
- Mortar joints as follows are to be used where applicable and subject to the approval by the City’s Representative:
  a. Construction joints 15mm;
  b. Between setts 10mm; and
  c. Edge joints 30-40mm.
6.4.6.1 Laying of Stone Setts in General

Preparation of Sub-grade
Refer Section B2 Earthworks for preparation of sub-grade.

Working with Concrete and Mortar
Setts need to be laid onto a full bed of mortar over a reinforced concrete base at least 100mm thick. Refer to standard drawings for details. For a mortar bed, mix 4 parts sharp sand with 1 part cement.

Sett pavements are traditionally edged with ‘channel course’ of setts laid lengthways and following the perimeter of the area. A sample panel of setts on sand or on flat ground shall be laid out beforehand to determine which arrangement best suits the project.

Channel courses are always laid first. They define the boundary of the pavement and act as a guide to level for the main area of paving.

Laying Procedures - Pattern
Stone setts/cobbles are to be laid in stretcher bond with the rows running across the street. Full sized stones are to be used to start and finish each row. This means that the first one, two or three stones will appear as if they are in a stack bond. These first few stones are to be chosen carefully so that they introduce a stretcher bond quickly throughout the rest of the row. A rejection criterion is if the joints align in subsequent rows at any joint after the third stone.

For general laying procedure refer to standard drawings and Section B5 Footways.

Laying of Stone Setts with Mortar Additive such as Laticrete or Equivalent
Use mortar additive as approved by City’s Representative and laying as per manufacturer’s instruction and guidelines.

Jointing
For cement mortar jointing, mix a mortar comprising 3 parts soft or building sand and 1 part of cement to a consistency that is very wet, like that of a pea soup. Spread over the pre-wetted setts and sweep into the joints using a stiff brush. The excess shall be swept off, repeating the sweeping until as much as possible of the mortar is removed, and eventually switching to a soft brush to remove the finer particles. The surface needs to be gently sprayed with clean water throughout to help with the cleaning. Once the joints are filled, smooth it using the blade of a pointing trowel or a special pointing bar that will give a flat or semi-round profile to the joint. Cement mortar jointed setts should be kept free of foot traffic for at least 3 days and vehicles are best kept off the paving for at least 7 days, preferably longer.
6.4.6.2 Quality Control on Site

For thoroughness of mixing, ensure that the mortar bed mix is of a consistent cement colour. No grains of sand shall be left without a cement coating. Failure to meet this acceptance criterion may result in rejection of the mix.

6.4.7 Construction of Roads with Unit Pavers

6.4.7.1 Sub-grade Preparation

Refer to Section B2 Earthworks for preparation of sub-grade.

6.4.7.2 Sub base

Sub base materials shall be DGB20 unless specified otherwise. Granular sub base material shall comply with RMS QA Specification 3051 Granular Base and Subbase Materials for Surfaced Road Pavements.

6.4.7.3 Base

The base shall be constructed to the specified thickness and depth below finished surface level, and to the design grade and crossfalls of the finished surface, as shown on the drawings and in accordance with Section B3 Concrete Works. The base course shall extend in width to at least the rear face of kerb. The finished surface of the base course for road pavements to be overlain with segmental paving shall be trimmed to within \( \pm 10\text{mm} \) of design levels. The deviation from a 3m long straight edge placed anywhere and laid in any direction on the top surface of the base course for all segmental paving shall not exceed 5mm. Sand bedding material shall not be used as a levelling material to compensate for base finishing outside the above tolerances. The finished surface of the base shall drain freely without ponding. The finished base shall be subject to the approval of the City’s Representative.

6.4.7.4 Edge Restraints

Edge restraints in the form of kerb and/or gutter or edge strips shall be constructed along the perimeter of all segmental paving as shown on the drawings. Concrete kerb and/or gutter and edge strips shall be constructed in accordance with Section B3 Concrete Works and Section B4 Kerb and Gutter.

Faces of edge restraints abutting paving units shall be vertical. Alternatively, silicone joint filler shall be applied between the paving unit and edge restraint. Edge restraints shall be supported on compacted base and/or sub-base of the thickness as shown on the drawings. Unless otherwise shown on the drawings, contraction joints 20mm deep shall be formed every 5m of edge restraint length.

6.4.7.5 Sand Bedding Course

Bedding sand shall be non-plastic and shall be free of deleterious quantities of soluble salts and other contaminants which may cause, or contribute to efflorescence. Bedding sand shall be of uniform moisture content when spread. It shall be covered when stored on site to protect it from rain penetration.
Where cement stabilised bedding is specified, 4 to 6% of cement by volume is to be thoroughly and evenly mixed in with the bedding sand prior to spreading. The volume of mixed material shall not exceed that required for the area of paving units to be laid in a period of 4 hours. Adequate precautions shall be taken to protect the sand-cement mixture from adverse weather conditions.

The sand bedding course shall be spread in a single uniform layer and screeded in a loose condition to the nominated design profile and levels plus that necessary to achieve a uniformly thick nominal 20-25mm layer following final compaction of the segmental paving. Any depressions in the screeding sand exceeding 5mm shall be loosened, raked and re-screeded before laying paving units. Depressions for the manual placing of paving units, the bedding sand shall be maintained at a uniform loose density. For mechanised laying, the bedding sand shall be uniformly and firmly, but not fully, compacted. Compaction screeded sand left overnight or subject to rain shall be checked for level and re-screeded where necessary before paving units are placed. The sand shall not be screeded more than two metres in advance of the laying face at the completion of work on any day.

6.4.7.6 Laying Paving Units

The laying patterns must be approved by the City’s Representative prior to installation on site. For general laying procedure refer to standard drawings and Section B5 Footways.

6.4.7.7 Bedding Compaction

After laying the paving units the sand bedding shall be fully compacted and the surface brought to design levels and surface profiles by not less than two passes of a high frequency low amplitude plate compactor which covers at least 12 units. Compaction shall continue until lipping between adjoining units has been eliminated.

Any units which are structurally damaged during bedding compaction shall be removed and replaced. The pavement shall then be re-compacted for at least one metre surrounding each replacement unit.

The paving operations shall be arranged so that the use of the plate compactor proceeds progressively behind the laying face without undue delay, and such that compaction is completed prior to cessation of construction activity on any day. Compaction shall not be attempted within one metre of the laying face except on completion of the pavement against an edge restraint.

The finished surface level shall not vary from the design level at any point laid in any direction by more than 5mm. Notwithstanding this, the finished surface of the segmental paving, including where the paving abuts an edge restraint other than a drainage inlet, shall not deviate from the bottom of a three metre straight edge laid in any direction, except at grade changes, by more than 5mm.

All compaction shall be complete and the pavement shall be brought to design profiles before spreading or placing sand filling in the joints.
6.4.7.8 Filling Joints

As soon as practicable after bedding compaction, and in any case prior to termination of work on any day, dry sand for joint filling shall be spread over the pavement and the joints filled by brooming. To ensure complete filling of the joints, both the filling sand and paving units shall be as dry as practicable when sand is spread and broomed into the joints. Note that sand shall be covered when stored on site to protect it from rain penetration. The pavement shall then receive one or more passes of a plate compactor and the joints then refilled with sand, with the process then repeated sufficiently to ensure that the joints are completely filled.

6.4.7.9 Opening to Traffic

As soon as practicable after the filling of joints, construction vehicles may use the pavement, and should be encouraged to traverse the greatest possible area of pavement to assist in the development of ‘lock-up’. Excess joint filling sand shall be removed prior to opening to traffic. The pavement shall then be inspected by the Service Provider at regular intervals up until the expiration of the Defects Liability Period to ensure that all joints remain completely filled.

6.4.8 Construction of Road Threshold

The service provider shall follow the specification and standard drawings for the construction of roadway threshold. The general installation procedures shall be as follows:

- Immediately prior to installation thoroughly clean the designated locations of all dirt, loose stone and other debris to the satisfaction of the City’s Representative;
- Mill A/C as indicated in the approved plans or standard drawings;
- For asphalt threshold components:
  - Spray a layer of binder across the road and heat it to bond the road and the new asphalt. (note, the designated locations shall be tacked i.e. rate of application as per AS1160 and special care shall be taken to avoid spraying the bituminous tack coat on adjacent kerbs, driveways and miscellaneous structure. Unless otherwise directed by the City’s Representative, the tack coat is to be applied to provide a uniform application rate of between 0.1L/m² and 0.2L/m². The Service Provider shall be responsible for all clean up should such over spray occur);
  - Once the binder is heated and ready for asphalt, tip the fresh asphalt on to the road surface and spread the asphalt as evenly as possible using rakers;
  - Use the small steel roller to compress and flatten the asphalt;
  - Tip the second layer of fresh asphalt to form the shape (grade) of the threshold as per the design & specification and compress as appropriate to maintain the configuration;
  - Allow the asphalt to harden for reflective markings and for erection of other traffic control signs as per drawing and specification; and
  - Apply stamped pattern and colouring as specified in approved plan and line markings.
- For concrete threshold components refer to Section B3 Concrete Works; and
- For paver infill threshold components, refer to Section 6.3.4 of this specification.
6.4.9 Stamped Asphalt

The imprinted pattern in the asphalt shall be created in accordance with the design drawings. Patterning shall begin only after the asphalt has reached its final compacted density and while there is still sufficient heat in the asphalt to permit imprinting. Patterning shall be achieved using steel rollers and/or vibratory plate compactors and shall be of a consistent depth.

Alternatively, imprinting can be carried out at a later stage, on existing asphalt (no older than 3 years), by applying heat to the asphalt surface to make the upper portion of the asphalt surface pliable enough to accept the imprint of the template. For proper imprinting success, the asphalt pavement must be adequately heat soaked (softened) to a depth of at least 12.5mm, without burning the asphalt. The asphalt surface temperature shall not exceed 150°C. Regular monitoring during heating is essential to prevent overheating.

If during the reheating process the surface is overheated and begins to emit black smoke work shall stop immediately. All damaged pavement shall be replaced, prior to stamping continuing.

6.4.10 Paint for Asphalt

The paint shall be in accordance with the manufactures recommendations.

Sufficient masking shall be used to ensure that the surface products are applied only where specified.

6.4.11 Inlayed Thermoplastic Paint

6.4.11.1 Surface Imprinting

The imprinted pattern in the asphalt shall be created in accordance with the design drawings. Patterning shall begin only after the asphalt has reached its final compacted density and while there is still sufficient heat in the asphalt to permit imprinting.

Alternatively, imprinting can be carried out at a later stage, on existing asphalt (no older than 3 years), by applying heat to the asphalt surface to make the upper portion of the asphalt surface pliable enough to accept the imprint of the template. For proper imprinting success, the asphalt pavement must be adequately heat soaked (softened) to a depth of at least 6mm, without burning the asphalt. The asphalt surface temperature shall not exceed 163°C. Regular monitoring of the surface treatment during heating is recommended to prevent overheating.

If during the reheating process the surface is overheated and begins to emit black smoke work shall stop immediately. All damaged pavement shall be replaced, prior to stamping continuing.

Patterning shall be achieved using plate compactors and shall be of a consistent depth of 3mm.

6.4.11.2 Installation and Bonding of Pre-formed Thermoplastic Panels

The thermoplastic shall be applied only in dry conditions. The thermoplastic shall be placed on the clean, dry, asphalt, in the imprinted pattern, prior to application of heat. Once the thermoplastic is in place, heat shall be applied using a reciprocal infrared heater. The asphalt surface temperature shall not exceed 163°C. If smoke is visible, that is an indication that the
asphalt and/or the thermoplastic material is burning. Apply sufficient heat to liquefy the thermoplastic. This is achieved when the joints of the thermoplastic panels flow together. Bonding of the thermoplastic material to the asphalt surface can be monitored by carefully lifting a corner of the thermoplastic material before it completely cools. If asphalt is attached to the base of the thermoplastic material sufficient heat was applied. If not re-apply heat.

6.4.12 Special Requirements

The Service Provider may be required to take levels on top of the finished base course surface or milled down surface prior to laying of the asphalt layer (two points at the edges and one point at the crown across the width of the pavement) and at 15 metre intervals along the length of the road. After laying the asphalt, the Service Provider shall again take levels on the same points and in a similar manner. The difference of the two levels shall determine the thickness of the asphalt surfacing. Any deviation from the designed grade and level shall have to be rectified by the Service Provider at its own cost. The cost of taking levels shall be borne by the Service Provider.

6.4.13 Trench Cut for Installation of Services & Temporary Road Restorations Works

All trenches cut for installation of services are to be restored to their existing road surface level and configuration. Refer to standard drawings for temporary road restorations.

The general procedure for road cuts and trench restoration outlined below is to be followed unless otherwise specified by the City’s Representative:

1. Saw cut or mill existing pavement to width of proposed trench plus 200m minimum each side. Refer Section B2 Earthworks for saw cutting;
2. Remove existing asphalt/concrete, stone setts or unit pavers between saw cuts using appropriate device and as per the methodology approved by the City’s Representative;
3. Excavate trench and install service(s) without damaging the edges of the remaining asphalt or concrete. Refer Section B2 Earthworks for excavation for trenches;
4. Place and compact the pipe zone area with approved select fill or other material to be approved by the City’s Representative and level the surface above the pipe zone. Refer to Section B12 Road Opening and Restoration for specifications, compaction materials and tolerances;
5. The service provider shall provide subsoil drain where excavation is below the bed rock’s surface levels. The subsoil drain shall be wrapped in geotextile and connected to the nearest stormwater pit.
6. Backfill the trench from top of the pipe zone to road formation or sub-grade level in accordance with section B12 Road Opening and Restoration for specifications; and
7. Following compaction and formation of sub-grade the trench has to be restored back to the original road surface level as per the trench restoration standard drawings for specific roads. Where standard restoration drawings are not available, the restoration shall follow the existing road configuration. Refer to standard drawings for temporary road restoration for flexible and rigid pavements and the same shall follow for unit pavers or stone setts. All
restorations shall be in accordance with section B12 Road Opening and Restoration for specifications.

6.4.14 Permanent Restoration of Roadworks

All permanent restorations shall be in accordance with part B12 of this specifications (Road Opening and Restoration.) The City’s Representative, following completion of temporary road restoration works, shall closely monitor the performance and characteristics of the road for approximately six months before deciding on permanent restoration works. If the road has settled to a degree and warrants permanent restorations, the standard drawings and specifications are to be followed for specific road types as mentioned below:

- Flexible Pavement;
- Rigid Pavement;
- Stone Setts/Stone Road; and
- Unit Paved Road.

6.4.15 Dry Rolled Concrete / Sandstone Ballast

The City prefers to reinstate dry rolled concrete/sandstone ballast surfaces with flexible road pavement configuration including the replacement of base course layers with a lean mix concrete having a 28 day compressive strength of 5MPa (with fly ash).

6.4.16 Site Testing Equipment

The road formation to be proof rolled with minimum 10 tonne 3-point roller or alternative method to the City's satisfaction. All testing equipment is to be approved by the City's Representative before use.
6.5 Quality

6.5.1 Hold and Witness Points for Flexible Pavement

<table>
<thead>
<tr>
<th>1 - Process Held</th>
<th>Use of each type or source of granular pavement material. (Section 6.3.1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submission Details:</td>
<td>At least three (3) working days before each granular pavement material is proposed for use the Service Provider shall submit all test results demonstrating conformance of materials.</td>
</tr>
<tr>
<td>Release of Hold Point:</td>
<td>The City’s Representative will consider the submitted documents and may carry out surveillance and audit, prior to authorising the release of the Hold Point.</td>
</tr>
<tr>
<td>2 - Process Held:</td>
<td>Sub-grade preparation and placement of overlaying base, subbase or select material layers. (Section 6.3.1)</td>
</tr>
<tr>
<td>Submission Details:</td>
<td>At least one (1) day before proposed overlay of base, subbase or select material layers the Service Provider shall submit all test and survey results demonstrating conformance of the layer for material properties, compaction, level, surface trim and width.</td>
</tr>
<tr>
<td>Release of Witness Point:</td>
<td>The City’s Representative will consider the submitted documents and shall carry out surveillance and audit to witness the compliance requirements of subsequent pavement layers, prior to authorising the release of the Hold Point.</td>
</tr>
<tr>
<td>3 -</td>
<td>(Section 6.4.4)</td>
</tr>
<tr>
<td>i) Preparation of sub-grade</td>
<td>Attend site to test roller pass, water truck and/or Benkelman beam test to RMS T160. The road formation to be proof rolled (at least 5 passes) with minimum 10 tonne 3-point roller (or alternative method to the City's satisfaction). Check level prior to placing of sub-base material.</td>
</tr>
<tr>
<td>(Provide photographic evidence including the methodology and other related documents)</td>
<td></td>
</tr>
<tr>
<td>ii) Preparation of sub-base</td>
<td>Attend site to test roller pass, water truck and/or Benkelman beam test to RMS T160. The road formation to be proof rolled (at least 5 passes) with minimum 10 tonne 3-point roller (or alternative method to the City's satisfaction). Check level prior to placing base material.</td>
</tr>
<tr>
<td>(Provide photographic evidence including the methodology and other related documents)</td>
<td></td>
</tr>
<tr>
<td>iii) Preparation of base early stage</td>
<td>Attend site to test roller pass, water truck and/or Benkelman beam test to RMS T160. The road formation to be proof rolled (at least 5 passes) with minimum 10 tonne 3-point roller (or alternative method to the City's satisfaction). Check level prior to placing asphalt.</td>
</tr>
<tr>
<td>(Provide photographic evidence including the methodology and other related documents)</td>
<td></td>
</tr>
</tbody>
</table>
4. Process Held:

| i) Delivery of materials for priming, primer sealing or sealing to be used in the works; and |
| ii) Sprayed bituminous surfacing work for each work location. |

Submission Details:

| i) At least three (3) working days prior to proposed priming, primer sealing or sealing the Service Provider shall submit all test results demonstrating conformance of the materials proposed; and |
| ii) At least one (1) working day prior to the proposed sprayed bituminous surfacing works the Service Provider shall submit primer, primer binder, binder, aggregate lot details and target application rates and notification that the prepared surface to accept the sprayed bituminous surfacing is ready for inspection. |

Release of Witness Point:

| i) The City’s Representative will consider the submitted documents and may carry out sampling, testing and audit, prior to authorising the release of the Hold Point; and |
| ii) The City’s Representative will consider the submitted documents and shall inspect the prepared surface and may carry out calculations and audit, prior to authorising the release of the Hold Point. |

5 - Process Held

| Binder application |

i) Final stage of base course: Base surface dry, clean and free from deleterious material and ready for priming. Attend site to inspect materials for priming, primer sealing or sealing. |

ii) Surface uniformly covered with a fine sprayed coat of bituminous emulsion as per approved rate of application (Provide photographic evidence including the methodology and other related documents) Attend site following application of tack coat. |

6. Process Held: Use of each asphalt nominated mix in the works.

Submission Details: At least ten (10) working days prior to proposed commencement of asphalt works the Service Provider shall submit all designs, test result, certificates and other documentation that demonstrate conformance of the
asphalt with the Specification requirements for each asphalt mix proposed to be used.

**Release of Witness Point:** The City’s Representative will consider the submitted documents and may carry out testing, calculations and audit, prior to authorising the release of the Hold Point.

### 7. Process Held:

Placement of overlaying asphalt layers and surface course. (Section 6.3.2)

**Submission Details:** At least one (1) working day before proposed overlay of asphalt layers the Service Provider shall submit all test and survey results demonstrating conformance of the layer for material properties, insitu voids, level and width.

**Release of Witness Point:** The City’s Representative will consider the submitted documents and may carry out surveillance and audit, prior to authorising the release of the Hold Point.

### 8 - Process Held

i) Laying of asphalt on the base surface and surface course

(Provide photographic evidence including the methodology and other related documents)

*Attend site to inspect laying of asphalt with no segregation allowed or to accumulate along the sides of the receiving hopper.*

*Attend site during laying of surface course.*

ii) Survey

*Survey as outlined in 6.4.10 and as directed by City’s Representative.*

iii) Cleanliness of road surface prior to opening to traffic

*Attend site prior to being opened to traffic.*

### 6.5.2 Hold and Witness Points for Rigid Pavement

The same hold and witness points determined for flexible pavement will be applicable for rigid pavement up to the base level and the rest i.e. from base to surface level are to be followed as per the table below.

<table>
<thead>
<tr>
<th>1 - Process Held:</th>
<th>Production of concrete for concrete paving. (Section 6.4.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Submission Details:</strong></td>
<td>At least twenty (20) working days prior to commencement of concrete paving the Service Provider shall submit details of the proposed methods of handling, storing and batching materials for concrete, details of proposed mixers and methods of agitation, mixing and transport.</td>
</tr>
<tr>
<td><strong>Release of Witness Point:</strong></td>
<td>The City’s Representative will review the submitted details, prior to authorising the release of the Hold Point.</td>
</tr>
<tr>
<td>Process Held</td>
<td>Submission Details</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>2 - Process Held:</td>
<td>Preparation of formwork and placement of re-bar for the base course layer (Section 6.4.5).</td>
</tr>
<tr>
<td>Submission Details (Photographic evidence including the methodology and test results of re-bar)</td>
<td>The City’s Representative will approve the formwork and re-bar prior to authorising the release of the Hold Point.</td>
</tr>
<tr>
<td>Release of Hold Points</td>
<td>The City’s Representative will inspect the finished concrete surface, prior to authorising the release of the Hold Point.</td>
</tr>
<tr>
<td>Submission Details: (Photographic evidence of concrete pour including the methodology and Test results of concrete)</td>
<td>Following inspection of re-bar placement the Service provider shall collect 3 set of Cylinders in presence of the City’s Representative and send it to NATA registered laboratory for testing the compressive strength of concrete.</td>
</tr>
<tr>
<td>Release of Hold Point:</td>
<td>The City’s Representative shall inspect the finished concrete surface, prior to authorising the release of the Hold Point.</td>
</tr>
<tr>
<td>4 – Process Held</td>
<td>Attend site to witness pouring of concrete for concrete paving (Section 6.4.5).</td>
</tr>
<tr>
<td>5 Process Held</td>
<td>Attend site to inspect sealing of joints Sealing of Joints. (At least 2 day notice is to be provided to the City’s Representative.</td>
</tr>
<tr>
<td>6. Process Held:</td>
<td>Removal and disposal of non-conforming concrete. (Section 6.4.5).</td>
</tr>
<tr>
<td>Submission Details:</td>
<td>At least two (2) working days prior to commencement of work the Service Provider shall submit details of the equipment and methods proposed for removal and disposal of concrete paving.</td>
</tr>
<tr>
<td>Release of Hold Point:</td>
<td>The City’s Representative will review the submitted details, prior to authorising the release of the Hold Point.</td>
</tr>
</tbody>
</table>

Note: A/C shall comply with flexible pavement.

**6.5.3 Hold and Witness Points for Unit Pavers/Stone Setts**

The hold and witness points for unit pavers/stone setts shall be the same as rigid pavement up to the top of concrete base.

<table>
<thead>
<tr>
<th>Process Held</th>
<th>Submission details (i.e. test results for breaking load, slip/skid resistance and abrasive resistance and others)</th>
<th></th>
<th>Release of Hold Point:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Process Held</td>
<td>Commencement of paver placement (Section 6.4.6 and 6.4.7)</td>
<td>At least five (5) working days prior to ordering segmental paving units the Service Provider shall submit two samples of each paver type and test results for each paver type stating source of paver and demonstrating conformance to Table 6.4.3-1.</td>
<td>The City’s Representative will review the submitted details, prior to authorising the release of the Hold Point.</td>
</tr>
</tbody>
</table>
Release of Hold Points  |  The City’s Representative will examine each paver type and associated documentation prior to authorising the release of the Hold Point

2 – Process Held  |  Commencement of bedding sand placement or mortar (Section 6.4.6 and 6.4.7)

Submission details  |  Survey top of concrete base for conformity with design levels. Submit survey result.

Release of Hold Points  |  The City’s representative will consider the submitted documents and may carry out surveillance and audit, prior to authorising the release of the Hold Point.

3 – Process Held  |  Finish surface prior to applying jointing sand (Section 6.4.6 and 6.4.7)

Submission details  |  2 day notice period prior to completion of surface levels.

Release of Hold Point  |  City’s Representative to approve levels.

4 – Process Held  |  Attend site for each phase from bed preparation to installation of unit pavers/stone setts.

### 6.5.4 Limits and Tolerances

#### 6.5.4.1 Unit Pavers Roads

<table>
<thead>
<tr>
<th>Item</th>
<th>Activity</th>
<th>Tolerances</th>
</tr>
</thead>
</table>
| 1. | **Base**<br>a. Surface Level | • Finished level of base for road pavements to be within +10mm or -10mm of design levels;  
• Finished level of base other than for road pavements, to be within ±10mm of design levels; and  
• The top surface of the base for all segmental paving shall not deviate from a 3m straight edge, laid in any direction, by more than 5 mm. |
| 2. | **Laying Paving Units**<br>a. Joint widths | • No more than 10% of joints along any 10 metre line of joints along a major axis of the laying pattern shall have widths outside the range 2 -4mm. |
| 3. | **Completed Segmental Paving**<br>a. Surface level | • Finished surface level of pavers shall not vary from design levels by more than ±5 mm; and  
• Finished surface of pavers shall not deviate from a 3m straight edge, laid in any direction, by more than 5 mm. |
### 6.5.4.2 Stone Sett Roads

<table>
<thead>
<tr>
<th>Item</th>
<th>Activity</th>
<th>Tolerances</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Stone Shape</td>
<td>• Bottom face to be no less than 75% of surface area of top face; and&lt;br&gt;• Stones to have vertical sides.</td>
</tr>
<tr>
<td>2.</td>
<td>Laying Stones&lt;br&gt;a. Joint widths</td>
<td>• Joint thicknesses of between 8mm and 15mm are recommended; and&lt;br&gt;• An absolute minimum width of 3mm is to be strictly enforced. The 3mm absolute minimum is only acceptable in a joint where the 8mm minimum is achieved throughout the majority of the joint and the 3mm minimum occurs only at a point.</td>
</tr>
</tbody>
</table>