



Technical Specification

Bluestone and Granite Materials

August 2023

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1. General

1.1. Council supervision

The engineer in this Specification shall be the Manager Infrastructure of the City of Melbourne or their nominated representative.

1.2. Keeping specifications and plans on the works

The contractor shall keep on hand at the works for reference a complete set of specifications and all plans for the work, all additional and revised plans furnished by the engineer, and all orders issued to the contractor by the engineer that relate to the works.

1.3. Work carried out by other authorities and persons

For work which may be carried out by Council or other Authorities and completed prior to or during, or in progress, or additional works not shown which may also be undertaken, the contractor shall co-operate fully with the authorities carrying out the works.

1.4. Works Program, Traffic Management Plans and Work Method Statement

Prior to commencement of any works on site the contractor shall submit to the engineers for approval the relevant Works Program, Traffic Management Plans and Work Methods Statement.

Works shall not commence until such approvals have been obtained.

Such approval in no way relieves the contractor of the obligation or responsibility for the safe and proper conduct of the works.

1.5. Prevention of noise and dust

The contractor shall be responsible for and shall be deemed to have made due allowance for the control of dust and prevention of any associated hazard both on and beyond the works by spraying earth or other dust-causing surfaces with water or by other approved means.

All plant and equipment supplied by the contractor for use on the works shall be effectively "sound-reduced" by means of silencers, mufflers, acoustic linings or shields or acoustic sheds or screens, to a level to the satisfaction of the engineer. In the event of emergency work necessary for the saving of life or property or for the safety of the works, this clause shall not be applicable.

1.6. Protection of structures, services and other property

The contractor shall satisfy himself by such means as he shall consider proper as to the location of all structures or services or other property that may be encountered in the performance of the works.

The contractor shall protect and maintain free from injury or interference, any structure of any public or private services or other property liable to be injured by the works. In the event of any injury to any such structure, service or property, the party controlling it shall be immediately informed of the injury.

The contractor shall, at their own expense, repair and restore any fence, structure, service or property injured in any way to the like order and condition in which it was before such injury.

The contractor shall also be liable for any loss or damage which may result from such injury or interference to such structure, services of property and for any claim arising from delay in repairing and restoring it.

1.7. Storage of materials

All materials which are required for the work shall be stored, if the contractor finds it necessary to do so, only on the land of which the contractor has possession for the execution of the works.

Any site selected for such purpose is subject to the approval of the engineer, who may direct it to another location.

1.8. Barricades and warning signs

Full precautions shall be taken to minimise danger and obstruction to pedestrians and vehicles.

The contractor shall be responsible for all temporary barricades and warning signs. Water filled barriers shall be used throughout the period of the works, unless otherwise approved by the engineer.

All signing shall be in accordance with the Traffic Management Code of Practice, AS 1742.3-2009 Part 3 Traffic Control Devices for Works on Roads and the Worksite Safety - Traffic Management Code of Practice of the Road Management Act 2004. Flashing lights around barricading shall be used during the night.

When the permanent warning signs or markers are to be installed, the temporary barricades and warning signs shall remain in place until the engineer gives permission for removal.

1.9. Provision for drainage

Adequate temporary drains shall be provided if necessary to take surface water and maintain existing drainage.

1.10. Access to properties

The contractor shall make suitable and satisfactory arrangements during the period of the works for access to all properties. Forty-eight (48) hours' notice to owners shall be required if access is unavoidably hindered.

1.11. Australian Standards

Most up to date standards shall be used. Every attempt has been made to ensure the current versions of Australian Standards have been referred to in this specification. When there is a later version use that version of standards or replacement standard.

2. Site preparation and earthworks

2.1. Excavation

Excavation, removal and disposal of all excavation material shall be carried out only on days approved by the engineer.

The existing asphalt footpath shall be saw cut to a depth not less than 75 mm (or unless otherwise stated) where shown on drawings, sufficient depth to produce a near vertical face when excavated.

The existing asphalt roadway shall be saw cut to a depth not less than 125 mm (or 350 mm where the road pavement is 100 mm asphalt on 200 mm concrete) where shown on drawings, sufficient depth to produce a near vertical face when excavated.

Excavation shall be carried out in the materials and conditions as found to the lines, levels and profiles required by the drawings.

Bluestone kerbstone and pitchers shall be excavated in a careful manner and either disposed of at the contractor's own legal disposal site or stockpiled on site for later use, as directed by the engineer. Where the engineer approves the existing kerbstones and pitchers for reuse, they shall be thoroughly cleaned of any adhering material to the satisfaction of the engineer, prior to resetting.

When loading and unloading bluestone kerbs, approved lifting equipment shall be used by the contractor.

Costs of loading/unloading and transport and disposal of all kerbstones and pitchers are to be borne by the contractor.

The bases of all excavation, except for plantation areas, shall be graded and compacted to ninety-five per cent (95%) Relative Compaction.

Any soft, wet or otherwise unstable sub-grade material shall be brought to the attention of the engineer and if he so directs shall be removed and replaced with well compacted crushed rock.

Spoil shall be removed from the site to a place of legal disposal arranged by the contractor.

3. Reinforced concrete bases

3.1. Sub-base

After sub-grade preparation, crushed rock sub-base of 50 mm minimum thickness shall be graded and trimmed to the appropriate levels, moistened as necessary, and compacted to 100% Relative Compaction.

3.2. Formwork

Formwork shall conform to the lines, grades and dimensions of the finished concrete as required by the Drawings and shall be constructed of approved timber and metal. Forms shall be smooth, watertight and adequately braced and fixed to maintain position and shape during and after the placing of concrete.

All dirt, chips, sawdust, nails or other foreign material shall be completely removed before any concrete is deposited therein. Before concrete is placed in forms, all inside surfaces of the forms shall be thoroughly coated in oil or other approved agent which shall not discolour the concrete but permit the ready release of the forms without damage to the concrete.

The formwork for each monolithic section of work shall be completely constructed before concreting of that section is commenced.

Placing of concrete shall not be permitted to commence until the formwork has been inspected and approved by the engineer. Such approval shall not relieve the contractor of their responsibility for any defects in formwork which may become apparent during or after the placing of concrete.

3.3. Reinforcement

Steel reinforcement shall consist of hard drawn steel wire fabric, in accordance with AS4671, which is free from scale, oil and any other coating which may decrease bond strength. All reinforcement shall be accurately placed in the positions shown on the drawings.

Reinforcement shall be securely held with bar-chairs or other approved supports placed on the prepared sub-base in a regular grid pattern at a maximum spacing of one metre. Lapping at ends and sides of fabric sheets shall be at least 225 mm measured between outermost wires of each sheet.

3.4. Concrete

All concrete shall be ready-mixed at an approved plant and transported on site in accordance with AS.1379-2007 unless the engineer approves and provides a specification for site mixed concrete.

Concrete shall be an approved type of high early strength concrete which attains a minimum 48 hours compressive strength of 25 MPa and minimum characteristic 28 day compressive strength of 50 MPa unless otherwise specified in the approved drawing/s and or by the engineer.

3.5. Testing

Testing of concrete, in accordance with AS.1012, shall be carried out by the contractor at no cost to the Council.

Any concrete samples which do not attain the compressive strengths specified shall be subject to rejection at the discretion of the engineer. Any concrete so rejected shall be removed and replaced at the contractor's expense.

3.6. Placement and compaction

Concrete shall not be placed until the engineer has examined the formwork and given consent to proceed.

Immediately before placing concrete, the formwork and bedding shall be thoroughly wetted. Concrete which has developed its initial set or which is not placed within 20 minutes of discharge from the mixer shall not be used.

During and immediately after placing, all concrete in the formwork shall be compacted with approved high frequency needle type vibrators or vibrating screeds. Compaction shall fill the formwork with a dense homogeneous concrete entirely free of voids.

Vibration shall not be applied directly to the reinforcement or to sections of layers which have hardened to a degree such that the concrete ceases to be plastic under vibration. Vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but shall not be continued so as to cause segregation.

Only persons experienced in the use of vibrators shall be engaged. Any workman who is deemed by the engineer to be unsatisfactory shall be replaced immediately. If a vibrator is not available, the pour shall not proceed, and a standby vibrator shall be made available at the site prior to the commencement of work.

3.7. Finishing

Immediately after placing and vibration, the concrete shall be screed and trowelled to the correct level.

Final finishing is not required.

Departure from design level shall not exceed 5 mm.

3.8. Protection and curing

Exposed faces of freshly placed concrete shall be protected against loss of moisture or damage by rain by covering with polythene film, wet hessian or other approved material, immediately following the finishing operation. The protection shall be maintained in place for a curing period of 48 hours, unless a shorter period is authorised by the engineer. The concrete surfaces not covered shall be kept moist by flushing or sprinkling.

Throughout the curing period, the hessian or similar covering shall be continuously maintained in a wet condition while water-proof coverings such as polythene shall be removed once each day to permit thorough wetting of the concrete surface.

Pedestrian traffic shall not be permitted on fresh concrete for a period of at least 24 hours. Vehicular traffic access to laneways and car parks shall be restricted to a maximum of twenty-four (24) hours after pouring.

If curing compound is proposed for curing purposes, the contractor shall submit full details to the engineer for approval. If approved, the compound shall be used strictly in accordance with the manufacturer's recommendations.

All concrete work shall be protected with barricades or by other suitable means from vehicular traffic or other heavy loading likely to damage it.

3.9. Joints

3.9.1 Construction joints

Construction joints shall be installed when concrete placement is interrupted for 30 minutes or longer and as indicated in the drawing. Construction joints shall be normal to the pavement and shall not deviate in line by more than 20 mm from a 3 m straight edge. No additional payment shall be made for the installation of construction joints.

Unless otherwise approved by the engineer, construction joints shall not be within 1.5 m of an expansion joint and shall be tied, using N12 deformed tie bars 800 mm long at 800 mm centres, to the steel reinforcing fabric.

3.9.2 Isolation Joints

Isolation joints shall be constructed around the perimeter of the new paving, against buildings, around all pits, covers, poles and at other locations where shown on the drawing. They shall consist of 160 mm x 10 mm Abelflex closed cell polyethylene foam jointing material or approved equivalent.

"HPL" by Tremco (colour grey) sealant or approved equivalent shall be placed in the joint to make a flush joint with the finished surface level.

An isolation sawn joint shall be constructed at the property boundary to fully isolate paving within the road reserve and paving within the property boundary. Use aluminium or brass strip 10-12 mm deep and 2-3 mm wide in the joint bonded with epoxy glue. This material shall remain flush with the finished pavement surface at all times.

3.9.3 Expansion joints

Expansion joints shall be constructed perpendicular to the centreline of the footpath pavement where shown on drawings or at not less than 10 m spacing and not more than 12 m.

Each joint shall consist of 300 mm long R16 mild steel dowels placed centrally in the concrete slab and located at 300 mm centres. One half of the dowel is to be greased with a bond breaking compound prior to the pouring of the slab.

Abelflex jointing material (or approved equivalent) and "HPL" sealant (or approved equivalent) shall be fitted and applied in accordance with the manufacturer's specification (refer to drawing).

3.9.4 Sealant

Sealant at expansion and isolation joints, building lines and back of kerb shall be "HPL" by Tremco (colour grey) or approved equivalent. Application shall be in accordance with manufacturer's specification. **Sealant shall be applied during night hours at building entrances and where pedestrian access is required at all times. In these cases the contractor shall at their own cost cover the joints with a metal plate or similar until sufficiently cured.**

3.9.5 Connection joint

The contractor shall drill into the existing concrete base slab and place and grout 800 mm long N12 deformed tie bars at 400 mm centres. Half of the length of the deformed tie bars shall be embedded into the existing concrete slab with grout injected into the holes.

The deformed tie bars shall be tied to the steel reinforcing fabric in the new concrete base slab.

4. Bluestone kerb, radial and gutterstone

4.1. Removal of existing bluestone kerb and channel

Existing bluestone kerbs, radials and pitchers shall be excavated as required in a careful manner and shall be delivered to and disposed at the contractor's own legal disposal site unless otherwise directed by the engineer. Where the engineer approves the existing kerbstones, radials and pitchers for reuse, they shall be thoroughly cleaned of any adhering material, to the satisfaction of the engineer, prior to resetting.

The removal of existing reusable bluestone kerbs/radials shall, unless otherwise agreed by the engineer, be carried out under the supervision of the engineer. Should the engineer consider that the contractor has not exercised the required degree of care and has been negligent in their attempts to extract or handle these bluestone materials then the contractor shall be required to replace broken, chipped or unusable kerbs and radials or gutterstones at contractors own cost.

4.2. Supply of bluestone kerb, radial and gutterstone

Bluestone kerb and gutterstone shall be supplied by the contractor in accordance with Section 6 of this specification. Bluestone material shall be sourced from an approved prequalified bluestone supplier.

The contractor shall be responsible for storage, security, handling and transport and shall bear the cost of damaged or stolen units.

4.3. Kerb length and cutting

All kerbs to be installed on site, except at access ramps, shall not be less than 800 mm long even after allowing for the cutting and removal, with the approval of the engineer, and be free of damaged, broken or chipped parts.

All costs associated with the cutting of kerbs shall be borne by the contractor.

The contractor shall ensure that cuts shall be square to the top and outside vertical faces of the kerb. Bluestone kerbs and gutterstones shall be cut wet.

4.4. Setting

Bluestone kerb, radial and gutterstone shall be laid, butted together, on a bed of low slump, 20 MPa concrete of 75 mm minimum thickness.

The following tolerances shall apply to bluestone setting:-

- Departure from line or level shall not exceed 7 mm at any point.
- The rate of deviation shall not exceed 10 mm in 10 m.
- Except on curves, the deviation from 3 m straight edge shall not exceed 5 mm.
- Departure from cross-sections shall not exceed 5 mm.

4.5. Gaps between kerbs

Where gaps between bluestone kerbs and radials are between 4 mm and 10 mm and only as a result of stone manufacturing faults, the contractor shall fill the gaps with charcoal coloured mortar. All costs shall be borne by the contractor.

5. Bluestone paving

5.1. Supply of bluestone paving slabs

The supply of bluestone paving slabs shall be in accordance with Section 6 of this Specification. Bluestone paving shall be sourced from an approved prequalified bluestone supplier (Appendix D).

5.2. General - bluestone paving

This Specification is limited to the installation of bluestone slabs over a concrete sub base.

Finished paved surface shall be uniform and even and conform to the following tolerances:

1. Departure from design level not more than 10 mm.
2. Any lipping of adjacent units not more than 2 mm.
3. Departure from a 2 metre long straight edge, placed longitudinally to the footpath shall not exceed 4 mm.

Paving shall proceed in one direction commencing from the street corner, in a continuous manner and constant rate. Discontinuity shall only be allowed around covers and other service openings where cutting of paving units is required.

Bluestone paving shall be laid perpendicular to the alignment of the kerb. Unless otherwise stated in the drawings, bluestone paving pattern shall be stretcher bond commencing with half and whole pavers from the back of kerb. The contractor shall be responsible for setting out control lines to ensure that paving is not out of square before laying. Where bluestone paving pattern appears to be ambiguous or does not match adjoining bluestone paving, the contractor shall clarify with the engineer before laying.

Vehicles shall be kept off the paving until sufficient pavement strength has been achieved. Pedestrian access to buildings shall be maintained at all times.

Pavement areas subject to pedestrian traffic within the first 12 hours of curing shall be protected using boards or similar to the satisfaction of the engineer.

The contractor shall make due allowance for cutting around covers, trees, kerbs, etc., cutting of slabs adjacent to buildings and in ramp crossings as necessary and grinding of bluestone surface to eliminate lips between paving units.

Bluestone pavers shall be cut and ground wet to control dust. Diagonal cuts in paving shall not be permitted unless approved by the engineer.

Immediately after paving the bluestone surface shall be ground to eliminate lips between pavers. Upon completion of laying and joint grouting, paving surfaces shall be washed clean with no mortar remaining.

The contractor shall bear all such cost and shall take care to minimise dust during this operation.

5.2.3 Laying of paving units inside building line

Laying of paving units on the footpath shall continue and extend inside the building line areas only where indicated in the plan.

Isolation joint shall be installed at the building structure. The existing building concrete surface and corners areas shall be waterproofed by applying Fosroc Nonporite 600 waterproofing membrane or other waterproofing membrane as approved by the engineer in accordance with the manufacture's specification.

5.3. Standards - mortars and admixtures

Mortar components shall, unless otherwise specified, comply with the relevant portions of the Australian Standards for building materials:

Cement: Portland Type A cement AS 3972 - 2010

Sand: Concrete aggregates AS 2758.1 - 1998

Water: Shall be drinking water, supplied from Local Water Authority water outlets, and shall be free of contaminants.

Colour: Where specified by the engineer or in the Drawings, 'charcoal' or grey coloured concrete shall be achieved by adding 15 kg/cum black oxide Bayer 318 or approved equivalent. Coloured rendering of the surface (only) shall not be accepted.

5.4. Slurry components and preparation

5.4.1 General

A bonding slurry shall be applied at the interface of the in situ concrete base and the bedding mortar at the interface of the bedding mortar and bluestone paving.

5.4.2 Components

The bonding slurry shall consist of, in measures by volume:

- 1 part fine washed sand
- 6 part Portland Type A cement

5.4.3 Mixing

Mixing shall be performed either by hand, using a clean container and mixing tool, or in a cement mixer by adding sand and cement to the liquid (which shall initially be proportioned as one part by volume) whilst mixing continuously to ensure a smooth, homogenous consistency, free of lumps.

The amount of mix shall not exceed the quantity required to lay bluestone within 45 to 60 minutes, depending on climatic conditions.

All components shall be measured by means of calibrated containers.

5.5. Mortar bed components & preparation

5.5.1 General

Bluestone paving shall be fully bedded in a sand/cement mortar mix of a minimum thickness of 25 mm and a maximum thickness of 40 mm.

5.5.2 Components

The mortar bed mix shall consist of, in measures by volume:

- 1 part brick sand
- 2 parts fine washed sand

- 1 part Portland type A cement

5.5.3 Mixing

Mixing shall be performed in cement mixer, free of fresh or loose mortar residues, by adding the aggregates to the liquid (which shall initially be proportioned as one part by volume) whilst mixing continuously to ensure a homogeneous consistency free of lumps.

All components shall be measured by means of calibrated containers.

Water may be added in the specified proportions to impart to the mix a consistency such that it may be loosely hand shaped into a "cricket ball" which shall remain whole when released whilst leaving hand slightly moist (not wet).

The amount of mix shall not exceed the quantity required to lay bluestone within 45 to 60 minutes, depending on climatic conditions.

5.6. Grout components & preparation

5.6.1 General

Joints 5 mm wide between bluestone paving slabs shall be grouted to full depth of the paving slab with a non-shrink cementitious grout.

5.6.2 Components

The grouting mix shall be a dry mix bagged proprietary brand fine aggregate/cement/admixtures type grout (Durabed or approved equivalent) with high flow and low shrinkage properties, non-staining in the course of its application and of a compressive strength in excess of 20 MPa at 7 days.

5.6.3 Mixing

Mixing shall be in accordance with manufacturer's specification.

5.7. Installation

The following installation procedure shall be strictly adhered to:

1. Sweep concrete sub base and remove all foreign materials.
2. Prepare mortar mix.
3. Prepare slurry mix.
4. Dampen concrete base with clean water using a hand broom, apply slurry mix to concrete (approx. 1 mm thick) to area which shall not exceed extent of bluestone/granite unit to be immediately laid. Slurry shall remain wet to carry out next step.
5. Shovel mortar mix into position and loosely screed so that combined bed and stone thickness is higher than desired surface level by 5 mm.
6. Bed down dry stone (moist is acceptable but not soaked) and hit evenly over whole stone.
7. Remove stone, by means of lifting tool or by hand, fill voids with additional mortar and then loosen up bed lightly by criss-crossing and trowel through bed.
8. Apply coating of slurry to underside of bluestone/granite, ensuring that the initial application is stiffly brushed into the stone in a rotating motion, and build up slurry thickness to approximately 1 mm.

9. Bed down stone as per step (6) to finished surface level.
10. Trowel fill any voids with mortar at front edge and/or front corners of stone.
11. Discard excess mortar.
12. On completion of area cover bluestone/granite with hessian sheets and spray with water mist. Allow to remain moist for 12 hours minimum. To the satisfaction of the engineer, place wooden boards, or similar, over paving which is subject to pedestrian traffic within the first 12 hours of curing.
13. After a minimum of 12 hours curing the joints may be grouted. Where necessary remove foreign material within joints.
14. Prepare grout mix.
15. Dampen joints with sponge and pour or caulk grout mix into joints ensuring full penetration for the thickness of the paving slab by lightly tamping down a trowel edge into the grouting mix. Use a rubber squeegee to spread grout evenly into all joints until filled flush with the top of the stone. Remove excess grout, allow initial set and lightly broom off remaining excess perpendicular to joints. Appropriate cleaning to remove grout material from pores/ vesiculation in the top face of the paver shall be conducted.
16. Wipe stone clean with damp sponge to remove residual grout/mortar.

5.8. Quality control

It shall be the contractor's responsibility to ensure strict compliance with the specification by their labour force and/or sub-contractors.

The contractor shall notify the engineer two hours before mixing of components for slurry and mortar bed. Mixing of components shall not be carried out until the engineer has examined the equipment and work procedures and given consent to proceed.

Mix shall be liable to be rejected if the mix has not been inspected and the proportion of components has not been verified by the engineer.

5.9. Quality programme

The contractor shall prepare and present a programme which shall include the necessary methods to cover all aspects of compliance with Section (6) of this specification for approval by the engineer. The contractor shall maintain records of material consumption rates (per sq.m) for bluestone paving and provide details of same to the engineer upon request.

The quality programme shall include details of testing methods to be adopted by the contractor, together with documented evidence of results, as to whether the bluestone paving meets the following minimum requirements.

1. Sand: Cement ratio of the mortar bedding is in proportion of 3:1 by volume.
2. By visual inspection, the mortar mix is homogenous and of constant density.
3. The compressive strength of the mortar exceeds 15 MPa at 7 days.
4. Failure in horizontal shear at the mortar/concrete, mortar/bluestone interface or the mortar proper occurs at more than 100 kPa at 7 days.
5. Council requires a minimum of one (1) test per 100 sq.m of paving.

The contractor shall provide the results of the tests to the engineer at practical completion stage. A Practical Completion Certificate shall not be issued until this document is produced and approved by the engineer. Reinstatement of bluestone paving shall include replacement of damaged bluestone pavers. Charcoal coloured mortar in-fill for reinstatement of test cores is not acceptable.

5.10. Future maintenance

On the satisfactory completion of the external works, the contractor shall be required to maintain the paved areas over a period of twelve (12) months, after which the paving shall become the responsibility of the Council.

6. Supply of bluestone materials

6.1. Definition

For the purpose of this section of the specification "Bluestone Material" is deemed to mean bluestone (basalt) natural stone, manufactured in the form of straight and radial kerb, straight and radial gutterstone, paving slabs and other pieces as specified.

6.2. General requirements

1. The surface finish of all bluestone materials shall be diamond sawn, with no saw marks on the surface.
2. All bluestone materials shall be the product of machining of sound basaltic stone. The presence of secondary minerals may have a detrimental effect on bluestone durability, though their effects are dependent on the size, distribution and type of secondary minerals present. Stone shall be considered sound only if it has less than 8% secondary minerals as determined by methods of microscopic examination.
3. The bluestone materials shall not be supplied from a quarry used for aggregate and shall be quarried only with black powder or other approved soft blasting technique.
4. Bluestone materials containing surface cracking, clay, overburden, soft, friable or weathered material and other foreign matter shall be rejected.
5. No material including mortar, grout, epoxy etc. shall be used to fill in any perforations, vesiculation or porosity. This section applies to all stages throughout the process being during quarrying and cutting, installation, grouting and post installation.
6. Bluestone materials which do not comply with this specification shall be rejected by Council and shall be removed and replaced by the contractor/developer at their cost.

6.3. Bluestone material property requirements

All bluestone materials shall be compliant with the City of Melbourne performance criteria as shown in Table 1 below.

Table 1: Bluestone material property requirements and performance criteria.

Material property	Test standard	City of Melbourne performance criteria
Compressive strength	ASTM C-170	100 MPa, min
Flexural strength	ASTM C-880	14 MPa, min
Water absorption	ASTM C-97	1.6% wt, max
Abrasive index	ASTM C-1353-09	19 Ha, min
Secondary mineral content	AS 1141.26 - 2008	8%, max
Slip resistance	AS 4586:2013, HB198:2014	P5 (wet pendulum test) or R12 (Oil – wet inclining platform test)

1. **Compressive strength** (ASTM C-170): Compressive strength is rarely the cause of pavement failures as its compressive strength is usually many times that anticipated from its use. Compression testing does however provide a strength benchmark for the material. The minimum compressive strength of 100MPa in the City of Melbourne Performance Criteria is based on the recommendations of the Australian Stone Advisory Association Natural Stone Design Manual.
2. **Flexural strength** (ASTM C-880): Flexural strength is a measure of a material's bending strength when subject to a 4 point loading test. Flexural strength is preferred to the modulus of rupture test as it can use specimens with the same thickness and finish as on site and provides a more evenly distributed stress to accentuate weak spots across a broader area of the test specimen. The minimum flexural strength of 12MPa in the City of Melbourne Performance Criteria is based on the recommendations of the Australian Stone Advisory Association Natural Stone Design Manual.
3. **Water absorption** (ASTM C-97): In general, bluestone materials with a higher water absorption and porosity result in stones with less durability, less stain resistance and an increased susceptibility to salt attack. This test method however gives no information on the size and distribution of pores which can contribute to efflorescence and 'cupping' through capillary action of moisture drawn through from the mortar bed. The maximum water absorption of 1.6% wt in the City of Melbourne Performance Criteria is based on the recommendations of the Australian Stone Advisory Association Natural Stone Design Manual.
4. **Abrasive index** (ASTM C-1353-09): The abrasive index is a measure of the wear rate of the bluestone material. The minimum abrasive index of 19Ha in the City of Melbourne Performance Criteria is 4Ha units higher than the Australian Stone Advisory Association Natural Stone Design Manual minimum recommendation due to the high rate of foot traffic in its application.
5. **Secondary mineral content** (AS 1141.26 – 2008): The presence of secondary minerals may have a detrimental effect on bluestone durability, though the extent is dependent on the size, distribution and type of secondary minerals present. Stone shall be considered sound only if it has less than 8% secondary minerals as determined by methods of microscopic examination. The City of Melbourne Performance Criteria of 8% secondary minerals is based on historical performance criteria in service.
6. **Slip resistance testing** (AS 4586:2013 and HB198:2014): The minimum slip resistance required is P5 (Wet pendulum test) or R12 (Oil-wet inclining platform test) as per the recommendations in the hand book (Table 3B) for external ramps and footpaths etc. steeper than 1 in 14.

6.4. Colour requirements

In order to maintain consistency in the colour and contrast of newly laid bluestone areas the colour specification set out in this section shall be adopted for new bluestone materials. As the effects of foot traffic and contamination are known to cause discolouration over time, this specification is designed only to apply to new diamond sawn bluestone materials. This colour specification does not apply when comparing new bluestone to adjacent aged bluestone in-situ as new bluestone materials are expected to darken over time to better match the aged bluestone.

1. Whilst it is accepted that basaltic bluestone is a natural stone and minor changes in colour across individual bluestone units are possible, a reasonably uniform colour is required. Bluestone material units with patchy discoloured regions, tide-like markings or distinct colour gradients shall be rejected.
2. The colour and brightness of new, diamond sawn bluestone materials shall be consistent across the area to be laid so as to avoid the patchy or checkerboard effect of light adjacent to dark or blue adjacent to grey etc. Where newly laid areas are separated by a significant distance (i.e.: a road, street or section of asphalt pavement) colour variation is permitted between these areas (but not within) as these are deemed separate areas and not observed in the same field of view. Particular attention should be paid to this clause during the material sourcing stage for bluestone materials.

3. Where a discrepancy exists regarding colour/brightness tolerances in Clause 6(b), a colour atlas is available on request from the City of Melbourne. Though it is appreciated all colours and shades of bluestone are not able to be simulated on the colour atlas, a best approximation shall be used. All new diamond sawn bluestone material to be laid within one area, as defined in Clause 6(b), shall be within four shade units on the City of Melbourne Bluestone Colour Atlas and on adjacent colour columns (see example only in Appendix C, **not to be used for colour specification**). Bluestone materials must be of a diamond sawn finish, washed with water and dried fully immediately prior to colour inspection to remove all contaminants present. Inspection shall be performed under natural lighting conditions. Care must be taken to prevent discolouration of the Bluestone Tile Colour Atlas from UV light or external contaminants and should only be sourced from the City of Melbourne's City Infrastructure Branch.
4. Bluestone material units which are outside the acceptable colour/contrast range as displayed in the 'Bluestone Colour Atlas' shall be rejected.

6.5. Vesiculation size and distribution

To maintain the aesthetic character of bluestone used in the walkways of Melbourne the presence of vesiculation within the bluestone material is required. Vesiculation refers to gas pores within the stone more commonly appearing as round agglomerations, colloquially known as 'Cats paws' or in long thin strips known colloquially as 'veining'. Vesiculation may also appear as broad irregular shapes which are also permitted. Examples are shown below.



Figure 2: Veining



Figure 2: catspaws



Figure 3: Broad irregular shapes

1. Each individual top surface perforation pore shall not exceed 5 mm in diameter.
2. A minimum of 50% of bluestone material units (straight and radial kerb, straight and radial gutterstone, paving slabs pavers etc.) across an area shall contain 'some' vesiculation. Vesiculation can be in the form of 'catspaws', 'veining' and/or broad irregular shapes.
3. Of the 50% of bluestone material units containing 'some' vesiculation, the total surface area (when laid) of vesiculation of each bluestone material unit shall be between 5% and 30%. Examples of bluestone pavers with calculated surface area of vesiculation are shown below.
4. Vesiculations must not be filled in with mortar, grout or epoxy etc. or contain secondary mineral deposits.



Figure 4: 5% vesiculations



Figure 5: 10% vesiculation



Figure 6: 18% vesiculation

6.6. Surface finish

1. The surface finish of all bluestone materials shall be diamond sawn, with no saw marks on the surface.
2. The face edge of the top surface of the kerbing (straights and radials) shall be finished with a 25 mm radius.
3. Unless otherwise specified, edges of all bluestone material shall be finished with a 2 mm chamfer.

6.7. Dimensions and tolerances

6.7.1 Straight kerb

The cross-sectional dimensions of straight kerbstone shall be 300 mm (or 200 mm wide only where specified in the approved drawings) ± 1 mm x 300 mm (deep) ± 1 mm with both diagonals equal and the length for each kerbstone varying between 800 mm and 1200 mm. Special pieces required for access ramps shall be cut to meet the requirements of the drawings.

6.7.2 Radial kerb

The cross-sectional dimensions of radial kerbstone shall be 300 mm wide (or 200 mm only where specified in the approved drawings) ± 1 mm x 300 mm (deep) ± 1 mm, manufactured to the radius specified in the drawings. The radius shall be measured to the face of radial kerbstone. The length for each radial kerbstone shall vary between 800 mm and 1200 mm. Special pieces required for access ramps shall be cut to meet the requirements of the drawings.

6.7.3 Straight gutterstone

The cross-sectional dimensions of straight gutterstone shall be 250 mm wide ± 1 mm x 100 mm (deep) ± 1 mm or 250 mm wide ± 1 mm x 150 mm (deep) ± 1 mm with both diagonals equal and the length for each gutterstone varying between 800 mm and 1200 mm.

6.7.4 Radial gutterstone

The cross-sectional dimensions of radial gutterstone shall be 250 mm wide ± 1 mm x 100 mm (deep) ± 1 mm or 250 mm wide ± 1 mm x 150 mm (deep) ± 1 mm manufactured to the radius specified in the drawings. The radius shall be measured to the outside edge of the radial gutterstone. The length for each radial kerbstone shall vary between 800 mm and 1200 mm unless otherwise specified.

6.7.5 Paving slabs

The dimensions of paving slabs, as specified in the drawings, shall be in accordance with the following Council standard:

- 995 mm ± 1 mm (length) x 495 mm ± 1 mm (width) x 40 mm ± 2 mm (thick) for **footpath use**
- 495 mm ± 1 mm (length) x 245 mm ± 1 mm (width) x 80 mm ± 2 mm (thick) for **road use**
- 245 mm ± 1 mm (length) x 245 mm ± 1 mm (width) x 100 mm ± 2 mm (thick) for **vehicle access use** and
- with both diagonals equal and all surfaces square to each other.

6.7.6 Overflow kerbs

The dimensions of overflow kerbs shall be in accordance with Council standard drawing No.1P50320.

6.7.7 Granite inlay for bluestone access ramps

- 50 mm (wide) X 40mm (thick) “Panda”, “Riverina”, “Harcourt” or “Spring White” granite inlay with exfoliated surface shall be used to delineate ramp edges.

6.7.8 Granite hazard and directional Tactile Ground Surface Indicators

- 300mm X 300mm X 40mm “Versatac” by Eigen Stones, “SAI Tactile” by SAI Stone or “SignTac” by Signature Stone & Tile granite Tactile Ground Surface Indicators (TGSI's) shall be used in bluestone paving.
- 300mm X 300mm X 40mm White, “Pandatac” (flamed finish) by Eigen Stones or “Solidtac” (flamed finish) by Signature Stone & Tile granite TGSI's shall be used in asphalt pavement.

6.8 Inspection

Approval of bluestone material units to the requirements of Section 6 by a City of Melbourne inspector is required both before installation of new bluestone material units and at the completion of installation works. Inspections conducted prior to installation works are intended to provide developers/installers with immediate feedback on material compliance issues. Inspections conducted after installation has been completed are intended to ensure quality and consistency in accordance with the specification has been achieved.

6.8.1 Pre-Installation Inspection

After bluestone tile materials have been delivered on-site for installation a pre installation inspection is to be conducted by a City of Melbourne inspector. 10m² of bluestone pavers are required to be set out (not laid), washed with water to remove dust and dirt contaminants from the paver surface and allowed to fully dry. An inspection of the 10m² of pavers shall then be conducted and a conformance checklist completed, Appendix B.

Installation of bluestone materials may only commence at the approval of the City of Melbourne inspector

6.8.2 Completion of installation inspection

After installation of the bluestone paved area has been fully completed, a Completion of Installation Inspection is to be conducted by a City of Melbourne Inspector.

This is to ensure the balance of the paved area meets the requirements of the specification as displayed in the area subject to the Pre-Installation Inspection. The laid area shall be cleaned to remove dust and dirt contaminants from the paver surface and allowed to dry fully before inspection. A conformance checklist is to be completed, Appendix B.

6.8.3 Third party independent inspection

Where conjecture exists as to compliance of bluestone materials to this specification, a third party authorised inspection body such as ATTAR may be employed to provide the inspection services listed in 6.8.1 and 6.8.2 above.

6.9 Approved bluestone material suppliers

Refer to Appendix D for Council approved prequalified bluestone material suppliers.

7 Cleaning up on completion

Upon completion of the works, the contractor shall clear away and remove from the site all constructional plant, surplus materials, rubbish and temporary works of every kind and leave the whole of the site and works clear and in a workmanlike condition, to the satisfaction of the engineer.

The contractor shall clean up any materials lost overboard from vehicles in transit delivering or removing material under this Contract, to the satisfaction of any local authorities.

Appendix A

Standard drawings

Drawing no.	Description	
1P50320	Overflow bluestone kerb	https://www.melbourne.vic.gov.au/SiteCollectionDocuments/drawing-50320f-mcc-overflow-bluestone-kerb.pdf ¹
1P50402	Bluestone paving construction details	https://www.melbourne.vic.gov.au/SiteCollectionDocuments/drawing-50402f-bluestone-paving-construction.pdf ²
1P50406	Kerb and channel setting details	https://www.melbourne.vic.gov.au/SiteCollectionDocuments/drawing-50406b-bluestone-kerb-channel-setting.pdf ³

Standard Drawings can be found at [Engineering Standard Drawings - City of Melbourne](#)⁴.

Paving details around tree plots shall be supplied by the engineer.

¹ <https://www.melbourne.vic.gov.au/SiteCollectionDocuments/drawing-50320f-mcc-overflow-bluestone-kerb.pdf>

² <https://www.melbourne.vic.gov.au/SiteCollectionDocuments/drawing-50402f-bluestone-paving-construction.pdf>

³ <https://www.melbourne.vic.gov.au/SiteCollectionDocuments/drawing-50406b-bluestone-kerb-channel-setting.pdf>

⁴ <https://www.melbourne.vic.gov.au/building-and-development/standards-specifications/pages/engineering-standard-drawings.aspx>

Appendix B

City of Melbourne: Supply of bluestone materials conformance checklist

- Pre-installation inspection
 Third party independent inspection

Client: _____ Inspection date: _____

Client contact: _____

Location description: _____

Item No	Checklist	YES	NO	PASS/ FAIL	Comments
1	Has the bluestone sourced from an approved prequalified bluestone supplier?				
2	Has the required 10m ² of paving been set out for inspection?				
3	Does the required 10m ² of paving appear to have been washed, dried and free of dust and contaminants?				
4	Are saw markings visible on the surface?				
5	Are cracks, clay, overburden, soft friable or weathered material visible?				
6	Do individual units contain patchy discolorations, tide marks and/or large colour gradients?				
7	Do all units within the area appear of consistent colour to avoid patchy or checkerboard effects. Or do they fall within the 'acceptable colour/contrast range' according to the 'Bluestone Paver Colour Atlas'?				
8	Do at least 50% of pavers include vesiculation?				
9	Of the 50% units that include vesiculation, is the combined area of vesiculation between 5 and 30% for each paver?				
10	Do any pores exceed 5mm in diameter?				
11	Has any mortar, grout, epoxy etc. been used to fill vesiculations/pores?				
12	Are all dimensions and tolerances within the specified limits?				

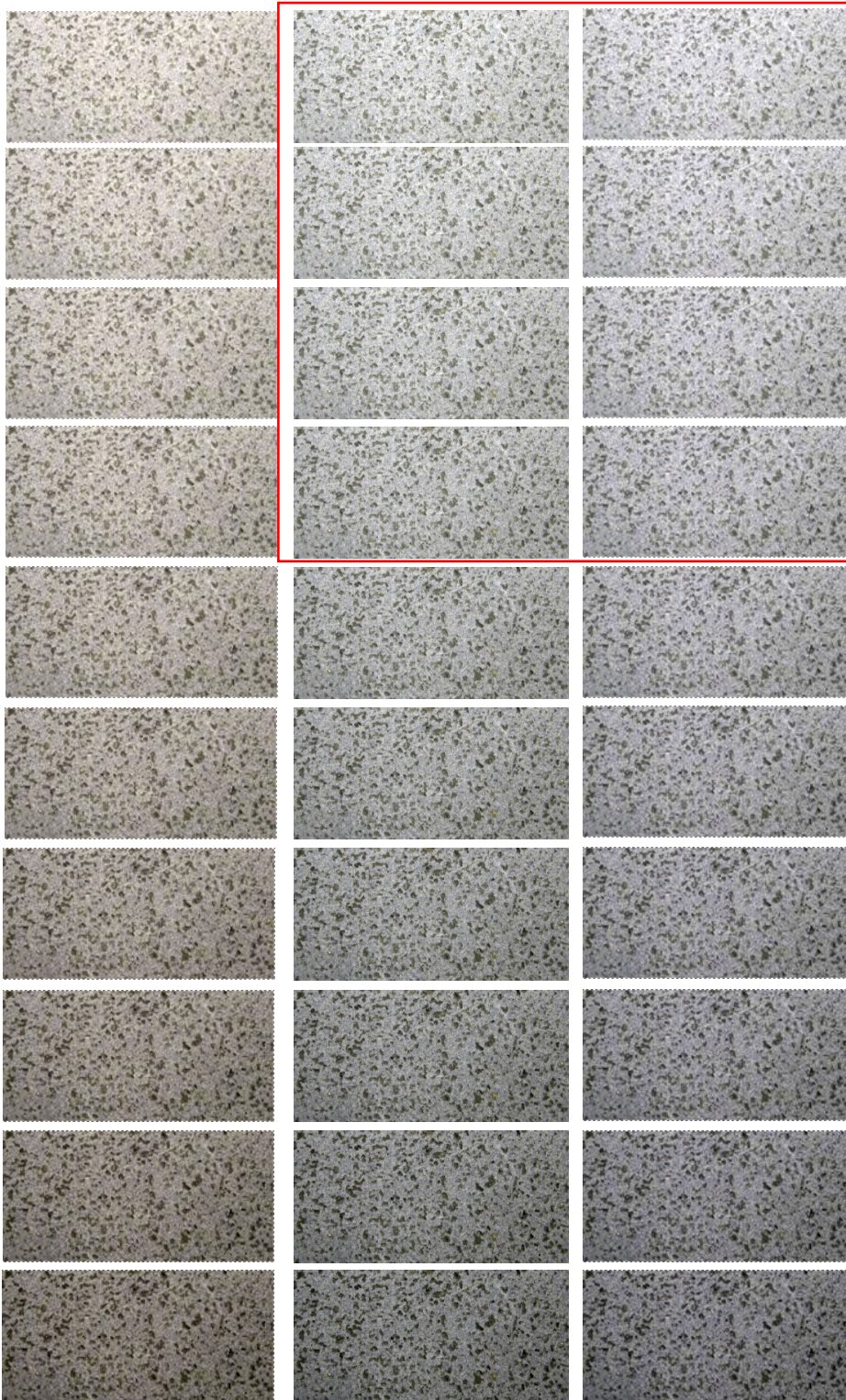
Inspector name: _____ Inspector signature: _____ Date _____

Conformance checklist outcome (Approved/Does not comply): _____

Appendix C

Supply of bluestone materials

Colour atlas example



2 (columns) x 4 (rows) box used to identify acceptable area for a single installation. Position of 2 x 4 box may be moved around the colour atlas as desired.

Contact City of Melbourne's City Infrastructure Branch for bluestone material colour atlas to be used with this specification.

Appendix D

Contract 8765A: Approved pre-qualified bluestone and granite suppliers: Registration period 3 August 2023 to 2 August 2026

Bluestone Supplier	Address	Contact details	Bluestone paving	Bluestone kerb	Bluestone channel	Bluestone radials	Bluestone access ramp	Bluestone blocks	Granite TGSI's
BAM & Associates Pty Ltd	206 Hamilton-Port Fairy Road Port Fairy VIC 3284	Michael Steel Managing Director Ph. 03 5568 2655 sales@bamstone.com.au	Yes	Yes	Yes	Yes	Yes	Yes	N/A
Victoria Bluestone Quarries	410-422 Francis Street Brooklyn VIC 3012	Tina Skliros Major Contracts Manager Ph. 03 9314 4700 sales@vicbluestone.com.au	Yes	Yes	Yes	Yes	Yes	Yes	N/A
Signature Stone & Tile Pty Ltd	30/ 11 Bryants Road Dandenong VIC 3175	Ms Jacinta Le General Manager Ph. 03 9708 2348 jle@signaturestone.com.au	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Eigen Stones	Unit 4 106-110 Highbury Road Burwood VIC 3125	Michael Lim Managing Director Ph. 03 9018 7954 info@eigenstones.com	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SAI Stone	5 Hamilton Street Oakleigh VIC 3166	Cameron Grover Sales Manager Ph. 1300 855 851 info@saistone.com	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prolific Stone International	4/ 59 Canterbury Road Kilsyth VIC 3137	Simon Heyblok Director Ph. 03 8751 8880 simon@prolificstone.com.au	Yes	N/A	N/A	N/A	N/A	N/A	N/A