PROJECT SPECIFICATION

TAFE NSW MEADOWBANK

LANDSCAPE TECHNICAL SPECIFICATION
ISSUED FOR DETAIL DESIGN – REVISION 01

REVISION	DATE OF ISSUE	CLIENT	PREPARED BY	CHECKED BY
01	04.08.20	HY	NN	LH
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0201 DEMOLITION

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Carry out demolition, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

General

Demolition: To AS 2601.

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection, the following definitions apply:

- Demolition: The complete or partial dismantling of a building or structure, by pre-planned and controlled methods or procedures.
- Dilapidation record: The photographic or video and written record of the condition of the portion of the existing building retained, adjacent buildings, and other relevant structures or facilities, before the start of demolition work.
- Dismantle: The reduction of an item to its components in a manner to allow re-assembly.
- Recover: The disconnection and removal of an item in a manner to allow re-installation.

1.5 SUBMISSIONS

Authority approvals

Evidence of compliance: Before starting demolition, submit evidence of the following:

- Requirements of authorities relating to the work under the contract have been obtained.
- A permit to demolish has been obtained from the appropriate authority.
- A scaffold permit has been obtained from the appropriate authority (if scaffolding is proposed to be used).
- Certification that each person having access to the construction site has completed site-specific WHS induction training.
- Precautions necessary for protection of persons and property have been taken and suitable protective and safety devices have been provided to the approval of the relevant authority.
- Treatment for rodent infestation has been carried out and a certificate has been obtained from the appropriate authority.
- Fees and other costs have been paid.

Execution details

Requirement: Submit the following, as documented:

- Hazardous Substances Management Plan.
- Investigation and work plan.

Off-site disposal locations: Submit details of the proposed locations for the disposal of material required to be removed from the site, and evidence of conformance with the requirements of relevant authorities.

Recycling: Submit details of the proposed recycling facility.

- Certification: Submit evidence of delivery of recycled materials.
- Concrete crushing: If proposed on site, submit details of plant and environmental controls.

Stockpile locations: Submit details of the proposed locations of on-site stockpiles for demolished materials for recycling in the works. Coordinate with the locations for storage of other waste streams, and prevent mixing or pollution.

Records

Dilapidation record:

- Before demolition: Submit to each owner of each adjacent property, a copy of the part of the record relating to that property and obtain their written agreement to the contents.
- Rectification work: Submit written acceptance of rectification works from the owner of each adjoining property affected.

Tests

Requirement: Submit test results of compliance tests for building service components to be re-used.

1.6 INSPECTION

Notice

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

- Adjacent structures before starting and at completion of demolition.
- Services before disconnection or diversion.
- Trees documented to be retained, before starting demolition.
- Contents of building before starting demolition.
- Structure after stripping and removal of roof coverings and external cladding.
- Underground structures after demolition above them.
- Excavations remaining after removal of underground work.
- Site after removal of demolished materials.
- Services after reconnection or diversion.

2 PRODUCTS

2.1 DEMOLISHED MATERIALS

Demolished material classes table

Class	Requirement	Ownership
Recovered items for re-use in the works	Recover without damage items identified in the **Recovered items for re-use in the works schedule**	Principal/proprietor
Recovered items for delivery to the principal	Recover without damage items identified in the **Recovered items for delivery to the principal schedule**	Principal/proprietor
Demolished material for recycling in the works	Stockpile material identified in the **Demolished material for recycling in the works schedule**	Contractor
Demolished material for recycling off-site	Demolish and deliver for recycling material identified in the **Demolished material for recycling off-site schedule**	Contractor

Class	Requirement	Ownership
Dismantle for relocation as part of the works	Dismantle without damage and store items identified in the **Dismantle for relocation schedule**	Principal/proprietor
Demolish for removal	Remove from the site demolished materials identified in the **Demolish for removal schedule**. Do not burn or bury on site Transit: Prevent spillage of demolished materials in transit	Contractor

3 EXECUTION

3.1 HAZARDOUS SUBSTANCES

Identified hazardous substances

Register: Hazardous substances have been identified as present on site and a Hazardous substances register has been prepared.

Audit

Requirement: Prepare a Hazardous Substances Management Plan to AS 2601 clause 1.6.1. Include the following:

- Asbestos or material containing asbestos.
- Flammable or explosive liquids or gases.
- Toxic, infective or contaminated materials.
- Radiation or radioactive materials.
- Noxious or explosive chemicals.
- Tanks or other containers which have been used for storage of explosive, toxic, infective or contaminated substances.

Removal of hazardous substances

Standard: To AS 2601 clause 1.6.2.

3.2 INVESTIGATION AND WORK PLAN

General

Requirement: Before demolition or stripping work, prepare the work plan to AS 2601 Section 2.

Include the check list items appropriate to the project from AS 2601 Appendix A, and the following:

- Method of protection and support for adjacent property.
- Locations and details of service deviations and terminations.
- Sequence of work.
- If the demolition program results in components temporarily cantilevered, provide a certificate from a professional engineer.
- Proposals for the safe use of mobile plant on suspended structural members including provisions for the protection of lower floors in the event of structural failure.
- If implosion methods are proposed, provide a separate report of methods and safeguards.
- Wheel loads of tipping or loading vehicles.

3.3 SUPPORT

Temporary support

General: If temporary support is required, certification for its design and installation is required from a professional engineer engaged by the contractor.

Existing buildings: Until permanent support is provided, provide temporary support for sections of existing buildings which are to be altered and which normally rely for support on work to be demolished.

Ground support: Support excavations for demolition of underground structures.

Adjacent structures: Provide supports to adjacent structures where necessary, sufficient to prevent damage resulting from the works.

- Lateral supports: Provide lateral support equal to that given by the structure to be demolished.
- Vertical supports: Provide vertical support equal to that given by the structure to be demolished.

Permanent supports

General: If permanent supports for adjacent structures are necessary and are not documented, give notice and obtain instructions.

3.4 PROTECTION

Encroachment

General: Prevent the encroachment of demolished materials onto adjoining property, including public places.

Weather protection

General: If walls or roofs are opened for alterations and additions or the surfaces of adjoining buildings are exposed, provide temporary covers to prevent water penetration. Provide covers to protect existing plant, equipment and materials intended for re-use.

Dust protection

General: Provide dustproof screens, bulkheads and covers to protect existing finishes and the immediate environment from dust and debris.

Security

General: If walls or roofs are opened for alterations or additions, provide security against unauthorised entry to the building.

Temporary screens

General: Fill the whole of designated temporary openings or other spaces using dustproof and weatherproof temporary screens, fixed securely to the existing structure, and installed to shed water to avoid damage to retained existing elements or adjacent structures and contents.

Type: Timber framed screens sheeted with 12 mm plywood and painted. Seal the junctions between the screens and the openings.

Temporary access

General: If required, provide a substantial temporary doorset fitted with a rim deadlock, and remove on completion of demolition.

Exposed surfaces

General: Where necessary, protect and weatherproof the surfaces of adjacent structures exposed by demolition.

Existing services
Location: Before starting demolition, locate and mark existing underground services in the areas which will be affected by the demolition operations.

Utility services: Contact DIAL BEFORE YOU DIG to identify location of underground utility services pipes and cables.

Excavation: Do not excavate by machine within 1 m of existing underground services.

Fixed items
Recovered items
General: If items are documented for recovery and re-use, minimise damage during removal and recover all associated components required for their re-use.

3.5 DEMOLITION – BUILDING WORKS

Encroachment
General: If encroachments from adjacent structures are encountered and are not documented, give notice and obtain instructions.

Sequence
Concrete slabs
General: Using a diamond saw, neatly cut back or trim to new alignment with a clean true face existing concrete slabs to be partially demolished or penetrated. Do not overcut at corners.

Material below grade
Remaining voids: Stabilise and provide barriers.

Explosives
General: Do not use explosives.

3.6 DEMOLITION – BUILDING SERVICES

General
Requirement: Decommission, isolate, demolish and remove from the site all equipment and associated components that become redundant as a result of the demolition.

Breaking down: Disassemble or cut up equipment where necessary to allow removal.

Demolition of refrigeration systems
Standard: To AS/NZS 5149.4.

Components for re-use
General: Before returning to service, clean components and test for conformance to Australian Standards, as required.

3.7 COMPLETION

Notice of completion
General: Give at least 5 working days' notice of completion of demolition so that adjacent structures may be inspected following completion of demolition.

Reinstatement
Assessment of damage: Use the dilapidation record to assess the damage and rectification work arising from the demolition work.

Rectification: Repair damage arising out of demolition work. Obtain written acceptance from the owner of each adjoining property of the completeness and standard of the rectification work.

Temporary support
General: Remove at completion of demolition.

0221 SITE PREPARATION

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide site preparation, as documented.

Performance

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0172 Environmental management*.

1.3 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definitions apply:

- Authority: Any organisation with statutory authority relating to the project, including clearances.
- Clearances: A formal certificate, approval or condition issued by a statutory authority allowing work in a particular area.
- Plant establishment period: The period between the date of practical completion and the end of the defects liability period.
- Utility service provider: Includes organisations providing power, water, sewerage, gas and telecommunications services.

1.4 SUBMISSIONS

Certification

Vermin: Submit pest exterminator's certification as evidence that the completed site works are free from vermin.

Execution details

Requirement: Submit details of methods and equipment proposed for the following:

- Clearing and grubbing.
- Tree removal and transplanting.
- Protecting ground within and adjacent to tree driplines from compaction by proposed earthworks machinery.

1.5 INSPECTION

Notice

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

- Enclosures around trees requiring protection.
- Trees requiring removal.
- Trees for transplanting to determine final orientation.

2 EXECUTION

2.1 COMMUNITY LIAISON

Notification

General: Notify residents about construction activities which will affect access to, or disrupt the use of, their properties.

Notice: Minimum 5 working days, unless the work is of an urgent nature with safety implications.

Notification content:

- Description of the work.
- The reason for the work.
- The expected duration.
- Changes to traffic arrangements and property access.
- The 24-hour contact number of the representative responsible.

2.2 EXISTING SERVICES

General

Requirement: Before starting earthworks, locate and mark existing underground services in the areas affected by the earthworks operations including clearing, excavating and trenching.

Utility services: Contact DIAL BEFORE YOU DIG to identify location of underground utility services pipes and cables.

Excavation: Do not machine excavate within 1000 mm of existing services.

Existing service lines: If required, divert services detected during excavation, clear of the building, and reconnect to the utility service provider's requirements.

2.3 SITE CLEARING

Extent

Requirement: Clear only areas occupied by works such as structures, paving, excavation, regrading and landscaping or other areas documented for clearing.

Contractor’s site areas: If not included within the areas documented above, clear only to the extent necessary for the performance of the works.

Clearing and grubbing

Clearing: Remove everything on or above the site surface, including rubbish, scrap, grass, vegetable matter and organic debris, scrub, trees, timber, stumps, boulders and rubble.

Grubbing: Grub out stumps and roots over 75 mm diameter to a minimum depth as follows:

- Below subgrade under buildings, embankments or paving: 500 mm.
- Below finished surface in unpaved areas: 300 mm.

Backfilling: Fill holes remaining after grubbing with sand material to prevent ponding of water. Compact the material to the relative density of the existing adjacent ground material.

Redundant/decommissioned works: Remove works no longer required, including slabs, foundations, paving, drain, and access chambers and covers within the works zone.

Fire hazard reduction
Batters
Temporary protection: If the change in level between crest and toe is more than 1500 mm, protect from erosion with geofabric, hessian and tar or heavy duty black polythene sheet cover. Securely fix down at crest and toe.

Surplus material
Topsoil and excavated material: Remove unwanted stripped soil and other material from the site as the work proceeds, including any material dropped on footpaths or roadways.

2.4 STORMWATER AND SEDIMENT CONTROL

General
Erosion and sediment control measures: To *0172 Environmental management*.

Waterways and drains
Waterways: If required, temporarily divert ditches, field drains and other waterways affected by excavation and reinstate on completion.

Stormwater drains: Divert drains detected during excavation, clear of the building, and reconnect as documented or obtain approval.

2.5 EXISTING WORKS TO REMAIN

Marking
Requirement: Identify existing works to remain with 1000 mm high, 50 x 50 mm timber stakes connected by yellow plastic tape to prevent accidental damage.

2.6 TREE REMOVAL

Designation
Marking: Identify trees and shrubs for removal by tagging 1000 mm above ground level.

2.7 TREE PROTECTION

General
Warning signs: In a prominent position at each entrance to the site, display warnings that trees and plantings require protection during the contract. Remove on completion.

Lettering: Road sign type sans serif letters, 100 mm high to AS 4970 Appendix C.

Protection measures: Provide before starting the earthworks.

Trees to remain
Extent: Trees not marked for removal.

Tree protection
Tree protection zone (TPZ): To AS 4970 Section 3.

Tree protective measures: To AS 4970 Section 4.

Monitoring and certification: To AS 4970 Section 5.

Work near trees
Materials placement: Conform to the following:

- Keep the area within the dripline of trees free of sheds and paths, construction material and debris.
- Do not place bulk materials and harmful materials within the dripline of trees.
- Do not place spoil from excavations against tree trunks.

- Prevent wind-blown materials such as cement from harming trees and plants.

Damage: Prevent damage to tree bark. Do not attach stays, guys and similar material to trees.

Work under trees: Do not remove topsoil from, or add topsoil to, the area within the dripline of the trees.

Excavation: If excavation is required near trees, give notice. Minimise period and extent of excavation within the dripline.

Hand methods: Use hand methods to locate, expose and cleanly remove the roots on the line of excavation. If excavation is required within the dripline, use hand methods so that root systems remain intact and undamaged.

Roots: Do not cut tree roots exceeding 50 mm diameter. If required to cut tree roots, use cutting methods that do not excessively disturb the remaining root system. Immediately after cutting, water the tree and apply a liquid rooting hormone to stimulate the growth of new roots.

Backfilling: Backfill excavations around tree roots. Place the backfill in layers of 300 mm maximum depth and compact to a dry density similar to that of the original or surrounding soil. Do not backfill around tree trunks to a height greater than 200 mm above the original ground surface. Immediately after backfilling, thoroughly water the root zone surrounding the tree.

Backfill material:

- Mix proportions (topsoil:well-rotted composts) by volume: 3:1.
- Neutral pH value.
- Free from weed growth and harmful materials.

Compacted ground: Do not compact the ground or use skid-steer vehicles under the tree dripline. If compaction occurs, give notice.

Compaction protection: Protect ground adjacent to the tree dripline.

Watering: Water trees as necessary, including where roots are exposed at ambient temperature more than 35°C.

Mulching: Spread 100 mm thick organic mulch to the whole of the area within the dripline of all existing trees to remain.

2.8 TEMPORARY LANDSCAPE FENCING

Fence dimensions

Height: 1200 mm.

Maximum post spacing: 5000 mm.

Component sizes

Corner and gate posts: Hardwood or preservative-treated softwood, 250 mm diameter.

Intermediate posts: Star picket.

Gate: Provide a suitable hinged gate with a gate latch.

Wire: Top, intermediate and bottom rows of 3.2 mm plain galvanized steel wire. Thread the top wire through pieces of plastic tube and through corner posts.

2.9 TREE TRANSPLANTING

General

Conditions: Select a time for transplanting based on the following criteria:

- Seasonal conditions.
- Length of operation.
- Rootball diameter and depth.
- Lifting methods.
- Weather conditions.

Preparation

Watering: Establish a temporary drip irrigation system, or manually water the identified trees for two weeks before ball excavation work.

Fertilising: Apply one application of liquid fertiliser mix, appropriate to the species, to the foliage and roots. Apply sufficient fertiliser to allow the spray to drip from foliage and soak into the rootball. Do not apply fertiliser on excessively hot, dry or windy days.

Rootball

General: Minimise the cutting of roots. Use only sharp tools, water blasting or water cutting.

Initial cut: Conform to the following:

- Cut manually or using chain trenching machine. Do not excavate using a backhoe or an excavator.
- Cut 250 mm beyond the required finished rootball dimension to allow trimming of damaged roots to final dimensions before sealing.

Hand trimming: To 100 mm less than the required finished rootball dimension. Cut back all roots greater than 25 mm diameter.

Rootball cutting: Conform to the following:

- Symmetrical about the trunk and in proportion to the overall size of the tree except where the limitations of individual tree planter openings require specific tailoring of the rootball dimension.
- Cut the rootball to a size that maximises the rootball for each specimen.

Trench: Backfill and lightly compact with clean sand, free of any foreign matter, pathogens or any substances that may be harmful to future root growth. Apply root inducing formulation to the manufacturer's recommended concentration, to saturate the backfill in the trench.

Maintenance of on-site plant material

Watering: Maintain a temporary drip irrigation system around each tree, located within the trenched rootball perimeter. Program the system to supply water at an optimum rate to encourage growth and avoid drying out through excessive transpiration following the cutting of the roots. Monitor the system continuously until the tree is lifted and transplanted.

Pruning: If pruning of branches is required to balance root loss, obtain approval. Prune only as directed and as documented in **TREE MAINTENANCE.**

Fertilising: Apply fertiliser at regular intervals during this period to maintain healthy growth.

Responsibility: Safeguard the health and well-being of all on-site plant material as required, before lifting and transplanting.

Execution
Lifting: Two days before transplanting each specimen, thoroughly irrigate to the full depth of the rootball. Do not disturb the soil around the root system. Maintain rootball in firm condition during transplanting by wrapping in hessian or other appropriate open weave material, securely tied.

Storage: Transport trees to a designated nursery site. Store and maintain until ready for planting.

Planting: Avoid disturbing the rootball during moving and planting. After placement, remove the rootball wrapping and ties by cutting.

Watering: After transplanting, water the rootball thoroughly and continue to water until established.

Transplanting schedule

Species	Method	Pruning

2.10 SITE NURSERY

Temporary works
Perimeter: Provide a bund wall of compacted fill as follows:

- Height: 400 mm.
- Batter grade (horizontal:vertical): 2:1.

2.11 TREE MAINTENANCE

General
Notice: Give notice before starting tree maintenance.

Pruning: To AS 4373 using a fully qualified and experienced arborist. Carry out all required works in a safe manner.

Execution
Requirement: Rectify any damage to existing trees to remain.

Operations: Remove dead and decayed wood or damaged limbs. Make all cuts at branch collars. If trees show signs of deterioration after the work is completed, amerliorate the soil by soil aeration, irrigation or incorporation of organic material. Continue this program until the end of the plant establishment period.

Root pruning: Do not excessively disturb the remaining root system. Cut off damaged roots cleanly inside the exposed or damaged area. Cover exposed root area with soil immediately after pruning, do not leave roots exposed.

Wetting and new root stimulation: Form a water collecting basin and apply a rooting hormone and wetting agent to the rootball.

Precautions: Avoid damage to trees being treated and to nearby trees and surroundings. Do not use trees as anchors for winching operations or bracing. Provide bracing as necessary before cutting to prevent uncontrolled breakages and damage to surroundings.

Failure: If repair work is impracticable, or is attempted and is rejected, remove the tree and root system and make restitution.

Tree maintenance schedule

Tree species	Description of work

2.12 COMPLETION

Temporary works
Site restoration
Requirement: Reinstate undeveloped ground surfaces to the condition existing at the commencement of the contract.

Clean up
Progressive cleaning: Keep the works clean and tidy, and regularly remove from the site, waste and surplus material arising from execution of the work.

Waste disposal: To *0172 Environmental management*.

Vermin management
Requirement: Employ a suitably qualified pest exterminator to remove vermin found during site preparation.

0241 LANDSCAPE – WALLING AND EDGING

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide landscape walling and edging, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.

1.3 SUBMISSIONS

Samples
Submit samples as follows: As identified in sections below.

1.4 QUALITY CONTROL SAMPLES – CONTRACTOR SUPPLIED ITEMS

Stone samples
For each type and grade of stone, submit shop drawings for approval and within 10 days of shop drawings being accepted, supply not less than 2 quality control samples of each stone unit, including all specified finishes of each stone unit.

Showing the expected range of variations of colour pattern, texture and surface finish in stone to be supplied.

Marking: Label each sample for verification.

Item	Size	Finish
Sandstone Capping (wall)	Length: 600mm Height: 400mm Thickness: 50mm	Appin Range Top: Sawn Front Chamfer: Sawn Ends: Sawn Base: Sawn
Sandstone Cladding (planter wall)	Length: 400-650mm Height: 200mm Thickness: 50mm	Appin Range Top: Sawn Front: Rock Face Back: Sawn Ends: Sawn Base: Sawn

Incorporation into the works: An approved sample panel, if suitably located, may be permitted to be incorporated into the works otherwise remove all traces on completion of the works.

1.5 QUALITY CONTROL

The surface finish and colour of all concrete work which will be exposed to view on completion of works shall be uniform, of the specified quality, consistent with the approved sample panels and to the satisfaction of the Superintendent.

1.1 TESTING

Concrete testing shall be carried out in accordance with AS 3600, Clause 18.7 and AS 1379.

The cost of all testing shall be borne by the Contractor.

The frequency of sampling and age at which testing is required may be varied at the Superintendent's discretion.

1.2 WEATHER CONDITIONS

Concrete shall not be poured during heavy rain or when heavy rain is imminent, nor immediately before or during frosts. Exposed slabs shall not be poured when outside air temperature is below 4.5°C or exceeds 35°C, nor shall it be poured when a hot wind is blowing.

1.3 CONTRACTOR'S SUBMISSIONS – DATA SUBMISSIONS

In addition to requirements specified elsewhere in the specification, submit the following before the commencement of the respective work for approval by the Superintendent:

Sandstone installation Work Method Statement and QA ITP for each type of sandstone

Precast paving installation Work Method Statement and QA ITP for each type of paving

Written submissions from the stone supplier are to be provided at the appropriate stages, stating:

1.4 TOLERANCES

Sandstone
Absolute level tolerance: ± 10 mm at any point on the finished surface.

Dimension stone units
Maximum deviation from required dimensions

Load bearing stones: 2mm

Maximum deviation from required dimensions
Face dimensions

Units ≤50mm thick: 1mm

Units> 50mm thick: 1mm in dimensions up to 90mm, thereafter 1mm in 300mm or part thereof.

Squareness (difference between diagonals): 1.5 times the tolerance on a long edge.

Thickness
Generally: 3mm

Flatness

Polished or honed surfaces: 0.5mm per metre

Sawn or sandblasted faces: 1.5mm per metre.

Edge Straightness: 0.5mm per metre

Maximum deviation of stone face from plane
Finishes: 1.5mm in 1200mm

Natural riven faces: 10mm in 1200mm

2 DEFINITIONS

Density Ratio: Percentage of the Maximum density at optimum moisture content as determined by AS 1289.5.2.1

Exfoliated: A rough surface produced by applying a high temperature gas flame to the surface of the stone.

Gang Sawn: Surface produced by a multi-bladed frame saw; may be smooth (diamond tipped) or grooved (steel shot).

Honed: A finished achieved by using abrasive stones or other materials to remove saw marks and yield a non-reflective surface. Additional hand finished buff where specified.

Polished: Smoothed with abrasives and buffed to a reflection reflective surface.

Shot Blast: A finished achieved by even blasting with shot.

3 DATA SUBMISSION – CONTRACTOR SUPPLIED ITEMS

Supplier's data
Written submissions from the stone supplier are to be provided at the appropriate stages, stating:

At tender stage

- Stone source
- Location of cutting dimensioned stone
- the suppliers experience in the required type of work;
- particulars of established quality control procedures (if any), and the category of the procedures to the relevant standard;
- the physical properties of the required material;
- test data for the material including for slip resistance;
- lead ties for delivery of the material to a local storage site

On delivery of material

- a warranty certifying that the material supplied complies with the specification and is suitable for the intended use;
- recommendation for installation and maintenance of the stonework.

Transportation and Delivery
The Contractor shall ensure all stone units are packed for delivery in a manner which will protect it from damage and staining.

Protection of stone against damage from the local crushing and chafing effects of lifting, transport equipment and storage racking must be undertaken. During transport protect all visible surfaces with thick, non-rigid, inert, non-absorbent, crushable castings.

Particular care shall be taken during loading, unloading and stacking to prevent damage and defacement. Under no circumstances shall unloading by tipping and/or dropping be permitted.

Take delivery of stone in the same sequence as it is to be installed in order to reduce double handling and to minimise chances of damage.

Storage and Protection

The Contractor shall ensure stone units are stacked clear of the ground on pallets or other suitable structures which will insulate them from rising damp and shall cover units with suitable water proof tarpaulins to prevent wetting.

Protect stone units from staining, discolouration, warping or change of shape. Particular care shall be exercised to prevent contact with oil, grease, smoke or wet concrete slurry.

Protect adjoining surfaces during masonry work. Finished faces in the vicinity of work being carried out shall be protected from staining and impact and all necessary precautions are to be taken to ensure that protection is provided and maintained.

Where potential for staining might reasonably be anticipated, the Contractor shall cover installed faces with non-staining waterproof paper or polyethylene sheet.

Prevention of Dust and Noise

The Contractor shall be responsible for and shall be deemed to have made due allowance for the control of dust and any associated hazard the dust may cause to workers or the general public. Generally, dampen down dust to reduce airborne particles and prevent its spread.

The Contractor shall use best practice equipment fitted with all appropriate silencers, mufflers and acoustic linings to effectively reduce noise.

3.1 INSPECTION

Notice

Inspection: Give notice so inspection may be made of the following:

- Set out before starting construction.

- Geotextiles and subsurface drainage in place before backfilling.

4 PRODUCTS

4.1 CONCRETE

General
Standard: To AS 1379.

Exposure classification: To AS 3600 Table 4.3.

Grade, if there are cast-in metal items: To AS 3600 Table 4.4.

4.2 SANDSTONE UNITS

Sandstone seawall capping unit and sea wall cladding + Sandstone planting wall capping unit and planter cladding
Product: Sandstone from Appin Range with a consistent tonal quality. All sandstone for architectural application to be suitable Architectural and structural quality, fit for purpose.

Dimensions: Refer to table above

Suppliers: Gosford Quarries, 50 Whiting Street Artarmon NSW 2064 ph 8585 8282

Grading: Select stone of the designated quality grade from Appin Range

Matching: Within each grade, select stone for the optimum matching of visual properties such as colour and pattern.

The sandstone shall be sound, strong and free from deleterious minerals and defects such as cracks, joints, veins, friable material, or clay patches. The sandstone shall be free of minerals that may cause objectionable staining under exposure to normal environmental conditions.

Vesicles, veining or fracture lines considered detrimental to strength will be rejected;

Colour variation, vesicles and veining shall be of an equivalent standard to the accepted sample.

Sandstone Surface Finishes:

All exposed faces shall be rock faced to match existing. Sandstone capping units have chamfered front edge. Refer to details

Shop Drawings:

Provide shop drawings of all sawn stone types at a suitable scale for information and review by the Superintendent prior to the production of stone supply.

Shop drawings are to show:

-Dimensions of each stone type, including stone (all types)

-Location and sizes of make-up stones

-Types of finishes

The Contractor shall be responsible for setting out the works and installing all stone to achieve the bond, the pattern, colour sorting and cut unit placements as shown on the landscape details.

Where required, accurately cut units to the required size and shape.

The Contractor shall co -ordinate the supply of units in batches as required to ensure that the Construction Programme is maintained without delays due to late deliveries.

Stone, Imperfections and Rejection

Spalling, chipping, cracking, staining, scratches and bruises to stone shall not be accepted and shall be grounds for the Superintendent to reject the unit.

The Contractor shall order sufficient numbers of stone items to account for rejections.

Repairs to Stone Units

Repairs to stone shall not be accepted. All stone requiring repair shall be replaced at the Contractor's expense. The Specifier shall select which parts of the below clause are relevant to the type of wall to be constructed

4.3 MORTAR AND GROUT

All mortar used shall conform with the applicable requirements of AS 3700 and AS 2701 and EN 12004, and shall be mixed on site. Mortar mixed off site or ready mixed mortar shall not be used.

Notwithstanding clauses within Australian standards retempering shall not be permitted. After the initial mixture has taken place, all unused mortar shall be discarded and not mixed into any subsequent batch.

Note to specifier: Select whether grouting is to be used natural grey or coloured:

All grout used for jointing or where visible shall be coloured as specified below by the addition of carefully controlled quantities of approved mineral oxide pigments to the mix, provided that the total volume of pigment does not exceed 8% of the volume of cement in the mix.

All pigments used shall be resistant to lime, alkali and ultra violet light, and shall be insoluble in water. The Superintendent shall approve a dried sample of grout prior to proceeding with any work in accordance with the samples schedule of this specification.

(The specifier shall select whether mortar is to be pigmented if no grouting is to be used)

Mortar shall be pigmented with the following metallic oxide: **100 Bianco (White)**

The grouting mix shall comply with section 10.7 of AS 3700

Grout shall be mixed with Mapei colour additive **100 Bianco (White)** to manufacturer's recommendations.

Coloured rendering of the grout surface alone will not be accepted.

Gauge boxes for proportioning of the mixes shall be used.

A mixer capable of thoroughly mixing, free from loose debris and dried residues must be used.

4.4 SEALING SYSTEM

The Contractor shall seal all visible faces upon installation. To protect from oil-based stains, a penetrating spirit based sealant approved by the Superintendent shall be used.

The sealer shall contain no pigmentation and as far as practicable shall not alter the appearance of the walling when sealant is dry.

4.5 MISCELLANEOUS MATERIALS

The Contractor shall install masonry ties to comply with AS3700. Where the walling is located within 10km of the coast wall ties shall be stainless steel or plastic.

Foundations, reinforcing and control joints shall be installed to the Structural Engineer's specification.

Control joints shall be caulked with an elastomeric sealing compound, coloured to match mortar colour.

4.6 MOVEMENT CONTROL

The Contractor shall provide written confirmation of the location and spacing of movement joints in accordance with the structural engineer's documentation for approval by Project Engineer prior to proceeding with laying of block.

5 PRODUCTS – CONCRETE WALLS AND EDGING

5.1 GENERAL

Standard: To AS 1379.

Exposure classification: To AS 3600 Table 4.3.

Grade, if there are cast-in metal items: To AS 3600 Table 4.4.

5.2 FORMWORK STANDARDS

Formwork classes: comply with AS 3610.1 2010, Table 3.2.1

The Contractor shall achieve the following finishes to the following concrete elements:

i. In-situ Concrete Slabs to receive stone and precast pavers

Class 3 formwork for concrete surfaces to be painted and concrete surfaces not otherwise specified or shown on the drawings. Good visual quality when viewed as a whole.

ii. Foundations

Class 5 formwork for footings, concrete surfaces in the ground and non-exposed rear surfaces of retaining walls. Alignment and texture not important.

5.3 REINFORCEMENT

The Contractor shall ensure all reinforcement is supplied, fabricated and fixed in accordance with the drawings and this specification.

The Contractor shall:

i. Refer discrepancies to the structural engineer for decision before proceeding with the work.
ii. Be solely responsible for the supply, fabrication and placing of reinforcing steel.
iii. Remove reinforcement which does not comply with the requirements of this specification and replace to the satisfaction of the structural engineer.
iv. Comply with Australian Standards as follows: AS 3600 and AS 4671.
v. Ensure that reinforcing is free from loose mill scale, rust, mud, oil, grease or other non-metallic coatings which would reduce the bond between the concrete and steel and is free from kinks or other defects, at the time of placing concrete
vi. When there is a delay between placing the reinforcement and pouring the concrete, the Superintendent may require the Contractor to restore the reinforcement to a condition satisfactory to receive concrete at the Contractor's expense.

5.4 READY MIXED CONCRETE

The Contractor shall ensure ready mixed concrete is in accordance with AS 1379, by the batch production process and delivered in agitating trucks.

The Contractor shall ensure the addition of water prior to commencement of discharge shall be in accordance with AS 1379.

Concrete is liable to be rejected if the elapsed time between the wetting of the mix at the plant and the discharge of the mix at the site exceeds the following criteria. Rejection and replacement of such concrete shall be at the Contractor's expense.

Concrete temperature at time of discharge:		Maximum elapsed time:
Less than:	24°C	2.00 Hours
	24 - 27°C	1.50 Hours
	27 - 30°C	1.00 Hours
Exceeding:	30°C	0.75 Hours

For each batch the Contractor shall supply a docket listing the information required by AS 1379, including the following additional information:

i. The total amount of water added at the plant and the maximum amount permitted to be added at the site; and
ii. The amount of water, if any, added at the site.

5.5 SITE MIXED CONCRETE

The Contractor shall mix concrete in an appropriately sized, approved plant located at the construction site and complying with the relevant requirements of AS 1379. Mixing by hand is not permitted.

5.6 SLUMP & WATER/CEMENT RATIO

The slump of concrete at the time of placing in the work as determined by the Superintendent or his authorised representative using the procedure in AS 1012, Part 3 shall not exceed the slumps indicated on the drawings, or 80mm.

Concrete not complying with the above shall be liable to rejection and replacement at the Contractor's expense.

5.7 ADMIXTURES

Admixtures to concrete shall be used in accordance with AS1379. Upon request the Contractor shall supply documentation to the Superintendent detailing admixture use.

5.8 PAVEMENT BASE COURSES

The Contractor shall supply and construct crushed rock sub-base and base courses as required to receive pavements in accordance with the detailed drawings and engineer's documentation.

Crushed rock shall be free from perishable material or any other material that will not compact to form a stable base.

5.9 GEOTEXTILES

General

Type: Polymeric fabric formed from a plastic yarn composed of at least 85% by weight of propylene, ethylene, amide or vinylidene chloride and containing stabilisers or inhibitors to make the filaments resistant to deterioration due to ultraviolet light.

Identification and marking: To AS 3705.

5.10 EDGING

Concrete

Standard: To AS 1379 – Grade N20.

Edge strip profile: 150mm high x 100mm wide concrete edge to all garden bed areas adjoining turf areas.

Concrete kerb profile to AS 2876

6 EXECUTION

6.1 GENERAL

Set-out

General: Set out the position of walls and edging and mark the position of furniture.

Workmanship

The landscape drawings show the general arrangement and intent of the wall set out and any alternative proposed layout shall be submitted to the Superintendent before any work is commenced.

The Contractor shall be responsible for checking all dimensions on site before any work proceeds.

All work shall be carried out in the best recognised trade practice by approved firms specialising in the particular work and employing skilled experienced tradesmen.

The Contractor shall provide all accessories and perform all operations necessary for the proper execution of first class stone and brick laying work including selecting, shaping, cutting, laying, setting, grouting and the like.

The Contractor shall build in all necessary fixings as required and shall provide all other fittings, such as service enclosures as detailed or necessary.

Confer with other trades as required.

The Contractor shall inspect all foundations and structural elements prior to commencing work to ensure to his satisfaction that these are suitable. Any claims arising out of unsatisfactory substrate shall not be recognised once wall construction has been installed.

Laying and Tolerances

The Contractor shall ensure finished faces, corners and angles are aligned true to the drawings, with no apparent irregularity or wavering. The appearance of the wall from base to the top, shall be generally uniform.

Carefully build in openings for weep holes and other trades as detailed to eliminate cutting.

Allow no part of the wall to rise more than 1000mm above adjacent unfinished work. Any stone that is accidently moved after initial laying shall be re-laid in fresh mortar.

Finish jointing as works progress and build stone cladding in the bond specified.

Stone cladding:

Keep walling straight, courses level and joints plumb. Walling shall not deviate more than 2 - 3mm from a vertical face.

The Contractor shall keep mortar stains to a minimum and protect all finishes from mortar droppings as work proceeds. Before mortar sets hard, remove excess mortar, by scrubbing stone or brickwork, within 24 hours of laying, using a bristle brush and detergent if necessary.

Cutting

Any cutting of brick or stone cladding shall be carried out using a bench saw with a wet diamond blade as per manufacturer's recommendation. To prevent staining of surface with cutting paste, the stone is to be washed immediately after cutting.

Bond, Joints and Pattern

The walling bond shall be stretcher bond, horizontally aligned. Refer to the drawings for locations. These bonds must be achieved and accurately maintained.

The joint width shall be nom. 5mm.

Joints shall be flush with the finished face.

The stone / brickwork pattern, colour arrangement shown on the drawings shall be accurately followed.

The Contractor is at all times to exercise extreme care to ensure that the colour blending complies with the design intent. The stones are to be arranged in position to present an appearance of even well balanced tones in colour, free from "panel" effects, or other effects caused by indiscriminate mixing of

Mortar Mixing and Tying

The Contractor shall measure materials to ensure that the specified mix proportions are maintained as per AS 3700. Mix in a suitable mixing machine until a uniform blending of the components, free of lumps is achieved.

Water shall be added to create a mix that is as wet as can be conveniently used by the stone mason.

Cavities shall be kept clean and free from mortar droppings.

Space masonry ties in accordance with AS 3700 to ensure absolute structural integrity in the finished wall.

Re-tempering to replace water lost by evaporation is encouraged until initial set begins. Discard mortar which has begun its initial set and do not re-temper.

Grouting
After a minimum of 12 hours curing, the Contractor shall grout the joints.

Where necessary, remove deleterious matter and foreign material from within the joints.

The Contractor shall prepare the grout mix to the manufacturer's recommendations.

The Contractor shall place grout mix into joints ensuring full penetration for the thickness of the joint.

Wipe stone / bricks clean with a damp sponge.

Sealing or Anti-Graffiti System
The Contractor shall seal all visible faces upon installation. To protect from oil-based stains, a penetrating spirit based sealant approved by the Superintendent shall be used

The sealer shall contain no pigmentation and as far as practicable shall not alter the appearance of the walling when sealant is dry.

Field Quality Control
The Contractor shall have the following tests performed in a laboratory NATA registered test laboratory. Supply copies of the resulting test certificates to the Builder.

7 EXECUTION – CONCRETE WALLS AND EDGING

7.1 EXAMINATION
The Contractor shall examine the area of works prior to commencing. Start of work means the total acceptance of conditions.

7.2 BASE COURSE
The Contractor shall spread base materials and compact to achieve the specified depth.

The Contactor shall finish pavement base courses to ensure a smooth and uniform surface that conforms to the line, grades and cross-sections shown on the drawings.

The Contractor shall ensure pavement base courses are completed within the following tolerances:

i. Thickness to be within +5mm -10mm of design thickness.
ii. Levels to be within 10mm of level shown on drawings.

7.3 FORMWORK
All formwork to exposed concrete surfaces generally shall be "Class 2" Formwork in accordance with AS 3610 - 1990 Section 3, unless noted otherwise.

The Contractor shall ensure forms are constructed to the shape, true to lines and dimensions required by the drawings and shall be substantial and sufficiently tight to prevent leakage. Curved formwork shall be smooth and continuous, with no abrupt changes in contour.

The Contractor shall ensure all formwork is properly supported, braced or tied to maintain position and shape without deflection or distortion during and after the placing of concrete and shall be so constructed that subsequent removal, can be effected without damage to the concrete.

Should any formwork become displaced during concreting, the Contractor shall remove concrete between such limits as determined by the Superintendent. The Contractor shall form construction joints, and reconstruct such section(s) of concrete after formwork has been strengthened and adjusted at his own expense.

7.4 REINFORCEMENT PLACEMENT

The Contractor shall install, tie and fix reinforcement to the alignments documented by the engineer.

The Contractor shall ensure the minimum concrete cover to reinforcing complies with the documentation of the engineer. Where necessary the Contractor shall use chairs to ensure reinforcement remains in the designed position.

7.5 CONCRETE PLACING

The Contractor shall place concrete so as to avoid segregation. The placing of concrete in a section shall be carried on continuously until that section is completed.

If, unforeseen circumstances prevent this, a construction joint as specified, shall be made and care shall be taken that concrete which is partially set in the form is not subsequently displaced.

During the placing operation the Contractor shall ensure concrete is thoroughly compacted and worked around any reinforcement and embedded fixtures and worked into the corners of the formwork.

The Contractor shall ensure compaction of all in-situ concrete is carried out in the best possible manner, so as to produce a homogeneous concrete of uniform density to the specified strength.

Immersion type vibrators may be used to assist in the compaction of the concrete. Immersion vibrators shall not be held against forms or reinforcing steel, nor shall they be used for flowing or spreading concrete across horizontal surfaces.

Experienced operators and supervision shall be provided by the Contractor and the forms shall be designed by the Contractor to withstand the action of the vibrators.

7.6 BONDING FRESH AND HARDENED CONCRETE

Before depositing new concrete on or against concrete which has set the Contractor shall, re-tighten forms, roughen the set concrete surface, clean off foreign matter and laitance and thoroughly wet to the Superintendent’s approval.

The Contractor shall remove excess water and cover the cleaned and wetted surfaces with a coating of 1:2 cement/mortar. The Contractor shall then place the new concrete against this before the mortar has attained its initial set.

Prior to placing the new concrete, the Contractor shall inform the Superintendent to allow for inspection of the degree of roughened surface and laitance removal.

The following procedures for the preparation of construction joint faces are approved:

i. Vertical joints: paint face of form with an approved retarder. Strip form the following day and remove retarded concrete with air-water jet to bare exposed aggregate face.
ii. Horizontal joints: spread 6mm bluestone chips on surface of freshly screeded concrete and blow off excess the following day with air-water jet.

iii. Comply with instructions on engineer's drawings.

7.7 BUILDING IN

The Contractor shall allow to build in the following elements using methods detailed below:

i. Built-in bolts and fittings generally: Accurately build in bolts, lugs and other fittings, provide holes and pockets as shown on the drawings. Prevent movement of these items during concrete pour. Clear screwed or machined portions of fittings of mortar and grease. Temporarily fill voids in sleeves, inserts and anchor slots and readily removable materials to prevent the entry of concrete into the voids.

ii. Grouting shall be installed as per the Masonry Wall Construction section of this specification

7.8 CURING

The Contractor shall ensure concrete is cured for at least seven days, continuously following the time of placement and shall undertake the following operations:

Specifier to delete as necessary

i. Footings:

Cover with at least 50mm of sand or earth maintained in a damp condition.

ii. Paving:

All paving is to be regularly sprayed with water as required to maintain uniform moisture for a period of 7 days after casting.

When weather conditions promote rapid evaporation due to winds, low humidity or high temperature, trowelled or screeded surfaces shall be covered.

Curing compounds whether waxed, hydro carbon or water based acrylic are only to be used after approval from the Superintendent.

7.9 CONSTRUCTION TOLERANCES

The Contractor shall ensure work is accurately set out, true to the positions, levels, shapes and dimensions shown on the drawings. The tolerances noted below may, however, be allowed in the finished structural concrete:

i. Cover to reinforcement where the nominal cover is 25mm or more = +/- 6mm.

ii. Cover to reinforcement where the nominal cover is less than 25mm = +/- 3mm

iii. Top surfaces of paving shall be within +3mm to -0mm of the levels shown on the drawings.

In addition, the maximum grade of any section of the surface within the actual level tolerances shall not exceed 3mm in 1500mm.

Finished pavements which do not drain freely or cause ponding will be subject to rejection.

If the tolerances listed above are exceeded, the Contractor may be required, at the discretion of the Superintendent, to remove and replace or modify the placed concrete before acceptance at his expense.

7.10 DEFECTIVE CONCRETE

Hardened concrete shall be liable to rejection at the Superintendent’s discretion if:

i. It is porous, segregated or honeycombed.

ii. It is damaged or pitted by water or rain

iii. A construction joint has been required at a location or made in manner not in accordance with the drawings and specification as a result of an interruption to casting of concrete.

iv. Concrete or embedded reinforcement has been disturbed after the initial set has taken place.

v. The construction tolerances have not been met, including thickness.

vi. The finish required has not been achieved.
vii. The strength test result is below the specified strength.
viii. The concrete is otherwise defective or does not meet the requirements of this specification.

7.11 REPLACEMENT OF REJECTED CONCRETE

All hardened concrete which is rejected shall be cut out and new concrete placed back in a manner determined by the Superintendent. All costs shall be borne by the Contractor.

7.12 JOINTS

The Contractor shall form joints in paving slabs and structures where specified and detailed on the drawings. This contract shall include all work associated with the supply of jointing materials and the making and forming of all joints. In addition the Contractor shall allow for dowelled joints where detailed.

i. Construction Joints:

Periods of stoppage in concrete of 3/4 hour or more are deemed to be construction joints.

When the location and type of construction joints are not shown on the drawings, the Contractor shall submit proposed location and detail of construction joints to the engineer for his approval prior to the start of formwork placement. The Superintendent shall inspect treatment before depositing the new concrete against a construction joint.

ii. Expansion Joints:

Formed joints using pre-cut Ormonoid Ableflex closed cell 10mm wide sheet with a 12mm deep pre-cut top section to be removed prior to placing the joint sealants.

Joint width shall be 10mm and the top section of the joint shall be completed using Fosroc Nitoseal 220 sealant applied in accordance with the manufacturer's recommendations. Refer to drawings for locations of all formed joints.

Include for formed joints at all abutments of paving slabs and walls. All formed joints shall be thoroughly cleaned and sealed with Fosroc Nitoseal 220 Sealant following the completion of the curing period. Joint sealant colour shall match as closely as possible specified concrete colour.

iii. Tooled Joints:

Tooled joints shall be made using a straight-edge, in accordance with the detail drawings and placed where indicated on the plan.

iv. Saw Cuts:

Saw cuts shall be clean, straight and show no visible chipping to edges.

30(d) x 6(w) mm saw cuts shall be made across the width of the pavement at centres as detailed and shown on the plans.

7.13 CURING AND PROTECTING CONCRETE

The Contractor shall be responsible for the curing and protection of concrete works and shall undertake the following activities to ensure this is achieved:

i. Protect freshly cast concrete from premature drying and excessively hot or cold temperatures. Erect windbreaks to shield the concrete surface during and after placing. Maintain the concrete at a reasonably constant temperature with minimum moisture loss for the curing period, refer AS 3600.
ii. Cure as soon as the surface of the concrete has hardened sufficiently to prevent damage but in no case later than 2 hours after the finishing operation has been completed.
iii. Continue final curing for 7 days for normal Portland Cement concrete.
iv. For high early strength concrete, continue the final curing for 3 days. Prevent rapid drying out at the end of the curing period. Keep wet steel and timber forms in contact with the concrete that have been heated by the sun during the final curing period.

v. Take special care with curing off-form concrete to avoid differences in colour. Prevent rapid or localised drying-out during the first 7 days after pouring.

vi. Maintain the form face in contact with the concrete up to the moment of striking. Programme stripping times to ensure that surfaces throughout the job are exposed at similar ages, differing by not more than 4 and preferably 2 or less hours.

vii. Ponding is preferable for horizontal surfaces. Use heavyweight covers, well secured and in continuous contact.

viii. If used, apply curing compounds to the manufacturer's recommendations and only after written approval is attained from the Superintendent.

ix. Keep vehicular traffic off completed concrete paving works for a minimum of twenty eight 28) days.

7.14 STRIPPING OF FORMWORK

The Contractor shall strip formwork in accordance with the recommendations of AS 3610, Table: "Recommended Minimum Stripping Times".

7.15 FINISHES

The Contractor shall undertake or avoid the following actions and ensure the following finishes are achieved:

i. Concrete shall conform with the finishes listed below.

- Stone Capping Seat Wall: Class 2 Off-form Smooth Finish
- Insitu Concrete Planter Wall: Class 2 Off-form Smooth Finish

ii. Construct concrete paving to design levels and gradients as shown. Refer to the Samples Schedule in the General Requirements section of this specification for sample requirements.

iii. Surface "Driers" such as bluestone dust and cement are expressly prohibited.

iv. Surface finish shall be obtained by power float or steel trowel and be within the specified construction tolerances as noted under Clause 305 of this Section (03000).

v. A delay period of at least one (1) hour shall be observed before finishing operations are commenced and this period may be extended to allow the excess water to evaporate before trowelling is commenced.

7.16 CONCRETE TESTING

When requested by the Superintendent, the Contractor shall conduct at his expense the following testing using the following methods:

i. Generally: perform concrete tests in accordance with AS 1012 or subsequent amendment using suitable and approved specimens, testing equipment and personnel to carry out tests.

ii. Materials testing: submit in writing, test certificates from an independent laboratory registered with the NATA as evidence that materials used comply with the requirements specified.

iii. Slump tests: provide slump test reports on the first batch of concrete to be placed and at least once for every 20 cubic metres of concrete placed thereafter on that day.

iv. If, in the opinion of the Superintendent, other batches of concrete appear to have an incorrect slump, conduct slump tests as directed by the Superintendent. Concrete shall be considered as complying with the specified slump tests when it complies with AS 3600.

v. Compression tests: the methods and frequency of sampling and the identification and testing of cylinders are to be in accordance with project control testing AS 3600.

vi. Acceptance and rejection of concrete: acceptance and rejection of compressive strength of concrete by the Superintendent will be in accordance with AS 3600.

7.17 CLEANING

The Contractor shall remove debris and formwork from each area after stripping concrete as each work section is completed. The Contractor shall leave each area clean to the satisfaction of the Superintendent.

7.18 COMPLETION

The Contractor shall complete contracted work in accordance with the contract documents and with written variation orders issued by the Superintendent.

7.19 EDGING

Concrete

Edging strip: Place in a shallow trench between timber forms. Wood float finish flush with the adjacent finished level. Provide control joints, filled with resilient bituminous material, at 3 m maximum centres.

Concrete kerb: Fixed form, extrusion or slip forms to AS 2876.

Steel

Refer to 0275 Paving – Mortar and Adhesive bed for stainless steel angle edge strip specification

0242 LANDSCAPE – FENCES AND BARRIERS

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide fences and barrier systems, as documented.

Performance
Requirements:

- Complete for their function.
- Conforming to the detail and location drawings.
- Firmly fixed in position.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.

1.3 SUBMISSIONS

Products and materials
Requirement: Submit the manufacturer's standard drawings and details showing methods of construction, assembly and installation; with dimensions and tolerances.

Prototypes
Requirement: The first installed portion of each assembly fixed in its final position in the works, at least 2 panels wide, incorporating at least one example of each typical panel is to be inspected and following approval will be considered the installed prototype.

Location: [complete/delete]

Samples
Submit samples as follows: [complete/delete]

Shop drawings
Custom-built items: Submit shop drawings to a scale that best describes the details, showing methods of construction, assembly and installation, with dimensions and tolerances.

Warranties
Requirements: Submit the manufacturer's published product warranties.

1.4 INSPECTION

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

- Boundary survey location.
- Set-out before construction.
- Foundation conditions after excavation.
- Completion of installation.

2 PRODUCTS

2.1 GENERAL

Storage and handling
General: Deliver, unload and store components and accessories in unbroken manufacturer's packaging.

2.2 STEEL

Steel tubes
Posts, rails, stays and pickets: To AS/NZS 1163.

- Grade: C350L0.

Post and rail finish: Hot-dip galvanize.

Fencing wire
Chain wire, cable wire, tie wire and barbed wire: To AS 2423.

Coating: [complete/delete]

2.3 CONCRETE

General
Standard: To AS 1379.

Exposure classification: To AS 3600 Table 4.3.

3 EXECUTION

3.1 CONSTRUCTION GENERALLY

Set-out
General: Set out the fence line and mark the positions of posts, gates and bracing panels.

Property boundaries: Confirm by survey.

Clearing
Fence line: Except for trees or shrubs to be retained, clear vegetation within 1 m of the fence alignment. Grub out the stumps and roots of removed trees and shrubs, and trim the grass to ground level. Do not remove the topsoil.

Excavation
Posts: Excavate post holes so that they have vertical sides and a firm base. Spread surplus material on the principal's side of the fence.

Earth footings
Base: Place 100 mm of gravel in the footing base under posts.

Compaction: Backfill with earth around posts, compacting firmly by hand or machine in 150 mm deep layers.

Concrete footings
In ground: Place mass concrete around posts to protect posts from waterlogged conditions and finish with a weathered top falling 25 mm from the post to ground level.

On slabs: Provide welded and drilled post base flanges for fixing with masonry anchors to the concrete.

Erection
Line and level: Erect posts vertically. Set heights to follow the contours of natural ground, unless documented otherwise.

3.2 GATES

Hardware
General: Provide the following:

- Drop bolt and ferrule to each leaf of double gates.
- Latch to one leaf of double gates.
- Provision for locking by padlock.
- Hinges with smooth operation and adjustment for future sagging.

Hand access
Requirement: Where required, provide hand holes to give access from outside to reach locking provision.

3.3 TEMPORARY LANDSCAPE FENCING

Fence dimensions
Height: 1200 mm.

Maximum post spacing: 5000 mm.

Component sizes
Corner and gate posts: Hardwood or preservative-treated softwood, 250 mm diameter.

Intermediate posts: Star picket.

Gate: Provide a suitable hinged gate with a gate latch.

Wire: Top, intermediate and bottom rows of 3.2 mm plain galvanized steel wire. Thread the top wire through pieces of plastic tube and through corner posts.

Removal
Completion: Remove the fence at the end of the planting establishment period.

3.4 COMPLETION

Cleaning
Requirement: Remove excess debris, metal swarf and unused materials. Clean all visible metal surfaces with soft clean cloth or brush and clean water or approved cleanser, finishing with a clean cloth. Do not use abrasive or alkaline materials.

Powder coated aluminium architectural applications: Clean completed assembly to AS 3715 Appendix C.

Powder coated metal, other than aluminium, architectural applications: Clean completed assembly to AS 4506 Appendix D.

Protection: Remove protective coatings using methods required by the manufacturer after completion.

Warranties
Requirement: Cover materials and workmanship in the terms of the warranty in the form of interlocking warranties from the manufacturer and the installer.

4 SELECTIONS

4.1 STEEL TUBE PICKET FENCING

Steel tube picket fencing schedule

Property	A	B	C
Product			
Height (mm)			
Posts: Size (mm)			
Posts: Spacing (mm)			
Rails (mm)			
Pickets: Size (mm)			
Pickets: Spacing (mm)			
Pickets: Pattern			
Gate: Type			
Gate: Size (h x w mm)			
Gate: Finish			
Gate: Hardware			
Finish			
Colour			

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0250 LANDSCAPE – COMBINED

1 GENERAL

1.1 RESPONSIBILITIES

General

Scope: Installation of all plant material including tree and shrub planting including sub-grade establishment, supply and installation of soil mixes, tree vaults, mulches, subsoil drainage, root barriers and filter fabrics.

Performance

Plants: Grown to a standard that allows rapid establishment and growth to maturity.

Maintenance: Encourage and maintain healthy growth for the duration of the contract.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *General Conditions of Contract*

1.3 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definitions apply:

- Imported topsoil: Similar to local natural soil, suitable for the establishment and ongoing viability of the selected vegetation, free of weed propagules and of contaminants, and classified by texture to AS 4419 Appendix K Table K1, as follows:
  - . Fine: Clay loam, fine sandy clay loam, sandy clay loam, silty loam, loam.
  - . Medium: Sandy loam, fine sandy loam.
  - . Coarse: Sand, loamy sand.
- Plant establishment period: The period between the date of practical completion and the end of the defects liability period.
- Site topsoil: Natural soil, excavated from the site, that contains organic matter, supports plant life, conforms generally to the fine-to-medium texture classification to AS 4419 and is free from the following:
  - . Stones more than 25 mm diameter.
  - . Clay lumps more than 50 mm diameter.
  - . Weeds and tree roots.
  - . Sticks and rubbish.
  - . Material toxic to plants.

1.4 SUBMISSIONS

Certification

Plant species: Submit the supplier's certification as evidence that plants are true to the required species and type and free from diseases, pests and weeds at time of delivery.

Operation and maintenance manuals

General: Submit recommendations for maintenance of plants.

Products and materials

Supplier's data: Submit supplier's data including the following:

- Material source of supply for topsoil, filling, stone and filter fabrics.

Samples

General: Submit representative samples of each material, packed to prevent contamination and labelled to indicate source and content.

Bulk materials: At least 5 working days before bulk deliveries, submit a 1 kg sample of each type documented with required test results.

Soil Mix Type A: Garden bed Soil mix – 3 KG bag, including soil test

Soil Mix Type B: Tree Pit Soil Mix + Vault soil including soil test

Lawn Soil mix: 3 KG bag, including soil test

Mulch: 3 kg bag

Subcontractors

General: Submit names and contact details of proposed suppliers and evidence of the following, if appropriate:

- Experience in the required type of work.
- Production capacity for material of the required type and quantity.
- Lead times for delivery of materials to the site.

1.5 INSPECTION

Notice

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

- Tree pits excavated and prior to planting and backfilling with soil
- Subgrades cultivated or prepared for placing topsoil.
- Topsoil spread before planting.
- Grassing bed prepared before turfing
- Grassing or turfing completed.
- Plant holes excavated and prepared for planting.
- Subsoil drains installed
- Root barriers installed
- Plant material set out before planting.
- Planting, staking and tying completed.
- Completion of planting establishment work.

2 PRODUCTS

2.1 TOPSOIL

Standard

Site and imported topsoil: To AS 4419.

Potting mixes: To AS 3743.

Composts, soil conditioners and mulches: To AS 4454.

Source
General: If the topsoil of documented quality cannot be provided from material recovered from site, provide imported topsoil.

Imported topsoil
General: Provide imported topsoil, as documented.

Imported topsoil particle size table (% passing by mass)

Sieve aperture (mm)	Soil textures		
	Fine	Medium	Coarse
2.36	100	100	100
1.18	90 – 100	90 – 100	90 – 100
0.60	75 – 100	75 – 100	70 – 90
0.30	57 – 90	55 – 85	30 – 46
0.15	45 – 70	38 – 55	10 – 22
0.075	35 – 55	25 – 35	5 – 10
0.002		2 – 15	2 – 8

Imported topsoil nutrient level table

Nutrient	Unit	Sufficiency range
Nitrate-N (NO_3)	mg/kg	> 25
Phosphate-P (PO_4) – P tolerant	mg/kg	43 - 63
Phosphate-P (PO_4) – P sensitive	mg/kg	< 28
Phosphate-P (PO_4) – P very sensitive	mg/kg	< 6
Potassium (K)	mg/kg	178 - 388
Sulphate-S (SO_4)	mg/kg	39 - 68
Calcium (Ca)	mg/kg	1200 - 2400
Magnesium (Mg)	mg/kg	134 - 289
Iron (Fe)	mg/kg	279 - 552
Manganese (Mn)	mg/kg	18 - 44
Zinc (Zn)	mg/kg	2.6 - 5.1
Copper (Cu)	mg/kg	4.5 - 6.3
Boron (B)	mg/kg	1.4 - 2.7
Method References pH in H_2O (1:5), pH in $CaCl_2$ (1:5) and Electrical Conductivity (EC) by Rayment & Higginson (1992) method 4A2, 4B2, 3A1 Soluble Nitrate-N by APHA 4500 Soluble Chloride by Rayment and Lyons 2011 modified method 5A2 Extractable P by Mehlich 3 – ICP Exchangeable cations – Ca, Mg, K, Na by Mehlich 3 – ICP Extractable S by Mehlich 3 – ICP Extractable trace elements (Fe, Mn, Zn, Cu, B) by Mehlich 3 - ICP		

Site topsoil
General: Provide site topsoil, as documented.

Soil blend: If required, stripped natural soil with sand and/or organic matter and recommended ameliorants.

Soil Mix Type A (Garden Beds)

General: Provide proprietary soil mix

Location: Garden Beds

Standard: To AS 4454.

Soil Mix: Equivalent to ANL organic garden mix.

Depth : Spread to a full depth of 425 mm.

Requirement: Provide soil tests and sample for approval

Soil Mix Type B (Tree Vaults)

Benedict Strata Cell Mix, (Product Code M01C22F). As per attached SESL test reports.

Strata Cell Mix is to have amendments as per SESL report homogeneously blended into material before delivery to site."

TESTS SCHEDULE:

Test Type Required: Complete Soil Test and Agronomists report as available from Sydney Environmental & Soils Laboratory.

Materials To Be Tested	No. of Tests Required
Soil Mix Type A	1 at approval stage
Soil Mix Type B	1 at approval stage to match performance specification. Retest as required to meet specification.

2.2 MULCHING

Mulch to garden beds

General: Provide mulch which is free of deleterious and extraneous matter such as soil, weeds and sticks.

Location: Garden Beds

Standard: To AS 4454.

Organic mulches: Free of stones.

Organic mulch types: Horticultural Grade Pine Bark: From mature trees, graded in size from

15 x 15 x 5mm, free from wood slivers equivalent to ANL Hort-bark 15mm graded pine bark

Requirement : Provide sample for approval

2.3 GEOFABRIC

Install a single layer of geotextile over all soil mix surfaces/strata vault installation prior to installation of concrete paving slabs to prevent contamination of placed soil mix. Geotextile to be formed from a plastic yarn composed of at least 85% by weight of propylene, ethylene, amide or vinylidene chloride and containing stabilisers or inhibitors to make the filaments resistant to deterioration due to ultraviolet light. Identification and marking: To AS 3705. Lap joints at least 250 mm. Extend beyond edge of tree pit and over garden bed tree hole to protect soil from contamination, remove section of membrane for tree planting zone after concrete slab and paving installation.

2.4 STRATA CELL TO TREE PITS IN PAVING

Use: To tree holes under pavement

Extent: Install Strata Vault cells as detailed on the drawings

Manufacturer: CityGreen Urban landscape solution or equivalent approved.

Installation: Installation in accordance with manufacturer's instructions. Backfill with Soil Mix Type B. Install 60mm aeration pipe equal to RootRain Urban Tree pit irrigation or equal approved.

Tests schedule:

All testing shall be undertaken by a competent laboratory for compliance to AS4419. The Contractor shall pay the cost of all tests, including transport of samples to the laboratory. Laboratory report shall be issued direct to the Superintendent. The Contractor shall incorporate all necessary amendments to tested samples in order to achieve compliance with the Specification.

All soil mixes installed on site shall be in accordance with the approved sample. Random sampling and testing of soil mixes will be undertaken by the Superintendent during the progress of the Works. All soil mixes which do not comply with the Specification will be rejected, and must be removed from the site. On site remediation is not acceptable.

Each load of soil mix delivered to site must be accompanied by the supplier's delivery docket which identifies the load, batch, and confirms the volume and weight, and certifies that the soil mix complies with the Specification. All dockets must be presented to the Superintendent prior to unloading of the soil mix. All soil mixes delivered without the above documentation may not be accepted onto the Site, such decision being at the sole discretion of the Superintendent.

Test Type Required: Complete Soil Test and Agronomists report as available from Sydney Environmental & Soils Laboratory.

TRANSPORTING: Soil mixes must be delivered to site pre-blended and covered. The soil mix must be transported in a moist condition to prevent segregation of components.

All soil mixes installed on site shall be in accordance with the approved sample. Random sampling and testing of soil mixes will be undertaken by the Superintendent during the progress of the Works. All soil mixes which do not comply with the Specification will be rejected, and must be removed from the site. On site remediation is not acceptable.

Each load of soil mix delivered to site must be accompanied by the supplier's delivery docket which identifies the load, batch, and confirms the volume and weight, and certifies that the soil mix complies with the Specification. All dockets must be presented to the Superintendent prior to unloading of the soil mix. All soil mixes delivered without the above documentation may not be accepted onto the Site, such decision being at the sole discretion of the Superintendent.

2.5 GRASS

Turf

Description: Cultivated turf of even thickness, free from weeds and other foreign matter.

Species: Zoysia macrantha

Supplier: A specialist grower of cultivated turf, eg. All About Turf, Sydney. Ph: 0412 354 032

2.6 ROOTBARRIER

Location : As shown on the drawings, generally along property boundaries, kerbs, structural piers and beams. Confirm on site with Superintendent the location of root barriers to avoid existing services.

Top of root barrier to installed to underside of proposed concrete slab.

Type: The root control barrier shall be HDPE root control barrier off the roll type, equal to Geofabrics Rootwall Root Barrier min. 900mm wide. High density polyethelene with Core profile of raised cusps both sides (square shape).

Core thickness:	7mm.
Tensile strength (ASTM D412)	31 kNm MD (nominal)
Burst Strength (CBR AS3706.4)	1100N
Installation:	Allow to hand excavate in location of services
Joins Overlap barrier	300mm at sheet joins.
Bonding Method:	50mm Double side Butyl Tape all along

Provide a sample of the barrier proposed for use, together with the manufacturer's product technical information for approval.

2.7 FERTILISER

General

Type: Proprietary fertilisers, delivered to the site in sealed bags marked to show manufacturer or supplier, weight, fertiliser type, N:P:K ratio, recommended uses and application rates.

Application rate: Vary the application rate to allow for the plant-available immediate fertilizer equivalence value of the soil conditioning compost.

The following fertiliser additions are to be incorporated into the topsoil mix:

Coated slow release fertiliser:	NPK 14:2:4 long term release rate (15 to 24 months)
	2 kg/cubic metre
Micromax trace element mix	300g/cubic metre
Dolomite limestone	As required to give pH 5.5 to 6.5

Fertiliser schedule – TBC by supplier

Property	A	B	C
Location	Garden Bed	Tree pit	Turf Lawn
N:P:K ratio	14:2:4	14:2:4	9:4:5
Application rate	As per Manufacturer's instructions	As per Manufacturer's instructions	As per Manufacturer's instructions
Fertiliser	Troforte M All Purpose	Troforte M All Purpose	Amgrows Shirleys No. 17 Lawn Food

2.8 PLANTS – GENERAL

All trees and garden bed stock is to be sourced by the Contractor and made available for inspection.

Stock is to be sourced within 14 days of signing the contract and inspections and photographs arranged to ensure that material proposed will meet the specification in terms of size, quality and health.

Nursery Inspection

The Superintendent will visit the Supply Nursery for one inspection only. All of the project plants are to be available for inspection in one location. If additional inspections, because all plants are not available for viewing, or the plants are not as specified, then the Superintendent's cost for any additional inspections and reporting will be paid by the Contractor.

Provide plants with the following characteristics:

- have foliage size, texture and colour consistent with that shown in healthy specimens of the species;

- have pests and disease to < 10% of the foliage, such that potential for long term success of the trees is not affected;
- other than tubestock shrubs or small trees are self-supporting unstaked;
- comply with the recommendations of AS 4373;
- Large healthy root systems, with no evidence of root curl, restriction or damage.
- Vigorous, well established, free from disease and pests, of good form consistent with the species or variety.
- Hardened off, not soft or forced, and suitable for planting in the natural climatic conditions prevailing at the site.

Plant materials requirements:

- Plant heights to be measured from top of rootball to top of foliage.
- Calliper to be measured 200mm above base of rootball top, adjacent to and perpendicular to bole.
- Supply trees with extension growth consistent with that shown in vigorous specimens of the species.
- Maximum variation in crown bulk on opposite sides of stem axis: ±20%.
- Supply trees which have a defined central leader and intact apical bud.

Replacement: Replace damaged or failed plants with plants of the same type and size.

Refer to plans for plant schedule.

Supply

Supply trees to AS 2303 and with the following properties:

- Stress: Free from stress resulting from inadequate watering, excessive shade or excessive sunlight experienced at any time during their development.
- Site environment: Grown and hardened off to suit anticipated site conditions at the time of delivery.
- Pests and disease: Free from attack by pests or disease.
- Native species with a history of attack by native pests: Restrict plant supply to those with evidence of previous attack to less than 15% of the foliage and make sure actively feeding insects are absent.

Labelling

General: To AS 2303 clause 4.2.1.

Label type: To withstand transit without erasure or misplacement.

Label at least one plant of each species or variety in a batch with a durable, readable tag.

Root system

Requirement: Supply plant material with a root system that is:

- Well proportioned in relation to the size of the plant material.
- Conducive to successful transplantation.
- Free of any indication of having been restricted or damaged.

Root inspection: If inspection is by the removal of soil test, such as investigative inspection, sample as follows:

- For > 100 samples: Inspect 1%.
- For < 100 samples: Inspect 1 sample.

Sample plants: Replace plants used in investigative inspection.

Rejection: Do not provide root bound stock.

2.9 IRRIGATION

General

Requirement: Provide automatically controlled, fixed irrigation systems, as Design and Construct item to satisfy Councils Requirements.

Backflow prevention: To meet statutory requirements.

Irrigation controllers

Type: Automatic controllers that are easily programmed and include the following:

- Manual cycle and individual control valve operation.
- Manual on/off operation of irrigation without loss of program.
- ≥ 4 on/off cycles per day.
- Day omit.
- 240 V input and 24 V output capable of operating 2 control valves simultaneously.
- ≥ 24 hour battery program backup.
- Power surge protection.
- Mounted in a lockable cabinet of minimum IP 54 to AS 60529 in external locations.

Drip systems

Integrated drip line systems: Tubing with integral drippers inserted into the tube during manufacture.

Discrete drip emitter systems:

- Tubing: Polyethylene micro-irrigation pipe.
- Drippers: Turbulent flow types, easily dismantled for cleaning. Connect directly into piping or provide appropriately sized micro-tubes.

Fittings

Type: Barbed fittings rated for the pressure class of the pipe, fastened with ratchet type clamps.

Valve boxes

Requirement: Provide the following in each valve box:

- Automatic control valve.
- Isolating valve.
- Filter:
  - Micro-irrigation systems: 200 µm.
  - Drip irrigation systems: 100 µm.
- Pressure-reducing valve with 170 kPa outlet pressure.

Construction: UV-resistant high impact plastic with high impact snap lock plastic cover.

3 EXECUTION

3.1 PREPARATION

Weed eradication

Herbicide: Eradicate weeds using environmentally acceptable methods, such as a non-residual glyphosate herbicide in any of its registered formulae, at the maximum application rate.

Manual weeding: Regularly remove weed growth by hand throughout grassed, planted and mulched areas. Remove weed growth from an area of 750 mm diameter around the base of the trees in grassed areas. Continue weeding throughout the course of the works and during the planting establishment period.

Vegetative spoil
Disposal: Remove vegetative spoil from site. Do not burn.

3.2 TREE PIT PREPARATION- PROPOSED TREES

Excavation For Tree Pits
Excavate by hand to the depths as detailed on the drawings. Notify Superintendent if excavated material is not suitable for plant growth or contaminated. Do not disturb services, excavate by hand around services. Excess excavated material to be disposed of site

Subgrade Preparation
Excavate holes from subgrade to depths shown on the drawings and leave all finished surfaces clean and straight.

Test subgrade soils for suitability to support plant growth, incorporate any additives that may be required. Manually cultivate subgrade to base of tree pit to a depth of 150mm. During cultivation, thoroughly mix in any materials to be incorporated in the subsoil.

Drainage To Tree Pits
Ensure positive drainage to all tree pits prior to backfilling. Notify Superintendent with two days' notice for inspection of tree hole prior to backfilling.

3.3 TREE PIT PREPARATION- PROPOSED TREES STRATA CELLS

Excavation for tree pits
Excavate by hand to the depths as detailed on the drawings. Notify Superintendent if excavated material is not suitable for plant growth or contaminated. Do not disturb services, excavate by hand around services. Excess excavated material to be disposed of site

Subgrade preparation
Excavate holes and trenches from subgrade to depths shown on the drawings and leave all finished surfaces clean and straight.

Test subgrade soils for suitability to support plant growth, incorporate any additives that may be required. Manually cultivate subgrade to base of tree pit to a depth of 150mm. During cultivation, thoroughly mix in any materials to be incorporated in the subsoil.

Drainage to tree pits
Ensure positive drainage to all tree pits prior to backfilling. Install subsoil drainage and connect to stormwater system. Notify Superintendent with two days' notice for inspection of tree hole prior to backfilling.

3.4 GARDEN BED PREPARATION

Excavation for Garden Beds
Excavate garden areas to depth of 400 mm as shown on the drawings. Remove all excavated material from site. Do not disturb services, or undermine existing kerbs. Excavate to profile as shown on the Drawings. Excavate by hand around services and existing trees.

Subgrade Preparation
Cultivate subgrade 150mm.

Test subgrade soils for suitability to support plant growth, incorporate any additives that may be required. Manually cultivate subgrade to base of tree pits to a depth of 150mm. During cultivation, thoroughly mix in any materials to be incorporated in the subsoil.

Drainage to Garden Beds
Fall garden bed subgrade to drain. Ensure positive drainage.

Notify Superintendent with two days' notice for inspection of drainage operation prior to backfilling.

3.5 SUBSOIL

Ripping
General: Rip parallel to the final contours. Do not rip when the subsoil is wet or plastic. Do not rip within the dripline of trees and shrubs to be retained.

Ripping depths: Rip the subsoil to the following typical depths:

- Compacted subsoil: 300 mm.
- Heavily compacted clay subsoil: 450 mm.

Planting beds
Excavated: Excavate to reduce the subsoil level to at least 300 mm below finished design levels. Shape the subsoil to fall to subsoil drains, if required. Break up the subsoil to a further depth of 100 mm.

Unexcavated: Remove weeds, roots, rubbish and other debris. Reduce the planting bed level to 75 mm below finished design levels.

Cultivation
Minimum depth: 100 mm.

Cultivation depths (mm):

- Grassed areas: 100mm depth
- Planting areas: 150mm depth

Services and roots: Do not disturb services or tree roots. If required, cultivate these areas by hand.

Cultivation: Cultivate manually within 300 mm of paths or structures. Remove stones exceeding 25 mm, clods of earth exceeding 50 mm, and weeds, rubbish or other deleterious material brought to the surface during cultivation. Trim the surface to design levels after cultivation.

Additives
General: Apply additives after ripping or cultivation and incorporate into the upper 100 mm layer of the subsoil as documented.

Gypsum: Incorporate at the rate of 0.25 kg/m^2.

3.6 TOPSOIL

Placing topsoil
Spreading: Spread the topsoil on the prepared subsoil and grade evenly, making allowances, if appropriate, for the following:

- Required finished levels and contours after light compaction.

- Grassed areas finished flush with adjacent hard surfaces such as kerbs, paths and mowing strips.

Steep batters: If using a chain drag, make sure there is no danger of batter disturbance.

Finishing: Feather edges into adjoining undisturbed ground.

Consolidation

General: Compact lightly and uniformly in 150 mm layers. Avoid differential subsidence and excess compaction and produce a finished topsoil surface which has the following characteristics:

- Finished to design levels.
- Smooth and free from stones or lumps of soil.
- Graded to drain freely, without ponding, to catchment points.
- Graded evenly into adjoining ground surfaces.
- Ready for planting.

Topsoil depths

General: Spread topsoil to the following typical depths:

- Excavated planting areas:
  . For organic mulch: 300 mm.
- Irrigated grassed areas generally: 150 mm.
- Non-irrigated grass areas: 100 mm.
- Top dressing: 10 mm.

Surplus topsoil

General: Spread surplus topsoil on designated areas on site or dispose off-site.

Designated areas: in garden beds or turf areas

3.7 TURFING

Supply

Elapsed time: Deliver the turf within 24 hours of cutting, and lay within 36 hours of cutting. Prevent turf from drying out between cutting and laying. If not laid within 36 hours of cutting, roll turf out on a flat surface with the grass up, and water as required to maintain a good condition.

Application

Method: Lay the turf as follows:

- Stretcher bond pattern with the joints staggered and close butted.
- Parallel with the long sides of level areas, and with contours on slopes.
- Finish flush, after tamping, with adjacent finished surfaces of ground, paving edging, or grass seeded areas.

Strip turf: Close butt the end joints and space the strips 300 mm apart. Lay top dressing between the turf strips. Finish with an even surface.

Tamping: Lightly tamp to an even surface immediately after laying. Do not use a roller.

Stabilising on steep slopes: Peg the turf to prevent downslope movement. Remove the pegs when the turf is established.

Watering

General: Water immediately after laying until the topsoil is moistened to its full depth. Maintain moisture to this depth.

Initial establishment
General: Maintain turfed areas until there is a dense continuous sward of healthy grass over the whole turfed area, evenly green and of a consistent height.

Failed turf: Lift failed turf and replace with new turf.

Levels: If levels have deviated from the design levels after placing and watering, lift turf and regrade topsoil to achieve design levels.

Top dressing: Mow the established turf and remove cuttings. Lightly top dress to a depth of 10 mm. Rub the dressing into the joints and correct any unevenness in the turf surface.

3.8 PLANTING

General
Plant location and spacing: If necessary to vary plant locations and spacings to avoid service lines, or to cover the area uniformly, or for other reasons, give notice.

Planting conditions
Weather: Do not plant in unsuitable weather conditions, including extreme heat, cold, wind or rain. In other than sandy soils, suspend excavation when the soil is wet, or during frost periods.

Watering
Timing: Thoroughly water the plants before planting, immediately after planting, and as required to maintain growth rates free of stress.

Preparation
Individual plantings in grassed areas: Prepare for planting as follows:

- Excavate a hole twice the diameter of the root ball and at least 100 mm deeper than the root ball.
- Break up the base of the hole to a further depth of 100 mm.
- Loosen compacted sides of the hole to prevent confinement of root growth.

Ripline planting: Prepare for planting as follows:

- Rip the row and excavate a plant hole for each plant large enough to accept the root ball plus 0.1 m³ of backfilling with topsoil.
- Clear weeds and other vegetative material within 300 mm radius of the plants.
- If planting holes are excavated by mechanical means, increase the hole size by 100 mm and loosen compacted sides to prevent confinement of root growth.

Placing
General: Place plants as follows:

- Remove the plant from the container with minimum disturbance to the root ball. Make sure that the root ball is moist.
- If required, root prune to make sure all circling roots have been either severed or aligned radially into the surrounding soil.
- Place the plant in its final position, in the centre of the hole and plumb, and with the topsoil level of the plant root ball level with the finished surface of the surrounding soil.

Fertilising
Pellets: In planting beds and individual plantings, place fertiliser pellets around the plants at the time of planting.

Backfilling
General: Backfill with topsoil mixture. Tamp lightly and water to eliminate air pockets. Make sure that topsoil is not placed over the top of the root ball, so the plant stem remains the same height above ground as it was in the container. Avoid mixing mulch with topsoil.

3.9 IRRIGATION

Drip systems
Piping: Lay polyethylene micro-irrigation pipe on finished ground surface under planting bed mulch and anchor at 1.5 m maximum intervals with U-shaped stakes.

Air release valves: Provide at the highest point in each section to drain the system when flow stops.

3.10 MULCHING

Placing mulch
General: Place mulch to the required depth and clear of plant stems, so that after settling it conforms to the following:

- Smooth and evenly graded between design surface levels.
- Flush with the surrounding finished levels.
- Sloped towards the base of plant stems in plantation bed.

Extent: Provide mulch to 750 mm diameter to surrounds of plants planted in riplines and grassed areas.

Depths:

- Organic mulch: 75 mm.

Installation:

- In ripline and grassed areas: Place mulch to 750 mm diameter around plants.
- In mass planted areas: Place after the preparation of the planting bed but before planting and other work.
- In smaller areas (e.g. planter boxes): Place after the preparation of the planting bed, planting and other work.

3.11 TREATMENT

General
Insect attack or disease: If evidence of insect attack or disease of plant material is discovered, immediately give notice.

Physical removal
General: Remove insect infestation and diseased plant material by hand if appropriate.

Pesticide
Product: Spray with insecticide, fungicide or both, as required.

3.12 STAKES AND TIES

Stakes
Material: Hardwood, straight, free from knots or twists, pointed at one end.

Installation: Drive stakes into the ground at least one third of their length, avoiding damage to the root system.

Stake sizes and quantities:

- For plants ≥ 2.5 m high: Three 50 x 50 x 2400 mm stakes per plant.
- For plants 1 to 2.5 m high: Two 50 x 50 x 1800 mm stakes per plant.
- For plants < 1 m high: One 38 x 38 x 1200 mm stake per plant.

Ties

General: Provide ties fixed securely to the stakes, one tie at half the height of the main stem, others as necessary to stabilise the plant. Attach ties loosely so as not to restrict plant growth.

Tie types:

- For plants ≥ 2.5 m high: Two strands of 2.5 mm galvanized wire neatly twisted together, passed through reinforced rubber or plastic hose, and installed around stake and stem in a figure of eight pattern.
- For plants < 2.5 m high: 50 mm hessian webbing stapled to the stake.

Trunk protection

Collar guards: 200 mm length of 100 mm diameter agricultural pipe split lengthways.

3.13 ESTABLISHMENT

Planting

Requirement: Make sure the general appearance and presentation of the landscape and the quality of plant material at date of practical completion is maintained for the planting establishment period.

Plant replacement: Replace failed, dead and/or damaged plants at maximum 3 weekly intervals as necessary throughout the plant establishment period.

Pruning: To AS 4373 and as documented.

Fertilising: Apply either an all purpose fertiliser or a 12 month slow release fertiliser, in two rows and cultivated into soil to a depth of 100 mm.

- Program: September and March according to seasonal growth requirement.

Weeding: Remove unwanted broadleaf plants and grasses considered invasive to the locality.

Remulching: Maintain the original ground levels around the base of plants.

Watering: Minimum 3 complete waterings, soaking to a depth of 150 mm at fortnightly intervals for the first 6 weeks of plant establishment irrespective of natural rainfall.

Grass

Preparation: Remove litter and fallen branches before mowing.

Mowing:

- Grass height: Consistent with the growth habit of the grass variety and maintained at 25 mm to 40 mm throughout the year. Do not remove more than one third of the grass height at any one time.
- Program: Weekly during the mowing season, November to March, and at fortnightly intervals from April to October. Do not mow during wet conditions.
- Clippings: Remove grass clippings from the site after each mowing.
- Raking: Once every month before mowing from November to March, rake the grass with a flexible rake. On alternate mowings, adopt a north-south and east-west pattern.

Weeding: Remove unwanted broadleaf plants and grasses considered invasive to the locality.

- Program: Quarterly, and as required to maintain the general lawn condition.

Edge trimming: At the same time as mowing, trim lawn edges to plant beds, pathways, base of trees and other obstacles. Do not damage trees and shrubs.

Topdressing for established lawns: Weed-free imported sandy topsoil to a depth of 5 mm.

- Program: The spring following initial establishment.

Fertilising: Apply lawn fertiliser at the completion of the first and last mowings of the plant establishment period, and at other times as required to maintain healthy grass cover.

3.14 COMPLETION

Irrigation

Requirement: On completion of the irrigation system, carry out the following:

- Flush system thoroughly, check heads, sprays and drippers and clean if blocked.
- Clean strainers.
- Adjust for even distribution with no dry areas.

Cleaning

Stakes and ties: Remove those no longer required at the end of the planting establishment period.

Temporary fences: Remove temporary protective fences at the end of the planting establishment period.

0256 LANDSCAPE – ESTABLISHMENT

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide plant establishment, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 INTERPRETATION

Definitions

General: For the purpose of this worksection the following definitions apply:

- Plant establishment period: The period between the date of practical completion and the end of the defects liability period.

1.4 SUBMISSIONS

Certification

Replacement plants species: Submit the supplier's certification as evidence that all plants are true to the required species and type and free from diseases, pests and weeds at time of delivery.

Execution details

General: Give two days' notice of the following operations:

- Application of herbicide.
- Application of fertiliser.
- Watering.
- Each site maintenance visit.

Reporting: Submit monthly reports by the last Friday of each month.

Monitoring program

General: Submit a monitoring program developed by a specialist monitoring consultant and incorporating the following:

- Photographic record including:
  - . Colour photographs.
  - . Documented monitoring locations and photograph angles.
- Reporting periods including photographic records at the following:
  - . Before commencement of the works.
  - . Date of practical completion.
  - . Three monthly intervals during the plant establishment period.
  - . End of defects liability period.
  - . Date of final completion.
  - . Benchmark definition based on remnant communities.
  - . Replicated measurements over time and comparative analysis with regard to the benchmark.

Specialist consultant: Submit the name, contact details and qualifications including research papers and scientific publication details of the specialist monitoring consultant.

Records
Logbook: Record the following on a weekly basis:

- Description, time and method of application of toxic material.
- Maintenance work details.
- Inclement weather to verify inability to carry out work within the specified time frame.

Availability: Upon request.

1.5 INSPECTION

Notice
Inspection: Give notice so that inspection may be made at the following intervals:

- Date of practical completion.
- Three monthly intervals during the plant establishment period.
- End of defects liability period.

2 EXECUTION

2.1 GENERAL

Special instructions
Requirement: If directed, attend to identified areas and procedures as a priority. Obtain approval for additional costs before starting the works.

Reporting
Monthly report: Provide regular written reports each month on the following:

- General status of works.
- Soil test results as required for the fertilising programs.
- Plant replacement requirements.

Incident reports: Report immediately verbally and confirm in writing any disturbance or incident affecting or likely to affect the day to day scheduling of works.

Disruption of works by others
Requirement: Make arrangements to work around the disturbance caused by other contractors.

Rubbish removal
Rubbish: Remove loose rubbish such as bottles, papers, and cigarette butts from the site. Execute this work regularly so that all areas are free from rubbish when observed at fortnightly intervals.

Leaf litter: Remove from all path and lawn areas.

Leaf litter distribution: [complete/delete]

2.2 PLANTING WORKS

Planting
Requirement: Make sure the general appearance and presentation of the landscape and the quality of plant material at date of practical completion is maintained for the planting establishment period.

Existing plant material: Maintain existing planting and grass within the landscape contract area as documented for the matching classifications of new grassland or planting.

Plant replacement: Replace failed, dead and/or damaged plants at maximum 3 weekly intervals as necessary throughout the plant establishment period.

Pruning
Prune: To AS 4373 and as documented.

Fertilising
Soil tests: Take samples from both planting beds and lawn areas and conduct tests.

Fertilising program: Base the program on soil testing results.

Application: Apply either an all purpose fertiliser or a 12 month slow release fertiliser, in two rows and cultivated into soil to a depth of 100 mm.

Program: September and March according to seasonal growth requirement.

Sensitive native species: Apply appropriate dosage.

Insect and disease control
Responsibility for insect and disease control: [complete/delete]

Period for treatment: Until the problem has been eliminated.

Chemical spray: Apply outside of normal working hours.

Stakes and ties
Generally: If plants are not self-supporting or if stakes are damaged, stake or restake the plants as follows:

- Drive three hardwood stakes placed diagonally with the first stake on the opposite side to the prevailing winds.
- Do not single stake large plants.

Removal: If plants are robust with well-developed systems and no longer require support, remove stakes and ties.

2.3 GRASS SURFACES

Mowing and trimming
Preparation: Remove litter and fallen branches before mowing.

Grass height: Consistent with the growth habit of the grass variety and maintained at 25 mm to 40 mm throughout the year. Do not remove more than one third of the grass height at any one time.

Program: Weekly during the mowing season, November to March, and at fortnightly intervals from April to October. Do not mow during wet conditions. Carry out last mowing not more than 7 days before end of plant establishment period.

Raking: Once every month before mowing from November to March, rake the grass with a flexible rake. On alternate mowings, adopt a north-south and east-west pattern.

Edges: At the same time as mowing, trim lawn edges to plant beds, pathways, base of trees and other obstacles. Do not damage trees and shrubs.

Clippings distribution: [complete/delete]

Topdressing
Topdressing for established lawns: Weed-free imported sandy topsoil to a depth of 5 mm.

- Program: The spring following initial establishment.

Topdressing for remediation of depressions or irregularities: Apply coarse or medium soil to AS 4419 suitable for application to turf or grass seeded areas.

Fertilising
Fertilising: Apply lawn fertiliser at the completion of the first and last mowings of the plant establishment period, and at other times as required to maintain healthy grass cover.

2.4 WEEDING

General
Requirement: Remove unwanted broadleaf plants and grasses considered invasive to the locality.

Program:

- Lawns: Quarterly, and as required to maintain the general lawn condition.
- Trees and shrubs: As required for planted, paved and mulched areas to be weed free when observed at fortnightly intervals.

Vigorous ground covers: Keep 200 mm clear from the base of any shrub or tree. Remove as follows:

- Small areas: By hand.
- Large areas: Proprietary herbicides.

Herbicide application: Apply as follows:

- To the manufacturer's instructions and Safety Data Sheets(SDS).
- When the weather is humid with moderate temperatures and maximum sunlight.
- When the ground has recommended soil moisture.
- Avoid windy days or if rain is likely to follow within 12 hours.

2.5 MULCHED SURFACES

General
Inspection: Fortnightly to determine mulch requirements.

Requirement: Maintain minimum depth as follows:

- 75 mm for organic mulch.
- 50 mm for gravel mulch.

Remulching: Maintain the original ground levels around the base of plants.

2.6 WATERING

Establishment
Extent: [complete/delete]

Water quality:

- pH between 5.5 and 7.5.
- Total soluble salts less than 1000 mg/litre.
- No substances toxic to plant growth.

Watering program: Minimum 3 complete waterings, soaking to a depth of 150 mm at fortnightly intervals for the first 6 weeks of plant establishment irrespective of natural rainfall. Confirm soaked depth and record in the log book.

Water restrictions: Coordinate the water supply and conform to legislation and restrictions applying at the time.

Hand watering
Requirement: Manually water all lawn and planting areas in absence of an irrigation system or until the proposed irrigation system is fully operational. Avoid frequent dampening of the surface. Allow the surface of the soil to partially dry out between waterings.

Irrigation
Irrigation system program: Adjust to suit the following:

- The precipitation requirements of the individual zones/stations with regard to types of plants.
- The infiltration rate of the soil/medium and associated physical factors, seasons, evaporation, exposure, topography and local authority restrictions.
- Adjustment or shut down during and after periods of prolonged heavy rain.
- Water supply and watering regime of legislation and restrictions applying at the time.

Equipment maintenance:

- Check all components for proper operation.
- Repair or replace damaged components with parts from the same manufacturer.
- Flush any dirt or foreign matter from the system and clear all blockages.

2.7 CONTROL MEASURES

Weed mats
Generally: Maintain mats in a weed free condition and reinstate missing or damaged mats to the documented standard, until completion of the plant establishment period.

Feral animal control
Generally: Implement feral animal control until the completion of the plant establishment period.

Feral animal guards: Maintain feral animal guards in a working upright and taut order with three stakes. Replace missing or damaged guards with materials as documented.

Removal: At the completion of the plant establishment period.

2.8 ROAD VERGES AND FIRE REDUCTION ZONES

Native grass
Generally: Allow native grasses planted within 2 m of road verges or 5 m of property boundaries to grow in a form consistent with the growth habit of the species.

Mowing
Native grasses: Maintain as follows:

- Do to not damage regeneration areas, including tree saplings.
- Mow at a minimum of twice a year and at least once at the end of October, before bush fire season, as a fire reduction measure.
- Maintenance mowing:
  - Use a single pass of a mower along medians and verges with maximum width of 1.7 m for a slasher and 1.2 m for a slope mower.
- Fire hazard reduction mowing:
  - Use a double pass of a mower along medians and verges with maximum width of 3.4 m for a slasher, and a single 1.2 m pass by a slope mower.

Other types of grass verges: Mow to maintain a maximum 250 mm height.

Pruning
General: Cut back tree and shrub growth to road verges, to on/off ramps, and around emergency telephones and signs as required to achieve clear sight distances when viewed from a minimum of

100 m along roadway. Cut back tree and shrub growth within fire reduction zones to minimise risk to adjoining properties.

Pruning: As documented.

2.9 PAVING AND STRUCTURES

Paving

Weed and grass control: [complete/delete]

Furniture, signage and barriers

Maintenance guidelines:

- Furniture and pots: Keep in a good condition and move as required to carry out maintenance works.

Directional and building signs: Keep in a good condition and maintain visibility.

Boundary and car park barriers: Keep in a good condition and maintain visibility.

Drains

Maintenance: Inspect and clean all drainage structures and pit covers and maintain in working order.

Frequency: As required, so that all overflow drains are clear when observed at fortnightly intervals.

2.10 COMPLIANCE

Criteria

Generally: Plant establishment shall be deemed complete, subject to the following:

- Repairs to plant material are complete.
- Ground surfaces are covered with the documented treatment to the documented depths.
- Pests, disease, or nutrient deficiencies or toxicities are not evident.
- Organic and gravel mulched surfaces are in a weed free and tidy condition and to the documented depth.
- Vegetation is established and well formed.
- Vegetation cover to cell, seeded and/or hydromulched areas is established
- Plants have healthy root systems that have penetrated into the surrounding, undisturbed ground and are not able to be lifted out of the planting holes.
- Vegetation is not restricting essential sight lines and signage.
- Only frangible species are growing within road side clear zones.
- Specified vegetation setbacks from services and road furniture are evident.
- All hard landscape works are installed and operating as documented.
- Litter collection and removal is complete.
- Mulch is removed from drainage and access areas.
- All non-conformance reports and defects notifications are complete.

Plant establishment compliance table

Plant material	Acceptable failure per area	Acceptable concentration of failure
Tube stock	< 10%	< 15% in any given location
140 mm	< 5%	< 15% in any given location
300 mm or larger	Nil	Nil
Turf	< 5%	Nil
Cells	< 5%	< 15% in any given location
Direct seeded native species and cover crop – including	Not less than 3 documented species per 1 m^2 grid (determined on a testing	Nil grids with < three (3) documented plant species

Plant material	Acceptable failure per area	Acceptable concentration of failure
hydromulch, drilled and broadcasted areas	frequency of 20 grid areas per 500 m^2)	
Direct seeded grass species and cover crop	< 15% (determined by a 1 m^2 grid on a testing frequency of 1 grid area per 500 m^2)	< 10%
Cover crop	< 5%	Nil

3 SELECTIONS

3.1 PRUNING

Pruning schedule

Plant species	Shape	Critical issues
Acer dissectum spp.	Prune off superfluous branches from trunk or wayward branches or excessive growth	
Agapanthus spp.	Prune to remove spent flowers and dead leaves at end of winter	Species not tolerant of severe consecutive frosts
Azalea species	Prune to control wayward growth following prime flowering period	Can be damaged by severe frost greater than -3°C
Buddleia salviifolia	Prune shoots late spring after flowering to within several nodes of older wood	Species not tolerant of severe frosts
Camellia japonica and species	Lightly prune to shape, rejuvenate plant. Prune before new spring growth	Sometimes damaged by severe frost in grown in exposed, windy locations
Conospermum stoechadis	Remove spent blooms and old leaves	Not suited to site and heavy moist soils. Species will not tolerate severe frosts
Cotoneaster microphyllus	Prune occasionally to retain compact growth	
Dietes grandiflora	Prune to remove spent flowers and old leaves	Species not tolerant of severe consecutive frosts
Fatsia japonica	Remove lanky shoots at base of plant	Species will not tolerate severe frosts
Gordonia axillaris	Tip prune to shape first 3 years following planting then prune annually in November to restrain vigorous growth	Sometimes burnt by severe consecutive frost
Gardenia spp.	Lightly prune to shape following summer flowering	Species not tolerant of severe consecutive frost
Hebe bluegem	Annual light to moderate prune. Remove spent flowers and capsules	Species not tolerant of severe consecutive frost unless grown in sheltered warm micro climates
Hypericum calycinum	Prune to control growth and to promote new flowers	
Juniperus conferta	Prune to shape and control growth	
Juniperus sabina and H. douglasii	Prune to shape and control growth – all seasons	

Plant species	Shape	Critical issues
Lavandula dentata	Lightly shape to restrain untidy growth, remove spent flowers	
Liriope muscari	Prune when foliage deteriorates in colour or becomes ragged in late winter	
Magnolia stellata	Prune to shape plant while young	
Murraya paniculata	Light annual pruning after autumn flowering	Species is not suitable for frosty locations
Nandina domestica	Remove oldest cones at ground level each winter and spent fruiting stems	
Rhaphiolepis spp.	Lightly prune terminal shoots in summer to induce lateral branching	
Rhododendron species	Prune to control wayward growth following flowering in late spring	
Rosmarinus spp.	Prune immediately after flowering	
Spiraea bumalda Anthony waterer	Prune to shape late winter/early spring	
Spiraea thunbergii	Remove old shoots at ground level after flowering	
Strelitzia regina	Prune to remove old leaves and spent flowers	Species not tolerant of severe consecutive frosts
Tibouchina jules	Light annual pruning	Species not tolerant of severe tablelands frosts
Tibouchina kathleen	Light annual pruning	Species not tolerant of severe consecutive frosts
Trachelospermum jasminoides	Prune to remove spent flowers and to control vigour after flowering	Sometimes burnt by severe consecutive frost
Viburnum tinus	Prune to shorten longest shoots early summer	
Vinca minor	Shear close to ground occasionally to promote fresh new growth – spring	

0259 LANDSCAPE – MAINTENANCE

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide landscape maintenance of the contract area during the maintenance period.

Performance

Extent of maintenance:

- Weeding of lawn, garden bed areas, and pavement.
- Supply and spreading of fertiliser to lawn, garden bed areas and pots.
- Supply and installation of mulch to existing garden bed areas and pots.
- Pruning, trimming and tree surgery.
- Adjustment of tree stakes and ties.
- Insect and disease control of lawn, shrubs and trees.
- Mowing and edge trimming to all lawn areas including collection and removal of clippings.
- Diagnosis of cause of dead or failed plants and recommendations for corrective actions.
- Replacement of dead or failed plants and lawns.
- Maintenance of irrigation systems.
- Removal of rubbish and debris in garden areas.
- Removal of leaves, mulch and organic debris from pavement and drains.
- Keeping a log book of maintenance activities.
- Providing monthly reports.

Maintenance period: Contractor to liaise and confirm with Hansen Yunken. Typically 12month period

Maintenance procedures: As documented.

Particular procedures: Contractor to provide maintenance procedure manuals for TAFE Approval

1.2 THE SITE

Record drawings

Contractor to record all drawings as part of maintenance contract with TAFE

Site restrictions

Entry permits: Make available, to persons entering designated secure areas, valid entry permits. Make sure these persons comply with conditions of entry.

Secure areas

Secure area visitors: At least 10 working days before entry is required, submit the full name, address, and date and place of birth of persons required to enter designated secure areas.

- Purpose of submission: Review.

Protection of persons and property

Temporary works: Provide and maintain required guards, fencing, footpaths, signs and lighting.

Accessways, services: Do not obstruct or damage footpaths, drains and watercourses or other existing services in use on or adjacent to the site.

Property: Do not interfere with or damage property which is to remain on or adjacent to the site, including adjoining property encroaching onto the site, and trees.

Rectification
Accessways, services: Rectify immediately any obstruction or damage to footpaths, drains and watercourses or other existing services in use on or adjacent to the site. Provide temporary services whilst repairs are carried out.

Property: Rectify immediately any interference or damage to property which is to remain on or adjacent to the site, including adjoining property encroaching onto the site, and trees.

1.3 GENERAL CONDITIONS

Contract
Form of contract: To be confirmed with Hansen Yunken

Payment
Payment period: To be confirmed with Hansen Yunken

Bond: Equal to one month's maintenance.

Expenditure of the bond: By the principal upon unsatisfactory maintenance, to employ others to carry out such work.

Contractor and staff
Representative: Nominate a senior partner/personal experienced in maintenance nursery practices and horticulture, to be responsible for taking and carrying out instruction, and reporting to the principal.

Special instructions
Priority: If instructed by the principal, attend to certain areas and procedures as a priority. Obtain approval for additional costs before starting the works.

Notice
Inspection: Provide two days' notice of the following operations:

- Application of herbicide.
- Application of fertiliser.
- Each site maintenance visit.
- Work affecting public access or amenity on the Thursday of the week before the work is planned.

Water restrictions: Provide immediate notification of any new restrictions that affect maintenance.

Reporting
Monthly report: Submit regular reports by the last Friday of each month to
SELECTIONS, **MAINTENANCE REPORT**, **Monthly reports schedule** and as follows:

- General status of the works.
- Soil test results included as required for the fertilising programs.
- Any plant replacement requirements.
- Irrigation operation schedules and water consumption.

Incident reports: Report immediately, verbally and confirm in writing, any disturbance or incidence affecting or likely to affect the scheduling of the works.

Log book
Records: Log the following on a weekly basis:

- Description, time and method of application of toxic material.
- Maintenance work details.
- Inclement weather to verify inability to carry out work within the specified time frame.

Availability: Upon request.

Replacement plants
Species: Provide written certification that all plant material is true-to-species and type, and free of disease and fungal infection.

Coordination with others
Other contractors: Coordinate work with other contractors to minimise conflicting activities and delays. If disturbances to planned works are unavoidable, make arrangements to work around them.

2 EXECUTION

2.1 GENERAL

Weeding
Requirement: Remove unwanted broadleaf plants and grasses considered invasive to the locality.

Program:

- Lawns: Quarterly.
- Trees and shrubs: As required for planted, paved and mulched areas to be weed free when observed at fortnightly intervals.

Vigorous ground covers: Keep 200 mm clear from the base of any shrub or tree. Remove as follows:

- Small areas: By hand.
- Large areas: Proprietary herbicides.

Herbicide application: Apply as follows:

- To the manufacturer's recommendations and the material data and safety data sheets.
- When the weather is humid with moderate temperatures and maximum sunlight.
- When the ground has adequate soil moisture.
- Avoid windy days or if rain is likely to follow within 12 hours.

Insect and disease control
Requirement: Control any insects or diseases affecting the lawn and garden bed areas as follows:

- Identify the problem.
- Execute the correct treatment until the problem has been eliminated.
- Apply hazardous material out of normal working hours.
- Protect staff and public from exposure to hazardous materials.

2.2 GRASS SURFACES

Mowing and trimming
Preparation: Remove litter and fallen branches before mowing.

Grass height: Consistent with the growth habit of the grass variety and maintained at 25 mm to 40 mm throughout the year. Do not remove more than one third of the grass height at any one time.

Program: Weekly during the mowing season, November to March, and at fortnightly intervals during April to October. Do not mow during wet conditions.

Raking: Once every month before mowing during the mowing season, rake the grass with a flexible rake. On alternate mowings, adopt a north-south and east-west pattern.

Edges: At the same time as mowing, trim lawn edges to plant beds, pathways, base of trees and other obstacles. Do not damage trees or shrubs.

Non-selective herbicide: Make sure application does not exceed the area limits of normal manual trimming. Repair any damage from overuse or over spray.

Fertilising
N:P:K (Nitrogen:Phosphorus:Potassium) ratio: Balanced 10:4:6.

Rate: To the manufacturer's recommendation.

Program:

- Regular application: Each September and April.
- Additional application: Each November and February at reduced rates.

Soil pH adjustment: Apply additional fertilisers and soil conditioners as indicated from soil testing or from the physical soil structure. Maintain a pH range of 5.5 to 6.5.

pH testing program: Two year schedule starting in the first year of the contract.

Application: Spread as follows:

- Dry: Crush lumps and broadcast dry material by hand or mechanically when the lawn is dry.
- Spray: Acceptable.
- Prevent fertiliser from leaching to adjoining planted beds, particularly those with sensitive native trees and shrubs.

Topdressing
Topdressing material for established lawns: Weed free imported sandy topsoil to a depth of 5 mm.

Topdressing material for remediation of depressions or irregularities: Apply coarse or medium texture soil, to AS 4419, suitable for application to turf or grass seeded areas.

Renovation
Established lawns of sandy soil profile: Renovate by dethatching or verticutting.

2.3 TREES AND SHRUBS

Pruning and trimming
General: Prune to reflect the natural growth, flowering and regrowth habit of the individual species.

Program generally: Spring and Summer and on a spot basis as required.

Shrubs: Prune after flowering.

Hedge trimming: Schedule trimming at times that maintains the character and design of hedges. Allow up to three times per season.

Tip pruning:

- Purpose: To encourage development of new shoots during the active growing season.
- Method: Removal of the top 25 mm or growing tip of each branch.
- Restriction: Do not remove buds before the flowering season in those plants that have terminal flowers.

Radical pruning:

- Purpose: To maintain a hedge or formal shape or when a particular problem, growth habit, damage, or disease requires branch removal.

Tree pruning:

- Purpose: To eliminate diseased or damaged growth, avoid inter-branch contact and thin out crowns in a natural manner.
- Maintain sight lines to signs and lights.
- Maintain visibility for personal security.

Tree branch removal:

- To AS 4373.
- Give notice and engage a suitably qualified arborist.

Fertilising

Fertilising program: Base the program on soil testing results.

Soil testing: Test soil as follows:

- At the start of the contract.
- Take samples from a cross section of planting beds.

Soil pH adjustment: Apply additional fertilisers and soil conditioners as indicated from soil testing or from the physical soil structure. Maintain a pH range of 5.5 to 6.5.

Program:

- Regular application: Each September and March.

Sensitive native species: Apply fertiliser at an appropriate rate.

Micro nutrients: Apply 1 kg of urea in 20 litres of water per 100 m^2, through a hose proportioner every four weeks during Summer.

Stakes and ties

Generally: If plants are not self-supporting or if stakes are damaged, stake or re-stake the plants as follows:

- Drive three hardwood stakes placed diagonally with the first stake on the opposite side to the prevailing winds.

Removal: If plants are robust with well developed systems and no longer require support, remove stakes and ties.

Plant replacements

General: Before replacement, diagnose cause of plant failure and report findings. If failure is due to species incompatibility with site conditions, recommend alternative species. Replace all evergreen plants that have died or lost 50% of their normal foliage cover. Provide replacement plants as follows:

- Of the same species and variety (or approved alternative) and of the closest commercially available size.
- With a balanced root system in relation to the size of the plant and conducive to successful transpiration. Inspect the root conditions of plants by knocking plants from their containers.
- Without signs of having been stressed at any stage during their development due to inadequate watering, excessive shade/sunlight, suffered physical damage or have restricted habit due to growth in nursery rows.
- Grown in final containers for not less than twelve (12) weeks.

2.4 WATERING

Grass and planted areas

Generally: Maintain a vigorous healthy appearance.

Application rates: Soak to a depth of 150 mm for grass areas and 300 mm for planting. Avoid frequent dampening of the surface. Allow the surface of the soil to partially dry out between waterings. Confirm soaked depth and record in the log book.

Timing: Water at times of day to minimise water evaporation loss. Do not water during the hottest period of Summer days.

Water restrictions: Coordinate the water supply and conform to legislation and restrictions applying at the time.

Hand watering
General: Manually water all lawn and planting areas in the absence of an irrigation system or until the proposed irrigation system is fully operational.

Irrigation
Irrigation system program: Adjust to suit the following:

- The precipitation requirements of the individual zones/stations with regard to types of plants.
- The infiltration rate of the soil/medium and associated physical factors, of seasons, evaporation, exposure, topography, local authority restrictions.
- Adjustment or shut down during and after periods of prolonged heavy rains.
- Water supply and watering regime of legislation and restrictions applying at the time.

Equipment maintenance: Conform to the following:

- Check all components for proper operation.
- Obtain approval to repair or replace damaged component with equivalent parts.
- Flush any dirt or foreign matter from the system and clear all blockages.

System maintenance: Conform to the **Irrigation system maintenance schedule**.

Programming
Automated systems: Program to coincide with optimum periods of water pressure and water absorption.

Public access: Do not inconvenience persons occupying the site by water spray or by blocking normal pedestrian or traffic flow.

2.5 MULCHING

General
Clean up: Remove all mulching materials from lawn or paved areas and maintain a clean and tidy appearance when viewed on a weekly basis.

Requirement: Maintain a minimum depth as follows:

- 75 mm for organic mulch.
- 50 mm for inorganic mulch.

Top up: Areas of excessive wear with mulch to match existing.

Appearance: Keep mulched areas clean and tidy with no soil disturbance evident on the surface of the mulch.

2.6 INCIDENTAL WORKS

Supplementary works
General: Execute the following:

- Removal of waste from maintenance work.
- Removal of leaf litter fortnightly during leaf fall.
- Wash paving on completion of herbicide application.

Furniture, signage and barriers

Scope: All fixed and movable features noted in the record drawings.

Furniture and pots:

- Move and relocate as required for maintenance of the area.
- Repair or replace items damaged by the maintenance contract staff.

Signage: Maintain sight line visibility.

Drains

General: Inspect and clean all drainage structures and pit covers and make sure they are in proper working order. Remove all organic debris.

Frequency: As required so that all overflow drains are cleared when observed at fortnightly intervals.

3 SELECTIONS

3.1 SCHEDULE OF RATES

Schedule of rates schedule

Item	Unit	Quantity	Rate	Total
Preliminaries/establishment (one off cost)	Item			
Mowing and edge trimming	Item			
Watering	Item			
Irrigation repair	Item			
Manual watering	Item			
Fertiliser: Lawn	m^2			
Fertiliser: Garden/pot	m^2			
Fertiliser: Trees	No.			
Weeding	Item			
Insect and disease control	Item			
Pruning and trimming	Item			
Plant replacement: In lawn areas: 150 mm	No.			
Plant replacement: In lawn areas: 5 litre	No.			
Plant replacement: In lawn areas: 15 litre	No.			
Plant replacement: In lawn areas: 25 litre	No.			

Item	Unit	Quantity	Rate	Total
Plant replacement: In lawn areas: 35 litre	No.			
Plant replacement: In lawn areas: 75 litre	No.			
Plant replacement: In lawn areas: 100 litre	No.			
Plant replacement: In lawn areas: 200 litre	No.			
Plant replacement: In garden areas: 150 mm	No.			
Plant replacement: In garden areas: 5 litre	No.			
Plant replacement: In garden areas: 15 litre	No.			
Plant replacement: In garden areas: 25 litre	No.			
Plant replacement: In garden areas: 35 litre	No.			
Plant replacement: In garden areas: 75 litre	No.			
Plant replacement: In garden areas: 100 litre	No.			
Plant replacement: In garden areas: 200 litre	No.			
Staking and tying	Item			
Mulching: Pine bark graded	m^3			
Mulching: Pine flake	m^3			
Mulching: Crushed gravel	m^3			
Lawn renovation	Item			
Topdressing	m^3			
Incidentals (including protective clothing)	Item			

Labour rates schedule

Item	Ordinary time $ per hour	Overtime $ per hour
Additional labour charge: Labourer	$	$
Additional labour charge: Tradesman	$	$

3.2 MAINTENANCE REPORT

Monthly reports schedule

Item	Action
Plant material	Replace failed plants
	Additional planting
	Treat for disease or insect attack
	Tree surgery
	Fertilising generally
	Fertilising for specific nutrient deficiencies
	Thin out planting
	Pruning/trimming
Turf	Returfing
	Seeding
	Treat for disease
	Topdressing
	Weeding
	Mowing/trimming
Soil	Erosion/bank stabilisation
	Additional soil
	Soil conditioner
	Weeding
Mulch	Top up mulch
Rubbish removal	Generally remove bottles, paper, cigarette butts etc.
	Remove leaf, litter from path and paved areas
Irrigation	Replace parts
	Repair
	Clean out
	Adjust
	Clean out subsurface drains
Paving and pathways	Repair dips, hollows, irregularities

Item	Action
	Remove stains and graffiti
	Replace sections of uplift
	Clear main pathway drains of debris
	Weeding
Infant playground	Make sure that all play structures are secure and in working order
Fencing	Repair fencing
Bench/seat	Repair loose or damaged parts
Bollard	Reinstate in original position
Lighting	Replace blown lamps and damaged diffusers
Barriers	Replace broken or dislocated palings or rails

3.3 MAINTENANCE PROCEDURE

Maintenance schedule

WEEK	SPRING (Sept, Oct, Nov)	SUMMER (Dec, Jan, Feb)	AUTUMN (Mar, Apr, May)	WINTER (Jun, Jul, Aug)
1	Mow and trim lawns	Mow lawns; weed	Mow lawns	Weed
2	Weed; trim and adjust trees and shrubs	Weed; mow lawns, trim and adjust trees and shrubs	Weed; mow lawns, trim and adjust trees and shrubs	Mow and trim lawns Trim and adjust trees and shrubs
3	Mow and fertilise lawns; treat plant material for insects and disease	Mow lawns; weed; treat plant material for insects and disease	Mow and trim lawn	Weed
4	Weed; topdress, condition lawns and oversow bare patches; issue maintenance report	Weed; mow and trim lawns; issue maintenance report	Weed; mow lawns; issue maintenance report	Mow lawns; issue maintenance report
5	Fertilise all trees and shrubs in garden beds; mow and trim lawns	Mow lawns; weed	Mow lawns	Mow lawns
6	Weed; inspect mulch for deficiencies in cover; check and adjust irrigation	Mow lawns; check and adjust irrigation	Weed; inspect mulch for deficiencies in cover; check and adjust irrigation	Mow and trim lawns; treat for insects and disease; check and adjust irrigation
7	Reinstate mulch as required; treat plant material for insects and disease; mow lawns	Mow lawns; weed	Reinstate mulch as required; mow, trim and fertilise lawns	Weed
8	Weed; inspect condition of paving	Mow and trim lawns; inspect condition of paving	Weed; inspect condition of paving	Mow lawns; Inspect condition of paving

WEEK	SPRING (Sept, Oct, Nov)	SUMMER (Dec, Jan, Feb)	AUTUMN (Mar, Apr, May)	WINTER (Jun, Jul, Aug)
	and furniture; issue maintenance report	& furniture; issue maintenance report	and furniture; issue maintenance report	and furniture; issue maintenance report
9	Mow and trim lawns	Mow lawns; treat plant material for insects and disease	Mow lawns	Weed
10	Weed; mow lawns	Mow and topdress lawns	Weed; treat plant material for insects and disease	Mow and trim lawns
11	Mow and fertilise lawns; trim and adjust trees and shrubs	Mow lawns; trim and adjust lawns; weed	Mow and trim lawns; trim and adjust trees and shrubs	Prune back trees and shrubs after flowering
12	Weed; mow lawns; treat plant material for insects and disease	Mow, trim & fertilise lawns	Weed	Mow lawns; treat plant material for insects and disease
13	Check and adjust irrigation; mow lawns; issue maintenance report	Check and adjust irrigation; mow lawns; weed; issue maintenance report	Check and adjust irrigation; mow lawns; weed; issue maintenance report	Check and adjust irrigation; weed; issue maintenance report

3.4 IRRIGATION

Irrigation system maintenance schedule

Item	Frequency
Filters – mainline	Monthly
Electrical source output (auto system)	Monthly
Controller (automatic systems)	Monthly
Operation – progression - Station to Station.	Weekly
Proper activation of valves	Monthly
Proper timing of stations	6 monthly
Proper time and day readings	Weekly
Exterior appearance	6 monthly
Valve operation	6 monthly
Open, close completely (weeping)	Weekly
Sprinkler operation	Weekly
Rotaries – clogged nozzles	2 monthly
Plant obstructed pattern	2 monthly
Arc coverage	2 monthly
Radius adjustment	2 monthly
Pop-up action	2 monthly
Riser seal leaks	2 monthly
Set to grade	2 monthly
Coverage pressure	2 monthly
Rotational speed	2 monthly
Clogged screens	2 monthly
Head damage	2 monthly

Piping	2 monthly
Leaks – broken or cracked pipe	As Needed
Bad solvent welds, bad threaded	As Needed
Connection	As Needed
Clogged pipe	As Needed

0261 LANDSCAPE – FURNITURE AND FIXTURES

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide landscape furniture and fixtures, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.
- *0262 External sports and playground surfacing*.

1.3 SUBMISSIONS

Operation and maintenance manual
Requirement: Submit the manufacturer's published use, care and maintenance requirements for each item.

Products and materials
Requirement: Submit the manufacturer’s standard drawings and details showing methods of construction, assembly and installation; with dimensions and tolerances.

Type test: Submit results as follows:

- Playground equipment: To AS 4685 series.

Shop drawings
Custom-built furniture and fixtures: Submit shop drawings to a scale that best describes the details, showing methods of construction, assembly and installation, with dimensions and tolerances.

Subcontractors
General: Submit names and contact details of proposed suppliers and installers.

Warranties
Requirement: Submit the manufacturer's published product warranties.

1.4 INSPECTION

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

- Custom-built furniture and fixtures fabricated and ready to be delivered to the site.
- Furniture items delivered to site before installation.
- Site locations or substrates prepared to receive furniture or fixtures before installation.
- Set-out of furniture and fixtures.
- Completed installation.

2 PRODUCTS

2.1 GENERAL

Storage and handling
General: Deliver, unload and store products and accessories in sealed manufacturer's packaging.

Preservative treatment
CCA treated timber: If proposed, provide details.

Labelling
Playground equipment: To AS 4685 series.

Weathering steel
Standard: To AS/NZS 3678.

Grade: WR350.

3 EXECUTION

3.1 INSTALLATION

Erection
Line and level: Erect posts or poles vertically. Erect furniture items level. Where installed on slopes, provide a level area around benches and seats.

Sand pits
Requirement: Compact aggregate to 100 mm depth after installation of play structure components. Lay agricultural pipe in aggregate and cover with filter fabric allowing for a fall of 1:75 towards the agricultural pipe. Top up with 300 mm (minimum) sand.

3.2 COMPLETION

Cleaning
General: On completion, remove protective coatings, clean all surfaces and remove all labels not required for maintenance, or by AS 4685 series.

4 SELECTIONS

4.1 FURNITURE

Benches
Type: Cantilevered bench CS1

Description: Cantilevered bench – L 1800 x W 800 x H 450 (2 joined back to back)

Supplier: CSA

Product No.: TM4540

Frame Finish: Mild Steel Powder coated black.

Batten: Australian Hardwood Timber (Class 1) Quantum Gold Oil Finish

Fixing: To Manufacturers Specifications

Type: Cantilevered bench WMS

Description: Wall Mounted Seat - Berwick curved bench modified as wall mounted and radius to suit wall.

Supplier: CSA

Product No.: TM4351

Frame Finish: Mild Steel Powder coated black.

Batten: Australian Hardwood Timber (Class 1) Quantum Gold Oil Finish

Fixing: To Manufacturers Specifications

Seats and tables
Type: Harbour bench CS2

Description: Harbour Bench w/ armrest and backrest – L 1800 x W 800 x H 450 (2 joined back to back)

Supplier: CSA

Product No.: TM4531

Frame Finish: Mild Steel Powder coated black.

Batten: Australian Hardwood Timber (Class 1) Quantum Gold Oil Finish

Fixing: To Manufacturers Specifications

Type: Harbour bench CS3

Description: Harbour Bench with armrest and backrest - L 1800 x W 400 x H 450

Supplier: CS3

Product No.: TM4531

Finish: Australian Hardwood Timber (Class 1) Quantum Gold Oil Finish

Fixing: To Manufacturers Specifications

4.2 PLANTING FITTINGS

4.3 FIXTURES

Bollards
Type: Elliptical Bollard – Fixed - B

Description: Fixed Bollard

Supplier: CSA

Product No.: SB2056

Size: Diameter 150mm High 1055mm

Finish: 304 Stainless Steel / Satin Polished

Fixing: To Manufacturers Specifications

Type: Elliptical Bollard – Removeable - RB

Description: Removeable Bollard

Supplier: CSA

Product No.: SB2056

Size: Diameter 150mm High 1055mm

Finish: 304 Stainless Steel / Satin Polished

Fixing: To Manufacturers Specifications

Drinking fountain
Type: Drink and refill station

Description: Alpine double water refill station and drinking fountain - 2100mm High

Supplier: Aquafil

Finish: Stainless Steel

Fixing: To manufacturers specifications

Services connection: Drain connection to engineers details

Litter bins
Type: Bin

Description: Timber Bin Enclosure

Supplier: CSA

Product No.: LR6225 240L

Batten: 86x19mm Australian Hardwood Timber Battens (Class 1)

Lid Type: 1x 304 Mild steel & 1x Recycling lid

Frame: Mild steel- Powder coated black

4.4 CUSTOM-BUILT FURNITURE AND FIXTURES

Custom-built furniture and fixtures schedule

Properties	A	B	C
Description	Handrail	Balustrade	
Location	As shown on Drawings	As Shown on Drawings	
Size	Steel 44.45mm OD 3.2mm – Height 1100mm	Refer detail	

Properties	**A**	**B**	**C**
Material	316 Stainless Steel	Stainless Steel Powdercoasted finish - black	
Finish	Linished		
Fixings			
Certification	TBC		

0271 PAVEMENT BASE AND SUBBASE

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide base and subbase courses as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0222 Earthwork*.

1.3 INTERPRETATION

Definitions

General: For the purposes of this worksection, the following definitions apply:

- Base: One or more layers of material, forming the uppermost structural element of a pavement and on which the surfacing may be placed.
- Subbase: Material laid on the subgrade below the base either for the purpose of making up additional pavement thickness required, to prevent intrusion of the subgrade into the base, or to provide a working platform.

1.4 SUBMISSIONS

Execution details

General: Submit details of the proposed work methods and equipment for each pathway and roadworks operation, including the following:

- Staging of the work, access and traffic control methods.
- Disposal of surface water, control of erosion, contamination and sedimentation of the site, surrounding areas and drainage systems.

Compaction: If a layer is proposed to exceed 200 mm in thickness, submit evidence that the proposed compaction equipment can achieve the required density throughout the layer.

Products and materials

Source of material: Submit the supplier name, material type (crushed rock, natural gravel, recycled concrete aggregate) and source quarry or recycling site.

Conformance: Submit type test results for each material listed in the **Base material properties and test methods table** and **Subbase material properties and test methods table** from an Accredited testing laboratory as evidence of material conformance.

1.5 INSPECTION

Notice

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

- Prepared subgrade.
- Proof rolling of subbase before spreading of base.
- Proof rolling of base before sealing.

2 PRODUCTS

2.1 BASE AND SUBBASE MATERIAL

Granular material

Requirement: Provide unbound granular materials, including blends of two or more different materials, which when compacted develop structural stability and are uniform in grading and physical characteristics.

Crushed rock

Requirement: Provide crushed rock as follows:

- Base: 20 mm nominal.
- Subbase: 40 mm nominal.

Recycled materials

Requirement: Provide recycled materials as follows:

- Base and subbase: Conform to the **Limits on use of recycled and manufactured materials as constituent materials table** and the **Undesirable material properties table**.

Natural gravel

Requirement: Provide unbound natural gravel materials as follows:

- Base: 20 mm nominal.
- Subbase: 40 mm nominal.

Subbase material properties and test methods table

Property and test method	**Differentiating criteria**	**Material requirements**	
		Crushed rock	**Natural gravel**
Particle size distribution or grading (% passing through sieve) to AS 1289.3.6.1	**Sieve size (mm)**	—	—
	53.0 mm	100	100
	37.5	90 - 100	95 - 100
	26.5	74 - 96	80 - 97
	19.0	62 - 86	—
	13.2	—	—
	9.5	42 - 66	48 - 85
	4.75	28 - 50	35 - 73
	2.36	20 - 39	25 - 58
	0.425	8 - 21	10 - 33
	0.075	3 - 11	3 - 21
Liquid limit (w_L) to AS 1289.3.1.1	—	max 25%	max 25%
Plasticity index (I_P) to AS 1289.3.3.1	—	max 12%	max 12%
Linear shrinkage (*LS*) to AS 1289.3.4.1	**Rainfall**	—	—
	Areas with annual rainfall > 500 mm	max 4.5%	max 4.5%
	Areas with annual rainfall < 500 mm	max 6.0%	max 6.0%
Maximum dry compressive strength on fraction passing 19 mm sieve (only applies if plasticity index is less than 1) to AS 1141.52	—	min 1.0 MPa	min 1.0 MPa

Property and test method	Differentiating criteria	Material requirements	
		Crushed rock	Natural gravel
Particle shape by proportional calliper - % misshapen (2:1) to AS 1141.14	—	max 35%	—
Aggregate wet strength* to AS 1141.22	—	min 50 kN	—
Wet/dry strength variation* (dry - wet)/dry to AS 1141.22	—	max 40%	—
Los Angeles value to AS 1141.23	—	max 40%	—
4 day soaked CBR (98% modified compaction) to AS 1289.6.1.1	—	min 30%	min 30%
*Use the fraction with the highest wet/dry strength variation as the value for determining conformance. Test the fraction 19.0 to 9.5 mm. For blended materials, also test the fraction 9.5 to 4.75 mm. Test any other fraction where there is risk of failing.			

Limits on use of recycled and manufactured materials as constituent materials table

Recycled material	Unbound or modified base and subbase	Bound base and subbase
Iron and steel slag	100%	100%
Crushed concrete	100%	100%
Brick	20%	10%
RAP	40%	40%
Fly ash	10%	10%
Furnace bottom ash	10%	10%
Crushed glass fines	10%	10%

Undesirable material properties table

Property and test method	Differentiating criteria	Material requirements		
		Crushed rock	Recycled material	Natural gravel
Undesirable constituent materials (% retained on a 4.75 mm sieve) to RMS T276	**Material type**	—	—	—
	Type I - Metal, glass, stone, ceramics and slag	—	max 2.0 %	—
	Type II - Plaster, clay lumps and other friable material	—	max 0.5%	—
	Type III - Rubber, plastic, paper, cloth, paint, wood and other vegetable matter	—	max 0.1%	—

Base material properties and test methods table

Property and test method	Differentiating criteria	Material requirements		
		Crushed rock	Recycled material	Natural gravel
Particle size distribution or grading (% passing	**Sieve size (mm)**	—	—	—
	26.5	100	100	100
	19.0	95 - 100	95 - 100	93 - 100

Property and test method	**Differentiating criteria**	**Material requirements**		
		Crushed rock	**Recycled material**	**Natural gravel**
through sieve) AS 1289.3.6.1	13.2	77 - 93	78 - 92	—
	9.5	63 - 83	63 - 83	71 - 87
	4.75	44 - 64	44 - 64	47 - 70
	2.36	29 - 49	30 - 48	35 - 56
	0.425	13 - 23	13 - 21	14 - 32
	0.075	5 - 11	5 - 9	6 - 20
Liquid limit (w_L) to AS 1289.3.1.1	—	max 25%	max 30%	max 25%
Plasticity index (I_P) to AS 1289.3.3.1	**Rainfall**	—	—	—
	All areas	—	—	—
	Areas with annual rainfall > 500 mm	max 6%	max 6%	max 6%
	Areas with annual rainfall < 500 mm	max 10%	max 10%	max 10%
Linear shrinkage (*LS*) to AS 1289.3.4.1	**Rainfall**	—	—	—
	All areas	—	—	—
	Areas with annual rainfall > 500 mm	max 2.0%	max 2.0%	max 2.0%
	Areas with annual rainfall < 500 mm	max 4.0%	max 4.0%	max 4.0%
For materials with plasticity index less than 1: Maximum dry compressive strength to AS 1141.52	—	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa
Particle shape by proportional caliper (% misshapen for 2:1 caliper ratio) to AS 1141.14	—	max 35%	max 35%	—
Aggregate wet strength* to AS 1141.22	—	min 80 kN	min 80 kN	—
Wet/dry strength variation* to AS 1141.22	—	max 35%	max 35%	—
Los Angeles value (% loss or abrasion) to AS 1141.23	—	max 35%	max 40%	—
CBR (98% modified compaction) to AS 1289.6.1.1	—	min 80%	min 80%	min 80%
Unconfined compressive strength to AS 5101.4	—	max 1.0 MPa	max 1.0 MPa	—
NOTES: *Use the fraction with the highest wet/dry strength variation as the value for determining conformance. Test the fraction 19.0 to 9.5 mm. For blended materials, also test the fraction 9.5 to 4.75 mm. Test any other fraction where there is risk of failing.				

Tests
Material property testing: Conform to the **Base material properties and test methods table** and the **Subbase material properties and test methods table**.

Frequency of material property tests: Not less than the following:

- Particle size distribution: 1 per 1000 t (or part of).
- Liquid limit: 1 per 1000 t (or part of).
- Plasticity index: 1 per 1000 t (or part of).
- Linear shrinkage: 1 per 1000 t (or part of).
- Foreign materials content: 1 per 1000 t (or part of).
- Maximum dry compressive strength: 1 per 5000 t (or part of).
- Particle shape: 1 per 1000 t (or part of).
- Los Angeles value: 1 per 1000 t (or part of).
- Aggregate wet strength: 1 per 5000 t (or part of).
- Wet/dry strength variation: 1 per 5000 t (or part of).

3 EXECUTION

3.1 SUBGRADE PREPARATION

General
Requirement: Prepare the subgrade in conformance with *0222 Earthwork*.

3.2 PLACING BASE AND SUBBASE

General
Weak surfaces: Do not place material on a surface that is weakened by moisture and is unable to support, without damage, the construction plant required to perform the works.

Spreading: Spread material in uniform layers without segregation.

Moisture content: Maintain wet mixed materials at the required moisture content before and during spreading. Add water to dry mixed materials through fine sprays to the entire surface of the layer after spreading, to bring the material to the required moisture content.

Compacted layer thickness: 200 mm maximum and 100 mm minimum. Provide layers of equal thickness in multilayer courses.

Joints
General: Plan spreading and delivery to minimise the number of joints. Offset joints in successive layers by a minimum of 300 mm.

Start of shift: Remix last 2 m of previous days' work for continuity of compaction.

Final trimming
General: Trim and grade the base course to produce a tight even surface with no loose stones or slurry of fines.

3.3 TOLERANCES

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

Subbase: + 10 mm, - 25 mm.

Base: + 10 mm, - 5 mm.

Base abutting gutters: ± 5 mm from the level of the lip of the gutter, minus the design thickness of the wearing course.

Surface deviation
Base: ≤ 5 mm from a 3 m straightedge laid on the surface.

3.4 BASE AND SUBBASE COMPACTION

General
Construction operation: Compact each layer of fill to the required depth and density, as a systematic construction operation.

Unstable areas: If unstable areas develop during rolling or are identified by proof rolling, open up, dry back and recompact, to the requirements of this worksection. If dry back is not possible, remove for the full depth of layer, dispose of and replace with fresh material.

Minimum relative compaction table

Item description	Minimum dry density ratio (modified compaction) to AS 1289.5.2.1
Subbase	95%
Base	98%

Compaction requirements
General: Apply uniform compactive effort over the whole area to be compacted, until the required density is achieved or until failure is acknowledged. If failure is acknowledged, conform to **Rectification**.

Equipment: Use rollers appropriate to the materials and compaction requirements documented.

Moisture content
General: During spreading and compaction, maintain material moisture content within the range of -2% to +1% from the optimum moisture content (modified compaction).

Spraying: Use water spraying equipment to distribute water uniformly, in controlled quantities, over uniform lane widths.

Dry back: Allow materials to dry to 60 to 80% of the optimum moisture content before applying the seal or wearing course.

Rectification
General: If a section of the pavement material fails to meet the required density or moisture content after compaction, remove the non-conforming material, dispose of off-site or rectify for re-use, replace with fresh material, and re-compact.

Level corrections
General: Rectify incorrect levels as follows:

- High areas: If the area can be rectified by further trimming to produce a uniform, hard surface by cutting without filling, trim so that the rectified area conforms to **TOLERANCES**.
- Low areas and high areas not rectifiable by further trimming: Remove layers to a minimum depth of 75 mm, lightly tyne and replace with new material and re-compact.

3.5 TESTING

Site tests

Compaction control tests: To AS 1289.5.4.1 and AS 1289.5.4.2.

Frequency of compaction control tests: Not less than the following (whichever requires the most tests):

- 1 test per layer per 100 lineal metres for two-lane roads.
- 1 test per layer per 2000 m^2 for carparks.
- 3 tests per layer.
- 3 tests per visit.

0274 CONCRETE PAVEMENT

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide concrete pavement as documented.

Performance

Requirement:

- Free draining and evenly graded between level points.
- Even and smooth riding surface.

Conformance: Conform to the local authority requirements for levels, grades and minimum thickness, reinforcement and concrete strength for pavements within the kerb-and-gutter property boundaries.

1.2 GREENSTAR REQUIREMENTS

The project is targeting a 4 star Green Star Design & As Built v1.2 rating. The Contractor must ensure they have received a copy of JHA's ESD Specification, JHA Detailed Design Report, Climate Adaptation Plan and other Project Documentation which form part of the tender contract documentation and shall be read in conjunction with this specification, all drawings and schedules.

It is the Contractor's responsibility to comply with all Green Star requirements and targeted credits and detailed compliance requirements as nominated in the ESD Green Star Specification, JHA ESD Detailed Design Report, Climate Adaptation Plan and other Project Documentation.

This includes but is not limited to all concrete complying with the requirements stated in the ESD Specification and providing solar reflectance index data for hardscaping elements in pursuit of the heat island effect credit as detailed in the ESD Specification.

Should there be a discrepancy between this document, the Project Documentation and ESD Specification, the ESD Specification shall take precedence.

1.3 DESIGN

General

Coordination: Determine the local authority requirements that may affect grades, transitions and work zones, including the following:

- Drainage.
- Trees (due to settlement).
- Adjacent structures.

1.4 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0222 Earthwork*.
- *0271 Pavement base and subbase*.

1.5 STANDARDS

Concrete

Specification and supply: To AS 1379.

Materials and construction: To AS 3600.

Residential pavements: To AS 3727.1.

Slip resistance
Classification: To AS 4586.

1.6 INTERPRETATION

Definitions
General: For the purposes of this work section the following definitions apply:

- Ambient temperature: The air temperature at the time of mixing and placing of concrete.
- Concrete class – normal: Concrete that is specified primarily by a standard compressive strength grade up to 50 MPa and otherwise in conformance with AS 1379 clause 1.5.3.
- Concrete class – special: Concrete that is specified to have certain properties or characteristics different from, or additional to, those of normal-class concrete and otherwise in conformance with AS 1379 clause 1.5.4.
- Weather – cold: Ambient shade temperature less than 10°C.
- Weather – hot: Ambient shade temperature greater than 30°C.

1.7 TOLERANCES

General
Surface abutting gutters: ± 5 mm from the level of the gutter edge.

Rigid pavement surface:

- From design level: + 10 mm, - 0 mm.
- From a 3 m straightedge placed anywhere on surface: 5 mm.

Horizontal position of outer concrete edge: 30 mm from documented position.

Joint locations in plan : 10 mm from documented position.

1.8 SUBMISSIONS

Certification
Test certificates and records: Submit test certificates and also retain results on site.

Compliance certificate: If product testing is not proposed, submit a manufacturer's certificate together with results of recent tests undertaken by the manufacturer, showing compliance with test criteria.

Execution details
Concrete: Submit proposals for mixing, placing, finishing and curing concrete including the following:

- Addition of water on site.
- Changes to the concrete mix.
- Temperature control, curing and protection methods.
- Cutting or displacing reinforcement.
- Handling, placing, compaction and finishing methods and equipment, including pumping.
- Sequence, size and times of concrete pours, and construction joint locations and relocations.

Cores, fixings and embedded items: If required, submit shop drawings showing the proposed locations, clearances and cover, and indicate any proposed repositioning of reinforcement.

Cutting or coring: If cutting or coring of hardened concrete is proposed, provide details.

Sawn joints: Submit proposed methods, timing and sequence of sawing joints.

Damaged galvanizing: If repair is required, submit proposals to AS/NZS 4680 Section 8.

Splicing: If undocumented splicing is proposed, submit details.

Welding: If welding of reinforcement is proposed, provide details and give notice before welding reinforcement.

Joint sealants: Submit proposals for installation methods and sealant performance.

Crack assessment: If unplanned cracks occur in the finished pavement, submit proposals for investigation.

Surface repair method: If required, submit details of the proposed method before commencing repairs.

Trial section: Submit proposal for trial pavement.

Products and materials

Aggregates: Nominate the source for all aggregates.

Reinforcement: Submit the manufacturer's certificate of compliance with AS/NZS 4671, or submit test certificates from an Accredited Testing Laboratory.

Liquid curing compounds: Submit certified test results, including the application rate and the efficiency index to AS 3799 Appendix B.

Curing by covering: Submit details of the proposed covering material.

Repair materials: Submit proposals for epoxy resin/grout and elastomeric sealant.

Concrete: Submit the concrete supply delivery dockets.

Trial mix design report: Six weeks before commencing production, submit a report for each mix design containing the information required in AS 1012.2, the individual and combined aggregate particle size distribution, and the records and reports for the tests.

Subcontractors

Pre-mixed supply: Submit names and contact details of proposed pre-mixed concrete suppliers, and alternative source of supply in the event of breakdown of pre-mixed or site mixed supply.

Tests

Site tests: Submit results, as follows:

- Slip resistance test of completed installations.

1.9 INSPECTION

Notice

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

- Base or subgrade before covering.
- Membrane or film underlay installed on the base or subgrade.
- Concrete formwork, reinforcement and dowels in position.
- Commencement of concrete placing.
- Completion of concrete placing.
- Evaluation of surface finish.

2 PRODUCTS

2.1 REINFORCEMENT

Steel reinforcement
Standard: To AS/NZS 4671.

Surface condition: Free of loose mill scale, rust, oil, grease, mud or other material that may reduce the bond between the reinforcement and concrete.

Protective coatings
Requirement: For concrete containing protective coated reinforcement, provide the same coating type to all reinforcement and embedded ferrous metal items, including tie wires, stools, spacers, stirrups, plates and ferrules.

Epoxy coating: Provide high build, high solids chemically resistant coating to AS/NZS 3750.14.

- Thickness: 200 µm minimum.

Galvanizing: To AS/NZS 4680, as follows:

- Sequence: If fabricating after galvanizing, repair damaged galvanising and coat cut ends.
- Zinc-coating (minimum): 600 g/m^2.

Steel fibres
Fibre reinforcement: To CIA CPN35.

Steel fibre content: 45 to 75 kg/m^3 and the steel fibre manufacturer's recommendations.

Accessories
Reinforcement supports: To AS/NZS 2425.

Tie wire: Galvanized annealed steel 1.25 mm diameter minimum.

Dowels
General: Provide each dowel in one piece, straight, cut accurately to length with ends square and free from burrs.

Standard: To AS/NZS 4671.

Grade: 250R steel bars 450 mm long.

Tie bars
Type: Deformed bar, 12 mm diameter, grade 500N, 1 m long.

2.2 AGGREGATE

Characteristics
Standards: AS 2758.1.

Aggregate: 10 -14mm crushed “Sunset Gold” river gravel

2.3 Curing

Use a method not inferior to covering the top with polythene sheet, which prevents cracking or crazing resulting from drying shrinkage.

Finishing

Pavement is to be water washed to expose a minimum 80% of aggregate in plan view, and to match the approved sample. The exposed aggregate finish shall be achieved by water washing the paved concrete using a water source of even pressure with a very fine spray prior to setting of the cement (ie within hour of paving). Washing should occur with the falls and across the narrowest width.

After the initial wash the surface is either worked over with a trowel or roller to ensure that the aggregate is fully embedded and compacted.

Some areas may appear to have poor exposed aggregate density. Stone from the excess of the pour should be trowelled into place to give a more uniform finish.

When the aggregate has been sufficiently brought together , and just prior to setting , the concrete is again washed to remove the slurry brought to the surface and to expose the aggregate. In areas of the slab where necessary the process is repeated a third time to ensure a uniform finish.

Further cleaning down with an approved acid wash may be required after the initial setting of the concrete (3-5 days).

It will be the Contractor's responsibility to obtain the required concrete finish without adversely affecting the other required concrete properties. Alternative methods of obtaining the exposed surface would be considered subject to the approval of the Superintendent.

Submit details of any alternatives at time of tender.

The visual appearance of the exposed aggregate shall match that of the forecourt of Liverpool Hospital on the corner of Elizabeth and Goulburn Streets, Liverpool, and the surrounds of the Exhibition Halls (RAS Dome + Halls) at Sydney Olympic Park The aggregate shall be 'close knit' and be of the sizes and blends as specified.

Protect surface of building walls during washing of concrete paving.

2.4 Falls & Levels

2.5 Grading: Where drainage is necessary, grade the paving surface to fall evenly, without ponding, to the outlets or surface run-off system provided.

2.6 Finished level

2.7 Maintain the same finished level across junctions between different finishes.

2.8 Deviations

Deviation of the finished paved surface from its required form, and without any ponding:-
Maximum ± 10 mm in 3 m from the bottom edge of a straightedge laid in any direction on an area of uniform grade.

3 CLEANING

3.1 Leave paving finish clean on completion. At the completion of all construction, wash all pavements to remove stains, laitance and the like, to achieve an even textured and uniform appearance concrete surface.

Durability: Tested to AS 1141.22:

- Wet strength not less than 80 kN.
- 10% Fines Wet/Dry Variation not to exceed 35%.

Recycled concrete aggregate (RCA): If blending coarse RCA with natural aggregates, make sure substitution rates are below 30%.

3.2 CEMENT

General
Standard: To AS 3972.

Type: CCS Colour Systems Colour Swatch: Echidna

Grey concrete is to be integrally coloured with Concrete Colour Systems CCS by adding pre-formulated bags (refer to quantity nominated under colour swatch) per cubic metre of 25 or 32MPa concrete. Create surface texture using a broom (or nominate alternative finish). Cure with Australian Standards compliant CCS Slab Clad R curing compound or a used wet hessian cloth. At the completion of the curing period, remove dirt and remnants of the curing compound with CCS HD Degreaser. Rinse, allow the concrete to completely dry.

Moisture: Protect from moisture until used. Do not use caked or lumpy cement.

Age: Less than 6 months old.

Storage: Store cement bags under cover and above ground.

Supplementary cementitious materials
Fly ash: To AS/NZS 3582.1.

Slag: To AS 3582.2.

Amorphous silica: To AS/NZS 3582.3.

3.3 WATER

General
Quality: Drinking water free from materials harmful to concrete or reinforcement, and not salty or brackish.

Limits: Not containing more than:

- 600 parts per million of chloride ion, tested to AS 3583.13.
- 400 parts per million of sulphate ion, tested to AS 1289.4.2.1.

3.4 ADMIXTURES

General
Standard: Chemical admixtures to AS 1478.1, used to the manufacturer's recommendations.

Quality: Free from calcium chloride, calcium formate, or triethanolamine or any other accelerator. Do not use admixtures or combinations of admixtures without prior written approval.

Dosage: Vary the dosage of chemical admixture to account for factors such as air temperature, setting time and cement content to the manufacturer's recommendations.

Types of admixtures
Air entraining agent: Adjust mix for workability allowing up to 5% air entrainment.

Warm season retarder: During the warm season, (October to March inclusive), use a lignin or lignin-based (ligpol) set-retarding admixture (Type Re or Type WRRe) if required to control slump within the limits stated in Concrete mix, properties.

Cool season accelerator: During the cool season, (April to September inclusive), use only a lignin or lignin based set-retarding admixture, if required, containing not more than 6% reducing sugars (Type Ac or Type WRAc to AS 1478.1).

3.5 CURING COMPOUNDS

General
Curing compounds: To AS 3799 and AS 1160, Type 2.

Sheet material covering: To ASTM C171, white opaque or clear polyethylene film, or white burlap-polyethylene sheet, or equivalent material.

3.6 OTHER MATERIALS

Tactile ground surface indicators
Standard: To AS/NZS 1428.4.1.

4 EXECUTION

4.1 GENERAL

Traffic control
Traffic restriction: Do not allow traffic or construction plant other than that associated with testing, sawcutting, cleaning or joint sealing on pavement for minimum 10 days after placing, or when the concrete has reached a compressive strength of at least 20 MPa, and joints have been completely sealed.

4.2 SUBGRADE

Preparation
Conformance: Prepare subgrade to *0222 Earthwork*.

Extent: Prepare a uniform subgrade for the full pavement formation, extending at least to the back of kerbs or at least 300 mm beyond each side of the carriageway if kerbs are not proposed.

Reinstatement: Make sure of uniformity for backfilling of any utility trenches.

4.3 SUBBASE

Thickness
Subbase thickness: To engineers Details

Width
Subbase width: Extend the subbase at its full depth to at least the back of kerbs or other edge stops before their installation.

No integral kerbs: Extend granular unbound subbase at least 300 mm beyond each side of the carriageway.

Tolerance
Subbase finished surface level: + 0 mm, - 10 mm.

Placement
Bound and unbound subbase materials and placement: To *0271 Pavement base and subbase*.

Friction reduction
Requirement: Provide 200 µm thick polyethylene sheeting with 200 mm taped minimum laps and/or a 20 mm thick layer of sand (silt and clay material less than 5%) directly beneath the concrete pavement.

4.4 TRIAL PAVEMENT

General
Requirement: Provide a trial section of pavement to demonstrate that the proposed method of placement produces a conforming pavement. Remove test sections that do not comply with requirements.

Minimum area of test section: 1x1m panel

Location: Multi Trade Hub Plaza

4.5 CONCRETE MIX

Standard
Concrete mix and supply: To AS 3600 clause 17.1 and AS 1379.

Properties
Concrete pavement thickness: Pedestrian Paving 100mm Thick
Vehicular paving 200mm thick
Concrete pavement strength: To Engineers Details

Slump: Maximum 100 mm.

Drying shrinkage: Maximum 450 με after 21 days of air drying.

Special class concrete additional properties
Insitu concrete paving with exposed aggregate finish
Pedestrian Paving P1A- 100mm Thick
Vehicular paving P1B - 200mm thick
Jointing Nom 2000 x 3000mm saw cut joints
Expansion Joints : along structures or as indicated
Aggregate: Crushed River Pebble nom 10 dia
Colour: CCS Colour Systems - Snow

Elapsed delivery time
General: Make sure that the elapsed time between the wetting of the mix and the discharge of the mix at the site is in conformance with the **Elapsed delivery time table**. Do not discharge at ambient temperature below 10°C or above 30°C unless approved heating or cooling measures are taken to deliver concrete within the range 5°C to 35°C.

Elapsed delivery time table

Concrete temperature at time of discharge (°C)	Maximum elapsed time (minutes)
5 – 24	120
24 – 27	90
27 – 30	60
30 – 35	45

Site mixed supply
Emergencies: If mixing by hand, provide details.

Plant: Mix concrete in a plant located on the construction site.

Pre-mixed supply
Addition of water: Do not add water.

Transport: Make sure the mode of transport prevents segregation, loss of material and contamination of the environment, and does not adversely affect placing or compaction.

Concrete delivery docket: For each batch, provide a docket listing the information required by AS 1379 clause 1.7.3, and the following information:

- Any binders or additives.
- Method of placement and climate conditions.
- Name of concrete delivery supervisor.
- The concrete element or part of the works for which the concrete was ordered, and where it was placed.

4.6 TESTING

Standards
Sampling, identification, testing and recording: To the AS 1012 series.

Specimens: Sample the concrete on-site, at the point of discharge from the agitator.

Type and frequency: To AS 1379.

Testing authority: Concrete supplier or Accredited Testing Laboratory.

Concrete testing methods
Slump: To AS 1379 clause 5.2.

Compressive strength: Test to AS 1012.8.1 and AS 1012.9.

Drying shrinkage: Test to AS 1012.8.4 and AS 1012.13.

Flexural strength: Test to AS 1012.8.2 and AS 1012.11.

Acceptance criterion for strength: The average strength of any set of 3 consecutive project samples must be equal to or greater than the specified minimum value.

Sampling frequency: Provide a minimum of one sample from each 50 m^3 of concrete.

4.7 INSTALLATION

Junctions with existing pavements

Trimming: If new pavement is to be joined to an existing pavement, trim the edge of the existing pavement to create a neat vertical edge for its full depth before placing new pavement material.

Fixed formwork

Description:

- Steel forms.
- Seasoned, dressed timber planks, free of warps, bends or kinks.

Depth: Equal to the edge thickness of the slab and in one piece.

Tolerances on position:

- Level of top of form: - 0 mm, + 10 mm from pavement surface design level.
- Horizontal tolerance: 10 mm (maximum departure from a plane surface).
- Verticality: 3 mm departure from vertical.

Staking: Stake forms in position using at least 3 steel stakes per form, not more than 1.5 m apart. Lock joints between form sections to prevent movement.

Release agent: Before placing reinforcement, apply a release agent compatible with the contact surfaces, to the interior of the formwork, except where the concrete is to receive an applied finish for which there is no compatible release agent.

Re-use: Clean and recoat the forms each time before placing concrete.

Keyways: Form the keyways of keyed construction joints using steel or timber form strips accurately located at the mid-depth of the slab and securely fastened flush against the formwork face.

Reinforcement

Tolerances in fabrication and fixing: To AS 3600.

Locate reinforcement: Place reinforcement in the top half of the pavement.

Minimum cover to reinforcement: 30 mm.

Splicing mesh: Overlap a minimum of 2 crosswires.

Supports: Provide reinforcement supports as follows:

- Able to withstand construction and traffic loads and maintain the concrete cover, as documented.
- With a protective coating if they are ferrous metal extending to the surface of the concrete.
- Use plastic or concrete supports with galvanized or zinc-coated reinforcement.
- Spacing:
  - Bars: ≤ 60 diameters.

. Mesh: ≤ 600 mm.
- Supports over membranes: Prevent damage to waterproofing membranes or vapour barriers. If appropriate, place a metal or plastic plate under each support.

Projecting reinforcement: If starter or other bars extend beyond reinforcement mats or cages, through formwork or from cast concrete, provide a plastic protective cap to each bar until it is cast into later work.

Tying: Secure the reinforcement against displacement at intersections with either wire ties, or clips. Bend the ends of wire ties away from nearby faces of formwork or unformed faces to prevent the ties projecting into the concrete cover.

Mats: For bar reinforcement in the form of a mat, secure each bar at alternate intersections.

Cores, fixings and embedded items
Position: Fix cores and embedded items to prevent movement during concrete placing. In locating cores, fixings and embedded items, displace but do not cut reinforcement, and maintain cover to reinforcement.

Isolation: Isolate embedded items to prevent water tracking to concrete providing minimum cover to reinforcement.

4.8 CONCRETE PLACING AND COMPACTION

Concrete placing
General: Place concrete uniformly over the width of the slab or lane and so that the face is generally vertical and normal to the direction of placement. Hand spread concrete using shovels, not rakes.

Ponding: Remove any water ponding on the base or subbase before starting placement.

Placing sequence: Commence from one corner (usually the lowest point) and proceed continuously out from that point.

Weather: Do not place concrete in ambient temperatures above 30°C or below 10°C, without adequate precautions.

Compaction
Thickness 100 mm or less: Compact by placing, screeding and finishing processes. If required use a hand-held vibrating screed at the surface. Do not use immersion vibrators.

Thickness more than 100 mm and downturns: Use an immersion vibrator.

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

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

Rain
Protection: During placement and before setting, protect surface from damage.

Concrete placing in cold weather
Cement: Do not use high alumina cement.

Temperature limits: Maintain the following:

- Freshly mixed concrete: ≥ 5°C.
- Formwork and reinforcement before and during placing: ≥ 5°C.
- Water: Maximum 60°C when placed in the mixer.

High early strength cement: If deteriorating weather conditions are predicted, use high early strength cement.

Temperature control: Heat the concrete materials, other than cement, to the minimum temperature necessary so that the temperature of the placed concrete is ≥ 5°C.

Admixtures: Do not use calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete.

Frozen materials: Do not allow frozen materials or materials containing ice to enter the mixer, and keep free of frost and ice any formwork, materials, and equipment coming in contact with the concrete.

Placed concrete: Prevent from freezing, without using salts or chemicals.

Concrete placing in hot weather

Handling: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses.

Hot weather placing: Maintain concrete at a temperature ≤ 35°C.

Formwork and reinforcement: Before and during placing maintain temperature ≤ 35°C.

Severe weather: If ambient shade temperature more than 38°C, do not mix concrete.

Temperature control: Select one or more of the following methods of maintaining the specified temperature of the placed concrete:

- Cool the concrete using liquid nitrogen injection before placing.
- Cover the container in which the concrete is transported to the forms.
- Spray the coarse aggregate using cold water before mixing.
- Use chilled mixing water or ice.

Evaporation control barriers: Erect barriers to protect freshly placed concrete from drying winds.

4.9 CONCRETE FINISH

General

Commencement: Immediately after placement, spreading and compaction of the concrete, start initial finishing procedures to achieve the documented finish.

Final finishing: Do not commence final finishing until all bleed water has evaporated from the surface after initial finishing procedures.

Unformed surfaces

General: Strike off, screed and level slab surfaces to finished levels, to the tolerance class and finish documented.

Formed surfaces

Damage: Do not damage concrete works through premature removal of formwork.

Curing: If forms are stripped when concrete is at an age less than the minimum curing period, commence curing exposed faces as soon as the stripping is completed.

Finishing methods - primary finish
Machine float finish:

- After levelling, consolidate the surface using a machine float.
- Cut and fill and refloat immediately to a uniform, smooth, granular texture.
- Hand float in locations inaccessible to the machine float.

Wood float finish: After machine floating use wood or plastic hand floats to produce the final consolidated finish free of float marks and uniform in texture and appearance.

Broom finish: After machine floating and steel trowelling draw a broom or hessian belt across the surface to produce a coarse even-textured transverse-scored surface.

Scored or scratch finish: After screeding, give the surface a coarse scored texture using a stiff brush or rake drawn across the surface before final set.

Sponge finish: After machine floating and steel trowelling, obtain an even textured sand finish by wiping the surface using a damp sponge.

Finishing methods - supplementary finish
Abrasive blast: After steel trowelling, abrasive blast the cured surface to provide texture or to form patterns without exposing the coarse aggregate, using hard, sharp graded abrasive particles.

Coloured applied finish: After machine floating, apply a proprietary liquid or dry shake material to the manufacturer's recommendations and trowel to achieve the required appearance.

Stamped and coloured pattern finish: Provide finishing system.

Surface repairs
Method: If surface repairs are required, detail proposals.

4.10 CONCRETE CURING

General
Curing: Commence curing as soon as possible after finishing, when the concrete has set sufficiently not to be damaged by the curing process, and extend for a minimum period of 7 days.

End of curing period: Prevent rapid drying out at the end of the curing period.

Protection: Maintain at a reasonably constant temperature with minimum moisture loss, during the curing period.

Cold weather curing
General: Maintain concrete surface temperatures above 5°C for the duration of the curing period.

Hot weather curing
Requirement: If the concrete temperature exceeds 25°C, or the ambient shade temperature exceeds 30°C, protect from drying winds and sun by using an evaporative retarder until curing is commenced.

Curing methods
Covering sheet method: Cover concrete using damp hessian or cotton mats overlapped at least 150 mm and anchored against displacement by wind or other interference. Keep the mats continuously damp until covered by the covering sheet material. Repair tears immediately.

Moist curing method: Keep the concrete surface continuously damp by ponding or spraying constantly with water, fog, or mist, using suitable spraying equipment. Continue wetting for the curing period.

Curing compound: Provide a uniform continuous flexible coating to AS 3799, without visible breaks or pinholes. Make sure coating remains unbroken at least for the required curing period after application. Respray defective areas within 30 minutes. Respray within 3 hours after heavy rain.

Self-levelling toppings: If used also as curing compounds, conform to AS 3799.

Coloured concrete: Do not cure with plastic sheeting, damp sand or wet hessian. Use only chemical curing compounds compatible with the sealer or a sealer to the manufacturer's recommendations.

4.11 JOINTS

General

Requirement: Construct expansion, contraction and construction joints straight and plumb. Make transverse joints normal to longitudinal joints. Extend transverse expansion and contraction joints continuously from edge to edge of the pavement through interconnected slabs.

Joint layout: Install joints as documented.

Contraction joints

Installation: Construct transverse and longitudinal contraction joints by early power sawing at an appropriate time, tooling or by placing an insert in the fresh concrete.

Dowelled joints

Requirement: Place dowels as documented, orthogonal to the joint direction and parallel to the pavement surface, accurate alignment is critical.

Dowel assembly: Use a dowel-assembly support frame firmly secured to the subbase during concrete placement. Prevent the dowel assembly support frame from passing through the joint. Do not insert dowels during the placement of concrete.

Debond dowel: Provide a proprietary sleeve or coat with a debonding coating to 0.5 length + 25 mm. Embed the unsleeved or unpainted half of the dowels in the slab placed first.

Dowelled expansion joints: Cap dowels at one end with a compressible material.

Movement: Do not distort or displace beyond the alignment tolerances under testing or during construction. Do not remove and replace dowels in pre-formed holes.

Dowel tolerances:

- Alignment: 1:150.
- Location: ± half the diameter of the dowel.

Tie bar joints

Longitudinal contraction joints: Place tie bars at 800 mm centres. Alignment accuracy of tie bars is not critical.

Construction joints

Installation: Place header board on the subbase or subgrade at right angles to the pavement centre line.

Planned location: Terminate each day’s placing operation at a transverse construction joint located to coincide with a planned contraction or expansion joint.

Unplanned joints: If placement is interrupted for 30 minutes or longer, form a tied transverse construction joint within the middle third of the distance between planned joints but no closer than 1.5 m to the nearest planned joint. If necessary remove placed concrete back to the required location.

Expansion joints
Joint filling: Fill with jointing materials as documented. Finish visible jointing material neatly flush with adjoining surfaces.

Jointing materials: Provide jointing materials compatible with each other, and non-staining to concrete in visible locations.

Foamed materials (in compressible fillers): Closed-cell or impregnated, not water absorbing.

Isolation joints
Requirement: Provide formed full depth joints around structures and features which project through, into or against the pavement, and elsewhere as required.

Formed joints
Full depth joints: Form the edge of the concrete placed first to provide a smooth, vertical face. After stripping and cleaning fix the joint filler with a suitable waterproof adhesive to the face of the slab, and place the adjoining concrete after the adhesive has set.

Weakened plane joint: Cut a crack-inducing groove by using a suitable tool into the plastic concrete during finishing of the concrete surface. Compact and refinish the plastic concrete around the groove after forming the joint.

Rebated groove joints: Form the rebate by securely fixing removable steel or timber form strips to the form or forms on the slab which is placed first, so that the top of the strip is flush with the top of the form. After stripping and cleaning, fix the joint filler in the rebate after placing the adjoining concrete.

Sawn joints
Weakened plane joint: Saw the hardened concrete to depth at least ¼ to ⅓ of the pavement thickness and to a uniform width in the range of 3 to 5 mm as follows:

- Timing: Commence sawing, regardless of time or weather conditions, as soon as the concrete has hardened sufficiently to permit cutting with only minor ravelling of the edges of the saw cut. Complete sawing no later than 24 hours after concrete placement.
- Sequence: If possible, saw every third transverse joint initially, then saw the intermediate joints. Start where concrete placement commenced.
- Cracking: If the concrete has already cracked near the location chosen for a joint, do not saw a joint in that location. If a crack develops ahead of the saw cut, discontinue sawing and submit proposals for extra sawn joints.
- Stand-by machines: Provide one stand-by sawing machine for each machine planned to be used.
- Cleaning and protection: Immediately after each joint is sawn, flush the saw cut and adjacent concrete surface using water, until the waste from sawing is removed from the joint.

Rebated groove joints: Saw straight, parallel sided grooves for joint seals on top of and centred on the sawn weakened plane joints.

- Timing: Commence sawing after the curing period has ended, immediately before joint sealing. Saw during daylight hours.

Preparing joints
Stripping time: At least 12 hours.

Clean: Immediately before installation of the sealer, make sure the joint space is dry, clean and free from loose material. Remove laitance, curing compound and protrusions of hardened concrete from the sides and upper edges of the joint.

Joint sealing
Sealant type: Provide silicone sealant in conformance with the manufacturer's recommendations.

Backing rod: Compressible closed cell polyethylene foam with a bond breaking surface.

4.12 SURFACE SEALERS

General
Application: Apply surface sealer after the curing period and when concrete has dried to allow the sealer to penetrate into the concrete surface.

Curing sealer compound: If using the sealer as a curing compound, apply directly after finishing.

4.13 COMPLETION

Completion tests
Slip resistance of completed installation: To AS 4663.

Rectification
Reinstating adjacent surfaces: Reinstate surfaces next to new pavements and associated elements. If an existing road pavement has been disturbed, trim back to a straight, neat and undisturbed edge, parallel to the new concrete for the full depth of the slab.

Concrete pavement: If pavement does not conform to the tolerances, submit rectification proposal.

Unplanned cracking:

- Maximum 0.4 mm wide crack is acceptable.
- > 1 mm must be assessed, detail a proposal for possible cause and rectification processes.

Cleaning
Excavated material: Remove from site.

5 SELECTIONS

5.1 SCHEDULES

Surface finishes schedule

Property	A	B	C
Location	Site Wide		
Primary finish	Lightly Exposed Aggregate concrete finish		
Colour	CCS Colour - Snow		
Supplementary finish	-		
Slip resistance classification	P5		
Surface modifier	-		

0275 PAVING – MORTAR AND ADHESIVE BED

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide paving, as documented.

Performance

Requirements:

- Consistent in colour and finish.
- Firmly bonded to substrates for the expected life of the installation.
- Resistant to expected impacts in use.
- Set out with joints accurately aligned in both directions.
- To direct all water flowing from supply points to drainage outlets without leakage to the substrate or adjacent areas.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

Slip resistance

Classification: To AS 4586.

1.4 INTERPRETATION

Definitions

General: For the purposes of this work section the following definitions apply.

- Absolute level tolerance: Maximum deviation from design levels.
- Adhesives - cementitious (C): Adhesive in which the binders are hydraulic, e.g. General purpose cement, with aggregates and organic additives.
- Bedding: Mixtures of materials which are applied to substrates in a plastic state and which dry, cure and adhere tiles to substrates:
  - . Adhesive bedding: Paving/tiling adhered by adhesives.
  - . Mortar bedding: Paving/tiling adhered in a cementitious mortar bed.
- Lippage: Height deviation between adjacent units.
- Pavers: Units made from clay, stone, precast concrete, ceramic, terrazzo and/or other inorganic raw materials, generally over 20 mm thick, used as coverings for horizontal surfaces. Larger pavers are often referred to as flags.
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.
- Substrate: The surface to which a material or product is applied.

1.5 TOLERANCES

Completed paving

Lippage:

- Unpolished pavers: Less than 2 mm.
- Polished pavers 300 x 300 mm or less: 1 mm, with 5% not exceeding 1.5 mm.
- Polished pavers over 300 x 300 mm: 1.5 mm, with 5% not exceeding 2 mm.

Paving surface level tolerances table

Item	Level tolerance	
	Absolute	**Relative**
Vehicular pavements	± 5 mm	5 mm
Pedestrian pavements	± 10 mm	10 mm

1.6 SUBMISSIONS

Execution details

Grouting: Submit proposals for grouting methods and materials.

Margins: If it appears that minor variations in joint widths or overall dimensions will avoid cut pavers, submit a proposal.

Operation and maintenance manuals

General: Submit a manual describing care and maintenance of the paving, including procedures for maintaining the slip-resistance grading stating the expected life of the slip-resistance grade.

Products and materials

Product conformity: Submit current assessments of conformity as follows:

- Marking and classification of adhesive to AS ISO 13007.1.

Type tests: Submit results, as follows:

- Slip resistance of pavers.
- Accelerated wear test of pavers.
- Stone paver properties.

Samples

General: Submit labelled samples of pavers, grout and sealants, illustrating the range of variation in colour and finish.

Sample panel: Prepare a sample panel of each type of finish as follows:

- Size: ≥ 2 m^2.
- Include samples of junction details and trim.
- Preserve each panel until related work is complete.

Tests

Site tests: Submit results, as follows:

- Slip resistance of completed installation.
- Stone paver properties tests.
- Salt efflorescence of paver prototype testing.

1.7 INSPECTION

Notice

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

- Substrate immediately before paving.
- Trial set-outs before execution.
- Control joints before sealing and grouting.

2 PRODUCTS

2.1 ADHESIVES

General
Standard: To AS ISO 13007.1.

Type
General: Provide adhesives compatible with the materials and surfaces to be adhered.

Prohibited uses: Do not provide the following combinations:

- Organic PVC-based adhesives and organic natural rubber latex adhesives in damp or wet conditions.
- PVA (polyvinyl acetate) based adhesives in wet areas or externally.

2.2 MORTAR

Materials
Cement: To AS 3972.

- Type: GP.
- Iron salt content:
  - . White cement: ≤ 1%.
  - . Off-white cement: ≤ 2.5%.

Lime: To AS 1672.1.

Sand: Fine aggregate with a low clay content selected for grading, sharp and free from efflorescing salts.

Water: Clean and free from any deleterious matter.

Measurement of volume: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

Bedding mortar
Mix proportion (cement:sand): Select from the range 1:3 to 1:4 to obtain satisfactory adhesion. Provide minimum water.

Mixing: To AS 3958.1 clause 2.15.

Gauging: Site gauged by volume.

2.3 GROUT

Type
Portland cement based grout: Mix with fine sand. Provide minimum water to achieve workability.

- Mix proportion (cement:sand): 1:3.

Pigments
Pigments for coloured grout: Provide colourfast pigments compatible with the grout material. For cement-based grouts, provide inorganic mineral pigments or lime-proof synthetic metallic oxides compatible with cement.

Water
General: Clean and free from any deleterious matter.

2.4 PAVERS

Precast Concrete pavers
Standard: To AS/NZS 4455.2.

Properties: To AS/NZS 4455.2 Table 2.8.

Standards to: AS/NZS 4455. Masonry Units and Segmental Pavers & AS 3661 Slip Resistance of Pedestrian Surfaces.

All supplied segmental pavers to be consistent in colour and finish quality so that they appear to be from the same batch. All dimensions required for the fabrication of unit pavers shall be verified from the site and contract documents provided prior to commencing production.

Dimensional Tolerance: +/- 2mm plan dimension and height

Minimum compressive strength (concrete units): 45Mpa

Dimensions: Refer to table below

Suppliers: Urbanstone and Adbri Masonry

Colour and Finish

Refer table below.

Direction of paving: The courses P5 paving which run along the building Multi Trade Hub Building edge are to run perpendicular to the building. The courses P4 paving are to be laid parallel to the Building and perpendicular to P5 at entry locations.

Setout of paving: Make up units to be no less than 100mm width. Paving slivers less than 100mm will be defected.

Slip resistance category: P4 min P5 required

Edge: No Arris

Joints: 3mm mortar joints as specified by civil engineers.

Precast Concrete Paver and Stair Tread Schedule

Code	Item	Size	Finish
P2	Precast pavers (Header Course)	Size: 208 (L) x 104 (W) x 60mm (H)	Adbri Masonry Colour: Natural Oatmeal Size: 208x 104x 60mm
P4	Precast pavers	**Pedestrian Paving P4A-** 40mm Thick	Urbanstone Colour - Casino Grey

		Vehicular paving P4B - 60mm thick 900X600 and 900x400 in stretcher bond laid on a mortar bed over concrete slab	Shotblast finished to exposed faces
P5	Precast pavers	**Pedestrian Paving P5A-** 40mm Thick **Vehicular paving P5B** - 60mm thick 900X600 and 900x400 in stretcher bond laid on a mortar bed over concrete slab	Urbanstone Colour - PPC Shotblast finished to exposed faces
	Precast Stair Treads	Size: 300 x 200 x 75 as detailed length varies: 300, 600, 900	Colour: CCS Colour Systems - Snow Finish: Riser – Polished Aggregate: Crushed River Pebble nom 10 dia Tread - Shotblast

2.5 OTHER MATERIALS

Tactile ground surface indicators
Standard: To AS/NZS 1428.4.1.

Precast Concrete Paver and Stair Tread Schedule

Code	Item	Size	Finish
	Tactile Indicator Pavers	Size: 300 (L) x 300 (W) x 60mm (H)	Urbanstone Colour – Gunmetal Honed Finish

Control joint types
General: As documented.

Divider strip: A proprietary expansion joint consisting of a neoprene filler sandwiched between plates with lugs or ribs for mechanical keying. Set flush with the finished surface.

Proprietary slide plate divider strip: An arrangement of interlocking metal plates grouted into pockets formed in the concrete joint edges.

Sealant: Two-pack self-levelling flexible mould resistant, one-part silicone or polyurethane sealant applied over a backing rod. Finish flush with the paver surface.

- Floors: Trafficable, shore hardness more than 35.

Backing rod: Compressible closed cell polyethylene foam with a bond-breaking surface.

3 EXECUTION

3.1 PREPARATION

Trial set-out

General: Prepare a trial paving set-out to each area as follows to:

- Maximise the size of equal margins of cut pavers.
- Locate control joints.
- Note minor variations in joint widths to eliminate cut pavers at margins.

Ambient temperature

General: If the ambient temperature is less than 5°C or more than 35°C, do not lay pavers.

Substrates

General: Make sure substrates are as follows:

- Clean and free of any deposit or finish which may impair adhesion or location of pavers.
- Projections are hacked off and voids and hollows are filled with a cement:sand mix not stronger than the substrate nor weaker than the bedding.

Drying and shrinkage: Before paving, allow at least the following times to elapse (for curing and initial shrinkage) for these substrates:

- Concrete slabs: 28 days.
- Toppings on slabs: A further 21 days.

Absorbent substrates: If suction is excessive, control it by dampening but avoid over-wetting and do not apply mortar bedding to substrates showing surface moisture.

Dense concrete: If not sufficiently rough to provide a mechanical key, roughen by scabbling or the like to remove 3 mm of the surface and expose the aggregate then apply a bonding treatment.

Fixtures

General: Before paving make sure that fixtures interrupting the surface are accurately positioned in their designed or optimum locations relative to the paving layout.

3.2 PAVING GENERALLY

Variations

General: If necessary, distribute variations in hue, colour, or pattern uniformly, by mixing pavers or paving batches before laying.

Paving joints

Joint widths: Set out pavers to give uniform joint widths of 6 to 12 mm.

Margins

General: Provide whole or purpose-made pavers at margins where practicable, otherwise set out to give equal margins of cut pavers. If margins less than half paver width are unavoidable, locate the cut pavers where they are least conspicuous.

Protection
Traffic: Keep pedestrian and vehicular traffic off paving until the bedding has set and attained its working strength.

Cleaning: Keep the work clean as it proceeds and protect finished work from damage.

3.3 MORTAR BEDDING

Preparation of pavers
Suction: Soak porous pavers in water for half an hour and then drain until the surface water has disappeared.

Bedding
General: Use bedding methods and materials which are appropriate to the paver, the substrate, the conditions of service, and which leave the paver firmly and solidly bedded in the bedding material and adhered to the substrate. Form falls integral with the substrate.

Mortar beds
Substrate preparation: Either lightly dust the screeded bed surface with dry cement and trowel level until the cement is damp, or spread a thin slurry of neat cement, on to the paver back. Do not provide mortar after initial set has occurred.

Nominal thickness: 30mm or to engineers details.

Sandstone flagging
Mortar bed thickness: Minimum 50 mm to maximum 60 mm.

Laying pattern: Random, with smaller stones filling the gaps to produce roughly uniform joint widths. Lay flags and fill joints in one operation.

Stone setts dry bed
Description: Lay and tamp setts on to a dry sand and cement mix, compact and moisten as follows:

- Mortar bed mix proportion (cement:sand): 1:3 screeded to the level required to allow setts to be firmly tamped.
- Select the top side of the sett for surface uniformity and tap into the mix to the pre-compaction position.
- Compact with a hand ram or mechanical compactor.
- Water spray the surface and allow the bedding to harden.
- Grout joints.

3.4 ADHESIVE BEDDING

Preparation of pavers
Adhesive bedding: Fix pavers dry.

Bedding
General: Use bedding methods and materials which are appropriate to the paver, the substrate, the conditions of service, and which leave the paver firmly and solidly bedded in the bedding material and adhered to the substrate. Form falls integral with the substrate.

Thick adhesive beds
General: Provide on substrates with deviations up to 6 mm when tested with a 2 m straight edge, and with pavers having deep keys or frogs.

Nominal thickness: 6 mm.

Adhesive bedding application
General: Apply adhesive by notched trowel to substrates and direct to pavers if required, to provide evenly distributed coverage of more than 90% after laying.

Pattern of distribution of adhesive: Conform to AS 3958.1. Verify by examining one paver in ten as work proceeds.

Grouting: Allow the adhesive to cure for the period recommended by the manufacturer before grouting.

3.5 MOVEMENT JOINTS

General
Requirement: Provide control joints as follows:

- Location:
  - . Over structural control joints.
  - . At internal corners.
  - . Close to external corners in large paved areas.
  - . Around the perimeter at abutments.
  - . At junctions between different substrates.
  - . To divide large paved areas into bays, maximum 5 m wide, maximum area 16 m^2.
  - . At abutments with the building structural frame and over supporting walls or beams where flexing of the substrate is anticipated.
- Depth of joint: Right through to the substrate.
- Sealant width: 6 to 25 mm.
- Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

3.6 GROUTED JOINTS

Grouting
General: Commence grouting as soon as practicable after bedding has set and hardened sufficiently. Clean out joints as necessary before grouting.

Face grouting: Fill the joints solid and tool flush. Clean off surplus grout and wash down as the grouting proceeds.

3.7 TESTING

Site tests
Completion tests
Slip resistance of completed installation: To AS 4663.

3.8 COMPLETION

Spares
General: Supply spare matching pavers of each type for future replacement purposes. Store the spare materials on site.

Quantity: At least 1% of the quantity installed.

Cleaning
Completion: Clean progressively and leave pavements clean on completion.

4 SELECTIONS

4.1 SCHEDULES

0277 PAVEMENT ANCILLARIES

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide pavement ancillaries, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements.*
- *0275 Paving - mortar and adhesive bed*

1.3 INTERPRETATION

Definitions
General: For the purposes of this worksection the following definitions apply:

- Absolute level tolerance: Maximum deviation from design levels.
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.

1.4 TOLERANCES

Channels and kerbs
Absolute level tolerance: ± 10 mm at any point on the finished surface.

Relative level tolerance: 5 mm to the top or face of kerbs, and to the surface of channels.

Plan position deviation: 25 mm.

Exception: Kerb laybacks, grade changes or curves, or at gully pits requiring channel depression.

Linemarking
Longitudinal line lengths: ± 20 mm from the lengths documented in AS 1742.2.

Longitudinal line widths: ± 10 mm from the widths documented in AS 1742.2

Transverse line lengths and widths: ± 10 mm from the lengths and widths documented in AS 1742.2.

Other markings: ± 50 mm from the dimensions documented or in AS 1742.2 for arrows, chevrons, painted medians, painted left turn islands and speed markings. Place arrows and speed markings square with the centreline of the traffic lane.

Raised pavement markers
Plan position deviation: 20 mm.

Directional displacement: ± 4°.

Vehicle barriers
Plan position deviation: 50 mm.

Length: ± 20 mm.

Bollard plumb: H/100.

1.5 SUBMISSIONS

Products and materials
Linemarking material properties: Submit Accredited Testing Laboratory test reports to the AS 4049 series, at least seven days before work is scheduled to start, including paint and glass beads.

1.6 INSPECTIONS

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

- Set-out of pavement ancillaries.
- Trial sections:
  - Channels and kerbs.
  - Linemarking.

2 PRODUCTS

2.1 CHANNELS AND/OR KERBS

Concrete
Precast: Proprietary precast units as documented.

In situ: To AS 2876.

Grade: N20.

Concrete profile to AS 2876: [complete/delete]

2.2 LINEMARKING

Pavement marking paint
Requirement: Conform to the following:

- Solvent-borne paint: To AS 4049.1.
- Waterborne paint: To AS 4049.3.
- High performance: To AS 4049.4.

Colour: [complete/delete]

Glass beads
Standard: To AS/NZS 2009.

Bead type: B.

2.3 RAISED PAVEMENT MARKERS

General
Standard: To AS/NZS 1906.3.

Marker category: [complete/delete]

Retroreflective markers:

- Class: [complete/delete]
- Type: [complete/delete]

Adhesives type: [complete/delete]

2.4 VEHICLE BARRIERS

Timber log barriers
Hardwood: To AS 2082.

Softwood: To AS 2858 and AS 1720.2, Grade 5.

Timber preservative for softwood: Minimum hazard class H4 to AS 1604.1.

Size: Diameter range 125 to 150 mm for both posts and rails.

Precast concrete wheel stops
Material: Precast concrete units with pre-drilled holes located 300 mm from each end for fixing to ground surface.

Size: 2000 x 150 x 100 mm high.

Steel tube bollards
Type: Bollards fabricated from heavy steel tube, to AS 1074.

Minimum nominal size: DN 100.

Finished height above surface: [complete/delete]

Finish: [complete/delete]

Timber bollards
Material: Sawn recycled turpentine.

Size and profile: [complete/delete]

Finished height above surface: [complete/delete]

Finish: [complete/delete]

3 EXECUTION

3.1 CHANNELS AND/OR KERBS

General
Precast: Install to manufacturer's instructions.

In situ: Construct channels and/or kerbs in fixed forms, by extrusion or by slip forming to AS 2876.

Preparation
Requirement: To AS 2876 Section 8.

Subgrade or subbase material: Shape and compact to form a firm base before placing channels and/or kerbs.

Setting out
General: Set out the work so that all channels and kerbs are placed with tolerances, as documented.

Joints
Requirement: To AS 2876 clause 11.

Concrete pavement: If channels and/or kerbs are cast adjacent to a concrete pavement, continue the same joint type, as documented for the concrete pavement, across the channels and/or kerbs.

Backfill
Timing: Not earlier than three days after placing channels and/or kerbs, backfill and reinstate the spaces on both sides of the channels and/or kerbs.

Material: Granular, free of organic material, clay and rock in excess of 50 mm diameter.

Compaction: Compact backfill in maximum 150 mm thick layers, to a relative compaction of 95% tested to AS 1289.5.4.1, for standard compactive effort.

Pavement: Backfill pavement material adjacent to new channels and/or kerbs to the documented requirements of the pavement material.

3.2 LINEMARKING

Preparation
Surface: Clean, dry and free of any deposit which may impair adhesion of the linemarking.

Wet weather: Do not apply linemarking during wet weather or if rain is likely to fall during application or paint drying time.

Provision for traffic: Allow for traffic during application and protect linemarkings until the material has dried sufficiently to carry traffic without being damaged.

Mixing of paint: Before use, mix all paint in its original container to produce a smooth uniform product consistent with the freshly manufactured product.

Setting out
General: Set out the work so that all linemarkings are placed within tolerances, as documented.

Application of linemarking
Longitudinal lines: Spray all longitudinal lines with a self-propelled machine. For a one-way or two-way barrier line pattern, concurrently spray the two sets of lines.

Hand spraying: Hand spray transverse lines, symbols, letters, arrows and chevrons using templates.

Paint thickness: Uniform wet film thickness: 0.35 mm to 0.40 mm.

Linemarking alignment: Straight or with smooth, even curves as documented.

Edges: Form clean, sharp edges. Remove any paint applied beyond the defined edge of the linemarking and leave a neat and smooth marking on the wearing surface of the pavement.

Glass bead application
Glass beads: Apply glass beads immediately after the application of the paint, at the following minimum rates:

- Longitudinal lines: 0.5 kg/m^2.
- Other markings: 0.3 kg/m^2.

Removal of existing pavement markings
General: Remove existing linemarking, as documented, from the wearing surface of pavements without causing significant damage to the surface.

3.3 RAISED PAVEMENT MARKERS

Preparation
Surface: For concrete wearing surfaces, scabble the full area below each marker to remove the fine mortar material.

Adhesive preparation: Freshly heat and mix the adhesive to the manufacturer's recommendations. Do not allow the adhesive to cool and do not reheat before use.

Setting out
General: Set out the work so that all raised pavement markers are placed within tolerances, as documented.

Installation to regular surfaces
Application of adhesive: Spread the adhesive uniformly over the underside of the raised pavement marker to a depth of approximately 10 mm.

Adhesion of marker to pavement: Conform to the following:

- Press the raised pavement marker onto the pavement surface in its correct position and rotate slightly until the adhesive is squeezed out around all edges of the marker.
- Do not disturb the raised pavement marker until the adhesive has set.

Installation to rough surfaces
Adhesion of marker: Conform to the following:

- Apply an initial pad of adhesive of diameter 20 mm larger than the diameter of the base of the raised pavement marker.
- Apply the adhesive to fill the irregularities in the pavement surface to produce a flat, smooth surface flush with the upper level.
- Allow the adhesive pad to set.
- Apply adhesive to the raised pavement marker and adhere to the adhesive pad on the pavement surface, in conformance with **Installation to regular surfaces**.

3.4 VEHICLE BARRIERS

Timber log barriers
Installation: Check out the posts to receive the rails. Set each post 600 mm below the finished surface level and surround with compacted fine crushed rock, gravel or cement stabilised rammed earth. Bolt rails to posts with M12 diameter galvanized bolts and washers, with bolt heads and nuts recessed.

Precast concrete wheel stops
Installation: Drive 12 mm diameter galvanized steel rods a minimum of 600 mm below finished surface level and stop the top of the rod 25 mm below the top of the wheel stop.

Concrete pavement/slab: Bolt the wheel stop to the pavement using galvanized steel masonry anchors, installed to manufacturer's recommendations. Top of bolt to stop 25 mm below the top of the wheel stop.

Completion: Grout fill the holes flush to match the concrete finish.

Steel tube bollards
Installation: Encase buried end of bollard in concrete footing, minimum 600 mm deep x 250 mm diameter. Finish top of footing minimum 100 mm below finished surface level.

On concrete slabs: Weld on a 10 mm thick baseplate drilled for 4 bolts, and bolt to concrete slab using galvanized steel masonry anchors installed to manufacturer's recommendations.

Filling: Fill the tube with 15 MPa concrete.

Open ends: Seal with matching fabricated end caps, spot welded and ground smooth.

Timber bollards
Installation: Encase buried end of bollard in concrete footing, minimum 600 mm deep x 300 mm diameter. Finish top of footing minimum 100 mm below finished surface level.

3.5 COMPLETION

Cleaning
Completion: Clean progressively and leave adjoining surfaces, pavements and ancillaries clean on completion.

4 SELECTIONS

Pavement ancillaries schedule

Item	A	B	C
Raised pavement markers			
Vehicle barriers: Timber log barriers			
Vehicle barriers: Precast concrete wheel stops			
Vehicle barriers: Steel tube bollards			
Vehicle barriers: Timber bollards			

0314 CONCRETE IN SITU

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide concrete in situ, as documented.

Performance

Requirements:

- Conforming to the design details and performance criteria.
- Satisfying the quality and inspection requirements.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0311 Concrete formwork*.
- *0312 Concrete reinforcement*.
- *0315 Concrete finishes*.

1.3 STANDARDS

General

Reinforced concrete construction: To AS 3600.

Specification and supply of concrete: AS 1379.

Concrete structures for retaining liquids: To AS 3735.

Design, installation and testing of post-installed and cast-in fastenings: To AS 5216.

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in AS 1379, AS 3600 and the following apply:

- Ambient temperature: The air temperature at the time of mixing and placing of concrete.
- Early age strength: A mean compressive strength at 7 days exceeding the values shown in AS 1379 Table 1.2.
- Green concrete: Concrete which has recently set but has not achieved any design strength.
- Sample: A physical example that illustrates workmanship, materials or equipment, and establishes standards by which the work will be judged. It includes samples and sample panels.
- Specimen: A portion of a sample which is submitted for testing.
- Weather – cold: Ambient shade temperature less than 10°C.
- Weather – hot: Ambient shade temperature greater than 30°C.

1.5 SUBMISSIONS

Execution details

Loading: Submit details of proposed construction systems, loads and procedures, including propping and re-shoring.

Concrete: Submit proposals for mixing, placing, finishing and curing concrete including the following:

- Changes to the concrete mix.
- Curing and protection methods.
- Curing period for low-pressure steam curing.
- Cutting or displacing reinforcement, or cutting or coring hardened concrete.
- Handling, placing, compaction and finishing methods and equipment, including pumping.
- Placing under water.
- Sequence and times for concrete placement, and construction joint locations and relocations. Include any proposed sequential placement of slab segments.
- Site storage, mixing and transport methods and equipment, if applicable.
- Temperature control methods.
- Sawn joints: Submit details of proposed methods, timing and sequence of sawing joints.

Pre-mixed supply delivery dockets: For each batch, submit a docket listing the information required by AS 1379, and the following:

- For special-class performance concrete: Documented performance and type of cement binder.
- For special-class prescription concrete: Details of mix, additives, and type of cement binder.
- Method of placement and climate conditions during pour.
- Name of concrete delivery supervisor.
- Project assessment carried out each day.
- The concrete element or part of the works for which the concrete was ordered, and where it was placed.
- The total amount of water added at the plant and the maximum amount permitted to be added at the site.

Products and materials

Product conformity: Submit evidence of conformity, as appropriate, as follows:

- Certification by a JAS-ANZ accredited third party.
- Report by an accredited testing laboratory describing tests and giving results which demonstrate that the product conforms.

Concrete mixes: Submit details, for each grade and type of concrete including any proposed use of special-purpose cement types.

Curing compounds: Submit details of any proposed curing compounds, including the following:

- Certified type-test results for water retention to AS 3799 Appendix B for liquid membrane-forming compounds.
- Evidence of compatibility with concrete, and with applied finishes including toppings and render, if any, including methods of obtaining the required adhesion.
- For visually important surfaces, evidence that an acceptable final surface colour will be obtained.

Admixtures: Submit details of any proposed admixtures, including the following:

- Brand name.
- Place of manufacture.
- Basic chemical composition.

Samples

Coloured concrete: Submit sample blocks of coloured concrete produced using the proposed mix and casting method before casting final concrete, as follows:

- Number: 4.
- Size (nominal): 300 x 300 x 50 mm.

Shop drawings
Cores, fixings and embedded items: Submit the proposed locations, clearances and cover and show any proposed repositioning of reinforcement.

Subcontractors
Pre-mixed supply: Submit names and contact details of proposed pre-mixed concrete suppliers and alternative source of supply in the event of breakdown of pre-mixed or site mixed supply.

Tests
Requirement: Submit test results, as follows:

- Concrete compressive strength test results to AS 1012.9.
- Other concrete properties: Test results as documented in the **Tests schedule**.

1.6 INSPECTION

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

- Base or subgrade before covering.
- Membrane or film underlay installed on the base or subgrade.
- Completed formwork and reinforcement, tendons, cores, fixings and embedded items fixed in place before placing concrete.
- Concealed surfaces or elements before covering.
- Commencement of concrete placing.

2 PRODUCTS

2.1 CONCRETE

General
Stockpile: If uniform, consistent colour is documented, stockpile sand, cement and aggregates.

Properties
Concrete mix and supply: Conform to the following:

- Normal-class: To AS 1379 clause 1.5.3.
  - Properties: As documented in the **Concrete properties schedule - performance**.
- Special-class: To AS 1379 clause 1.5.4.
  - Performance properties: As documented in the **Concrete properties schedule - performance**.
  - Prescription properties: As documented in the **Concrete properties schedule - prescription**.

Aggregates
Standard: To AS 2758.1.

Cement
Standard: To AS 3972.

Age: Less than 6 months old.

Storage: Store cement bags under cover and above ground.

Supplementary cementitious materials:

- Fly ash: To AS/NZS 3582.1.
- Slag: To AS 3582.2.
- Amorphous silica: To AS/NZS 3582.3.

Water
Standard: To AS 1379 clause 2.4.

Requirement: Clean, free from oil, acid, alkali, organic or vegetable matter and including not more than 500 mg/l of chloride ions.

Concrete colour
Standard: To AS 3610.1.

Chemical admixtures
Standard: To AS 1478.1, used to manufacturer's recommendations.

2.2 MISCELLANEOUS

Polymeric film underlay
Vapour barriers and damp-proofing membranes: To AS 2870 clause 5.3.3.

Curing compounds
Liquid membrane-forming compounds: To AS 3799.

3 EXECUTION

3.1 POLYMERIC FILM UNDERLAY

Location
Requirement: Under slabs on ground, including integral ground beams and footings, provide a vapour barrier or, in areas prone to rising damp or salt attack, a damp-proofing membrane.

Base preparation
Requirement: Conform to base type, as follows:

- Concrete working base: Remove projections above the plane surface, and any loose material.
- Graded prepared subgrade: Blind with sand to create a smooth surface free from hard projections. Lightly wet the sand just before laying the underlay.

Installation
Standard: To AS 2870 clause 5.3.3.

Requirement: Lay underlay over the base, as follows:

- Lap joints at least 200 mm and seal the laps and penetrations with waterproof adhesive tape.
- Face the laps away from the direction of concrete pour.
- Continue up vertical faces past the damp-proof course where applicable, and tape fix at the top.
- Patch or seal punctures or tears before placing concrete.
- Cut back as required after concrete has gained strength and formwork has been removed.

3.2 CONCRETE SUPPLY

Elapsed delivery time
General: Make sure that the elapsed time between the wetting of the mix and the discharge of the mix at the site is in conformance with the **Elapsed delivery time table**. Do not discharge at ambient temperature below 10°C or above 30°C unless approved heating or cooling measures are taken to deliver concrete within the range 5°C to 35°C.

Elapsed delivery time table

Concrete temperature at time of discharge (°C)	Maximum elapsed time (minutes)
5 – 24	120
24 – 27	90

Concrete temperature at time of discharge (°C)	Maximum elapsed time (minutes)
27 – 30	60
30 – 35	45

Pre-mixed supply
Addition of water: To AS 1379 clause 4.2.3.

Transport method: Select to prevent segregation, loss of material and contamination of the environment, and not to adversely affect placing or compaction.

Site mixed supply
Emergencies: If mixing by hand, provide details.

Plant: Mix concrete in a plant located on the construction site.

3.3 TESTING

General
Test authority: Concrete supplier or an Accredited Testing Laboratory.

Reports and records of test results: To the relevant parts of the AS 1012 series. Keep results on site.

Assessment process of test results
Standard: To AS 1379.

Method of assessment: Project assessment.

Sampling
Method of sampling: AS 1012.1.

Sampling locations: To AS 1012.1 and the following:

- Slump tests: On site, at the point of discharge from the agitator.
- Compressive strength tests: Spread the site sampling evenly throughout the pour.

Frequency of sampling: To AS 1379 Sections 5 and 6 and the following:

- Slump tests: Take at least one sample from each batch.
- Compressive strength tests: To the **Project assessment strength grade sampling table.**

Project assessment strength grade sampling table

Number of batches for each type and grade of concrete per day	Minimum number of samples: Columns and load bearing wall elements/batch	Minimum number of samples: Other elements/day
1	1	1
2-5	1	2
6-10	1	3
11-20	1	4
each additional 10	1	1 additional

Making and curing of specimens
General: To AS 1012.8.1 and AS 1012.8.2.

Specimens for compressive strength tests: Make and cure at least two specimens from the sample of each grade.

Specimen size:

- Aggregate size ≤ 20 mm: Nominally 200 x 100 mm diameter.
- Aggregate size > 20 mm: Nominally 300 x 150 mm diameter.

Test methods
General: To the relevant parts of the AS 1012 series.

Acceptance criteria:

- General: As documented in the **Concrete properties schedule – performance**.
- Early age compressive strength: As documented in the **Control tests schedule**.

Drying shrinkage at 56 days: To AS 1012.8.4 and AS 1012.13.

Other concrete properties tests: As documented in the **Tests schedule**.

Liquid retaining structures
Testing for liquid tightness: To AS 3735.

3.4 CORES, FIXINGS AND EMBEDDED ITEMS

General
Requirement: Install fasteners to manufacturer's recommendations and the assumptions of AS 5216 Appendix D.

Adjoining elements
Fixings: Provide fixings for adjoining elements. If required, provide temporary support to the adjoining elements during concreting, to prevent movement.

Protection
General: Grease threads. Protect embedded items against damage.

Compatibility: Provide inserts, fixings and embedded items that are compatible with each other, with the reinforcement and with the documented concrete mix and surface finish.

Corrosion: In external or exposed locations, galvanize anchor bolts and embedded fixings.

Structural integrity
Position: Fix cores and embedded items to prevent movement during concrete placement. In locating cores, fixings and embedded items, displace but do not cut reinforcement, and maintain documented cover to reinforcement.

Isolation: Isolate embedded items to prevent water tracking to concrete that provides minimum cover to reinforcement.

Tolerances
General: Maximum deviation from correct positions:

- Anchor bolt groups for structural steel: To AS/NZS 5131.
- Cores and embedded items generally: 10 mm.
- Other fixing bolts: 3 mm.

3.5 CONCRETE WORKING BASE

Finish
Membrane support: Wood float finish or equivalent.

Installation
General: Lay over the base or subgrade and screed to the required level.

Surface flatness tolerance
Maximum deviation: 6 mm from a 3 m straightedge.

3.6 PLACING AND COMPACTION

Placing
Horizontal transport: Use suitable conveyors, clean chutes, troughs, hoppers or pipes.

Methods: Avoid segregation and loss of concrete, and minimise plastic settlement. Maintain a nominally vertical and plastic concrete edge during placement.

Horizontal elements: Place concrete in layers not more than 300 mm thick. Compact the following layer into previous layer before previous layer has taken initial set.

Compaction
Methods: Use immersion and screed vibrators accompanied by hand methods as appropriate to remove entrapped air and to fully compact the mix.

Vibrators: Do not allow vibrators to contact set concrete, reinforcement or items including pipes and conduits embedded in concrete. Do not use vibrators to move concrete along the formwork. Avoid causing segregation by over-vibration.

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

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

Rain
Protection: During placement and before setting, protect the surface from damage.

Time between adjacent placements
Minimum time delay: As documented in the **Minimum time delay schedule.**

Vertical elements
Placement: Limit the free fall of concrete to maximum of 2000 mm.

Placing in cold weather
Cement: Do not use high alumina cement.

Temperature limits: Maintain the following:

- Freshly mixed concrete: ≥ 5°C.
- Forms and reinforcement before and during placing: ≥ 5°C.
- Water: Maximum 60°C when placed in the mixer.

High early strength cement: If deteriorating weather conditions are predicted, use high early strength cement.

Temperature control: Heat the concrete materials, other than cement, to the minimum temperature necessary so that the temperature of the placed concrete is ≥ 5°C.

Admixtures: Do not use calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete.

Frozen materials: Do not allow frozen materials or materials containing ice to enter the mixer, and keep free of frost and ice any forms, materials, and equipment coming in contact with the concrete.

Freezing: Prevent concrete from freezing.

Placing in hot weather

Handling: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses.

Temperature limits: Maintain the following:

- Normal concrete in footings, beams, columns, walls and slabs: ≤ 35°C.
- For concrete strength grade less than 40 MPa with section thickness ≥ 1 m in all dimensions: ≤ 27°C.
- For concrete strength grade 40 MPa or greater with section thickness ≥ 600 mm in all dimensions: ≤ 27°C.
- Forms and reinforcement before and during placing: ≤ 35°C.

Evaporation control barriers: Erect barriers to protect freshly placed concrete from drying winds.

Temperature control: Select one or more of the following methods of maintaining the temperature of the placed concrete at 35°C or less:

- Cool the concrete using liquid nitrogen injection before placing.
- Cover horizontal transport containers.
- Spray the coarse aggregate using cold water before mixing.
- Use chilled mixing water.

Placing under water

General: Do not place under water unless conditions prevent dewatering.

Minimum cement content for the mix: Increase by 25%.

3.7 JOINTS

Construction joints

Location: Do not relocate or eliminate construction joints, or form undocumented construction joints. If emergency construction joints are made necessary by unforeseen interruptions to the concrete pour, submit a report on the action taken.

Finish: Butt join the surfaces of adjoining pours. In visually important surfaces make the joint straight and true, and free from blemishes impermissible for its surface finish class.

Preparation: Roughen and clean the hardened concrete joint surface. Remove loose or soft material, free water, foreign matter and laitance. Dampen the surface just before placing the fresh concrete and coat with a neat cement slurry.

Expansion joints

Joint filling: Fill with jointing materials as documented. Finish visible jointing material neatly, flush with adjoining surfaces.

Preparation: Before filling, dry and clean the joint surfaces, and prime.

Watertightness: Apply the jointing material so that joints subject to ingress of water are made watertight.

Jointing materials: Provide jointing materials compatible with each other, and non-staining to concrete in visible locations.

Bond breaking: Provide back-up materials for sealants, including backing rods, which do not adhere to the sealant.

Foamed materials (in compressible fillers): Closed-cell or impregnated, not water absorbing.

Slip joints
Requirement: If concrete slabs are supported on masonry, provide proprietary slip joints.

3.8 CURING

General
Requirements: Taking into account the average ambient temperature at site over the relevant period affecting the curing, adopt procedures to make sure of the following:

- Curing: Cure continuously from completion of finishing, when the concrete has set sufficiently not to be damaged by the curing process, until the minimum total cumulative number of days or fractions of days, during which the air temperature in contact with the concrete is above 10°C, conforms to the following, unless accelerated curing is adopted:
  - Fully enclosed internal surfaces/Early age strength concrete: 3 days.
  - Other concrete surfaces: 7 days.
- End of curing period: Prevent rapid drying out at the end of the curing period.
- Protection: Maintain at a reasonably constant temperature with minimum moisture loss, during the curing period.

Curing compounds
Liquid membrane-forming compounds: Provide a uniform continuous flexible coating without visible breaks or pinholes, which remains unbroken for at least the required curing period after application.

Substrates: Do not use wax-based or chlorinated rubber-based curing compounds on surfaces forming substrates to applied finishes, concrete toppings and cement-based render.

Self-levelling toppings: If used also as curing compounds, conform to AS 3799.

Visually important surfaces: Apply curing compounds to produce uniform colour on adjacent surfaces.

Cold weather curing
Temperature: Maintain concrete surface temperatures above 5°C for the duration of the curing period.

Hot weather curing
Requirement: If the concrete temperature exceeds 25°C, or the ambient shade temperature exceeds 30°C, protect from drying winds and sun by using an evaporative retarder until curing is commenced.

Water curing
Method: Select a method of ponding or continuously sprinkling to prevent damage to the concrete surface during the required curing period.

3.9 COMPLETION

Protection
General: Protect the concrete from damage due to construction loads, physical and thermal shocks, and excessive vibrations, particularly during the curing period.

Surface protection: Protect finished concrete surfaces and applied finishes from damage.

4 SELECTIONS

4.1 SCHEDULES

Concrete properties schedule – performance

Property	**A**	**B**	**C**
Normal and special-class			
Air entrainment – air volume (%)			
Maximum aggregate size (mm)			
Assessment process			
Slump (mm)			
Strength grade/characteristic compressive strength f'_c (MPa)			
Special-class			
Bleeding (mL/mm^2)			
Cement type			
Density of hardened concrete (kg/m^3)			
Density of plastic concrete (kg/m^3)			
Early age strength (MPa)			
Flexural strength (MPa)			
Indirect tensile strength (MPa)			
Mineral oxide content			
Mix type			
Water:cement ratio maximum			
Drying shrinkage			
Duration of air drying			

Concrete properties schedule – prescription

Property	**A**	**B**	**C**
Aggregate water absorption, maximum (%)			
Admixtures: Proportions			

Property	**A**	**B**	**C**
Admixtures: Types			
Coarse aggregate: Proportions			
Coarse aggregate: Size (mm)			
Coarse aggregate: Types			
Coarse aggregate: Colour			
Fine aggregate: Proportions			
Fine aggregate: Types			
Minimum cement content (kg/m^3)			
Mix type			
Water:cement ratio, maximum			

0315 CONCRETE FINISHES

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide finishes to formed and unformed concrete surfaces, as documented.

Performance
Requirement: Compatible with documented applied finishes.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

General
Formed surfaces: To AS 3610.1.

Slip resistance
Classification: To AS 4586.

1.4 INTERPRETATION

Definitions
General: For the purposes of this worksection the following definition applies:

- Green concrete: Concrete which has recently set but has not achieved any design strength.

1.5 TOLERANCES

Formed surfaces
Finish quality: To AS 3610.1 Table 3.3.3.1.

Unformed surfaces
Flatness: To the **Flatness tolerance class table,** using a straightedge placed anywhere on the surface in any direction, for the documented class of finish.

Flatness tolerance class table

Class	Measurement	Maximum deviation (mm)
A	2 m straightedge	4
B	3 m straightedge	6
C	600 mm straightedge	6

1.6 SUBMISSIONS

Execution details
Surface repairs: If surface repairs are required, submit proposed methods.

Prototypes
Test panels: Provide test panels to AS 3610.1 clause 3.7 and as documented in the **Test panels schedule**.

Manufacture: Cast the panels using the form, concrete, compaction equipment, form release agents, curing and formwork removal methods which are to be used in the final work.

Storage: Once accepted, maintain the panels on site undamaged and protected from the weather, as reference prototypes for evaluation of completed work.

Surface treatment: Do not proceed with the related work until the acceptable range of surface treatments has been determined.

Tests
Site tests: Submit test results, as follows:

- Slip resistance test of completed installations.

1.7 INSPECTION

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

- Completed formwork before placing concrete.
- Evaluation of the off-form finishes.
- Evaluation of surface finish.

2 PRODUCTS

2.1 MATERIALS

Surface modifiers
Hardeners, sealants and protectors: If documented, proprietary products conforming to the manufacturer’s recommendations.

Slip resistance treatment: If documented, proprietary products conforming to the manufacturer's recommendations.

3 EXECUTION

3.1 SURFACE MODIFIERS

General
Application: Apply to clean surfaces, to the manufacturer’s recommendations.

3.2 FORMED SURFACES

General
Surface finish: As documented in the **Surface finish class schedule** and the **Formed surface finishes schedule.**

Damage: Do not damage concrete works through premature removal of formwork.

Curing
Requirement: If formwork is stripped before the minimum curing period for the concrete has elapsed, continue curing the exposed faces as soon as the stripping is completed.

Evaluation of formed surfaces
General: If evaluation of formed surface is required, complete the evaluation before surface treatment.

Finishing methods
Requirement: If soffits of horizontal concrete elements or faces of vertical concrete elements are to have a finish other than an off-form finish, provide finishes as documented.

Form removal: If vertical face formwork needs to be removed for finishing methods, while the concrete is green, make sure the concrete has sufficiently set to prevent slump.

Blasted finishes:

- Abrasive: Blast the cured surface using hard, sharp graded abrasive particles until the coarse aggregate is in uniform relief.
- Light abrasive: Blast the cured surface using hard, sharp graded abrasive particles to provide a uniform matt finish without exposing the coarse aggregate.

Bush hammered finish: Remove the minimum matrix using bush hammering to expose the coarse aggregate, recessing the matrix no deeper than half the aggregate size, to give a uniform texture.

Exposed aggregate finish: While the concrete is green, wet the surface and scrub with stiff fibre or wire brushes, flushing continuously with clean water, until the aggregate is uniformly exposed. Do not use acid etching. Rinse the surface with water.

Floated finishes:

- Sand floated finish: While the concrete is green, wet the surface and rub using a wood float. Rub fine sand into the surface until a uniform colour and texture are produced.
- Grout floated finish: While the concrete is green, dampen the surface and spread a slurry, using hessian pads or sponge rubber floats. Remove surplus slurry and work until a uniform colour and texture are produced.

Smooth rubbed finish: While the concrete is green, wet the surface and rub using a carborundum or similar abrasive brick until a uniform colour and texture are produced.

3.3 UNFORMED SURFACES

General
Surface finish: As documented in the **Unformed surface finishes schedule**.

Finished levels: Strike off, screed and level slab surfaces to finished levels and to the flatness tolerance class documented.

Finishing methods – primary finish
Machine float finish:

- After levelling, consolidate the surface using a machine float.
- Cut and fill and refloat immediately to a uniform, smooth, granular texture.
- Hand float in locations inaccessible to the machine float.

Steel trowel finish: After machine floating, finish as follows:

- Use power or hand steel trowels to produce a smooth surface relatively free from defects.
- When the surface has hardened sufficiently, re-trowel to produce the final consolidated finish free of trowel marks and uniform in texture and appearance.

Burnished finish: Continue steel trowelling until the concrete surface attains a polished or glossy finish, uniform in texture and appearance, and free of trowel marks and defects.

Wood float finish: After machine floating, use wood or plastic hand floats to produce the final consolidated finish free of float marks and uniform in texture and appearance.

Broom finish: After machine floating and steel trowelling use a broom or hessian belt drawn across the surface to produce a coarse even-textured transverse-scored surface.

Scored or scratch finish: After screeding, use a stiff brush or rake drawn across the surface before final set, to produce a coarse scored texture.

Sponge finish: After machine floating and steel trowelling, use a damp sponge to wipe the surface to produce an even textured sand finish.

Exposed aggregate finish: After floating and when concrete has stiffened, wet the surface and scrub with stiff fibre or wire brushes, flushing continuously with clean water, until the aggregate is uniformly exposed. Rinse the surface with water.

Finishing methods – supplementary finish
Abrasive blast: After steel trowelling, abrasive blast the cured surface to provide texture or to form patterns without exposing the coarse aggregate, using hard, sharp graded abrasive particles.

Coloured applied finish: After machine floating, apply a proprietary liquid or dry shake material to the manufacturer's recommendations and trowel to achieve the required appearance.

Stamped and coloured pattern finish: Provide a proprietary finishing system.

Polished finish: After steel trowelling, grind the cured surface of the concrete.

3.4 TESTING

Completion tests
Slip resistance of completed installation: To AS 4663.

0321 PRECAST CONCRETE

1 GENERAL

1.1 RESPONSIBILITIES

General

Responsibility: Provide precast concrete elements, as documented.

Performance

Requirement: Conform to the following:

- Designed and certified by a professional engineer.
- Designed to conform to the documented performance requirements.
- Designed for handling, transport and erection.
- Fabricated in conformance with the shop drawings.
- Undamaged by handling and installation.
- Certified by a professional engineer after erection.

1.2 DESIGN

General

In-service structural design: To AS 3600 and BCA B1.1.

Erection design: To AS 3850.2.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0313 Concrete post-tensioned*.

1.4 STANDARDS

General

Precast elements: Conform to NP PCH (Precast concrete handbook).

Materials, components and equipment for manufacture: To AS 3850.1.

Planning, design, construction, casting, transportation, erection and installation: To AS 3850.2.

Precast flooring systems: To AS 3600.

Design, installation and testing of post-installed and cast-in fastenings: To AS 5216.

1.5 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in AS 3850.1 clause 1.4 and the following apply:

- Precast concrete: Concrete building elements, cast in moulds and cured away from the final structural position, and then transported, lifted and fixed into position.

1.6 TOLERANCES

General

Reinforcement and tendon position: To AS 3600 clause 17.5.3.

Manufacturing, installation, fixings and embedded items tolerance for precast elements: To AS 3610.1 Table 3.3.6.2 and AS 3850.2 clause 2.11.

Formed surfaces finish quality: To AS 3610.1 Table 3.3.3.1.

1.7 SUBMISSIONS

Certification
Design: Provide independent certification by a professional engineer of conformance of the design to project criteria.

Design documentation
Calculations: Submit structural performance calculations.

Execution details
Element casting: Submit element casting checklist.

Manufacturer's details: Submit name, contact details and credentials of proposed manufacturer of precast elements.

Safe work method statement: Prepare a safe work method statement specific to the project for the precast erection and submit on request.

Erection documentation: Submit details of lifting device locations and rigging systems, including marking plans and shop drawings.

Early lifting: If it is proposed to lift the precast elements by their designated lifting points before 28 day strength has been achieved, submit evidence to demonstrate that the element has adequate strength to carry its own weight without damage or residual cracking or deflection on removal of the lifting device.

Lifting and handling equipment: Submit details and specification of proposed equipment along with qualifications and training of the operating personnel in the form of a qualification register.

Products and materials
Protective coating details: Submit proposals for protective coatings to exposed metallic components to AS 2312.1 or AS/NZS 2312.2 with regard to site-specific corrosivity zoning.

Colour: Provide details of method of achieving the selected colour including details of the type and colour of the cement, sand and aggregates as well as any colouring oxide pigments or stain.

Proprietary inserts: Submit proprietary documentation for any lifting, bracing or fixing inserts. Include make, type and working load limit.

Non-proprietary inserts: Submit certificate from a professional engineer certifying the working load limit.

Welding of cast-in inserts: Submit written permission from insert manufacturer to proposed welding of cast-in inserts, to AS 3850.1 clause 2.5.1.

Concrete mix: Submit concrete mix details including the proportions and source of the constituents, admixtures, release agents and curing compounds.

Samples
Surface finish: Submit samples for texture and colour.

Sample size: [complete/delete]

Shop drawings

Precast concrete drawings: Submit shop drawings of architectural and structural precast concrete elements showing the proposed details for their design, manufacture, assembly, transport and installation, including the following:

- Project title and manufacturer's name.
- Marking plans and elevations referenced to the building grids and floors to locate each precast element.
- Shape or profile drawings (submit these before fabrication of moulds and tooling).
- Concrete mix and type of cement if special-class concrete.
- Locations, sizes, details, materials, ductility and stress grades of tendons and reinforcement.
- Locations, sizes, details, materials, corrosion protection and grades of cast-in ferrules, locating plates and angles, cut outs and openings, bolts, anchors and lifting devices.
- Cast-in services.
- Site fitments.
- Details of all joints, caulking, baffles and waterproofing.
- Surface finish class and surface treatment, if applicable.
- Curing and protection methods.
- Weight of each precast element.
- Calculated maximum loading on lifting and bracing inserts and attachments.
- Equipment and methods for handling, transport and installation, including lifting inserts and pick-up points.
- Evidence of load capacity of lifting and bracing inserts and attachments in the form of test reports or calculations.
- Specification of plugs for sealing recesses for cast-in fixings.

Tests

Lifting inserts and attachments for precast elements: Submit test results.

Structural performance: Submit test results of prior testing for static load tests.

1.8 INSPECTION

Notice

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

- Formwork dimensions and stability.
- Edge details and penetrations prior to casting of element.
- Connection materials and inserts in place prior to casting of element.
- Reinforcement and/or prestressing tendons in place prior to casting of element.
- Concreting.
- First precast element of each type at the earliest possible time before and immediately after stripping.
- Stripping and storage.
- Site erection including fixings and any in situ topping.
- Installed temporary bracing.
- Final structure before removal of temporary bracing.

2 PRODUCTS

2.1 MATERIALS

General

Standard: To AS 3600 and AS 1379.

Stockpile: If uniform, consistent colour is documented, stockpile sand, cement and aggregates.

Aggregates
Standard: To AS 2758.1.

Cement
Standard: To AS 3972.

Age: Less than 6 months old.

Storage: Store cement bags under cover and above ground.

Type: Do not use high alumina cement.

Supplementary cementitious materials:

- Fly ash: To AS/NZS 3582.1.
- Slag: To AS 3582.2.
- Amorphous silica: To AS/NZS 3582.3.

Water
Standard: To AS 1379 clause 2.4.

Requirement: Clean, free from oil, acid, alkali, organic or vegetable matter and including not more than 500 mg/l of chloride ions.

Chemical admixtures
Standard: To AS 1478.1, used to manufacturer's recommendations.

Concrete colour
Standard: To AS 3610.1.

Pigments (oxides): As follows:

- Chemically inert.
- Alkaline resistant.
- Insoluble.
- Light-fast.

Pigment selection: [complete/delete]

Reinforcement
Standard: To AS/NZS 4671.

Surface condition: Free of loose mill scale, rust, oil, grease, mud or other material which would reduce the bond between the reinforcement and concrete.

Structural welding: To AS/NZS 1554.3.

Corrosion protection: To AS 3600 clause 17.2.1.2.

Prestressing tendons
Standard: To AS 4672.1.

Type: 7 wire, stress relieved, high tensile steel and strand.

Prestressing hardware: To AS 3600.

Welding tendons: Do not weld prestressing tendons.

Post-tensioning bars/tendons
Requirements: To *0313 Concrete post-tensioned*.

2.2 PRECAST CONCRETE

General
Concrete: To AS 3600.

Testing: To the AS 1012 series.

Durability
Exposure classification: [complete/delete]

Concrete cover: To AS 3600 clause 4.10.

Fire-resistance level (FRL): [complete/delete]

Strength
Minimum compressive strength: [complete/delete]

Flexural strength required at lifting to AS 3850.2: [complete/delete]

Finishes
Off-form surface finish class to AS 3610.1: [complete/delete]

Colour: [complete/delete]

Surface finish: [complete/delete]

Applied finishes: [complete/delete]

Unformed (face up) surface finish: [complete/delete]

Acid cleaning required: [complete/delete]

Protective coatings: [complete/delete]

2.3 GROUTS AND MORTARS

General
Grout: [complete/delete]

Grout duct: Thin walled galvanised duct or similar, sized to provide erection tolerance and clearance for grout flow.

Post-tensioning grout: Conform to *0313 Concrete post-tensioned*.

2.4 CAST-IN ITEMS

Fixings and embedded items
Compatibility: Provide inserts, fixings and embedded items that are compatible with each other, with the reinforcement and with the documented concrete finish.

Corrosion: In external or exposed locations, galvanize anchor bolts and embedded fixings, as follows:

- All threaded products: To AS/NZS 1214.
- All non-threaded products: To AS/NZS 4680.

Structural steel
Protective coating: [complete/delete]

Stainless steel: [complete/delete]

2.5 MISCELLANEOUS

Bearing pads
Selections and testing: To AS 5100.4.

Width: [complete/delete]

Length: [complete/delete]

Thickness: [complete/delete]

Type: [complete/delete]

Flashings
Standard: To AS/NZS 2904.

Sealants
Compression-seals: Polyethylene or polyurethane foam strip.

Sealant: [complete/delete]

Baffle strip: [complete/delete]

3 EXECUTION

3.1 PRECAST ELEMENTS

Marking
Precast element identification: Located so as not to be visible in the completed structure and to remain legible until the panel is being fixed in place. Include the following:

- Plank thickness (mm).
- Number of strands.
- Strand diameter (mm).
- Concrete cover (mm).
- Date of casting.
- Orientation of the element.
- On precast elements other than those manufactured as a standard product, indicate their location within the structure, in conformance with the marking plan.
- Weight of the element.

Attachments for structural or architectural fixings
Requirement: To AS 3850.1 clause 2.5.

Ferrules: Provide ferrules anchored behind the reinforcing, as documented.

Dowel bars: Provide dowel bars loose, cast in or screwed into a ferrule or coupler and projecting from the precast element. Alternatively, where dowels are cast into and project from in situ concrete, provide a mating sleeve with grout tube.

Grout tube: Provide grout tubes as documented, cast into either in situ concrete or the precast element into which a dowel bar will be grouted.

Cast in plates and bolts: Provide purpose made steel brackets with bars, bolts or studs welded to them, to manufacturer's written permission.

Welding of connections: To AS/NZS 1554.1.

Restraint brackets: Provide all restraint brackets for the precast elements, as documented or as required.

Starter bars: Provide all starter bars, as documented or as required.

Requirement: Cast in all lifting, bracing and fixing inserts.

External walls: Wall panels and connections to BCA C1.11.

Curing compounds
Liquid membrane-forming compounds: To AS 3799 and used to manufacturer's recommendations.

Release agent: Provide a release agent that is compatible with the curing compound.

Rejection
Assessment: Set aside for inspection any element having damage such as cracking, deformation or spalling, or exhibiting lack of adequate concrete cover. Repair or recast, as instructed.

Lifting points
Standard: To AS 3850.2.

General: Provide proprietary lifting devices with published load data designed specifically for lifting concrete elements. Use face and edge lifters, as required.

Cast in inserts: Provide hot-dipped galvanized finish with a minimum coating mass of 600 g/m^2 to all cast-in lifting and bracing devices.

Bracing inserts or strongbacks: Provide bracing inserts or strongbacks designed by a professional engineer.

Proprietary systems: Use in conformance with manufacturer’s specifications and recommendations.

Lifting loops: Do not use deformed bars or stressing tendons as lifting loops.

Sealing: Recess lifting attachments such as bracing ferrules, or other types of cast-in fixings, and provide plugs for sealing.

Location: Do not place lifting attachments, holes and other temporary fixings for handling purposes on faces visible upon completion.

Marking: Clearly mark all lifting points and the positions for temporary bearing for storage and transport.

Welding: Do not site weld lifting, bracing or fixing inserts.

Requirement: Only lift or support members at specified points.

Lifting devices: Do not use the fixing devices for lifting or hoisting unless they have been designed to do so and confirmed as such by a professional engineer.

Precautions: Use handling methods which do not overstress, warp or damage the elements.

Completion: Remove, seal and rectify temporary attachments after erection.

Storage
Support points: Support elements at designated support points during storage.

Prevent damage: Store precast elements and protect to prevent warping, twisting, crushing, cracking, staining, discolouration and other damage until they are installed in their final location.

3.2 PREPARATION

Pre-installation
Requirement: Conform to AS 3850.2 clause 4.4.2.

3.3 INSTALLATION

Lifting and handling
Requirement: To AS 3850.2.

Site conditions: Make sure the wind and temperature conditions allow for safe handling and fixing, and are consistent with the structural capability and geometry of the element.

Site Cranes: To AS 2550.1.

Temporary bracing and propping: To AS 3850.2 Section 5.

Fixing
Fixing: Fix the precast elements securely and accurately in their final position.

Ancillaries: Provide components and materials, including fasteners, braces, shims, jointing strips, sealant, flashings, grout and mortar, bearing pads or strips, ties and dowels, clips and fixings necessary for the installation of the elements.

Flooring systems
Shear keys: Grout with mix proportion (sand:cement) 3:1.

Waterproofing to exposed flooring: [complete/delete]

Preparation: Immediately before in situ topping, wet surface of plank without pooling.

Topping: Properties as follows:

- Type: [complete/delete]
- Thickness: [complete/delete]
- Reinforcement: [complete/delete]

Topping minimum grade: N32 to AS 1379.

Surfaces bonded to in situ concrete
Requirement: Fully scabble and roughen all surfaces required to bond with in situ concrete to achieve a shear plane surface coefficient in conformance with AS 3600 Table 8.4.3.

3.4 COMPLETION

Compliance
Tolerances: Check element compliance with AS 3610.1 Section 3.

Rejection: Reject any precast elements not conforming to the documented tolerances.

4 SELECTIONS

4.1 SCHEDULE

Prototypes schedule

Element type	Number of prototypes

0331 BRICK AND BLOCK CONSTRUCTION

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide brick and block construction, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

General

Materials and construction: To AS 3700.

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions in AS 3700 clause 1.5.2, AS/NZS 4455.1 clause 1.4 and the following apply:

- Facework: Masonry intended to be exposed in a wall.

1.5 TOLERANCES

General

Requirement: To AS 3700 Table 12.1.

1.6 SUBMISSIONS

Fire performance

Fire-resistance level: Submit evidence of conformity to PRODUCTS, **FIRE PERFORMANCE**, **Fire-resistance of building elements**.

Products and materials

Type tests: Submit results, as follows:

- Characteristic unconfined compressive strength of masonry unit: To AS/NZS 4456.4.

Samples

Face units: Submit face units of each type illustrating the range of variation available, including colour, texture, surface irregularities, defective arrises, and shape.

- Number of each type: 6.

Facework sample panel: Submit a sample panel in a suitable position for each type of facework including face or pointing mortar and a finished vertical control joint.

- Minimum size (face of panel): 1200 mm high x 1190 mm or closest unit module long.

Sand: Submit a 2 kg sample of each type of sand required to be of a particular colour, grade or source.

Tests

Site tests: Submit results as follows:

- Mortar.
- Special masonry.

1.7 INSPECTION

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

- Set-out.
- Unit type, colour and texture.
- Bottoms of cavities, after cleaning out.
- Bottoms of core holes, before grouting.
- Reinforcement type and diameter.
- Positioning of reinforcing before grouting.
- Control joints, ready for insertion of joint filler.
- Damp-proof courses, in position.
- Flashings, in position.
- Lintels, in position.
- Structural steelwork, including bolts and shelf angles, in position.

2 PRODUCTS

2.1 FIRE PERFORMANCE

Fire-resistance of building elements
Fire-resistance level: Tested to AS 1530.4.

2.2 DURABILITY

General
Exposure locations: To AS 3700 clause 5.4.

2.3 MATERIALS

Brick and block units
Selections: As documented.

Standard: To AS/NZS 4455.1 and AS/NZS 4455.3.

Salt attack resistance grade: To AS 3700 Table 5.1.

Minimum age of clay bricks: 7 days.

Mortar materials
Mortar class: To AS 3700 Table 5.1.

Cement: To AS 3972.

White cement: With ≤ 1% iron salts content.

Lime: To AS 1672.1.

Sand: Fine aggregate with a low clay content and free from efflorescing salts, selected for colour and grading.

Water: Clean and free from any deleterious matter.

Admixtures: To AS 3700 clause 11.4.2.4.

Pigment: To EN 12878, and as follows:

- Integral pigment mix proportion: ≤ 10% by weight of cement.

Masonry cement mortar mix proportions table (cement:lime:sand), by volume

Mortar class to AS 3700	Clay	Concrete	Calcium silicate	Water thickener
M3	1:0:4	1:0:4	n/a	Yes
M4	1:0:3	n/a	n/a	Yes

Cement (GP/GB) mortar mix proportions table (cement:lime:sand), by volume

Mortar class to AS 3700	Clay	Concrete	Calcium silicate	Water thickener
M2	1:2:9	n/a	n/a	No
M3	1:1:6	1:1:6	n/a	Optional
M3	1:0:5	1:0:5	1:0:5	Yes
M4	1:0.5:4.5	1:0.5:4.5	n/a	Optional
M4	1:0:4	1:0:4	1:0:4	Yes
M4	1:0-0.25:3	1:0-0.25:3	n/a	Optional

Grout
Standard: To AS 3700 clause 11.7.

Minimum characteristic compressive strength: 12 MPa.

2.4 BUILT-IN COMPONENTS

General
Durability class of built-in components: To AS 3700 Table 5.1.

Steel lintels
Angles and flats: To AS/NZS 3679.1.

Cold formed proprietary lintels: Designed to AS/NZS 4600.

Corrosion protection: To AS/NZS 2699.3.

Galvanizing: Do not cut after galvanizing.

Reinforcement
Standard: To AS/NZS 4671.

Corrosion protection: To AS 3700 clause 5.9.

Minimum cover: To AS 3700 Table 5.1.

Wall ties
Standard: To AS/NZS 2699.1.

Corrosion protection: To AS/NZS 2699.1.

Connectors and accessories
Standard: To AS/NZS 2699.2.

Corrosion protection: To AS/NZS 2699.2.

Flashings and damp-proof courses
Standard: To AS/NZS 2904.

Slip joints
Standard: To AS 3700 clause 4.14.

Air vents
Blockwork: Select from the following:

- Concrete framed: Bronze wire mesh in concrete frame, 390 x 190 mm.
- Vent blocks: Purpose-made vent blocks.

Brickwork: Select from the following:

- Concrete framed: Bronze wire mesh in concrete frames, 470 x 160 mm.
- Cut brick: 2 cut bricks laid vertically and evenly spaced in a 230 mm wide x 2 course high opening, backed with bronze wire mesh built in.
- Terracotta: Perforated, 230 x 160 mm.

3 EXECUTION

3.1 GENERAL

Mortar mixing
General: Measure volumes accurately to the documented proportions. Machine mix for at least six minutes.

Protection
Masonry materials and components: Protect from ground moisture and contamination.

During construction: Cover the top surface of brickwork and blockwork to prevent the entry of rainwater and contaminants.

Bond
Type: Stretcher bond.

Building in
Embedded items: Build in wall ties and accessories as the construction proceeds. If not practicable to obtain the required embedment within the mortar joint in hollow masonry units, fill appropriate cores with grout or mortar.

Steel door frames: Fill the backs of jambs and heads solid with mortar as the work proceeds.

Clearance for timber frame shrinkage
General: In timber frame brick veneer construction, leave clearances between window frames and brick sill and between roof frames and the brick veneer as follows:

- Single storey frames and ground floor windows (not for slab on ground): 10 mm.
- Two storey frames and upper floor windows: 20 mm.
- Additional clearance: To accommodate additional shrinkage of unseasoned floor timbers.

Monolithic structural action
Construction at different rates or times: If two or more adjoining sections of masonry, including intersecting walls, are constructed at different rates or times, rake back or tie the intersections between those sections to obtain monolithic structural action in the completed work.

Header units: Except in stretcher bond facework, provide brick and block header units, to AS 3700 clause 4.11.2.

- Spacing: 600 mm maximum.
- Location: Provide header units in the following locations:
  . At engaged piers.
  . At engagement of diaphragms with the leaves in diaphragm walls.
  . At intersections of flanges with shear walls.
  . At intersections with supporting walls and buttresses.
  . Between leaves in solid masonry construction.

Joining to existing
General: Provide a control joint where joining to existing structures. Do not tooth new masonry into existing work unless approved by a professional engineer.

Mortar joints
General: Set out masonry with joints of uniform width and minimum cutting of masonry units.

Solid and cored units: Lay on a full bed of mortar. Fill perpends solid. Cut mortar flush.

Face-shell bedded hollow units: Fill perpends solid. Cut mortar flush.

Joint thickness: 10 mm.

Finish: Conform to the following:

- Externally: Tool to give a dense water-shedding finish.
- Internally: If wall is to be plastered, do not rake more than 10 mm to give a key.

Rate of construction
General: Regulate the rate of construction to eliminate joint deformation, slumping or instability.

Rods
Set-out: Construct masonry to the following rods:

- 75 mm high units: 7 courses to 600 mm.
- 90 mm high units: 6 courses to 600 mm.
- 190 mm high units: 3 courses to 600 mm.

Temporary support
General: If the final stability of the masonry is dependent on construction of (structural) elements after the brickwork and blockwork is completed, provide proposals for temporary support or bracing.

3.2 FACEWORK

Cleaning
General: Clean progressively as the work proceeds to remove mortar smears, stains and discolouration. Do not erode joints if using pressure spraying.

Acid solution: Do not use.

Colour mixing
Distribution: In facework, distribute the colour range of units evenly to prevent colour concentrations and banding.

Below ground
Facework: Commence face brickwork at least 1 full course for blockwork, or 2 full courses for brickwork, below adjacent finished surface level.

Double face walls
Selection: Select face units for uniform width and double-face qualities.

Preferred face: Before starting, obtain approval of the preferred wall face, and favour that face should a compromise be unavoidable.

Perpends
General: If other than vertically aligned perpends in alternate courses are proposed, provide details.

Sills and thresholds
General: Solidly bed sills and thresholds and lay them with the top surfaces draining away from the building.

Minimum size of cut unit: Three quarters full width.

3.3 SUBFLOOR WORK

Access openings
General: In internal walls, leave door width openings beneath doorways to give access to underfloor areas.

Air vent locations
General: Provide air vents to give adequate cross ventilation to the space under suspended ground floors.

Cavity walls: Provide matching vents in the internal leaves located as near as practicable to the vents in the external leaves.

Location: Below damp-proof course to internal and external walls.

Underpinning
Requirement: Install underpinning , without causing damage to the building.

Grouting: Pack dry mix M4 mortar between underpinning and existing structure at the completion of each panel of underpinning.

3.4 CAVITY WORK

Cavity clearance
General: Keep cavities clear at all times.

Cavity fill
General: Fill the cavity with mortar to 1 course above adjacent finished (ground) level. Fall the top surface towards the outer leaf.

Cavity width
General: Construct minimum cavity widths in conformance with the following:

- Masonry walls: 50 mm.
- Masonry veneer walls: 40 mm between the masonry leaf and the load bearing frame and 25 mm minimum between the masonry leaf and sheet bracing.

Openings
Jambs of external openings: Do not close the cavity.

Wall ties, connectors and accessories
Protection: Install to prevent water passing across the cavity.

3.5 DAMP-PROOF COURSES

Location
General: Locate damp-proof courses, as follows:

- Timber floors: In the first course below the level of the underside of ground floor timbers in internal walls and inner leaves of cavity walls.
- Cavity walls built off slabs on ground: In the bottom course of the outer leaf, continuous horizontally across the cavity and up the inner face bedded in mortar, turned 30 mm into the inner leaf 1 course above.
- Masonry veneer construction built off slabs on ground: In the bottom course of the outer leaf, continuous horizontally across the cavity. Fasten to the inner frame 75 mm above floor level.
- Walls adjoining infill floor slabs on membranes: In the course above the underside of the slab in internal walls and inner leaves of cavity walls. Project 40 mm and dress down over the membrane turned up against the wall.

Height: Not less than:

- 150 mm above the adjacent finished ground level.
- 75 mm above the finished paved or concrete area.
- 50 mm above the finished paved or concreted area and protected from the direct effect of the weather.

Installation

General: Lay in long lengths. Lap full width at angles and intersections and at least 150 mm at joints. Step as necessary, but not exceeding 2 courses per step for brickwork and 1 course per step for blockwork. Sandwich damp-proof courses between mortar.

Junctions: Preserve continuity of damp-proofing at junctions of damp-proof courses and waterproof membranes.

Lap sealing: Seal with a bituminous adhesive and sealing compound.

3.6 FLASHINGS

Location

General: Locate flashings, as follows:

- Floors: Full width of outer leaf immediately above slab or shelf angle, continuous across cavity and up the inner face bedded in mortar, turned 30 mm into the inner leaf 2 courses above for brick and 1 course above for block. If the slab supports the outer skin and is not rebated, bed the flashing in a suitable sealant.
- Under sills: 30 mm into the outer leaf bed joint 1 course below the sill, extending up across the cavity and under the sill in the inner leaf or the frame for masonry veneer. Extend at least 150 mm beyond the reveals or each side of the opening.
- Over lintels to openings: Full width of outer leaf immediately above the lintel, continuous across cavity, turned 30 mm into the inner leaf 2 courses above for brick and 1 course above for block or turned up against the inner frame and fasten to it. Extend at least 150 mm beyond the lintels.
- At abutments with structural frames or supports: Vertical flash in the cavity using 150 mm wide material, wedged and grouted into a groove in the frame opposite the cavity.
- At jambs: Vertically flash jamb, extending 75 mm into the cavity, interleaved with the sill and head flashing at each end. Fix to jambs.
- At roof abutments with cavity walls: Cavity flash immediately above the roof and over-flash the roof apron flashing.

Installation

General: Sandwich flashings between mortar except where on lintels or shelf angles. Bed flashings, sills and copings in one operation to maximise adhesion.

Laps: If required, lap full width at angles and intersections and at least 150 mm at joints. Step as necessary, but not exceeding 2 courses per step for brickwork and 1 course per step for blockwork.

Lap sealing: Seal with a bituminous adhesive and sealing compound.

Pointing: Point up joints around flashings, filling voids.

Weepholes
Requirement: Locate weepholes to external leaves of cavity walls in the course immediately above flashings, and cavity fill, and at the bottoms of unfilled cavities.

Form: Open perpends.

Maximum spacing: 1200 mm.

3.7 WALL TIES

Location
General: Space wall ties in conformance with AS 3700 clause 4.10 and at the following locations:

- Not more than 600 mm in each direction.
- Adjacent to vertical lateral supports.
- Adjacent to control joints.
- Around openings.

Installation
Fixing of masonry veneer ties:

- To timber frames: Screw fix to outer face of timber frames with fasteners to AS 3566.1.
- To concrete: Masonry anchors.
- To steel frames: Screw fix to outer face of steel studs with fasteners to AS 3566.1.

3.8 CONTROL JOINTS

General
Location and spacing: Provide contraction joints, expansion joints or articulation joints to AS 3700 clause 4.8.

Control joint filling
Filler material: Provide compatible sealant and bond breaking backing materials which are non-staining to brickwork and blockwork. Do not use bituminous materials with absorbent masonry units.

- Bond breaking materials: Non-adhesive to sealant, or faced with a non-adhering material.
- Foamed materials: Closed-cell or impregnated, not water-absorbing.

Installation: Clean the joints thoroughly and insert an easily compressible backing material before sealing.

Sealant depth: Fill the joints with a gun-applied flexible sealant for a depth of at least two-thirds the joint width.

Fire-resisting control joints
General: If a control joint is located in an element of construction required to have a fire-resistance level (FRL), construct the control joint with fire stopping materials which maintain the FRL of the element.

Fire-stopping: To AS 4072.1.

3.9 BRICKWORK AND BLOCKWORK DUCT RISERS

General
Location: Build a one-piece corrosion resistant metal tray to the masonry duct risers at roof level.

Material: Concrete blockwork to Engineers Specification

Installation
General: Cut an opening for the riser. Turn tray edges up 25 mm around the opening 13 mm clear of the walls. Externally turn the tray up 100 mm under the stepped flashing and down 100 mm over the apron flashing. Lap and solder joints.

Weepholes
General: Provide 2 weepholes through the masonry duct riser walls on opposite sides immediately above the tray.

3.10 BRICKWORK BED JOINT REINFORCEMENT

Location
General: Locate as follows:

- In 2 bed joints below and above head and sill flashings to openings.
- In 2 bed joints below and above openings.
- In third bed joint above bottom of wall.
- In second bed joint below top of wall.

Maximum vertical intervals: 500 mm.

Installation
General: Lap 450 mm at splices. Fold and bend at corners so that the longitudinal wires are continuous. Stop 50 mm short of control joints. Extend 450 mm beyond each side of openings.

Reinforcement
Material: Galvanized welded wire mesh.

Width: Equal to the width of the leaf, less 15 mm cover from each exposed surface of the mortar joint.

3.11 REINFORCED AND GROUTED BLOCKWORK

Cleaning core holes
General: Provide purpose-made cleanout blocks or machine cut a cleaning hole at the base of each grouted core.

Location: Locate on the side of the wall which is to be rendered or otherwise concealed.

Cleaning: Rod cores to dislodge mortar fins protruding from the blocks and mortar droppings from reinforcement. Remove through the clean-out blocks.

Grouting
Commencement: Do not commence until grout spaces have been cleaned out and the mortar joints have attained sufficient strength to resist blow-outs.

Height of lift: Limit the height of individual lifts in any pour to make sure that the grout can be thoroughly compacted to fill all voids.

Compaction: Compact by vibration or by rodding.

Topping up: On the completion of the last lift, top up the grout after 10 min and within 30 min, and vibrate or rod to mix with the previous pour.

3.12 LINTELS

Location
General: Install one lintel to each wall leaf as documented in the **Lintel schedule**.

Installation
General: Do not cut on site. Keep lintels 10 mm clear of heads of frames.

Steel lintels: Pack mortar between any vertical component and supported masonry units. For angles, install the long leg vertical.

Minimum bearing each end:

- Span ≤ 1000 mm: 100 mm.
- Span > 1000 mm ≤ 3000 mm: 150 mm.
- Span > 3000 mm: To structural drawings.

Propping: Provide temporary props to lintels to prevent deflection or rotation.

- Minimum propping period: 7 days.

3.13 CONNECTORS AND ACCESSORIES

Slip joints
General: Install slip joints to top of all unreinforced masonry walls supporting concrete slabs and other concrete elements.

Protection: Keep the slip joints in place and protect from displacement.

Flexible masonry ties
General: Install stabilising ties at control joints and abutting structural elements, including columns, beams and slab soffits.

Locations and details: As documented.

3.14 ARCHES

Arch voussoirs
General: Cut units using a masonry saw.

Shapes and dimensions
General: Form arches using solid or cored (not hollow) masonry units.

3.15 BAGGING

Preparation
General: Cut joints flush before bagging.

Dry bagging
Application: Apply laying mortar to the surface using a hessian bag or similar. Flush up irregularities, but leave a minimum amount of mortar on the surface.

Textured bagging
Application: Apply laying mortar to the surface using a sponge float. Flush up irregularities, but leave approximately 2 mm of mortar on the surface. When initial set is reached, texture using a hand bristle brush.

3.16 TESTING

Mortar
Durability: Scratch index test to AS 3700 Appendix E.

Compressive strength: To AS 3700 Appendix C.

Flexural strength: To AS 3700 Appendix D.

Special masonry
Sampling and testing: To AS 3700 clause 12.7.

Performance: As documented in the **Brick and block construction performance schedule for special masonry**.

4 SELECTIONS

4.1 SCHEDULES

Brick and block construction schedule

Property	A	B	C
Bricks and blocks: Name or type			
Bricks and blocks: Fire-resistance level (FRL)			
Bricks and blocks: Work size (mm)			
Bricks and blocks: Category			
Bricks and blocks: Salt attack resistance category			
Bricks and blocks: Characteristic unconfined compressive strength (MPa)			
Bricks and blocks: Coefficient of contraction			
Bricks and blocks: Coefficient of expansion			
Bricks and blocks: Air vent units			
Bricks and blocks: Sill units			
Bricks and blocks: Threshold units			
Mortar: Cement			
Mortar: Colour			