

# Taylor Park, Grenfell

## Landscape Specification

Hardworks

Revision	Date	Approved by
1	30-01-24	SM
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<b>0131 PRELIMINARIES</b>
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## 1 GENERAL

### 1.1 GENERAL

#### General conditions

Contract: As provided by Weddin Shire Council

#### Interpretation

General: The words owner and architect have the same meaning, respectively, as principal and contract administrator, unless the context requires otherwise.

Cross reference: **INTERPRETATION** in *0171 General requirements* also applies.

### 1.2 THE SITE

#### Occupied premises

General: For the parts of the site documented in the **Occupied premises schedule**:

- Allow occupants to continue in secure possession and occupancy of the premises for the required period.
- Maintain safe access for occupants.
- Arrange work to minimise nuisance to occupants and for their safety.
- Protect occupants against weather, dust, dirt, water or other nuisance.

Proposals: Submit details of proposed methods.

- Purpose of submission: For information.
- Timing of submission: Before commencement of work.

#### Occupied premises schedule

Occupants	Occupied premises	Period of occupancy
General public	Taylor Park	Duration

#### Reinstatement

Accessways and services: Do not obstruct or damage roadways and footpaths, drains and watercourses and other existing services in use on or adjacent to the site. Determine the location of such services. Rectify immediately any obstruction or damage to such services and provide temporary services whilst repairs are carried out.

Trees and properties: Do not interfere with or damage trees and properties that are to remain on or adjacent to the site, including adjoining property encroaching onto the site. Rectify immediately any interference or damage to such trees and properties.

#### Existing services

Service to be continued: Repair, divert or relocate service, as documented.

Trenches: If the existing service crosses the line of a required trench or will lose support when the trench is excavated, provide permanent support for the existing service.

Redundant services: Remove redundant parts and make safe.

Interruptions to services: Minimise the number and duration of interruptions.

Changes to existing services: Submit proposals.

- Purpose of submission: For review.
- Timing of submission: Before starting work to existing services.

### 1.3 CONSTRUCTION PLANT

#### General

Temporary works: Provide and maintain required hoardings, barricades, guards, fencing, shoring, temporary roadways, footpaths, signs, lighting and traffic management.

#### Access roads

Owner's existing roads: Use only designated roads.

#### Parking

Owner's existing parking areas: Use only designated parking areas.

#### Protective clothing

Requirement: Make available protective clothing for the use of visitors, as follows:

- Safety helmets: Type 1 to AS/NZS 1801 (1997).
- High visibility safety vests: To AS 4602.1 (2011).

Certification: Required.

- Certification provider: An organisation accredited by the Joint Accreditation System of Australia and New Zealand (JASANZ).

#### Temporary fence

Requirement: Landscape fencing as specified

#### Use of existing services

General: Existing services may be used as temporary services for the performance of the contract subject to conditions of use, as documented in the **Existing services schedule**.

#### Existing services schedule

Service	Conditions of use
Electricity	As required
Water	As required

### 1.4 BUILDING THE WORKS

#### Survey marks

Definition: A survey peg, benchmark, reference mark, signal, alignment, level mark or any other mark used or intended to be used for the purpose of setting out, checking or measuring the work.

Care of survey marks: Preserve and maintain the owner's survey marks in their true positions.

Rectification: If survey marks are disturbed or obliterated, immediately rectify.

#### Safety

Accidents: Promptly notify the architect of the occurrence of the following:

- Accidents involving death or personal injury.
- Accidents involving loss of time.
- Incidents with accident potential such as equipment failure, slides and cave-ins.

Accident reports: Submit reports of accidents.

- Purpose of submission: For information.
- Timing of submission: As accidents occur

**Contractor's representative**

General: Must be accessible, and fluent in English and technical terminology.

Contacts: Submit names and telephone numbers of responsible persons who may be contacted after hours during the course of the contract.

- Purpose of submission: For information.
- Timing of submission: At the first site meeting.

**Subcontracting**

General: Submit a complete list of proposed subcontractors and suppliers.

- Purpose of submission: For information.
- Timing of submission: One week prior to commencement

**Order of work schedule – Submit for approval**

Portion of work	Order of work	Time of work
Submit for approval		

**Program of work**

Construction program: Submit a construction program showing the following:

- Sequence of work.
- Critical paths of activities related to the work.
- Allowance for holidays.
- Activity inter-relationships.
- External dependencies including provision of access, document approvals and work by others.
- Periods within which various stages or parts of the work are to be executed.

Time scale: Working days.

Updated program: Identify changes since the previous issue, and show the estimated percentage of completion for each item of work.

Purpose of submission: For information.

Timing of submission: As changes occur

Program chart: Display in the contractor's site office an up-to-date bar chart and network diagram based on the construction program.

**Site meetings**

General: Hold and attend site meetings throughout the contract and arrange for the attendance of appropriate subcontractors, architect and appropriate consultants.

Frequency: Weekly

Minutes: Make a record of site meetings. Distribute a copy of the minutes to each party.

- Purpose of submission: For review.
- Timing of submission: Within 5 working days after each meeting.

**Progress photographs**

General: Take colour progress photographs within 5 working days, before each site meeting. Submit 2 sets of prints and the digital files. Identify the project, date, time, location and orientation.

- Purpose of submission: For information.
- Timing of submission: At each site meeting.

Format: jpg or tiff

### Items supplied by owner

General: Materials and other items supplied free of charge to the contractor for installation in the execution of the works. Unload and take delivery, inspect for defects and take care of the items. If defects are found, advise. Return unused items to the owner.

Conditions of supply: TBA by Council

Notice for delivery: Contractor to liaise with Council

### Items supplied by owner schedule

Location	Item	Quantity	Date
Refer to drawings	Accessible Play Tower	1	To be discussed with Council
Refer to drawings	Flying Fox	1	To be discussed with Council
Refer to drawings	Giant Pendulum Nest Swing	1	To be discussed with Council
Refer to drawings	Story Poles	20	To be discussed with Council
Refer to drawings	Climbing structure	1	To be discussed with Council
Refer to drawings	Talk Tubes	2	To be discussed with Council
Refer to drawings	Learn to Ride signage	6	To be discussed with Council
Refer to drawings	Fencing	147 lm	To be discussed with Council
Refer to drawings	Shelter 10mx x6m	1	To be discussed with Council
Refer to drawings	Shelter 8mx 6m	1	To be discussed with Council
Refer to drawings	Barbeque	2	To be discussed with Council
Refer to drawings	Bubbler	1	To be discussed with Council
Refer to drawings	Picnic table	6	To be discussed with Council
Refer to drawings	Park seat	8	To be discussed with Council
Refer to drawings	General litter bin	2	To be discussed with Council
Refer to drawings	Recycling bin	2	To be discussed with Council
Refer to drawings	Single bike rack - TBA	1	To be discussed with Council

### Changes to existing items

General: At least 5 working days before changing existing items, give notice.

Existing items requiring notification: Swings

### Control of runoff stormwater

Requirement: Refer to 0172 Environmental Management

**Persons other than contractor**

Facilities: Refer to person other than contractor documentation.

Contractor/person other than contractor interfaces: Refer to person other than contractor documentation.

**1.5 COMPLETION OF THE WORKS****Final cleaning**

General: Before the date for practical completion, clean throughout, including interior and exterior surfaces exposed to view. Vacuum carpeted and soft surfaces. Clean debris from the site, roofs, gutters, downpipes and drainage systems. Remove waste and surplus materials.

Samples: Remove non-incorporated samples, prototypes and sample panels.

**Reinstatement**

General: Before the date for practical completion, clean and repair damage caused by installation or use of temporary work and restore existing facilities used during construction to original condition.

**Adjoining properties**

Evaluation: At practical completion, for each property documented in the **Adjoining properties to be recorded schedule**, inspect the property with the architect and owner and occupant of the property, recording any damage that has occurred since the pre-commencement inspection.

**Removal of plant**

General: Within 10 working days after practical completion, remove temporary works and construction plant no longer required. Remove the balance before the end of the defects liability period.

**1.6 PAYMENT FOR THE WORKS****Progress claims**

Anticipated progress claims: Submit a schedule of anticipated progress claims for the contract period.

- Purpose of submission: For information.
- Timing of submission: At commencement of the works.

Progress claim breakdown: Submit a statement of amounts claimed in respect of each worksection or trade heading designated in the specification.

- Purpose of submission: For review.
- Timing of submission: With each progress claim.

**Method of measurement**

General: In conformance with the principles of the Australian and New Zealand standard method of measurement of building works (ANZSMM) (2022).

**1.7 MISCELLANEOUS****Contractor and owner to observe confidentiality**

Publicity: Do not issue information concerning the project for publication in the media without prior written approval of the owner. Refer enquiries from the media concerning the project to the owner.

**Compliance with the law**

Requirements of authorities: The owner, before entering into the contract, has given the notices, paid the fees, and obtained the permits, approvals and other authorisations, as documented in the

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**0171 GENERAL REQUIREMENTS****1 GENERAL****1.1 PRECEDENCE****General**

Order of precedence: If there is conflict or inconsistency between the worksections of this specification, the requirements of worksections take the following order of precedence:

- All worksections other than those listed below.
- *0701 Mechanical systems, 0801 Hydraulic systems, 0901 Electrical systems and 1001 Fire services systems.*
- 018 Common requirements worksections.
- *0171 General requirements.*

**1.2 CROSS REFERENCES****Common requirements**

Requirement: Conform to the following worksections:

- *0181 Adhesives, sealants and fasteners.*
- *0182 Fire-stopping.*
- *0183 Metals and prefinishes.*
- *0184 Termite management.*
- *0185 Timber products, finishes and treatment.*

**Cross referencing styles**

General: Within the text, titles are cross referenced using the following styles:

- Worksection titles are indicated by *Italicised* text.
- Subsection titles are indicated by CAPITAL text.
- Clause titles are indicated by **BOLD CAPITAL** text.
- Subclause titles are indicated by **Bold Sentence case** text.

**1.3 REFERENCED DOCUMENTS****General**

Precedence: The requirements of worksections override conflicting requirements of their referenced documents. The requirements of the referenced documents are minimum requirements.

Contractual relationships: Responsibilities and duties of the principal, contractor and contract administrator are not altered by requirements in the documents referenced in this specification.

Current editions: All referenced documents are the editions, with amendments, current on 1st September 2023.

Exception to current editions: If statutory requirements reference other editions or standards, conform to those other editions or standards. Where the NCC (2022) references editions other than the current edition, the same editions cited in the NCC (2022) are referenced in each worksection.

Maintenance and repair works: If statutory requirements applicable to the maintenance or repair works reference other editions or standards, conform to those other editions or standards.

European standards: Any national European Standard (e.g. IS EN or DIN EN) may be used in place of the equivalent referenced European Standard (EN).

**1.4 CONTRACT DOCUMENTS****Services diagrammatic layouts**

General: Layouts of service lines, plant and equipment shown on the drawings are diagrammatic only, except where figured dimensions are provided or calculable.

Before commencing work:

- Obtain measurements and other necessary information.
- Coordinate the design and installation in conjunction with all trades.



**Levels**

General: Spot levels take precedence over contour lines and ground profile lines.

**Drawings and manuals for existing services**

Subsurface services: No information is provided and the contractor is expected to undertake their own investigations including but not limited to a Dial Before You Dig.

Warranty: No warranty is given as to the completeness or accuracy of drawings and/or manuals of existing services.

**1.5 INTERPRETATION****Abbreviations**

General: For the purposes of this specification the following abbreviations apply:

- AS: Australian Standard.
- BCA: National Construction Code Series Volume One: Building Code of Australia Class 2 to 9 Buildings and Volume Two: Building Code of Australia Class 1 and Class 10 Buildings.
- EN: European Norm (European Standard).
- GRP: Glass Reinforced Plastic.
- IP: Ingress protection.
- NATA: National Association of Testing Authorities.
- NCC: National Construction Code.
- NZS: New Zealand Standard.
- PCA: National Construction Code Series Volume 3: Plumbing Code of Australia.
- PVC: Polyvinyl Chloride.
- PVC-U: Unplasticised Polyvinyl Chloride. Also known as UPVC.
- SDS: Safety data sheets.
- VOC: Volatile Organic Compound.
- WHS: Work Health and Safety.

**Definitions**

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

- Access for maintenance: Includes access for maintenance, inspection, measurement, operation, adjustment, repair, replacement and other maintenance related tasks.
- Accessible, readily: Readily accessible, easily accessible, easy access and similar terms mean capable of being reached quickly and without the use of a tool, without hazard, climbing over or removing obstructions, using a movable ladder, and in any case not more than 2.0 m above the ground, floor or platform.
- Accredited Testing Laboratory:
  - . An organisation accredited by the National Association of Testing Authorities (NATA) to undertake the relevant tests; or
  - . An organisation outside Australia accredited to undertake the relevant tests by an authority recognised by NATA through a mutual recognition agreement; or
  - . An organisation recognised as being an Accredited Testing Laboratory under legislation at the time the test was undertaken.
  - . An organisation accredited for compliance with ISO/IEC 17025 (2017) to undertake the relevant tests.
- Appropriately qualified person: To NCC (2022) Schedule 1.
- Attendance: Attendance, provide attendance and similar expressions mean give assistance for examination and testing.
- Baseline data: Data derived from the final design, installation and commissioning, which serve as a basis for verification of results of routine servicing.
- Commissioning: Advancement of an installation from static completion to full working order, including verification that the systems, subsystems, and their components meet the project requirements. This includes all work described as commissioning in referenced documents, even if carried out before static completion.

- Contract administrator: Has the same meaning as architect, superintendent or principal's authorised person and is the person appointed by the owner or principal under the contract.
- Contractor: Has the same meaning as builder and is the person or organisation bound to carry out and complete the work under the contract.
- Default: Specified value, product or installation method that is to be provided unless otherwise documented.
- Design life: The period of time for which it is assumed, in the design, that an asset will be able to perform its intended purpose with only anticipated maintenance but no major repair or replacement being necessary.
- Design parameters: Information used as the basis for design. It includes design requirements, performance criteria, performance parameters and similar terms.
- Documented: Documented, as documented and similar terms mean contained in the contract documents.
- Economic life: The period of time from the acquisition of an asset to the time when the asset, while still physically capable of fulfilling its function and with only anticipated maintenance, ceases to be the lowest cost alternative for satisfying that function.
- Electricity distributor: Any person or organisation that provides electricity from an electricity distribution system to one or more electrical installations. Includes distributor, supply authority, network operator, local network service provider, electricity retailer or electricity entity, as may be appropriate in the relevant jurisdiction.
- Errors and omissions: For the design prepared by the contractor, errors and omissions have the same meaning as defects.
- Fire hazard properties: To NCC (2022) Schedule 1.
- Gas Network Operator: Has the same meaning as network operator in AS/NZS 5601.1 (2022).
- Geotechnical site investigation: The process of evaluating the geotechnical characteristics of the site in the context of existing or proposed construction.
- Give notice: Give notice, submit, advise, inform and similar expressions mean give notice (submit, advise, inform) in writing to the contract administrator.
- High level interface: Systems transfer information in a digital format using an open system interface.
- Hot-dip galvanized: Zinc coated to AS/NZS 4680 (2006) after fabrication with coating thickness and mass to AS/NZS 4680 (2006) Table 1.
- Ingress protection: IP, IP code, IP rating and similar expression have the same meaning as IP Code in AS 60529 (2004).
- Joints:
  - . Construction joint: A joint with continuous reinforcement provided to suit construction sequence.
  - . Contraction joint: An opening control joint with a bond breaking coating separating the joint surfaces to allow independent and controlled contraction of different parts or components, induced by shrinkage, temperature changes or other causes. It may include unbound dowels to assist vertical deflection control.
  - . Control joint: An unreinforced joint between or within discrete elements of construction that allows for relative movement of the elements.
  - . Expansion joint: A closing control joint with the joint surfaces separated by a compressible filler to allow axial movement due to thermal expansion or contraction with changes in temperature or creep. It may include unbound dowels to assist vertical deflection control.
  - . Sealant joint: A joint filled with a flexible synthetic compound that adheres to surfaces within the joint to prevent the passage of dust, moisture and gases.
  - . Structural control joint: A control joint (contraction, expansion and isolation) in structural elements when used with applied material and finishes.
  - . Substrate joint: A joint in the substrate, which includes construction joints and joints between different materials.
  - . Weakened plane joint: A contraction joint created by forming a groove, extending at least one quarter the depth of the section, either by using a grooving tool, by sawing, or by inserting a premoulded strip.

- Local authority (local council): A body established for the purposes of local government by or under a law applying in a state or territory.
- Low level interface: Systems transfer information via terminals and voltage free contacts.
- Manufacturer's recommendations: Recommendations, instructions, requirements, specifications (and similar expressions) provided in written or other form by the manufacturer and/or supplier relating to the suitability, use, installation, storage and/or handling of a product.
- Metallic-coated: Steel coated with zinc or aluminium-zinc alloy as follows:
  - . Metallic-coated steel sheet: To AS 1397 (2021). Metal thicknesses specified are base metal thicknesses.
  - . Ferrous open sections zinc coated by an in-line process: To AS/NZS 4791 (2006).
  - . Ferrous hollow sections zinc coated by a continuous or specialised process: To AS/NZS 4792 (2006).
- Network Utility Operator: To NCC (2022) Schedule 1. A person who undertakes the piped distribution of drinking water or non-drinking water for supply; or is the operator of a sewerage system or a stormwater drainage system.
- Obtain: Obtain, seek and similar expressions mean obtain (seek) in writing from the contract administrator.
- Pipe: Includes pipe and tube.
- Practical completion or defects free completion: The requirements for these stages of completion are defined in the relevant building contract for the project.
- Pre-commissioning: Verifying that the installation of a system is complete and ready for commissioning.
- Principal: Principal has the same meaning as owner, client and proprietor and is the party to whom the contractor is legally bound to construct the works.
- Professional engineer: To NCC (2022) Schedule 1.
- Proprietary: Identifiable by naming the manufacturer, supplier, installer, trade name, brand name, catalogue or reference number.
- Prototype: A full size mock-up of components, systems or elements to demonstrate or test construction methods, junctions and finishes, and to define the level of quality.
- Provide: Provide and similar expressions mean supply and install and include development of the design beyond that documented.
- Record drawings: Record drawings has the same meaning as as-installed drawings, as-built drawings and work-as-executed drawings.
- Recovered/reclaimed materials: Material previously used in a building or project that is then re-used in another project. The material may be altered, re-sized, refinished, or adapted, but is not reprocessed in any way, and remains in its original form.
- Referenced documents: Standards and other documents whose requirements are included in this specification by reference.
- Required: Required by the contract documents, the local or statutory authorities.
  - . If required: A conditional specification term for work that may be shown in the documents or is a legislative requirement.
- 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.
- Statutory authority: A public sector entity created by legislation, that is, a specific law of the Commonwealth, State or Territory.
- Static completion: The state of a system when installation works are complete but have not been commissioned.
- Supply: Supply, furnish and similar expressions mean supply only.
- Tests - integrated system: Tests conducted on the project as a complete, integrated system to verify successful integration, interaction, and operation of all interrelated systems to the project requirements.
- Tests - production: Tests carried out on an item, before delivery to the site.
- Tests - site: Tests carried out on site.

- Tests - type: Tests carried out on an item identical with a production item, including with respect to materials, material suppliers, manufacturing processes, dimensions and marking.
- Tolerance: The permitted difference between the upper limit and the lower limit of dimension, value or quantity.
- Utility service provider: Includes Electricity distributor, Network Utility Operator, Gas Network Operator and organisations providing other reticulated utilities including data and telecommunications services.
- Verification: Provision of evidence or proof that a performance requirement has been met or a default exists.

## **2 SUBMISSIONS AND INSPECTIONS**

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### **2.1 INSPECTION**

#### **Notice**

Concealment: If notice of inspection is required for parts of the works that are to be concealed, give notice when the inspection can be made before concealment.

#### **Notification times**

Minimum notice: As documented.

#### **Light levels**

Lighting levels for inspection: To AS/NZS 1680.2.4 (2017).

#### **Attendance**

General: Provide attendance for documented inspections and tests.

## **3 PERFORMANCE**

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### **Galvanizing**

Severe conditions: Galvanize mild steel components (including fasteners) to AS/NZS 1214 (2016) or AS/NZS 4680 (2006) as appropriate, if:

- Exposed to weather.
- Embedded in masonry.
- Exposed to or in air spaces behind the external leaf of masonry walls.
- In contact with chemically treated timber, other than copper chrome arsenate (CCA).

### **3.1 NOISE LEVELS**

#### **General**

Requirement: Install systems to operate within the noise level limits, as documented for the contract design and documented equipment performance.

### **3.2 STRUCTURE**

#### **General**

Requirement: If required, provide structures, installations and components as follows:

- Fixed accessways: To AS 1657 (2018).
- Structural design actions: To the AS/NZS 1170 series.

## **4 DESIGN**

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### **4.1 DESIGN DEVELOPMENT**

#### **General**

Requirement: Complete the design of the work, including development of the design beyond that documented.

Conflict with the documents: If it is believed that a conflict exists between statutory requirements and the documents, notify the contract administrator immediately and provide a recommendation to resolve the conflict.

**Certification of the design**

Requirement: Submit certification verifying conformance of the design to the documented and statutory requirements.

Certifier: To **DESIGNER**.

**Safety in design**

Requirement: Provide a design that allows for safe construction, operation and maintenance, and demolition in conformance with statutory requirements.

**4.2 DESIGNER****General**

Design by contractor: If the contractor provides design, use only appropriately qualified and registered persons.

**5 PRODUCTS AND MATERIALS**

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**5.1 GENERAL****Sources policy**

General: Conform to the *Modern Slavery Act 2018 (Cth)*.

**Consistency**

General: For each material or product use the same source or manufacturer and provide consistent type, size, quality and appearance.

**Low VOC emitting paints**

Paint types: To the recommendations of AS/NZS 2311 (2017) Table 4.2.

**Prohibited materials**

General: Do not provide the following:

- Materials, exceeding the limits of those listed, in the Safe Work Australia *Hazardous Chemical Information System* (HCIS) Workplace exposure standards.
- Blowing agents:
  - . Materials that use chlorofluorocarbon (CFC) or hydrochlorofluorocarbon (HCFC) in the manufacturing process.
  - . A blowing agent with a global warming potential (GWP)  $\geq 700$ .

**5.2 PROPRIETARY ITEMS****Manufacturer's or supplier's recommendations**

General: Provide manufactured items to the manufacturer's or supplier's recommendations.

Proprietary items/systems/assemblies: Assemble, install or fix to substrate to the manufacturer's or supplier's recommendations.

Project modifications: Advise of activities that supplement, or are contrary to the manufacturer's or supplier's recommendations.

**Identification of proprietary items**

Sealed containers: If items are supplied by the manufacturer in closed or sealed containers or packages, bring them to point of use in the original containers or packages.

Other items: Marked to show the following, as applicable:

- Manufacturer's identification.
- Brand name.
- Product type.
- Quantity.
- Reference code and batch number.
- Date of manufacture.

**5.3 SUBSTITUTIONS****General**

Identified proprietary items: Identification of a proprietary item does not necessarily imply exclusive preference for the identified item, but indicates the necessary properties of the item.

Alternatives: If alternatives to the documented products, methods or systems are proposed, submit sufficient information to permit evaluation of the proposed alternatives, including the following:

- Product, method or system identification.
- Manufacturer's contact details.
- Detailed comparison between the properties of the documented product and proposed substitution.
- Details of manufacturer and/or installer warranty.
- Statement of NCC compliance, if applicable.
- Evidence of conformity to a cited standard.
- Evidence that the performance is at least equal to that specified.
- Samples.
- Essential technical information, in English.
- Reasons for the proposed substitutions.
- Statement of the extent of revisions to the contract documents.
- Statement of the extent of revisions to the construction program.
- Statement of cost implications including costs outside the contract.
- Statement of consequent alterations to other parts of the works.

Availability: If the documented products or systems are unavailable within the time constraints of the construction program, submit evidence.

Criteria: If the substitution is for any reason other than unavailability, submit evidence that the substitution:

- Is of net enhanced value to the principal.
- Is consistent with the contract documents and is as effective as the identified item, detail or method.

#### **5.4 SAMPLES AND PROTOTYPES**

##### **General**

Incorporation of samples: Only incorporate samples that have been endorsed for inclusion in the works. Do not incorporate other samples.

Retention of samples: Keep endorsed samples in good condition on site, until the date for practical completion.

Unincorporated samples: Remove on completion.

## **6 BUILDING SERVICES**

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### **6.1 SERVICES CONNECTIONS**

#### **Connections**

General: Connect to utility service provider services or service points. Excavate to locate and expose connection points. Reinstatement of the surfaces and facilities that have been disturbed.

#### **Utility service provider requirements**

General: If the utility service provider elects to perform or supply part of the works, make the necessary arrangements. Install equipment supplied, but not installed, by the utility service provider.

### **6.2 SERVICES INSTALLATION**

#### **General**

Installation: Install equipment and services as follows:

- Plumb and securely fixed.
- Allow for movement in both structure and services.
- Arrange services running together, parallel to each other and adjacent building elements.

Concealment: Conceal all cables, ducts, trays and pipes except where installed in plant spaces, ceiling spaces and riser cupboards or documented to be exposed. If alternative routes are available, do not locate on external walls.

Lifting: Provide heavy items of equipment with permanent fixtures for lifting to the manufacturer's recommendations.

Suspended ground floors: Keep all parts of services suspended under ground floors at least 150 mm clear of the ground surface. Make sure services do not impede access.

### **Dissimilar metals**

Jointing: Join dissimilar metals with fittings of electrolytically compatible material.

### **Temporary capping**

Pipe ends: During construction, protect open ends of pipe with metal or plastic covers or caps.

### **Piping**

General: Install piping in straight lines at uniform grades without sags. Arrange to prevent air locks. Provide sufficient unions, flanges and isolating valves to allow removal of piping and fittings for maintenance or replacement of plant.

Spacing: Provide at least 25 mm clear between pipes and between pipes and building elements, additional to insulation.

Changes of direction: Provide as follows:

- If practicable, long radius elbows or bends and sets, and swept branch connections.
- If pipes are led up or along walls and then through to fixtures, provide elbows or short radius bends.
- Do not provide mitred fittings.

Vibration: Arrange and support piping to prevent vibration whilst permitting necessary movement. Minimise the number of joints.

Embedded pipes: Do not embed pipes that operate under pressure in concrete or surfacing material.

Valve groupings: If possible, locate valves in groups.

Pressure testing precautions: Isolate items not rated for the test pressure. Restrain pipes and equipment to prevent movement during pressure testing.

### **Support and structure**

Requirement: Provide incidental supports and structures to suit the services.

### **Pipe support systems**

Standard: To AS 4041 (2006) clause 3.28.

General: Provide hangers, brackets, saddles, clips, and support system components to resist live and dead loads and to control pipe movement caused by thermal and water pressure effects. Incorporate provisions for adjustment of spacing, alignment, grading and load distribution. Support pipework from associated equipment or building structure. Support valves, strainers and major line fittings so that no load is placed on connected piping or transmitted to it during operation and maintenance.

Fixings: Provide fixings to the associated equipment or building structure designed to withstand the loads imposed by the pipe supports.

Channel section supports: Proprietary channel section with clamps and hangers sized to match external diameter of pipe being supported. Provide all components from the same manufacturer.

Channel and fixing material: Metallic-coated steel or as documented.

Vertical pipes: Provide anchors and guides to maintain long pipes in position, and supports designed for the mass of the pipe and its contents.

Saddles: Do not use saddle type supports for pipes larger than DN 20.

Dissimilar metals: If pipe and support materials are dissimilar, provide industrial grade electrically non-conductive material securely bonded to the pipe to separate them. Provide fasteners of electrolytically compatible material.

Fixing to masonry and concrete: Provide metallic-coated steel or non-ferrous metal bolts or screws into chemical or expanding metal masonry anchors.

Uninsulated pipes: Clamp piping supports directly to pipes. Provide electrical isolation of dissimilar metals.

Insulated pipes:

- Spacers: Provide spacers at least as thick as the insulation between piping supports and pipes. Extend either side of the support by at least 20 mm.
- Spacer material: Rigid insulation material of sufficient strength to support the piping and suitable for the temperature application.
- Vapour barriers: For cold pipes, apply aluminium foil tape over the circumference of the spacer to form a vapour barrier. Fit to spacer before installation of the bracket on the pipe.

- Metal sheathing: If metal sheathing is documented, provide a band of the documented sheathing materials between the aluminium foil tape and the support for the full width of the spacer.

Hanger sizes: Conform to the following:

- Gas installations: To AS/NZS 5601.1 (2022) Table 5.8.3.
- Other pipes: Provide hangers sized to the manufacturer's recommendations to suit operating conditions and regulatory requirements including the loads due to valves and other attached components, pipe material, pipe contents and temperature and seismic loads.

Support spacing: Provide supports at no greater spacing than the following:

- Cold and heated water: To AS/NZS 3500.1 (2021) Table 5.7.4.
- Sanitary plumbing: To AS/NZS 3500.2 (2021) Table 10.2.1.
- Stormwater: To AS/NZS 3500.2 (2021) clause 4.9.
- Fuel gas: To AS/NZS 5601.1 (2022) Table 5.8.2.
- Fire sprinklers and combined wet suppression systems: To AS 2118.9 (1995) Table 2.6.1.
- Fire hydrants:
  - . Metal piping: To AS 2419.1 (2021) clause 10.6.
  - . Plastic piping: To AS/NZS 3500.1 (2021).
- Gaseous fire suppression systems:
  - . General gaseous fire suppression systems: To AS 4214 (2018) clause 6.3.4.
  - . Carbon dioxide fire suppression systems: To AS 6183 (2011) clause 6.3.4.
- Medical gases: To AS 2896 (2021) Table 4.1.
- Refrigerant: To AS/NZS 5149.2 (2016) Tables 5 and 6.
- Other ferrous pipes under pressure: To AS 4041 (2006) Table 3.28.2.
- Other copper pipes: To AS 4809 (2017) Table 6.2.
- ABS pipes: To AS/NZS 3690 (2009) Table 6.2.
- PVC pipes: To AS/NZS 2032 (2006) Table 6.3.
- PE pipes: To AS/NZS 2033 (2008) Table 6.1.
- Other non-ferrous pipe carrying liquids: To AS/NZS 3500.1 (2021) Table 5.7.4.
- Other pipes carrying air or gases: To AS/NZS 5601.1 (2022) Table 5.8.2.
- Proprietary grooved piping systems: To the manufacturer's recommendations.

Additional supports: Provide additional supports as follows:

- Proprietary grooved piping systems: To the manufacturer's recommendations.
- Valves and other heavy pipe mounted components: Adjacent to the valve or component.
- Adjacent pipe mounted components requiring regular maintenance.
- At changes of direction and adjacent to wall or floor penetrations.
- Where required to anchor piping or control thermal or other movement.

### Differential movement

General: If the geotechnical site investigation report predicts differential movements between buildings and the ground in which pipes or conduits are buried, provide control joints in the pipes or conduits, as follows:

- Arrangement: Arrange pipes and conduits to minimise the number of control joints.
- Magnitude: Accommodate the predicted movements.

## 6.3 PLANT AND EQUIPMENT

### General

Location: Locate so failure of plant and equipment (including leaks) does not create a hazard for the building occupants and causes a minimum or no damage to the building, its finishes and contents including water sensitive equipment or finishes.

Safe tray and an overflow pipe: Provide to each tank, hot water heater and storage vessel.



## 6.4 ACCESS FOR MAINTENANCE

### General

Requirement: Provide access for maintenance of all items requiring inspection, measurement, operation, adjustment, repair, replacement and other maintenance-related tasks.

Standards: Conform to the relevant requirements of AS 1657 (2018), AS 1892.1 (2018), AS 2865 (2009) and AS/NZS 3666.1 (2011).

Work Health and Safety: Conform to the requirements of the applicable Work Health and Safety regulations.

Refrigerated or cooling plant: If the space is a refrigerated or cooling chamber inside a duct, air handling plant or similar, provided with an access door or personnel access panel and of sufficient size for a person to enter, provide the following to BCA (2022) G1D3:

- An access door.
- Internal lighting with external indicator lamp.
- An alarm.

Protection from injury: Protect personnel from injury caused by contact with objects including those that are sharp, hot or protrude at low level.

Plant room flooring surfaces: R10 Slip resistance classification to AS 4586 (2013).

Trip hazards: Do not run small services including drains and conduits across floors where they may be a trip hazard.

Manufacturer's standard equipment: If necessary, modify manufacturer's standard equipment to provide the plant access documented.

### Clearances

Minimum clearances for access: Conform to the following:

- Vertical clearance:  $\geq 2100$  mm, vertically above horizontal floors, ground and platforms.
- Horizontal clearance: Preferably  $\geq 750$  mm clear, but in no case less than 600 mm between equipment or between equipment and building features including walls.
- If tools are required to operate, adjust or remove equipment, provide sufficient space so the tools can be used in their normal manner and without requiring the user to employ undue or awkward force.
- Hinged or removable components: To the manufacturer's recommendations.
- Within plant items: Conform to the preceding requirements, and not less than the clearances recommended in BS 8313 (1997).

### Elevated services other than in occupied areas

Access classifications:

- Access class A: Readily accessible. Provide clear and immediate access to and around plant items. If plant or equipment is located more than 2.0 m above the ground, floor or platform, provide a platform with handrails accessible by a stair, all to AS 1657 (2018).
- Access class B: If the plant item requiring access is located more than 2.0 m above the ground, floor or platform, provide a platform with handrails accessible by a non-vertical ladder, all to AS 1657 (2018).
- Access class C: Locate plant so temporary means of access conforming to Work Health and Safety regulations can be provided.

Temporary means of access: Make sure there is adequate provision in place, which is safe and effective.

Areas in which access is restricted to authorised maintenance personnel: Provide access as follows:

- Instruments, gauges and indicators (including warning and indicating lights) requiring inspection at any frequency: Readily accessible.
- Access required monthly or more frequently: Access class A.
- Access required between monthly and six monthly: Access class A or B.
- Access required less frequently than six monthly: Access class A, B or C.

Other areas: Provide access as follows:

- Locate to minimise inconvenience and disruption to building occupants or damage to the building structure or finishes.
- In suspended ceilings, locate items of equipment that require inspection and/or maintenance above tiled parts. If not possible, provide access panels where located above set plaster or other inaccessible ceilings. Arrange services and plant locations to reduce the number of access panels. Coordinate with other trades to use common access panels where feasible.
- Do not locate equipment requiring access above partitions.
- Instruments, gauges and other items requiring inspection at any frequency: Readily accessible.
- Labelling: If equipment is concealed in ceilings, provide marking to **MARKING AND LABELLING, Equipment concealed in ceilings.**

#### **Facilities for equipment removal and replacement**

Requirement: Provide facilities to permit removal from the building and replacement of plant and equipment, including space large enough to accommodate it and any required lifting and/or transportation equipment. Arrange plant so large and/or heavy items can be moved with the minimum changes of direction.

Removal of components: Allow sufficient space for removal and replacement of equipment components including air filters, tubes of shell and tube heat exchangers, removable heat exchanger bundles, coils and fan shafts. Provide access panels or doors large enough to permit the safe removal and replacement of components within air handling units.

#### **Facilities for access**

Equipment behind hinged doors: Provide doors opening at least 150°.

Equipment behind removable panels: Provide panels with quick release fasteners or captive metal thread screws.

Removable panels: Provide handles to permit easy and safe removal and replacement.

Insulated plant and services: If insulation must be removed to access plant and services for maintenance, arrange it to allow for removal and replacement without damage.

#### **Piping**

Requirement: Conform to the following:

- Provide access and clearance at fittings that require maintenance, inspection or servicing, including control valves and joints intended to permit pipe removal.
- Arrange piping so it does not interfere with the removal or servicing of associated equipment or valves or block access or ventilation openings.
- Preferably run piping, conduits, cable trays and ducts at high level and drop vertically to equipment.

#### **Electrical equipment and controls**

Electrical equipment: Provide clearances and access space to AS/NZS 3000 (2018).

Switchboards and electrical control equipment: Locate near the main entrance to plant space and with switchboards visible from the plant being operated.

Control panels: Locate near and visible from the plant being controlled.

### **6.5 VIBRATION SUPPRESSION**

#### **General**

Requirement: Minimise the transmission of vibration from rotating or reciprocating equipment to other building elements.

#### **Standard**

Machinery noise and vibration: Vibration severity in Zone A to ISO 20816-1 (2016) and ISO 20816-3 (2022).

#### **Speeds**

General: If no maximum speed is prescribed, do not exceed 1500 r/min for direct driven equipment.

#### **Connections**

General: Provide flexible connections to rotating machinery and assemblies containing rotating machinery. Isolate pipes by incorporating sufficient flexibility into the pipework or by use of proprietary flexible pipe connections installed to prevent placing stress on pipes due to end reaction.

**Inertia bases**

General: If necessary to achieve the required level of vibration isolation, provide inertia bases having appropriate mass and to the following:

- Construction: Steel or steel-framed reinforced concrete with reinforcing bars welded between base sections. Position foundation bolts for equipment before pouring concrete.
- Supports: Support on vibration isolation mountings using height saving support brackets.

**Vibration isolation mountings**

General: Except for external equipment that is not connected to the structure of any building, support rotating or reciprocating equipment on mountings as follows:

- For static deflections < 15 mm: Single or double deflection neoprene in-shear mountings incorporating steel top and base plates and a tapped hole for bolting to equipment.
- For static deflections ≥ 15 mm: Spring mountings.

Selection: Provide mountings selected to achieve 95% isolation efficiency at the normal operating speeds of the equipment.

Installation: Set and adjust vibration isolation mounting supports to give clearance for free movement of the supports.

Spring mountings: Provide freestanding laterally stable springs as follows:

- Clearances: ≥ 12 mm between springs and other members such as bolts and housing.
- High frequency isolation: 5 mm neoprene acoustic isolation pads between base plate and support.
- Levelling: Provide bolts and lock nuts.
- Minimum travel to solid: ≥ 150% of the designated minimum static deflection.
- Ratio of mean coil diameter to compressed length at the designated minimum static deflection: ≥ 0.8:1.
- Snubbing: Snub the springs to prevent bounce at start-up.
- Vertical resilient limit stops: To prevent spring extension when unloaded, to serve as blocking during erection and which remain out of contact during normal operation.

**6.6 FINISHES TO BUILDING SERVICES****General**

Requirement: If exposed to view (including in plant rooms), paint building services and equipment.

Surfaces painted or finished off-site: Conform to *0183 Metals and prefinishes*.

Exceptions: Do not paint chromium or nickel plating, anodised aluminium, GRP, stainless steel, non-metallic flexible materials and normally lubricated machined surfaces. Surfaces with finishes applied off-site need not be re-painted on-site provided the corrosion resistance of the finish is not less than that of the respective finish documented.

Standard: Conform to the recommendations of AS/NZS 2311 (2017) Sections 3, 6 and 7 or AS 2312.1 (2014) Sections 6, 7 and 8, as applicable.

Inaccessible surfaces: If surfaces are inaccessible after installation, complete finish before installation.

**Painting systems**

New unpainted interior surfaces: To AS/NZS 2311 (2017) Table 5.1.

New unpainted exterior surfaces: To AS/NZS 2311 (2017) Table 5.2.

**Paint application**

Coats: Apply the first coat immediately after substrate preparation and before contamination of the substrate can occur. Make sure each coat of paint or clear finish is uniform in colour, gloss, thickness and texture and free of runs, sags, blisters or other discontinuities.

Combinations: Do not combine paints from different manufacturers in a paint system.

Protection: Remove fixtures before starting to paint and refix in position undamaged when painting is complete.

**Underground metal piping**

Requirement: Provide corrosion protection for the following:

- Underground ferrous piping.
- Underground non-ferrous metal piping in chemically aggressive soils and environments.

Corrosion protection: Select from the following:

- Cathodic protection: Sacrificial anodes or impressed current. Incorporate a facility for periodic testing. Conform to the recommendations of AS 2832.1 (2015).
- Continuous wrapping using proprietary petroleum taping material.
- Impermeable flexible plastic coating.
- Sealed polyethylene sleeve.

Aggressive soils: If metallic piping or components are installed in chemically aggressive soil, provide additional protection as follows:

- Material: Continuous polyethylene sleeve to ASTM D1248 (2016) with a minimum thickness of 0.25 mm.
- Installation: Wrap or sleeve pipes and components. Tape joints between sections of polyethylene and between polyethylene and piping.

### Repairs to finishes

Requirement: Repair damaged finishes to restore their corrosion protection, appearance and service life.

Painting of pipe threads: After pipe installation and before other finishes or insulation are applied, paint exposed threads in metallic-coated steel pipe with zinc rich paint.

## 6.7 MARKING AND LABELLING

### General

Requirement: Mark and label services and equipment for identification purposes as follows:

- Locations exposed to weather: Provide durable materials.
- Pipes, conduits and ducts: To AS 1345 (1995) throughout its length, including in concealed spaces.
- Cables: Label to indicate the origin and destination of the cable.

Consistency: Label and mark equipment using a consistent scheme across all services elements of the project.

### Label samples and schedules

Requirement: For each item or type of item, prepare a schedule of marking and labelling, including the following:

- A description of the item or type of item for identification.
- The proposed text for marking or labelling.
- The proposed location of the marking and labelling.

Submission timing: Before marking or labelling.

### Electrical accessories

Circuit identification: Label isolating switches and outlets to identify circuit origin.

### Operable devices

Requirement: Mark to identify the following:

- Controls.
- Indicators, gauges, meters.
- Isolating switches.

### Equipment concealed in ceilings

Location: Provide a label on the ceiling, to indicate the location of each concealed item requiring access for routine inspection, maintenance and/or operation and as follows:

- Tiled ceilings, locate the label on the ceiling grid closest to the concealed item access point.
- Flush lined ceilings, locate adjacent to closest access panel.

Concealed equipment: Items to be labelled include the following:

- Fan coil units and terminal equipment (e.g. VAV terminals).
- Fire and smoke dampers.
- Isolating valves not directly connected to items otherwise labelled.
- Motorised dampers.

### Wall mounted equipment in occupied areas

Location: Provide labels on wall mounted items in occupied areas including the following:

- Services control switches.

- Temperature and humidity sensors.

**Points lists**

Automatic control points: Provide plasticised, fade-free points lists for each automatic control panel and include terminal numbers, point addresses, short and long descriptors in the lists. Store in a pocket on the door of the panel.

**Pressure vessels**

General: Mount manufacturer's certificates in glazed frames on a wall next to the vessel.

**Valves and pumps**

General: Label to associate pumps with their starters and valves. Screw fix labels to body or attach label to valve handwheels with a key ring.

**Underground services**

Survey: Accurately record the routes of underground cables and pipes before backfilling. Include on the record drawings.

Records: Provide digital photographic records of underground cable and pipe routes before backfilling. Include in operation and maintenance manual.

Location marking: Accurately mark the location of underground cables and pipes with route markers consisting of a marker plate set flush in a concrete base, engraved to show the direction of the line and the name of the service.

Markers: Place markers at ground level at each joint, route junction, change of direction, termination and building entry point and in straight runs at intervals of not more than 100 m.

Marker bases: 200 mm diameter x 200 mm deep, minimum concrete.

Direction marking: Show the direction of the cable and pipe run by means of direction arrows on the marker plate. Indicate distance to the next marker.

Plates: Brass, aluminium or stainless steel with black filled engraved lettering, minimum size 75 x 75 x 1 mm thick.

Plate fixing: Waterproof adhesive and 4 brass or stainless steel countersunk screws.

Marker height: Set the marker plate flush with paved surfaces, and 25 mm above other surfaces.

Marker tape: Where electric bricks or covers are not provided over underground wiring, provide a 150 mm wide yellow or orange marker tape bearing the words WARNING – electric cable buried below, laid in the trench 150 mm below ground level.

Plastic pipe: Provide a detectable marker tape with trace wire to identify the route of buried piping. Terminate with 1000 mm coil in a readily accessible location. Tag to match the record drawings.

**Labels and notices**

Materials: Select from the following:

- Cast metal.
- For indoor applications only, engraved two-colour laminated plastic.
- Proprietary pre-printed self-adhesive flexible plastic labels with machine printed black lettering.
- Stainless steel or brass minimum 1 mm thick with black filled engraved lettering.

Emergency functions: To AS 1319 (1994).

Colours: Generally to AS 1345 (1995) as appropriate, otherwise black lettering on white background except as follows:

- Danger, warning labels: White lettering on red background.
- Main switch and caution labels: Red lettering on white background.

Edges: If labels exceed 1.5 mm thickness, radius or bevel the edges.

Labelling text and marking: To correspond to terminology and identifying number of the respective item as shown on the record drawings and documents and in operating and maintenance manuals.

Lettering heights:

- Danger, warning and caution notices: Minimum 10 mm for main heading, minimum 5 mm for remainder.
- Equipment labels within cabinets: Minimum 5 mm.
- Equipment nameplates: Minimum 40 mm.
- Identifying labels on outside of cabinets: Minimum 5 mm.

- Isolating switches: Minimum 5 mm.
- Switchboards, main assembly designation: Minimum 25 mm.
- Switchboards, outgoing functional units: Minimum 10 mm.
- Switchboards, sub assembly designations: Minimum 15 mm.
- Valves:
  - . ≥ DN 65: Minimum 25 mm.
  - . < DN 65: Minimum 10 mm.
- Self-adhesive flexible plastic labels:
  - . Labels less than 2000 mm above floor: 5 mm.
  - . Labels minimum 2000 mm above floor: 10 mm.
  - . Other locations: Minimum 5 mm.

Label locations: Locate labels so they are easily seen and are either attached to, below or next to the item being marked.

Fixing: Fix labels securely using screws, rivets, proprietary self-adhesive labels or double-sided adhesive tape and as follows:

- If labels are mounted in extruded aluminium sections, use rivets or countersunk screws to fix the extrusions.
- Use aluminium or monel rivets for aluminium labels.

Vapour barriers: Do not penetrate vapour barriers.

## 7 COMPLETION

### 7.1 TOOLS AND SPARE PARTS

#### Spare parts

General: Provide spare parts listed as documented.

Replacement: Replace spare parts used during the maintenance period.

#### Tools and spare parts schedule

Submission timing: At least 8 weeks before the date for practical completion.

Requirement: Prepare a schedule of tools, portable instruments and spare parts necessary for maintenance of the installation. For each item state the recommended quantity and the manufacturer's current price. Include the following in the prices:

- Checking receipt, marking and numbering in conformance with the spare parts schedule.
- Packaging and delivery to site.
- Painting, greasing and packing to prevent deterioration during storage.
- Referencing equipment schedules in the operation and maintenance manuals.
- Suitable means of identifying, storing and securing the tools and instruments. Include instructions for use.

### 7.2 TRAINING

#### General

Standard: To SA TS 5342 (2021).

Duration: Instruction to be available for the whole of the commissioning and running-in periods.

Format: Conduct training at agreed times, at system or equipment location. Also provide seminar instruction to cover all major components.

Operation and maintenance manuals: Use items and procedures listed in the final draft operation and maintenance manuals as the basis for instruction. Review contents in detail with the principal's staff.

Certification: Provide written certification of attendance and participation in training for each attendee. Provide register of certificates issued.

#### Demonstrators

General: Use only qualified manufacturer's representatives who are knowledgeable about the installations.

**Operation**

General: Explain and demonstrate to the principal's staff the purpose, function and operation of the installations.

**Maintenance**

General: Explain and demonstrate to the principal's staff the purpose, function and maintenance of the installations.

**Seasonal operation**

General: For equipment requiring seasonal operation, demonstrate during the appropriate season.

**7.3 CLEANING****Final cleaning**

General: Before the date for practical completion, clean throughout, including all exterior and interior surfaces except those totally and permanently concealed from view.

Labels: Remove all visible labels not required for maintenance.

**Removal of material**

General: Dispose of building waste material off site to the requirements of the relevant authorities.

**7.4 WARRANTIES****General**

Requirement: If a warranty is documented, name the principal as warrantee. Register with manufacturers as necessary. Retain copies delivered with components and equipment.

Approval of installer: If installation is not by manufacturer, and product warranty is conditional on the manufacturer's approval of the installer, submit the manufacturer's written approval of the installing firm.

Principal's responsibilities: Submit details of responsibilities of the principal required to keep warranties in force.

**8 TESTING AND COMMISSIONING**

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**8.1 TESTING - GENERALLY****Inspection and testing plan**

Requirement: Provide inspection and testing plan consistent with the construction program including details of test stages and procedures.

**Notice**

Site tests: Give notice of the time and place of documented tests.

Inspection: Give sufficient notice for inspection to be made of the commissioning, testing and verification tests on completion of commissioning.

**Attendance**

General: Provide attendance at tests.

Suppliers: If necessary to carry out documented tests, arrange equipment suppliers to assist.

**Testing authorities**

Requirement: Have tests carried out by an Accredited Testing Laboratory, accredited for the documented test method, except for site tests or test methods that do not have an accredited testing laboratory.

**Test equipment**

Accuracy: Use testing equipment designed to test and/or measure system performance within the documented tolerances.

Calibration: Use only instruments that have current calibration certificates issued by an Accredited Testing Laboratory. Tag or label instruments with calibration date and calibration authority name. Provide copies of certification if requested.

Maximum period since last calibration: As recommended by the manufacturer but less than 12 months, except as documented.

Recalibration: If dropped or damaged, recalibrate instruments.

Testing equipment: Provide test equipment and tools to perform documented tests as follows:

- Special testing equipment: If documented, provide special equipment, tools and instruments required for testing or calibration.
- Other testing equipment: Provide standard testing equipment.

### Testing procedures

Verification: Verify test procedures by:

- Manual testing.
- Monitoring performance and analysing results using the control system trend logs.
- A combination of the above methods.

Sampling: Sampling may be used subject to the following:

- Use a sampling strategy only for multiple identical pieces of non-life-safety or otherwise non-critical equipment.
- If at any point, more than one identical item has failed, stop testing, determine the cause, rectify and document changes made to remaining units, before continuing with functional testing of the remaining units.

### Type tests

Type test reports: Required, as evidence of conformance of proprietary equipment.

### Sound pressure level measurements

Requirement: Conform to the following:

- Correction for background noise: To AS/NZS 2107 (2016) Table B1.
- External: To AS 1055 (2018).
- Internal: To AS/NZS 2107 (2016).
- Measurement positions: If a test position is designated only by reference to a room or space, do not take measurements less than 1 m from the floor, ground or walls. For large equipment items including chillers, measure at 2 m and 7 m from the equipment item.
- Sound pressure level analysis: Measure the sound pressure level and the background sound pressure level over the full range of octave band centre frequencies from 31.5 Hz to 8 kHz at the designated positions.
- Sound pressure levels: Measure the A-weighted sound pressure levels and the A-weighted background sound pressure levels at the designated positions.

### Test outcome

Requirement: Test as documented and achieve the following:

- Pass the documented Pass/Fail test, and/or
- Values that meet documented requirements, and/or
- Verification of manufacturer's claimed performance.

### Failure of multiple items

Requirement: If 10% or 3, whichever is greater, of identical pieces (size does not constitute a difference) of equipment fail to perform as documented for any reason, treat all identical units as having failed. Submit notice of failure and conform to the following:

- Within one week of notification, examine all other identical units and record the results. Submit a report of the findings within two weeks of the original failure notice.
- Within two weeks of the original failure notification, submit a signed and dated explanation of the problem, including the cause of failure, the proposed solution, full equipment details and any other information. Do not exceed the documented requirements of the original installation with the proposed solution.

### Rectification of failure under test

Requirement: If an item fails a documented test, rectify the cause of failure and repeat the test.

Submissions: If submission of test results is documented, submit results of both successful and unsuccessful tests.

### Test reports

Requirement: Include the following:

- Documented performance criteria including, if documented, tolerances.
- Observations and results of tests and conformance or non-conformance with documented requirements.



**Test validity period**

Requirement: As documented or, if no validity period is documented, no older than 5 years.

**Controls**

General: Calibrate, set and adjust control instruments, control systems and safety controls.

**Circuit protection**

General: Confirm that circuit protective devices are sized and adjusted to protect installed circuits.

**Certification**

General: On satisfactory completion of the installation, testing and commissioning and before the date for practical completion, certify that each installation is operating correctly.

**Integrated system tests**

Requirement: Conduct integrated system tests as documented.

Tests: Provide the following:

- Test the integrated operation of the systems listed in each mode documented.
- Restoration of the systems to their pre-test condition on completion of the tests above.

Failure: If any of the systems fails to perform as documented, including return to normal operation, rectify the cause and repeat the integrated system test.

**Deferred and seasonal tests**

Deferred tests: If documented testing cannot be completed at the scheduled or documented time, the Superintendent may direct that they be deferred to a later time but as soon as possible after the scheduled or documented time.

Seasonal tests: If documented tests are dependent on specific weather conditions, they may be deferred to a time when weather conditions are close to the documented test conditions. Complete seasonal testing as soon as possible but no later than one month before the end of the defects liability period.

**Functional tests**

Function: Carry out functional and operational tests on each energised equipment item and circuit.

## 8.2 COMMISSIONING

**Standard**

Requirement: Conform to SA TS 5342 (2021).

**Static completion**

Requirement: Systems, components and building elements are statically complete when:

- Their construction and installation is complete and as documented, including completion of all systems, components and building elements on which they are dependent for commissioning.
- All pre-commissioning tests have been successfully completed.
- They are safe and ready for commissioning.
- All cleaning that may adversely affect commissioning is complete.
- They have been inspected and all outstanding remedial work that may adversely affect commissioning is complete.
- All spaces required for access for commissioning are safe to use and cleared of obstructions that may adversely affect commissioning.

**Commissioning plan**

Requirement: Provide a commissioning plan to SA TS 5342 (2021) including the following:

- A summary of the work covered by the commissioning plan.
- The parties responsible for this work and any commissioning interrelationships.
- The basis of the design.
- General sequence of commissioning.
- Project specific commissioning methodologies for each system and building element to be commissioned.
- Pre-commissioning requirements.
- Project specific commissioning procedures for each commissioning activity including integrated system tests, deferred and seasonal tests.

- A project specific building tuning plan for all commissioned systems. Include building tuning procedures and tuning team members.
- Requirements for witnessing of tests and documented demonstrations of completion of commissioning.
- Commissioning program to **COMMISSIONING, Commissioning program.**

### **Commissioning program**

Submissions: Submit a program consistent with, and forming part of, the construction program as follows:

- Set out the proposed program for completion, commissioning, testing and instruction.
- Identify related works and timing of the works prerequisite to successful and timely completion of the works.

Revisions: Submit revisions of the program as the project proceeds.

Plant operating period: Include time in the program for the documented plant operating period before the date for practical completion.

### **Commissioning activities**

Requirement: Provide the following to SA TS 5342 (2021):

- Manage the commissioning process.
- Establish and manage the completion process.
- Review design documents for commissionability. Submit a report including any recommended changes.
- Review documented commissioning requirements. Submit a report including any recommended changes.
- Review construction documents for commissionability. Submit a report including any recommended changes.
- Develop, review and update the commissioning plan and commissioning program.
- Develop, review and update commissioning methodologies.
- Develop, review and update commissioning procedures.
- Report on interdependencies between trades that may affect commissioning.
- Develop, review and update procedures for initial start-up of systems.
- Develop, review and update integrated system test procedures.
- Carry out pre-commissioning activities. Record results and submit pre-commissioning records.
- Conduct commissioning activities to the commissioning methodologies and procedures. Record and submit commissioning records.
- Facilitate and conduct integrated system tests and demonstrations. Record and submit integrated system test records.
- Conduct documented demonstrations of completion of commissioning.
- Report on the progress of commissioning work.
- Report on conformance to the commissioning plan and program.
- Report on commissioning defects and issues and progress on their resolution.
- Develop, review and update commissioning report.
- Develop, review and update training materials, conduct training sessions to **TRAINING.**
- Develop, review and update operation and maintenance manuals to **OPERATION AND MAINTENANCE MANUALS.**
- Manage and report deferred and seasonal testing activities to **TESTING - GENERALLY.**
- Management and reporting of building tuning process.
- Periodically review performance data.

### **Verification of commissioning**

Requirement: On completion of commissioning of the equipment or system, provide additional tests to verify that it is fully commissioned and operating to documented requirements.

### 8.3 BUILDING TUNING

#### General

Standard: To SA TS 5342 (2021).

Frequency: Three monthly or more frequently.

Duration: Until the end of the maintenance period. Provide last building tuning in the month before the end of the maintenance period.

Requirement: Provide the following:

- Review data from all recording systems against documented requirements.
- Review of building occupant feedback.
- If discrepancies are identified from the above, take corrective action to rectify them.
- Report on the findings of the reviews, corrective action and effect of corrective action.
- Recommend other action to improve the effectiveness, reliability and efficiency of systems.

## 9 PROJECT RECORDS

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### 9.1 TACTICAL FIRE DRAWINGS

#### General

Requirement: Provide sets of colour coded tactical fire drawings, showing all items and systems relevant in a fire to BCA (2022) Spec 19.

Scale: 1:200 or larger if required to be easily read under emergency conditions.

Coordination: Agree the format, colour coding and contents of the tactical fire plans with the Local Fire Authority before beginning documentation.

Location: Provide one set of the laminated drawings fixed to the wall or supplied in a vertical plan hanger in the fire control room.

Loose set: Provide a second set of identical drawings.

Operation and maintenance manuals: Provide a set of colour coded tactical fire drawings in each copy of the operating and maintenance manual.

#### Inclusions

Requirement: Include the following on the tactical fire drawings:

- Legend sheet at front of set.
- Colour coding key.
- Building: As follows:
  - . Floor plans.
  - . Pressurised and non-pressurised fire isolated stairs and passages.
  - . Smoke and fire compartments.
  - . Special risk areas.
- Fire services: As follows:
  - . Automatic fire detection systems.
  - . Automatic suppression systems including gas flooding systems.
  - . Communications including warden intercommunication points.
  - . Fire control room.
  - . Fire equipment including booster connections.
  - . Fire hydrants, hose reels, portable fire extinguishers.
  - . Fire detection control and indicating equipment (FDCIE).
  - . Fire service lifts.
  - . Fire telephone and control panel.
  - . Hydrant and sprinkler pumps.
  - . Hydrant/hose reels.
  - . Sprinkler and hydrant, suction and booster connections.
  - . Sprinkler control valves.

- Electrical services: As follows:
  - . Emergency power supplies.
  - . Essential services switchboards.
  - . Evacuation warning panel.
  - . Standby power plant.
  - . Substations/transformers.
  - . Switchboards, main switchroom.
- Mechanical ventilation and air handling equipment: As follows:
  - . Air intakes, fans, ducts, shafts.
  - . Conditioners and mixing boxes.
  - . Fire dampers.
  - . General exhaust air fans, ducts, shafts, discharges.
  - . Smoke dampers.
  - . Smoke fans including exhaust fans, zone and stair pressurisation fans.
  - . Stair pressurisation systems.
  - . Supply air system.
- Mechanical ventilation and air handling equipment operation: As follows:
  - . Statement of normal condition.
  - . Condition upon fire alarm.
  - . Manual controls available.
- Hydraulic services: As follows:
  - . Gas meters.
  - . Gas supply control.
  - . Incoming water supplies and valves for the sprinkler, hydrant and fire hose reel systems.
  - . Water tank.

## 9.2 RECORD DRAWINGS

### General

Requirement: Prepare record drawings showing the following:

- Installed locations of building elements, services, plant and equipment.
- Off-the-grid dimensions and depth if applicable.
- Any provisions for the future.

### Recording, format and submission

Requirement: Record changes made during the progress of the works on a set of drawings kept on site for that specific purpose.

Drawing layout: Use the same borders and title block as the contract drawings.

Quantity and format: Conform to **SUBMISSIONS**.

Endorsement: Sign and date all record drawings.

Accuracy: If errors in, or omissions from, the record drawings are found, amend the drawings and re-issue in the quantity and format documented for **SUBMISSIONS**.

Date for submission: Not later than 2 weeks after the date for practical completion.

### Services record drawings

General: To **RECORD DRAWINGS, General** and **Recording, format and submission** and the following:

- Extensions and/or changes to existing: If a drawing shows extensions and/or alterations to existing installations, include sufficient of the existing installation to make the drawing comprehensible without reference to drawings of the original installation.
- Detention: If on-site detention tanks or pondage are provided, include the volume required on the drawing and the permitted flow rate to the connected system.
- Domestic cold water or fire mains: Show the pressure available at the initial connection point and the pressure available at the most disadvantaged location on each major section of the works.

- Stormwater: If storm water pipes are shown, include the pipe size and pipe grade together with the maximum acceptable flow and the actual design flow.

Diagrams: Provide diagrammatic drawings of each system including the following:

- Controls.
- Piping including all valves and valve identification tags.
- Principal items of equipment.
- Single line wiring diagrams.
- Acoustic and thermal insulation.
- Access provisions and space allowances.
- Fasteners.
- Fixtures.
- Switchgear and control gear assembly circuit schedules including electrical service characteristics, controls and communications.
- Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

CAD base drawings: .dwg

Subsurface services: Record information on underground or submerged services to the documented quality level, conforming to AS 5488.1 (2022).

### 9.3 BASELINE DATA

#### General

Requirement: Provide baseline data to permit routine service of fire protection systems and equipment to AS 1668.1 (2015), AS 1670.1 (2018), AS 1851 (2012) and AS/NZS 2293.1 (2018). Include baseline data for the following:

- Active fire and smoke systems including automatic fire sprinkler systems, fire pumpsets, fire hydrant systems and water storage tanks for fire protection systems.
- Fire detection and alarm systems.
- EWIS, exit signs and emergency lighting.
- Standby generator sets and batteries.
- Lay flat fire hose, fire hose reels, portable and wheeled fire extinguishers and fire blankets.
- Passive fire and smoke systems including vertical and horizontal fire and smoke elements such as:
  - . Walls.
  - . Floors.
  - . Ceilings.
  - . Access panels and hatches
  - . Structural fire-resistant elements - beams, columns, girders, trusses.
  - . Fire-resisting doorsets - hinged, pivoted and horizontal sliding.
  - . Smoke doors - hinged and pivoted
  - . Fire shutters.
  - . Fire-resisting glazing.
  - . Ducts.
  - . Dampers.
- Fire and smoke control features of mechanical services.
- Emergency planning in facilities.

Format: Provide baseline data in a format that facilitates the carrying out and recording of routine service tasks including drawings showing the extent and location of items to be serviced, schedules of items and unique identification of each item.

### 9.4 OPERATION AND MAINTENANCE MANUALS

#### General

Standard: To SA TS 5342 (2021).

Authors and compilers: Personnel experienced in the maintenance and operation of equipment and systems installed, and with editorial ability.

Referenced documents: If referenced documents or worksections require submissions of manuals, include corresponding material in the operation and maintenance manuals.

Subdivision: By installation or system, depending on project size.

Revisions: Amend operation and maintenance manuals to include changes made to the installation during the construction and maintenance.

### Contents of manual

Table of contents: Include a table of contents in each volume. Title to match cover.

Table of amendments: Include a table of amendments.

Directory: Include names, addresses, email addresses and telephone and facsimile numbers of principal consultant, subconsultants, contractor, subcontractors and names of responsible parties.

Record drawings: Include complete set of record drawings, full size.

Drawings and technical data: Include as necessary for the efficient operation and maintenance of the installation.

Installation description: Include a general description of the installation.

Systems descriptions and performance: Include a technical description of the systems installed including the basis of design, the interrelation with other systems and the building and mode of operation, presented in a clear and concise format readily understandable by the principal's staff. Identify function, normal operating characteristics, safety features and limiting conditions.

Baseline data: Include the baseline data to **BASELINE DATA**.

Commissioning records: Include commissioning records to SA TS 5342 (2021). Link commissioning records to item codes on the record drawings.

Training material: Include materials used to provide training, to **TRAINING**, in a form that can be used to train others.

Fire systems and equipment: Include documentation to AS 1851 (2012), including the schedule of essential functionality and performance requirements.

Digital photographic records: Include records to **MARKING AND LABELLING, Underground services**.

Equipment: Include schedules with the following details for installed equipment:

- Item code for use on record and diagrammatic drawings, and spare parts schedule.
- Equipment name plate data including serial number, if any.
- Name and contact details of the manufacturer and supplier.
- Catalogue list number(s).
- Location.
- Function.
- Performance figures and capacity data.
- Date of manufacture.
- Manufacturer's product data sheets including only relevant matter for the project. Mark each product data sheet to clearly identify specific products and component parts used in the installation, and data applicable to the installation.
- Additional information and commentary to illustrate relations of component parts.

Certificates:

- Certificates from authorities.
- Product certification.
- Test certificates for each service installation and all equipment.
- Warranties.

Trends: 7 day record of all trends at commissioning.

Operation procedures: Include for systems installed:

- Manufacturer's technical literature as appropriate.

- Safe starting up, running-in, operating and shutting down procedures. Include logical step-by-step instructions for each procedure.
- Control sequences and flow diagrams.
- Legend for colour-codes services.
- Schedules of fixed and variable equipment settings established during commissioning and maintenance.
- A list of special safety devices and their set points.
- Procedures for seasonal changeovers.
- Warnings to operators.
- Procedures for identifying and rectifying common faults.
- Recommendations for efficient plant operation.
- If the installation includes cooling towers, recommendations for water efficiency.
- Building tuning plan and procedure to **COMMISSIONING, Commissioning plan**.

Building occupants' guide: Include a concise guide written and illustrated for building occupants with no technical background. Include the following:

- Security provisions.
- Safety and access.
- Environmental features, including energy and water efficiency and waste management.
- Occupant relevant information on design and operation.
- Information for occupants on environmental systems that rely partially or wholly on local controls for heating, lighting, cooling, and ventilation.
- Contact details for faults, maintenance and emergencies.

Maintenance procedures:

- Detailed recommendations for periodic maintenance and procedures, including schedule of maintenance work with frequency and manufacturers' recommended tests.
- Manufacturer's technical literature as appropriate. Register with manufacturer as necessary. Retain copies delivered with equipment.
- Safe trouble-shooting, disassembly, repair and reassembly, cleaning, alignment and adjustment, balancing and checking procedures. Provide logical step-by-step instructions for each procedure.
- Schedule of spares, recommended to be held on site, for those items subject to wear or deterioration and that may involve the principal in extended deliveries when replacements are required. Include complete nomenclature and model numbers, and local sources of supply.
- Schedule of normal consumable items, local sources of supply, and expected replacement intervals up to a running time of 40 000 hours. Include lubrication schedules for equipment.
- Instructions for use of tools and testing equipment.
- Troubleshooting procedures.
- Emergency procedures, including telephone numbers for emergency services, and procedures for fault finding.
- Safety data sheets (SDS).
- Instructions and schedules conforming to AS 1851 (2012), AS/NZS 3666.2 (2011), AS/NZS 3666.3 (2011) and AS/NZS 3666.4 (2011).

Maintenance records:

- Prototype routine service records conforming to AS 1851 (2012) prepared to include project specific details.
- Prototype periodic maintenance records and report to AS/NZS 3666.2 (2011), AS/NZS 3666.3 (2011) and AS/NZS 3666.4 (2011) as appropriate, prepared to include project specific details.
- Hard copies: Binders to match the manuals, containing loose leaf logbook pages designed for recording completion activities including operational and maintenance procedures, materials used, test results, comments for future maintenance actions and notes covering the condition of the installation. Include completed logbook pages recording the operational and maintenance activities performed up to the date for practical completion.

- Number of pages: The greater of 100 pages or enough pages for the maintenance period and a further 12 months.

Emergency information: For each type of emergency, including fire, flood, gas leak, water leak, power failure, water failure, system or subsystem failure, chemical release or spill, include the following:

- Emergency instructions.
- Emergency procedures including:
  - . Instructions for stopping or isolating.
  - . Shutdown procedures and sequences.
  - . Instructions for actions outside the property.
  - . Special operating instructions relevant to the emergency.
  - . Contact details relevant to the emergency.

### Emergency information manual

Form of emergency information: Provide one of the following:

- An index and coloured tabs identifying emergency information for each type of emergency within the Operation and maintenance manual.
- A separate Emergency manual containing copies of emergency information from the main Operation and maintenance manual.

### Format – electronic copies

Scope: Provide the same material as documented for hardcopy in electronic format.

Delivery method: By email or file sharing platform

Quantity and format: Conform to **SUBMISSIONS, Electronic submissions.**

Printing: Except for drawings required in **RECORD DRAWINGS** provide material that can be legibly printed on A4 size paper.

### Format – hard copies

General: A4 size loose leaf, in commercial quality, 4 ring binders with hard covers, each indexed, divided and titled. Include the following features:

- Cover: Identify each binder with typed or printed title *OPERATION AND MAINTENANCE MANUAL*, to spine. Identify title of project, volume number, volume subject matter, and date of issue.
- Dividers: Durable divider for each separate element, with typed description of system and major equipment components. Clearly print short titles under laminated plastic tabs.
- Drawings: Fold drawings to A4 size with title visible, insert in plastic sleeves (one per drawing) and accommodate them in the binders.
- Pagination: Number pages.
- Ring size: 50 mm maximum, with compressor bars.
- Text: Manufacturers' printed data, including associated diagrams, or typewritten, single-sided on bond paper, in clear concise English.

Number of copies: 3.

### Date for submission

Draft submission: The earlier of the following:

- 4 weeks before the date for practical completion.
- Commencement of training.

Final submission: Within 2 weeks after practical completion.

## 10 MAINTENANCE

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### 10.1 PERIODIC MAINTENANCE

#### General

Requirement: Provide documented maintenance so that the condition and performance of the maintained work throughout and at the end of the maintenance period is equal to or better than that at the beginning of the maintenance period including with respect to the following:

- Performance, service delivery.
- Service life and reliability.



- Compliance with statutory requirements.
- Compliance with building rating requirements.
- Energy and water efficiency.
- Environmental impact.
- Health and safety.
- Risk management.

Inclusions: Include the following:

- Periodic and statutory maintenance, cleaning and replacement of consumables.
- Emergency repairs.
- Condition reporting.

Duration: From the time systems and equipment are put into service to the end of the maintenance period.

Maintenance period: The greater of the defects liability period and the period documented.

Faults: Rectify promptly.

Emergencies: Attend emergency calls promptly.

Annual maintenance: Carry out recommended annual maintenance procedures within the four weeks before the end of the maintenance period.

### **Maintenance program**

General: Submit details of maintenance procedures and program, relating to installed plant and equipment, 6 weeks before the date for practical completion. Indicate dates of service visits. State contact telephone numbers of service operators and describe arrangements for emergency calls.

### **Maintenance records**

General: Record in binders provided with the operation and maintenance manuals.

Referenced documents: If referenced documents or technical worksections require that logbooks or records be submitted, include this material in the maintenance records.

Certificates: Include test and approval certificates.

Service visits: Record comments on the functioning of the systems, work carried out, items requiring corrective action, adjustments made and name of service operator. On completion of the visit, obtain the signature of the principal's designated representative on the record of the work undertaken.

### **Site control**

General: Report to the principal's designated representative on arriving at and before leaving the site.

## **10.2 STATUTORY INSPECTIONS AND MAINTENANCE**

### **General**

Duration: From the time systems and equipment are put into service to the end of the maintenance period.

Requirement: Provide inspections and maintenance of safety measures required by the following:

- AS 1851 (2012).
- Other statutory requirements applicable to the work.

Records: Provide mandatory records.

Certification: Certify that mandatory inspections and maintenance have been carried out and that the respective items conform to statutory requirements.

Annual inspection: Perform an annual inspection and maintenance immediately before the end of the maintenance period.

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**0172 ENVIRONMENTAL MANAGEMENT****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide environmental management, as documented.

**Management and control plans**

Implementation: To approved management plans.

**Management and control measures**

Implementation: To the documented management and control measures.

**1.2 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0171 General requirements.

**1.3 INTERPRETATION****Abbreviations**

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

- EIA: Environmental impact assessment.
- EMP: Environmental management plan.

**Definitions**

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

- Clearances: A formal certificate, approval or condition issued by a statutory authority allowing work in a particular area.
- Contamination of land: The presence of a substance in, on or under the land that is designated hazardous material and/or is at a concentration above that which is normally found in that locality, and presents a risk of harm to human health or to the environment.
- Environment: The physical factors of the surroundings of human beings including the land, waters, atmosphere, climate, sound, odours, tastes; and the biological factors of animals; and plants and the social factor of aesthetics.
- Environmental audit: A review of environmental management practices, in particular the evaluation of a site for environmental liability.
- Environmental impact assessment (EIA): A method for predicting environmental impacts of a proposed development including strategies for minimising identified impacts.
- Environmental management plan (EMP): A project or site specific plan describing the management of the environmental issues and considerations for the activity being undertaken. This applies to the design, construction and operation of the buildings, external works and infrastructure.
- Organic waste: Includes all food wastes, vegetative wastes from land clearing and pruning operations, biosolids produced from the treatment of liquid wastes, garden wastes and forestry waste (bark and saw dust) and paper and cardboard products.
- Pollution incident: An incident or set of circumstances during or as a consequence of which there is, or is likely to be, a leak, spill or other escape of a substance as a result of which pollution has occurred, is occurring or is likely to occur.
- Weed: An invasive plant that degrades natural areas, reduces the sustainability or affects the health of people and animals.

**1.4 SUBMISSIONS****Control plans**

Requirement: Submit the following:

- Environmental management plan.
  - . Control plans: As specified

Time for submissions: 7 days prior to commencement of work

### **Subcontractors**

Weed management personnel: Submit details of the following:

- Subcontractors: Names and contact details for proposed subcontractors and evidence of experience in treatment of weed infestations.
- Chemical treatments: Name and qualifications of handlers and treatment type and application date.

## **1.5 INSPECTION**

### **Notice**

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

- Non-conforming items, e.g. ground contamination.
- Completed removal or rectification of non-conforming items.
- Unexpected finds.

## **2 ENVIRONMENTAL ADMINISTRATION, MONITORING AND REPORTING**

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### **2.1 PROCEDURAL AND PERSONNEL**

#### **Legislative environmental control requirements**

Development approval conditions: TBA by Weddin Shire Council

Environmental impact statement issues: To be advised by Weddin Shire Council

#### **Community liaison**

General: Notify residents of construction activities that 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.
- Reason for the work.
- Expected duration.
- Changes to traffic arrangements and property access.
- 24-hour contact number of the representative responsible.

#### **Emergency response**

Emergency response personnel: Provide staff names and contact details.

Response procedure: TBA by Weddin Shire Council

Response time: TBA by Weddin Shire Council

Penalty for failure to respond: TBA by Weddin Shire Council

#### **Complaints**

Reporting: Within 1 working day of receiving a complaint about an environmental impact, including pollution incidents, submit a written report detailing the complaint and remedial action taken.

Register: Keep a register of all complaints and action taken.

#### **Unexpected finds**

Requirement: Give notice and close off affected site area with barrier tapes and warning signs to prevent access. Unexpected finds include asbestos and other hazardous or volatile contaminants, archaeological finds and items of heritage value.

## **2.2 MONITORING**

### **Internal monitoring**

Approval authority: Weddin Shire Council

Documentation: Provide descriptions of the following:

- Environmental monitoring: Implementation and recording procedures.
- For all control measures to be implemented: Non-conformance control and corrective action procedures.

Records: Maintain records of results of environmental monitoring, including the effectiveness of any remedial action taken.

Internal monitoring personnel: Provide staff names and contact details.

Machinery and equipment: Provide details of proposed plant.

Review timing: Undertake reviews of the EMP or control measures at the following stages:

- When there is a change in the project, e.g. scope.
- Following significant environmental impacts or pollution incidents.
- When improved performance is required to reduce a specific environmental impact.
- At completion of environmental audits.
- At the end of the project.

## 2.3 REPORTING

### General

Requirement: Prepare environmental management reports that record the progress of the following:

- Performance against statutory requirements.
- Performance against the EMP, environmental objective and policy, and ecologically sustainable development outcomes and targets.
- Summary of monitoring, inspection and audits.
- Summary of reports required to meet the statutory requirements.
- Summary of environmental impacts, pollution incidents, non-conformance and complaints.
- Summary of corrective actions where required.
- Unexpected finds.

Reporting frequency: Weekly

## 3 ENVIRONMENTAL MANAGEMENT

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### 3.1 ENVIRONMENTAL MANAGEMENT PLAN

#### Control plan

EMP: Prepare an environmental management plan with the following details:

- Project description, including site location, construction activities, and project schedule.
- EMP context, describing how the EMP fits into the overall project planning process.
- EMP objective and environmental policy.
- Risk assessment.
- Assignment of responsibility for environmental controls, including hierarchy of management.
- Conditions of approvals, licences and permits to meet statutory requirements.
- Reporting requirements.
- Environmental training plan and procedures: Include in the plan, a program to familiarise staff with the EMP and/or management controls, environmentally sensitive areas and responsibilities.
- Environmental audit program and corrective action procedures.
- Emergency response procedures including response time.
- Control plans, as required.
- Details of operational control measures to reduce risk of environmental impacts on the following:
  - . Heritage.
  - . Visual values.
  - . Endangered species.
  - . Habitat.
- Locations of, and environmental controls for, environmentally sensitive areas.
- Details of environmental protection for each activity.
- Communication procedures.
- Other items necessary to protect the surrounding environment.

Activities staging: Address the phases of activity, as appropriate:

- Before construction and site establishment.
- During construction.
- After construction, including rehabilitation activities and site and landscaping maintenance.

### 3.2 SOIL EROSION AND SEDIMENT CONTROL

#### Control plan

Plan: Prepare a soil erosion and sediment control plan to protect natural stormwater drainage systems from sedimentation by minimising soil erosion and sediment transportation. Include the following details:

- Staging of operations and sequence of works.
- Diversion of upstream water around the site.
- Provision of temporary drains and catch drains.
- Erosion control measures.
- Sediment control measures.
- Stormwater control measures, including diversion, dispersal and/or retention to control and dissipate stormwater throughout the site without damage.
- Maintenance procedures for control measures.
- Progressive restoration of disturbed areas.

Extent: All site areas, access and haulage tracks, borrow pits, stockpile and storage areas and compound areas.

Maintenance of controls: Check control measures, minimum daily and following storms, and rectify as required.

Extent: All site areas, access and haulage tracks, borrow pits, stockpile and storage areas and compound areas.

### 3.3 WASTE MANAGEMENT

#### Control plan

Plan: Prepare a waste management control plan to minimise solid waste generated by construction activities and to dispose of the solid waste. Include the following details:

- Major waste streams.
- For each waste stream describe the following:
  - . Location.
  - . Disposal method.
  - . Transport method.
  - . Storage method.

### 3.4 GROUND CONTAMINATION

#### Control plan

Plan: Prepare a ground contamination control plan for land suspected of being contaminated or the presence of acid sulfate soil is found, in conformance with the state Environmental Protection Authority (EPA) and the relevant state planning guidelines. Include the following details:

- Preliminary investigation.
- Detailed investigation.
- Site Remedial Action Plan (RAP).
- Stockpile sites.
- Site auditing and reporting procedures.
- Record of maintenance procedures, including record of remediation work, certificates issued and restrictions placed on the site.

### 3.5 WEED MANAGEMENT

#### Control plan

Plan: Prepare a weed management control plan with the following details:

- Weed species.
- Weed infestation zones within the work site and the investigation period.
- Treatment of infestation, including treatment type and application rate.
- Cleaning methods for vehicles and machinery, including cleaning bay location and treatment date.
- Subcontractors: Names and contact details for proposed subcontractors and evidence of experience in treatment of weed infestations and name and qualifications of chemical treatment handlers.

### 3.6 AIR QUALITY

#### Control plan

Plan: Prepare an air quality control plan to protect adjoining owners, residents and the public from emissions of dust and exhaust gases. Include the following details:

- Dust control.
- Exhaust gases emission control.

### 3.7 WATER QUALITY

#### Control plan

Plan: Prepare a water quality control plan to keep earthworks free of water and to reduce impacts on groundwater and surface water. Include the following details:

- Dewatering system.
- Washout prevention.
- Cross connection prevention to public sewerage system.
- Water disposal.

### 3.8 NOISE CONTROL AND VIBRATION

#### Control plan

Plan: Prepare a noise and vibration control plan to protect adjoining owners, residents and the public from noise and vibration impacts. Include the following details:

- Noise control and vibration: To the recommendations of AS 2436 (2010).
- Maximum noise level at the site boundary.
- Noise control.
- Vibration assessment.
- Vibration control.

### 3.9 FLORA AND FAUNA

#### Control plan

Plan: Prepare a flora and fauna control plan to protect native flora and fauna on site and prevent introduction of pest species. Include the following details:

- Native flora and fauna assessment.
- Pest species assessment.
- Tree pruning.
- Habitat provision.

### 3.10 CULTURAL AND ABORIGINAL HERITAGE

#### Control plan

Plan: Prepare a cultural heritage management plan to protect and prevent damage or loss of items of cultural heritage or Aboriginal sites and artefacts. Include the following details:

- Cultural heritage assessment.
- Aboriginal heritage assessment.
- Unexpected finds.
- Training.

Notice: If any item is suspected to be an artefact of heritage value, relic or material that is Aboriginal or belonging to early settlement, give notice.

Action: Stop construction work that might affect the item and protect the item from damage or disturbance.

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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 (2001).

**1.4 INTERPRETATION****Definitions**

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

- Demolition: The complete or partial removal 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 from the appropriate authority.
- A scaffold permit 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.
- Certificate from the relevant authority confirming treatment for any rodent infestation has been carried out.
- Fees and other costs have been paid.

**Execution details**

Requirement: Submit the following, as documented:

- Hazardous Substances Management Plan, including laboratory analysis of hazardous substances.
- Investigation and work plan.
- Safe Work Method Statement.



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, and the following:

- Certification: Submit evidence of disposal 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. Prevent mixing and pollution.

### Records

Dilapidation record:

- Before demolition: Submit to each owner of each adjoining or 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 or adjacent property affected.

### Tests

Requirement: Submit compliance test results for building services components to be re-used.

## 1.6 INSPECTION

### Notice

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

- Adjoining and adjacent structures before starting 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.
- Remaining excavations after removal of underground work.
- Site after removal of demolished materials.
- Services after reconnection or diversion.
- Adjoining and adjacent structures at completion of demolition.

## 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 <b>Recovered items for re-use in the works schedule</b>	Principal/proprietor
Recovered items for delivery to the principal	Recover without damage items identified in the <b>Recovered items for delivery to the principal schedule</b>	Principal/proprietor
Demolished material for recycling in the works	Stockpile material identified in the <b>Demolished material for recycling in the works schedule</b>	Contractor
Demolished material for recycling off-site	Demolish and deliver for recycling material identified in the <b>Demolished material for recycling off-site schedule</b>	Contractor

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

### 3 EXECUTION

#### 3.1 HAZARDOUS SUBSTANCES

##### Audit

Requirement: Prepare a Hazardous Substances Management Plan to AS 2601 (2001) clause 1.6.1.

Include the following:

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

##### Removal of hazardous substances

Standard: To AS 2601 (2001) clause 1.6.2.

#### 3.2 INVESTIGATION AND WORK PLAN

##### General

Requirement: Before demolition or stripping work, prepare the work plan to AS 2601 (2001) Section 2. Include the checklist items appropriate to the project from AS 2601 (2001) Appendix A, and the following:

- Method of protection and support for adjoining or adjacent structures.
- 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.
- Structural engineering report and demolition methodology, as appropriate, if the structure is suspected to contain unbonded prestress tendons.
- 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, or parts of buildings, being retained and which normally rely on support from work to be demolished.

Suspended slabs: If mobile plant is required for use on suspended structural members, conform to structural engineering requirements and the work plan.

Ground support: Support excavations for demolition of underground structures.

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

Lateral and vertical supports: At least equal in capacity to that originally provided by the structural element or 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 spaces.

### **Weather protection**

General: If walls or roofs are opened for alterations and additions, 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. Install to shed water to avoid damage to retained existing elements, and 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 adjoining structures exposed by demolition.

**Existing services**

Location: Before starting demolition, locate and mark existing underground services by potholing or other non-destructive digging, in the areas that will be affected by the demolition operations.

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

Essential services: Shut off, cap or control services not required for the demolition work, at or outside the building line before commencing demolition. Conform to the requirements of the relevant existing utility authority, as appropriate.

Underground utility services to be retained: Do not excavate by machine within 1 m of existing underground services.

**Fixed items**

Individual protection: Protect the following items in their existing positions:

- Trees and paths as documented, bandstand, shade sails, playground edging

**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****General**

Requirement: To the approved Safe Work Method Statement and work plan.

**Encroachment**

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

**Sequence**

Sequence of demolition: Submit details for approval

**Concrete slabs**

Partial demolition or penetrations: Using a diamond saw, neatly cut back or trim to new alignment with a clean true face. Do not overcut at corners. If required, provide protection to exposed reinforcement along the newly sawn concrete slab edge, as documented.

Storage: Do not store demolished materials on suspended slabs.

**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 have become redundant as a result of the demolition.

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

**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 adjoining or 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 from the demolition work. Obtain written acceptance from the owner of each adjoining or adjacent property of the completeness and standard of the rectification work.

#### Removal of temporary supports

General: Obtain written instructions from the structural engineer at the completion of demolition before removing temporary supports.

## 4 SELECTIONS

### 4.1 DEMOLITION

#### Recovered items for delivery to the principal schedule

Item	Delivery location
Small slide in playground	TBA by Council
Rocker in playground	TBA by Council
Big slide/climbing structure in playground	TBA by Council
Picnic benches	TBA by Council
Seats	TBA by Council

#### Dismantle for relocation schedule

Item	Location for re-assembly
Toddler's swing	Refer to drawings
Children's swing	Refer to drawings
Brick pavers from demolished path (Excess to be delivered to the principal, location TBA by Council)	Refer to drawings

#### Demolish for removal schedule

Item
Playground fencing – cut posts flush with adjacent logs
Trees
Garden beds

**0221 SITE PREPARATION****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide site preparation, as documented.

**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.

**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 that 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 BEFORE YOU DIG AUSTRALIA 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 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.

### 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 polyethylene 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.

Extent: Refer to drawings

Tags: Surveyor's ribbon

## 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 (2009) 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 (2009) Section 3.

Tree protective measures: To AS 4970 (2009) Section 4.

Monitoring and certification: To AS 4970 (2009) 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.

**Removal**

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

**2.9 COMPLETION****Temporary works**

Remove at completion: Temporary landscape fencing

**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.

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**0222 EARTHWORK****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide earthworks to the dimensions and tolerances, as documented.

**1.2 DESIGN****General**

Designer: Weddin Shire Council Engineers

**Requirements**

General: To DESIGN in *0171 General requirements*.

Responsibility: For design coordination

Design of footing or pier depths: Contractor

Contract depths: The footing or pier depths shown on the drawings are provisional.

Authority requirements: Weddin Shire Council Engineers

**1.3 CROSS REFERENCES****General**

Requirement: Conform to the following:

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

**1.4 STANDARDS****General**

Earthworks: Conform to the recommendations of those parts of AS 3798 (2007) that are referenced in this worksection.

Description and classification of soils: To AS 1726 (2017).

**1.5 INTERPRETATION****Abbreviations**

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

- GITA: Geotechnical inspection and testing authority.
- GTA: Geotechnical testing authority.

**Definitions**

General: For the purposes of this worksection, the definitions given in AS 3798 (2007) and the following apply:

- Bad ground: Ground unsuitable for the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground that is, or becomes, soft, wet or unstable.
- Rock: Monolithic material with volume greater than 0.3 m<sup>3</sup> that cannot be removed until broken up by rippers or percussion tools.
- 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 (2018) 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.
- Subgrade: The trimmed or prepared earth material on which the pavement, footing or slab is constructed. Generally taken to relate to the upper line of the earth material.
- Zone of influence: A foundation zone bounded by planes extending downward and outward from the bottom edge of a footing, slab or pavement and defining the extent of foundation material having influence on the stability or support of the footings, slab or pavement.

## 1.6 TOLERANCES

### General

Finish: Finish the surface to the required level, grade and shape within the following tolerances:

- Under building slabs and load bearing elements: +0, -25 mm.
- Pavement subgrades: +0, -40 mm.
- Batters: No steeper than the slope shown on the drawings. Make sure flatter slopes do not impact on boundaries or required clearances to buildings, pavements or landscaping.
- Other ground surfaces:  $\pm 50$  mm, provided the area remains free draining and matches adjacent construction where required. Provide smoothness as normally produced by a scraper blade.

## 1.7 SUBMISSIONS

### Design documentation

Calculations: Submit calculations by a professional engineer showing the stability and safety of proposed excavations and temporary supports, including supports required for adjacent structures.

### Execution details

Report: Submit a time-based schedule detailing the methods and equipment proposed for the earthworks, including the following:

- Dewatering and groundwater control and disposal of surface water.
- Excavation methods, stages, clearances, batters and temporary supports.
- Stockpiles and borrow pits.
- Placing and compaction methods and stages.

Geotechnical site investigations: Provide a geotechnical report supporting the methods proposed for excavation.

Disposal location: Submit details of the locations and evidence of compliance with the appropriate authority requirements for the disposal of material requiring removal from site.

Temporary shoring: Submit a proposal for any temporary shoring required, including the progressive removal.

Proof rolling: Submit details of proposed method and equipment for proof rolling.

Records of measurement: Submit a certified copy of the agreed records of measurement.

Site records: Submit the following to AS 3798 (2007) clause 3.4 and Appendix B:

- Geotechnical site visit record.
- Earthworks summary report or daily geotechnical reports.

### Products and materials

Imported fill: Submit certification or test results by a GTA registered laboratory of the imported fill as evidence of conformity with the contract, including the source.

### Tests

Compaction: Submit certification and/or test results in conformance with the documented level of inspection and testing to AS 3798 (2007).

## 1.8 INSPECTION

### Notice

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

- Items to be measured as listed in **RECORDS OF MEASUREMENT**.
- Areas to be cleared and/or stripped of topsoil.
- Areas stripped of topsoil.
- Excavation completed to contract levels or founding material.
- Proof rolled subgrade before placing fill.
- Filling completed to contract levels.
- Stockpiled topsoil before spreading.

## 2 PRODUCTS

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### 2.1 FILL MATERIALS

#### General

Suitable material: To AS 3798 (2007) clause 4.4 including inorganic, non-perishable material suitably graded and capable of compaction to the documented density.

Unsuitable materials: Do not use fill defined as unsuitable by AS 3798 (2007) clause 4.3.

Sulfur content: Do not provide material with sulfur content exceeding 0.5% within 500 mm of cement bound elements (for example concrete structures or masonry) unless the elements are protected by impermeable membranes or equivalent means.

Re-use of excavated material: Only re-use suitable material to AS 3798 (2007) clause 4.4.

### **Stockpiles**

General: Segregate the earth and rock material and stockpile for re-use in backfilling operations.

Location: Do not stockpile excavated material against tree trunks, buildings, fences or obstruct the free flow of water along drainage channels.

## **2.2 GEOTEXTILE**

### **General**

Material: UV stabilised, permeable, polymeric, woven or non-woven textile material used in contact with soil/rock material.

Identification and marking: To AS 3705 (2012).

Product: Submit details for approval

## **3 EXECUTION**

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### **3.1 SITE PREPARATION**

#### **Erosion and sedimentation control**

Requirement: To *0172 Environmental management*.

### **3.2 GEOTECHNICAL**

#### **As found site conditions**

General: If the following are encountered, give notice and obtain instructions before carrying out any further work in the affected area:

- Bad ground.
- Discrepancy in expected conditions.
- Rock.
- Springs, seepages.
- Topsoil more than 100 mm deep.

### **3.3 RECORDS OF MEASUREMENT**

#### **Excavation and backfilling**

Agreed quantities: If a schedule of rates applies, provisional quantities are documented, or there are variations to the contract levels or dimensions of excavations, do not backfill or place permanent works in the excavation until the following have been agreed and recorded:

- Depths of excavations related to the datum.
- Final plan dimensions of excavations.
- Quantities of excavations in rock.

Method of measurement: By registered surveyor.

#### **Rock**

Level and class: If rock is measured for payment purposes, either as extra over excavation of material other than rock or for adjustment of provisional measurements, do not remove the rock until the commencing levels and the classes of rock have been determined.

### **3.4 REMOVAL OF TOPSOIL**

#### **General**

Extent: Areas of cut or fill and areas occupied by structures, pavements and embankments.

Maximum depth: 200 mm.

Disposal: Remove topsoil unsuitable for re-use from the site to AS 3798 (2007) clause 6.1.8.

#### **Topsoil stockpiles**

General: Stockpile site topsoil intended for re-use.

Stockpile maximum height: 1.5 m.

Identification: Mark and label stockpiles of different soil types.

Vegetation: Do not burn off or remove plant growth that occurs during storage.

Protection: Conform to the following:

- Provide drainage and erosion protection.
- Do not allow traffic on stockpiles.
- If a stockpile is to remain for more than four weeks, sow with temporary grass.
- Protect the topsoil stockpiles from contamination by other excavated material, weeds and building debris.

### 3.5 EXCAVATION

#### Extent

Site surface: Excavate the site to the levels and profiles required for the documented structures, pavements, filling and landscaping. Make allowance for compaction, settlement or heaving.

Footings, pits, wells and shafts: Excavate to the required sizes and depths. Confirm that the foundation conditions meet the design bearing capacity.

#### Bearing surfaces

Requirement: Provide even plane bearing surfaces for loadbearing elements including footings. Step to accommodate level changes. If supporting masonry, make the steps appropriate to the courses.

#### Rock

General: Do not use explosives.

#### Existing footings

Requirement: If excavation is required within the zone of influence of an existing footing, provide supports to the footing sufficient to prevent damage arising from the works. Use methods including temporary shoring or underpinning.

#### Existing services

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

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

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

#### Proof rolling

Extent: Proof roll excavations for pavements, filling and non-spanning slabs on ground to determine the presence of bad ground.

Proof rolling method and equipment: To AS 3798 (2007) clause 5.5.

Requirement: If excessive settlement, rebound or heaving is encountered, provide test pits or trenching to determine the extent of bad ground.

#### Disposal of excess excavated material

General: Remove excess excavated material from site not required or unsuitable for fill.

Standard: To AS 3798 (2007) clause 6.1.8.

### 3.6 REINSTATEMENT

#### Deterioration of bearing surfaces

Requirement: If the bearing surface deteriorates because of water or other cause, excavate to a sound surface before placing the loadbearing element.

#### Subgrades affected by moisture

Requirement: If, due to high moisture content, the subgrade cannot support construction equipment or the overlying pavement cannot be compacted, perform one or more of the following:

- Allow the subgrade to dry until it provides support for equipment and allows compaction.
- Scarify the subgrade to a depth of 150 mm, work as necessary to accelerate drying, and recompact when the moisture content is satisfactory.
- Excavate the wet material and remove to spoil, and backfill excavated areas.

**Over excavation**

Requirement: If excavation exceeds the required depths, reinstate to the correct depths, levels and bearing capacity.

Zone of influence: Within the zone of influence of footings, beams, or other structural elements, use concrete of strength equal to the structural element, minimum 15 MPa. Make sure that remedial concrete does not create differential bearing conditions.

Below slabs or pavements: Rectify the over excavation as follows:

- Generally: Provide selected fill compacted to the documented density.
- Less than 100 mm: Do not backfill. Increase the thickness of the layer above.

Rock depressions and subsoil drains: Backfill rock depressions and over excavation of subsoil drains using coarse subsoil filter.

**3.7 SUPPORTING EXCAVATIONS****Removal of supports**

General: Remove temporary supports progressively as backfilling proceeds.

**Voids**

General: If voids occur outside sheeting or sheet piling, fill and compact voids to a dry density similar to that of the surrounding material.

**3.8 ADJACENT STRUCTURES****Temporary supports**

General: If required, provide supports to adjacent structures, sufficient to prevent damage arising from the works.

Lateral supports: Provide lateral support with shoring.

Vertical supports: If required, provide vertical support with piling or underpinning or both.

**Permanent supports**

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

**Encroachments**

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

**Zone of influence**

Angle from horizontal: Site determination

**3.9 ROCK BOLTING****General**

Requirement: For temporary or permanent support of rock faces, provide proprietary high strength steel bars or tubes anchored into holes drilled in the rock and tensioned against plates bearing on the rock face. Schedule the installation to conform to systematic bolting or calculated relief, as documented.

Standard: To AS 4678 (2002).

**Protection**

General: Protect permanent rock bolts by grouting the drilled hole with cement grout after tensioning the rock bolt. Protect the bearing plate and the exposed portion of rock bolt and anchorage with a protective coating or by embedment in concrete.

**3.10 GEOTEXTILE****General**

Preparation: Trim the ground to a smooth surface free from cavities and projecting rocks.

Installation: Lay the fabric flat, not stretched tight, and secure with anchor pins. Overlap joints 300 mm minimum.

### 3.11 PREPARATION FOR FILLING

#### Preparation

Stripping: Prepare the ground surface before placing fill (including topsoil fill), ground slabs or load bearing elements to AS 3798 (2007) clause 6.1.5. Remove material that inhibits or prevents satisfactory placement of fill layers, loose material, debris and organic matter.

Foundation preparation: To AS 3798 (2007) clause 6.1.7.

Compaction: Compact the ground exposed after stripping or excavation, to a minimum depth of 150 mm, to the minimum relative compaction in AS 3798 (2007) Table 5.1.

Ground treatment or improvement methods:

- Scarify method: Loosen exposed excavation by scarifying to a minimum of 150 mm, moisture-condition and compact to AS 3798 (2007) Section 5.
- Impact roller and impact compaction: Use an approved method.

Slope preparation: If fill is placed on a surface steeper than 4:1 (horizontal:vertical), bench the surface to form a key for the fill. As each layer of fill is placed, cut the existing ground surface progressively to form a series of horizontal steps more than 1 m in width and more than 100 mm deep. Recompact the excavated material as part of the filling. Shape to provide free drainage.

Working platform: If compaction of the existing or stripped surface is impractical, obtain advice from a geotechnical engineer for a working platform or a geosynthetic to place across the natural or stripped surface.

#### Under earth mounds

General: Cultivate the ground to a depth of 200 mm before mound formation.

#### Under slabs, paving and embankments

General: If required, loosen the ground to a depth of more than 200 mm and adjust the moisture content before compaction to a density consistent with subsequent filling.

#### Rock ledges

General: Remove overhanging rock ledges.

### 3.12 PLACING FILL

#### General

Extent: Place fill to the documented dimensions, levels, grades, and cross-sections so that the surface is always self-draining.

Layers: Place fill in near-horizontal layers of uniform thickness no greater than 150 mm after compaction, deposited systematically across the fill area.

Edges: At junctions of fill and existing surfaces, do not feather the edges.

Mix: Place fill in a uniform mixture.

Previous fill: Before placing subsequent fill layers, make sure that previously accepted layers still conform to requirements, including moisture content.

Protection: Protect the works from damage due to compaction operations. If required, limit the size of compaction equipment or compact by hand.

Protective covering to membranes: Do not disturb or damage during backfilling.

#### Placing at structures

Fill adjacent structures and trenches: To AS 3798 (2007) clause 6.2.6.

Requirement: Place and compact fill in layers simultaneously on both sides of structures, culverts and pipelines to avoid differential loading. Commence compacting each layer at the structure and proceed away from structure.

Over the top of structures: Carefully place first layers of fill.

Retaining walls: Do not place fill against concrete retaining walls until the concrete has been in place for 28 days unless the structure is supported by struts.

**Compaction**

General: Compact the subgrade and each layer of fill to the required depth and density, as a systematic construction operation. Shape surface to provide drainage and prevent ponding.

Maximum rock and lump size in layer after compaction: To AS 3798 (2007) clause 6.2.2.

Fill batter faces: Either compact separately, or overfill and cut back. Form roughened surfaces to the faces.

Minimum relative compaction: To AS 3798 (2007) Table 5.1.

**3.13 PLACING TOPSOIL****Stockpiled topsoil**

Cultivation: Rip subgrade to a depth of 100 mm or to the depth of rippable subgrade if less. Cultivate around services and tree roots by hand. Trim to allow for the required topsoil depth.

Herbicide: Apply before placing topsoil.

Herbicide product: Multi purpose herbicide and a pre-emergent herbicide

Placing: Spread and grade evenly.

Compaction: Lightly compact topsoil so that the finished surface is smooth, free from lumps of soil, at the required level, ready for cultivation and planting.

Edges: Finish topsoil flush with abutting kerbs, mowing strips and paved surfaces. Feather edges into adjoining undisturbed ground.

**Disposal of excess topsoil**

On-site: Dispose of surplus topsoil remaining on site by spreading evenly over the areas already placed.

Off-site: Remove excess topsoil from the site and dispose of legally.

**3.14 FILL MOISTURE CONTROL****General**

Moisture content: Adjust the moisture content of fill during compaction within the range of 85% to 115% of the optimum moisture content determined by AS 1289.5.1.1 (2017) or AS 1289.5.2.1 (2017), as appropriate, to achieve the required density.

**3.15 TESTING****Site tests**

Compaction control tests: To AS 1289.5.4.1 (2007) or AS 1289.5.7.1 (2006).

Test frequency: To AS 3798 (2007) Table 8.1.

**3.16 COMPLETION****Grading**

External areas: Grade to give falls away from buildings, minimum 1:100.

Subfloor areas: Grade the ground surface under suspended floors to drain ground or surface water away from buildings without ponding.

**Site restoration**

Requirement: If variation of existing ground surfaces is not required as part of the works, restore surfaces to the condition existing at the commencement of the contract.

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**0223 SERVICE TRENCHING****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide trenching for underground services, as documented.

**1.2 DESIGN****Requirements**

General: To DESIGN in *0171 General requirements*.

Responsibility: Design and coordinate all trenching required for proposed inground services, as documented.

Existing services: Where possible, design to avoid all existing services. Locate existing services to EXECUTION, **EXISTING SERVICES**.

Authority requirements: To Weddin Shire Council's requirements

**1.3 CROSS REFERENCES****General**

Requirement: Conform to the following:

- *0171 General requirements*.

**1.4 STANDARDS****Trenching**

Earthworks: To AS 3798 (2007).

Electrical services: To AS/NZS 3000 (2018).

Hydraulic services: To the AS/NZS 3500 series.

Communication services: To AS/CA S009 (2020).

**1.5 TOLERANCES****Surface levels**

Earthworks: Finish the surface to the required level, grade and shape within the following tolerances:

- Under building slabs and load bearing elements: +0, -25 mm.
- Pavement subgrades: +0, -40 mm.
- Batters: No steeper than the slope shown on the drawings. Make sure flatter slopes do not impact on boundaries or required clearances to buildings, pavements or landscaping.
- Other ground surfaces:  $\pm 50$  mm, provided the area remains free draining and matches adjacent construction where required. Provide smoothness as normally produced by a scraper blade.

Pavement base and subbase: Finish the surface to the required level, grade and shape within the following tolerances:

- Subbase: +10 mm, -25 mm.
- Base: +10 mm, -5 mm.

Finished pavement or paving surface: Conform to the documented level within the following tolerances:

- Asphalt:  $\pm 10$  mm.
- Concrete: +10 mm, -0 mm.
- Paving:
  - . Finished level:  $\pm 8$  mm.
  - . Height deviation between adjacent units (lippage):  $\pm 2$  mm.
- Granular surfaces:  $\pm 10$  mm.
- Lippage between restored surface and adjacent existing surface:  $\pm 5$  mm.

## 1.6 SUBMISSIONS

### Execution details

Excavation method: Submit details of proposed equipment and method of excavation, including the following:

- Service location and type: A plan of the trench works showing the location and type of service.
- Open excavation: Proposed duration.
- Shuttering and/or bracing of trench sides: If required for safety and stability, provide proposals.
- Geotechnical data: Geotechnical report supporting the procedures proposed for trenching and/or boring.
- Boring: Proposals for the following:
  - . Limits on length.
  - . Existence of other services and method of protection.
  - . Pressure grouting to voids.
  - . The effect of pressure grouting on other services, ground heave and proposals for minimising such effects.
  - . Access to properties outside the site.
  - . Council permits.
  - . Service interruptions including a plan for minimising unintended interruptions.
- Hazards: Identify WHS hazards that may be encountered with deep trenches including toxic gases and liquids.

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

### Records

As-built location: Upon completion, submit to the relevant authority as-built documentation showing the location of the installed services.

### Tests

Trench backfill: Submit results of the following:

- Compaction tests.
- Density tests.

## 1.7 INSPECTION

### Notice

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

- Items to be measured as listed in **GROUND CONDITIONS, Records of measurement**.
- Service trenches excavated before laying the service.
- Services laid in trenches and ready for backfilling.
- Completed surface restoration.

## 2 PRODUCTS

### 2.1 FILL MATERIALS

#### General

Suitable material: To AS 3798 (2007) clause 4.4 including inorganic, non-perishable material suitably graded and capable of compaction to the documented density.

Unsuitable materials: Do not use unsuitable material for fill in conformance with AS 3798 (2007) clause 4.3.

Sulfur content: Do not provide filling with sulfur content exceeding 0.5% within 500 mm of cement bound elements (for example concrete structures or masonry) unless such elements are protected by impermeable membranes or equivalent means.

Re-use of excavated material: Only re-use suitable material in conformance with AS 3798 (2007) clause 4.4.

Material in reactive clay areas: In sites classified M, M-D, H1, H1-D, H2, H2-D, E or E-D to AS 2870 (2011), re-use excavated site material at a moisture content within  $\pm 1\%$  of that of the adjoining in situ clay.

## 2.2 SURFACE RESTORATION MATERIALS

### General

Re-use: If possible re-use the existing surface materials that were removed during trench excavation, whilst conforming to the documented material requirements.

### Subbase and base

Requirement: Provide crushed rock material configured in layers and depths to match existing and adjacent work, as follows:

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

### Pathways and paved surfaces generally

Requirement: Provide materials consistent with those of the existing surface before service trenching works commenced.

### Concrete surfaces

Material requirements: Normal-class to AS 1379 (2007).

Concrete strength grade: N25.

Slump: Maximum 100 mm.

### Asphalt surfaces

Aggregate: To AS 2758.5 (2020) or to AS 2758.2 (2021) for sprayed bituminous surfaces.

Asphalt: To AS 2150 (2020).

Medium cut back bitumen: To AS 2157 (1997).

Bitumen emulsion: To AS 1160 (1996).

Bitumen binder: Class 170.

### Pavers

Concrete and clay pavers: To AS/NZS 4455.2 (2010).

Bedding and joint filling sand: Well-graded sand, free of deleterious material, such as soluble salts, that may cause efflorescence.

Stone pavers and setts: Provide sound stone pavers and setts of uniform quality. Reject any with defects liable to affect strength and durability.

Bedding mortar mix (cement:sand): Select from the range 1:3 to 1:4 to obtain satisfactory adhesion. Provide minimum water.

## 3 EXECUTION

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### 3.1 EXISTING SERVICES

#### Location

Requirement: Before commencing service trenching, locate and mark existing underground services in the areas that will be affected by the service trenching operations.

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

#### Excavation

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

### 3.2 EXISTING SURFACES

#### Concrete and asphalt pavements

Method: Sawcut trench set out lines for the full depths of the bound pavement layers except where the set out line is located along expansion joints.

Removal of concrete and asphalt: Break out concrete or asphalt pavement material between the trench set out lines, remove and dispose of off-site.

**Paving**

Removal: Take up paving units both full and cut by hand, between the trench set out lines, and neatly stack on wooden pallets.

Concrete edging: Break out, remove and dispose of off-site.

Concrete subbase: If present, sawcut along the trench set-out lines.

**Grass**

Removal method: Neatly cut grass turf between trench set-out lines into 300 mm squares.

Grass suitable for re-use: Take up and store the turf and water during the storage period.

Unsuitable grass: Remove and dispose of off-site.

**Small plants, shrubs and trees**

Remove for re-planting: Take up and store. Wrap the rootball in a hessian or plastic bag with drain holes and water during the storage period.

Unsuitable vegetation: Remove and dispose of off-site.

**3.3 GROUND CONDITIONS****As found site conditions**

Unexpected conditions: If the following are encountered, give notice immediately and obtain instructions before carrying out any further work in the affected area:

- Bad ground.
- Discrepancies to expected ground conditions.
- Rock.
- Springs, seepages.
- Topsoil > 100 mm deep.

**Records of measurement**

Excavation and backfilling: If a schedule of rates applies, provisional quantities are specified, or there are variations to the contract levels or dimensions of excavations, do not commence backfilling or place permanent works in the excavation until the following have been agreed and recorded:

- Depths of excavations related to the datum.
- Final plan dimensions of excavations.
- Quantities of excavations in rock.

**3.4 EXCAVATION****General**

Requirement: Excavate for underground services in conformance with the following:

- To required lines and levels, with uniform grades.
- Straight between access chambers, inspection points and junctions.
- With stable sides.
- Width tolerance:  $\pm 50$  mm, unless constrained by adjacent structures.
- Tree protection: To AS 4970 (2009).

**Adjacent structures**

Existing footings: If excavation is required within the zone of influence of an existing footing, use methods including (temporary) shoring or underpinning that maintain the support of the footing and make sure that the structure and finishes supported by the footing are not damaged.

Temporary supports: Provide supports to adjacent structures where necessary, sufficient to prevent damage arising from the works, as follows:

- Lateral supports: Provide lateral support using shoring.
- Vertical supports: Provide vertical support where necessary using piling or underpinning or both.

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

Encroachments: If encroachments from adjacent structures are encountered and are not shown on the drawings, give notice and obtain instructions.

**Trench widths**

General: Keep trench widths to the minimum, consistent with the laying and bedding of the relevant service and construction of access chambers and pits.

**Trench depths**

General: As required by the relevant service and its bedding method.

**Obstructions**

General: Clear trenches of sharp projections. Cut back roots encountered in trenches to at least 600 mm clear of services. Remove other obstructions including stumps and boulders that may interfere with services or bedding.

**Dewatering**

General: Keep trenches free of water. Place bedding material, services and backfilling on firm ground, free of surface water.

Pumping: Provide pump-out from adjacent sumps or install well points.

Adjacent subsidence: Provide recharge points to isolate the dewatering zone.

**Excess excavation**

General: If trench excavation exceeds the correct depth, reinstate to the correct depth and bearing value using compacted bedding material or sand stabilised with 1 part of cement to 20 parts of sand by volume.

**Stockpiles**

Topsoil removal: Stockpile topsoil intended for re-use to a maximum height of 1500 mm.

Excavated material for backfill: If required, segregate the earth and rock material and stockpile, for re-use in backfilling operations.

Locations: Do not stockpile excavated material against tree trunks, buildings, fences or obstruct the free flow of water along gutters where stockpiling is permitted along the line of the trench excavation.

Disposal: If stockpiling is not permitted, dispose of excavated material off-site.

**Unsuitable material**

Disposal: Remove unsuitable material from the bottom of the trench or at foundation level and dispose of off-site. Replace with trench backfill material.

**Boring**

Subcontractor: If boring is required instead of trenches, engage a suitably qualified subcontractor to do the work.

**3.5 TRENCH BACKFILL****General**

Place fill: To AS 3798 (2007) clauses 6.2.2 and 6.2.6.

Timing: Backfill service trenches as soon as possible after laying and bedding the service, if possible on the same working day.

Removal of supports: Remove temporary supports progressively as backfilling proceeds.

**Marking services**

Marking tape: Provide marking tape above service, with appropriate labelling, to AS/NZS 2648.1 (1995) and as follows:

- Non-metallic services: Provide tape capable of being detected by inground scanning devices.
- Location: Locate tape approximately half the depth of the service being marked, to a maximum depth of 200 mm below the finished ground level.

Boring: If boring techniques are used to install the service, provide permanent on site labelling at the start and end of the service run and record on the as-built documentation.

**Bedding, haunch, side and overlay zones**

Installation and material: To the particular utility authority or utility service requirements. Secure pipes against floatation.

Bedding of services: Surround pipes or conduits on all sides with a minimum of 75 mm compacted bedding sand, or as documented.

Overlay zone thickness: Maximum 300 mm immediately over the utility service.

**Trees**

Backfill at trees: Backfill minimum 300 mm thick, around tree roots with a topsoil mixture. Place and compact in layers of 150 mm minimum depth to a dry density equal to that of the surrounding soil.

Original surface level: Do not place backfill above the original ground surface around tree trunks or over the root zone.

Watering: Thoroughly water immediately after backfilling the tree root zone.

**Compaction**

Control moisture within backfill: To AS 3798 (2007) clause 6.2.3.

Layers: Compact all material in layers not exceeding 150 mm compacted thickness. Compact each layer to the required relative compaction before starting the next layer.

Compaction: To AS 3798 (2007) Section 5.

Frequency of testing: To AS 3798 (2007) clause 8.7.

Precautions: Use compaction methods that do not cause damage or misalignment to utility services.

**Density tests**

Testing authority: Carry out density tests of pipe bedding and backfilling by an Accredited Testing Laboratory.

Test methods: Conform to the following:

- Compaction control tests: To AS 1289.5.4.1 (2007) or AS 1289.5.7.1 (2006).
- Field dry density: To AS 1289.5.3.2 (2004) or AS 1289.5.3.5 (1997).
- Standard maximum dry density: To AS 1289.5.1.1 (2017).
- Dry density ratio: To AS 1289.5.4.1 (2007).
- Density index: To AS 1289.5.6.1 (1998).

**3.6 SURFACE RESTORATION****Subbase and base**

Compaction: Uniformly compact each layer of the subbase and base courses over the full area and depth within the trench to a relative compaction of 100% when tested in conformance with AS 1289.5.4.1 (2007).

Compacted layer thickness:

- Maximum: 200 mm.
- Minimum: 100 mm.

Compaction test frequency: Minimum 1/every second layer/50 m<sup>2</sup> of restoration surface area.

**Concrete surfaces**

Construction: Conform to the following:

- Prime coat the cut edges of the existing surfaces with cement slurry. Lay and compact concrete so that the edges are flush and the centre is cambered 5 mm above the adjoining existing surfaces.
- Surface finish and pattern: Match existing adjoining work.
- Minimum thickness: 75 mm or the adjacent pavement thickness, whichever is thicker.
- Reinforcement and dowels: If required, provide steel reinforcement with dowels into the adjacent concrete.
- Expansion joints: 15 mm thick preformed jointing material of bituminous fibreboard placed in line with joints in existing concrete.
- Control joints:
  - . Form control joints strictly in line with the control joints in existing concrete.
  - . Around service poles: Terminate the concrete paving 200 mm from the pole and fill the resulting space with cold mix asphalt.

Weather: Do not place concrete in ambient temperatures above 30°C or below 10°C, without adequate precautions. Protect surface from rain damage, if required.

Compaction: Compact as follows:

- 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.

Curing: Cure by keeping continuously wet for 7 days.

**Asphalt surfaces**

Placement: To AS 2150 (2020).

Operations: Spread the asphalt mix in layers covering the full width of the trench.

Thickness: Match the adjoining asphalt surface.

Finish: Compact to a smooth even surface.

Sprayed bituminous surfaces: To AS 3727.1 (2016) Section 8.

**Pavers**

Bedding: Replicate the bedding used for the original paved surface. Use bedding methods and materials that are appropriate to the paver, the substrate, the conditions of service, and which leave the paver firmly and solidly bedded in the bedding material.

Laying: Re-lay to match the pattern and surface levels of the existing paving.

Damaged pavers unsuitable for relaying: Replace with new pavers of the same material, type, size and colour as the existing.

**Landscaped areas**

In topsoil areas: Complete the backfilling with topsoil for at least the top 100 mm.

Grass: Re-lay stockpiled turf. If existing turf is no longer viable, re-sow grass over the trench and other disturbed areas.

Planted areas: Overfill to allow for settlement.

**3.7 COMPLETION****General**

As-built documentation: Upon completion, record the location of all installed services on the as-built documentation.

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**0224 STORMWATER – SITE****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide stormwater drainage, as required by Council Engineers to permeable play softfall areas and sandpit.

**1.2 DESIGN****General**

Designer: Contractor for Council Engineers' approval

**Requirements**

General: To DESIGN in *0171 General requirements*.

Responsibility: Contractor

Performance requirements: As required by Council Engineers

**1.3 CROSS REFERENCES****General**

Requirement: Conform to the following:

- *0171 General requirements*.

**1.4 STANDARDS****Stormwater drainage**

Standard: To AS/NZS 3500.3 (2021).

**1.5 INTERPRETATION****Definitions**

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

- Pipe surround: Includes pipe overlay, pipe side support, side zone and haunch zone.

**1.6 SUBMISSIONS****Certification**

Requirement: Submit certificate stating that network is leak free upon completion.

**Samples**

General: Submit samples of the following:

- Each type of imported pipe bedding material.
- Each type of filter material.

**Tests**

Results: Submit results from pre-completion leak testing.

**1.7 INSPECTION****Notice**

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

- Excavated surfaces prior to placing bedding material.
- Underground services, or services to be concealed, before being covered.
- Pipe joints before covering.
- Placing of concrete.
- Completion of stormwater drainage.



## 2 PRODUCTS

### 2.1 MATERIALS

#### Concrete and mortar

Concrete: To AS/NZS 3500.3 (2021) clause 2.9 and the following:

- Grade: Minimum N15.
- Cement: To AS 3972 (2010).
  - . Type: GP, GL or GB.

Steel reinforcement:

- Bars and machine welded mesh: To AS/NZS 4671 (2019).

#### Joints

Solvent cement and priming fluid: To AS 3879 (2011).

Rubber ring joints/elastomeric seals: To AS 1646 (2007).

#### Pipes and fittings

Fibre reinforced cement (FRC): To AS 4139 (2003) and the following:

- ≤ 450 mm diameter: Rubber ring joints to AS 4139 (2003).
- > 450 mm diameter: With a purpose machined internal spigot and socket system within the pipe wall.

Glass-reinforced plastic (GRP): To AS 3571.1 (2009).

Access covers and grates: To AS 3996 (2019).

Polyvinyl chloride (PVC): To AS/NZS 1254 (2010), AS/NZS 1260 (2017) or AS 1273 (1991), as appropriate.

Best environmental practice (BEP) PVC: Conform to AS/NZS 1260 (2017) Appendix C, including all marking requirements.

Polyethylene (PE): To AS/NZS 4129 (2020), AS/NZS 4130 (2018), ISO 8770 (2003) or AS/NZS 2033 (2008), as appropriate.

Precast concrete: To AS 3850.3 (2021) and AS/NZS 4058 (2007).

Plastic pipe for subsoil drainage: To AS 2439.1 (2007).

Vitrified clay or ceramic: To AS 1741 (1991).

#### Bedding material

Bed and haunch zones: Provide granular material graded to the AS 1141 series.

#### Bedding material grading table

Sieve size (mm)	Weight passing %	
	Bed and haunch	Side zones
75.0	-	100
19.0	100	-
9.5	-	50 - 100
2.36	50 - 100	30 - 100
0.60	20 - 90	15 - 50
0.30	10 - 60	-
0.15	0 - 25	-
0.075	0 - 10	0 - 25

#### Gravel drainage material

Requirement: Materials consisting of natural clean washed sands and gravels and screened crushed rock, to AS/NZS 3500.3 (2021) clause 2.13.1.

## 2.2 GEOTEXTILES

### General

Material: UV stabilised, permeable, polymeric, woven or non-woven textile material used in contact with soil/rock material.

Identification and marking: To AS 3705 (2012).

Product: Ag drain

Properties: With filter sock. Submit details for Council approval.

### Subsoil drainage

Filter: Conform to AS/NZS 3500.3 (2021) clause 2.13.2.

## 2.3 PREFABRICATED PITS

### General

Requirement: Precast or prefabricated pits conforming to AS/NZS 3500.3 (2021) clauses 2.12.8 and 7.5, and AS 3850.3 (2021).

### Access covers and grates

Cover finish and load classification: Provide access cover and grate with the documented finish, slip resistance and load class.

## 3 EXECUTION

### 3.1 PIPING

#### Installation

Laying: Lay lengths separately with the barrel bearing evenly on the prepared bedding.

Sockets: Lay with socket ends pointing upstream.

Cleaning: Clean pipe interior of dirt, debris, mortar and other foreign matter.

Protection: Provide temporary caps over the ends of incomplete sections to prevent the entry of foreign matter.

### 3.2 TOLERANCES

#### Pipeline tolerances table

	Permissible angular deviation from the documented alignment	Permissible displacement from the documented positions
Horizontal	1:300	15 mm
Vertical	1:500	5 mm

Note: These tolerances are conditional on falls to outlets being maintained and no part of a pipeline having less than the documented gradient.

### 3.3 STORMWATER DRAINS

#### Location

General: Provide stormwater drains to connect surface drains, subsoil drains and drainage pits to the outlet point or point of connection. Make sure location of piping will not interfere with other services and building elements not yet installed or built. Subject to the preceding and documented layouts, follow the most direct route with the least number of changes in direction.

#### Laying

Installation: Lay in straight lines between changes in direction or grade. If other pipes are adjacent, set each pipe true to line and complete each joint before laying the next pipe. If work is not continuous, cap open ends to prevent entry of foreign matter.

#### Identification

Requirement: Lay a detectable strip or plastic tape in the trench after pipe laying, testing and initial backfilling.

#### Pipe underlay

General: Bed piping on a continuous underlay of bedding material, minimum 75 mm and maximum 150 mm thick after compaction. Grade the underlay evenly to the gradient of the pipeline.

Chases: If required, form chases to prevent projections such as sockets and flanges from bearing on the trench bottom or underlay.

#### **Pipe surrounds**

General: Place the material in the pipe surround in layers, maximum 200 mm loose thickness, and compact without damaging or displacing the piping.

#### **Trench backfill**

General: Backfill the remainder of the trench to the underside of the subgrade with fill material placed in layers, maximum 200 mm loose thickness and compacted to minimum 90%, or 95% under pavements, of the standard maximum dry density.

#### **Lifting holes**

Sealing: Seal lifting holes in all pipes with plastic preformed plugs or 3:1 (sand:cement) mortar, before the commencement of backfilling.

#### **Anchor blocks**

Restraint: If required to restrain lateral and axial movement of the stormwater pipes, provide reinforced concrete anchor blocks at junctions and changes of grade or direction conforming to AS/NZS 3500.3 (2021) clause 7.9.

### **3.4 SUBSOIL DRAINS**

#### **General**

Requirement: Provide subsoil drains to intercept groundwater seepage and prevent water build-up behind walls and under pavements. Connect subsoil drains to surface drains or to the stormwater drainage system as applicable.

Piping: As documented.

Trench width: Minimum 450 mm.

Trench floor: Grade the trench floor evenly to the gradient of the pipeline. If the trench floor is rock, correct any irregularities with compacted bedding material.

Pipe depth: Provide the following minimum clear depths, measured to the crown of the pipe, where the pipe passes below the following elements:

- Formation level of the pavement, kerb or channel: 100 mm.
- Average gradient of the bottom of footings: 100 mm.
- Finished surface of unpaved ground: 450 mm.

#### **Jointing**

General: At junctions of subsoil pipes, provide tees, couplings or adaptors to AS 2439.1 (2007).

#### **Pipe underlay**

Bedding: Bed piping on a continuous underlay of bedding material, minimum 75 mm and maximum 150 mm thick after compaction. Grade the underlay evenly to the gradient of the pipeline.

Chases: If required, form chases to prevent projections such as sockets and flanges from bearing on the trench bottom or underlay.

#### **Pipe surrounds**

General: Place the material in the pipe surround in layers, maximum 200 mm loose thickness, and compact without damaging or displacing the piping.

Depth of overlay:

- To the underside of the bases of overlying structures such as pavements, slabs and channels.
- To within 150 mm of the finished surface of unpaved or landscaped areas.

#### **Geotextiles**

Marking: To AS 3705 (2012).

Laying: Place geotextile, as documented.

Protection: Provide heavy duty protective covering. Store clear of the ground and out of direct sunlight. During installation, do not expose the filter fabric to sunlight for more than 14 days.

#### **Filter socks**

General: Provide permeable polyester socks, capable of retaining particles 0.25 mm and greater. Securely fit or join the sock at each joint.

### 3.5 PITS

#### Installation

General: Prepare foundation, install pit and connect pipes, to manufacturer's recommendations.

Location: At junctions, changes of gradient and changes of direction of stormwater drains, as documented.

#### Finish to in situ exposed surfaces

General: Provide a smooth, seamless finish, using steel trowelled render or concrete cast in steel forms.

Corners: Cove or splay internal corners.

#### Metal access covers and grates

Cover levels: Top of cover or grate, including frame:

- In paved areas: Flush with the paving surface.
- In landscaped areas: 25 mm above finished surface.
- Gratings taking surface water runoff: Locate to receive runoff without ponding.

### 3.6 TESTING

#### Site tests

General: Before backfilling or concealing, carry out an air or water pressure test to AS/NZS 3500.3 (2021) Section 9.

Leaks: If leaks are found, rectify and re-test.

Best environmental practice (BEP) PVC: Conform to AS/NZS 1260 (2017) Appendix C, including all marking requirements.

### 3.7 COMPLETION

#### Cleaning

General: Clean and flush the whole installation.

## 4 SELECTIONS

### 4.1 STORMWATER

#### Stormwater pipeline schedule

	A	B	C
Pipe material and nominal size (mm)	To Council Engineer's requirements		
Class			
Jointing			
Pipe support			
Concrete encasement			

#### Pipe bedding schedule

	A	B	C
Bedding application	To Council Engineer's requirements		
Bedding zone			
Bedding type			
Material and grading			
Required density			

**Subsoil pipeline schedule**

	<b>A</b>	<b>B</b>	<b>C</b>
Trench depth (mm)	To Council Engineer's requirements		
Pipe size (nominal)			
Pipe type			
Pipe class			

**Pit schedule**

	<b>A</b>	<b>B</b>	<b>C</b>
Type	To Council Engineer's requirements		
Size (mm)			
Cover type			
Cover finish			
Slip resistance to AS 4586 (2013)			
Load class to AS 3996 (2019)			

**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**

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

**Warranties**

Requirement: Submit warranties to **COMPLETION**, **Warranties**.

**1.4 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.

**2 PRODUCTS****2.1 GENERAL****Samples**

Requirement: Provide samples as follows: Any new bricks

**2.2 TIMBER****Durability**

Natural durability class to AS 5604 (2022): Class 1.

**Preservative treatment**

Timber type: Provide only timbers with preservative treatment appropriate to the hazard class.

Cut surfaces: Provide supplementary preservative treatment to all cut and damaged surfaces.

CCA treated timber: If proposed, provide details.

**Hardwood**

General: To AS 2796.1 (1999) Section 2.

**Softwood**

General: To AS 4785.1 (2002) Section 2.

**2.3 CONCRETE****General**

Standard: To AS 1379 (2007).

Exposure classification: To AS 3600 (2018) Table 4.3.

Grade, if there are cast-in metal items: To AS 3600 (2018) Table 4.4.

**2.4 EDGING****Concrete**

Requirement: As documented.

Standard: To AS 1379 (2007).

Grade: Minimum N20.

**Brick**

Requirement: Provide masonry units, as documented.

### 3 EXECUTION

#### 3.1 GENERAL

**Set-out**

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

**Clearing**

Extent: Except for trees or shrubs to be retained, clear vegetation within 1 m of the landscape walls. Grub out stumps and roots of removed trees or shrubs and trim the grass to ground level but do not remove the topsoil.

**Excavation**

Extent: Excavate for foundations and footings.

**Geotextiles**

Storage and handling: Store clear of the ground and out of direct sunlight. During installation do not expose the filter fabric to sunlight for more than 14 days.

#### 3.2 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.

**Brick**

Setting: On a 1:1:6 (cement:lime:sand) mortar haunch.

Laying: Lay edging bricks to the documented bond or coursing pattern.

Joints: 3 mm struck flush.

Alignment: Even and free from dips, humps and bends.

Cleaning: Wash off mortar progressively.

### 4 SELECTIONS

#### 4.1 EDGING SCHEDULES

**Concrete edging schedule**

	A
Edge strip profile	Refer to drawings
Kerb profile	Refer to drawings

**Brick edging schedule**

	A
Product	Existing bricks, bricks to match existing
Type	Existing bricks, bricks to match existing
Laying pattern	As documented

**0242 LANDSCAPE – FENCES AND BARRIERS****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Install fences and barrier systems, as documented. Note Council to provide fencing.

**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 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.
- Completed prototypes.
- Completion of installation.

**2 PRODUCTS****2.1 GENERAL****Storage and handling**

General: 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 (2016).

- Grade: C350L0.

Post and rail finish: Hot-dip galvanized.

**Fencing wire**

Chain link, cable wire, tie wire and barbed wire: To AS 2423 (2002).

**2.3 CONCRETE****General**

Standard: To AS 1379 (2007).

Exposure classification: To AS 3600 (2018) Table 4.3.

**2.4 COMPONENTS****Steel panel fencing**

Steel framing: Zinc-coated or aluminium/zinc alloy coated steel to AS 1397 (2021).

Steel sheeting: Prepainted to AS/NZS 2728 (2013).

**Gates**

General: As documented.

**Barriers for swimming pools**

Design, construction and performance: To AS 1926.1 (2012).

Location of barriers for private swimming pools: To AS 1926.2 (2007).



### 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 STEEL FENCING

##### Steel picket fencing

Requirement: As documented.

##### Steel picket fencing installation

General: Fit tightly fittings caps to steel posts. Attach panels to posts with fixing clips and galvanized M8 x 75 mm hexagon head bolts before concreting footing.

##### Steel panel fencing

Requirement: As documented.

Protection: Make sure bottom rails have drain holes or clearance to posts and are at least 50 mm clear of the ground.

#### 3.4 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.

**3.5 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 (2002) Appendix C.

Powder coated metal, other than aluminium, architectural applications: Clean completed assembly to AS 4506 (2005) 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.

- Form: Against failure of materials and execution under normal environment and use conditions.
  - Period: As offered by the manufacturer and the installer.
-

**0261 LANDSCAPE – FURNITURE AND FIXTURES****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Install landscape furniture and fixtures, as documented. Note: Weddin Shire Council will supply the furniture and fixtures, with the exception of the Sandstone Seating Blocks, Entrance Signage, Entrance Signage Posts and fixings, which the contractor is to supply.

**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 manuals**

Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals.**

**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 the 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 the AS 4685 series.

**Weathering steel**

Standard: To AS/NZS 3678 (2016).

Grade: WR350.

**2.2 ELEMENTS****Playground equipment and exercise stations**

Soft surfacing: To *0262 External sports and playground surfacing.*

Playground equipment: To the AS 4685 series.

**Sand pit materials**

Aggregate: 15 mm gauge road base.

Agricultural pipe: 75 mm diameter slotted PVC pipe.

Sand: Clean, sharp river sand.

Filter fabric: Submit details for approval

---

**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 the AS 4685 series.

**Operation and maintenance manuals**

Requirement: Prepare a manual that includes the manufacturer's published use, care and maintenance requirements for each item.

---

**4 SELECTIONS****4.1 FURNITURE****Benches**

Type: Citistyle 2m Park Seat with Armrests - Surface Mount - Blackbutt Timberimage

Description: Standard seat 2m, timber look aluminium with bolt-down legs

Supplier: GX Outdoors

Product No.: CPS-SM-TIM-001-BB

Fixing: Surface mount

**Seats and tables**

Type: Citistyle 2m Table Setting - Wheelchair Accessible Both Ends - Surface Mount - Blackbutt Timberimage

Description: Standard setting, 2m, timber look aluminium with bolt-down legs

Supplier: GX Outdoors

Product No.: CTS-SM-TIM-009-BB

Fixing: Surface mount

**4.2 FIXTURES****Barbeque**

Type: Contour Single BBQ - Single Cabinet - Aluminium - Hotplate (doors in REAR) - 10Amp

Description: Standard single hotplate electric access barbeque

Supplier: GX Outdoors

Product No.: CSR-SC-STD-002-10AMP

Fixing: Bolt-down

Services connection: To electric mains

Type: Contour Double BBQ - Double Cabinet (Doors in Rear) 10Amp

Description: Standard double hotplate electric access barbeque

Supplier: GX Outdoors

Product No.: CDB-DC-STD-003-10AMP

Fixing: Boltdown

Services connection: To electric mains

### **Drinking fountain**

Type: Reviva Drinking Fountain with Dog Bowl & Side Refill Spout

Description: Standard drinking fountain with side tap and dog bowl, boltdown attachment

Supplier: GX Outdoors

Product No.: RDF-SM-DEL-004

Fixing: Boltdown

Services connection: To water mains

### **Litter bins**

Type: Integra-EX 120L Waste Bin Enclosure - Deluxe Finish

Description: Standard 120L waste receptacle with boltdown attachment

Supplier: GX Outdoors

Product No.: IXBE-SC-DEL-003

Fixing: Boltdown

Type: Integra-EX 120L Recycle Bin Enclosure - Deluxe Finish

Description: Standard 120L Recyclable litter receptacle with boltdown attachment

Supplier: GX Outdoors

Product No.: IXBE-SC-DEL-006

Fixing: Boltdown

### **Shade structures**

Type: Standard Peninsula shelter

Description: Standard Peninsula 8m x 6m skillion roof shelter with boltdown hardwood posts

Supplier: Landmark or similar approved

Product No.: K305

Size: 8m x 6m

Type: Standard Peninsula shelter

Description: Standard Peninsula 10m x 6m skillion roof shelter with boltdown hardwood posts

Supplier: Landmark or similar approved

Product No.: K307

Size: 10m x 6m

### **Bicycle Rack - TBA**

#### **Bollard**

Type: Disabled carpark bollard

Description: Blue flexible disabled carpark bollard

Supplier: Access and Safety

Size: 1300mm x 95mm

Fixing: To manufacturer's recommendation

### 4.3 PLAY EQUIPMENT AND EXERCISE STATIONS

#### Play equipment and exercise stations

Type: Flying fox

Description: 25m Double Cableway

Supplier: Kompan / Play By Design

Product No.: M88111

Fixing: To manufacturer's details

Type: Swing

Description: 3.5m pendulum nest swing

Supplier: Moduplay

Product No.: S-8799

Fixing: To manufacturer's details

Type: Talk tubes

Description: Pair of talk tubes

Supplier: Forpark

Product No.: FS57

Fixing: To manufacturer's details

Type: Stop Signs x 2

Description: Correctly proportioned stop sign for learn to ride cours

Supplier: Moduplay

Product No.: G-9907

Fixing: To manufacturer's details

Type: Give Way Signs x 4

Description: Correctly proportioned give way sign for learn to ride course

Supplier: Moduplay

Product No.: G-9908

Fixing: To manufacturer's details

### 4.4 CUSTOM-BUILT FURNITURE AND FIXTURES

#### Custom-built furniture and fixtures schedule

Description	Sandstone seating blocks	Entrance Signage	Entrance Signage Posts
Location	Refer to drawings	Refer to drawings	Refer to drawings
Size	600x600x1000mm	841mm x 1189mm sign	200mm x 200mm x 3000mm posts, cut in half to make 2 x 1500mm posts
Material	Sandstone – submit supplier details for approval	Digitally printed with anti-graffiti coating and applied to 3mm aluminium composite panel/ or similar approved. Artwork supplied.	Hardwood timber
Finish	Sawn	Rounded corners and smooth edges	Sawn and splinter free
Fixings	Placed	Screwed to hardwood posts	Concrete footings
Certification	Council Engineers	Council Engineers	Council Engineers

Description	Story Poles	Climbing Structure
Location	Refer to drawings	Refer to drawings
Size	Refer to drawings	Refer to drawings
Material	Hardwood Timber	Hardwood Timber frame with netting
Finish	Prepared for painting	Oiled
Fixings	Concrete footing to Council Engineer's requirements	Concrete footing to Council Engineer's requirements
Certification	Playground certifier	Playground certifier

Description	Tower	Handrail with kick rail for ramp	Handrail for stairs
Location	Refer to drawings	Refer to drawings	Refer to drawings
Size	Refer to drawings	To meet the standard	To meet the standard
Material	TBA	Galvanised steel	Galvanised steel
Finish	TBA	To meet the standard	To meet the standard
Fixings	TBA	Boltdown	Boltdown
Certification	Playground certifier	Playground certifier	Playground certifier

#### Refurbished furniture and fixtures schedule

	A	B
Description	Children's swing	Toddler's Swing
Location	Refer to drawings	Refer to drawings
Other	Replace worn component parts	Replace worn component parts
Certification	Playground certifier	Playground certifier

**0262 EXTERNAL SPORTS AND PLAYGROUND SURFACING****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide external sports and playground surfacing, as documented.

**1.2 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0171 General requirements.
- 0271 Pavement base and subbase.
- 0272 Asphalt.
- 0310 Concrete – combined.

**1.3 STANDARDS****General**

Playground surfacing: To AS 4685.0 (2017) and AS 4685.1 (2021).

**1.4 INTERPRETATION****Abbreviations**

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

- EDPM: Ethylene propylene diene monomer (M-class) rubber.
- SBR: Styrene-butadiene rubber.

**Definitions**

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

- Critical fall height: The maximum free height of fall for which a surface provides an acceptable level of impact attenuation.
- Polymeric material: A compound, including those manufactured from plastics, rubber or textile, having the same elements combined in the same proportions by weight, but differing in molecular weight.
- Rubber: Polymeric material, either natural or synthetic that is elastomeric.
- Substrate: The surface to which a material or product is applied.
- Unitary surfacing: An impact-attenuating surface consisting of one or more material components cast in situ or formed into a sheet, tile or other continuous surface where the underlying protective properties of the impact surfacing remain constant with consecutive and/or repeated use.

**1.5 TOLERANCES****Playground unitary surfacing**

General: No ridges, bumps or hollows to cause a hazard, with a 2.5 m gradual transition from playground surfacing to adjacent surfaces.

**Playground loose-fill surfacing**

General: No ridges, bumps or hollows to cause a hazard.

**1.6 SUBMISSIONS****Operation and maintenance manuals**

Requirement: Submit manual to **COMPLETION**, **Operation and maintenance manuals**.

**Products and materials**

Manufacturer's data: Submit the manufacturer's product data for each type of surfacing, and the manufacturer's recommendations for its application in the project including the following, as appropriate:

- Product data sheets.



- Maintenance recommendations.

Type tests: Submit results, as follows:

- Impact-attenuation performance of surfaces: To AS 4422 (Int) (2022).
- Slip resistance: To AS 4586 (2013).

### **Samples**

Synthetic turf surfacing: For each type, submit a sample of the following:

- Turf fabric: 300 mm x 300 mm.
- Game line turf fabric: 300 mm long by line width.
- Infill material: 100 g of each type.
- Impact-attenuation layer: 300 mm x 300 mm.
- Seam sample: 300 mm x 300 mm square with seam centered in sample.

Polymeric cast in situ surfacing and polymeric liquid coatings: For each type, submit a sample of the following:

- Coating system including impact-attenuation layer on a suitable base.
- Minimum size per sample: 450 mm x 450 mm.
- Game line sample: 450 mm long by line width.

Polymeric cast prefabricated surfacing: For each type, submit a sample of the following:

- Minimum size per sample: 450 mm x 450 mm.
- Game line sample: 450 mm long by line width.

Polymeric granular material: For each type, submit a 100 g sample of the material.

Loose-fill material: For each type, submit a 1 kg sample of the material.

Identification: Label each sample, with brand, product name, and manufacturer's code reference (including the code for each coat of multi-coat work).

### **Shop drawings**

Synthetic turf surfacing: Submit shop drawings to a scale that best describes the detail, showing the following:

- Plans, sections and details.
- Locations of seams and method of seaming.
- Layout of game lines, numbers, and letters. Indicate application method of each line and marking.

Polymeric surfacing: Submit shop drawings to a scale that best describes the detail, showing the following:

- Installation details.
- Layout of game lines, numbers, and letters. Indicate application method of each line and marking.
- Location of equipment inserts.
- Method of joining different colours and separate pours.

### **Subcontractors**

General: Submit names and contact details of proposed suppliers and applicators.

Evidence of experience: Submit for approval

Substrate acceptance: Submit evidence of applicator's acceptance of the surfacing substrate before commencing installation.

### **Warranties**

Requirement: Submit warranties to **COMPLETION, Warranties.**

## **1.7 INSPECTION**

### **Notice**

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

- Base preparation completed.
- Substrate preparation completed.
- Setting out completed.
- Installation completed.

## 2 PRODUCTS

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### 2.1 GENERAL

#### Storage and handling

General: Deliver, unload and store surfacing materials in unbroken manufacturer's packaging. Inspect for damage upon delivery.

Storage: Store in a dry environment and in a location to allow installation of the surfacing without excess disturbance of the substrate.

### 2.2 SUBSTRATES

#### Base and subbase

Requirement: To 0271 *Pavement base and subbase*.

#### Asphaltic concrete

Requirement: To 0272 *Asphalt*.

#### Concrete

Requirement: To 0310 *Concrete – combined*.

### 2.3 GEOTEXTILE MATERIALS

#### General

Material: UV stabilised polymeric fabric formed from a plastic yarn composed of at least 85% by weight of propylene, ethylene, amide or vinylidene chloride.

Identification and marking: To AS 3705 (2012).

Quality: Free of flaws, stabilised against UV radiation, rot proof, chemically stable and with low water absorbency. Filaments resistant to delamination and dimensionally stable.

### 2.4 IMPACT-ATTENUATION LAYER

#### General

Description: Proprietary resilient layer between the base and surface with the following properties:

- Reduce injury risk from falls.
- Reduce lower leg stress.
- Control ball bounce.

### 2.5 LOOSE FILL MATERIALS

#### General

Material: Consisting of unbound, granular, chipped or fibrous elements such as sand, wood-fibre, bark mulch and wood chips.

Particle or grain size: To AS 4685.1 (2021) Table 4.

### 2.6 POLYMERIC GRANULAR MATERIAL

#### General

Definition: Proprietary system comprising loose laid granular rubber.

Granular rubber: Shredded particles free of metal, non-metallic fibres, rubber dust and contaminants.

Edging: Water-resistant interconnected modular units.

### 2.7 POLYMERIC LIQUID COATINGS

#### General

Description: Proprietary system comprising acrylic or polyurethane coatings with or without an impact-attenuation layer.

Game lines and markings: Painted.

## 3 EXECUTION

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### 3.1 GENERAL

#### Subcontractors

Requirement: Use specialist applicators recommended by the material manufacturer.

**Combinations**

General: Do not combine products from different manufacturers in a surfacing system.

**3.2 SUBSTRATES****Drying and shrinkage**

General: Before laying surfaces, allow at least the following times to elapse for these substrates:

- Concrete slabs: 28 days.
- Asphaltic concrete: 14 to 21 days.

**3.3 PREPARATION****Substrate condition**

Requirement: Sound, clean and free of any moisture, deposit or finish, including laitance, efflorescence, curing compounds, dirt and grease, which may impair bonding or is incompatible with the surfacing.

Substrate alkalinity and adhesion: Verify the concrete pH is within the range recommended by the manufacturer. Perform adhesion tests to the manufacturer's recommendations, do not proceed with application unless the substrate passes the test.

**Substrate correction**

Substrate rectification: Conform to the following:

- Surface treatments: Mechanically remove the following surface treatments:
  - . Sealers and hardeners.
  - . Curing compounds.
  - . Waterproofing additives.
  - . Surface coatings and contamination.
- Planeness, smoothness, projections: Remove projections and fill voids and hollows with a smoothing and self-levelling compound compatible with the adhesive. Allow filling or levelling compound to dry to manufacturer's recommendations.

**Ambient conditions**

Ambient air temperature: If less than 5°C or more than 35°C, do not lay surfacing.

Ambient surface temperature: If less than 10°C or more than 60°C, do not lay surfacing.

Rainfall and humidity: If rainfall is imminent or high humidity may prevent drying, do not lay surfacing.

**Falls**

Requirement: Make sure the fall in the substrate conforms to the fall documented for the surface finish.

**Geotextile**

Preparation: Trim the ground to a smooth surface free from cavities and projecting rocks.

Placing: Lay the fabric flat, but not stretched tight, and secure it with anchor pins. Overlap joints 300 mm minimum.

**Priming**

General: If required by the surfacing manufacturer, prime the substrates with a primer compatible with the surfacing system.

**3.4 LOOSE FILL MATERIALS****Installation**

General: Make sure that loose fill surfacing is spread to a uniform level.

Depth: To AS 4685.0 (2017).

Foundation clearance for loose fill surfacing: To AS 4685.1 (2021) clause 4.2.14.

**3.5 IN SITU RUBBER WET POUR****Installation**

General: Mix and apply components of seamless surfacing to manufacturer's recommendations to produce uniform, monolithic, and impact-attenuating surfacing of required overall thickness.

Substrate primer: Apply over prepared substrate.

Impact-attenuating layer: Spread evenly over primed substrate to form a uniform layer with a minimum of cold joints.

Intercoat primer: Apply primer over cured cushioning layer.

Wearing layer: Spread over primed substrate or impact-attenuation layer to form a uniform layer and, except where colour changes, with a minimum of cold joints. Finish surface to standard wearing surface texture.

Topcoat: Spray or roller apply in one continuous operation.

Joints: To the manufacturer's detail.

Edge treatment: Fully adhere edges to substrate with full coverage of substrate. Maintain the cushioned thickness required to conform with performance requirements.

### 3.6 TESTING

#### Completion tests

Slip resistance of testing of completed installation: To AS 4663.

Impact-attenuation performance of completed surfaces: TO AS 4422.

### 3.7 COMPLETION

#### Protection

General: Keep traffic off finished work for 48 hours after installation.

#### Reinstatement

Extent: Repair or replace faulty or damaged work. If the work cannot be repaired satisfactorily, replace the whole area affected.

#### Spare materials

General: Supply spare matching surfacing and accessories of each type for future replacement purposes. Store the spare materials on site where directed.

Quantity: At least 1% of the quantity installed.

#### Operation and maintenance manuals

Requirement: Prepare a manual that includes the manufacturer's published use, care and maintenance requirements for each type of surfacing.

#### Warranties

Requirement: Cover materials and workmanship in the terms of the warranty in the form of interlocking warranties from the supplier and the applicator.

- Form: Against failure of materials and execution under normal environment and use conditions.

- Period: As offered by the supplier and the applicator.

## 4 SELECTIONS

### 4.1 PERFORMANCE

#### Playground surfacing performance schedule

	A	B
Playground type	Refer to drawings	Refer to drawings
Surfacing type	Insitu rubber wet pour, referred to as poured rubber softfall and base layer in details and drawings.	Softfall mulch
Base	Compacted granular material	Existing subgrade
Abrasion resistance	To manufacturer's recommendation	To manufacturer's recommendation
Minimum thickness	To manufacturer's recommendation	To manufacturer's recommendation
Permeability	To manufacturer's recommendation	To manufacturer's recommendation
Slip resistance classification	To code	To code
Critical fall height tested to AS 4422 (Int) (2022)	To manufacturer's details	To Manufacturer's details

## 4.2 PRODUCT

### In situ rubber wet pour schedule

	A	B
Location	Basket Swing and Flying Fox	Toddler Play Area
Product	Rosehill TPV INPLAY 1-4mm, distributed by Surface Designs or similar approved.	Rosehill TPV INPLAY 1-4mm, distributed by Surface Designs or similar approved.
Total thickness	To manufacturer's specification. Referred to as poured rubber softfall and base layer in details.	To manufacturer's specification. Referred to as poured rubber softfall and base layer in details.
Wear layer	To manufacturer's specification	To manufacturer's specification
Impact-attenuation layer	To meet Australian Standards for required fall height.	To meet Australian Standards for required fall height.
Colour	40% RH10, 30% RH12, 30% RH11	50% RH32, 30% RH30, 20% RH40

### Mulching softfall schedule

	A
Location	Refer to drawings
Mulch type and depth (mm)	Certified playground mulch for approval, 300mm

**0271 PAVEMENT BASE AND SUBBASE****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide base and subbase courses as documented.

**Performance**

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

**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. Usually designated as Dense graded base (DGS), NGS 40mm gravel, CRS, CCS or RCMS.

**1.4 TOLERANCES****Surface level**

Subbase: +10 mm, -25 mm.

Base: +10 mm, -5 mm.

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

**Surface deviation**

Base:  $\leq 5$  mm from a 3 m straightedge laid on the surface.

**1.5 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.

Alternative materials: If proposed, submit type test results for the relevant properties 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.

### Tests

Compaction tests: Submit results of compaction testing to **TESTING, Site tests**.

## 1.6 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 (2009)	<b>Sieve size (mm)</b>	—	—
	53.0	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 (2009)	—	max 25%	max 25%
Plasticity index ( $I_P$ ) to AS 1289.3.3.1 (2009)	—	max 12%	max 12%
Linear shrinkage ( $LS$ ) to AS 1289.3.4.1 (2008)	<b>Rainfall</b>	—	—
	Areas with annual	max 4.5%	max 4.5%

Property and test method	Differentiating criteria	Material requirements	
		Crushed rock	Natural gravel
	rainfall > 500 mm		
	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 (2019)	—	min 1.0 MPa	min 1.0 MPa
Particle shape by proportional calliper - % misshapen (2:1) to AS 1141.14 (2007)	—	max 35%	—
Aggregate wet strength <sup>a</sup> to AS 1141.22 (2019)	—	min 50 kN	—
Wet/dry strength variation <sup>a</sup> (dry - wet)/dry to AS 1141.22 (2019)	—	max 40%	—
Los Angeles value to AS 1141.23 (2021)	—	max 40%	—
4 day soaked CBR (98% modified compaction) to AS 1289.6.1.1 (2014)	—	min 30%	min 30%
a. 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 <sup>a</sup>	100%	100%
Brick	20%	10%
RAP	40%	40%
Fly ash <sup>b</sup>	10%	10%
Furnace bottom ash	10%	10%
Crushed glass fines	10%	10%
Notes:		
a. For pavements using high percentages of crushed concrete, take into account the amount of available cement that will rehydrate when subjected to moisture to create rigid or semi-rigid pavement and result in subsequent shrinkage cracking.		
b. For pavements using fly ash, take into account the possibility of hydration and binding when subject to moisture to create rigid or semi-rigid pavement and result in subsequent shrinkage cracking.		

#### 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 (2012)	<b>Material type</b>	—	—	—
	Type I - Metal, glass, stone, ceramics and slag	—	max 2.0 %	—
	Type II - Plaster, clay lumps and other friable material	—	max 0.5%	—



Property and test method	Differentiating criteria	Material requirements		
		Crushed rock	Recycled material	Natural gravel
	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 through sieve) AS 1289.3.6.1 (2009)	<b>Sieve size (mm)</b>	—	—	—
	26.5	100	100	100
	19.0	95 - 100	95 - 100	93 - 100
	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 (2009)	—	max 25%	max 30%	max 25%
Plasticity index ( $I_P$ ) to AS 1289.3.3.1 (2009)	<b>Rainfall</b>	—	—	—
	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 (2008)	<b>Rainfall</b>	—	—	—
	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 (2019)	—	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 (2007)	—	max 35%	max 35%	—
Aggregate wet strength <sup>a</sup> to AS 1141.22 (2019)	—	min 80 kN	min 80 kN	—
Wet/dry strength variation <sup>a</sup> to AS 1141.22 (2019)	—	max 35%	max 35%	—
Los Angeles value	—	max 35%	max 40%	—

Property and test method	Differentiating criteria	Material requirements		
		Crushed rock	Recycled material	Natural gravel
(% loss or abrasion) to AS 1141.23 (2021)				
CBR (98% modified compaction) to AS 1289.6.1.1 (2014)	—	min 80%	min 80%	min 80%
Unconfined compressive strength to AS 5101.4 (2008)	—	max 1.0 MPa	max 1.0 MPa	—
NOTES:				
a. 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 to *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 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 (2017)
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, re-compact and test.

**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 and replace with new material and re-compact.

**3.4 TESTING****Site tests**

Compaction control tests: To AS 1289.5.4.1 (2007) and AS 1289.5.4.2 (2007).

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<sup>2</sup> for car parks.
- 3 tests per layer.
- 3 tests per visit.

**0274B 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 surfaces.

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 CROSS REFERENCES****General**

Requirement: Conform to the following:

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

**1.3 STANDARDS****Concrete**

Specification and supply: To AS 1379 (2007).

Materials and construction: To AS 3600 (2018).

Residential pavements: To AS 3727.1 (2016).

**Slip resistance**

Classification: To AS 4586 (2013).

**1.4 INTERPRETATION****Definitions**

General: For the purposes of this worksection, 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 (2007) 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 (2007) clause 1.5.4.
- Weather – cold: Ambient shade temperature less than 10°C.
- Weather – hot: Ambient shade temperature greater than 30°C.

**1.5 TOLERANCES****General**

Surface abutting gutters:  $\pm 5$  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:  $\pm 20$  mm from documented position.

Joint locations in plan: 10 mm from documented position.

**1.6 SUBMISSIONS****Products and materials**

Aggregates: Nominate the source for all aggregates.

Reinforcement: Submit the manufacturer's certificate of compliance with AS/NZS 4671 (2019), or submit test certificates from an Accredited Testing Laboratory.

Pre-mixed supply delivery dockets: For each batch, submit a docket listing the information required by AS 1379 (2007), 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.

Liquid curing compounds: Submit certified test results, including the application rate and the efficiency index to AS 3799 (1998) Appendix B.

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

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

Trial mix design report: Six weeks before commencing production, submit a report for each mix design containing the information required in AS 1012.2 (2014), the individual and combined aggregate particle size distribution, and the records and reports for the tests.

### Tests

Requirement: Submit test results of the following:

- Concrete:
  - . Compressive strength.
  - . Drying shrinkage.
  - . Flexural strength.
  - . Slump.
- Luminance contrast of completed tactile ground surface indicator installations.
- Slip resistance test of completed installations.

## 1.7 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 placement and compaction.
- Finishing and curing of concrete.
- Evaluation of surface finish.

## 2 PRODUCTS

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### 2.1 GENERAL

#### Samples

Sample panel: Prepare a sample panel of each type of finish as follows:

- Include samples of junction details and trim.
- Preserve each panel until related work is complete.

### 2.2 REINFORCEMENT

#### Steel reinforcement

Standard: To AS/NZS 4671 (2019).

Surface condition: Provide surfaces conforming to the following:

- Free of loose or flaking mill scale and rust

- Clean from oil, grease, mud or other material that may reduce the bond between the reinforcement and concrete.

Storage: Store reinforcement above the surface of the ground and protect from damage and from deterioration by exposure.

#### **Dowels**

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

Standard: To AS/NZS 3679.1 (2016).

Finish: Hot-dipped galvanized.

#### **Tie bars**

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

#### **Tie wire**

General: Annealed steel 1.25 mm diameter (minimum).

External and corrosive applications: Galvanized.

#### **Supports**

Standard: To AS/NZS 2425 (2015).

### **2.3 CONCRETE MIX**

#### **Standard**

Concrete mix and supply: To AS 3600 (2018) clause 17.1 and AS 1379 (2007).

#### **Properties**

Slump: Maximum 100 mm.

Drying shrinkage: Maximum 450  $\mu\epsilon$  after 21 days of air drying.

#### **Special class concrete additional properties**

### **2.4 AGGREGATE**

#### **Characteristics**

Standard: To AS 2758.1 (2014).

Durability: Tested to AS 1141.22 (2019):

- 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%.

### **2.5 CEMENT**

#### **General**

Standard: To AS 3972 (2010).

Age: Less than 6 months old.

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

Storage: Store cement bags in a dry, under cover and above ground environment.

#### **Supplementary cementitious materials**

Fly ash: To AS/NZS 3582.1 (2016).

Slag: To AS 3582.2 (2016).

Amorphous silica: To AS/NZS 3582.3 (2016).

Manufactured pozzolans: To AS 3582.4 (2022).

### **2.6 WATER**

#### **General**

Mixing water: To AS 1379 (2007) clause 2.4.

Requirement: Clean potable water, free from any material that may be harmful to the concrete or reinforcement including oil, acid, alkali, organic or vegetable matter.

Limits of impurities in mixing water: To AS 1379 (2007) Table 2.2 and the following:

- Chloride ion: Maximum 300 parts per million to AS 1478.1 (2000) Appendix C.

- Sulfate ion: Maximum 400 parts per million to AS 1289.4.2.1 (2020).

## 2.7 ADMIXTURES

### General

Standard: Chemical admixtures to AS 1478.1 (2000), used to the manufacturer's recommendations.

Quality: Free from calcium chloride, calcium formate, 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.

## 2.8 CURING COMPOUNDS

### General

Curing compounds: To AS 1160 (1996) and AS 3799 (1998), Type 2.

Sheet material covering: To ASTM C171 (2020), white opaque or clear polyethylene film, or white burlap-polyethylene sheet, or equivalent material.

## 2.9 OTHER MATERIALS

### Tactile ground surface indicators

Standard: To AS/NZS 1428.4.1 (2009).

## 3 EXECUTION

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### 3.1 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.

### 3.2 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.

### 3.3 SUBBASE

#### Thickness

Subbase thickness: As detailed

#### 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.

### 3.4 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

Type:

- 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 (2018).

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:  $\leq 60$  diameters.
  - . Mesh:  $\leq 600$  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.

## 3.5 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**

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.

**3.6 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.

**Standards**

Sampling, identification, testing and recording: To the AS 1012 series.

Type and frequency: To AS 1379 (2007).

**Concrete testing methods**

Specimens: Sample the concrete on-site, at the point of discharge from the agitator.

Slump: To AS 1012.3.1 (2014).

Compressive strength: To AS 1012.8.1 (2014) and AS 1012.9 (2014).

Drying shrinkage: To AS 1012.8.4 (2015) and AS 1012.13 (2015).

Flexural strength: To AS 1012.8.2 (2014) and AS 1012.11 (2000).

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<sup>3</sup> of concrete.

**Slip resistance tests**

Slip resistance of completed installation: To AS 4663 (2013).

**Tactile ground surface indicators**

Luminance contrast of completed installation: To AS/NZS 1428.4.1 (2009) Appendix E.

**3.7 CONCRETE PLACING AND COMPACTION****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.

Fibre-reinforced concrete: For pumped concrete, use a 100 to 150 mm mesh screen on the pump hopper to catch fibre balls.

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**

Logbook: Keep on site and make available for inspection a logbook 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.

**Placing in cold weather**

Cement: Do not use high alumina cement.

Temperature limits: Maintain the following:

- Freshly mixed concrete:  $\geq 5^{\circ}\text{C}$ .
- Formwork and reinforcement before and during placing:  $\geq 5^{\circ}\text{C}$ .
- Water: Maximum  $60^{\circ}\text{C}$  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  $\geq 5^{\circ}\text{C}$ .

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 formwork, materials, and equipment coming in contact with the concrete free of frost and ice.

Freezing: Prevent concrete from freezing.

**Placing in hot weather**

Requirement: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses.

Severe weather: If ambient shade temperature more than  $38^{\circ}\text{C}$ , do not mix concrete.

Temperature control: Select one or more of the following methods to make sure the temperature of the concrete mix does not exceed  $35^{\circ}\text{C}$ :

- Cool the concrete using liquid nitrogen injection before placing.
- Cover horizontal transport containers.
- Forms and reinforcement before and during placing:  $\leq 35^{\circ}\text{C}$ .
- Spray the coarse aggregate using cold water before mixing.
- Use chilled mixing water.

Evaporation control barriers: Erect barriers to protect freshly placed concrete from drying winds.

Evaporation rate limit:  $\leq 0.50 \text{ kg/m}^2/\text{h}$ .

**3.8 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 strip formwork prematurely if damage to the concrete may be caused.

Curing: 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, and within an hour of exposure.

**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 use a broom or hessian belt drawn across the surface to produce a coarse even-textured transverse-scored surface.

Scored or scratched finish: After screeding, use a stiff brush or rake drawn across the surface before final set to produce a coarse scored texture.

#### **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.

### **3.9 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 AS 3600 (2018) clause 17.1.5. Cure for at least 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.

Respray defective areas within 30 minutes. Respray within 3 hours after heavy rain.

Visually important surfaces: Apply curing compounds to produce uniform colour on adjacent surfaces.

#### **Water curing**

Method: Select a method of ponding or continuous sprinkling that does not damage the concrete surface during the required curing period.

#### **Wet hessian curing**

Method: Place wet hessian sheets/bags over concrete surface. Keep hessian wet during the required curing period by regularly sprinkling with water. Protect from wind and traffic.

#### **Impermeable sheet curing**

Method: Place impermeable sheets, to ASTM C171 (2020), over concrete surface. Anchor down and tape joints in material to retain concrete moisture. Keep the concrete surface covered for the required curing period.

#### **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 has commenced.

### **3.10 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.

Joint spacings: Submit for approval

Joint widths: Submit for approval

### **Non-dowelled 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.

### **Construction joints**

Installation: Place header board on the subbase or subgrade at right angles to the pavement centreline.

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.

### **Sawn joints**

Weakened plane joint: Saw the hardened concrete to depth at least 0.25 to 0.33 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 raveling 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.

## **3.11 COMPLETION**

### **Material removal**

Excavated material: Remove from site.

**4 SELECTIONS**

**4.1 SCHEDULES**

**Unformed surface finishes schedule**

	<b>A</b>
Location	Refer to drawings
Primary finish	Broom
Slip resistance classification	To the Standard
Conduits	Lay conduit for electrical and water connections

**0276 PAVING - SAND BED****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide paving, as documented.

**Performance**

Requirements:

- Consistent in colour and finish.
- Resistant to expected loads in use.
- Within documented level tolerances.
- All surface water directed to drainage outlets.

Conformance: Conform to local authority requirements for levels, grades and paving details (including shape, colour and laying pattern) for paving to footpaths and driveways.

**1.2 DESIGN****Requirements**

General: To DESIGN in *0171 General requirements*.

**1.3 CROSS REFERENCES****General**

Requirement: Conform to the following:

- *0171 General requirements*.
- *0222 Earthwork*.
- *0224 Stormwater - site*.
- *0271 Pavement base and subbase*.

**1.4 STANDARDS****General**

Residential pavements: To AS 3727.1 (2016).

**1.5 INTERPRETATION****Abbreviations**

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

- CBR: California Bearing Ratio.

**Definitions**

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

- Absolute level tolerance: Maximum deviation from design levels.
- Base: One or more layers of material, forming the uppermost structural element of a pavement and on which the surfacing may be placed.
- Concrete segmental pavers: Units of not more than 0.10 m<sup>2</sup> in gross plan area, manufactured from concrete, with top and bottom faces parallel, with or without chamfered edges and identified by the following shape types:
  - . Shape Type A: Dentated chamfered units that key into each other on four sides, are capable of being laid in herringbone bond, and by plan geometry, when interlocked, resist the spread of joints parallel to both the longitudinal and transverse axes of the units.
  - . Shape Type B: Dentated units that key into each other on two sides, are not (usually) laid in herringbone bond, and by plan geometry, when keyed together, resist the spread of joints parallel to the longitudinal axes of the units and rely on dimensional accuracy and accuracy of laying to interlock on the other faces.

- . Shape Type C: Units that do not key together rely on dimensional accuracy and accuracy of laying to develop interlock.
- Density ratio (soil): Percentage of the maximum density at optimum moisture content as determined by AS 1289.5.2.1 (2017).
- Lippage: Height deviation between adjacent units.
- Pavers: Units made from concrete, clay, stone and/or other inorganic raw materials, generally over 20 mm thick, used as coverings for horizontal surfaces.
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.
- Soldier course: A course of whole or trimmed rectangular pavers at the pavement restraint edge.

## 1.6 TOLERANCES

### Completed paving

Level tolerance:

- Absolute:  $\pm 8$  mm.
- Relative: 8 mm.

Lippage: Less than 2 mm.

## 1.7 SUBMISSIONS

### Authority approvals

Local authority: Submit authority approvals for paving products, laying patterns, alignment and drainage for footpaths or crossovers.

### Execution details

Base material: Submit test results on quality, grading and compaction.

Margin: If it appears that minor variations to joint widths will minimise cutting, submit a proposal.

### Products and materials

Clay and concrete paver properties: Submit evidence of conformity to AS/NZS 4455.2 (2010).

Type tests: Submit test results of the following:

- Slip resistance:
  - . Concrete and clay pavers: To **CONCRETE AND CLAY PAVERS, Tests**.
  - . Stone pavers: To **STONE PAVERS, Tests**.
- Accelerated wear:
  - . Concrete and clay pavers: To **CONCRETE AND CLAY PAVERS, Tests**.
  - . Stone pavers: To **STONE PAVERS, Tests**.

### Samples

Requirement: Submit samples to PRODUCTS, **GENERAL, Samples**.

### Warranties

Requirement: Submit warranties to **COMPLETION, Warranties**.

## 1.8 INSPECTION

### Notice

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

- Completed base preparation.
- Trial set-out before execution to **INSTALLATION, Trial set-out**.
- Completed paving.

## 2 PRODUCTS

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### 2.1 GENERAL

#### Samples

Requirement: Provide labelled samples of pavers, showing the range of variation in colour and finish.

Sample panel: Prepare a sample panel of each type of finish as follows:

- Size:  $\geq 2$  m<sup>2</sup>.

- Include samples of junction details and trim.
- Preserve each panel until related work is complete.

## 2.2 SAND

### Bedding sand

Quality: Free of deleterious material, such as soluble salts that may cause efflorescence.

Grading: To the **Bedding sand grading table** tested to AS 1141.11.1 (2020)

Fines: Do not use single-sized, gap-graded or excessive fine material.

Cement: Do not use cement bound material.

Moisture content: Make sure moisture content is uniform and between 4 to 8%.

### Bedding sand grading table

Sieve size (mm)	Percentage passing (by mass) %
9.52	100
4.75	95 – 100
2.36	80 – 100
1.18	50 – 85
0.6	25 – 60
0.3	10 – 30
0.15	5 – 15
0.075	0 – 10

### Joint filling sand

General: Well-graded, free of deleterious material such as soluble salts that may cause efflorescence.

Moisture content: Use dry sand.

Cement: Do not use cement.

Grading: To the **Joint filling sand grading table** tested to AS 1141.11.1 (2020).

### Joint filling sand grading table

Sieve size (mm)	Percentage passing %
2.36	100
1.18	90 – 100
0.6	60 – 90
0.3	30 – 60
0.15	15 – 30
0.075	5 – 10

## 2.3 BEDDING MORTAR

### General

Cement: To AS 3972 (2010).

Water: Clean and free from any deleterious matter.

Mix proportion (cement:sand): Select from the range 1:3 to 1:4 to obtain satisfactory adhesion. Provide minimum water.

## 2.4 GEOTEXTILE MATERIALS

### General

Standard: To AS 3705 (2012).

Type: Woven geotextile

Quality: Free of flaws, stabilised against UV radiation, rot-proof, chemically stable and with low water absorbency. Filaments resistant to delamination and dimensionally stable.



## 2.5 CONCRETE AND CLAY PAVERS

### General

Standard: To AS/NZS 4455.2 (2010).

Permeable interlocking concrete segmental pavers: To CMAA PE01 (2024).

### Properties

Requirements: To AS/NZS 4455.2 (2010) Table 2.8.

Application to AS/NZS 4455.2 (2010) Table 2.8: Public space for pedestrians

### Tests

Slip resistance: To AS 4586 (2013).

Accelerated wear: Tested for slip resistance after being subjected to accelerated wear conditioning, as evidence of the permanence of slip resistance.

## 2.6 STONE PAVERS

### Natural stone

Description: Natural stone pavers of uniform quality and sound. Reject stone pavers with any of the following defects liable to affect strength and durability:

- Vents.
- Cracks.
- Fissures.
- Seams.
- Porous inclusions.
- Foreign material.
- Loose surface material.
- Discolouration.

Matching: Select for optimum matching of colour and pattern.

Split flagging thickness: Minimum 50 mm, maximum 75 mm.

Face size: Use smaller sizes for pathways and larger sizes for open areas and maintain traditional stone flagging appearance.

### Cast stone

Description: Stone manufactured from selected aggregates and cement.

### Tests

Slip resistance: To AS 4586 (2013).

Accelerated wear: Tested for slip resistance after being subjected to accelerated wear conditioning, as evidence of the permanence of slip resistance.

## 2.7 OTHER MATERIALS

### Tactile ground surface indicators

Standard: To AS/NZS 1428.4.1 (2009).

## 2.8 EDGE RESTRAINT

### Concrete

Standard: To AS 1379 (2007).

Compressive strength: 32 MPa.

### Sleepers

Hardwood: Sound hardwood railway sleepers to AS 3818.2 (2010).

Softwood: Sound preservative-treated softwood sleepers.

Preservative treatment: Hazard class H4 to AS/NZS 1604.1 (2021).

### 3 EXECUTION

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#### 3.1 SUBGRADE

##### Preparation

Subgrade preparation: To 0222 *Earthwork*.

Extent: To the rear face of the proposed edge restraints or to the face of existing abutting structures.

##### Drainage of subgrade

Subgrade drainage: Prepare piped or channelled stormwater and subsoil drainage to 0224 *Stormwater - site*.

Service trenches: Backfill all drainage trenches to perform similar to the undisturbed ground.

#### 3.2 BASE COURSE

##### Preparation

Base course: To 0271 *Pavement base and subbase*.

Extent: Extend base course below the edge restraint for its full width except at walls or pits.

#### 3.3 EDGE RESTRAINT

##### Lateral restraint to segmental paving

Perimeter: If not provided by other structures, provide edge restraints to bedding and units.

Drainage: Position edge restraint and pavers so that the tops of the pavers are slightly above the front edge of the edge restraint.

Edge restraint shape: Make sure the edge restraint has a vertical or near vertical side abutting the pavers.

Type: [complete/delete]

##### Sleeper edging

General: Fix sleepers in position by spiking with two 13 mm diameter galvanized mild steel rods per sleeper, penetrating at least 400 mm into the subgrade. Drive the rods flush with the upper surface of the sleeper. Arris the upper exposed sleeper edges to produce a 15 mm wide chamfer at 45° to the edges.

##### Concrete edging or kerb

Construction: Fixed form, extrusion or slip form.

Edging or kerb: Place in a shallow trench between timber forms. Wood float finish flush with the adjacent finished level.

Joints: Provide contraction joints 20 mm deep every 5 m.

Timing: Complete concrete edge restraints before bedding course. Allow concrete edge restraints to harden before vibration of the surface course.

##### Brick

Setting: Set on a mortar haunch.

Laying: On edge in running bond

Joints: 3 mm struck flush.

Alignment: Even and free from dips, humps and bends.

Cleaning: Wash off mortar progressively.

#### 3.4 BEDDING COURSE

##### General

Preparation: Remove all loose material from the prepared base.

##### Geotextile

Position: Place fabric between the base course and the bedding sand and lap 150 mm at joints.

##### Bedding sand

Spreading: Screed uncompacted sand over prepared base uniformly to achieve a 30 mm thick layer. Maintain sand at a uniform loose density and moisture content.

Bedding course drainage: If water ponding occurs at edge restraint, drain bedding course to existing subsurface drain or drainage pit using geotextile and 20 mm diameter PVC pipe.

### 3.5 INSTALLATION

#### General

Laying: Lay paving on the screeded sand bedding to the documented set-out and pattern.

Joints: 2 to 5 mm in width.

Cut courses: 50 mm minimum plan dimension. On footpaths and other linear elements, use at least two cut courses and maintain symmetry.

Control: Control alignment and laying pattern by stringlines or chalked stringlines every 5 m intervals.

Variable width areas: Include in situ concrete infill strips to make a straight area for paving and take up the variable width. If there is a concrete base, provide paving control joints as follows:

- Located over base control joints.
- 10 mm wide and filled with bitumen impregnated fibreboard.

#### Trial set-out

Requirement: 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.

#### Laying around obstacles

Public utility access pits and penetrations: Adjust access covers as required before commencing paving. Make sure water drains away from pits with lids and into surface inlet drainage structures.

Concrete surrounds:

- Plan shape: Square or rectangular with a smooth connection with the laying pattern of the pavers.
- Pit position: Centring not required.
- Minimum thickness between the pit and paving: 100 mm.
- Strength grade: N32.
- Colour: Natural.

Precast access chamber: Lay pavers to suit specific dimensions of authority access chambers.

Patterns around obstacles: Lay up both sides of the feature from the main or original laying face.

#### Compaction of bedding

Compaction: Compact the sand bedding after laying paving units with a vibrating plate compactor and appropriate hand methods and continue until lipping between adjoining units is eliminated.

Sequence: Compact paving as follows:

- Progressively behind the laying face.
- Complete compaction of laid paving at end of each day.
- Do not compact within 1 m of the laying face except where adjacent to an edge restraint.

Joint filling: Compact all paving units to design levels before starting of joint filling.

#### Joint filling

Filling: Spread dry sand over the paving units and fill the joints by brooming. Carry out one or more passes with the vibrating plate compactor and refill the joints with sand. Repeat the process until the joints are completely filled.

Timing: Start joint filling immediately after compaction.

### 3.6 COMPLETION

#### Protection of the work

Protection: Prevent all vehicular and pedestrian traffic from using the pavement until all compaction and joint filling is completed and all edge restraints are in place.

#### Spare pavers

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.

Storage location: TBA by Council

**Cleaning**

General: Leave pavements clean on completion.

**Final inspection**

General: Before the date for practical completion carry out the following inspections and rectify defects as required:

- Cracking in bound pavements: Maximum width 1.5 mm.
- Subsidence: Offset less than 1.5 m length of the design profile, not more than 5 mm.
- Stepping: Between adjacent elements within the pavement area, not more than 5 mm.
- Chipping and spalling to pavement units: Maximum 10/100 units with chipped or spalled arises.
- Ponding: Maximum 10 mm deep 15 minutes after rain ceases.
- Paving joints: Refill joints as required.

**4 SELECTIONS****4.1 SCHEDULE****Paver schedule**

	<b>FT1</b>	<b>FT2</b>
Product	Recycled bricks from demolished paths	New bricks to match existing
Material	As provided	To match existing
Work size	As provided	To match existing
Shape type	As provided	To match existing
Application	Pedestrian	Pedestrian
Colour	As provided	To match existing
Thickness	As provided	To match existing
Surface finish	As provided	To match existing
Laying patterns	Stretcher bond across the path, not lengthways	Stretcher bond, across the path, not lengthways
Soldier course	Nil	Nil

**0278 GRANULAR SURFACES****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide geotextile, base, granular surfacing and edging, as documented.

**1.2 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0171 *General requirements.*
- 0241 *Landscape – walling and edging.*

**1.3 INTERPRETATION****Definitions**

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

- Absolute level tolerance: Maximum deviation from design levels.
- Base: One or more layers of material, forming the uppermost structural element of a pavement and on which the surfacing may be placed.

**1.4 TOLERANCES****Base**

Absolute level tolerance: +10 mm, -5 mm.

**Finished granular surface**

Absolute level tolerance: ±10 mm.

**1.5 SUBMISSIONS****Samples**

Granular surfacing: Submit a sample of the granular material.

**Tests**

Site tests: Submit results, as follows:

- Compaction tests.

**Warranties**

Requirement: Submit warranties to **COMPLETION, Warranties.**

**1.6 INSPECTION****Notice**

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

- Completed base preparation.
- Completed granular surfacing.

**2 PRODUCTS****2.1 BASE MATERIALS****General**

Description: Fine crushed rock, free of sand and coatings of clay or organic material, and containing not more than 1% disintegrated, weathered, soft fractured, friable or poorly indurated fragments.

**2.2 GEOTEXTILE MATERIALS****General**

Quality: Free of flaws, stabilised against UV radiation, rot proof, chemically stable and with low water absorbency. Filaments resistant to delamination and dimensionally stable.

Identification and marking: To AS 3705 (2012).

### 2.3 EDGE RESTRAINTS

#### General

Requirement: To *0241 Landscape – walling and edging*.

### 2.4 GRANULAR SURFACE MATERIAL

#### Decomposed granite

Particle size: 5 to 20 mm with 40% of 5 to 10 mm.

Stabilising: Screen out the fines and replace with off white cement:

- Mix proportions: As recommended by the decomposed granite supplier.

### 2.5 STABILISED SAND SURFACES

#### General

Sand: Bricklayer's bush sand (fatty sand) with a high percentage of fines less than 75 microns as a plasticising agent.

## 3 EXECUTION

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### 3.1 SUBGRADE

#### Preparation

Excavation: Cut and trim the subgrade to the required profile and extend to the rear face of the proposed edge restraints or to the face of existing abutting structures.

Weed eradication: Pre-emergent and multi-purpose herbicide

### 3.2 BASE

#### Placement

Method: Mechanically spread material to the loose thickness required to achieve the finished compacted thickness. Do not transport new material over uncompacted material.

Moisture: Bring base material to the optimum moisture content before and during placing. Do not add water during compaction except as required to replace evaporation.

Repair: If the subgrade is disturbed during placing or becomes mixed with new material, remove all contaminated material and replace, regrade and compact.

### 3.3 COMPACTION

#### Subgrade and base

Hand compaction: Condition the material by moisture adjustment before compaction.

Compaction: 95% of the maximum dry density.

Finished compacted base thickness: As detailed

### 3.4 GEOTEXTILE

#### Storage and handling

Requirement: Store clear of the ground and out of direct sunlight. During installation do not expose the filter fabric to sunlight for more than 14 days.

#### Installation

General: To the manufacturer's requirements.

Joint lapping: Lap minimum 150 mm at joints.

### 3.5 EDGE RESTRAINTS

#### General

Requirement: If edging is not provided by other structures, install edge restraints to *0241 Landscape – walling and edging* before placing the granular surfacing.

### 3.6 SURFACING

#### General

Falls: Slightly camber surfaces at a nominal 1:100, to fall to adjacent surfaces and edge restraints.

Finished surface: Firm, even and flush with adjacent surfaces and edge restraints.

#### **Gravel**

Requirement: Spread loose material over the compacted base.

Thickness: Screed to minimum 25 mm thick.

#### **Decomposed granite**

Requirement: Spread blended dry mix over compacted subgrade.

Thickness: Screed to minimum 100 mm thick.

Compaction: 90% of the maximum dry density.

Moisture: Do not add water to surface material. Allow the natural ground water to rise and stabilise the mixture.

#### **Stabilised sand surface**

Requirement: Spread loose material over compacted subgrade and consolidate by rolling and watering.

Thickness: Screed to minimum 100 mm thick.

Stabilising method: Spread general purpose cement over the prepared sand surface at a ratio of 1:20 (general purpose cement:sand). Rotary hoe cement through the sand mix and re-roll.

#### **Existing sand and earth**

Stabilising mix proportions (general purpose cement:sand and earth) by volume: 1:6.

Stabilising method: Spread cement over the prepared surface. Rotary hoe to a depth of 130 mm and consolidate by rolling.

### **3.7 TESTING**

#### **Site tests**

Compaction: Subgrade, base and decomposed granite surface:

- Sampling: To AS 1289.1.2.1 (1998).
- Testing: To AS 1289.5.1.1 (2017), AS 1289.5.3.1 (2004), AS 1289.5.4.1 (2007) or AS 1289.5.8.1 (2007).

### **3.8 COMPLETION**

#### **General**

Adjacent surfaces: Rake and finish granular surface flush against adjacent surfaces and edge restraints.

#### **Warranties**

Requirement: Cover workmanship in the terms of the warranty.

- Form: Against failure under normal environment and use conditions.
- Period: As offered by the supplier.

## **4 SELECTIONS**

### **4.1 SCHEDULES**

#### **Granular material schedule**

	<b>A</b>
Material	Decomposed granite
Source	ANL or similar approved
Colour	Brown
Edging	Refer to drawings

**0310 CONCRETE – COMBINED****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide cast in situ reinforced concrete, as documented.

**Performance**

Requirements:

- Conforming to the design details and performance criteria.
- Satisfying quality and inspection requirements.
- Compatible with documented applied finishes.

**1.2 DESIGN****General**

Formwork: The design of formwork, other than permanent composite form systems, is the contractor's responsibility. Allow for dimensional changes, deflections and cambers resulting from the following:

- Imposed actions.
- Concrete shrinkage and creep.
- Temperature changes.
- The application of prestressing forces (if any).

Structural design: To AS 3600 (2018).

Post-tensioned concrete: To AS 3600 (2018).

Concrete structures retaining liquids: To AS 3735 (2001).

**Requirements**

General: To DESIGN in *0171 General requirements*.

Responsibility: Design coordination

Authority requirements: Weddin Shire Council

**1.3 CROSS REFERENCES****General**

Requirement: Conform to the following:

- *0171 General requirements*.

**1.4 STANDARDS****General**

Formwork design and construction: To AS 3610.1 (2018).

Plywood formwork: To AS 6669 (2016).

Composite steel-concrete construction, including profiled steel sheeting and shear connectors: To AS/NZS 2327 (2017).

Reinforced concrete construction: To AS 3600 (2018).

Specification and supply of concrete: To AS 1379 (2007).

Concrete structures for retaining liquids: To AS 3735 (2001).

Residential ground slabs and footings: To AS 2870 (2011).

Post-tensioned concrete: To AS 3600 (2018).

Strand, bar and wire: To AS 4672.1 (2007).

Design, installation and testing of post-installed and cast-in fastenings: To AS 5216 (2021).

Formed surfaces: To AS 3610.1 (2018).

**Slip resistance**

Classification: To AS 4586 (2013).



## 1.5 INTERPRETATION

### Definitions

General: For the purposes of this worksection, the definitions given in AS/NZS 1314 (2003), AS 1379 (2007), AS 3600 (2018), AS 3610.1 (2018) and the following apply:

- Ambient temperature: The air temperature at the time of mixing and placing of concrete.
- Anti-burst reinforcement: Reinforcement cage surrounding anchorages to control the tensile bursting stresses.
- Early age strength: A mean compressive strength at 7 days exceeding the values shown in AS 1379 (2007) Table 1.2.
- Green concrete: Concrete that 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 that is submitted for testing.
- Weather – cold: Ambient shade temperature less than 10°C.
- Weather – hot: Ambient shade temperature greater than 30°C.

## 1.6 TOLERANCES

### Formwork

Plumb of elements > 8 m high: 1:1000.

Plumb of elements ≤ 8 m high: To AS 3610.1 (2018).

Position: Construct formwork so that finished concrete conforms to AS 3600 (2018) clause 17.5, AS 3610.1 (2018) clause 3.3 and as documented.

### Reinforcement

Fabrication: To AS 3600 (2018) clause 17.2.

Reinforcement and tendon position: To AS 3600 (2018) clause 17.5.3.

### Formed surfaces

Form face deflections: To AS 3610.1 (2018) Table 3.3.4.1.

Straight elements: To AS 3610.1 (2018) Table 3.3.5.1.

### 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

## 1.7 SUBMISSIONS

### Certification

Formwork design certification: For all formwork other than permanent composite form systems, submit certification by a professional engineer experienced in formwork design verifying conformance of the design.

Formwork execution certification: Submit certification by a professional engineer experienced in formwork design and construction, verifying conformance of the completed formwork, including the suitability of the formwork for the documented surface finish class.

### Design documentation

Formwork calculations: Submit calculations by a professional engineer experienced in formwork design to show that allowable concrete stresses will not be exceeded and if proposed, formwork designed for the following:

- Formwork procedures or loadings that differ from those documented.
- Props above a floor that do not coincide with the props below.
- Undocumented formwork shoring or stripping procedures.

- Loadings from stacked materials.

Post-tensioned calculations: Submit the following:

- Calculations of tendon jacking forces, theoretical extensions and losses for each stressing stage and at final stressing, before stressing operations begin.
- Expected loss of prestress due to friction in the jack and anchorage, and along the tendon including the friction curvature coefficient and the angular deviation due to wobble effects.
- Expected draw-in during anchorage.

#### **Execution details**

Moveable formwork: Provide the following details on the formwork drawings:

- Table form and climbing formwork: Proposed method and sequence of moving the formwork to provide concrete of the documented quality and surface finish.
- Continuously climbing formwork (Slipform): The average rate of movement.

Reshoring: Submit details of any proposed reshoring.

Reinforcement: Submit the following:

- General: Details of any proposed changes to documented reinforcement.
- Damaged galvanizing: Details of proposed repair to AS/NZS 4680 (2006) Section 8.
- Mechanical bar splices: Details and test certificates for each size and type of bar to be spliced.
- Provision for concrete placement: Details of spacing or cover to reinforcement that does not conform to AS 3600 (2018).
- Splicing: Details of any proposed changes to documented requirements.
- Welding: Details of any proposed welding of reinforcement to AS/NZS 1554.3 (2014).

Post-tensioning: Submit the following:

- Details of the proposed post-tensioning system tested and certified to AS/NZS 1314 (2003).
- Safe work method statement (SWMS) including the name and contact details of the subcontractor.
- Details of proposed gauging, stressing and grouting equipment including current calibration certificates from an Accredited Testing Laboratory.

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

- Changes to the concrete mix.
- Changes to documented joint locations.
- Curing and protection methods.
- Cutting or displacing reinforcement, or cutting or coring hardened concrete.
- Handling, placement, compaction and finishing methods and equipment, including pumping.
- Placement under water.
- Sequence and times for concrete placement, and construction joint locations. Include any proposed sequential placement of slab segments.
- Site storage, mixing and transport methods and equipment, if applicable.
- Temperature control methods to suit hot or cold atmospheric conditions during concrete placement.
- Sawn joints: Submit details of proposed methods, timing and sequence of sawing joints.

Loading: Submit details of proposed construction systems, loads and procedures, including propping, re-shoring and any proposals for early application of superimposed loads.

Formwork removal: Submit formwork removal procedures.

Surface repairs: If surface repairs are required, submit proposed methods.

#### **Products and materials**

Void formers: Submit type-test results as evidence of conformity to requirements of **FORMWORK, Void formers**.

Reinforcement strength and ductility: Submit type-test reports as evidence of conformity to AS 3600 (2018) Table 3.2.1 for each reinforcement type.

Post-tensioning: Submit the following:

- Grout: Proposed grout mix (including grading, proportions, compressive strength, shrinkage and additives if any).

- Epoxy grout: If required, proposed formulation.
- Duct-forming material: Samples of proposed material.

Post-tensioning type tests: Submit test reports for the following:

- Anchorage.
- Anchorage assemblies and couplings.
- Post-tensioning steel: Test certificates for every delivery of strand, bar or wire proposed.

Concrete product conformity: Submit evidence of conformity, as appropriate, as follows:

- Certification by a JASANZ accredited third party.
- Report by an Accredited Testing Laboratory describing tests and giving results that 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.

Pre-mixed supply delivery dockets: For each batch, submit a docket listing the information required by AS 1379 (2007), 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.
- Fibre reinforcement type and dosage.
- 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.

Curing compounds: Submit details of any proposed curing compounds, including the following:

- Dosage rates.
- Certified type-test results by an Accredited Testing Laboratory for water retention to AS 3799 (1998) 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.

### **Prototypes**

Test panels: Provide test panels to AS 3610.1 (2018) clause 3.7 and as documented.

Manufacture: Cast the panels using the form, concrete, compaction equipment, form release agents, curing and formwork removal methods that 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 have been determined.

### **Records**

Post-tensioning: Submit the following:

- Tendon installation record.
- Post-tensioning stressing schedule.
- Post-tensioning grouting record.

### **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**

Formwork: Submit shop drawings including details of proposed forms, falsework, form liners, bolt positions, release agents and, where applicable, re-use of formwork.

Post-tensioned drawings: Submit shop drawings showing the following:

- Concrete profiles.
- Reinforcement.
- Profiles, sizes and details of tendons, tendon numbers, anchorages, ducts, duct formers, splicing, sheathing, end block reinforcement and other associated components.
- Stressing requirements including sequence of stressing, jacking forces and the basis of assumed loss calculations.
- Number, size and position of grout openings, vents and drain holes in the ducts.

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 of the following:

- Concrete:
  - . Early age compressive strength.
  - . Other concrete properties, as documented.
- Grout:
  - . Fluidity.
  - . Bleeding.
  - . Early expansion.
  - . Compressive strength.
- Slip resistance test of completed installations.

**1.8 INSPECTION****Notice**

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

- Used forms, after cleaning and before re-use.
- Base or subgrade before covering.
- Membrane or film underlay installed on the base or subgrade.
- Completed formwork with all dust and debris removed from forms and reinforcement, tendons, cores, fixings and embedded items fixed in place before placing concrete.
- Concealed surfaces or elements before covering.
- Commencement of concrete placement and compaction.
- Finishing and curing of concrete.
- Evaluation of the off-form finishes.
- Evaluation of surface finish.

**2 PRODUCTS****2.1 FORMWORK****General**

Form face, linings and release agents: Compatible with documented concrete surface finish and any proposed applied finishes to concrete.

Lost formwork: Free of timber or chlorides and not to impair the structural performance of the concrete members.

#### **Void formers**

Requirement: Material capable of maintaining rigidity and shape until the concrete has set, capable of withstanding construction loads and non-collapsible on absorption of moisture.

Laboratory testing: Use void formers tested under laboratory conditions for conformance with the following:

- Deflection during placing and compaction of the concrete does not exceed beam or slab span/1000.
- Additional deflection between initial set and 7 days does not exceed span/400.

Test method: Place formers on damp sand and load with a mass of wet concrete at least equal to the mass of the beams or slabs to be supported.

#### **Profiled steel sheeting composite forms**

Material: Hot-dipped zinc-coated sheet steel to AS 1397 (2021).

Minimum steel grade: G550.

Accessories: Use materials and corrosion protection compatible with the profiled steel sheeting.

#### **Plywood forms**

Material: To AS 6669 (2016).

Grade: Use appropriate grade for the documented design dimensions, loading and surface quality.

Joints: Seal the joints consistent with the documented surface finish class.

Tolerances: To AS 3610.1 (2018) Section 3.

## **2.2 REINFORCEMENT**

#### **Fibre reinforcement**

Steel fibres: To AS 3600 (2018) clause 16.7.1.

Synthetic fibres: To EN 14889-2 (2006).

Storage: Store in a dry environment. Do not stack.

#### **Steel reinforcement**

Standard: To AS/NZS 4671 (2019).

Fabrication tolerances: To AS 3600 (2018) clause 17.2.2.

Surface condition: Provide surfaces conforming to the following:

- Free of loose or flaking mill scale and rust.
- Clean from oil, grease, mud or other material that would reduce the bond between the reinforcement and concrete.

Storage: Store reinforcement above the surface of the ground and protect from damage and deterioration by exposure.

#### **Protective coating**

Standard: To AS 3600 (2018) clause 17.2.1.2.

Requirement: For concrete elements containing protective coated reinforcement, provide the same coating type to all that element's reinforcement and embedded ferrous metal items, including tie wires, stools, spacers, stirrups, plates and ferrules, and protect other embedded metals with a suitable coating.

Epoxy coating: High-build, high solids, chemically resistant coating to AS/NZS 3750.14 (1997).

- Thickness: 200 µm minimum.

Galvanizing: To AS/NZS 4680 (2006), and as follows:

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

#### **Tie wire**

General: Annealed steel 1.25 mm diameter (minimum).

External and corrosive applications: Galvanized.

#### **Supports**

Standard: To AS/NZS 2425 (2015).

## 2.3 POST-TENSIONING

### Grout properties

Standard: To AS 3600 (2018) clause 17.1.8.

Fluidity: Efflux times as follows:

- Immediately after mixing: 15 to 20 seconds.
- At the end of grouting or 45 minutes after mixing, whichever occurs first: Within  $\pm 3$  seconds of the efflux time recorded immediately after mixing.

Maximum bleed: 0.5% final bleeding.

Maximum early expansion: 0.5% at 3 hours.

Maximum shrinkage: 1% by volume after 24 hours.

Maximum water:cement ratio: 0.4 (by mass).

Compressive strength: 32 MPa at 7 days.

### Grout materials

Fine aggregates: Maximum nominal aggregate size of 1 mm. Do not use aggregates for post-tensioning grout when the cross-sectional area of the duct is less than 5 times the cross-sectional area of the tendon.

Cement: To AS 3972 (2010), free from calcium chloride and less than two months old.

Admixtures: To AS 1478.1 (2000). Include an anti-bleed additive.

Fly ash: To AS/NZS 3582.1 (2016), proportioned according to obtain early strength requirements.

Water: To AS 1379 (2007). Clean, free from oil, acid, alkali, organic or vegetable matter and including not more than 500 mg/L of chloride ions.

Epoxy grout type: Commercial epoxy formulation of compressive strength exceeding 40 MPa.

### Ducts

Robustness: Provide ducts with sufficient strength to retain their shape, resist damage during construction, and prevent deterioration or electrolytic action due to cement paste or water from the concrete entering the duct.

Wall thickness: To allow for abrasion during stressing of the tendon.

Size: To allow feeding of tendons and grouting.

### Tendon material

Prestressing steel: Provide the following:

- Type and grade of strand, wire or bar, to AS 4672.1 (2007).
- Testing to AS/NZS 4672.2 (2007).

Strand type: 7 wire, stress relieved, high tensile steel.

Quality: Make sure tendons are not galvanized, have no nicks, pitting, indents, damage or foreign matter such as mud and dirt. Inspect at delivery and store the prestressing steel on supports clear of the ground.

Straightening of tendons: Not permitted. Supply tendons in coils large enough to self-straighten.

High tensile steel bars: Inspect individually and reject any bars with surface imperfections.

### Anchorage, coupling or anchorage assembly

General: To AS/NZS 1314 (2003).

Anchor plates: Hot-dip galvanized to AS/NZS 4680 (2006).

Anchorage: Stressing anchorage efficiency to AS/NZS 1314 (2003) Appendix C and non-stressing anchorage efficiency to AS/NZS 1314 (2003) Appendix D.

Anchorage assemblies and couplings: Gripping efficiency to AS/NZS 1314 (2003) Appendix B and non-stressing anchorage efficiency to AS/NZS 1314 (2003) Appendix D.

## 2.4 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 (2007) clause 1.5.3.

- . Properties: As documented.
- Special-class: To AS 1379 (2007) clause 1.5.4.
  - . Performance properties: As documented.
  - . Prescription properties: As documented.

**Aggregates**

Standard: To AS 2758.1 (2014).

Storage: Store in silos or on a hardstand located away from surface and ground water runoff. Allow for free drainage of rainwater and prevent contamination and intermixing of aggregates.

**Cement**

Standard: To AS 3972 (2010).

Age: Less than 6 months old.

Storage: Store cement bags in a dry, under cover and above ground environment.

Supplementary cementitious materials:

- Fly ash: To AS/NZS 3582.1 (2016).
- Slag: To AS 3582.2 (2016).
- Amorphous silica: To AS/NZS 3582.3 (2016).
- Manufactured pozzolans: To AS 3582.4 (2022).

**Water**

Standard: To AS 1379 (2007) clause 2.4.

Requirement: Clean, free from oil, acid, alkali, organic or vegetable matter and not more than 500 mg/L of chloride ions.

**Concrete colour**

Standard: To AS 3610.1 (2018).

**Chemical admixtures**

Standard: To AS 1478.1 (2000), used to manufacturer's recommendations and free from chlorides, and other substances detrimental to concrete or reinforcing steel.

**2.5 MISCELLANEOUS****Polymeric film underlay**

Vapour barriers and damp-proofing membranes: To AS 2870 (2011) clause 5.3.3.

**Curing compounds**

Liquid membrane-forming compounds: To AS 3799 (1998).

**Joint fillers and sealants**

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.

**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 POLYMERIC FILM UNDERLAY****Location**

Vapour barrier: Under slabs on ground, including integral ground beams and footings.

Damp-proofing membrane: Areas prone to rising damp or salt attack.

**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 (2011) 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 FORMWORK**

#### **General**

Requirement: As documented.

#### **Bolt holes**

Formwork tie bolts left in the concrete: Position to achieve minimum 50 mm concrete cover to bolt.

#### **Corners**

Work above ground: Bevel with a chamfer at re-entrant angles, and a fillet at corners.

Face of bevel: 25 mm.

#### **Embedments**

Fixing: Fix embedments through formwork to prevent movement, or loss of slurry or concrete, during concrete placement.

#### **Joints**

Requirement: Provide joints that prevent loss of grout.

#### **Openings**

Vertical forms: Provide openings or removable panels for inspection and cleaning, at the base of columns, walls and deep beams.

Access: For thin walls and columns, provide access panels for placing concrete.

#### **Release agents**

Application: Before placing reinforcement, apply a release agent to form face and linings. Spread the coating uniformly in a thin film and remove any surplus before placing concrete.

Staining: If oil or grease is used, make sure that surfaces to be exposed will not be stained or discoloured.

Unlined timber forms: Thoroughly wet timber before oiling.

#### **Climbing formwork**

Provision for inspection: Provide access below the movable formwork, from which surface treatment and inspection may be carried out.

#### **Profiled steel sheeting composite formwork**

Fixing: If sheeting cannot be fixed to structural steel supports with puddle welds, or with welded shear studs, provide details of proposed fixings.

#### **Steel linings**

Rust: Clean off any rust and apply rust inhibiting agent prior to re-use.

#### **Visually important surfaces**

Surface finish classes 1, 2 or 3: Set out the formwork to give a regular arrangement of panels, joints, bolt holes, and similar visible elements in the formed surface.

#### **Void formers**

Protection: Keep void formers dry until use, install on a firm level surface and place reinforcement and concrete with minimum delay.

### **3.3 REINFORCEMENT**

#### **General**

Fixing: To AS 3600 (2018) clause 17.2.5 and as documented.



**Dowels**

Fixing: If a dowel has an unpainted half, embed that half in the concrete placed first.

Tolerances:

- Alignment: 1:100.
- Location:  $\pm$  half the diameter of the dowel.

Grade: 250N.

**Cover**

Generally: As documented, to AS 3600 (2018) clause 4.10.

Structures for retaining liquids: As documented, to AS 3735 (2001) clause 4.4.

Residential ground slabs and footings: As documented, to AS 2870 (2011).

**Supports**

Concrete, metal or plastic supports: Provide as follows:

- Able to withstand construction and traffic loads.
- With a protective coating if they are ferrous metal, located within the concrete cover zone, or are used with galvanized or zinc-coated reinforcement.

Spacing:

- Bars:  $\leq$  60 bar diameters.
- Mesh:  $\leq$  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**

Protection: 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.

**Bending**

Restriction: Use only bars with bends as documented.

Site bending: If required to bend or straighten bars on site, conform to AS 3600 (2018) clause 17.2.3.2. Do not use heat, and only use methods that will not damage the steel and its structural properties.

Protective coatings: Repair coatings damaged by cutting or bending.

**Tying**

Requirement: Secure the reinforcement against displacement at intersections with wire ties or clips. Bend the ends of wire ties to prevent the ties projecting into the concrete cover.

Beams: Tie stirrups to bars in each corner of each stirrup. Fix other longitudinal bars to stirrups at 1 m maximum intervals.

Bundled bars: If required, tie bundled bars in closest possible contact. Provide tie wire at least 2.5 mm diameter and spaced not more than 24 times the diameter of the smallest bar in the bundle.

Columns: Secure longitudinal column reinforcement to all fitments (or helical reinforcement) at every intersection.

Mats: For bar reinforcement in the form of a mat, secure each bar at alternate intersections.

**Splices**

Requirement: Provide splices, as documented.

Welding: Do not weld reinforcement less than 3 bar diameters in length from any part of a bar that has been bent or re-straightened.

**Fibre-reinforced concrete**

Steel fibres: To AS 3600 (2018) Section 16.

Synthetic fibres: To EN 14889-2 (2006).

**3.4 POST-TENSIONING****General**

Protection: Protect post-tensioning tendons, anchorages, ducts, supports and grout from damage or contaminants, including from swarf, loose grease, oil and paint.

Tolerances: To AS 3600 (2018) clause 17.5.3.

Concrete cover: As documented.

Anchorage, ducts and tendons: To AS 3600 (2018) clause 17.3.

### **Ducts**

Placement: Locate and secure to positions, as documented.

Supports: Support and fix at regular intervals. Protect from collapse and other damage.

Sheathing: If ducts are formed with sheaths, provide sheathing material capable of transferring the tendon stresses to the body of the concrete.

Sequence: Assemble tendons on site by installing strand, bar or wire within the duct before concreting.

Damage: If damaged, repair ducts as follows:

- Small holes: Waterproof adhesive tape.
- Larger holes: Metal strips wrapped around the duct, with 100 mm overlap and sealed by a waterproof adhesive tape.

Crossover points: If ducts running in opposite directions clash, consult the professional engineer. Do not relocate ducts without approval.

### **Anchorage**

Anti-burst reinforcement: As documented.

### **Tendons**

Conformance: Provide tendons, as documented.

Care: Do not weld tendons. Do not expose tendons to sparks, ground current or excessive temperatures. Cut to length using mechanical means.

Grout fittings and ducts: Protect from collapse and other damage. Prevent ingress from concrete slurry.

Protection: Make sure tendons are not displaced by heavy and prolonged vibration, the pressure of the concrete being placed, workmen or construction traffic.

Slab marking: If there is possibility for future slab penetrations, mark the tendon locations, either on the slab surface or the soffit.

Tendon installation record: Provide details of the following:

- Date.
- Strand source.
- Coil number.
- Heat or cast number.
- Anchorage, duct and wedge batch numbers.
- Operator and supervisor names.
- Locations products are installed.
- Drawing number and revision.

### **Grout openings**

Provision: Provide grout openings, vents and drain holes as documented, including at each end, and at high points except where the tendon curvature is small and the tendon is relatively level.

### **Gauges and jacks**

General: To AS 1349 (1986).

Accuracy: Use equipment capable of establishing loads within 3% accuracy.

Calibration period: Calibrate gauges and jacks at intervals not exceeding 100 operations or 6 months, whichever is earlier, or if any inaccuracy in the gauges is suspected.

Sets: Calibrate and use jacks and gauges as a set.

### **Stressing**

Requirement: To the approved SWMS.

Tensioning: To AS 3600 (2018) clause 17.3.4.5.

Stressing procedure: Carry out stressing after early age test results indicate concrete has attained the required strength.

Stressing stages: As documented.

Marking: Mark strands after wedges are installed and before initial stress.

Slip: Check markings whilst stressing to make sure there is no slip of strands.

Site extensions: Submit the site extensions on the same day as measured for review and approval by a professional engineer.

Non-conformance: If the difference between theoretical and measured extensions is greater than 10%, provide an explanation of the cause.

Cutting tendons: Do not cut tendons until the actual extensions are approved.

Re-stress or de-stress: Adjust stress in tendons if necessary, after the theoretical and site extensions have been compared.

Post-tensioning stressing schedule: Provide a stressing schedule, including the following information.

- Date.
- Early age concrete compressive strength results.
- Operator and supervisor names.
- Equipment calibration date, including the identification number of dynamometers, gauges, pumps and jacks.
- Tendon identification.
- Initial and final stressing force (or pressure).
- Theoretical and actual extensions for each stressing stage.
- Non-conformance including tendon breakage.
- Drawing number and revision.

### **Grouting**

Grout mixing and preparation: To AS 3600 (2018) clause 17.1.8.2 or to the manufacturer's recommendations for prebagged grout. Use grout as soon as possible and within 45 minutes of adding cement to mixing water.

Ambient air temperature: Do not grout, if the surrounding air temperature is lower or expected to be lower than 5°C.

Timing: Grout tendons as soon as practicable after stressing and within the time limits applicable to the atmospheric corrosivity category, as documented:

- C1 or C2: Three weeks.
- C3: Two weeks.
- C4: One week.
- C5 or CX: Seek specialist advice.

Exterior and interior corrosivity categories: To **CORROSION RESISTANCE, Atmospheric corrosivity category** in *0171 General requirements*.

Equipment: Do not use manually powered grouting machines.

Procedure: Prevent damage to grout vents and fittings during grouting. Completely fill the duct during grouting. Inject grout into voids between tendons, ducts and anchorages, until grout flows from vents without air bubbles. Close vents as they fill, progressively in the direction of flow. If there is a blockage or interruption, completely flush grout from the duct using water.

Grout caps: Provide at each anchorage and seal for grouting and venting operations.

Post-tensioning grouting record: For each duct grouted, provide the following:

- Date and time.
- Composition of the grout (water:cement ratio, admixtures) and batch numbers.
- Ambient temperature.
- Operator and supervisor names.
- Duct and tendon identification.
- Grout properties.
- Details of grouting interruptions including pumping or supply interruptions, blockages or loss of grout.

### **Protection**

Grout ducts: Do not subject grouted ducts to shock, vibration, construction traffic or similar loads until 24 hours after completion of grouting.

**Permanent protection**

Tendons and anchorages: On completion of stressing and grouting, permanently protect anchorage and tendons. Provide at least 40 mm of cover over the cut tendons when the recesses are concreted. Keep anchorages free of foreign matter (rust, grease, oil, paint).

**3.5 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
27 – 30	60
30 – 35	45

**Pre-mixed supply**

Addition of water: To AS 1379 (2007) 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.

**3.6 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 (2007).

Method of assessment: Project assessment.

**Sampling**

Sampling method: To AS 1012.1 (2014).

Sampling locations: To AS 1012.1 (2014) and the following:

- Slump and spread tests: On site, at the point of discharge from the agitator.
- Compressive strength tests: Spread the site sampling evenly throughout the pour.

Sampling frequency: To AS 1379 (2007) Sections 5 and 6 and the following:

- Slump and spread 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 per batch: Columns and load bearing wall elements	Minimum number of samples per day: Other elements
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 (2014), AS 1012.8.2 (2014) and AS 1012.8.4 (2015).

**Test methods**

General: To the relevant parts of the AS 1012 series.

Compressive strength: To AS 1012.9 (2014).

Flexural strength: To AS 1012.11 (2000).

Acceptance criteria:

- Concrete properties: As documented.
- Early age compressive strength: As documented.

Drying shrinkage at 56 days: To AS 1012.13 (2015).

Other concrete properties: As documented.

**Early age concrete compressive strength for post-tensioning**

Sampling frequency: For each post-tensioned element, take at least 3 samples for testing at the age of each intended stage of stressing plus at least 3 reserve samples. Take at least one sample every 2 batches.

Sampling locations: Distribute sampling locations randomly, include anchorage areas and the final concrete placement area. Reference the structural element from which the sample is taken.

Making and curing of specimens: To AS 1012.8.1 (2014) and the following:

- Site cure all test cylinders for early age testing.
- For slab samples, maintain exposure to the same weather and temperature by curing the samples on the adjacent deck.
- Retain test cylinders on site until the morning of the test.

**Grout properties**

Fluidity: To ASTM C939/C939M (2022) for each grout batch.

Bleeding and early expansion: To ASTM C940 (2022), modified to simulate the wicking of strands and tested once every 20 m<sup>3</sup>.

Compressive strength: To AS 1478.2 (2005) at a frequency of 3 cubes per grouting session.

**Liquid retaining structures**

Testing for liquid tightness: To AS 3735 (2001) Section 7.

**Slip resistance tests**

Slip resistance of completed installation: To AS 4663 (2013).

**3.7 CORES, FIXINGS AND EMBEDDED ITEMS****General**

Requirement: Install fasteners to manufacturer's recommendations and the assumptions of AS 5216 (2021) Appendix G.

**Adjoining elements**

Fixings: Provide fixings for adjoining elements. If required, provide temporary support to the adjoining elements during concreting, to prevent movement.

**Protection**

General: Protect embedded and projecting 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 protection: In external or exposed locations, galvanize anchor bolts and embedded fixings as follows:

- All threaded products: To AS/NZS 1214 (2016).
- All non-threaded products: To AS/NZS 4680 (2006).

Grease: Grease threads that will project from the concrete.

**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 (2016) Appendix F.
- Cores and embedded items generally: 10 mm.
- Other fixing bolts: 3 mm.

### **3.8 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.

### **3.9 PLACING AND COMPACTION**

#### **Preparation**

Cleaning: Before placing concrete, remove free water, dust, debris and stains from the form face and the formed space.

#### **Placing**

Horizontal transport:

- Use suitable conveyors, clean chutes, troughs, hoppers or pipes.
- Minimise jolting and vibration of concrete whilst transporting around site.
- Discharge vertically in a controlled manner into forms or further distribution equipment.

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.

Vertical elements: Limit the free fall of concrete to maximum of 2 m.

Fibre-reinforced concrete: For pumped concrete, use a 100 to 150 mm mesh screen on the pump hopper to catch fibre balls.

Reinforcement: Maintain the documented concrete cover to reinforcement.

#### **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 embedded in concrete including pipes and conduits. Do not use vibrators to move concrete along the formwork. Avoid causing segregation by over-vibration.

#### **Placing records**

Logbook: Keep on site and make available for inspection a logbook 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.

#### **Placing in cold weather**

Cement: Do not use high alumina cement.

Temperature limits: Maintain the following:

- Freshly mixed concrete:  $\geq 5^{\circ}\text{C}$ .
- Forms and reinforcement before and during placing:  $\geq 5^{\circ}\text{C}$ .
- Water: Maximum  $60^{\circ}\text{C}$  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  $\geq 5^{\circ}\text{C}$ .

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 forms, materials, and equipment coming in contact with the concrete free of frost and ice.

Freezing: Prevent concrete from freezing.

#### **Placing in hot weather**

Requirement: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses.

Evaporation control barriers: Erect barriers to protect freshly placed concrete from drying winds.

Evaporation rate limit:  $\leq 0.50 \text{ kg/m}^2/\text{h}$ .

Temperature control: Select one or more of the following methods to make sure the temperature of the concrete mix does not exceed  $35^{\circ}\text{C}$ :

- Cool the concrete using liquid nitrogen injection before placing.
- Cover horizontal transport containers.
- Forms and reinforcement before and during placing:  $\leq 35^{\circ}\text{C}$ .
- 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.

### **3.10 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.

Joint preparation: Scabble hardened concrete joint surface to a minimum 3 mm amplitude. Do not damage projecting reinforcing steel. Remove loose or soft material, foreign matter and laitance.

Dampen the surface just before placing the fresh concrete and coat with a neat cement slurry.

#### **Expansion and isolation joints**

Expansion joint dowels: Make sure the location and alignment of installed dowels match the documented requirements. Make sure dowels are not displaced during concrete placement.

Bond breaking: Provide back-up materials for sealants, including backing rods, which do not adhere to the sealant.

Preparation: Before filling, dry and clean the joint surfaces, and prime.

Joint filling: Fill with jointing materials as documented. Finish visible jointing material neatly, flush with adjoining surfaces.

Watertightness: Apply the jointing material so that joints subject to ingress of water are made watertight.

#### **Slip joints**

General: Provide slip joints, as documented.

Requirement: If concrete slabs are supported on masonry, provide proprietary slip joints.

#### **Slab-on-grade control joints**

General: Provide control joints, as documented.

Tooled and sawn joints: Form joints within the concrete surface with either a grooving tool or a mechanical circular saw.

Timing: Form joints as early as possible after placement of concrete. Make sure the concrete has hardened sufficiently to prevent dislodging aggregate.

Joint width: 3 to 5 mm wide.

Joint depth: A minimum of  $(0.25 - 0.33) \times$  depth of the concrete.

### 3.11 SURFACE MODIFIERS

#### General

Application: Apply to clean surfaces, to the manufacturer's recommendations.

### 3.12 FORMED SURFACES

#### General

Surface finish: To AS 3610.1 (2018) Table 3.3.3.1 and as documented.

Damage: Do not strip formwork prematurely if damage to the concrete may be caused.

#### 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, and within an hour of exposure.

#### Evaluation of formed surfaces

General: If evaluation of a 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 is 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 is 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 is produced.

### 3.13 UNFORMED SURFACES

#### General

Surface finish: As documented.

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 scratched 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.

### **3.14 CURING**

#### **General**

Requirements: Take into account the average ambient temperature at site over the relevant period affecting the curing and 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.
- Minimum curing period: 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 AS 3600 (2018) clause 17.1.5 and 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 also used as curing compounds, conform to AS 3799 (1998).

Visually important surfaces: Apply curing compounds to produce uniform colour on adjacent surfaces.

#### **Water curing**

Method: Select a method of ponding or continuous sprinkling that does not damage the concrete surface during the required curing period.

**Wet hessian curing**

Method: Place wet hessian sheets/bags over concrete surface. Keep hessian wet during the required curing period by regularly sprinkling with water. Protect from wind and traffic.

**Impermeable sheet curing**

Method: Place impermeable sheets, to ASTM C171 (2020), over concrete surface. Anchor down and tape joints in material to retain concrete moisture. Keep the concrete surface covered for the required curing period.

**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 has commenced.

**3.15 COMPLETION****Early loading**

Prohibition: Submit proposals for the application of any superimposed load (including backfilling), to any part of what will become a load bearing structure, within 21 days of placing concrete. Do not apply superimposed loads unless it can be demonstrated that 95% of the design strength of the concrete has been achieved.

**Formwork removal**

Extent: Remove formwork, other than permanent forms and trapped forms, including formwork in concealed locations.

Timing: Do not disturb formwork until concrete has reached sufficient hardness to withstand formwork movements and removal without damage.

Stripping:

- General: To AS 3600 (2018) where it is more stringent than AS 3610.1 (2018).
- Vertical formwork: To AS 3610.1 (2018) Appendix C Table C2.
- Multi-storey work: Remove formwork without disturbing props supporting succeeding floors.
- Post-tensioned concrete: Remove formwork supporting post-tensioned concrete members to AS 3600 (2018) clause 17.6.2.7.

Removable bolts: Remove tie bolts without damaging the concrete.

Bolt hole filling: Provide material with durability and colour matching the concrete.

Recessed filling: Fill or plug the hole to 6 mm below the finished surface.

Curing: 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, within an hour of exposure.

**Protection**

General: Protect the concrete from damage due to construction loads, physical and thermal shock, and excessive vibration, particularly during the curing period.

Surface protection: Protect finished concrete surfaces and applied finishes from damage.

**4 SELECTIONS****4.1 SCHEDULES****Unformed surface finishes schedule**

	<b>A</b>
Primary finish	Broom
Slip resistance classification	To the standard

**0671B PAINTING****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide coating systems to substrates, as documented.

**1.2 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0171 General requirements.

**1.3 STANDARDS****Painting**

General: To the recommendations of those parts of AS/NZS 2311 (2017) referenced in this worksection.

**1.4 SUBMISSIONS****Products and materials**

General: Submit the following at least 3 weeks before the paint is required:

- Paint brand name and product range quality statement.
- The published recommendations for maintenance.

**Samples**

Clear finish coatings: Submit labelled samples of timber or timber veneer matching those to be used in the works as follows:

- Label for identification and prepare, putty, stain, seal and coat, as documented.
- Size: Minimum 500 x 500 mm.

Opaque coatings: Submit labelled samples of each coating system, on representative substrates, showing surface preparation, colour, gloss level, texture, and physical properties.

**1.5 INSPECTION****Notice**

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

- Opaque finishing stages:
  - . Completion of surface preparation.
  - . After application of final coat.
- Clear finishing stages:
  - . Before surface preparation of timber.
  - . Completion of surface preparation.
  - . After application of final coat.

**2 PRODUCTS****2.1 GENERAL****Storage and handling**

General: Store materials not in use in tightly covered containers in well-ventilated areas with temperatures maintained at the manufacturer's recommendations.

Delivery: Deliver paints to the site in the manufacturer's labelled and unopened containers.

## 2.2 PAINTING MATERIALS

### Standards

Paint types: To AS/NZS 2311 (2017) Table 4.2 and the following:

- Metal primer - general purpose for iron and steel: To AS/NZS 3750.19 (2008).
- Metal primer - latex for metallic zinc surfaces: To AS 3730.15 (2006).
- Metal primer - solvent borne for ferrous metallic surfaces: To AS 3730.21 (2006).
- Metal primer - zinc-rich organic for iron and steel: To AS/NZS 3750.9 (2009).

### Combinations

General: Do not combine products from different manufacturers in a paint system.

Clear timber finish systems: Provide only the combinations of putty, stain and sealer recommended by the manufacturer of the topcoat.

### Putty and fillers

Material: To the recommendations of the paint system manufacturer, suitable for the substrate and compatible with the primer.

### Tinting

General: Provide only products that are colour tinted by the manufacturer or supplier.

### Toxic ingredients

General: To the *Therapeutic Goods (Poisons standard) Instrument (2023)* Part 2 Division 9.

## 3 EXECUTION

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### 3.1 PREPARATION

#### Order of work

Other trades: Before painting, complete the work of other trades as far as practicable within the area to be painted, except for the installation of fittings, floor sanding and laying flooring materials.

Clear finishes: Complete clear timber finishes before commencing opaque paint finishes in the same area.

#### Protection

General: Before painting, clean the area and protect it from dust contamination. Use drop sheets and masking agents to protect surfaces, including finished surfaces and adjacent finishes, during painting.

Fixtures and furniture: Remove door furniture, switch plates, light fittings and other fixtures before painting, and conform to the following:

- Labelling and storage: Attach labels or mark fixtures using a non-permanent method, identifying location and refixing instructions, if required. Store and protect against damage.

Difficult to remove fixtures: Where removal is impractical or difficult, apply surface protection before substrate preparation and painting.

#### Substrates

General: Prepare substrates to receive the documented paint system.

Cleaning: Clean down the substrate surface. Do not cause damage to the substrate or the surroundings.

Filling: Fill cracks and holes with fillers, sealants, putties or grouting cements as appropriate for the finishing system and substrate, and sand smooth:

- Clear finish: Provide filler tinted to match the substrate.

Clear timber finish systems: Prepare the surface so that its attributes will show through the clear finish without blemishes, using methods including the following:

- Removal of bruises.
- Removal of discolourations, including staining by oil, grease and nail heads.
- Bleaching where necessary to match the timber colour sample.
- Puttying.
- Fine sanding, with the last abrasive no coarser than 220 grit, so that there are no scratches across the grain.

Treated surfaces: If surfaces have been treated with preservatives or fire retardants, make sure the paint system is compatible with the treatment and does not adversely affect its performance.

#### **Substrate moisture content**

Requirement: Use a moisture meter to demonstrate that the moisture content of the substrate is at or below the recommended maximum level for the type of paint and the substrate material.

#### **Unpainted surfaces**

Standard: To AS/NZS 2311 (2017) Section 3.

#### **Previously painted surfaces**

Preparation of a substrate in good condition: To AS/NZS 2311 (2017) clause 7.4.

Preparation of a substrate in poor condition: To AS/NZS 2311 (2017) clause 7.5.

Preparation of steel substrates with protective coatings: To AS 2312.1 (2014) Section 8 and AS 1627.1 (2003).

PVC-U: Clean with methylated spirit and a nylon scouring pad.

Wallcovering: Remove wallcovering and residual paste with clean water. Patch and repair substrate to a uniform surface before painting.

Lime wash paints: Remove by brushing with warm water.

Reconditioned damaged surfaces in galvanized steel: To AS/NZS 4680 (2006) clause 8.

### **3.2 PAINTING SYSTEMS**

#### **General**

Number of coats: Except where one or two coat systems are documented, each paint system consists of at least 3 coats.

#### **Low VOC emitting paints**

General: Provide the VOC limits as documented.

#### **New unpainted interior surfaces**

Standard: To AS/NZS 2311 (2017) Table 5.1.

#### **New unpainted exterior surfaces**

Standard: To AS/NZS 2311 (2017) Table 5.2.

#### **Previously painted surfaces**

Interior surfaces: To AS/NZS 2311 (2017) Table 8.2.

Exterior surfaces: To AS/NZS 2311 (2017) Table 8.3.

#### **Specialised painting systems**

Standard: To AS/NZS 2311 (2017) clause 5.2. Provide the following final coats:

- High build textured or membrane finishes for concrete and masonry: Paint reference number B38 using products conforming to the AS/NZS 4548 series.
- Two-pack gloss pigmented polyurethane: Paint reference number B44.
- Two-pack epoxy: Paint reference number B29.
- Two-pack water-based epoxy: Paint reference number B29A.

### **3.3 APPLICATION**

#### **Light levels**

General:  $\geq 400$  lux.

#### **Paint application**

Standard: To AS/NZS 2311 (2017) Section 6.

Timing: Apply the first coat immediately after substrate preparation and before contamination of the substrate can occur. Apply subsequent coats after the manufacturer's recommended drying period has elapsed.

#### **Painting conditions**

General: Unless the paint is recommended by the manufacturer for such conditions, do not paint under the following conditions:

- Dusty conditions.
- Relative humidity:  $> 85\%$ .
- Surface temperature:  $< 10^{\circ}\text{C}$  or  $> 35^{\circ}\text{C}$ .

**Priming timber before fixing**

General: Apply one coat of wood primer, and 2 coats to end grain, to the back of the following before fixing in position:

- External fascia boards.
- Timber door and window frames.
- Bottoms of external doors.
- Associated trim and glazing beads.
- Timber board cladding.

**Spraying**

General: If the paint application is by spraying, use conventional or airless equipment that conforms to the following:

- Satisfactorily atomises paint being applied.
- Does not require paint to be thinned beyond the maximum amount recommended by the manufacturer.
- Does not introduce oil, water or other contaminants into the applied paint.

Coatings with known health hazards: Not permitted on site.

**Sanding**

Clear finishes: Sand the sealer using abrasives no coarser than 320 grit without cutting through the colour. Take special care with round surfaces and edges.

**Repair**

Requirement: Clean off marks, paint spots and stains progressively and restore damaged surfaces to their original condition.

Maintenance painting: To AS/NZS 2311 (2017) Section 8.

**Repair of galvanizing**

Cleaning: For galvanized surfaces that have been subsequently welded, power tool grind to remove all surface contaminants, including rust and weld splatter. Prime affected area immediately after cleaning.

Primer: Type 2 organic zinc-rich coating for the protection of steel to AS/NZS 3750.9 (2009).

**Tinting**

General: Tint each coat of an opaque coating system so that each has a noticeably different tint from the preceding coat, except for top coats in systems with more than one top coat.

**Windows**

Operation: Make sure opening windows function correctly before and after painting.

**Doors**

Drying: Maintain door leaf in the open position during drying. Do not allow door hardware or accessories to damage the door finish during the drying process.

**Wet paint warning**

Notices: Place in a conspicuous location and do not remove until the paint is dry.

**3.4 COMPLETION****General**

Protection and masking: Remove masking and protection coverings before paint has dried.

Cleaning: On completion of painting, remove splatters by washing, scraping or other methods that do not scratch or damage the surface.

Reinstatement: Repair, replace or refinish any damage, including works of other trades. Touch up new damaged paintwork or misses only with the paint batch used in the original application.

Fixtures: Refix removed and undamaged fixtures in the original locations. Make sure they are properly fitted and in proper working order.

**Disposal of paint and waste materials**

Requirement: Conform to requirements of the local government authority.

**4 SELECTIONS**

**4.1 PAINTING SCHEDULES**

**Linemarking colours schedule**

<b>Location</b>	<b>Colour</b>
Street marking	Standard safety yellow
Wheelchair accessible parks	Standard disability blue
Bicycle education course	Standard disability blue