

STANDARDISED FOOTPATH PAVEMENT DESIGN SPECIFICATION

Technical Specification

City of Adelaide

05/04/2023

ACKNOWLEDGEMENT OF COUNTRY

The City of Adelaide acknowledges that we are located on the traditional Country of the Kaurna people of the Adelaide Plains and pays respect to Elders past, present, and emerging.

We recognize and respect their cultural heritage, beliefs, and relationship with the land. We also extend that respect to visitors of other Aboriginal Language Groups and other First Nations.

DOCUMENT PROPERTIES

Contact for enquiries and proposed changes

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Record Details

HPRM Reference:

HPRM Container:

Version History

Version	Revision Date	Revised By	Checked by
1	04/04/2023	Adithia Maria Paul	Rasika Krishan

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1 INTRODUCTION

1.1 Terminology

The following terminology shall apply to this specification:

Term	Definition
Principal	City of Adelaide
The Superintendent	The Principal's project manager, Principal's delegate or external consultant engaged by the Principal to oversee the works and release hold points on behalf of the Principal.

1.2 General

This technical specification specifies the technical requirements for the supply and construction of works associated with footpaths and paving to all areas within the City of Adelaide (CoA).

This specification is to be read in-conjunction with endorsed CoA Standards Suite and approved contract set drawings and shall take precedence over the afore-mentioned documents.

Any variations or ambiguity between the Technical Specification, the endorsed CoA Standards Suite or other approved contract set drawings shall be referred to the CoA Representative for a decision before proceeding with any Tendering or Works.

1.3 Scope of Works

This Technical Specification shall comprise the whole of the plant, labour, and materials necessary to execute the works as shown on the contract set drawings and CoA Standards Suite for footpath construction, including any obvious items for the proper completion of the work comprising but not limited to:

Preliminaries and General Construction Works include:

- Liaison and co-operation with The Superintendent, the Principal and Service Authorities
- Notification and liaison with residents & businesses adjoining the site.
- Setting out the works from established benchmarks and boundaries
- Location and identification of underground and overhead services (Before You Dig Australia–BYDA)
- Protection of services during construction
- Co-ordination with Service Authorities for all necessary relocation / adjustment of services required for the construction of works.
- All associated traffic controls for works on roads.

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Earthworks include:

- Soil erosion and drainage management plan during construction
- Clearing the site
- Excavation of footpath pavement as required to complete the works.
- Disposal of surplus excavated material, preferably recycling offsite.
- Placing and compaction of fill material
- Ground preparation required to bring the site to the correct shape and level.
- Preparation of the subgrades.
- Quality Assurance – Testing and Tolerances.

Concrete Works include:

- Supply and installation of Formwork, including stripping.
- Supply and installation of Reinforcement.
- Supply and installation of Concrete.
- Placement and Finishing of Concrete.
- Jointing of Concrete.
- Curing & Protection of Concrete.
- Stripping of formwork.
- Supply & installation of Kerb, Guttering, Surface Drainage and Miscellaneous Structures. Refer to CoA Stormwater Drainage Specification for these works.
- Quality Assurance – Testing and Tolerances.

Paving Works include:

- Supply of various pavement materials and finishes.
- The quality of various pavement materials and finishes.
- The placement of various pavement materials and finishes.
- Supply and installation of Natural Stone Pavers.
- Supply and installation of Clay Pavers.
- Supply and installation of Concrete Pavers.
- Supply and installation of Asphalt Paths.
- Supply and installation of Concrete Paths.
- Supply and installation of Rubble Paths.
- Ensuring the alignment, dimensions, cross sections, and levels indicated on the approved contract drawing set and the CoA Standards Suite are within tolerance levels indicated within this specification.
- Quality Assurance – Testing and Tolerances.

Practical Completion to include:

- Clean-up and demobilisation.
- Defects Inspection and Testing, as required.
- Provision of 'As-Constructed' drawings.

2 GENERAL PROVISIONS

2.1 Public Utilities

Information provided by the Superintendent to the Contractor is neither necessarily complete nor accurate and is provided for general information only. The Contractor shall investigate the existence and location of buried and overhead public and private services within the working area. The Contractor shall satisfy itself as to their exact location in liaison with the relevant service authority.

The Contractor shall comply with the guidelines issued by the Office of the Technical Regulator and relevant authorities when working in the vicinity of underground and overhead services. The Contractor shall take due care when working in the vicinity of existing services and take all necessary precautions during the Contract to protect all services from damage. The Contractor shall be responsible for any cost resulting from damage to services through its operations.

The Contractor shall be responsible for determining the effect of the existing services on construction activities and shall make all arrangements and necessary payments to the respective authorities for any temporary or permanent relocation of services and new service connections which may be required by or because of its operations and the project requirements. Authorities shall be given six (6) weeks' notice prior to any service work being undertaken.

If, while works are in progress, any authority desires to place a service, the Contractor shall allow reasonable access and working space for the authority to carry out such placement, if so, requested by the Superintendent.

Any existing or abandoned service that is disturbed shall be restored to the satisfaction of the service authority at the Contractor's cost.

2.2 Temporary Alterations to Public Utilities

If, during construction works, the Contractor deems it necessary to have Public Utilities removed or altered to enable easier or quicker construction, such removal or alterations will be arranged by the Contractor and any costs incurred will be paid by the Contractor.

2.3 Relevant Authorities

The Contractor shall be responsible for liaising with all relevant authorities about programming of works. Where work is to be undertaken in accordance with relevant authorities' standards and specifications, the Contractor is to seek and obtain the necessary standard details and approvals.

2.3.1 Utility Covers

The contractor shall check the site and confirm the locations, sizes, and numbers of the existing utility pits.

All covers shall be recessed and in-filled with paving material specifically constructed to lie flush with the cover edge and surrounding pavement. Infills to be concrete unless specified by the Principal, except for footpaths with natural stone paving. Infill lids in granite shall be constructed as per the CoA standard drawings.

Refer to CoA standard drawing CoA 970-974 for matching into service pits.

2.3.1.1 Adjustment and Relocation

Where the level of the footpath is altered from its existing level, the contractor shall liaise with the service provider to adjust and relocate all the existing pit frames and covers that are to be retained to finish flush with the adjacent finished footpath surface.

The contractor shall ensure that the existing pit frames and pit covers that are to be re-used are free from rust and from twists and warps, which would result in uneven seating of the pit covers when relocated.

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Where stone paving is to be installed, all existing complying Class C & non-slip metal lids are to remain, and any new infill lids are to be stone infill as per the CoA standard drawing CoA 970-974 for matching into service pits.

2.3.1.2 Loading

For pit covers in the footpath, loading Class C, 150kN shall be used unless noted otherwise on the contract drawings.

2.4 Quality Management

The Contractor shall plan, establish, and maintain a Quality Management System to ensure the materials and their works comply with the drawings and the specification.

2.4.1 Inspection and Testing

As part of the Quality Plan the Contractor shall prepare Inspection and Test Plans (ITP) for critical items in the project. The ITPs shall detail the Contractor's proposals for inspections and testing as detailed in the Technical Specification.

The Contractor shall be responsible for undertaking all testing and coordinating all inspections required in the Technical Specification.

The Contractor shall nominate the person responsible for the quality control of each item of the ITP. The Contractor shall maintain the ITPs during the works and make the ITP available for inspection by the Superintendent on request.

The frequency of testing shall be as detailed in the Technical Specification. If no minimum frequency is stated, the Contractor shall nominate appropriate industry or Australian Standard frequencies in the ITP.

The Contractor shall provide a copy of the draft Inspection and Test Plans to the Superintendent prior to commencement of the works.

Prior to the date of Practical Completion, the Contractor shall provide a copy of all completed ITPs. This documentation should provide sufficient assurances for Council that all pavers supplied on site comply with the required standard and are in accordance with the specification. The acceptance of the completed ITPs shall be a requirement for the issue of a Certificate of Practical Completion.

2.4.2 Hold Points

Hold Points are critical aspects of the works requiring assessment by the Superintendent.

The Contractor shall not proceed to the next stage of the works or cover the work until the release of the Hold Point by the Superintendent. Such release shall not, in whole or in part, release the Contractor from responsibility for the quality of the work subject to the Hold Point.

The Contractor shall advise the Superintendent with sufficient notice (nominally 24 hours excluding weekends and public holidays) when a Hold Point has been reached (or is anticipated to be reached) to enable inspections as required.

The Contractor shall submit relevant testing, survey and other documentation associated with the Hold Point to the Superintendent.

If following the inspection and review of relevant documentation, the Superintendent does not release a hold point, the Superintendent shall advise the Contractor, as soon as practical in writing (or within 24 hours), the reasons why a hold point has not been released and any remedial works required to enable the release of the hold point.

The Superintendent or Principal shall NOT be liable for any cost (including standby costs) incurred by the Contractor as a result the Superintendent not releasing a hold point due.

2.4.3 Non-Conformances

The Contractor shall notify the Superintendent if the completed works do not comply with the contract drawings, CoA Standards Suite or technical requirements and issue in writing the non-conformances by the issuing of a Non-Conformance Report (NCR).

The NCR shall indicate the nature and location (as applicable) of the non-conformance and the proposed rectification method for correcting the Non-Conformance. The NCR shall include all relevant tests, inspection, or survey reports.

The identification of a Non-Conformance shall constitute a Hold Point on that item. No further works may proceed on the non-conforming item until release of the Hold Point by the Superintendent.

The Superintendent shall review and approve the proposed rectification method detailed by the Contractor or alternatively instruct the Contractor to complete other rectification works as required.

If the Superintendent becomes aware of any section of the works not conforming with the drawings or specification, the Superintendent may issue a Corrective Action Request (CAR). The Contractor shall review the corrective action request and address the CAR as per the procedure for an NCR.

2.4.4 Testing Laboratories

The Contractor shall ensure suitably qualified NATA accredited Material Testing Laboratories carry out all field and laboratory testing, compliance testing etc as required under the Contract.

2.4.5 Traceability

The Contractor shall as part of the Quality Plan develop a system to enable the traceability of all materials including but not limited to structural concrete (in situ and precast), pavement material, paver wearing surfaces and asphalt from the source to the location where the material is incorporated into the works.

Traceability shall include:

- the date of works.
- a detailed description of the materials used (e.g., material type, production lot etc.).
- a detailed description of the location where the material is incorporated (e.g., structure reference).

The Contractor shall keep (in good condition) delivery records (dockets) of the materials used and detailed descriptions of where the materials were incorporated in the works until Final Completion.

2.5 Survey

2.5.1 Survey Marks

The attention of the Contractor is drawn to the appropriate sections of the Crown Lands Act and the Surveyors Act regarding the care of survey marks.

2.5.2 Levels

Existing levels at the time of the most recent survey are supplied for the assistance of the Contractor and are not intended to indicate every detail of the surface profile.

Some levels may be required to be determined on site in the presence of the Project Superintendent.

2.5.3 Setting Out

The works are to be set out in accordance with the information provided on the drawings, or as otherwise directed by the Superintendent. From this information the Contractor shall set out the whole of the works and shall accept the full responsibility for the alignment, levels, and dimensions of all parts of the works.

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The Contractor shall exercise proper care in the preservation of all boundaries, alignment, reference and level pegs or marks set out for his use and that of the Superintendent. If such pegs or marks are damaged, lost or removed by the Contractor's operations, they shall be reset at the Contractor's expense.

2.5.4 Verification Surveys

The Contractor shall provide a verification survey detailing the variance between the design level and the actual level at the following frequency:

Table 2.1 Verification Surveys

Item	Frequency of Survey
Sub-grade	One level per 10 lineal m per 3m width
Finished pavement layers	One level per 10 lineal m per 3m width, per layer

A copy of the survey reports shall be provided to the Superintendent within seven (7) days of completion of the survey. The survey reports shall clearly indicate whether the works are within tolerance and if not, areas that are outside of the tolerance. Provision of this survey report constitutes a **HOLD POINT**.

If the survey indicates the work out of tolerance, unless approved by the Superintendent, the Contractor shall rectify the works and arrange re-survey at the Contractor's cost.

2.5.5 As-Constructed Drawings

The Contractor shall provide all labour, plant, and equipment, including all field survey, measurements and drafting, to produce 'As Constructed' drawings. 'As Constructed' drawings shall be produced by amending the original design drawings to reflect all works as executed to a level equal to that shown on the original design drawings, unless noted otherwise below. The following as-constructed details shall be shown as a minimum:

- Earthwork levels, in a grid suitable to give a true representation of the finished surface (e.g., top and toe of batters, finished surface level of cut and fill zones etc)
- Pavement – finished surface level including grade changes.
- Other infrastructure as required by local service authorities.

In addition to design and 'as constructed' details, any relevant additional information obtained during construction of the works, such as the verification of location, size, type and level of existing services, or location of additional services not shown on the design drawings, shall also be shown on the 'As Constructed' drawings.

Existing survey and design information that is shown on the original design drawings and is considered to be relevant for the information of the Principal (such as TBMs, borehole locations, street names, cadastral and ownership information etc), shall be retained on the 'As Constructed' drawings.

The Principal shall provide drawings as issued "for construction" to the Contractor in AutoCAD format to assist in drafting "as constructed" details.

The "As Constructed" details shall be electronically drawn onto sheets to the same size as the original design drawings. The Contractor's 'As Constructed' drawings shall be drafted to match the layout, scales, style, and format of the original design drawings. Scales, layouts, and formats shall not be changed by the Contractor without the approval of the Superintendent's Representative.

'As Constructed' drawings shall be drafted using the same drawing numbers as per the initial design drawings as issued for construction and revised as required to show "as constructed" status.

The drawings should meet City of Adelaide Standard AutoCAD Drawing Information outlined on Council's website. Refer to the below link for detailed CAD drafting guidelines.

<https://www.cityofadelaide.com.au/development-infrastructure/infrastructure/construction-standards-guidelines/>

All survey data shall be to Geocentric Datum of Australia (GDA2020) and elevations to the Australian Height Datum (AHD).

Final 'As Constructed' drawings shall be marked with the name of the Contractor and be endorsed on the drawings as being correct by the Contractor.

Final 'As Constructed' drawings shall be provided in AutoCAD, PDF, and hardcopy format. The Contractor shall provide a DWG file together with all fonts, style and XREF details and with a drawing exchange file (DXF) for each drawing.

The Superintendent's Representative shall retain the right to withhold the issue of Practical Completion until satisfactory "As Constructed" information is received from the Contractor.

2.6 Environmental Management and Protection

The Contractor shall take all measures necessary to ensure minimum disturbance to the existing environment by its operations.

The Contractor shall observe all environmental management rules, regulations and codes of practice and shall comply with all notices and instructions issued by the Superintendent in relation to such Rules and Regulations.

When flammable or combustible materials are to be stored or used, the Contractor shall adhere strictly to relevant standards or codes of practice.

2.6.1 Environmental Control During Construction

The Contractor shall carry out the work with reference to the EPA Codes of Practice listed at the end of this specification clause.

The Contractor shall ensure that pollutants such as dust, sediment, litter and wash down water do not leave the site during construction of the works. Prior to construction commencing, the Contractor shall prepare a Soil Erosion and Drainage Management Plan (SEDMP) showing how this is to be achieved. The Plan shall include a site layout together with a written manual. These shall include all aspects of site management including:

- site access from public or private roads.
- access around the site.
- areas of earthworks, stockpiles, loading areas.
- site drainage including all relevant information including sediment collection devices, drainage lines and discharge points.
- management of creek or river flows.

Water shall be used in a judicious manner to avoid wastage and in accordance with any applicable water restrictions.

The approval of a Soil Erosion and Drainage Management Plan by the Superintendent shall constitute a **HOLD POINT**.

2.6.2 Trucking

Trucks accessing the site with earth materials or loose debris shall be loaded in such a manner as to prevent dropping of materials and prevent a dust nuisance. The wheels, tracks and body surfaces of all plant and vehicles leaving the site shall be free of mud so that mud is not carried on to adjacent roads or paved areas.

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2.6.3 Solid, Liquid and Gaseous Contaminants

The Contractor shall be responsible for the proper disposal of all solid, liquid and gaseous contaminants in accordance with all Statutory and Contractual Requirements.

2.6.4 Disposal of Refuse

Refuse from construction operations, including food scraps and the like, shall be removed from the site.

2.6.5 References

Stormwater Pollution Prevention – Code of Practice for the Building and Construction Industry – EPA.

Stormwater Pollution Prevention – Code of Practice for Local, State and Federal Government – EPA.

2.7 Preservation of Trees and Vegetation

The Contractor shall refrain from destroying, removing, or clearing trees and shrubs to an extent greater than is necessary for the execution of the work under the contract. Areas to be cleared shall be inspected by the Contractor and the Superintendent's approval obtained before any trees or shrubs are removed, cleared, or destroyed.

The Contractor shall take every reasonable precaution not to damage any tree, including its root system, which is nominated to be retained.

All construction activities, including storage of materials, vehicles, equipment, or rubbish, must be kept away from existing trees which are to be retained. Before any excavation is carried out over roots of trees to be retained, obtain a ruling from the Superintendent as to whether the levels in the vicinity of the tree can be adjusted to protect the roots.

The Superintendent may direct the Contractor to repair any damage or injury to a tree that is to remain. This work shall be carried out by an approved tree surgeon engaged by the Contractor.

2.8 Drainage of Site During Construction

The Contractor shall carry out the work in such a way as to ensure that no heading up of floodwaters in new or existing drains or gutters occurs. The Contractor shall be responsible for any damage to public or private property caused by his operations, or which may arise from such operations. Should this clause not be complied with, the Superintendent may order work to cease, until in his opinion, satisfactory arrangements for such drainage have been made.

The site may be subject to surface water in the form of base flows or flood flows during the construction period. The Contractor is required to account for and handle all flows, base, and flood, during the construction period, and shall be deemed to have made do allowance in his tender for all costs involved.

2.9 Traffic Management

The Contractor shall prepare, implement and maintain Traffic Management Plan for all works on or adjacent to existing roadways, for the protection of the public and of the works, in accordance with AS 1743 – “Road signs - Specifications”, DIT Requirements and City of Adelaide Requirements outlined at <https://www.cityofadelaide.com.au/business/permits-licences/city-works/>

Should this clause not be complied with, the Superintendent may order work to cease until in his opinion the placement of lights, signs and barricades is satisfactory for the protection of the public and the works. All such lights, signs and barricades shall be placed by the Contractor and in accordance with the relevant requirements of that code.

2.9.1 Traffic Management Plan

The Contractor shall develop a Traffic Management Plan including the full layout plans of the proposed traffic management scheme and the estimated times that any proposed detours will be in operation and shall show relationship to the construction program.

The traffic management plan shall be developed by the Contractor to minimise the disruption to traffic flow and consider peak traffic concentrations. Where possible the Contractor shall limit traffic restrictions to weekend or non-peak periods.

The Contractor shall submit a detailed traffic control proposal to the Superintendent within seven (7) days of acceptance of the tender. No work shall commence on site until the traffic control proposal has been reviewed by the Superintendent. No roads shall be used as detour routes, in the compliance with this clause, without the prior approval of the Superintendent.

The Traffic Management Plan shall show in detail:

- the traffic management proposed during each stage of all projects.
- all temporarily trafficked areas associated with the deviation of traffic.
- proposals for the placement of temporary signs, advance direction signs, barriers and other warning devices including a list of the types and numbers of signs proposed to be used.
- detour path for buses (where required).
- proposed speed restrictions.

If the Contractor varies the construction program at any time throughout the works, a revised Traffic Management Plan shall be submitted twenty-four (24) hours before the relevant section of work commences.

2.9.2 Notice of Traffic Management

Prior to commencing works on or adjacent to existing roadway and the implementation of traffic management controls the Contractor shall notify the relevant authorities including:

- Local Council – City Works Department
- Emergency Services
- Passenger Transport Board
- The Superintendent
- DIT as required

Notice shall include as a minimum the nature of traffic restrictions, the time commencement and time of removal of traffic of restrictions as appropriate.

2.9.3 Maintenance of Traffic Management

The Contractor shall be responsible for the maintenance in good working order of all traffic management structures, signs, traffic control devices, temporary access roads and temporary line-marking required for the completion of the Contract.

The Contractor shall provide an emergency contact of a representative responsible for the maintenance of the traffic management.

The Contractor shall implement a regular documented inspection programme to ensure that the traffic management plan is installed and maintained as per the approved traffic management plan and any damaged or missing traffic control devices are reinstated.

2.9.4 Provision for Vehicular Traffic

The Contractor shall provide and maintain access to property entrances adjoining the works and local traffic throughout the Contract. The Contractor shall provide temporary ramps for local traffic and access to side streets.

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2.9.5 Provision for Pedestrian Traffic

In accordance with AS 2124–1992 Clause 15 “Protection of People and Property”, provision for safe and convenient pedestrian traffic shall be always maintained.

2.9.6 Traffic Controllers

Traffic Controllers shall be used when traffic movement is temporarily restricted to one direction, in accordance with AS 1742, Clause 4.4. Traffic controllers shall be employed to provide additional control for the safety of traffic and the work.

2.9.7 Traffic Management Audit

During the Contract period, the Superintendent may undertake audits of the traffic management.

2.10 Site Facilities

2.10.1 Site Amenities

The Contractor shall provide all statutory and necessary amenities and sanitary facilities for workers and other persons lawfully upon the site and shall remove them on completion of the Works.

The Contractor is required to contain the Works within fenced/barricaded areas that prevents access to the public.

The Contractor may be permitted to store materials within the work site area if space can be made available and provided, they can be adequately secured from the public and maintain clear access to adjacent pedestrian paths. The Contractor is responsible for the security of all materials and assets in use or left at the work site during the Works and must maintain adequate insurances. Materials and equipment must not be stored outside fenced/barricaded areas, without the written approval by the Superintendent.

Apart from vehicles that are essential for the Works, no other vehicles are permitted to be parked on the work site. Refer City of Adelaide City Works Guidelines:

<https://www.cityofadelaide.com.au/business/permits-licences/city-works/>

2.11 Water for Works

The Contractor shall make all necessary arrangements for the supply of any water necessary for the works.

2.12 Electricity for Works

The Contractor shall make all necessary arrangements for the supply of electrical power for use temporarily or permanently on the works and shall pay all fees, charges etc. in connection therewith.

2.13 Dilapidation Survey of Adjoining Properties and Structures

The Contractor shall arrange for a dilapidation survey of the general site where works are to be carried out in conjunction with the Superintendent.

The Contractor shall record via visual inspection, written inspection logs, photographs and videos (as appropriate) the condition of all buildings, infrastructure, surfaces, or services which may be affected by the Works, either directly or indirectly. The Contractor shall provide such records, dated, and titled, to the Superintendent’s Representative before commencement of the Works.

The Contractor shall allow for the costs associated with the dilapidation survey.

2.14 Matching in and Making Good

In addition to the requirements specified in this specification, any damage caused or any temporary relocations necessary to existing stormwater drains, signposts, street signs, barrier posts, litter bins or other similar items shall be made good to a standard which is at least equal to the existing construction and in a workmanlike manner and to the satisfaction of the Superintendent.

Unless otherwise specified, where the specified works adjoin or abut an existing roadway, footpath or other existing construction, the existing pavement shall be removed within the limits shown on the drawings, the existing bitumen shall be saw-cut in a straight line so that the new pavement matches to give a smooth riding surface and satisfactory drainage properties.

The new kerbs and gutters shall match the existing kerbs and gutters at the locations shown on the drawings.

The Contractor shall be responsible for making good any damage which occurs to adjacent existing works because of his operations, and such making good shall be to the satisfaction of the Superintendent.

2.15 Cleaning Up

During the progress and on completion of the work, the site shall be maintained and left in a clean and tidy condition to the satisfaction of the Superintendent.

3 SITE PREPARATION AND EARTHWORKS

This section of the specification details the requirements for Earthworks, including selection of materials, clearing, grubbing, stripping topsoil, proof rolling, excavation, and filling. This section shall be read in conjunction with the approved Contract Drawing Set and CoA Standards Suite.

3.1 General

This specification shall be read in conjunction with the following Standards and references, which are deemed to form a part of this specification.

AS 1141.1	Methods for sampling and testing aggregates
AS 1289.2.2.1	Methods of testing soils for engineering purposes
AS 3798	Guidelines on earthworks for commercial and residential developments
AS 2436	Guide to noise and vibration control on construction, demolition and maintenance sites
AS 1726	Geotechnical site investigations
DIT Master Specification	RD-EW-C1 – Earthworks
DIT Master Specification	RD-EW-C2 – Trench Excavation & Backfill
DIT Master Specification	RD-PV-S1 – Supply of Pavement Materials
DIT Test Procedure TP 134	Particle Size Distribution – Standard Method of Analysis by Sieving

DIT Test Procedure TP 320	Compaction Control Test – Dry Density Ratio, Moisture Variation and Moisture Ratio
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3.2 Materials

3.2.1 General

Site preparation and earthworks materials are to be as specified herein or as otherwise approved by The Superintendent.

3.2.2 Unsuitable and Suitable Materials

Unsuitable materials shall include:

- organic soils and severely root-affected soils
- peat
- materials contaminated through past site usage which may contain toxic substances or substances that can be dissolved or leach out that may be harmful to site users, groundwater, or agriculture. Where known these areas will be identified on the drawings.
- materials containing substances that can be dissolved or leached out in the presence of moisture. (Gypsum, for example) or which undergo volume change or loss of strength when disturbed and exposed to moisture (some shales and sandstones, for examples) unless those materials are specifically addressed in the design.
- silts or materials that have the deleterious engineering properties of silts.
- Potentially Acid Sulphate soils (PASS)
- other materials that are unsuitable for forming structural fill
- fill that contains wood, plastic, boulders, or other deleterious materials in sufficient proportions to negatively affect the performance of the fill.

Suitable materials shall be materials other than unsuitable materials capable of being compacted to form a homogeneous mass and suitable for the construction of structural fill. These will generally comprise clean soil or soil-aggregate mixtures.

3.2.3 Classified Fill

Backfilling or filling in this section refers to all filling required to the subgrade level.

Classified Fill shall not include unsuitable materials and grading limits shall meet the following requirements:

Table 3.1 Fill Material Classification

Characteristic	Type A as detailed in RD-EW-C1	General Fill
Fill grading – % passing sieve size		
100 mm	–	100
75 mm	100	–
37.5 mm	80–100	–
0.075 mm	0–25	
Max. Plasticity Index	12	–
Max. Linear Shrinkage	6%	–
Instability Index	0.4%	2%
Max. Weighted Plasticity Index	1000	3000

The Contractor shall obtain a copy of the Supplier's grading tests of the fill materials supplied. The Contractor shall furnish this certificate upon request by the Superintendent.

Special consideration may be required for the following suitable materials, which have higher risks associated with their behaviour after placing:

- Clays of high plasticity, which are likely to swell and shrink with moisture changes and therefore need to be selectively placed within the fill subject to strict moisture content and density control.
- Material, which, after compaction, contains large particles which may lead to difficulties in the subsequent excavation of trenches for footings or services etc.
- Single-sized or gap-graded materials or rock fill that will not break down on compaction, leaving voids into which finer material may subsequently migrate.
- Saline, chemically aggressive or polluted soils, and carbonate soils where acid disposal may occur.
- Materials that cannot be tested to demonstrate compliance with the specification (for instance, soils containing gypsum and other deliquescent materials where moisture content cannot be measured reliably).

Where such materials become apparent during filling operations, The Superintendent shall be informed. The Superintendent may direct the placing or treatment of filling to mitigate the risks associated with the fill material.

3.2.3.1 Oversized Suitable Materials

Oversized suitable materials shall be otherwise suitable materials that cannot be broken down by construction plant to the required maximum size (100 mm). Oversized material shall not be used unless approved by The Superintendent.

3.2.4 Imported Fill Materials

Material that is to be imported to the site and is not a quarry product shall be assessed and confirmed as being suitable for use on the site by an approved Environmental Consultant at the cost of the contractor and in accordance with the National Environmental Protection (Assessment of Site Contamination) Measure. The confirmation that the material is suitable for use on the site shall be submitted to The Superintendent for their approval prior to the material being brought to site.

No fill material may be brought into site without written approval from The Superintendent and appropriate accompanied documentation. Material imported on site that does not have the appropriate documentation or that fails to meet the requirement of the National Environmental Protection (Assessment of Site Contamination) Measure shall be removed from site and disposed of appropriately at the Contractor's cost.

3.2.5 Backfilling Sand

Backfilling sand shall be Type Sa - D Sand in accordance with DIT Master Specification RD-PV-S1.

Type Sa – D sand shall only be applied when backfilling services trenches below subgrade level.

3.3 Construction and Workmanship

3.3.1 Site Clearing and Grubbing

The site shall be cleared only in those parts on which the specified construction works are to be carried out, or as otherwise shown on the drawings.

All vegetation must be removed in accordance with DIT Part CH50 'Environmental Protection Issues'. Loose material, rubbish, and existing structures within the zone of the earthworks must be removed to a depth of not less than 300mm below the:

- subgrade level and batters in areas of cut; and
- stripped surface in areas of fill.

Unless specified otherwise, grubbed holes must be backfilled with Type A material.

All materials resulting from the site clearing shall be removed from the site and disposed of by the Contractor at their expense.

3.3.2 Clearance of Surface Vegetation

Prior to stripping of topsoil, the Contractor is to remove existing surface vegetation, and dispose of this off-site to a legal place of disposal.

3.3.3 Removal of Trees

Trees shall be removed only where necessary for construction of the works, where nominated on the drawings or as otherwise directed by the Superintendent. Where trees are to be removed in areas of proposed structures, stumps and root systems shall be removed to a depth of at least 1.0 m below formation level.

The excavation shall be backfilled with suitable material placed and compacted in layers of 200 mm maximum compacted depth a density at least that of the adjacent undisturbed natural material.

3.3.4 Removal of Rubbish

The Contractor is to remove and dispose of any rubbish materials on the site as indicated on the drawings.

3.3.5 Stripping and Re-spreading of Topsoil

Topsoil shall be stripped from all areas of construction to a nominal depth of 75 mm and shall be stockpiled on site for later re-use in filling to road reserves, nature strips, batter slopes etc if applicable.

Stockpiles shall have adequate drainage and erosion protection and be protected from contamination by other excavated material, weeds and building debris.

The Contractor shall provide details of proposed temporary topsoil stockpile locations, for approval by the Superintendent.

Following completion of earthworks topsoil shall be spread on all batters and other areas designated in a layer with a thickness as specified with the surface of the topsoil and free of lumps greater than 75 mm.

Any topsoil not required for such re-use, or topsoil surplus to requirements, shall remain the property of the principal and shall be left in a neat stockpile in the position or positions on the site as directed by the Superintendent.

3.3.6 Excavation

3.3.6.1 General

The contractor shall undertake a BYDA enquiry prior to any excavation and shall take any precautions necessary to identify and avoid existing services where applicable.

The Contractor shall judge for itself the nature of the material to be excavated and will be deemed to have made do allowance for excavating material of whatever nature may be encountered, providing that, in the opinion of The Superintendent, it is capable of being excavated by a mechanical excavator with a capacity appropriate for the situation without the use of a rock breaker, jack hammers and/or blasting.

Overcut shall be made good to the satisfaction of The Superintendent at the Contractor's expense.

If soft spots are revealed in the formation, after proof rolling exercise, the Contractor shall immediately notify The Superintendent. If The Superintendent considers it necessary, the Contractor shall carry out further excavation as directed and backfill the excavation with material as directed by The Superintendent.

The cost of such additional excavation and backfilling will be considered as an extra to the contract unless it results from the Contractor's actions or negligence. The Contractor must obtain approval from The Superintendent prior to the excavation of soft spots or no claim for excavation and backfilling will be entertained. The Contractor shall take and record all survey measurements necessary to allow accurate calculation of the volume of additional excavation and filling and submit these to The Superintendent for approval.

3.3.6.2 Bulk excavation

All excavated areas shall be finished to an even surface. The floors and sides of excavations shall be trimmed to the lines, levels, grades, and batters shown on the drawings within the specified tolerances.

All areas disturbed by the excavation activities and all loose surface material shall be compacted by moisture conditioning, if necessary, and rolling with approved compaction equipment to the density specified for such filling. The top 200mm of fill under the pavement (subbase) shall consist of Type A fill, with fill below this to consist of General Fill.

3.3.6.3 Trench excavation

Unless otherwise approved by The Superintendent, trench work for pipes laid to grade shall proceed from the lowest point to the highest point in each system.

Trenches shall be excavated to the lines, levels and grades shown on the contract drawing set and CoA Standards Suite of Details. Minimum trench widths shall be as nominated on the contract

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drawing set and CoA Standards Suite of Details or, where no width is shown, as narrow as practicable consistent with good construction techniques.

The floors of all excavations shall be evenly trimmed, and all protrusions, loose soil and debris shall be removed.

Excavated material must not be used for backfilling of trenches below subgrade level.

The maximum length of open trench excavation in any one section shall be 100 metres unless approved otherwise by Superintendent.

Saw cutting into existing paving for trench excavations (refer to CoA 416)

Excavation around services

- Contractor to refer to Service Utilities clearance & protection requirements
- Contractor to immediately inform Superintendent of any items encountered on site not captured on the contract drawings or existing survey that may affect construction and/or program and seek further guidance from Superintendent.

Excavation of latent conditions below ground level

Excavation of Hazardous Materials - if identified on the drawings the contractor shall provide a process for excavation of hazardous materials as part their testing requirements.

3.3.6.4 Excavation of Rock

If rock, as defined below, is encountered during excavation and the Contractor considers that the only practical means of excavation is by rock breaker, jack hammer and/or blasting, the Contractor shall immediately notify The Superintendent.

If The Superintendent agrees that the material to be excavated should be classified as rock, authority will be given for the use of a rock breaker, jack hammer and/or blasting and payment will be made as an extra to the contract based on the volumes of rock required to be excavated at the appropriate rate in the Schedule of Unit Rates. The Contractor must obtain prior approval from The Superintendent that the material is to be classified as rock for payment purposes, otherwise no claim will be entertained. The Contractor is to record measurements for the calculation of the volume of rock and submit these to The Superintendent for approval.

For the purposes of interpretation, measurement and/or payment relevant to the term 'rock' as used in this Specification, rock shall be defined as only that material found in ledges, masses, bedded deposits and/or conglomerate deposits and presenting the characteristics of rock which in the opinion of The Superintendent cannot be removed for bulk excavation by a ripper dozer (Caterpillar D8 or equivalent) or for trench excavation, by using a bucket excavator (nominally 30 tonne excavator) with rock bucket and would normally be removed by blasting, pneumatic tools or mechanical impactor.

Where, due to limited access, the use of a machine as above is impracticable a side-shift bucket backhoe will be approved. If the restricted access is caused because of the contractor's previous work and the contractor could have expected rock in the vicinity, the rock would be assessed based on the previous equipment rating. All trenches in areas with a high likelihood of rock should be pre-dug prior to restricted access.

Floater in trenches, foundation or similar excavations shall be classified as rock only when their least dimension exceeds 0.6 m or where the volume of the floater exceeds 0.25 m³.

Materials which could be excavated by the plant described above at the rates set out above or faster, such as broken shale, weak conglomerates etc, shall not be classified as rock for payment purposes.

Measurement of rock excavation for payment purposes shall be made on the following basis:

- The rock shall be measured in the solid form, within the design limits of the excavation, before any backfilling is placed, or new work commenced.
- For bulk excavation, the volume of rock shall be calculated by an independent engineering surveyor engaged by the Contractor based on the difference between the rock surface(s) following removal of overburden as approved by The Superintendent and the 'extent of rock' or 'design' surface, whichever is less, as approved by The Superintendent
- For trench excavation, the volume shall be calculated from the depth and length measured in liaison with The Superintendent, and the minimum width of trench for the application shown on the drawings.
- No payment shall be made for over break beyond the limits of the required excavation.

3.3.6.5 Protection of excavation

All work necessary to ensure the stability of the construction excavations and to prevent damage to adjoining structures, services and property is the responsibility of the Contractor. This responsibility includes installation and maintenance of timbering, shoring, strutting, bracing, sheeting, piling, etc.

CoA assumes no responsibility whatsoever in respect to the stability of the ground to be excavated. The Contractor is deemed to have satisfied themselves through their own investigations regarding the conditions to be encountered.

The provisions of Chapter 6, Part 3, Division 3 of the *Work Health and Safety Regulations 2012* (SA) under the *Work Health and Safety Act 2012* (SA) apply to excavation works in South Australia.

Should the Contractor fail to provide equipment and/or fail to adopt methods which are to the satisfaction of The Superintendent, The Superintendent may order work to cease until such time as equipment is provided and methods adopted which are to the satisfaction of The Superintendent.

3.3.6.6 Dewatering of excavation

Excavations are to be always maintained in a thoroughly drained condition. If ground water is encountered during excavation, the Contractor shall be responsible for de-watering the excavation in a safe and efficient manner.

The Contractor shall judge for themselves the likely extent of groundwater (if any) and its effect on the execution of the Contract and is deemed to have made appropriate allowance in the Tender for all costs involved in managing groundwater.

Groundwater pumped from excavations shall be disposed of in a manner which satisfies the requirements of the Environmental Protection Authority and other relevant government organisations.

3.3.6.7 Disposal of Surplus Excavated Material

All surplus excavated material arising from the specified works is to be disposed of by the Contractor off site and in a recycling plant where possible and practical.

The Contractor is responsible for conducting and paying for any environmental testing (or additional environmental testing if testing has previously been undertaken) and reporting necessary to dispose of the excavated material.

3.3.7 Fill Construction

Filling construction includes all operations associated with the preparation of areas where fill is to be placed, and the subsequent placing and compaction of suitable material.

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In locations where filling is required to achieve the design formation levels, such as footpaths on sloping ground or fill to achieve required longitudinal grades, the filling shall be carried out in the manner specified hereunder.

Fill is characterised as the sub-grade layer below the subbase pavement layer.

3.3.7.1 Fill Foundation and proof rolling

Prior to placement of fill material, the natural surface shall be inspected by The Superintendent (and Geotechnical Inspection and Testing Authority as applicable to meet the requirements of AS 3798) and the subgrade on which the fill is to be placed shall be proof rolled. Proof rolling is intended to assess the uniformity of subgrade response in supporting the filling and evaluating the ability of the subgrade to withstand the fill construction process.

Proof rolling shall be conducted using either:

- A pneumatic-tyred roller, not less than 4.5 tonnes per tyre and 600 kPa tyre pressure or
- A water tanker carrying not less than 10,000L of water during the proof roll, with internal baffles to minimise sloshing and with a minimum 600 kPa tyre pressure.
- Or where site constraints do not allow for the above, a proof roll may be undertaken with at least 6 passes of the heaviest plant practicable. A leg rammer may be used, but a plate compactor or similar is not acceptable.

The test equipment shall be operated at a speed in the range 3 km/h to 10 km/h, as directed by The Superintendent. The rolling pattern shall cover the area to be tested with successive passes of the equipment offset laterally by 40% to 50%.

Prior to inspection by The Superintendent and/or GITA (Geotechnical Inspection and Testing Authority), the contractor shall undertake their own inspection and proof roll to confirm the surface is ready for inspection, at the cost of the contractor.

The Superintendent and /or GITA shall assess the surface deformation under the proof roll as acceptable or not acceptable at specific locations and as uniform or non-uniform over the entire test area.

If The Superintendent or GITA as applicable considers the surface is suitable, the Contractor shall commence filling as described below. If The Superintendent or GITA as applicable considers that the surface is unsuitable, the Contractor shall carry out additional excavation or other measures as may be directed by The Superintendent.

Filling shall commence only after the surface upon which fill material is to be placed has been approved by The Superintendent. This constitutes a **HOLD POINT**.

3.3.7.2 Placing Fill

The Contractor shall adopt methods of excavating, transporting, placing, and spreading the materials to ensure that the fill is mixed to form a homogeneous material before compaction is applied.

Fill materials shall be placed in horizontal layers of uniform thickness and shall be deposited systematically across the fill area so that the surface is always self-draining. Large particles shall be broken down and evenly distributed through the fill material or, if not capable of being broken down removed from the filling. The maximum size of rock particles throughout the fill material shall not exceed the grading requirement as per Table 3.1.

The layers shall be uniformly compacted from a maximum loose thickness of 200 mm unless otherwise approved by The Superintendent.

Prior to placing subsequent fill layers, the Contractor shall ensure that previously placed layers remain in conformance with the specified requirements, including moisture content.

Care shall be taken by the Contractor to use equipment and construction techniques that minimise surface heaving or other damage to the lower layers including damage by over working or construction traffic.

Unless otherwise specified on the Drawings or in this Specification, fill materials shall be as detailed in Table 3.2:

Table 3.2 Fill Material Schedule

Location	Material
The upper 200 mm of fill areas supporting pavements (sub-grade)	Type A
Below pavement other	General fill
Road reserves, roadways, park lands and public reserves	General fill
Allotment filling	General fill
Trench backfills (around services/drainage)	Sand Type D

3.3.7.3 Compacting fill

All fill layers shall be systematically compacted with appropriate equipment to ensure compaction for the full depth and width of each layer. Embankment slope faces shall either be compacted separately or overfilled and cut back to the tolerances required.

Unless otherwise specified on the Drawings or in this Specification, the compaction shall meet the requirements described in Table 3.3:

Table 3.3 Earthworks Compaction Requirements

Location	Requirement
Upper 200 mm below pavements (sub-grade)	98% of Maximum Dry Density (Standard)
More than 200 mm depth below pavements	95% of Maximum Dry Density (Standard)
Road reserves (other) and public reserves	95% of Maximum Dry Density (Standard)
Trenches in road reserves	98% of Maximum Dry Density (Standard)
Trenches not in road reserves	95% of Maximum Dry Density (Standard)

Acceptance of the compaction results forms a **HOLD POINT**.

3.3.7.4 Moisture Control

Unless otherwise specified on the Drawings or in this Specification, the moisture content at the time of compaction shall be $\pm 2\%$ of the optimum moisture content measured in Standard compaction.

The Contractor shall adjust the moisture content of the fill material as required to achieve the specified density or moisture content prior to compaction.

Completed fill layers shall be sealed and graded to prevent concentration or ponding of water on the surface. Any soils found with moisture content greater than the afore-mentioned compaction range shall be removed and replaced with complying material.

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3.3.7.5 Benching

Where new embankment slopes are to be constructed against an existing slope which is steeper than 8 horizontal to 1 vertical, the existing slope shall be stepped by benching successive terraces to a minimum length of 1.0 m to form a key for the fill. The minimum depth for a bench shall be the minimum compacted layer thickness.

3.3.7.6 Oversize Suitable material

The Contractor shall advise of oversize suitable materials won from site that cannot be broken down to the required size to allow The Superintendent to assess their suitability for inclusion in the fill. If approved, the Contractor shall develop a method specification for suitable placement of the material and provide this to The Superintendent for approval prior to placing or compacting any of this fill material.

3.3.7.7 Filling Adjacent to Structures

The Contractor shall use appropriate equipment and construction techniques to prevent damage to adjacent structures due to filling operations.

Filling shall not be carried out against new concrete structures until at least fourteen days after the concrete is placed, as per the contract drawings or until such other time as may be approved by The Superintendent.

3.3.8 Backfilling of Trenches

3.3.8.1 General

Trenches shall be backfilled with Type D backfilling sand after the pipes, culverts, cables, or conduits have been installed, surrounded, and overlaid, and all specified testing has been completed as specified in other parts of this Specification.

No backfilling material shall be placed until The Superintendent has approved the work to be covered and the materials to be used for backfilling.

3.3.8.1 Road Reserves

Where a trench is located under an existing or proposed road pavement or where the nearest side of the trench is within 2.0 m of an existing or proposed road pavement, the part of the trench above the specified material surrounding and overlaying the pipe shall be backfilled using Type D backfilling sand.

Sand shall be placed in layers not exceeding 200 mm uncompacted thickness with each layer being compacted and tested in accordance with this specification. The sand backfill material shall be placed and compacted to the formation level of the pavement construction works specified.

3.3.9 Filling Behind Kerbs and Gutters

On completion of the construction of the concrete kerbs and gutters, the area behind the kerb shall be filled with General Fill As per CoA Construction Standard 900 – 901 and compacted to the density specified herein.

After construction of the footpath (if any) the area shall be surfaced with 150 mm thickness of lightly compacted topsoil, garden loam, or match existing material or other surfacing as shown on the drawings. After construction of the footpath, any residual area between back of kerb and new footpath edge shall be surfaced with 150mm lightly compacted topsoil, garden loam or matching footpath material or other surfacing as shown on the contract drawings.

3.4 Quality Requirements

3.4.1 General

The Contractor shall arrange for field and laboratory compaction testing of bulk earthworks filling and trench backfilling. The testing shall be carried out by a NATA-accredited laboratory. All costs associated with the testing shall be borne by the Contractor.

Copies of the test results shall be made available to The Superintendent for its approval as soon as reasonably practicable following testing and in any case within a week of the test being performed. The risk of proceeding with subsequent construction before the Contractor has received NATA-endorsed test certificates shall rest with the Contractor and no claims for extension of time or associated costs will be considered due to unavailability of such test results.

The frequency of field density testing shall be as set out in AS 3798 unless specified otherwise.

3.4.2 Materials

Prior to the construction of the works the Contractor is to provide the Superintendent details of the fill materials to be used. Filling materials shall be placed in identifiable lots and shall be tested for compliance at the rates set out in this specification.

3.4.3 Inspections

The following Hold Points are required during the construction of Earthworks:

H-E1	Installation of Soil Erosion Management Plan, prior to the commencement of works
H-E2	Inspection of final excavated levels prior to placement of fill (if applicable)
H-E3	Completion of earthworks formation

3.4.4 Quality Testing

The following test procedures shall be used for Quality testing:

Table 3.4 Test Procedures for Earthworks

Test Type	Test Procedure
Atterberg Limits	AS 1289.3.2.1
Particle Distribution	DIT TP134
Compaction Control Test – Dry density ratio, Moisture Variation, Moisture Ratio	DIT TP 320

Note:

- Dry Density Ratio shall be calculated to the nearest 0.1%.
- Density measurements shall be made to the nearest 0.01 tonne/m³.
- Test location co-ordinates shall be measured to the nearest 100 mm.

The Contractor shall undertake testing of the earthworks at the following minimum frequency:

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Table 3.5 Quality Testing Requirements for Earthworks

Item	Test Type	Minimum Testing Frequency
Types A Fill Material	Grading	One test per 1,000 tonnes
	Plasticity Index	One test per 1,000 tonnes
	Linear Shrinkage	One test per 1,000 tonnes
	Weighted Plasticity Index	One test per 1,000 tonnes
General Fill Material	Partial Grading	One test per 1,000 tonnes
	Plasticity Index	One test per 1,000 tonnes
	Weighted Plasticity Index	One test per 1,000 tonnes
Bulk Fill under Pavements (subbase)	Field Density	1 per 500 m ² per layer (a minimum of 3)
	Laboratory Compaction	1 per field test
Trench Fill under pavements (subbase)	Field Density	1 per 50 lineal metres per layer
	Laboratory Compaction	1 per field test

Trenches for water reticulation and sewer construction shall be backfilled and tested in accordance with SA Water requirements and override the requirements nominated in this specification.

If no rate of testing is specified, testing rates shall be in accordance with AS 3798.

3.4.5 Materials Being Used in the Works

Where in the opinion of The Superintendent the material being used in the Works differs from the specified material, The Superintendent may order a sample to be taken and tested. If the tested material does not comply with the specification, the cost of sampling and testing shall be borne by the Contractor. In addition, the work which incorporates the non-compliant material shall be liable to be rejected at The Superintendent's discretion.

3.4.6 Vertical Tolerances

Construction Tolerances on earthworks are as follows:

Table 3.6 Tolerances on Earthworks

Item	Tolerance
Field Density	- 0% + 4% of specified compaction
Thickness of each fill layer	Within ± 25 mm of maximum layer thickness with an absolute minimum compaction thickness of 80mm.

Finished level of pavement subgrade As detailed in the pavement design on the contract drawing set.

Finished level of private allotments	Within ± 50 mm of design level
Finished level of public reserves	Within ± 75 mm of design level
Finished surface of batters	Within ± 75 mm of design level, but without reverse falls
Shape of pavement subgrade	Longitudinal ± 20 mm below a 3.0 m straightedge
	Transverse ± 40 mm below a 3.0 m straightedge

The shape of the finished surface shall deviate below a 3.0 m straightedge, measured between any two points, by not more than the tolerances specified above.

3.4.7 Acceptance Criteria

Where test results show that the compaction of filling material that has been achieved is below that specified, the areas or volumes represented by the tests (as determined by The Superintendent) may be rejected. The Contractor is to replace any defective material and re-work or further compact the area and re-submit it for further testing until the specified requirements are achieved and The Superintendent's approval received. All costs associated with remedial works and re-testing shall be borne by the Contractor.

4 PAVEMENT SUBGRADE

This section of the specification details the requirements for preparation of the pavement subgrade. It shall be read in conjunction with the Site Preparation and Earthworks section of this specification, the pavement design schedule detailed on the contract drawing set and CoA Standards Suite.

The subgrade shall comprise the uppermost 200 mm of the formation directly under the pavement (subbase).

4.1 General

This specification shall be read in conjunction with the following Standards and references, which are deemed to form a part of this specification.

Methods of testing soils for engineering purposes

AS 3798	Guidelines on earthworks for commercial and residential developments
DIT Master Specification RD-EW-C1	Earthworks
DIT Test Procedure TP 320	Compaction Control Test – Dry Density Ratio, Moisture Variation and Moisture Ratio

4.2 Construction and Workmanship

4.2.1 General

Preparation of the subgrade shall follow completion of the underlying earthworks as detailed in the Site Preparation and Earthworks section of this specification.

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4.2.2 Subgrade Preparation

Following the completion of formation earthworks, the subgrade shall be trimmed to produce a tight dense surface to the tolerances specified.

The subgrade shall be systematically compacted for its full width with appropriate compaction equipment to the compaction specified in the Site Preparation and Earthworks section of this specification.

Where required the subgrade shall be moisture conditioned and compacted as detailed in the Site Preparation and Earthworks section of this specification. Moisture conditioning may require tining of the subgrade and aeration to reduce its moisture content prior to spreading and recompaction. Care shall be taken to ensure the subgrade is not affected by inclement weather during moisture conditioning.

Trafficking of the subgrade by construction activities shall be kept to a practical minimum to reduce “pumping” of moisture from lower layers into the subgrade.

Subgrades shall be finished and always maintained with adequate drainage to ensure that water runs off without ponding.

4.2.3 Maintenance of Subgrade

The Contractor shall maintain the subgrade to ensure that the shape and degree of compaction immediately prior to the placement of the first pavement course conforms with the requirements of the specification.

Trafficking of the subgrade by construction activities shall be kept to a practical minimum.

Areas of subgrade affected by moisture after they have achieved the specification requirements shall be re-worked as required to maintain their conformance with those requirements.

4.2.4 Proof Rolling

The Contractor shall make available a suitable vehicle for proof rolling of the subgrade. Payment will not be made for transportation of the proof rolling vehicle to the site or around the site. The Contractor shall undertake proof rolling in the presence of The Superintendent. Proof rolling shall be carried out within 24 hours of completing subgrade preparation and prior to any trafficking by construction traffic of the subgrade. The Superintendent will determine whether a particular section of subgrade should not be proof rolled (e.g., over utility services with limited cover) and the method of proof rolling for small areas.

Proof rolling shall be conducted using either:

- A pneumatic-tyred roller, not less than 4.5 tonnes per tyre and 600 kPa tyre pressure or
- A water tanker carrying not less than 10,000L of water during the proof roll, with internal baffles to minimise sloshing and with a minimum 600 kPa tyre pressure.
- Or where site constraints do not allow for the above, a proof roll may be undertaken with at least 6 passes of the heaviest plant practicable. A leg rammer may be used, but a plate compactor or similar is not acceptable.

The test equipment shall be operated at a speed in the range 3 km/h to 10 km/h, as directed by The Superintendent. The rolling pattern shall cover the area to be tested with successive passes of the equipment offset laterally by 40% to 50%.

The Superintendent will assess the surface deformation under the proof roll as perceptible or not perceptible at specific locations and as uniform or non-uniform over the entire test area.

If The Superintendent considers that the surface is unsuitable, the Contractor shall carry out additional compaction or other measures as may be directed by The Superintendent. Such remedial work will not be considered as a variation to the contract.

4.2.5 Protection of the Subgrade

Once an area or lot has been proof rolled and accepted by The Superintendent, any damage to the subgrade due to weather or the Contractor's activities shall be the responsibility of the Contractor. No further payment will be made for the repair of any such damage.

If construction of the pavement does not commence immediately following approval of the subgrade, the Contractor shall put appropriate measures in place to protect the subgrade from inclement weather and/or construction traffic.

4.2.6 Subgrade Remediation

Where directed by The Superintendent, the Contractor shall carry out remedial works to areas that have failed the proof roll or to areas of subgrade damaged after meeting the specified requirements due to weather, vehicular traffic or the Contractor's activities. Areas where the subgrade is damaged after meeting the specified requirements due to weather, vehicular traffic or the Contractor's activities shall be re-worked to meet the specified requirements at the Contractor's cost.

The Contractor shall first prepare a remediation method plan for review and acceptance by The Superintendent, including the:

- depth of excavation required to meet sound material; and,
- proposed replacement material (e.g., appropriately moisture conditioned excavated material, PM 3/40QG or PM2/20QG).

Once the remediation plan has been agreed, the Contractor shall execute the plan. Appropriate records of the remediation process shall be kept, and all requirements of this Specification in relation to compaction, shape, tolerances, and soundness shall be achieved before the placement of pavement material above remediated subgrade.

4.3 Quality Requirements

4.3.1 Inspections

The following HOLD POINTS are required during the subgrade preparation:

H-SG1 Approval and proof roll of the subgrade, prior to commencing pavement construction.

4.3.2 Quality Testing

The Contractor shall undertake testing of the subgrade at the following minimum frequency:

Table 4.1 Quality Testing Requirements for Subgrade Preparation

Item	Test type	Minimum Testing Frequency
Subgrade	Field Density	1 per 300 m ² or min of 3
	Laboratory Compaction	1 per field density
Pavement Content	Moisture Field Moisture content	1 per field density
Level of finished Subgrade	Verification Survey	10 m spacing longitudinally; 3 points per cross section

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The following test procedures shall be used for Quality testing:

Table 4.2 Test Procedures for Sub-Grade Preparation

Test Type	Test Procedure
Laboratory Compaction	
Moisture Content	
Field Density	Nuclear Method
Compaction Control Test – Dry Density Ratio, Moisture Variation, Moisture Ratio	DIT Test Procedure – TP 320

Note:

- Dry Density Ratio shall be calculated to $\pm 0.1\%$.
- Density measurements shall be made to ± 0.01 tonne /m³.
- Test location co-ordinates shall be measured to ± 100 mm.

4.3.3 Tolerances

Construction tolerances on each finished granular pavement layer below the subbase are as follows:

Item	Tolerance
Finished level of subgrade	As detailed in the pavement design on the drawings.
Field Moisture content	-5% + 2% of Optimum Moisture Content

4.3.4 Acceptance Criteria

Areas where the subgrade fails to meet the specified requirements including:

- compaction and moisture content
- level tolerances and shape
- surface finish; or
- soft / over wet areas, surface cracking, shoving and ruts.

may be rejected by The Superintendent and shall then be reworked, moisture conditioned and respread and compacted to meet the specified requirements at the Contractor's cost.

Areas where the subgrade is damaged subsequent to meeting the specified requirements due to weather, vehicular traffic or the Contractor's activities shall be re-worked to meet the specified requirements at the Contractor's cost.

5 GRANULAR PAVEMENT

This section of the specification details the requirements for supply, spreading, compaction and maintenance of unbound and cementitious-bound granular pavements. This section shall be read in conjunction with the pavement design details of the contract drawing set, CoA Standards Suite and the Site Preparation & Earthworks and Pavement Subgrade sections of this specification.

5.1 General

This specification shall be read in conjunction with the following Standards and references, which are deemed to form a part of this specification.

	Sampling and Testing of Aggregates.
AS 1289.5.3.5	Methods of testing soils for engineering purposes
	Methods for sampling and testing aggregates.
DIT Master Specification RD-PV-S1	Supply of pavement materials
DIT Master Specification RD-PV-C1	Construction of Unstabilised Pavements
DIT Master Specification RD-PV-S2	Plant Mixed Stabilised Pavement
DIT Environmental Instruction 21.6	Recycled Fill Materials in Construction
DIT Test Procedure TP226	Sampling of Soil, Aggregates and Rocks
DIT Test Procedure TP320	Compaction Control Test – Dry Density Ratio, Moisture Variation and Moisture Ratio
DIT Test Procedure TP349	Determination of Pavement Hardness (Ball Penetration Test)
AS 3972	General purpose and Blended Cements

Plant mixed stabilised pavement has been nominated for the pavement stabilisation procedure. However, should the Contractor nominate in-situ pavement stabilisation, the material, construction, and quality testing to be in accordance with DIT Master Specification RD-PV-C3 In-situ Pavement Stabilisation.

5.2 Materials

Granular pavement materials are to be as specified herein or as otherwise approved by The Superintendent.

The properties of the granular pavement material shall comply with the grading-based requirements of DIT Master Specification RD-PV-S1 Appendix 1.

5.2.1 Quarried Pavement Materials

Quarried granular pavement materials shall be obtained from the crushing of approved hard, sound, clean and durable natural rock in accordance with the DIT Master Specification RD-PV-S1.

The type, class and size of the quarried pavement materials shall be as detailed in the pavement design on the design contract drawing set.

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5.2.2 Cement-Stabilised Material

Cementitious material shall be in accordance with AS 3972 and DIT Master Specification RD-PV-S2 and shall be Type GB. A retarder shall be used with cement binders.

Cement-treated materials shall achieve a 7-day unconfined compression strength of not less than 2.0 MPa and not more than 5.0 MPa based on DIT Master Specification.

5.3 Construction and Workmanship

5.3.1 General

Placement of each granular pavement layer shall not commence until the subgrade or underlying layers have been approved by The Superintendent unless prior approval has been granted, and any preceding Hold Points have been released.

5.3.2 Placement of Un-bound Granular Pavement

Each pavement layer shall be spread as a uniform homogeneous layer, which after compaction and trimming will provide the compacted layer thickness as specified in the pavement design.

Care shall be taken through the spreading process and at junctions with existing pavements to ensure material is uniform in moisture and particle distribution. Placement of the material shall be planned to reduce the number of joints between placement runs.

During and/or following the compaction process each layer shall be trimmed to produce a tight dense surface to the tolerances specified. Any areas identified as low shall be tyned, respread and recompacted.

5.3.3 Placement of Stabilised material

The spreading and shaping of the stabilised materials shall be undertaken by hand or small plant (e.g., bobcat) or grader in accordance with DIT Master Specification RD-PV-S2.

The rate of delivery shall be sufficient to enable all spreading, shaping and compaction to be carried out within 2.75 hours of the material being stabilised. The rate of delivery and placing shall also be sufficient to enable the first (or initial) compaction testing to be undertaken within 1.5 hours of the material being stabilised. This is to enable additional rolling of the material if the compaction standard has not been achieved.

Stabilised material shall not be delivered when the shade air temperature exceeds 35°C and material shall not be placed if the mix temperature at the site exceeds 27°C.

5.3.3.1 Stabilised material Pavement Joints

The works shall be planned to minimise the number of joints. All joints, whether single or double layer, shall be near vertical and shall be continuous through the full depth of the stabilised material.

At the end of each days' work and where spreading operations have been halted for any reason for a period exceeding 3 hours, the Contractor shall provide construction joints at each discontinuity in the operation. Joints shall be cut within one hour of completion of compaction.

Joints shall be made either transverse or parallel to the direction of the stabilising run. The joints shall be formed by cutting back into the compacted stabilised material to the extent necessary to form a near vertical face. The loose trimmed material shall not be incorporated into the pavement. Joints shall be kept moist prior to commencement of the next stabilising run.

5.3.3.2 Curing Stabilised Pavement material

The surface of compacted stabilised layers shall be kept continuously moist by watering with suitable spraying equipment for a minimum period of 7 days. The time period will commence at the completion of compaction of the section being stabilised.

No vehicular traffic or construction equipment (except for vehicles and plant required for curing purposes provided vehicles utilised are only single axle units not exceeding 8 t per axle) will be permitted on stabilised areas for a period of 7 days from the completion of the compaction of the section being stabilised.

After the 7-day period the only traffic permitted on stabilised areas shall be construction equipment used for construction of subsequent pavement layers and backfilling of kerb and gutter.

The Contractor shall not use any section of stabilised pavement as a construction / haul track.

Where heavy commercial vehicle access over the stabilised pavement area is required, the Contractor shall place a sacrificial 200 mm thick layer of PM2/20Q Class 2 Pavement Material over the area to be trafficked.

Equipment and vehicles required for kerb laying purposes will be permitted on stabilised areas after a period of 3 days from the completion of compaction of the stabilised section.

5.3.3.3 Finish of Stabilised material

The surface of the pavement layers shall be uniformly tight and free of loose uncompacted material, segregated or 'bony' material or soft, over wet areas and free of roller indentations. The surface of the subbase layer shall have a well graded aggregate texture.

5.3.4 Compaction of Pavement

All pavement layers shall be systematically compacted in layers as detailed in the standard pavement details with appropriate compaction equipment to ensure the full depth and full width of each layer.

Care shall be taken to ensure that vibration from compaction equipment does not affect adjacent structures. The maximum size of compaction equipment in established residential area shall be a nominal 6 tonne roller, unless noted otherwise. For confined locations and where larger equipment is not appropriate, a leg rammer can be used for compaction.

Following compaction, the surface finish of each granular pavement layer shall be a tight dense surface, free of loose material, excessive slurry fines, or segregated 'bony' material.

5.3.5 Moisture Control

Moisture shall be uniformly distributed through the material by use of 'wet mix' materials and/or spraying by fine mist sprays prior to spreading and compaction. Care shall be taken to ensure that fines are not washed out of the base during spraying operations.

On completion of pavement layers, the moisture content shall be reduced to achieve dry back, prior to installation of the next layer. The Contractor shall make allowance in his Tender and construction programme for this process.

5.3.6 Maintenance of Pavement Layers

Completed pavement layers shall be maintained with adequate drainage to ensure that water runs off the surface without ponding.

Pavement layers affected by moisture, and which are therefore outside the specified requirements, even though they may have met those previously, shall be dried out, reworked and recompacted as required to achieve the specified requirements. If this is within the standard defects liability period, and rework is to be at the cost of the contractor.

5.3.7 Rubble Footpath

Where footpaths are nominated on the drawings as unsealed, the construction shall be in accordance with CoA 470 Rubble: Pavement requirements.

The rubble shall be placed and compacted in accordance with CoA 470 Rubble: Pavement requirements. The rubble shall be finished to conform to the adjacent existing paths in level and appearance and to give satisfactory drainage properties.

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The Contractor shall ensure that completed works are not hazardous or threaten in any way the safety of the public.

5.4 Quality Requirements

5.4.1 Materials

Granular pavement materials shall be produced into identifiable lots and tested in accordance this specification.

Records of materials shall be kept in the form of delivery dockets or similar to enable traceability of materials incorporated into the pavement.

5.4.2 Inspections

The following HOLD POINT inspections are required during the construction of granular pavements:

H-GP1	Approval of pavement materials
H-GP2	Approval of subgrade and underlying pavement layers (below subgrade) prior to the commencement of subsequent layers
H-GP3	Submission of Procedures (if not in Post Tender Submission) and Plant Details
H-GP4	Approval of completed pavement layers

For remediation works or small projects, the Superintendent may release one or more of the above Hold Points prior to the commencement of works. Principal approval is also required in these cases.

5.4.3 Quality Testing

Where directed by The Superintendent, the Contractor shall dig test holes in the pavement at specified locations to ensure that minimum pavement thicknesses.

The Contractor shall undertake testing of the granular pavement at the following minimum frequency:

Table 5.1 Quality Testing Requirements for Granular Pavements

Item	Test Type	Minimum Testing frequency
Granular	Particle Size Distribution	One test per 1,000 tonnes
Pavement material	Atterberg Limits	One test per 1,000 tonnes
	Los Angeles Value	One test per 1,000 tonnes
Recycled material	Foreign Materials Content	One test per 1,000 tonnes
Each granular material type	Maximum Dry Density	1 per material type
	Optimum Moisture Content	1 per material type
Pavement compaction	Field Dry Density	2 per 300 sq.m or min of 3 per lot (refer table RD-PV-S2 12.1)
Pavement Moisture	Field Moisture content	1 per field dry density
Binder content	Refer Quality Plan	One test per 150 tonnes or part thereof

For remediation works or small projects, the Superintendent may reduce the amount of testing prior to the commencement of works. Principal approval is also required in this case.

If approved by The Superintendent frequency of field dry density testing for granular pavement layers may be reduced to for areas greater than 2,000 m².

The following test procedures shall be used for Quality testing:

Table 5.2 Test Procedures for Granular Pavements

Test Type	Test Procedure
Particle Size Distribution	DIT Test Procedure – TP134
Atterberg Limits	AS 1289.3.1.2 ,3.2.1, 3.3.1 and 3.4.1
Los Angeles Value	AS 1141.23
Foreign Materials Content	RTA Test Procedure – T276
Sampling of materials	DIT Test Procedure – TP 226
Preparation of samples	AS 1289.1.1
Maximum Dry Density	AS 1289.5.2.1
Optimum Moisture Content	AS 1289.2.1.1 and AS 1289.2.1.4
Field Density	AS 1289.5.8.1 (Nuclear Method)
Dry Density Ratio	DIT Test Procedure – TP 320
Pavement hardness testing	DIT Test Procedure – TP 349

Note:

- Dry Density Ratio shall be calculated to the nearest 0.1%.
- Density measurements shall be made to the nearest 0.01 tonne /m³.
- Test location co-ordinates shall be measured to the nearest 100 mm.

The following tolerances shall apply to finished unsealed footpaths:

Table 5.3 Tolerances on Unsealed Footpaths

Item	Tolerance	
Unsealed Footpaths	Absolute	±10mm
	Relative	±6 mm from a 1.0 m straight edge
	Alignment	±10 mm from design location

5.4.4 Quality Plan

The Contractor shall prepare and implement a Quality Plan that includes:

- details of the type of mixing plant proposed, including type, proposed location, output capacity and method of controlling binder content and moisture content (including methods to ensure uniformity);
- details of the retarder to be used with cement binder.

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- procedures for calibration of plant (including frequency).
- procedure for verifying binder content, including evidence of reliability of the procedure.
- procedures for material handling, including loading of mixer and control of segregation during loading and mixing; and
- detailed procedures for pavement construction.

If not provided beforehand, the documentation shall be submitted at least 7 days prior to the commencement of site work. Provision of the documentation listed in this Clause shall constitute a **HOLD POINT**.

5.4.5 Tolerances

Construction Tolerances on each finished granular pavement layer are as follows:

Table 5.4 Tolerances on Granular pavements

Item	Tolerance
Filed Dry Density	-0% + 5% of specified compaction
Depth of each pavement layer	As detailed in the pavement design
Binder Content	Within ± 0.5 % of that specified
Shape of finished base/ subbase course surface	Longitudinal ± 10 mm below a 3.0 m straightedge Transverse 5mm (above) to 15mm (below) a 3.0 m straightedge

The shape of the finished surface shall deviate below a 3.0 m straightedge, measured between any two points, by no more than the tolerances specified above.

5.4.6 Acceptance Criteria

Areas where the pavement fails to meet the specified requirements including:

- minimum thicknesses
- relative compaction and moisture content
- level tolerances and shape
- surface finish; or
- soft / over wet areas, surface cracking, shoving and ruts.

may be rejected (as determined by The Superintendent) and shall be reworked, moisture conditioned and respread and compacted to meet the specified requirements at the Contractor's cost.

Areas where the pavement is damaged subsequent to meeting the specified requirements due to weather, vehicular traffic or the Contractor's activities shall be reworked to meet the specified requirements at the Contractor's cost.

6 CONCRETE – BASECOURSE

This section of the specification details the requirements for concrete basecourse work, to be used in the construction of natural stone footpaths.

This section shall be read in conjunction with the contract drawings, subgrade and granular pavement section of this specification and CoA Standard Suite.

6.1 General

This specification shall be read in conjunction with the following Standards and references, which are deemed to form a part of this specification.

AS 1012	Methods of testing concrete
AS 1379	Specification and supply of concrete
AS 1478.1 & AS 1478.2	Chemical admixtures for concrete
AS/NZS 1554.3	Structural steel welding
AS/NZS 1748.1	Timber – Solid – Stress-graded for structural purposes
AS 2758.1	Aggregates and rock for engineering purposes - Concrete aggregates
AS 3600	Concrete structures
AS 3610.1	Formwork for concrete – Specifications
AS 3799	Liquid membrane-forming curing compounds for concrete
AS 3972	General purpose and blended cements
AS 4671	Steel reinforcing materials

6.1.1 Extent of the Work

The extent of the concrete work shall include but not be limited to the following:

- Design, supply, erection and removal of all formwork and falsework
- Supply and fixing of all reinforcement.
- Supply and fixing of all inserts, anchor bolts, embedded fixings, waterstops and membranes.
- Supply and placing of all concrete.
- Sampling and testing of concrete and its components and reporting to The Superintendent
- Finishing of all concrete surfaces
- Curing and protecting of all concrete

6.1.2 Responsibility

The Contractor shall be wholly responsible for carrying out all concrete works in accordance with the drawings and this specification.

6.2 Materials – Concrete

The Contractor shall be responsible for the supply of the concrete in accordance with this specification and the drawings. If requested by The Superintendent, and prior to the supply of concrete to the site, the Contractor shall supply copies of NATA-endorsed test certificates covering all relevant tests described in the referenced Standards.

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6.2.1 Aggregates

Aggregates shall comply with AS 2758-1. The maximum nominal size of aggregate shall be 20 mm or as shown on the drawings. Non-ferrous – metallurgical slag aggregate shall not be used.

6.2.2 Cement

All cement shall comply with AS 3972. Cement used in precast work shall be from one manufactured batch.

6.2.3 Water

Water shall be free from substances harmful to concrete, reinforcement and other embedded items.

6.2.4 Chemical Admixtures

No admixture shall be used without prior written approval from The Superintendent. If approved for use, admixtures shall not contain chlorides, fluorides or nitrates and shall comply with AS 1478.1.

6.2.5 Storage

Cement shall be stored in water tight buildings, bins or silos which provide protection against damp and contamination.

Aggregate stockpiles shall be arranged and used to prevent segregation or contamination with other types or sizes of aggregate. Stockpiles shall be arranged to be free draining. Where colour uniformity of aggregates is important for concrete finishing, all aggregate required for the project shall be stored so that colour changes in the finished concrete are prevented.

Admixtures shall be stored to prevent any detrimental effect on their properties. The Contractor shall comply with any special requirements of the manufacturer of the product regarding storage or handling of the admixture.

6.2.6 Performance Requirements

The concrete for the work shall be designed and produced to meet the performance requirements of this specification and the contract drawings.

The selection, proportioning and mixing of the concrete materials shall produce a mix which works readily into corners and angles of the forms and around reinforcement using the method of placement employed on the work, while ensuring that the concrete does not segregate and excess free water does not collect on the surface. The resultant concrete shall be sound and have the other qualities specified.

The minimum performance requirement of the concrete for the various concrete elements shall be as follows, or as shown otherwise on the contract drawings:

Table 6.1 Concrete Performance Requirements

Element	Compressive Strength f'_c (MPa)	Flexural Strength f'_{cf}	Slump (mm)	Drying Shrinkage (μm)
Concrete basecourse	32	4.5 MPa @ 28days	80	650

6.2.7 Ready Mixed Concrete

Except where otherwise specified, all concrete is to be ready mixed by a batch production process and supplied in accordance with AS 1379. Ready mixed concrete shall be delivered in agitating trucks.

6.2.8 Transportation

Concrete is liable to be rejected if the elapsed time between charging of mixer and the discharge of the concrete to the formwork exceeds the following time periods at various temperatures.

Table 6.2 Concrete Transportation Requirements

Concrete Temperature at Time of Discharge	Maximum Elapsed Time (hours)
less than 24°	2.0
24°–27°	1.5
27°–30°	1.0
30°–32°	0.75
greater than 32°	not permitted

6.3 Materials – Reinforcement

6.3.1 Reinforcement

All reinforcing fabric, reinforcing bars and hand drawn steel wire shall comply with the requirements of AS 4671.

The Contractor shall provide copies of the Manufacturer's test certificates required by AS 4671 for the steel reinforcing materials.

6.4 Construction and Workmanship – Formwork

Forms shall be of steel or timber faced with a smooth hard surface to the lines, shapes and dimensions of the concrete as called for by the drawings and specification.

Forms shall be mortar tight to prevent leakage and shall be rigid enough to prevent distortion due to the pressure of the concrete, vibration, or any incidental construction loads.

Forms shall be set, strutted, and tied so that the finished concrete will conform accurately to the lines and dimensions shown on the drawings.

6.4.1 Formwork Design

Formwork shall be designed in accordance with AS 3610.1. Formwork shall be designed and constructed so that elastic shortening, deflection and cambers resulting from prestressing forces are not restricted.

Falsework shall be designed to provide lateral stability for the forms against the loads resulted from wind, lateral pressure of plastic concrete and vibration of equipment.

The Contractor shall submit formwork documentation to The Superintendent in accordance with AS 3610.

6.4.2 Dimensional Tolerances

Dimensional tolerances applicable to formed and other surfaces shall comply with the requirements of AS 3610.

6.4.3 Types of Formwork

The formwork required throughout the project shall be designed by the Contractor to achieve the surface finishes and the shapes, lines, levels, and dimensions of the concrete work required by the drawings and this specification. Unless otherwise shown on the drawings, for work above ground, forms shall be chamfered for re-entrant angles and filleted for corners. The face of the bevel in each case shall be 25 mm unless noted otherwise. The materials to be used in the formwork shall comply with AS3610.

6.4.4 Treatment of Formwork

6.4.4.1 Release Agents

Internal faces of the forms shall be coated, before placing reinforcement, with an approved release agent compatible with the contact surfaces. The Contractor shall ensure that the release agent does not puddle due to excessive application and so causing staining or retardation of the concrete surface. No part of the reinforcement or construction joints shall be coated with the release agent.

6.4.4.2 Cleaning of Formwork

All forms shall be thoroughly cleaned prior to placing concrete. All dust, debris, rust, and other stains shall be removed.

6.4.5 Finished Formwork

6.4.5.1 Classes of Finishes

The classes of finishes are to be in accordance with AS 3610 and shall comply with the requirements of the drawings for class and location of finishes together with reference to critical face, form liners, surface pattern, form face deflection and surface treatment.

Unless noted otherwise colour control shall be in accordance with AS 3610.

Concrete basecourse: class of finish 3

6.4.5.2 Repair to Concrete Finishes

Where the concrete finish fails to comply with the specification and AS 3610, the Contractor may propose a repair method complying with AS3600 for approval by The Superintendent. The Superintendent may impose additional requirements in accordance with AS 3600. If the method is not approved, or if the approved method does not, in the opinion of The Superintendent, produce a satisfactory concrete finish, the concrete shall be removed to the extent determined by The Superintendent and recast against properly formed construction joints.

6.4.5.3 Stripping of Formwork

Forms shall not be stripped, or any formwork supports removed, until the concrete has acquired sufficient strength to support its own weight and any superimposed loads without detriment to its intended use.

Stripping of forms and removal of formwork supports shall comply with the requirements of AS 3600.

6.5 Construction and Workmanship – Reinforcement

The Contractor shall be responsible for the supply and fixing of the reinforcement together with all tie wire, support chairs etc in accordance with the drawings and Specification.

6.5.1 Supports for Reinforcement

Bar chairs, spacers and ties made of concrete, steel or plastic shall be used to support all reinforcement in its position within the tolerance specified in AS 3600 until the concrete has hardened. Wood, aggregate, brick, or other materials shall not be used.

The supports shall be adequate to withstand construction traffic and shall be in sufficient number and spacing to maintain the correct position of the reinforcement before and during concrete placing. Appropriate plates shall be used under each chair situated over a membrane or moisture barrier to prevent damage to the membrane or moisture barrier.

6.5.2 Bending

Bending of reinforcement shall comply with AS 3600.

6.5.3 Welding

Welding of reinforcement shall comply with AS 3600 and AS/NZS 1554.3. Written approval from The Superintendent shall be obtained before reinforcement is welded.

6.5.4 Laps

Unless otherwise directed by The Superintendent, the minimum end lap for mesh shall be 300 mm and the minimum side lap 150 mm. The minimum lap for deformed bars shall be 38 times the bar diameter. The location of any laps is subject to the approval of The Superintendent.

6.5.5 Cover

The minimum clear cover to any reinforcement shall be as follows unless otherwise noted on the drawings:

Concrete basecourse: minimum clear cover to reinforcement = 50 mm

Damp proof membranes are to be installed between the concrete basecourse and surrounding soil.

6.5.6 Fabrication

Reinforcement shall be fabricated to the shape and dimensions shown in the drawings and to the dimension tolerances specified in AS 3600.

6.5.7 Surface Condition of Reinforcement

Reinforcement shall be free from loose mill scale, loose rust, oil, grease and other non-metallic coatings which would reduce the bond to the concrete. Where reinforcement is to be left exposed, it shall be protected by coating with a cement wash to the approval of The Superintendent.

6.5.8 Fixing of Reinforcement

Reinforcement shall be held in its correct position within the tolerances specified in AS 3600 until the concrete has hardened.

6.5.9 Protection in Hot Weather

Where there is a likelihood of an ambient air temperature greater than 32°C during the placement of the concrete, then the reinforcement shall be adequately shaded or sprayed with water to prevent the temperature of the concrete adjoining the bars rising above 32°C.

6.6 Construction and Workmanship – Placing of Concrete

The Contractor shall be responsible for placing concrete so that the requirements of the drawings and specification are met.

Care shall be exercised to avoid segregation of the concrete during placing. All the form shall be filled. Concrete shall be placed and moved to surround the reinforcement without displacing it.

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Coarse aggregate shall be worked back from the face of formwork and all air bubbles and voids removed from the concrete. Concrete shall be placed in horizontal layers not exceeding 225 mm in height and each layer shall be thoroughly compacted before additional concrete is placed.

Under no circumstances shall concrete be dumped in a heap and spread with vibrating tools.

During placing of concrete the specified slump shall be maintained within the specification tolerance. No water shall be added to the concrete after discharge from the agitator has started.

The concrete shall not be placed when the conditions which will not permit the requirements of this specification to be met, either at the time or subsequently.

6.6.1 Compaction

The concrete shall be compacted using immersion and screed vibrators to remove air bubbles and to fill all voids. At least one reserve vibrator in working order is to be provided on site during concrete placing. Concrete shall not be over vibrated so that segregation results.

6.6.2 Laitance

Care shall be exercised during compaction to avoid laitance forming to a reasonably practicable extent.

6.6.3 Disturbance after placing

Under no circumstances shall formwork or projecting reinforcement be shaken, displaced, or disturbed within 20 minutes after concrete placing finishes. Concrete shall not be walked on or otherwise trafficked or disturbed until at least 48 hours after concrete placing finishes.

6.6.4 Weather Requirements

In addition to the requirements for cold weather and hot weather concreting set out in AS 3600, concrete shall not be poured if the shade air temperature at the site is less than 10°C or greater than 35°C.

6.6.5 Joints

Joints (construction, isolation expansion sawcut etc) shall be placed as indicated on the Drawings.

Wherever placing concrete stops until the concrete has taken its initial set, the point of stopping shall be formed into a construction joint. The location of construction joints shall be planned and shall be approved by the Engineer at least four (4) weeks before the joint is made.

The placing of the concrete shall be carried out continuously from joint to joint in one unit of operations.

Construction joints on exposed faces shall be truly horizontal or vertical. If necessary, a beading shall be fixed inside wall forms on exposed faces to ensure that the joint is regular.

Before concrete is deposited against the hardened concrete at a construction joint, the joint surface of the hardened concrete shall be thoroughly roughened and cleaned so that all loose or soft material, foreign matter and laitance are removed. The joint surface shall be dampened with clean water and coated with neat cement slurry before new concrete is placed against it.

6.6.6 Saw Cut Joints

Saw cut transverse joints are to be made within 24 hours of the concrete being placed to prevent undesired shrinkage cracking.

Refer CoA 435/ CoA 436

6.6.7 Type of Finishes

Concrete basecourse shall be steel trowelled finish unless otherwise specified on the contract drawings.

The concrete shall be placed, struck off, consolidated, and levelled to a Class C tolerance.

6.6.8 Curing of Concrete

All concrete work shall be cured in accordance with the requirements set out in AS 3600. Curing shall commence immediately after initial set of concrete and continuously for seven days during which the air temperature in contact with the concrete shall be held above 10°C, if necessitated by the ambient conditions.

Acceptable methods of curing include:

- ponding or continuous sprinkling with water
- an absorption cover kept continuously wet
- an impermeable membrane
- low pressure steam curing
- an impermeable sheet membrane over a moistened surface so fixed and lapped that air cannot circulate at the concrete surface.

6.6.9 Cold and Hot Weather Curing

Precaution shall be made to prevent concrete from freezing at any time. When the temperature of the surrounding air during curing is less than 10°C the concrete temperature shall be maintained between 10°C and 20°C for the required period of curing. Salts or chemicals shall not be used to prevent freezing.

When the temperature of the surrounding air during curing is higher than 32°C the concrete shall be cured only by either ponding or continuous sprinkling with water, or an absorption cover kept continuously wet.

6.6.10 Curing Compound

When curing compounds are to be used, the Contractor shall provide documentary evidence from the manufacturer of tests showing a satisfactory efficiency index, that the adhesion of the proposed applied finish will not be adversely affected and proof that the compound will not react detrimentally with the concrete. No curing compound shall be used unless it is approved by The Superintendent prior to application to the concrete.

6.7 Quality Requirements

6.7.1 Quality Control

A quality control testing system shall be implemented throughout the supply of the concrete to ensure compliance with the requirements of this specification. A copy of the test results shall be submitted to The Superintendent within 5 days from the test being carried out.

Daily reports shall be prepared for all concrete placed. The report shall contain information clearly identifying the batch of concrete supplied, the amount of water, if any, added prior to discharge and the results of any testing carried out during the day of placing. The report should identify where each batch was placed on the project, the method of placement and the climatic conditions during the pour. The reports shall be provided to The Superintendent within 3 working days of the concrete pour.

6.7.2 Inspections

The Contractor shall notify The Superintendent 24 hours prior to any concrete being placed to enable an inspection of excavation, formwork, and reinforcement to be made and for supervision of concreting to be arranged. No concrete shall be placed prior to such inspections.

The following Hold Points are required during the construction of Concrete Structures:

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H-CS1	Supply of formwork design documentation.
H-CS2	Approval of Concrete mix design
H-CS3	Inspection of completed formwork
H-CS4	Inspection of completed reinforcement

6.7.3 Quality Testing

The sampling and testing of concrete shall be in accordance with AS 1012.

All aspects of sampling, site treatment and testing of concrete specimens shall be carried out by NATA registered laboratory and personnel. On sites where this is not practicable, The Superintendent may approve of suitably experienced personnel proposed by the Contractor provided this has the agreement of the concrete supplier. The Contractor shall allow for the whole of the costs involved in this section.

Where concrete is liable to rejection, the costs of any further checking or testing that may be permitted by The Superintendent to demonstrate the concrete's compliance with the specification and drawings shall be borne by the Contractor.

6.7.3.1 Location of Sampling

All concrete samples shall be taken at the point of discharge from the agitator. Where required by The Superintendent additional sampling shall be carried out at the point of discharge into the forms.

6.7.3.2 Method of Sampling

Sampling and identification shall be carried out in accordance with AS 1012, Part 1

6.7.3.3 Frequency of Sampling

For project assessment the minimum frequency of sampling of the concrete shall be in accordance with the following table:

Table 6.3 Quality Testing for Concrete

Number of Batches per Day	Number of Samples
1	1
2 to 5	2
6 to 10	3
11 to 20	4
For each additional 10 batches	1 additional sample

For elements that are designed as being critical on the drawings or other documents the sampling frequency for strength testing shall be one sample per batch. Where requested by The Superintendent, testing facilities are to be available on site at agreed times during a concrete pour.

6.7.3.4 Test Specimens

At least two specimens shall be taken from the sample to represent a test property and be prepared and cured in accordance with AS 1012.

6.7.3.5 Characteristic Compressive Strength f'_c & Characteristic Flexural Strength f'_{cf}

At least two specimens 200 mm high and 100 mm diameter from each sample shall be tested in accordance with the relevant clauses of AS 1012 at 28 days.

6.7.3.6 Slump

The slump of the concrete shall be determined in accordance with AS 1012. Tolerance on slump shall be in accordance with AS 1379.

6.7.3.8 Drying Shrinkage

Three specimens shall be taken in accordance with AS 1012 and the assessment of drying shrinkage shall be based on the average results of these three specimens.

The manufacturer shall sample and test each type of concrete supplied for drying shrinkage at least every 3 months during the project or for every 3000 m³ placed and provide a report to the Contractor, which shall be passed on to The Superintendent.

Where drying shrinkage results in accordance with Clause 5.6 of AS 1379 are not available, at least two samples shall be taken of trial mixes in accordance with AS 1012 and each sample shall provide a result being the average of three specimens at 56 days.

These results shall show a maximum drying shrinkage as noted above. Project assessment of shrinkage using specimens prepared in the field may show a maximum tolerance of 150 μ m on the production assessment results or the results from trial mixes.

6.7.4 Tolerances

The surface of the concrete shall be finished to tolerance class C as specified below, determined by a straight edge placed anywhere on the surface in any direction, unless otherwise specified on the contract drawings.

Table 6.4 Tolerances on Finished Concrete

Class	Tolerance (mm)	
A	3	Maximum deviation from a 3 m straight edge
B	6	Maximum deviation from a 3 m straight edge
C	6	Maximum deviation from a 0.6 m straight edge

6.8 Acceptance Criteria

Concrete which has been specified to satisfy certain performance requirements and which has been tested for such performance, shall be deemed to comply if the criteria specified in this section are satisfied, otherwise it will be liable to rejection.

The Superintendent may allow the rejected concrete to be retained subject to a structural investigation, additional tests or approved remedial work. The cost of any further checking, testing or remedial work shall be borne by the Contractor.

The rejected concrete shall be removed to the extent determined by The Superintendent.

The acceptance criteria shall be as follows:

6.8.1 Defective Formwork

Should any formwork be displaced during concreting or within the period specified for retention of the formwork, so that tolerance on finished concrete will be exceeded, any concrete which has been poured may be rejected.

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In that case concrete shall be removed as The Superintendent shall determine:

- construction joints shall be formed
- formwork shall be strengthened and adjusted
- the section of work shall be reconstructed.

6.8.2 Characteristic Compressive Strength f'_c and Characteristic Flexural Strength f'_{cf}

The concrete shall be deemed to comply with the strength requirements of this specification if its characteristic strength at 28 days complies with AS 1379.

6.8.3 Slump

The slump shall be deemed to complies if it lies within the specified tolerances. Concrete found to have slump outside these tolerances shall be removed from the site.

6.8.4 Drying Shrinkage

The concrete shall be deemed to comply if the average test results for the drying shrinkage do not exceed the specified value.

6.8.5 Other Criteria

Hardened concrete shall also be liable to rejection if any of the following defects occur:

- It does not comply with AS 3600
- A construction joint has been made at a location or in manner not in accordance with the specification.
- The construction tolerances have not been met
- The reinforcing steel has displaced from its correct position.
- Waterstops, inserts and other items embedded in concrete have been displaced from their correct position
- The required surface finish has not been achieved
- The concrete work can be shown to be otherwise defective.

7 HOT MIX ASPHALT

This section of the specification details the requirements for supply, spreading, compaction and testing of Hot Mix Asphalt. This section shall be read in conjunction with the contract drawing set, granular pavement section of this specification and CoA Standards Suite.

7.1 General

This specification shall be read in conjunction with the following Standards and references, which are deemed to form a part of this specification.

AS 1160	Bituminous emulsions for the construction and maintenance of pavements
AS 1289.5.3.5	Methods of testing soils for engineering purposes
AS 2008	Bitumen for pavements
AS 2150	Hot mix asphalt – A guide to good practice
AS 2157	Cutback bitumen
AS 2706	Numerical values – Rounding and interpretation of limiting values
AS 2758	Aggregates and rock for engineering purposes
AS/NZS 2891.3.3	Methods of sampling and testing asphalt
DIT Master Specification RD-PV-S1	Supply of Pavement Materials
DIT Master Specification RD-BP-S1	Supply of Bituminous Materials
DIT Master Specification RD-BP-C5	Application of Sprayed Bituminous Surfacing
DIT Master Specification RD-BP-S2	Supply of Asphalt
DIT Master Specification RD-BP-C3	Construction of Asphalt Pavements
ASTM D3549	Standard Test Method for Thickness or Height of Compacted Asphalt Mixture Specimens
DIT Test Procedure TP 226	Sampling of Soils, Aggregates and Rocks
DIT Test Procedure TP 425	Sampling of Asphalt
EPA (SA)	Stormwater pollution prevention, code of practice for the building and construction industry

7.2 Materials

The properties of the materials, mixing, manufacture, and transport of hot mix asphalt shall comply with the following requirements.

7.2.1 Asphalt Aggregate and Sand

Asphalt aggregate shall be sourced from clean, hard, and durable crushed rock and free from lumps of clay and other aggregations of fine materials, organic material and any other deleterious material.

Asphalt aggregates and sand shall comply with the DIT Master Specification RD-PV-S1.

The production of aggregate and sand shall provide a material to meet the grading requirements for the asphalt as nominated in the asphalt mix design.

7.2.2 Mineral Filler

Mineral filler (mineral matter passing a 75-micron sieve) shall include rock dust derived from coarse and fine aggregates and any other materials added to supplement the quantity and properties of filler in the mix.

Mineral Filler shall comply with the DIT Master Specification RD-PV-S1.

7.2.3 Bitumen

Standard classes of bitumen shall comply with the requirements of AS 2008 and the additional requirements as detailed in DIT Master Specification RD-BP-S1.

7.2.4 Bitumen Emulsion

Bitumen emulsion shall comply with the requirements of AS 1160.

7.2.5 Asphalt Hot Mix Design

The Contractor shall provide and be responsible for the asphalt hot mix design. The Contractor's mix design shall be assessed by The Superintendent for compliance with this specification and approved by The Superintendent prior to use.

The mix design shall comply with DIT Master Specification RD-BP-S2 Supply of Asphalt.

7.2.6 Fine or Coarse Dense Graded Asphalt

The dense graded asphalt mix properties, design, aggregate grading, bitumen content, Marshall stability, Marshall flow, and air voids and production control shall comply with the DIT Master Specification RD-BP-S2 – "Supply of Asphalt".

The control of the mix design shall be in accordance with the DIT Master Specification RD-BP-S2 – "Supply of Asphalt".

7.2.7 Approval of Asphalt Hot Mix Design

At least seven (7) days before commencing production of asphalt, the Contractor shall submit details of each asphalt hot mix proposed to The Superintendent for review, including:

- details of constituent materials including aggregate, binder, filler, and additives (if used).
- the nominated aggregate grading, binder content, design air voids and proportion of each component in the mix.
- test results verifying the constituent material properties.
- test results on proposed mix design including, binder content, maximum density, air voids % at laboratory design compaction level.

This shall constitute a **HOLD POINT**.

The asphalt hot mix designation and binder type shall be as per the City of Adelaide standard pavement details.

Records of materials shall be kept in the form of delivery dockets or similar to enable traceability of materials incorporated into the pavement.

7.3 Construction and Workmanship

Asphalt hot mix shall be placed in accordance with the DIT Master Specification RD – BP – C3 – Construction of Asphalt Pavement

7.3.1 Environmental protection

The Contractor shall prevent pollutants such as tack coat, binder, asphalt, or other materials from entering waterways including creeks, rivers, drainage pits, stormwater retention basins or pipelines, in accordance with EPA (SA) Stormwater pollution prevention code of practice for the building and construction industry.

The Contractor shall prevent tack coat, prime, binder, aggregate, asphalt, or other material used on the work from adhering or obstructing gratings, hydrants, valve boxes, inspection pit covers, kerbs and other road fixtures.

7.3.2 Adjacent Structures

The Contractor shall adjust all sewer castings, water supply top stones and other service covers to the finished pavement design levels prior to installation of the asphalt wearing course.

7.3.3 Acceptance of Pavement

Placement of Hot Mix Asphalt shall not commence until the previous pavement layers have been inspected by The Superintendent, and any preceding Hold Points have been released.

7.3.4 Notice

The Contractor shall provide at minimum of 24 hours' notice to The Superintendent and obtain approval before commencing tack coat and asphaltting operations.

7.3.5 Preparation of Surface

Prior to placing a prime, tack coat the surface shall be cleaned free of loose stones, dirt, or any deleterious material.

Where required, the Contractor shall sweep clean the area on which asphalt is to be placed. The Contractor shall take care to limit damage or disturbance to the surface to the minimum practicable. Wire brooms shall not be used.

7.3.6 Priming

The class grade and rate of application of the prime shall be as detailed in the contract drawing set and CoA Standards Suite.

Primer shall be applied by means of a mechanical sprayer where practical. The sprayer shall have a current sprayer certificate issued by a NATA accredited testing authority or state road authority.

Spraying of prime shall commence on a heavy paper laid across and held securely to the pavement surface to avoid overspray. The sprayer shall maintain a constant speed throughout the length of each spray run to ensure the correct application rate is attained.

Priming shall not take place unless the:

- pavement temperature is 10°C or above.
- wind speed is no greater than 20 km/hr;

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- field moisture content of the underlying granular pavement layer is less than 70% of the Optimum Moisture Content (OMC).

After the application of the primer, the surface shall be a thoroughly dry surface, prior to the application of the asphalt surface. A minimum period of 48 hours curing time shall be allowed for cutback bitumen with volatile solvents. An emulsion prime (minimum wait time 2 hours) can be used as an alternative if approved by the Superintendent.

Traffic shall be kept off the primer surface until it has dried sufficiently to minimise the risk of damage to the surface. The Contractor shall supply, place, and maintain the traffic management necessary to comply with this requirement.

7.3.7 Tack Coating

Tack coat shall be applied to the cleaned surface prior to placing asphalt. Where the hot mix asphalt is to be spread over clean, freshly placed asphalt, or over a clean primed surface, The Superintendent may direct the Contractor to omit the tack coat.

Tack coat shall consist of bituminous emulsion complying with AS 1160. The type and breaking rate shall be suitable to the climatic and surface conditions of use such that it is fully broken, free of surface water and intact before the commencement of asphalt spreading.

Tack coat shall be applied by spray bar fitted to a mechanical sprayer to provide a uniform application rate of residual binder as detailed in the contract drawing set and CoA Standards Suite. Hand spraying shall only be carried out in those areas where it is impracticable to use a spray bar.

7.3.8 Transportation and Delivery of Asphalt

Hot mix asphalt shall be transported to works inside clean vehicle bodies coated with a thin film of an appropriate release agent. During transportation the body of the vehicle shall be covered to prevent contamination and reduce the rate of cooling of the mix.

Where the length of the haul, weather or local conditions are such that the temperature of the hot mix asphalt may drop below a suitable placing temperature the transportation vehicles shall be suitably insulated.

7.3.9 Ambient Conditions for Placing

The surface on which the hot mix asphalt is to be placed shall be dry and free from free-standing water.

Hot mix asphalt shall not be placed when the underlying pavement surface temperature is less than 10°.

7.3.10 Granular Pavement Dry-Back

Unless specified otherwise on the Drawings, hot mix asphalt placement shall not commence until the field moisture content of the underlying granular pavement layer is less than 70% of the Optimum Moisture Content (OMC) in Modified Compaction.

i.e. $(\text{Field Moisture Content}) / (\text{Optimum Moisture Content}) \times 100 < 70\%$.

Field moisture content tests shall be undertaken at the minimum frequency of 1 per field dry density test (refer Granular Pavement section of this Specification).

Provision of field moisture content test results shall constitute a **HOLD POINT**.

7.3.11 Placing

The hot mix asphalt shall be placed by means of a self-propelled mechanical paving machine capable of evenly distributing the hot mix asphalt over the full width of the strip being spread and adjustable for slope and depth as required.

The asphalt shall be spread in layers of sufficient thickness to provide the design thickness after compaction as detailed in the contract drawing set and CoA Standards Suite.

The Contractor shall conduct spreading operations to ensure that the paver speed matches the rate of supply so that the number of paving stops is minimised.

Areas inaccessible to the paving machine shall be spread using approved hand methods. Hand work shall not be excessively raked.

7.3.12 Compaction

The compaction of the hot mix asphalt shall be commenced as soon as the placed asphalt mix will support the compaction equipment without undue displacement. Rolling shall start longitudinally at the low side of the road cross fall and proceed towards the high side of the run.

Initial rolling shall be carried out with a steel drum roller and the final rolling with a pneumatic tyred multi-wheeled roller. Rolling shall be carried out continuously until such time to achieve the required standard of compaction.

In areas inaccessible to rollers, the mix shall be compacted to the specified standard by tamping with heated iron tampers or mechanical tampers.

Following compaction, the completed surface shall be a tight dense surface, free of “bony” or “fatty” areas ravelling and loose material, surface cracking, shoving and ruts.

Asphalt shall be compacted in accordance with the DIT Master Specification RD – BP – C3 – Construction of Asphalt Pavement

7.3.13 Joints

Construction joints shall be provided longitudinally (where the width of the pavement is such that more than one paving run is necessary) and transversely (after the completion of a day’s paving operations, or where a delay in paving operation allows asphalt to cool and adversely affect placing).

The location of joints shall be planned before work commences. The number of joints shall be minimised. All joints shall comply with the specified shape requirements.

Where hot mix asphalt is placed against a joint edge that has not cooled below 100°C it shall be considered a hot joint. Hot joints shall be constructed by leaving a 150 mm strip of asphalt unrolled along the free edge until the adjoining lane is placed and compacting the unrolled strip simultaneously with the material in the adjoining lane.

Where asphalt is placed against a joint edge that has not cooled below 60°C it shall be considered a warm joint. Warm joints shall be constructed by rolling the full width of the first lane being placed, prior to placing the adjoining lane.

Where asphalt is placed against a joint edge that has cooled below 60°C it shall be considered a cold joint. Asphalt placed against a cold edge should overlap the previous edge by 25 mm to 50 mm. The overlap should be pushed back immediately after spreading using lutes to form a slight ridge that is compacted with the steel wheel roller.

7.4 Quality Requirements

Hot mix asphalt shall meet the requirements in the DIT Master Specification RD – BP – C3 – Construction of Asphalt Pavement

7.4.1 Materials

Hot mix asphalt materials and binder shall be sampled and tested for product control and verification purposes during manufacture. Samples shall be selected randomly throughout the day’s production for each mix type shall at the frequency detailed in quality testing section.

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7.4.2 Inspections

The following HOLD POINTS are required during the construction of hot mix asphalt:

H-AC1	Approval of asphalt hot mix design
H-AC2	Approval of underlying pavement (including prime as applicable) prior to the commencement of the asphalt and granular pavement dry back
H-AC3	Ambient conditions prior to the placement of asphalt

7.4.3 Quality Testing

The Contractor shall undertake quality testing of hot mix asphalt to meet the requirements in the DIT Master Specification RD – BP – C3 – Construction of Asphalt Pavement:

In addition to the DIT Master Specification requirements a minimum of 1 core samples tests for a lot of production.

The testing shall also cater for of all the following requirements:

- At least one core shall be taken on each footpath, on each day of asphalt surfacing.
- At least 1 core adjacent to a cold joint, on the more recently laid side

The relative compaction of a core shall be expressed as the in-situ density of the compacted asphalt as a percentage of the reference density.

The reference density shall be the arithmetic mean of the five most recent test results of the same mix design, provided that:

- they are from tests done within the past 4 weeks.
- the binder content of the samples tested are within $\pm 0.3\%$ of the job mix binder content
- there has been no change in mix components or proportions.

Where five test results are not available the Contractor shall carry out a minimum of five tests to ascertain the reference density value.

Relative compaction data shall be calculated and reported to one decimal place and rounded to one unit in the last figure as described in AS 2706.

The above-mentioned test procedures shall be used for Quality testing.

7.4.4 Tolerances

Construction tolerances on Hot Mix Asphalt are as set out the DIT Master Specification RD – BP – C3 – Construction of Asphalt Pavement

The finished surface shall meet the requirements of the Master Specification RD – BP – C3 and be self draining.

7.4.5 Acceptance Criteria

The finished surface of the hot mix asphalt shall be smooth and of uniform texture without any step at the joints. If the material supplied is not within the tolerances and quality requirements as detailed in this specification and the pavement design standards for manufacture or placing of asphalt, The Superintendent may direct:

- the removal of non-complying material; or
- that the reduced service life arising from the non-complying material is offset by reducing payment for the non-complying material by the method determined by The Superintendent, or
- any other remedial treatment that is expected to provide the required level of service.

8 SEGMENTAL PAVING

This section of the specification details the requirements for supply, placing and finishing of segmental paving units. This includes concrete (including flagstone), clay and masonry segmental pavers. This section shall be read in conjunction with the contract drawing set, CoA Standards Suite, and granular pavement section of this specification.

8.1 General

This specification shall be read in conjunction with the following Standards and references, which are deemed to form a part of this specification.

Concrete Masonry Association of Australia publication PA01/02/03	Concrete Segmental Pavements – Detailing Guide, for Residential Access ways and Roads Concrete Segmental Pavements- Specifying Guide
AS 4663	Slip resistance measurement of existing pedestrian surfaces
AS 4455.2	Masonry units, pavers, flags and segmental retaining wall units – Pavers and flags
AS 4586	Slip resistance classification of new pedestrian surface material

8.2 Materials

8.2.1 Granular Base Materials

The material to be used for the paving base course shall be in accordance with the granular pavement sections of this specification.

8.2.2 Bedding Sand

Bedding sand shall be a natural pit material, dune sand or crushed quarry product as approved by the Superintendent. The sand shall be free of pebbles, clay lumps, organic matter or deleterious soluble salts or other contaminants likely to cause efflorescence or lead to reduced skid resistance.

The bedding sand shall comply with the following design criteria requirements:

Table 8.1 Tolerances on Block Paved Pavement

Characteristic	Requirement
Particle Size Distribution	6.7 mm sieve 95–100 %
	0.075 mm sieve 0–10 %
Liquid Limit	<25 %
Plasticity Index	<6%
Linear Shrinkage	<3%

8.2.2.1 Joint Filling Sand

The sand for joint filling shall be well graded and free of deleterious material such as soluble salts.

The joint filling sand shall comply with the following design criteria requirements:

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Table 8.2 Tolerances on Segmental Paving

Characteristic		Requirement
Particle Size Distribution	2.36 mm sieve	100 %
	1.18 mm sieve	90-100 %
	0.60 mm sieve	60-90 %
	0.30 mm sieve	30-60 %
	0.15 mm sieve	15-30 %
	0.075 mm sieve	5-10 %

8.2.2.2 Joint Mortar

Joint mortar shall be an approved flow able non-shrink grout.

8.2.2.3 Segmental Paving Units

Concrete paving units shall comply with Concrete Masonry Association of Australia publications (PA01/PA03/PA05) Concrete Segmental Pavements - Detailing Guide, Concrete Segmental Pavements - Specifying Guide and Concrete Flag Pavements – Design and Construction Guide.

8.3 Construction and Workmanship – Block Paved Pavements

8.3.1 Subgrade

The subgrade for the block paving shall be constructed as specified in the Site Preparation and Earthworks sections of this specification.

8.3.2 Sub-Base and Base Course

The sub-base and base course for the block paving shall be placed and compacted in accordance with the granular pavement section of this specification.

Care shall be taken to ensure the surface of the base course is finished to within the specified tolerances.

8.3.3 Bedding Sand

The bedding sand shall be spread in a uniform layer, to give the specified thickness after compaction. The bedding sand shall be screeded off in an uncompacted condition to the design levels, grades and cross falls to give a uniform layer.

The bedding sand shall not be used to make up levels of the base course surface.

8.3.4 Bedding Mortar

Bedding mortar where specified on the Drawings shall consist of “Parex Davco Streetscape Fine Bedding Concrete” or an approved equivalent by the Principal.

Table 8.3 Characteristic Requirements for Mortar

Characteristic	Requirement
Minimum Compressive Strength	40 MPa
Flexural Strength	4.5 MPa
Minimum Adhesive Strength	2.0 MPa
Modulus of Elasticity	18,000 \pm 3,500 MPa
Maximum Shrinkage	Not greater than 0.10%
Slump	150 mm

8.3.5 Grout

Grout shall consist of “Parex Davco Streetscape Fluid Grout” or an approved equivalent by the Principal.

Table 8.4 Characteristic Requirements for Grout

Characteristic	Requirement
Minimum Compressive Strength	40 MPa
Minimum Flexural Strength	6.0 MPa
Minimum Adhesive Strength	1.5 MPa
Modulus of Elasticity	20,000 \pm 4,000 MPa
Minimum Density	2,000 kg/m ³
Maximum Shrinkage	Not greater than 0.10%
Maximum Aggregate Particle Size	3mm
Slump	150 mm

8.3.6 Laying of Units

The paving units on concrete pavement shall be laid on the specified bed in the approved pattern, with gaps of 2 mm to 5 mm wide between adjoining joint filled sand units and between units and bordering construction.

Pavers shall be cut using a masonry saw. Any infill spaces which are of insufficient size for cut units (minimum width 75 mm, minimum depth 75 mm) shall be filled using a dry packed mortar, with an oxide additive shall be used in the concrete mix so that the colour of the concrete closely matches the colour of the pavers.

The disturbance of the units prior to the compaction of the placed units shall be prevented.

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As soon as practical after placement of paving units, joints shall be filled flush with dry joint filling sand and broomed into the joints. On completion of joint filling paving units shall be set in place using a minimum of two passes of a vibratory plate compactor. Any units damaged during compaction shall be immediately removed and replaced.

Following initial compaction, joints shall be topped and filled flush with jointing sand and compacted with a further pass of the vibratory compactor.

All work, except within 1.0 m of the laying face shall be fully compacted at the completion of each day's laying. Prior to completion the contractor shall ensure that all joints are filled flush and excess sand is removed from the pavers.

8.4 Quality Requirements

The individual pavers shall meet the 'Paver Properties & Criteria' outlined on the City of Adelaide Footpath 'Construction Standards'. The contractor shall provide evidence, in the form of test results, showing that these criteria has been met.

The Supplier shall provide written certification that the supplied paver meets the minimum performance criteria stipulated within the above-mentioned CoA Design Standards.

8.4.1 Materials

The Contractor shall submit colour and paver samples to the Superintendent for approval.

Supplied paving units shall comply with the dimensional tolerances and requirements as detailed in CMAA PA05 and recently developed design standards.

8.4.2 Inspections

The following HOLD POINTS are required during the construction of segmental unit pavements:

H-SP1	Approval of paving units' colour and shape
H-SP2	Approval of subgrade and underlying pavement layers prior to the commencement of bedding layer
H-SP3	Approval of completed paved units

8.4.3 Tolerances

Construction tolerances on segmental unit pavements are as follows:

Table 8.5 Tolerances on Block Pavement

Item	Tolerance	
Top of Pavers	Absolute	±5 mm
	Relative	±10 mm from a 3.0 m straight edge
	Alignment of pavers	±10 mm over a 5 m length or 20 mm over a 50 m length for large areas
Depth of bedding sand	+ 10 mm – 5 mm	
Joints between paving units	Max of 6 mm	

8.4.4 Acceptance Criteria

Areas where the pavement fails to meet the specified requirements including:

- specified colour, pavers type or laying pattern;
- level tolerances and shape; • paving joints and alignment;
- paving cuts and in-fills.

may be rejected, as directed by the Superintendent.

If an area of pavement is rejected, the Superintendent may direct the Contractor to complete the following remedial works, at the Contractor's cost:

- removal and re-laying of the non-complying areas.
- re-working of non-complying areas;
- any other remedial treatment that is expected to provide the required level of service.

9 IN-SITU CONCRETE PAVING

This section of the specification details the requirements for in-situ concrete pavements. This section shall be read in conjunction with the contract drawing set, CoA Standards Suite, and granular pavement section of this specification.

9.1 General

This specification shall be read in conjunction with the following Standards and references, which are deemed to form a part of this specification.

AS 3600	Concrete Structures
AS 3610	Formwork for Concrete
AS 3972	General purpose and Blended Cements
AS 1379	Specifications and supply of concrete
AS 1478.1 & AS 1478.2	Chemical admixtures for concrete, mortar and grout - Admixtures for concrete
AS 1012	Methods of Testing Concrete
AS 2758	Concrete Aggregates
AS 3799	Liquid membrane-forming curing compounds for concrete
AS 4671	Steel for the reinforcement of concrete

9.2 Materials Concrete Pavement

The Contractor shall be responsible for the supply of the concrete in accordance with this specification and the associated contract documents. Upon the request of the Superintendent and prior to the supply of concrete the Contractor shall supply copies of NATA endorsed test certificates covering the relevant tests from the current Australian Standards.

In-situ concrete paving is to consist of coloured exposed aggregate concrete and coloured in-situ concrete.

9.2.1 Exposed Aggregate Concrete

In accordance with Council requirements, the concrete mix shall be as nominated on the contract drawings, CoA Construction Standards Suite or similar equivalent approved by the Superintendent.

9.2.2 Aggregates

Aggregates shall comply with AS 2758 concrete aggregates. The maximum nominal size of aggregate shall be 10 mm or as shown on the drawings. Non ferrous - metallurgical slag aggregate shall not be used.

9.2.3 Water

Water shall be potable, free from matters harmful to concrete, reinforcement and other embedded items.

9.2.4 Chemical Admixtures

Admixtures shall not contain chlorides, fluorides, or nitrates and if approved for use shall comply with AS 1478.1 & AS 1478.2. No admixture shall be used without a written approval from the Superintendent.

9.2.5 Curing Compounds

All Curing compounds shall comply with AS 3799 Curing Compounds.

9.2.6 Joint Sealants

Joint sealants shall be Silyl Modified Polymer sealant for use in concrete pavements. The sealant shall have a durometer hardness between 34 – 42, minimum 35N average peel strength and enable joint movement capability' of +/-20% (40% total)

9.2.7 Reinforcement

All reinforcing fabric, reinforcing bars and hand drawn steel wire shall comply with the requirements of AS 4671 Steel Reinforcing Materials. The Contractor shall provide copies of the Manufacturer's test certificates required by the relevant Australian Standards for the steel reinforcing materials.

9.2.8 Concrete Mix Design

In accordance with Council requirements, the concrete mix shall be as nominated on the drawings, CoA Construction Standards Suite or similar equivalent approved by the Superintendent.

The Contractor shall be responsible and provide the concrete mix design to meet the project performance requirements. The Contractor's mix design shall be reviewed by the Superintendent for compliance with this specification and approved by the Superintendent prior to use.

The following information on the concrete mix design shall be provided as a minimum:

- Material constituents (aggregate, cement).
- Relevant test data, including flexural strength (7 & 28 days), compressive strength (7 & 28 days), dry shrinkage (21 days).
- Any proposed admixtures.
- Curing method and compounds.

9.2.9 Performance Requirements

The concrete for the various parts of the work shall be so designed and produced that the performance requirements of this specification shall be met.

The selection, proportioning and mixing of the concrete materials shall be such as to produce a mix which works readily into corners and angles of the forms and around reinforcement with the method of placement employed on the work, but without permitting the material to segregate or excess free water to collect on the surface. The resultant concrete shall be sound and have the other qualities specified.

The minimum performance requirement of the concrete for the various concrete elements shall be as follows, or as shown otherwise on the drawings:

Table 9.1 Concrete Performance Requirements

Element	Compressive Strength f'_c	Flexural Strength f'_{cf} (@ 21 days)	Slump	Drying Shrinkage (@ 21 days)
Concrete Base - Slipformed	32 MPa	4.5 MPa	20-40 mm	450 μm
Concrete Base – Fixed from	32 MPa	4.5 MPa	55- 65mm	450 μm

9.2.10 Transportation

Concrete is liable to be rejected if the elapsed time between charging of mixer and the discharge to the formwork exceeds the following time periods for concrete of various temperatures.

Table 9.2 Concrete Transportation Requirements

Concrete Temperature at Time of Discharge (degrees)	Maximum Elapsed Time (hours)
less than 24	2.0
24 - 27	1.5
27 - 30	1.0
30 - 32	0.75
greater than 32	not permitted

9.3 Construction and Workmanship – Formwork

Forms shall be of steel or timber faced with a smooth hard surface to the lines, shapes and dimensions of the concrete as called for by the plans. Forms shall be mortar tight to prevent leakage and shall have sufficient rigidity to prevent distortion due to the pressure of the concrete, vibration or any incidental construction loads.

Forms shall be set, strutted and tied so that the finished concrete shall conform accurately to the lines and dimensions shown on the plan.

9.3.1 Release Agents

Internal faces of the forms shall be coated, before placing reinforcement, with an approved release agent compatible with the contact surfaces. No part of the reinforcement or construction joints shall be coated with the release agent.

9.3.2 Cleaning of Formwork

All forms shall be thoroughly cleaned prior to placing concrete. All dust, debris and rust or other stains shall be removed.

9.4 Construction and Workmanship – Reinforcement

The Contractor shall be responsible for the supply and fixing of the reinforcement together with all tie wire, support chairs etc in accordance with the Contract drawings and this Specification.

9.4.1 Supports for Reinforcement

Bar chairs, spacers and ties made of concrete, steel or plastic shall be used to support all reinforcement in its position within the tolerance in accordance with the relevant Australian Standard until the concrete has hardened. Wood, aggregate, brick, or the like shall not be used.

The supports shall be adequate to withstand construction traffic and shall be in sufficient number and spacing to maintain the correct position of the reinforcement. Plates shall be used under each chair situated over a membrane or moisture barrier to prevent damage.

9.4.2 Bending and Splices (Laps)

Bending of reinforcement shall comply with the relevant Australian Standard. The minimum splice for deformed bars shall be 38 times the bar diameter. The minimum end splice for reinforcement mesh shall be 300 mm and the minimum side lap 150 mm.

9.4.3 Surface Condition of Reinforcement

Reinforcement shall be free from loose mill scale, loose rust, oil, grease, and other non-metallic coatings which would reduce the bond to the concrete.

9.4.4 Fixing of Reinforcement

Reinforcement shall be securely held in their correct position within the tolerance specified in Section 19 of AS 3600 until the concrete has hardened.

9.4.5 Concrete Cover to Reinforcement

The minimum clear concrete cover to any reinforcement unless otherwise noted on the drawings shall be as 50mm.

9.5 Construction and Workmanship – Concrete Placement and Curing

The Contractor shall be responsible for the placement of concrete in such a manner that the requirements of this specification and the associated documents are met.

Care must be exercised to avoid segregation of the concrete during placing operations. Every part of the form shall be filled, and concrete shall be forced under and around the reinforcement without displacing it.

Coarse aggregate shall be worked back from the face of forms and all air bubbles and voids removed from the concrete. Under no circumstances shall concrete be dumped in a heap and spread with vibrating tools.

During placing of concrete the slump shall be maintained within the limits required by this specification. No water shall be added to the concrete after commencement of discharge from the agitator.

The concrete shall not be placed at a time or under such conditions which will not permit the requirements of this specification to be met.

9.5.1 Addition of Water to the Concrete Mix

No water shall be added to the concrete mix on-site unless approved in writing by the Superintendent.

9.5.2 Compaction

The concrete shall be compacted using immersion and screed vibrators to remove air bubbles and to fill all voids. At least one reserve vibrator is to be provided in working order. Care shall be taken to ensure that concrete is not over vibrated resulting in segregation.

9.5.3 Disturbance after placing

Under no circumstances shall formwork or projecting reinforcement be shaken, displaced, or disturbed more than twenty minutes after placing the concrete, and concrete shall not be walked on or otherwise disturbed until at least 48 hours thereafter.

9.5.4 Weather Requirements

In addition to the requirements for Cold Weather and Hot Weather concreting as contained in AS 3600 concretes shall not be poured if the shade air temperature at the site is less than 10degC or greater than 35degC

9.5.5 Saw Cut Joints

Saw cut transverse joints are to be made within 24 hours of the concrete being placed to prevent undesired shrinkage cracking.

9.5.6 Construction Joints

Wherever the work of placing concrete is delayed until the concrete has taken its initial set, the point of stopping shall be deemed a construction joint. The location of construction joints shall be planned and shall be approved by the Superintendent before the joint is made.

The placing of the concrete shall be carried out continuously from joint to joint, irrespective of any meal hour, thereby forming one unit of operations.

Construction joints on exposed faces shall be truly horizontal or vertical.

Before concrete is deposited against the hardened concrete at a construction joint, the joint surface of the hardened concrete shall be thoroughly roughened and cleaned so that all loose or soft material, foreign matter and laitance are removed. The joint surface shall be dampened with clean water and coated with neat cement slurry.

Sealants must extend down the vertical edge of the slab at all joints to prevent the ingress of incompressible.

Refer to CoA Construction Standard 434 to 436 In situ Concrete – joint details for further information.

9.5.7 Exposed Aggregate Finish

The exposed aggregate finish shall be Medium, with a preferred 4mm exposure, where the exposed stone is 40/60 with the concrete (top course exposed half stone width). I.e., where a 10mm aggregate stone is utilised, 4m of the stone shall be exposed.

The contractor shall allow for and prevent the flow of removed concrete into the local stormwater network to the satisfaction of the Superintendent.

Refer to CoA Construction Standard 461 Insite Concrete- Wearing Surface requirements for further information.

9.5.8 Charcoal Finish

The charcoal in-situ concrete shall be 'circular Paddle/ wood trowel finish' perpendicular to the kerb. The concrete should be oxide coloured concrete from Hanson in 'Raven' colour or similar approved by the Superintendent.

9.5.9 Curing of Concrete

All concrete work shall be cured in accordance with the requirements set out in AS 3600. Curing shall commence immediately after initial set of concrete and continuously for seven days during which the air temperature in contact with the concrete is above 10degC. Acceptable methods of curing include:

- ponding or continuous sprinkling with water
- an absorption cover kept continuously wet
- an impermeable membrane
- low pressure steam curing
- an impermeable sheet membrane over a moistened surface so fixed and lapped that no air circulation can occur at the concrete surface.

9.5.9.1 Cold and Hot Weather Curing

Precaution shall be made to prevent concrete from freezing at any time. When the temperature of the surrounding air during curing is less than 10degC the concrete temperature shall be maintained between 10degC and 20degC for the required period of curing. Salts or chemicals shall not be used for the prevention of freezing.

When the temperature of the surrounding air during curing is higher than 32degC the concrete shall be cured only by means of methods (a) and (b) specified above.

9.5.9.2 Curing Compound

When curing compounds are to be used, the contractor shall be providing documentary evidence from the manufacture of tests showing a satisfactory efficiency index, that the adhesion of the proposed applied finish will not be adversely affected and a proof that the compound will not react detrimentally with the concrete.

The compound shall not be used unless it is approved by the Superintendent.

9.6 Quality Requirements

9.6.1 Quality Control

A quality control testing system shall be implemented throughout the supply of the concrete to ensure compliance with the requirements of this specification. A copy of the test results shall be submitted within 5 days from the test being carried out.

A daily report shall be prepared on all concrete placed. The report shall contain the serial numbers of the identification certificates of each batch, the amount of water, if any, added prior of discharge and the project assessment carried during the day. The report should report where each batch was placed on the project, the method of placement and the climatic conditions during the pour.

9.6.2 Inspections

The Contractor shall notify the Superintendent 24 hours prior to any concrete being placed to enable an inspection of excavation, formwork, and reinforcement to be made and for supervision of concreting to be arranged. No concrete shall be placed prior to such inspections.

The following HOLD POINTS are required during the construction of Concrete Structures:

H-CS 1	Approval of Concrete mix design
H-CS 2	Inspection of completed formwork
H-CS 3	Inspection of completed reinforcement

9.6.3 Quality Testing

The sampling and testing of concrete shall be in accordance with AS 1012, Methods of Testing Concrete.

All aspects of sampling, site treatment and testing of concrete specimens shall be carried out by NATA registered laboratory and personnel. On sites where this is not practicable, the Superintendent may approve of suitably experienced personnel proposed by the Contractor provided this has the agreement of the manufacturer. The Contractor shall allow for the whole of the costs involved in this section.

Where concrete is liable to rejection, the costs of any further checking or testing that may be permitted by the Superintendent shall be borne by the Contractor.

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9.6.3.1 Location of Sampling

All concrete samples shall be taken at the point of discharge from the agitator. Where required by the Superintendent additional sampling shall be carried out at the point of discharge into the forms.

9.6.3.2 Method of Sampling

Sampling and identification shall be carried out in accordance with AS 1012, Part 1.

9.6.3.3 Characteristic Compressive Strength f'_c & Characteristic Flexural Strength f'_{cf}

At least two specimens shall be taken from the sample to represent a particular property and be prepared and cured in accordance with the relevant section of AS 1012.

The Test Specimen Size for Compressive strength shall be sampled using a 100mm diameter cylinder. Flexural strength specimens shall be a beam 100 * 100 * 350mm.

9.6.3.4 Slump

The slump of the concrete shall be determined in accordance with AS 1012.3. Tolerance on slumps shall be in accordance with AS 1379.

9.6.3.5 Drying Shrinkage

Three specimens shall be taken in accordance with AS 1012.13 and the assessment of drying shrinkage shall be based on the average results of the three specimens.

Where previous production testing is to be used for the assessment of drying shrinkage for each mix design supplied, production tests shall be from within the last 6 months.

Where drying shrinkage results in accordance with Clause 5.6 of AS 1379 are not available, at least two samples shall be taken of trial mixes in accordance with AS 1012.13 and each sample shall provide a result being the average of three specimens at 56 days.

9.6.4 Tolerances

The surface of the concrete shall be finished to one of the tolerance classes as specified below, determined by a straight edge placed anywhere on the surface in any direction.

Table 9.3 Tolerances on Finished Concrete

Item	Tolerance
Thickness	-0mm + 10mm of design thickness.
Integral Kerb Height	-0mm, + 5mm of design thickness
Shape	Longitudinal ± 5 mm below a 3.0m straightedge
	Transverse ± 10 mm below a 3.0m straightedge

9.7 Acceptance Criteria

Concrete which has been specified to satisfy certain performance requirements and which has been tested for such performance in accordance with section 7, shall be deemed to comply if the criteria specified in this section are satisfied, otherwise it will be liable to rejection.

The Superintendent may allow the rejected concrete to be retained subject to a structural investigation, additional tests or approved remedial work. The cost of this further checking, testing or remedial work shall be borne by the Contractor. The rejected concrete shall be removed to the extent determined by the Superintendent.

9.7.1 Concrete Cracking

Concrete cracking shall be categorised as follows:

- Plastic Shrinkage cracks – discrete cracks which form during the plastic stage which do not intersect a formed joint that are less than 500mm long and depth of less than 50 % of the concrete base thickness.
- Drying Shrinkage Cracks in reinforced slabs – occurring in the central part of the slab extending full depth and continuous between joints.
- Unplanned structural cracks – all other concrete cracks

The Contractor shall manage the quality requirements and curing to minimise cracking of the concrete base. Concrete base slab will be accepted according to the following criteria:

- Jointed Reinforced Concrete Pavement - plastic shrinkage cracks with a cumulative length of one metre or less in any slab and drying shrinkage cracks.

All other cracked slabs shall be removed and replaced or as directed by the Superintendent.

9.7.2 Defective Formwork

Should any formwork be displaced during concreting or within the period specified for retention of the formwork, so that tolerance on finished concrete will be exceeded, any concrete which has been poured may be rejected.

9.7.3 Characteristic Compressive Strength f'_c & characteristic Flexural Strength f'_{cf}

The concrete shall be deemed to comply with the strength requirements of this specification if its characteristic strength at 28 days complies with AS 1379.

9.7.4 Slump

The slump shall be deemed to comply if it lies within the specified tolerances. Concrete found to have slump outside these tolerances shall be removed from the site.

9.7.5 Drying Shrinkage

The concrete shall be deemed to comply if the average test results for the drying shrinkage shall not exceed the specified value.

9.7.6 Other Criteria

Hardened concrete shall also be liable to rejection if any of the following defects occur:

- It does not comply with Clause 19.1.10.2 of AS 3600
- A construction joint has been made at a location or in manner not in accordance with the specification.
- The construction tolerances have not been met.
- The reinforcing steel has displaced from its correct position.
- Water stops, inserts and other items embedded in concrete have been displaced from their correct position.
- The required surface finish has not been achieved.
- The concrete work can be shown to be otherwise defective.

10 NATURAL STONE PAVING

This section of the specification details the requirements for supply, placing and finishing of natural stone paver units including Adelaide Black, Balmoral Green, Mintaro Slate and Katmantoo Bluestone. This section shall be read in conjunction with the pavement design details, CoA Construction Standards Suite, and concrete - basecourse and granular pavement sections of this specification.

10.1 General

This specification shall be read in conjunction with the following Standards and references, which are deemed to form a part of this specification.

AS1141.5	Method for sampling and testing aggregates: Particle density and water absorption of fine aggregate
AS/NZS 4455.1, AS/NZS 4455.2, AS/NZS 4455.3	Masonry Units, pavers, flags and Segmental retaining wall units
AS/NZS 4456.0	Masonry Units and Segmental Pavers – Methods of Test
AS/NZS 4456.5	Determining Breaking Load of Segmental paver and flags
AS/NZS 4456.9	Determining Abrasion Resistance
AS/NZS 4456.10	Determining Resistance to Salt Attack
AS 4586	Slip Resistance Classification of New Pedestrian Surface Materials
ASTM C615/C615M-11	Standard Specification for Granite Dimension Stone
BS 7533 Part 12	Pavements constructed with clay, natural stone or concrete pavers-Part 12 : Guide to the structural design of trafficked pavements constructed on a bound base using concrete paving flags and natural stone slabs
Concrete Masonry Association of Australia publication (PA02/03)	Concrete Segmental Pavements – Detailing Guide, Design Guide for Residential Access ways and Roads, Specifying Guide

10.2 Materials

10.2.1 Natural Stone Paver Units

Natural stone paver units shall be uniform in quality and free of defects (including vents, cracks, fissures, seams, porous inclusions, foreign material, loose surface material striations, stains and discolouration) which may compromise either the strength, appearance, durability or proposed function based on the intended conditions of use. The individual pavers shall meet the 'Paver Properties & Criteria' outlined on the City of Adelaide Footpath 'Construction Standards'. The contractor shall provide evidence, in the form of test results, showing that this criteria has been met.

Stone pavers from Suppliers must be selected to match colour, pattern, dimensions and quality of the specified paver.

The Supplier shall provide written certification that the supplied stone paver meets the minimum performance criteria stipulated within the above-mentioned CoA Design Standards.

10.2.2 Mortar

10.2.2.1 Primer

Mortar primer shall consist of “Parex Davco Streetscape Bond Plus Primer” or an approved equivalent by the Principal.

10.2.2.2 Bedding Mortar

Bedding mortar shall consist of “Parex Davco Streetscape Fine Bedding Concrete” or an approved equivalent by the Principal.

Table 10.1 - Characteristic Requirements for Bedding Mortar

Characteristic	Requirement
Minimum Compressive Strength	40 MPa
Flexural Strength	4.5 MPa
Minimum Adhesive Strength	2.0 MPa
Modulus of Elasticity	18,000 ±3,500 MPa
Maximum Shrinkage	Not greater than 0.10%
Slump	150 mm

10.2.3 Grout

Grout shall consist of “Parex Davco Streetscape Fluid Grout” or an approved equivalent by the Principal.

Table 10.2 - Characteristic Requirements for Grout

Characteristic	Requirement
Minimum Compressive Strength	40 MPa
Minimum Flexural Strength	6.0 MPa
Minimum Adhesive Strength	1.5 MPa
Modulus of Elasticity	20,000 ±4,000 MPa
Minimum Density	2,000 kg/m ³
Maximum Shrinkage	Not greater than 0.10%
Maximum Aggregate Particle Size	3mm
Slump	150 mm

10.2.4 Sealant

Sealant shall be flexible and mould resistant with one part silicone or polyurethane applied over a backing rod and indicated on the Drawings.

10.3 Construction and Workmanship

10.3.1 General

The contractor shall duly plan the installation of natural stone paving to ensure that all products are installed “wet-on-wet”. The contractor is expected to have made sufficient allowance to co-ordinate the installation of the natural stone paving with the proposed joint layout, service pit adjustments, service pit covers, existing street furniture and any memorial plaque reinstatement.

No natural stone paving works shall be undertaken below 5°C or above 35°C.

10.3.2 Removal of Natural Stone Paving Units

Natural stone paver units shall be removed by the Contractor with care to avoid damage. Removed pavers shall be free of other excavated material and stored for later re-use to the satisfaction of the principal.

10.3.3 Storage of Natural Stone Paving Units

Natural stone paver units shall be stored in a location protected from the weather and atmospheric pollution that provides clear separation from the ground and without overloading individual paver units (e.g. no potential for staining or over loading). The Superintendent may reject the storage location and request an alternative location to be used.

10.3.4 Cutting of Natural Stone Paving Units

The Contractor shall ensure that cutting natural stone pavers does not produce dust or debris that deposits onto adjacent areas including buildings and vegetation. All cutting works shall be conducted in an isolated area that is not near entrances to existing buildings.

Pavers shall be cut using a masonry saw. The Contractor shall not cut natural stone paver units on site with the dry cutting method. The contractor shall use wet methods to cut all natural stone pavers and shall duly collect the residual water and slurry in at a location separated from the stormwater system and any irrigation points for existing street vegetation.

Any infill spaces which are of insufficient size for cut units (minimum width 75 mm) shall be filled using bedding mortar; with an oxide additive that matches the colour of the adjacent natural stone paver units to the satisfaction of the Principal.

Natural stone paving units shall be cut and shaped to the required size to fit neatly around all existing penetrations as per CoA Design Standards sheet CoA 970 – 974.

10.3.5 Basecourse

The basecourse for natural stone paving shall consist of either of the following as per the contract drawings and CoA Standards Suite:

- Cement stabilised granular pavement as per the granular pavement section of this specification.
- Concrete slab as per the concrete – basecourse section of this specification.

10.3.6 Mortar Primer

Mortar primer shall be applied with either a brush or trowel to the top surface of the concrete slab and the underside surface of the natural stone paver units which have been pre-moistened with water - without evidence of ponding.

10.3.7 Bedding Mortar

Bedding mortar shall be spread in a uniform layer immediately after the application of the mortar primer to the specified thickness on the drawings.

10.3.8 Pavement Preloading

On completion of the filling of the joints in each complete section of paving, the pavement shall be preloaded to assist in the development of block lock-up. The pre-loading shall be carried out by the application of at least six (6) passes of a pneumatic tyred multi-wheel roller having a gross weight not less than 10 tonnes. If it is not possible to accommodate this size machinery, alternative acceptable loading vehicles should be agreed with the Superintendent. Any areas of block paving which show excessive deformation as a result of the preloading shall be removed and replaced to the satisfaction of The Superintendent.

10.3.9 Laying of Natural Stone Paving Units

Natural stone paving units shall be laid immediately on the bedding mortar in the approved pattern with gaps established between adjoining natural stone paving units and between existing natural stone paving units bordering the site to reflect the approved construction joint layout.

The approved paving pattern shall be replicated within all service pit cover infills.

As soon as practical after placement, the natural stone paver units shall be tamped down to ensure full contact with the mortar bed with minimum displacement for adjacent paver units.

The contractor shall ensure that individual natural stone paver units are checked prior to installation for dimensional straightness and uniformity. Where natural stone paver units are either loose, rock or do not align, the contractor shall remove the non-compliant units and repeat the mortar bed and natural stone paver installation.

10.3.10 Concrete Edge Restraint

Edge restraints shall be constructed to the edge of any natural stone paving which is not adjacent to a hard, paved surface. The form of the edge restraint shall be confirmed with the Principal.

The paving edge shall be restrained by hidden concrete haunching. Haunching shall extend from 5 mm below the top of the pavers to the top of base course and be battered at 45 degrees to the vertical, or as detailed in the drawings.

10.3.11 Cleaning

The Contractor shall handover the paving works to the Principal at the stage of Practical Completion of the project in a clean condition. If the Contractor has opened any section of new paving to the public before practical completion is issued, they must be clean and be ready for Practical Completion.

10.4 Quality Requirements

The individual pavers shall meet the 'Paver Properties & Criteria' outlined on the City of Adelaide Footpath 'Construction Standards'. The Supplier shall provide written certification that the supplied stone paver meets the minimum performance criteria stipulated within the above-mentioned CoA Design Standards.

10.4.1 Materials

The contractor shall provide a 1mx1m paver sample on site for approval by the Principal. This constitutes a **HOLD POINT**. Where the nature of the work consists of minor works such as repair works, the Principal may release this Hold Point prior to works, or request an alternative sample to release the Hold Point.

Stone pavers are to meet the requirements of BS 7533 Part 12.

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10.4.2 Inspections

The following Hold Points are required during the construction of Natural Stone Pavement:

H-NSP1 Approval of colour for:

- grout
- closed cell polyethylene backing rod for expansion joints
- 2-part polysulphide sealant
- oxide colour additive for bedding mortar (in areas where paving less than 75mm wide)

H-NSP2 Approval of construction joint layout

H-NSP3 Approval of concrete surface prior to installation of mortar prime. Refer to concrete – basecourse section of this specification.

H-NSP4 Approval of natural stone paver units installed before opening to public

10.4.3 Tolerances

Construction tolerances on block paved pavements are as follows:

Table 10.3 Tolerances on Natural Stone Pavement

Item	Tolerance	
Top of Pavers	Absolute	±5 mm
	Relative	±10 mm from a 3.0 m straight edge
	Alignment pavers	of ±10 mm over a 5 m length or 20 mm over a 50 m length for large areas
	Adjacent to Kerb	+ 10 mm – 0 mm of the adjacent gutter level
Joints between paving units	6-9 mm (preference 7.5mm)	
Depth of Mortar	+ 10 mm – 5 mm	
Total Depth of pavement	+ unspecified – 5 mm	

10.4.4 Acceptance Criteria

Areas where the pavement fails to meet the specified requirements including:

- specified colour, pavers type or laying pattern;
- paver strength;
- level tolerances and shape;

- paving joints and alignment;
- paving cuts and in-fills; may be rejected, as directed by The Superintendent.

In the event that an area of pavement is rejected, The Superintendent may direct the Contractor to complete the following remedial works, at the Contractor's cost:

- removal and re-laying of the non-complying areas;
- re-working of non-complying areas; and any other remedial treatment that is expected to provide the required level of service.