



Rainbow Skatepark

Hindmarsh Shire Council

Technical Specifications – Rainbow Skatepark
Prepared by Enlocus
for the Hindmarsh Shire Council

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A	31.08.2016	JM Enlocus Director
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0121 TENDERING**1 CONDITIONS OF TENDERING****1.1 RESPONSIBILITIES****General**

General: Provide a complete genuine tender.

1.2 GENERAL**Status**

General: These conditions of tendering will not form part of the contract.

Definition

General: In these conditions of tendering, the word principal has the same meaning as owner and proprietor.

1.3 PROJECT INFORMATION**Outline description of the works**

Rainbow Skatepark

Description of the site

Location: Corner of King St and Dawson Lane, Rainbow, Victoria, 3424

Tender documents

The tender documents comprise the following:

- Conditions of tendering.
- Schedule of rates.
- General conditions of contract.
- Special conditions of contract.
- Appendix or annexure to general conditions of contract, partly pre-completed.
- Specifications.
- Drawings.
- Nominated subcontracts.
- Deeds of novation for nominated subcontracts.
- Subcontract interfacing information, including services and facilities.
- Geotechnical site investigation reports, as follows - BRUCE HOLLIOAKE [REPORT NO: 17200 DATED 29TH OF MARCH]

Security: Do not disclose to third parties tender documents marked with a classification such as Restricted, Confidential or Secret, except with prior written approval of the principal and subject to conditions imposed.

1.4 FURTHER INFORMATION

Contact person

Inquiries: Refer inquiries to the following:

- Name: Simon Landrigan
- Telephone: (03) 5391 4429
- Email: slandrigan@hindmarsh.vic.gov.au

Examination

General: A full set of documents is available for examination, which may be arranged through the contact person.

Site inspections

General: Information on dates and times at which the site will be available for inspection can be obtained from the contact person.

Conferences

General: Information on dates and times of tender conferences can be obtained from the contact person.

Addenda

General: Written addenda issued by the principal are the only recognised explanations of, or amendments to, the tender documents.

1.5 PREPARATION OF TENDERS

Tender form

Form: Submit the tender on the *Tender form* provided.

Addenda: Confirm on the Tender form that allowance has been made of each addendum and any extensions of the tender period.

Name and address of tenderer: State the following:

- If an individual, the name in full and address of the individual.
- If an unincorporated body, the registered business name and address of the body and the name in full and address of each member of the body.
- If a company, the name, ABN and registered office address of the company.

Address for service of notices: Include on the Tender form an address for service of notices for the purpose of this tender and any subsequent contract arising out of this tender.

Execution: Sign the *Tender form* or, if a company, comply with the relevant provisions of the Corporations Law and regulations.

Scope

Scope: Tender for the whole of the work described in the tender documents unless the tender documents provide otherwise.

Exclusions: If unable to tender on parts of the works, inform the contact person in writing as soon as possible, defining the relevant parts and giving reasons.

Completion

General: Complete in full the *Tender form* and other required documents.

Alterations: Do not alter or add to tender documents except as may be required by these conditions of tendering.

Selected subcontracts

General: Submit with the tender the identity of subcontractors proposed for selected subcontract work.

Alternatives

General: Alternative proposals may be submitted with the tender for consideration, but:

- A conforming tender must be submitted, which complies with the tender documents.
- A detailed description of the alternative must be submitted, stating clearly the manner in which it differs from the requirements of the tender documents whilst complying with the principal's commercial and technical objectives.

Alternative working hours and working days: If the tender includes an allowance for work at times other than the working hours or working days prescribed in the tender documents, submit the working hours and days proposed.

Evidence of contractor's registration or licensing

General: If it is a statutory requirement of the state or territory in which the works are located that a contractor (as defined by the statutory requirement) be registered or licensed to carry out the work described in the tender documents, submit with the tender evidence of registration or licence.

Supporting costing information

Complete and submit the following supporting costing information:

Rainbow Skatepark - Schedule of Items

Program

General: Submit a construction program in the form of a preliminary bar chart and network diagram, showing the following:

- Sequence of work.
- Periods within which various stages or parts of the work are to be executed.
- Critical paths of activities related to the work.
- Allowance for holidays.
- Restraints imposed by the contract documents.
- Significant milestones including separable parts, if any.
- Activity inter-relationships, including those activities to be undertaken by subcontractors and suppliers, both on and off site.
- External dependencies including provision of access, document approvals and work by others.
- The estimated value of work completed for each month.

Quality system

Tenderer's submission: Submit a statement of quality control resources.

1.6 PROCEDURES AFTER TENDER PERIOD**Tender validity period**

General: Unless withdrawn, tenders must remain valid from the date and time for closing of tenders, for the following period: Six months

Additional information

General: If required, submit additional information, by the stipulated date and time, to allow further consideration of the tender before any tender is accepted. Failure to meet this requirement may result in the tender being rejected.

Confidentiality

General: Treat as confidential any information provided after the tender period.

Acceptance of tender

Non-acceptance: The principal is not bound to accept the lowest or any tender, or to give reasons.

Acceptance: A tender is not accepted until notice in writing of acceptance is:

- Handed to the tenderer.
- Sent by prepaid post to, or left at, the address for service of notices stated in the Tender form.
- Transmitted by facsimile to the tenderer's facsimile number.

Formal instrument of agreement: Required.

0144 PRELIMINARIES – AS 4000**1 GENERAL****1.1 GENERAL****General conditions**

General: To AS 4000, General conditions of contract.

Interpretation

Cross reference: The clause **INTERPRETATION**, in the *General requirements* worksection, also applies.

1.2 PROVISIONAL SUMS**Provisional sums**

General: Provisional sums identified in the **Provisional sums schedule** are for purposes stated in relevant worksections of the specification.

1.3 CONTRACT DOCUMENTS**Contractor-supplied documents**

Number of copies: 1x Contract Documentation, 1x Schedule of Items, 1x Technical Specifications, 1x Geotechnical Report

Confidential information

The following principal-supplied information is confidential: Contract Documentation, Schedule of Items, Technical Specifications. All copyright owned by designer (Enlocus)

Confidentiality agreement: Required.

1.4 ASSIGNMENT AND SUBCONTRACTING**Selected subcontract work**

Facilities: Refer to selected subcontract documentation.

Contractor/selected subcontractor interfaces: Refer to selected subcontract documentation.

Novated subcontract work

Facilities: Refer to novated subcontract documentation.

Contractor/novated subcontractor interfaces: Refer to novated subcontract documentation.

1.5 PROTECTION OF PEOPLE AND PROPERTY**Occupied premises**

For the parts of the site designated as occupied premises:

- Permit occupants to continue in secure possession and occupancy of the premises for the required period.
- Make available 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, by such means as temporary screens.

Proposals: Submit details of proposed methods.

- Purpose of submission: Information only.

Safety

Accidents: Promptly notify the superintendent 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: Information only.

-

Protective clothing

Protective clothing: Make available protective clothing for the use of visitors.

- Safety helmets: To AS/NZS 1801, Type 1.
- Certification: Required.
 - . Certification provider: An organisation accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ).

Adjoining property

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

Notice: At least 14 days before commencing work, submit to owners and occupants of adjoining property written notice of intention to commence work and an outline description of the type and extent of work.

Records:

Inspect the properties with the superintendent and owners and occupants of the properties, before commencement of work.

- Make detailed records of conditions existing within the properties, especially structural defects and other damage or defacement.
- Arrange for at least 2 copies of each record, including drawings, written descriptions, and photographs, to be endorsed by the owners and occupants, or their representatives, as evidence of conditions existing before commencement of work.

Endorsed copies: Submit one endorsed copy of each record. Keep the other endorsed copy on site.

- Purpose of submission: Information only.

Services

General: 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.

1.6 CARE OF THE WORK AND REINSTATEMENT OF DAMAGE

Existing services

Attendance: Attend to existing services as follows:

- If the service is to be continued, repair, divert or relocate. Submit proposals.
- If such a service crosses the line of a required trench, or will lose support when the trench is excavated, provide permanent support for the existing service. Submit proposals.
- If the service is to be abandoned, remove redundant parts and make safe.

Proposals: Submit proposals for action to be taken with respect to existing services before starting this work. Minimise the number and duration of interruptions.

- Purpose of submission: For review.

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1.7 DAMAGE TO PERSONS AND PROPERTY OTHER THAN WUC

Property on the site

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

Repair of property: Rectify immediately any interference or damage to property which is to remain on the site, including trees.

Reinstatement

General: Clean and repair damage caused by installation or use of temporary work and restore existing facilities used during construction to original condition.

Adjoining property

Repair of services: Rectify immediately any obstruction or damage to roadways and footpaths, drains and watercourses and other existing services adjacent to the site. Provide temporary services whilst repairs are carried out.

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

Records: For properties described in the **Adjoining properties to be recorded schedule** inspect the properties with the superintendent and owners and occupants of the properties, on completion of the works, recording any damage that has occurred since the pre-commencement inspection.

1.8 SUPERINTENDENT'S REPRESENTATIVE

Superintendent's representatives

Name: Simon Landrigan (Hindmarsh Shire Council)

Delegated function: Project Manager

1.9 SITE

Site restrictions

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

List: At least 14 days before entry is required, submit the full name, address, and date and place of birth of persons required to enter designated secure areas.

- Purpose of submission: Review.

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1.10 SETTING OUT THE WORKS

Setting out

Refer to 1610_CD004 Site Plan

Surveys

Refer to 1610_CD004 Site Plan

1.11 CLEANING UP

Final cleaning

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

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

1.12 MATERIALS, LABOUR AND CONSTRUCTION PLANT

Use of existing services

Existing services may be used as temporary services for the performance of the contract subject to conditions by the Principal.

Temporary services

As directed by the Superintendent

Temporary fence

Contractor to provide 2.1m high security fencing around perimeter of site as indicated on plans. Fencing to include a singular area as nominated for a locked gate access for all vehicular traffic onto site. Fencing to also include all required signage, plan of works and shade cloth where required. All security fencing to comply with relevant OH&S requirements and for approval by Superintendent.

Project signboard

General: Provide project-specific signboards and include the following:

- Locate where directed.
- Maintain in good condition for duration of the work.
- Obtain written permission for removal.
- Remove on completion.

Other signboards: Obtain approval before display of advertisements or provision of other signboards.

Run off

As per EPA and local Council requirements

1.13 WORKING HOURS

General

Working hours: 7:00am - 7:00pm

Working days: Monday - Saturday. Excludes Sunday and Public Holidays.

1.14 PROGRAMMING

Program of work

Construction program: Within 14 days after the date for possession of the site, 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.

Revisions: Revise the construction program as required by the progress of the work. Submit revisions with each progress claim. Identify changes since the previous issue, and show the estimated percentage of completion for each item of work.

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

Site meetings

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

Frequency: weekly

Minutes: Keep minutes of site meetings. Within 5 working days after each meeting, submit to each party written copies of the minutes.

- Purpose of submission: Review.

Contacts: At the first site meeting, submit names and telephone numbers of responsible persons who may be contacted after hours during the course of the contract.

- Purpose of submission: Information only.

Progress photographs

General: Take colour progress photographs within 7 days before each site meeting. At each site meeting submit digital files.

Purpose of submission: Information only.

Minimum frequency: weekly

1.15 PAYMENT

Progress claims

Break down: With each progress claim submit a statement of amounts claimed in respect of each worksection or trade heading designated in the specification, together with variations included in the claim.

Purpose of submission: Review.

Method of measurement

General: In conformance with the principles of the Australian Standard Method of Measurement of Building Works (ASMM).

Other civil engineering work: To AS 1181.

0160 QUALITY

1 GENERAL

1.1 RESPONSIBILITIES

General

General: Provide a project Quality Management System, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- *General requirements.*

1.3 STANDARDS

General

Standard: To AS/NZS ISO 9001.

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in AS/NZS ISO 9000 and the following apply:

- Quality package: A designated part of the works, which may include the whole works, for which an individual quality system is required.
- Service: After sales service, repairs and maintenance.

1.5 SUBMISSIONS

Authority approvals

General: Provide project Quality Management System documents to the following authority:

- Hindmarsh Shire Council

Calculations

Statistical techniques: Provide the methodology for statistical evaluation.

Execution details

Requirement: Provide the procedure for sign-off and audit.

2 PROJECT QUALITY MANAGEMENT SYSTEM REQUIREMENTS

2.1 DOCUMENTATION REQUIREMENTS

Quality plan

Standard: Conform to the recommendations of AS/NZS ISO 10005. Include inspection and test plans.

Documented procedures

Review: Provide evidence of revision(s) (including dates), approval and status of each procedure.

Register: Maintain a register of documented procedures including the title, identifier and revision status.

2.2 INSPECTION AND TEST PLANS

Content

Plan: Include the following:

- Detail all inspections and tests required including **Hold points**.

- Identify acceptance criteria, sampling and testing and frequency of sampling/testing.
- Identify responsibilities for inspection and testing and product/service approval.

Control of nonconforming product

Acceptance of concession: Before the provision or repair of a nonconforming product, obtain permission to use the product.

Hold points

Stages: Hold points during the construction/manufacturing process require release by the contract administrator.

Release: Requirements for release of a **Hold point** may include the following:

- Provision of information required by the technical specifications.
- Certification of design/construction or installation.
- Submission of any checklists or nonconformance forms as required.
- Inspection/demonstration of works.

Frequency of testing

Schedule: Conform to the testing requirements and hold points for test requirements specific to the appropriate work section and the relevant standards.

2.3 CORRECTIVE ACTION

General

Review: Provide procedure to review the various control methods to minimise nonconformance. Record amendments to the project Quality Management System resulting from corrective action.

Nonconforming works: Include in the Quality Plan the procedure for reporting any nonconforming works to the contract administrator and any corrective action requests.

2.4 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

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

2.5 INSPECTION

Notice

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

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

Light level requirements: to AS/NZS 1680.2.4.

Attendance

General: Provide attendance for documented inspections and tests.

2.6 SUBMISSIONS

General

Submit to: Principal

Default timing: Make submissions at least 5 working days before ordering products or starting installation of the respective portion of the works.

Program: Allow in the construction program for at least the following times for response to submissions as highlighted in these specifications:

- Shop drawings:
- Samples and prototypes:
- Manufacturers' or suppliers' specifications
- Product data:
- Product/design substitution or modification:

Proposed products schedules: If major products are not specified as proprietary items, submit a schedule of those proposed for use within 3 weeks of site possession.

Identification: Identify the project, contractor, subcontractor or supplier, manufacturer, applicable product, model number and options, as appropriate and include pertinent contract document references. Include service connection requirements and product certification.

Non-compliance: Identify proposals for non-compliance with project requirements, and characteristics which may be detrimental to successful performance of the completed work.

Errors: If a submission contains errors, make a new or amended submission as appropriate, indicating changes made since the previous submission.

Electronic copies file format: .dwg, .jpg, .pdf

Transmission medium: email to Superintendent and designer (Enlocus)

- Loose documents larger than A3: One transparency on heavyweight plastic film the same size as the standard contract drawings.

- Loose documents up to and including A3: One copy.

Standard contract drawing size: A1

Authority approvals

Authorities' approvals: Submit documents showing approval by the authorities whose requirements apply to the work.

Correspondence: Submit copies of correspondence and notes of meetings with authorities whose requirements apply to the work.

Marking and labelling

General: Before marking and labelling submit:

- Samples of the proposed labels.
- A schedule showing, for each item or type of item:
 - . A description of the item or type of item sufficient to identify it.
 - . The proposed text of the marking or label
 - . The proposed location of the marking or label.

Materials

Product certification: If products must conform to product certification schemes, submit evidence of conformance.

Product data: For proprietary equipment, submit the manufacturer's product data as follows:

- Technical specifications and drawings.
- Type-test reports.
- Performance and rating tables.
- Recommendations for installation and maintenance.

Samples

Submission: Submit nominated samples.

Incorporation of sample : If it is intended to incorporate samples into the works, submit proposals. Incorporate samples in the works which have been endorsed for inclusion. Do not incorporate other samples.

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

Shop drawings

HOLD POINT [Shop Drawings]

Submit shop drawings, at least 10 working days before work on that package commences. Keep on site a copy of each approved plan.

Record drawings: Submit all documented shop drawings amended to include changes made during the progress of the work and up to the end of the defects liability period.

Services coordination: Coordinate with other building and service elements. Show adjusted positions on the shop drawings.

Space requirements: Check space requirements of equipment and services indicated diagrammatically in the contract documents.

Electronic or Hard copy. Nominate alternatives or include both.

Drawing size: A3/A1

Checking: Make sure that the drawings have been checked before submission.

Tests

General: Submit an inspection and testing plan which is consistent with the construction program. Include particulars of test stages and procedures.

Test reports: Submit written reports on nominated tests.

3 PRODUCTS

3.1 GENERAL**Manufacturers' or suppliers' recommendations**

General: Provide and select, if no selection is given, transport, deliver, store, handle, protect, finish, adjust and prepare for use the manufactured items in conformance with the current written recommendations and instructions of the manufacturer or supplier.

Proprietary items/systems/assemblies: Assemble, install or fix to substrate in conformance with the current written recommendations and instructions of the manufacturer or supplier.

Project modifications: Advise of activities that supplement, or are contrary to, manufacturers' or suppliers' written recommendations and instructions.

Sealed containers

General: If materials or products are supplied by the manufacturer in closed or sealed containers or packages, bring the materials or products to point of use in the original containers or packages.

Prohibited materials

Do not provide the following:

- Materials listed in the Safe Work Australia Hazardous Substances Information System (HSIS).
- Materials that use chlorofluorocarbon (CFC) or hydro chlorofluorocarbon (HCFC) in the manufacturing process.

Substitutions

Identified proprietary items: Identification of a proprietary item does not necessarily imply exclusive preference for the item so identified, 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:

- Evidence that the performance is equal to or greater than that specified.
- Evidence of conformity to a cited standard.
- 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.

3.2 MATERIALS AND COMPONENTS

Consistency

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

Corrosion resistance

General: Conform to the following atmospheric corrosivity category as defined in AS/NZS 2312.

Galvanizing

Severe conditions: Galvanize mild steel components (including fasteners) to AS 1214 or AS/NZS 4680 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).

4 EXECUTION

4.1 OFF-SITE DISPOSAL

Removal of material

General: Dispose of building waste material off site to the requirements of the relevant authorities and Principal. All materials are to be recycled where applicable.

4.2 FIXING

General

Suitability: If equipment is not suitable for fixing to non-structural building elements, fix directly to structure and trim around penetrations in non-structural elements.

Fasteners

General: Use proprietary fasteners capable of transmitting the loads imposed, and sufficient for the rigidity of the assembly.

4.3 SERVICES CONNECTIONS

Connections

General: Connect to network distributor services or service points. Excavate to locate and expose connection points. Reinstall the surfaces and facilities that have been disturbed.

Network distributors' requirements

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

4.4 SERVICES INSTALLATION

General

Fixing: If non-structural building elements are not suitable for fixing services to, fix directly to structure and trim around holes or penetrations in non-structural elements.

Installation: Install equipment and services plumb, fix securely and organise reticulated services neatly. Allow for movement in both structure and services.

Concealment: Unless otherwise documented, conceal all cables, ducts, trays and pipes except where installed in plant spaces, ceiling spaces and riser cupboards. If possible, do not locate on external walls.

Lifting: Provide heavy items of equipment with permanent fixtures for lifting as recommended by the manufacturer.

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

Arrangement: Arrange services so that services running together are parallel with each other and with adjacent building elements.

Dissimilar metals

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

Vibration: Arrange and support piping so that it remains free from vibration whilst permitting necessary movements. 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.

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.

4.5 SUPPORT AND STRUCTURE

General

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

4.6 FINISHES TO BUILDING SERVICES

General

General: If exposed to view (including in plant rooms), paint new structures, services and equipment. Surfaces painted or finished off-site: Conform to the *Metals and prefinishes* worksection.

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

General: Conform to the recommendations of AS/NZS 2311 Sections 3, 6 and 7 or AS/NZS 2312 Sections 5, 8 and 10, as applicable.

Powder coating

Standard:

- Other metals: To AS 4506.

Painting systems

New unpainted exterior surfaces: To AS/NZS 2311 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.

Low VOC emitting paints

Provide the following low odour/low environmental impact paint types with the following VOC limits:

- Primers and undercoats: < 65 g/litre.
- Low gloss white or light coloured latex paints for broadwall areas: < 16 g/litre.
- Coloured low gloss latex paints: < 16 g/litre.
- Gloss latex paints: < 75 g/litre.

HOLD POINT [Service Locations]**Accurately record the routes of underground cables and pipes before backfilling.**

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.

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.

4.7 WARRANTIES**General**

General: If a warranty is documented or if a manufacturer's standard warranty extends beyond the end of the defects liability period, name the principal as warrantee. Register with manufacturers as necessary. Retain copies delivered with components and equipment.

Commencement: Commence warranty periods at practical completion or at acceptance of installation, if acceptance is not concurrent with practical completion.

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.

4.8 RECORD DRAWINGS**General**

General: Submit 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

Progress recording: Keep one set of updated drawings on site at all times, expressly for the purpose of marking changes made during the progress of the works.

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 **RECORD DRAWINGS**.

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

Services record drawings

General: Submit record drawings of services to **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.
- 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.
- Access provisions.
- Fixings.
- Fixtures.
- Switchgear and controlgear 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.

4.9 COMPLETION TESTS**Reports**

General: Submit reports indicating observations and results of tests and compliance or non-compliance with requirements.

Notice

Inspection: Give sufficient notice for inspection to be made of the commissioning and completion testing of the installation.

Controls

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

Samples

General: Remove unincorporated samples on completion.

Completion tests

General: Test the works under the contract to demonstrate compliance with the documented performance requirements of the installation.

Functional checks: Carry out functional and operational checks on energised equipment and circuits and make final adjustments for the correct operation of safety devices and control functions.

Proprietary equipment: Submit type test reports confirming compliance of proprietary equipment.

4.10 CLEANING

Final cleaning

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

Labels: Remove all labels not required for maintenance.

4.11 POST-CONSTRUCTION MANDATORY INSPECTIONS AND MAINTENANCE

General

General: For the duration of the defects liability period, provide inspections and maintenance of safety measures required by the following:

- The Building Code of Australia.
- AS 1851.
- 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. Submit certification.

Annual inspection: Provide an annual inspection and maintenance immediately prior to the end of the defects liability period.

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

General: Provide site management, as documented.

Designated areas for protection: 1610_CD003

Outline of the works: 1610_CD004

Incidental works

Generally: Undertake the following:

- Reinstatement: Reinstatement undeveloped ground surfaces to the condition existing at the commencement of the contract.
- Minor trimming: As required to complete the works, as documented.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*

1.3 INTERPRETATION**Definitions**

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

- Clearance authority: Any authority covering statutory requirements relating to the project and requiring clearances for work in that particular area.
- Clearances: A formal certificate, approval or condition issued by a statutory authority to allow work to be carried out in a particular area.
- Contamination of land: The presence of a substance in, on or under the land which is a designated hazardous material and/or is at a concentration above that which is normally found in that locality, such that there presents a risk of harm to human health or to the environment.
- Green and 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.
- Environment: The physical factors of the surroundings of human beings including the land, waters, atmosphere, climate, sound, odours, tastes, the biological factors of animals and plants and the social factor of aesthetics.
- Environmental audits: A review of environment management practices, in particular the evaluation of a site for environmental liability.
- Environmental impact assessment: A method for predicting environmental impacts of a proposed development including minimising identified impacts.
- Environmental management plan (EMP): A 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 and infrastructure.
- 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 our natural areas, reduces the sustainability or affects the health of people and animals.

1.4 INSPECTION

Notice

HOLD POINT [Existing vegetation]

- Enclosures to trees to be retained.

1.5 MANAGEMENT AND CONTROL

Plans submitted by the contractor

Implementation: Approved management plans documented in **Submissions**.

Management and control measures

Implementation: Management and control measures documented in **Execution**.

1.6 SUBMISSIONS

Submissions program

Training program: Submit a program to familiarise staff regarding the site environmental management plan, environmentally sensitive areas and responsibilities.

Environmental management plan (EMP)

EMP: Submit an environmental management plan and include the following details:

- Assignment of responsibility for environmental controls.
- Conditions of approvals, licences and permits to meet statutory requirements.
- Details of potential environmental impacts and operational control measures for implementation including:
 - . Heritage.
 - . Preservation of visual values.
 - . Preservation of habitat.
- Details of environmental protection for each activity.
- Locations of environmental controls and environmentally sensitive areas.
- Communication procedures.
- Emergency response procedures including response time.
- Environmental training plan and procedures.
- Other items necessary to protect the surrounding environment.

Address the phases of activity, as appropriate:

- Before construction and site establishment.
- During construction.
- After construction, including rehabilitation activities and maintenance of erosion and sedimentation controls.

Completed environmental management plan: Submit before work commences on site.

Soil erosion and sediment control plan

Plan: Submit a soil erosion and sediment control plan and include the following details:

- Staging of operations and sequence of works.
- Provision of temporary drains and catch drains.
- Spreader banks or other structures to disperse concentrated runoff.
- Temporary grassing or other treatments such as contour ploughing or bunding to disturbed areas and long-term stockpiles.
- Restoration of disturbed areas in progress with the works.
- Use of mulch materials to protect disturbed or exposed areas where suitable.

Areas: Include all site areas and access and haulage tracks, borrow pits, stockpile and storage areas and compound areas.

Waste management plan

Plan: Submit a waste management plan and identify major waste streams that will be generated during the contract including:

- Green waste and organic waste.
- Construction waste, including:
 - . Spoil.
 - . Demolition waste.
 - . Asphalt or bitumen.
 - . Concrete
 - . Metal.
 - . Paint materials and empty containers.
 - . Office waste.
 - . Sewage effluent.
- For each waste stream indicate:
 - . How and where the waste is to be re-used, recycled, stockpiled or disposed off as approved by the Principal.
- Indicate how the waste will be transported between the site and point of re-use, recycling, stockpiling, treating or disposal and who will be responsible.

Plan: Submit details of location, labelling and protection of separate skips for the identified waste stream.

Site preparation

Mulching: Submit details of provisions for mulching cleared vegetation.

2 EXECUTION

2.1 GENERAL

Community liaison

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

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

Notification content:

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

Complaints

Report: Within 1 working day of receiving a complaint about any environmental issue, including pollution, submit a written report detailing the complaint and action taken.

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

Cultural heritage

Known cultural heritage site/areas:

Training: Ensure that all personnel working on site have received training relating to their responsibilities regarding cultural heritage and are made aware of any sites/areas, which must be

avoided. Mark-up such sites/areas on a site map and make available to all relevant personnel during the works.

Notice: Give notice if any item is encountered which is suspected to be an artefact of heritage value or any relic or material suspected of being of Aboriginal or early settlement origin.

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

Aboriginal sacred sites protection

Refer to the appropriate State or Territory legislation and any Authority e.g. the Northern Territory Aboriginal Areas Protection Authority (AAPA).

2.2 CONTROL AND PROTECTION

Air quality control

General: Protect adjoining owners, residents and the public against dust, dirt and water nuisance and injury. Use dust screens and watering to reduce the dust nuisance.

Noise control and vibration

Monitoring: Measure vibration levels of the peak particle velocity to AS 2187.2.

Limits: Do not exceed the vibration or airblast overpressure recommended in AS 2187.2 Appendix J.

Vegetation and fauna

Wild life protected: All native.

Trees to be removed: Inspect to establish if nesting native fauna are present. If present give notice.

Pruning: To AS 4373.

Water quality

Wash out: Make sure that wash out does not enter waterways or stormwater drains.

Cross connection: Make sure that there are no cross connections between the stormwater and the public sewerage system.

Dewatering

General: Keep earthworks free of water. Provide and maintain slopes, crowns and drains on excavations and embankments to make sure free drainage. Place construction, including fill, masonry, concrete and services, on ground from which free water has been removed. Prevent water flow over freshly laid work.

Disposal: Dispose of water off-site.

2.3 TRUCK CONTAMINATION

Truck contamination precautions

Covers: Use tarpaulins to prevent the dropping of materials on public roads.

Washing: Wash the underside of all vehicles leaving the site as follows:

- Mud: Do not carry mud on to adjacent paved streets or other areas.
- Noxious plants: If noxious plants, as designated by the local authority, are present on the site ensure seeds are not carried on to adjacent paved streets or other areas.

2.4 MANAGEMENT AND CONTROL PLAN IMPLEMENTATION

Approval

Approval authority: Hindmarsh Shire Council
e.g. the contract administrator.

Implementation

General: Implement the following approved management and control plans:

- Environmental management control plan.

- Waste management plan.

Reporting

General: Compile the environment management plan (EMP) reports regularly to report the progress in relation to:

- Performance against statutory requirements.
- Performance against the EMP and the EMP policy, ecologically sustainable development outcomes and targets.
- Summary of monitoring, inspection and audits.
- Summary of reports required to meet the statutory requirements.
- Summary of environmental emergencies, incidents, non-compliance and complaints.

2.5 TEMPORARY LANDSCAPE FENCING

Fence dimensions

Height: 1800 mm.

Maximum post spacing: 5000 mm.

Components sizes

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

Intermediate posts: Star picket.

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.

2.6 TREE PROTECTION

Standard

General: Comply with the recommendations of those parts of AS 4970 which are referenced in this worksection.

General

Warning sign: Display a sign in a prominent position at each entrance to the site, warning that trees and plantings are to be protected during the contract. Remove on completion.

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

Protection measures program: Before commencement of earthworks.

Trees to be retained

Extent: All trees NOT marked for removal.

Tree protection

Tree protection zone: To AS 4970 Section 3.

Tree protective measures: To AS 4970 Section 4.

Monitoring and certification: To AS 4970 Section 5.

Work near trees

Harmful materials: Keep the area within the dripline free of sheds and paths, construction material and debris. Do not place bulk materials and harmful materials under or near 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 the like 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 to be retained, give notice and obtain instructions. Open up excavations under tree canopies for as short a period as possible.

Hand methods: Use hand methods to locate, expose and cleanly remove the roots on the line of excavation. If it is necessary to excavate within the drip line, use hand methods such that root systems are preserved intact and undamaged.

Roots: Do not cut tree roots exceeding 50 mm diameter. Where it is necessary to cut tree roots, use means such that the cutting does not unduly 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 to excavations around tree roots with a mixture consisting of three parts by volume of topsoil and one part of well rotted compost with a neutral pH value, free from weed growth and harmful materials. Place the backfill layers, each of 300 mm maximum depth, compacted 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.

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

Compaction protection: Protect areas adjacent the tree dripline. Submit proposals for an elevated platform to suit the proposed earthworks machinery.

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 covered by the drip line of all protected trees.

2.7 EXISTING SERVICES

Location

HOLD POINT [Dial Before You Dig]

- **Contact D.B.U.D for all up to date service information onsite. Any issues or works to be carried out near services to be submitted to and approved by Superintendent.**

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

Excavation

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

2.8 TREES TO BE REMOVED

Designation

Extent: Refer to drawings

Marking: Mark trees and shrubs to be removed as follows:

- Tags: Surveyors ribbon
- Location: 1000 mm above ground level.

2.9 SITE CLEARING

Extent

General: Clear only the following site areas:

- Areas to be occupied by works such as structures, paving, excavation, regrading and landscaping.
- Other areas designated to be cleared.

Contractor's site areas: If not included within the areas documented above, clear generally 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 of 500 mm below subgrade under buildings, embankments or paving, or 300 mm below finished surface in unpaved areas. Backfill 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.

Old works: Remove old works, including slabs, foundations, pavings, drains and access chambers covers found on the surface.

2.10 TREE MAINTENANCE**General**

General: Conform to the Site plans

Notice: Give notice before commencing tree maintenance.

Work on trees: If it is necessary to perform any work on trees to be retained, give notice.

Pruning requirements: Carry out all pruning in conformance with AS 4373 and Work Health and Safety Act 2011 and the relevant industry code of practice by a fully qualified and experienced arborist. Carry out all required works in a safe and progressive manner.

Execution

Repair: Undertake tree surgery and make good damage to existing trees noted to be retained. bracing as necessary before cutting to prevent uncontrolled breakages and damage to surroundings.

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

Restitution by replacement tree: Replace the tree with a replacement tree of the same species and similar size, or nominate an alternative.

2.11 SEDIMENT FILTERS**General**

Inspection: Inspect for displacement, undercutting, over-topping and soil build-up, after each rain event. Effect repairs immediately.

Removal: When the upslope areas have been permanently stabilised.

Straw bale filters

Description: Temporary structures made of straw bales (cereal straw) laid end to end across direction of stormwater flow in order to filter sediment.

Slopes: If filter is at toe of a slope, place bales 1500 – 2000 mm away from slope, to provide access for maintenance and to allow coarse sediment to drop out of suspension before reaching sediment filter.

Binding: Wire-bound or with string-tied bindings wrapped around the bale sides.

Installation:

- Trench: 100 mm deep trench the width of a bale and the length of the proposed sediment filter.
- Placement: Lengthwise in the trench with ends tightly abutting and corners lapped.
- Fixing: Drive two 50 x 50 mm wooden stakes or metal star pickets through each bale. Ensure bales are packed closely and staked securely. Eliminate gaps with loose straw wedged between tight.

Backfilling: Compacted excavated soil to ground level on downhill side of barrier, and 100 mm above ground level on the uphill side of the bales.

Silt fence

Description: A temporary barrier of geotextile, supported on wire or mesh fencing in order to filter sediment from stormwater flow.

Slopes: If filter is at toe of a slope, locate fence 1500 – 2000 mm away from slope, to provide access for maintenance and to allow coarse sediment to drop out of suspension before reaching sediment filter.

Contours: Locate fence line and posts along contours curving upstream at the sides to direct flow toward middle of the fence.

Installation:

- Trench: 100 mm wide x 200 mm deep along line of posts and upslope from barrier.
- Posts: 1200 mm long pre drilled steel star picket posts at 3000 mm centres, driven 600 mm and fitted with plastic safety caps.
- Wire mesh: ≥ 14 gauge x ≤ 150 mm mesh spacing. Fasten wire mesh to upslope side of posts with 25 mm long heavy-duty wire staples and tie wire. Extend wire mesh 150 mm into trench.
- Filter: Geotextile selected to suit local soil conditions cut from a continuous roll to minimise joints.
- Fixing: Wire ties to the uphill side of fence posts, and extended 200 mm into the trench. Do not staple onto trees.
- Joints: 150 mm overlap at a support post, with both ends fastened to the post.

Performance: Retain soil found on site but with openings large enough to permit drainage and prevent clogging.

Fence height: 600 mm average.

Backfilling: Backfill trench over toe of geotextile and compact soil.

2.12 DISPOSAL OF MATERIALS

Disposal

Spoil: Remove cleared and grubbed material from the site and dispose of legally and where applicable recycle.

2.13 COMPLETION

Temporary works

Remove at completion: temporary tree enclosures

Joining up

Abutments: Join new and existing work including cutting if required, in the manner appropriate to the materials and make good to existing work.

Clean up

Progressive cleaning: Keep the work under the contract clean and tidy as it proceeds and regularly remove from the site rubbish and surplus material arising from the execution of the work including any work performed during the defects liability period or the plant establishment period.

Removal of plant: Within fourteen days of the date of practical completion, remove temporary works, construction plant, buildings, workshops and equipment not forming part of the works, except what is required for work during the defects liability period or the plant establishment period. Remove these on completion.

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

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

Design

- Geotechnical and environmental reports provided: - BRUCE HOLLIOAKE [REPORT NO: 17200 DATED 29TH OF MARCH]

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

Designer: Enlocus

Authority requirements: Approvals required to AS 3798 Section 2

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*
- *Site management.*

1.3 STANDARDS**General**

Earthworks: To AS 3798.

General: Conform to the recommendations of those parts of AS 3798 which are referenced in this worksection.

1.4 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 1348, AS 3798 and the following apply:

- Description and classification of soils: To AS 1726.
- Site classification: To BCA 3.2.4.
- Bad ground: Ground unsuitable for the purposes of the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground which is or becomes soft, wet or unstable.
- Base: Layer(s) of material forming the uppermost structural element of a pavement and on which the surfacing may be placed.
- Discrepancy: A difference between contract information about the site and conditions encountered on the site, including but not limited to discrepancies concerning the following:
 - . The nature or quantity of the material to be excavated or placed.
 - . Existing site levels.
 - . Services or other obstructions beneath the site surface.

- Rock: Monolithic material with volume greater than 0.5 m³ which cannot be removed until broken up by rippers or percussion tools.
- Site topsoil: Soil excavated from the site which contains organic matter, supports plant life, conforms generally to the fine to medium texture classification to AS 4419 (loam, silt, clay loam) and is free from:
 - . Stones > 25 mm diameter.
 - . Clay lumps > 75 mm diameter.
 - . Weeds and tree roots.
 - . Sticks and rubbish.
 - . Material toxic to plants.
- Subbase: The 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.
- Subgrade: The trimmed or prepared portion of the formation on which the pavement or slab is constructed. Generally taken to relate to the upper line of the formation.
- 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.

1.5 INSPECTION

Notice

HOLD POINT [Clearing of site]

- **Areas to be cleared and/or stripped of topsoil.**
- **Areas stripped of topsoil.**
- **Excavation completed to contract levels or founding material.**
- **Proof roll subgrade before placing fill.**
- **Filling completed to contract levels.**
- **Stockpiled topsoil before spreading.**

1.6 TOLERANCES

General

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

- Under 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: ± 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

Execution details

Report: Submit a time based schedule noting the methods and equipment proposed for the groundworks, including the following:

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

Disposal location: Submit the locations and evidence of compliance with the relevant authorities for the disposal of material required to be removed from site.

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

Construction records: Submit the following to AS 3798 clause 3.4 and Appendix B:

Materials

Imported fill: Submit certification or test results by a GTA registered laboratory which establish the compliance of imported fill with the contract including the source.

Tests

Compaction: Submit certification and/or test results in conformance with the specified level of responsibility to AS 3798.

2 PRODUCTS

2.1 FILL MATERIALS

General

HOLD POINT [Fill]

- **Principal to inspect all fill to be used on site.**

Suitable material: To AS 3798 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 clause 4.3.

Sulphur content: Do not provide filling with sulphur 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 clause 4.4.

Stockpiles: 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 under the contract, dispose of excavated material off-site to AS 3798 clause 6.1.8.

2.2 BORROW OR IMPORTED FILL

Borrow or imported material: Only when no suitable excavated material is available.

- Suitable material: To AS 3798 clause 4.4.

Material complying with the following: Refer to Geotechnical report.

Borrow pits:

- Location: More than 3 m from any fence line, boundary, edge of excavation or embankment.
- Strip and stockpile topsoil.
- Provide erosion protection during winning operations of material and ensure drainage is maintained.
- On completion of winning operations grade abrupt changes of slope, respread topsoil and apply and maintain hydroseeded grassing.

Borrow and imported fill additional testing: Refer to Geotechnical report.

3 EXECUTION

3.1 SITE PREPARATION

Erosion and sedimentation control

Drainage, erosion and sedimentation control: To the *Site management* worksection.

3.2 GEOTECHNICAL

As found site conditions

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

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

Inspection and testing

Inspection and testing: Conform to the following:

- Level 1 GITA required to AS 3798 clause 8.2.
- Level 2 GTA required to AS 3798 clause 8.3.

3.3 RECORDS OF MEASUREMENT

Excavation and backfilling

Agreed quantities: 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.

Method of measurement: By registered surveyor unless otherwise agreed.

Rock

Level and class: If rock is measured for payment purposes, whether 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.

Topsoil stockpiles

General: Stockpile site topsoil intended for re-use and imported topsoil where necessary.

Stockpile heights: Establish stockpiles to maximum height of 1.5 m.

Mark: Identify stockpiles of different soil types.

Vegetation: Do not burn off or remove plant growth which may occur during storage.

Protection: Provide the following:

- 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.

Remove: Remove topsoil that is unsuitable for re-use from the site to AS 3798 clause 6.1.8.

3.5 EXCAVATION

HOLD POINT [Proposed levels]

- Principal to inspect and approve all proposed levels onsite after excavation and/or fill have been undertaken.

Extent

Site surface: Excavate over the site to give correct levels and profiles as the basis for structures, pavements, filling and landscaping. Make allowance for compaction, settlement or heaving.

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

Rock

General: Do not use explosives.

Existing footings

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

Existing services

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

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

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

Proof rolling

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

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

Outcome: 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 clause 6.1.8.

3.6 SUBGRADES AFFECTED BY MOISTURE

General

General: If the subgrade is unable to support construction equipment, or it is not possible to compact the overlying pavement only because of a high moisture content, perform one or more of the following:

- Allow the subgrade to dry until it will support equipment and allow 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.

3.7 BEARING SURFACES

General

General: Provide even plane bearing surfaces for loadbearing elements including footings. Step to accommodate level changes. Make the steps to the appropriate courses if supporting masonry.

Deterioration

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

3.8 REINSTATEMENT OF EXCAVATION

General

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

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. Ensure that remedial concrete does not create differential bearing conditions.

Below slabs or pavements: Provide selected fill compacted to the specified density.

Cut subgrades: Where the over excavation is less than 100 mm, do not backfill. Make good by increasing the thickness of the layer above.

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

3.9 SUPPORTING EXCAVATIONS

Removal of supports

General: Remove temporary supports progressively as backfilling proceeds.

Voids

General: Guard against the formation of voids outside sheeting or sheet piling if used. Fill and compact voids to a dry density similar to that of the surrounding material.

3.10 ADJACENT STRUCTURES

Temporary supports

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

Lateral supports: Provide lateral support using shoring.

Vertical supports: Provide vertical support where necessary using piling or underpinning or both.

Permanent supports

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

Encroachments

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

Zone of influence

Angle from horizontal: 30° for granular material, 45° for stiff clay

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 clause 6.1.5. Remove materials which will inhibit or prevent satisfactory placement of fill layers, loose material, debris and organic matter.

Foundation preparation: To AS 3798 clause 6.1.7.

Compaction: Compact the ground exposed after stripping or excavation to the minimum relative compaction in AS 3798 Section 5 and **Compaction Table**.

Scarify method: Loosen exposed excavation by scarifying to a minimum of 150 mm, moisture condition and compact to AS 3798 Section 5 and **Compaction Table**.

Impact roller compaction: Use an approved impact roller or impact completion.

Slope preparation: If fill is placed on a surface which slopes steeper than 4 H:1 V, 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.

Under slabs, paving and embankments

General: Compact the ground to achieve the densities specified in the **Compaction table**. If necessary 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.

3.12 PLACING FILL**General**

Layers: Place fill in near-horizontal layers of uniform thickness, deposited systematically across the fill area.

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

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, ensure that previously accepted layers still conform to requirements, including moisture content.

Protection: Protect the works from damage due to compaction operations. Where necessary, limit the size of compaction equipment or compact by hand. Commence compacting each layer at the structure and proceed away from it.

Protective covering: Do not disturb or damage the protective covering of membranes during backfilling.

Placing at structures

General: Place and compact fill in layers simultaneously on both sides of structures, culverts and pipelines to avoid differential loading. Carefully place first layers of fill over the top of structures.

Concrete: 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.

3.13 PLACING TOPSOIL**Stockpiled topsoil**

Cultivation: Rip 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.

Placing: Spread and grade evenly.

Disposal of excess topsoil

On-site: Where applicable 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 to Superintendent approved location.

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.

3.14 FILL MOISTURE CONTROL**General**

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

3.15 COMPACTION REQUIREMENTS FOR FILL AND SUBGRADE

Density

General: Other than rolled fill, to AS 2870 clause 6.4.2(b). Compact the subgrade and each layer of fill to the required depth and density, as a systematic construction operation and to conform to the **Compaction table**. Shape surfaces to provide drainage and prevent ponding.

Compaction table

Location	Cohesive soils. Minimum dry density ratio (standard compaction) to AS 1289.5.4.1	Cohesionless soils. Minimum density index to AS 1289.5.6.1
Residential: Lot fill, house sites.	95	70
Commercial: Fills to support minor loadings incl. floor loadings < 20 kPa and isolated pad or strip footings < 100 kPa.	98	75
Pavements: Fill to support pavements	95	70
Subgrade to 300 mm deep	98	75

Excavated and stripped ground surface: After excavation and/or stripping, compact these surfaces in conformance with the **Compaction table** to a minimum depth of 150 mm.

Maximum rock and lump size in layer after compaction: 2/3 compacted layer thickness.

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

Compaction control tests

Compaction control tests: To AS 1289.5.4.1 or AS 1289.5.7.1.

Compaction control test frequency

Standard: To AS 3798 Table 8.1.

Confined operations: 1 test per 2 layers per 50 m².

3.16 COMPLETION

Grading

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

Temporary works

Tree enclosures: Remove temporary tree enclosures at completion.

Tree marking: Remove temporary marks and tags at completion.

Temporary supports: Remove temporary supports to adjacent structures at completion.

Site restoration

Requirement: Where 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.

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

General: Provide trenching for underground services, as documented.

Design

Steel shoring and trench lining systems: To AS 4744.1.

Hydraulic shoring and trench lining equipment: To AS 5047.

Authority requirements: Relevant local authorities

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*
- *Earthwork.*
- *Pavement base and subbase.*
- *Asphaltic concrete.*
- *Segmental pavers – mortar and adhesive bed.*

1.3 STANDARDS**General**

Earthworks: To AS 3798.

1.4 INTERPRETATION**Abbreviations**

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

- CBR value: California Bearing Ratio value.

1.5 INSPECTION**Notice****HOLD POINT [Trenching]**

- **Service trenches excavated before laying the service**
- **Services laid in trenches and ready for backfilling**

1.6 TOLERANCES**General**

Earthworks: To **Tolerances** in the *Earthwork* worksection.

1.7 SUBMISSIONS**General**

Extent: Submit a plan of trench works noting the location and type of service.

Notice: Advise proposed duration of open excavation.

Construction: Submit details of proposed equipment and method of excavation.

Stability: If shuttering and/or bracing of the sides of a trench is required for safety and stability, provide proposals.

Hazards: Identify WHS hazards that may be encountered with deep trenches including toxic gases and liquids.

Boring: Submit 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.

Off site disposal

Disposal location: Submit the locations and evidence of compliance with the relevant authorities for the disposal of material required to be removed from the site.

2 EXECUTION

2.1 EXISTING SERVICES

Location

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

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

Excavation

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

2.2 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.

Grass

Method: Neatly cut grass turf between trench set out lines into 300 mm squares. If the grass is suitable for re-use, take up and store the turf and water during the storage period, otherwise remove and dispose of it off-site.

Small plants, shrubs and trees

Storage: If required for re-planting, take up small plants and store. Wrap the root ball in a hessian or plastic bag with drain holes and water during the storage period.

Unsuitable vegetation: Remove and dispose of off-site.

2.3 EXCAVATING

Site preparation

As found site conditions: To **Geotechnical** in the *Earthwork* worksection.

Records of measurement: If Records of measurement are required, to **Records of measurement** in the *Earthwork* worksection.

Remove topsoil: To **Removal of topsoil** in the *Earthwork* worksection.

Excavation

General: 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: ± 50 mm, unless constrained by adjacent structures.
- Excavation: To the *Earthwork* worksection **Excavation and Adjacent structures**.

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.

Adjacent to footings: If excavation is necessary below the zone of influence of the underside of adjacent footings, give notice, and provide support for the footings as instructed.

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 which may interfere with services or bedding.

Tree protection: To AS 4970.

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

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 backfill material.

Boring

Subcontractor: If under road boring is required in lieu of trenches, engage a suitably qualified subcontractor to do the work.

2.4 TRENCH BACKFILL

General

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

Marking services: Underground marking tape to AS/NZS 2648.1.

Place fill: To **Placing fill** in the *Earthwork* worksection.

Bedding, haunch, side and overlay zones

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

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

Topsoil areas: Complete the backfilling with at least 100 mm of topsoil.

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

Selected material zone

Extent: The section of trench within the zone, if applicable.

Backfill material: Selected material free from stones larger than 100 mm maximum dimension and the fraction passing a 19 mm Australian Standard sieve to have a 4 day soaked CBR value, in conformance with AS 1289.6.1.2, and not less than that of the adjacent selected material zone.

Trees

General: Backfill at trees, for a minimum 300 mm thickness, around tree roots with a topsoil mixture, placed and compacted in layers of 150 mm minimum depth to a dry density equal to that of the surrounding soil.

Backfill level: Do not place backfill material 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 **Fill moisture control** in the *Earthwork* worksection.

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

Compaction: To **Compaction requirements for fill and subgrade** in the *Earthwork* worksection and AS 3798 Section 5.

Frequency of testing: To AS 3798 clause 8.7.

Precautions: If compacting adjacent to utility services, use compaction methods which do not cause damage or misalignment.

Density tests

Testing authority: Have density tests of pipe bedding and backfilling carried out by a Registered testing authority.

Test methods:

- Compaction control tests: To AS 1289.5.4.1 or AS 1289.5.7.1.
- Field dry density: AS 1289.5.3.2 or AS 1289.5.3.5.
- Standard maximum dry density: AS 1289.5.1.1.
- Dry density ratio: AS 1289.5.4.1.
- Density index: AS 1289.5.6.1.

2.5 SURFACE RESTORATION

Subbase and base

Material: Provide crushed rock, DGS20 or DGB20 material and configure in layers and depths to match existing and adjacent work.

Supply and installation: To the *Pavement base and subbase* worksection.

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 per cent when tested in conformance with AS 1289.5.4.1.

Tests: Test for compaction at a minimum frequency of 1/ every second layer/50 m² of restoration surface area.

Pathways and paved areas generally

Materials: Provide material consistent with the surface existing before commencement of the works.

Subbase: 150 mm crushed stone DGB20 compacted to 100 percent relative compaction in conformance with AS 1289.5.4.1.

Lippage at patches: Match the surface level at any point along the patch's edge with the adjoining footpath surface within ± 5 mm.

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 10 mm above the adjoining existing surfaces.
- Material: 32 MPa concrete
- 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 where new concrete abuts existing concrete and in line with joints in existing concrete.
- Control joints:
 - . Form control joints strictly in line with the control joints in existing concrete.
 - . Around electricity supply poles: Terminate the concrete paving 200 mm from the pole and fill the resulting space with cold mix asphalt.

Curing: Cure by keeping continuously wet for 7 days.

Landscaped areas

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

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

Planted areas: Overfill to allow for settlement.

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

General: Provide stormwater drainage, as documented.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*
- *Earthwork.*

1.3 STANDARDS**Stormwater drainage**

Standard: To AS/NZS 3500.3.

1.4 INTERPRETATION**Definitions**

General: For the purposes of this worksection the following definition applies:

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

1.5 INSPECTION**HOLD POINT [Stormwater]**

- **Excavated surfaces prior to placing bedding material**
- **Concealed or underground services prior to being covered.**
- **Pipe joints before covering.**
- **Placing of cast in situ concrete.**
- **Upon completion.**

1.6 SUBMISSIONS**Products – documentation**

Conformance: Produce documentary evidence that the pipes conform to the requirements of this worksection.

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.

2 PRODUCTS**2.1 MATERIALS****Concrete and mortar**

Concrete: To AS 1379 and the following:

- Grade: N15.
- Cement: To AS 3972.

. Type: GP, GL or GB.

Steel reinforcement:

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

Joints

Solvent cement and priming fluid: To AS/NZS 3879.

Type of pipes and fittings

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

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

Glass-reinforced polyester (GRP): To AS 3571.1.

Cast iron access chamber covers and frames: To AS 1830 or AS 1831, as appropriate.

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

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

Precast concrete: To AS/NZS 4058.

Rubber ring joints/elastomeric seals: To AS 1646.

Plastic pipe for subsoil drainage: To AS 2439.1.

Vitrified clay or ceramic: To AS 1741.

Bedding material

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

Conformance: Conform to the **Bedding material grading table**.

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

Filter material

General: Provide filter materials consisting of natural clean washed sands and gravels and screened crushed rock conforming to AS/NZS 3500.3 clause 2.14.1.

2.2 GEOTEXTILES

General

Requirement: Provide polymeric fabric formed from plastic yarn composed of at least 85% by weight propylene, ethylene amide or vinylidene chloride and containing stabilisers or inhibitors which provide resistance to deterioration due to ultraviolet light.

2.3 PREFABRICATED PITS

General

Requirement: Provide precast or prefabricated pits in conformance with AS/NZS 3500.3 clauses 2.13.8 and 8.6 and/or as detailed.

Metal access covers and grates

Standard: To AS 3996.

3 EXECUTION

3.1 PIPING

General

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

Sockets: Lay with sockets 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

General

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

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

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 that 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

General: Lay in straight lines between changes in direction or grade with socket end placed upstream. 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

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

Pipe underlay (bedding)

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

Chases: If necessary, 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 ≤ 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 in conformance with the *Earthwork* worksection.

Lifting holes

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

Anchor blocks

General: If necessary, to restrain lateral and axial movement of the stormwater pipes, provide anchor blocks at junctions and changes of grade or direction conforming to AS/NZS 3500.3 clause 8.10.

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 in the **Drainage Plan**

Trench width: ≥ 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:

- 100 mm below subgrade level of the pavement, kerb or channel.
- 100 mm below the average gradient of the bottom of footings.
- 450 mm below the finished surface of unpaved ground.

Jointing

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

Geotextiles

Marking: To AS 3705.

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 polyester permeable 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 specifications.

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:

- Refer to details
- In paved areas: Flush with the paving surface.
- Gratings taking surface water runoff: Locate to receive runoff without ponding.

3.6 TESTING**Pre-completion tests**

General: Before backfilling or concealing, carry out the following tests:

- Site stormwater drains and main internal drains: Air or water pressure test to AS/NZS 3500.3 Section 10.

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

3.7 COMPLETION**Cleaning**

General: Clean and flush the whole installation. Specify and detail to the recommendations of the product supplier.

0271 PAVEMENT BASE AND SUBBASE**1 GENERAL****1.1 RESPONSIBILITIES****General**

General: Provide base and subbase courses as documented.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*
- *Earthwork.*

1.3 INTERPRETATION**Abbreviations**

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

- CBR: California bearing ratio.
- CRB: Crushed rock base.
- CRS: Crushed rock subbase.
- NGB: Natural gravel base.
- NGS: Natural gravel subbase.
- RCCB: Recycled crushed concrete base.
- RCCS: Recycled crushed concrete subbase.

Definitions

General: For the purposes of this worksection the definitions given in AS 1348 and the following apply:

- Absolute level tolerance: Maximum deviation from design levels.
- Base: Layer(s) of material forming the uppermost structural element of a pavement and on which the surfacing may be placed.
- Flexible pavement: A pavement which obtains its load-spreading properties from intergranular pressure, mechanical interlock and cohesion between the particles of the pavement material.
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.
- Subbase: Material laid on the subgrade (or selected material), below the base, either for the purpose of making up additional pavement thickness, to prevent intrusion of the subgrade into the base, or to provide a working platform.

1.4 INSPECTION**HOLD POINT [Subgrade]**

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

1.5 SUBMISSIONS**Execution**

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.
- Sources of materials.

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.

Materials

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

Compliance of material: Provide certification and test results from a NATA registered laboratory confirming that the material conforms to the documented requirements.

Tests

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

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

- Maximum dry compressive strength: 1 per 5000 t (or part of).

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 and recycled material class

Requirement: Provide crushed rock and recycled material as documented, from the following classes:

- Class 1: Pavement base material (with a minimum plasticity index) for unbound pavements requiring a very high standard of surface preparation for a sprayed sealed or thin asphalt surfacing.
- Class 2: Pavement base material (with no minimum plasticity index) for unbound pavements which may not require a very high standard of surface preparation.
- Class 3: Not applicable.
- Class 4: Subbase material for unbound flexible pavements.

Crushed rock

Designation: Unbound crushed rock materials are designated as follows:

- CRB20-1: 20 mm nominal sized class 1 crushed rock base.
- CRB20-2: 20 mm nominal sized class 2 crushed rock base.
- CRS20: 20 mm nominal sized crushed rock subbase.
- CRS40: 40 mm nominal sized crushed rock subbase.

Recycled crushed concrete

Designation: Recycled crushed concrete materials are designated as follows:

- RCCB20-1: 20 mm nominal sized class 1 recycled crushed concrete base.
- RCCB20-2: 20 mm nominal sized class 2 recycled crushed concrete base.
- RCCS20: 20 mm nominal sized recycled crushed concrete subbase.

Natural gravel

Designation: Unbound natural gravel materials are designated as follows:

- NGB20: 20 mm nominal sized natural gravel base.
- NGS20: 20 mm nominal sized natural gravel subbase.
- NGS40: 40 mm nominal sized natural gravel subbase.

Base material properties

Base materials: Conform to the **Base material properties table**.

Base material properties table

Test method	Description	CRB20-1	CRB20-2	RCCB20-1	RCCB20-2	NGB20
AS 1289.3.6.1	Particle size distribution					
AS 1289.3.6.1	% passing 26.5 mm sieve	100	100	100	100	100
AS 1289.3.6.1	% passing 19.0 mm sieve	95-100	95-100	95-100	95-100	93-100
AS 1289.3.6.1	% passing 13.2 mm sieve	77-93	77-93	78-92	78-92	-
AS 1289.3.6.1	% passing 9.5 mm sieve	63-83	63-83	63-83	63-83	71-87
AS 1289.3.6.1	% passing 4.75 mm sieve	44-64	44-64	44-64	44-64	47-70
AS 1289.3.6.1	% passing 2.36 mm sieve	29-49	29-49	30-48	30-48	35-56
AS 1289.3.6.1	% passing 0.425 mm sieve	13-23	13-23	13-21	13-21	14-32
AS 1289.3.6.1	% passing 0.075 mm sieve	5-11	5-11	5-9	5-9	6-20
AS 1289.3.1.1	Liquid limit	max 30	max 30	max 35	max 35	max 25
AS 1289.3.3.1	Plasticity index:					
	All areas	min 2	-	min 2	-	-
	Areas with annual rainfall > 500 mm	max 6	max 6	max 6	max 6	max 6
	Areas with annual rainfall < 500 mm	max 10	max 10	max 10	max 10	max 10
AS 1289.3.4.1	Linear shrinkage:					
	All areas:	min 0.7	-	min 0.7	-	-
	Areas with annual	max 2.0	max 2.0	max 2.0	max 2.0	max 2.0

Test method	Description	CRB20-1	CRB20-2	RCCB20-1	RCCB20-2	NGB20
	rainfall > 500 mm					
	Areas with annual rainfall < 500 mm	max 4.0				
Direct measurement	Foreign materials in that fraction of RCCB retained on 4.75 mm sieve - % by mass:					
	High density (brick, etc.)	—	—	max 2.0	max 2.0	—
	Low density (plaster, etc.)	—	—	max 0.5	max 0.5	—
	Organic matter (wood, etc.)	—	—	max 0.1	max 0.1	—
	Asbestos and hazardous	—	—	0	0	—
AS 1141.52	Maximum dry compressive strength on fraction passing 19 mm sieve (only applies if plasticity index is less than 1)	min 1.7 MPa				
AS 1141.14	Particle shape by proportional calliper - % misshapen (2:1)	max 35%	max 35%	max 35%	max 35%	—
AS 1141.22	Aggregate wet strength*	min 100 kN	min 80 kN	min 100 kN	min 80 kN	—
AS 1141.22	Wet/dry strength variation* (dry - wet)/dry	max 35%	max 35%	max 35%	max 35%	—
AS 1289.6.1.1	4 day soaked CBR (98%)	min 80%				

Test method	Description	CRB20-1	CRB20-2	RCCB20-1	RCCB20-2	NGB20
	modified compaction)					
<p>NOTES:</p> <p>* All fractions of the proposed mix must satisfy this requirement. Use the fraction with the highest wet/dry strength variation as the value for determining conformance. Test the fraction 19.0 mm to 9.5 mm. In the case of blended materials, also test the fraction 9.5 mm to 4.75 mm. Test any other fraction which is at risk of failing in the opinion of the Engineer.</p>						

3 EXECUTION

3.1 SUBGRADE PREPARATION

General

Requirement: Prepare the subgrade in conformance with the *Earthwork* worksection.

3.2 PLACING BASE AND SUBBASE

General

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

Spreading: Spread material in uniform layers without segregation.

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

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

Joints

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

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

Final trimming

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

3.3 TOLERANCES

Surface level

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

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

Tolerances: Conform to the **Surface level tolerances table**. The tolerances apply to the finished level of each layer, unless overridden by the requirements (including tolerances) for the finished level and thickness of the wearing course.

Surface level tolerances table

Item	Level tolerance	
	Absolute	Relative
Subbase surface	+ 10 mm, - 25 mm	10 mm
Base surface	+ 10 mm, - 5 mm	5 mm

3.4 SUBBASE AND BASE COMPACTION

General

Construction operation: Compact each layer of fill to the required depth and density, as a systematic construction operation and to conform to the **Minimum relative compaction table**.

Minimum relative compaction table

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

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.

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 acknowledged, the subclause **Rectification** applies.

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 material to dry back to 60% to 80% of the optimum moisture content prior to application of seal or wearing course.

Rectification

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

Level corrections

General: Rectify incorrect levels as follows:

- High areas: Grade off.
- Low areas: Remove layers to a minimum depth of 75 mm, lightly tyne and replace with new material and recompact.

3.5 TESTING

Compaction control tests

Standard: To AS 1289.5.4.1 and AS 1289.5.4.2.

Frequency of compaction control tests

General: Not less than the following (whichever requires the most tests):

- 1 test per layer per 100 lineal metres for 2-lane roads.
- 1 test per layer per 2000 m² for carparks.
- 3 tests per layer.
- 3 tests per visit.

0272 ASPHALTIC CONCRETE

1 GENERAL**1.1 RESPONSIBILITIES****General**

General: Provide a finished asphaltic concrete surface as documented and as follows:

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

Design

Designer: Enlocus

Authority requirements: Hindmarsh Shire Council

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*

1.3 STANDARDS**General**

Hot mix asphalt: To AS 2150.

1.4 INTERPRETATION**Definitions**

General: For the purposes of this worksection the definitions given below apply:

- Absolute level tolerance: Maximum deviation from design levels.
- Lot: A lot consists of any part of the works which has been constructed/manufactured under a continuous operation of uniform conditions and is essentially homogeneous with respect to material and general appearance. The whole of the work included in a lot is of a uniform quality without obvious changes in attribute values.
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.
- Relative compaction: The ratio between the field bulk density and the bulk density of the job mix when compacted in the laboratory.

1.5 INSPECTION**Notice**

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

- Surface prepared for priming, sealing or asphalt surfacing.
- Commencement of asphalt surfacing.
- Completion of asphalt surfacing.

1.6 TOLERANCES

General: To the **Tolerances table** which applies to the finished level of each layer, unless overridden by the requirements (including tolerances) for the finished level and thickness of the surface course.

Tolerances table

Item	Level tolerance	
Level (Longitudinal)	± 10 mm Absolute	5 mm Relative
Level (Transverse)	± 10 mm Absolute	10 mm Relative
Compacted layer thickness (Any one sample)	+ 10 mm, - 5 mm.	
Edges abutting gutters	± 5 mm from the level of the lip of the gutter.	
Shape	Conform to AS 2150 Table 15.	

Item	Level tolerance
Roughness	Conform to AS 2150 Table 16.

1.7 SUBMISSIONS

Execution details

General: Submit proposals for work methods and equipment including the following:

- Survey control.
- 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.
- Methods and equipment for each operation.
- Material stockpiles.

Trial: Submit trial paving using the proposed job mix and all equipment as proposed. Trial may be incorporated into the final works, if satisfactory.

Products

Certificate of compliance: As an alternative to testing a product, submit the manufacturer's certificate together with the results of recent tests undertaken by the manufacturer, showing conformance with test criteria.

Proposals: Submit the following details before commencing production:

- Combined aggregate particle size distribution.
- Binder content expressed as a percentage of the total mix.
- The filler content expressed as a percentage by mass of the combined aggregates.
- The asphalt mix properties.
- The proposed mixing temperature.
- Sources of materials.
- Reclaimed asphalt pavement stockpile and proportion.

Samples

Samples: Submit samples to AS 1141.3.1 at least one month before use:

- Granular materials: Submit samples of each proposed type and size of asphalt and cover aggregate.

Identification: Attach a tag to each sample showing relevant information including description, source and nominal size of material.

2 PRODUCTS

2.1 AGGREGATE

Properties

Description: Clean, sound, hard, angular, of uniform quality, free from deleterious matter in conformance with the **Aggregate properties table**.

Standard: To AS 2758.5.

Mineral filler: To AS 2150 clause 4.2.

Combined aggregate grading: To AS 2150 clause 5.2.

Crushed slag: Air-cooled blast furnace slag of uniform quality, generally free from vesicular, glassy or other brittle pieces.

Fine aggregate: Clean, sound, hard, durable particles of natural sand or particles derived from crushed stone, gravel or slag, free from injurious coating or particles of clay, silt, loam or other deleterious matter.

Aggregate properties table

Property	Test method	Value
Particle shape	AS 1141.14	≤ 25 for wearing course ≤ 30 for binder course and

Property	Test method	Value
		corrective course
Wet strength	AS 1141.22	≥ 100 kN
Wet/dry strength variation	-	≤ 35%

2.2 ASPHALT

General

Hot mix asphalt: To AS 2150.

Medium cut back bitumen: To AS 2157.

Bitumen emulsion: To AS 1160.

Bitumen binder: Class 170.

Mix design

Design: To AS 2891.5 and AS 2150 and the Marshall method:

- Marshall stability: > 4.5 kN.
- Marshall flow: 2 - 4 mm.
- Voids in total mix (maximum theoretical density based on apparent specific gravity of aggregates):
 - . Wearing courses: 3% – 5%.
 - . Binder courses and 7 mm mixes: 4% – 6%.
- Voids in aggregate filled with bitumen:
 - . Wearing courses: 75% – 85%.
 - . Binder courses and 7 mm mixes: 70% – 80%.

Reclaimed asphalt pavement: To AS 2150 clause 4.6.

Warm mix asphalt additive

General: If required, include warm mix asphalt additive to asphalt to reduce the asphalt manufacturing temperature and/or to improve workability during the paving and compaction operations.

Product tests

General: Take samples from trucks at the mixing plant and test for mix properties using one of the following methods as applicable:

Standard: To AS 2150 Table 9 and AS 2891.5.

- Marshall stability of compacted mix:
 - . Compactive effort:
 - * 35 blows for light traffic,
 - * 50 blows for general conditions
 - * 75 blows for heavy traffic or deep lifts.

Variations in mix properties

General: Ensure that the maximum variation between the mix property of each sample and the job mix value conforms to the **Mix property table**.

Mix property table

Mix property	Maximum variation from job mix value
Aggregate passing 4.75 mm sieve or larger	± 7% by mass
Aggregate passing 2.36 mm to 300 µm sieves	± 5% by mass
Aggregate passing 150 µm sieve	± 2.5% by mass
Aggregate passing 75 µm sieve	± 1.5% by mass
Bitumen content	± 0.3% by mass
Added filler content	± 0.3% by mass
Mixing temperature	± 10°C

2.3 OTHER MATERIALS

Tactile ground surface indicators

Standard: To AS/NZS 1428.4.1.

3 EXECUTION

3.1 PREPARATION

Cleaning

Remove: Immediately before priming or tack coating remove loose stones, dust and foreign material from the base surface using a power broom or blower. Keep traffic off the cleaned surface.

Priming

Protection: Prime the base surface as soon as possible after compaction and finishing.

Potholes

Patching: Trim to a regular shape and a uniform depth of at least 75 mm, tack coat the edges and patch with asphaltic concrete.

Level anomalies

Final levels: Flush kerbing, gutter or other concrete or metal components may require level modification to achieve safe foot surfaces or drainage. Prepare adjacent asphaltic areas as for potholes to achieve uniform or tapered depth to match final levels.

Pre-treatment: Regulate to AS 2150 clause 14.3.2.

Protection

Adjacent surfaces: Protect adjacent surfaces during spraying. Protect freshly sprayed surfaces from contamination.

Tack coating

Application rate: Apply tack coat 30 – 120 minutes before asphalt surfacing is placed. Cover the surface uniformly at an application rate of 0.20 – 0.40 L/m² of residual bitumen.

3.2 SURFACING

Spreading

Conditions: Place asphalt surfacing in dry weather on a dry pavement surface at a pavement temperature of at least 10°C.

Operations: Spread the mix in layers covering the full width of the pavement, or, in the case of carriageways and wide pavements, in lanes of minimum width 3 m. Place layers in adjoining lanes to the same compacted thickness.

Method: Spreading by self propelled paving machine to AS 2150 clause 12.2.

Hand spreading: To AS 2150 clause 12.3.

Average thickness tolerance:

- Thickness > 50 mm: ± 10% of total thickness up to a maximum of ± 15 mm.

Frequently check thickness: Measure uncompacted and compacted layer to conform with AS 2150.

Abutting structures

Level: Place asphalt surfacing to match the level of abutting surfaces such as kerbs, gutters, edge strips, access chamber covers, or adjoining pavement in the same manner as for longitudinal and transverse joints.

Fill: Fill spaces left unfilled between the spreader run and abutting edges with sufficient material to the proper height before compaction.

Assess: On site level anomalies to determine the need to raise the surface level of a structure where the use of infill or tapered asphalt would create a local pedestrian trip hazard or effect the durability.

Matched junctions

Smooth joints: If asphalt surfacing is to match an existing pavement, bridge deck, rail or other fixture, place the material to provide a smooth riding surface across the junction.

As required: Remove existing pavement or taper the thickness of layers.

Junction: Terminate layers at a 20 mm deep and 400 mm wide chase cut into the existing pavement.

Remove: Coarse particles from a layer of tapering thickness using hand raking.

Tack coat: Where the thickness of the layer tapers to less than twice the nominal size of the mix, tack coat the area upon which material of such thickness is to be placed uniformly at an application rate 0.50 - 0.75 L/m².

Joints

Standard: To AS 2150 clause 12.6.

Minimise the number of joints: Make joints that are well bonded and sealed and provide a smooth riding surface across the joint.

Transverse joints: Construct a transverse joint if the operation is stopped for more than 20 minutes or the pavement temperature falls below 90 °C. Construct to a straight vertical face for the full depth of the layer, and offset in adjoining spreader runs and layer to layer by at least 1 m.

Longitudinal joints: Offset joints from layer to layer by at least 150 mm. Position longitudinal joints in the wearing course to coincide with the lane line.

Edges: Form exposed edges of each spreader run while hot to a straight line with a dense face inclined between vertical and 45°.

Cold joints: Tack coat the surface of cold longitudinal and transverse joint before placing the adjoining asphalt.

Compaction

Trimming: Before commencing compaction, correct any irregularities in line or level. Trim lane edges to a straight line.

Rolling: Compact asphalt surfacing uniformly as soon as it will support rollers without undue displacement, and complete rolling while the mix temperature is above 90 °C.

Density tests: Perform a field bulk density test for each test site from either of the following:

- On a core sample taken from the asphalt surfacing layer.
- If the nominal layer thickness is 50 mm or greater, measured in situ using a nuclear gauge.

Sample preparation: To AS 2891.2.1 and AS 2891.2.2, as applicable.

Number of tests per lot: To AS 2150, generally 6 tests per lot for simple/small works.

Nuclear gauge tests: To AS/NZS 2891.14.2.

3.3 COMPLETION

Rejection

Extent: Remove areas of rejected asphalt surfacing, including defective joints and finish, to the full depth of the layer, and replace with complying pavement.

Joints: Treat edges of remedial work as specified for cold joints.

Reinstating adjacent surfaces

General: Reinststate surfaces next to new pavements and associated elements. Where an existing flexible road pavement has been disturbed, trim it back to a straight and undisturbed edge 250 – 300 mm from and parallel to the new concrete for the full depth of the slab. Backfill with asphalt rammed solid, using suitable rammers.

Removal: Disposal of any residual or rejected material to a location off site.

Traffic on pavement

General: Give notice before opening the pavement to traffic before the work is completed. Provide protection.

Junctions with existing pavements

Trimming: Where the pavement is to be joined to an existing pavement remove a strip of the existing pavement at least 300 mm wide for its full depth and trim the edge to an angle of approximately 45 in steps of maximum height 150 mm before placing new pavement material.

Existing sealed pavement: Trim the seal to a neat edge.

Finished pavement properties

Tolerances: Check finished pavement levels, thickness and shape with the **Tolerances table**.

Reject surfaces: Where tolerances are exceeded reject surface.

3.4 TESTING

General

Tests: Perform tests of the type and frequency necessary to control the materials and processes used in the construction of the works and as documented in the **Tests schedule**.

Process control tests

Records: Show the results of process control tests on control charts or graphs displayed on site in a readily accessible location and updated daily.

Methods: Use wet preparation methods where applicable.

Sampling: Timing and location to AS 2891.1.1.

Compliance assessment tests

Timing: Obtain materials samples at the time of delivery to the site.

Location: Sample from selected sample sites within designated uniform test lots, consisting of an area placed, or compacted or both in one day. Test lots must be uniform in terms of material properties and density.

0278 GRANULAR SURFACES**1 GENERAL****1.1 RESPONSIBILITIES****General**

General: Provide base and granular surfacing as documented and as follows:

- To the level tolerances.
- To the compaction requirements.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*

2 PRODUCTS**2.1 MATERIALS****Base**

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.

Granular surface material

Gravel: Unscreened natural stone as follows:

- 3% cement stabilised granitic gravel toppings as specified to be installed in 2 layers, 'lilydale topping. Refer to detail.

3 EXECUTION**3.1 SUBGRADE****Preparation**

Excavation: Cut and trim the subgrade to enable the finished compacted thickness to finish flush with adjacent surfaces.

3.2 BASE**Gravel surfaces**

Method: Mechanically spread material to the loose thickness required to produce the documented finished compacted thickness. Do not transport new material over uncompacted material. If the subgrade is disturbed during placing or becomes mixed with new material, remove all contaminated material and replace, regrade and compact.

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.

3.3 COMPACTION**Subgrade and base**

Hand compaction: Condition the material by moisture adjustment before compaction. Compact to 95% of the maximum dry density.

Sampling: To AS 1289.1.2.1.

Testing: To AS 1289.5.1.1, AS 1289.5.3.1 or AS 1289.5.8.1.

3.4 SURFACING**Finished levels**

Absolute level tolerance: ± 10 mm from the documented profile.

Gravel

Thickness: Spread loose material screeded to 25 mm minimum over the compacted base.

Decomposed granite

Thickness: Spread blended dry mix screeded to 100 mm minimum over the compacted subgrade.

Compaction: To 90% of the maximum dry density when tested to AS 1289. Discard stones more than 25 mm.

Moisture: Do not water in the surface material. Allow the natural ground water to rise and stabilise the mixture.

Stabilised sand surface

Thickness: Spread loose material screeded to 100 mm minimum over the compacted subgrade and consolidate by rolling and watering.

Stabilising: General purpose cement at the rate of 5% of the sand spread over the prepared sand surface. Rotary hoe the cement throughout the entire mix and re roll.

Existing sand/earth

Stabilising: 1 part Portland cement to 6 of the sand/earth spread over the prepared surface. Rotary hoe the cement to a depth of 130 mm and consolidate by rolling.

0310 CONCRETE – COMBINED**1 GENERAL****1.1 RESPONSIBILITIES****General**

General: Provide cast concrete, as documented and as follows:

- Conforming to the design details and performance criteria.
- Satisfying quality and inspection requirements.
- Compatible with documented finishes.

Design

Designer: Enlocus

Formwork: The design of formwork, other than profiled steel sheeting composite formwork, 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.

Post-tensioning: To AS 3600.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*

1.3 STANDARDS**General**

Formwork design and construction, formed surfaces: To AS 3610 and AS 3610.1.

Plywood formwork: To AS 6669.

Profiled steel sheeting, including shear connectors: To AS 2327.1.

Specification and supply of concrete: To AS 1379.

Concrete materials and construction: To AS 3600.

Residential ground slabs and footings: To AS 2870.

Post-tensioning: To AS 3600.

Concrete structures for retaining liquids: To AS 3735.

Strand, bar and wire: To AS/NZS 4672.1.

1.4 INTERPRETATION**Definitions**

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

- Anti-burst reinforcement: Reinforcement cage surrounding anchorages to control the tensile bursting stresses.
- Ambient temperature: The air temperature at the time of mixing and placing of concrete.

- Average ambient temperature: Average value of the daily maximum and minimum ambient temperatures over the relevant period at a site.
- Batch: A quantity of concrete containing a fixed quantity of ingredients and produced in a discrete operation.
- Concrete class:
 - . Normal: Concrete which is specified primarily by a standard compressive strength grade and otherwise conforming to AS 1379 clause 1.5.3.
 - . Special: Concrete which is specified to have certain properties or characteristics different from, or additional to, those of normal-class concrete and otherwise conforming to AS 1379 clause 1.5.4.
- Early age strength: A mean compressive strength at 7 days exceeding the values shown in AS 1379 Table 1.2.
- Formwork:
 - . Jump formwork: Incrementally moved formwork.
 - . Lost formwork: Sacrificial formwork left in place.
 - . Slip formwork: Continuously slipped or moving formwork.
 - . Table forms: Prefabricated and re-usable formwork systems for slabs and beams.
- Green concrete: Concrete which has set but not appreciably hardened.
- Production assessment: An assessment procedure for concrete specified by strength grade, carried out by the supplier on concrete produced by a specific supplying plant and based on the statistical assessment of standard compressive strength tests on concrete.
- Project assessment: An assessment procedure for concrete specified by strength grade, specified at the customer's option, which provides additional test data for the statistical assessment of concrete supplied to a specific project.
- Sample: A portion of the material used in the works, or to take such a sample.
- Specimen: A portion of a sample which is submitted for testing.
- Weather:
 - . Cold: Ambient shade temperature < 10°C.
 - . Hot: Ambient shade temperature > 30°C.

1.5 INSPECTION

HOLD POINT [Concrete]

- **Base or subgrade before covering.**
- **Completed formwork and reinforcement, tendons, cores, fixings and embedded items fixed in place.**
- **Concealed surfaces or elements before covering.**
- **Commencement of concrete placing.**
- **Evaluation of the off-form finishes.**
- **Evaluation of surface finish.**

1.6 TOLERANCES

Formwork

Plumb of elements > 8 m high: 1:1000.

Plumb of elements ≤ 8 m high: To AS 3610.1.

Position: Construct formwork so that finished concrete conforms to AS 3600 clause 17.5.

Reinforcement

Fabrication and fixing: To AS 3600 clause 17.2.

Reinforcement and tendon position: To AS 3600 clause 17.5.3.

Finishes

Formed surfaces quality of surface finish: To AS 3610.1 Table 3.3.2.

Unformed surfaces flatness: To the **Flatness tolerance class table**, for the documented class of finish, using a straightedge placed anywhere on the surface in any direction.

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

Design

Loading: Submit details of proposed construction systems, loads and procedures, including propping and re-shoring.

Execution details

Surface repair method: Submit details of any proposed surface repair method before starting repairs.

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

- Changes to the concrete mix.
- Curing and protection methods.
- Cutting or displacing reinforcement, or cutting or coring hardened concrete.
- Handling, placing, compaction and finishing methods and equipment, including pumping.
- Sequence and times for concrete placement, and construction joint locations and relocations.
- Site storage, mixing and transport methods and equipment, if applicable.
- Temperature control methods.
- Sequence of concrete placement: Submit details of any proposed If sequential placement of slab segments.
- Sawn joints: Submit details of proposed methods, timing and sequence of sawing joints.

Reinforcement: Submit the following:

- General: Details of any proposed changes to documented reinforcement.
- Damaged galvanizing: Details of proposed repair to AS/NZS 4680 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.
- Splicing: Details of any proposed changes to documented requirements.
- Welding: Details of any proposed welding of reinforcement.

Post-tensioning: Submit the following:

- Details of the proposed post-tensioning system tested and certified to AS/NZS 1314, including performance test certificates for each type and size of anchorage and coupler.
- Safe work method statements including the name and contact details of the subcontractor.
- Concrete strength early age test results.

Pre-mixed supply delivery dockets: For each batch, submit a docket listing the information required by AS 1379, and the following:

- For special class performance concrete: Documented performance and type of cement binder.
- For special class prescription concrete: Details of mix, additives, and type of cement binder.

- Method of placement and climate conditions during pour.
- Name of concrete delivery supervisor.
- Project assessment carried out each day.
- The concrete element or part of the works for which the concrete was ordered, and where it was placed.
- The total amount of water added at the plant and the maximum amount permitted to be added at the site.

Materials

Product conformity: Submit current assessments of conformity, as appropriate, as follows:

- Certificate of conformity by a JAS-ANZ accredited third party.

Concrete mixes: Submit details, for each grade and type of concrete including any proposed use of special-purpose cement types.

Curing compounds: Submit details of any proposed liquid membrane-forming curing compound, including the following:

- Certified test results for water retention to AS 3799 Appendix B.
- 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.

Void formers: Use void formers tested under laboratory conditions. 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.

Submit certified test results to verify conformance with the following requirements:

- 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.
- Collapse and loss of load carrying capacity occurs not more than 48 hours after flooding with water, creating a void at least 60% of the original depth of the void former.

Reinforcement strength and ductility: Submit type-test reports to verify conformance to AS 3600 Table 3.2.1 for each reinforcement type.

Samples

Coloured concrete: Submit sample blocks of coloured concrete produced using the proposed mix and method before casting final concrete as follows:

- Number: 1.
- Size (nominal): 300 x 300 x 50 mm.

Subcontractors

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

Tests

Site tests: Submit results, as follows:

- Concrete compressive strength test results to AS 1012.9.

2 PRODUCTS

2.1 MATERIALS

General

Stockpile: If uniform, consistent colour is documented, stockpile sand, cement and aggregates.

Aggregates

Standard: To AS 2758.1.

Cement

Standard: To AS 3972.

Age: Less than 6 months old.

Storage: Store cement bags under cover and above ground.

Water

Standard: To AS 1379 clause 2.4.

Requirement: Clean, free from oil, acid, alkali, organic or vegetable matter and including not more than 500 mg/l of chloride ions.

Polymeric film underlay

Vapour barriers and damp-proofing membranes: To AS 2870 clause 5.3.3.

Chemical admixtures

Standard: To AS 1478.1.

Contents: Free of chlorides, fluorides and nitrates.

Curing compounds

Curing compounds: To AS 3799.

2.2 CONCRETE

Properties

Concrete mix and supply: Conform to the following:

- Normal-class: To AS 1379 clause 1.5.3.
 - . Properties: As documented in the plans.
- Special-class: To AS 1379 clause 1.5.4.
 - . Properties: As documented in the plans.

Coloured concrete

Standard: To AS 3610.1.

2.3 TESTING

General

Test authority: Concrete supplier or NATA registered laboratory.

Reports and records of test results: To the relevant parts of the AS 1012 series. Keep results on site.

Assessment process of test results

Standard: To AS 1379.

Method of assessment: Project assessment.

Sampling

Method of sampling: AS 1012.1.

Sampling locations: To AS 1012.1 and the following:

- Slump tests: On site, at the point of discharge from the agitator.
- Compressive strength tests: Spread the site sampling evenly throughout the pour.

Frequency of sampling: To AS 1379 Sections 5 and 6 and the following:

- Slump tests: Take at least one sample from each batch.
- Compressive strength tests: To the **Project assessment strength grade sampling table**.

Project assessment strength grade sampling table

Number of batches for each type and grade of concrete per day	Minimum number of samples: Columns and load bearing wall elements (per batch)	Minimum number of samples: Other elements (per day)
1	1	1
2-5	1	2
6-10	1	3
11-20	1	4
each additional 10	1	1 additional

Making and curing of specimens

General: To AS 1012.8.1 and AS 1012.8.2.

Specimens for compressive strength tests: Make and cure at least two specimens from the sample of each grade.

Specimen size:

- Aggregate size ≤ 20 mm: Nominally 200 x 100 mm diameter.
- Aggregate size > 20 mm: Nominally 300 x 150 mm diameter.

Test methods

General: To the relevant parts of the AS 1012 series.

Acceptance criteria:

- General: As documented in the **Concrete properties schedule – performance**.
- Early age compressive strength: As documented in the **Control tests schedule**.

Slump tests: Assess slump for every batch. Perform slump test on each strength sample.

Drying shrinkage at 56 days: To AS 1012.13.

Embedded pressure pipes

General: Complete leak tests before embedding pipes.

Liquid retaining structures

Testing for liquid tightness: To AS 3735.

2.4 FORMWORK

General

Form linings, facings and release agents: Compatible with finishes applied to concrete.

Lost formwork: Free of timber or chlorides, and not to impair the structural performance of the concrete members.

Void formers: Material capable of maintaining rigidity and shape until the concrete has set, capable of withstanding construction loads and non-collapsible on absorption of moisture.

Profiled steel sheeting composite formwork

Material: Hot-dipped zinc-coated sheet steel to AS 1397.

Minimum steel grade: G550.

Zinc coating weight: Z350: 350 g/m² zinc coating weight is recommended for use in non-aggressive areas

Accessories: Adopt material and corrosion protection to match the profiled steel sheeting.

Plywood formwork

Material: Plywood sheeting to AS 6669.

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 Section 3.

2.5 REINFORCEMENT

Fibre reinforcement

Standard: To CIA CPN35.

Steel reinforcement

Standard: To AS/NZS 4671.

Shape: R, N and welded wire mesh

Ductility class: To AS/NZS 4671 clause 5.2(c): L (low), N (normal)

Strength grade and ductility class: AS/NZS 4671 considers only 3 strength grades 250 MPa, 300 MPa and 500 MPa

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

Protective coating

Standard: To AS 3600 clause 17.2.1.2.

General: 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.

- Thickness: 200 µm minimum.

Galvanizing: To AS/NZS 4680, as follows:

- Sequence: If fabricating after galvanizing, repair damaged galvanising and coat cut ends.
- Zinc-coating (minimum): 600 g/m².

Tie wire

General: Annealed steel 1.25 mm diameter (minimum).

External and corrosive applications: Galvanized.

2.6 MISCELLANEOUS

Surface hardeners, sealants and protectors

Supply: If documented, provide proprietary products conforming to the manufacturer's specifications.

Slip resistance treatment

Slip resistance classification: To AS/NZS 4586.

3 EXECUTION

3.1 POLYMERIC FILM UNDERLAY

Location

General: Under slabs on ground, including integral ground beams and footings, provide a vapour barrier or, in areas prone to rising damp or salt attack, a damp-proofing membrane.

Base preparation

General: Conforming to base type, as follows:

- Concrete working base: Remove projections above the plane surface, and loose material.

- Graded prepared subgrade: Blind with sufficient sand to create a smooth surface free from hard projections. Lightly wet the sand just before laying the underlay.

Installation

Standard: To AS 2870 clause 5.3.3.

General: 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.

Preparation

Cleaning: Before placing concrete, remove free water, dust, debris and stains from the formwork and the formed space.

Bolt holes

Removable bolts: Remove tie bolts without damaging the concrete.

Formwork tie bolts left in the concrete: Position more than 50 mm from the finished surface.

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.

Corners

Work above ground: Fillet at re-entrant angles, and chamfer 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.

Openings

Inspection: In vertical formwork 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 linings and facings.

Slip formwork

Provision for inspection: Provide access below the moveable formwork for surface treatment and inspection.

Profiled steel sheeting composite formwork

Fixing: If sheeting cannot be fixed to structural steel supports with puddle welds, or with welded shear studs in composite construction, provide details of proposed fixings.

Steel linings

Rust: Clean off any rust and apply rust inhibiting agent before 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**Dowels**

Fixing: If a dowel has an unpainted half, embed in the concrete placed first.

Tolerances:

- Alignment: 1:50.
- Location: \pm half the diameter of the dowel.

Grade: 250 N.

Cover

Concrete cover generally: To AS 3600 clause 4.10.

Concrete cover for structures for retaining liquids: To AS 3735.

Concrete cover for residential ground slabs and footings: To AS 2870.

Supports

Proprietary concrete, metal or plastic supports: Provide chairs, spacers, stools, hangers and ties, 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 diameters.
- Mesh: \leq 800 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.

Tying

General: 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.

Beams: Tie stirrups to bars in each corner of each stirrup. Fix other longitudinal bars to stirrups at 1 m maximum intervals.

Bundled bars: Tie bundled bars in closest possible contact. Provide tie wire of 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 ties at every intersection.

Mats: For bar reinforcement in the form of a mat, secure each bar at alternate intersections.

3.4 CONCRETE**General**

Conformance: As documented in the plans.

Elapsed delivery time

General: Make sure the elapsed time between the wetting of the mix and the discharge of the mix at the site conforms to 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)
10 – 24	120
24 – 27	90
27 – 30	60
30 – 32	45

Pre-mixed supply

Addition of water: To AS 1379 clause 4.2.3.

Transport method: Prevent segregation, loss of material and contamination of the environment, and do not 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.

3.5 CORES, FIXINGS AND EMBEDDED ITEMS**Adjoining elements**

Fixings: Provide fixings for adjoining elements. If required, provide temporary support to the adjoining elements during concreting, to prevent movement.

Protection

General: Grease threads. Protect embedded items against damage.

Compatibility: Provide inserts, fixings and embedded items that are compatible with each other, with the reinforcement and with the documented concrete mix and the documented surface finish.

Corrosion: In external or exposed locations, galvanize anchor bolts and embedded fixings.

Structural integrity

Position: Fix cores and embedded items to prevent movement during concrete 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.

Tolerances

General: Maximum deviation from correct positions:

- Anchor bolt groups for structural steel: To AS 4100.
- Cores and embedded items generally: 10 mm.
- Other fixing bolts: 3 mm.

3.6 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 tolerance

Deviation: Flatness tolerance Class B.

3.7 PLACING AND COMPACTION

Placing

Horizontal transport: Use suitable conveyors, clean chutes, troughs, hoppers or pipes.

Methods: Avoid segregation and loss of concrete, and minimise plastic settlement. Maintain a nominally vertical and plastic concrete edge during placement.

Layers: Place concrete in layers not more than 300 mm thick. Compact the following layer into previous layer before previous layer has taken initial set.

Compaction

Methods: Use immersion and screed vibrators accompanied by hand methods as appropriate to remove entrapped air and to fully compact the mix.

Vibrators: Do not allow vibrators to contact set concrete, reinforcement or items including pipes and conduits embedded in concrete. Do not use vibrators to move concrete along the formwork. Avoid causing segregation by over-vibration.

Placing records

Log book: Keep on site and make available for inspection a log book recording each placement of concrete, including the following:

- Date.
- Specified grade and source of concrete.
- Slump measurements.
- The portion of work.
- Volume placed.

Rain

Protection: During placement and before setting, protect the surface from damage.

Vertical elements

Placement: Limit the free fall of concrete to maximum of 2000 mm.

Placing in cold weather

Cement: Do not use high alumina cement.

Placing concrete: Maintain temperature of the freshly mixed concrete at 5°C or more.

Formwork and reinforcement: Before and during placing maintain temperature at 5°C or more.

Severe weather: If severe 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 within the documented limits.

Admixtures: Do not use calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete.

Frozen materials: Do not allow frozen materials or materials containing ice to enter the mixer, and keep free of frost and ice any formwork, materials, and equipment coming in contact with the concrete.

Maximum temperature of water: 60°C when placed in the mixer.

Freezing: Prevent concrete from freezing.

Placing in hot weather

Handling: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses. Mix, transport, place and compact the concrete conforming to the **Elapsed delivery time table**.

Placing concrete: Maintain the temperature of the freshly mixed concrete conforming to the **Hot weather placing table**.

Evaporation control barriers: Erect barriers to protect freshly placed concrete from drying winds.

Formwork and reinforcement: Before and during placing, maintain temperature at 35°C or less.

Temperature control: Select one or more of the following methods of maintaining the temperature of the placed concrete at 35°C or less:

- Cool the concrete using liquid nitrogen injection before placing.
- Cover horizontal transport containers.
- Spray the coarse aggregate using cold water before mixing.
- Use chilled mixing water.

Hot weather placing table

Concrete element	Temperature limit
Normal concrete in footings, beams, columns, walls and slabs	35°C
Concrete in sections 1 m or more in all dimensions except for concrete of strength 40 MPa or more, in sections exceeding 600 mm in thickness	27°C

3.8 CURING

General

Requirements: Taking into account the average ambient temperature at site over the relevant period affecting the curing, adopt procedures to make sure of the following:

- Curing: Cure continuously from completion of finishing until the total cumulative number of days or fractions of days, during which the air temperature in contact with the concrete is above 10°C, conforms to the following, unless accelerated curing is adopted:
 - . Fully enclosed internal surfaces/Early age 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 method: To be nominated by Contractor and approved by the Superintendent.

Curing compounds

Application: Provide a uniform continuous flexible coating without visible breaks or pinholes, which remains unbroken at least for the required curing period after application.

Substrates: Do not use wax-based or chlorinated rubber-based curing compounds on surfaces forming substrates to applied finishes, concrete toppings and cement-based render.

Self levelling toppings: If used also as curing compounds, conform to AS 3799.

Visually important surfaces: Apply curing compounds to produce uniform colour on adjacent surfaces.

Cold weather curing

Temperature: Maintain concrete surface temperatures above 5°C for the duration of the curing period.

Hot weather curing

Curing compounds: If curing compounds are proposed, provide details.

Protection: Select a protection method from the following:

- If the concrete temperature is more than 25°C or if not protected against drying winds, protect the concrete using a fog spray application of aliphatic alcohol evaporation retardant.
- If ambient shade temperature is more than 35°C, protect from wind and sun using an evaporative retarder until curing is commenced.
- Immediately after finishing, either cover exposed surfaces using an impervious membrane or hessian kept wet until curing begins, or apply a curing compound.

3.9 JOINTS

Sawn Joints

HOLD POINT [SAWN JOINTS - chalked line approval]

All sawn joints are to be chalked on surface to the location shown on drawings. Contractor to get approval of chalked layout from Superintendent before proceeding with cutting.

The location of sawn joints shall be as shown on the plans. Sawing shall commence within 6-18 hours after pour, regardless of time or weather conditions. The line of the joint shall be without any discontinuities. Neither edge shall deviate from a 3m straight edge by more than 10 mm.

Sawcuts are to be machine cut only at - 4mm wide and 30mm deep - following approved chalked line.

The joint surface shall not exhibit any horizontal edge dislodging of aggregate particles. Saw debris shall be washed from the joint and pavement immediately after sawing.

Construction joints

Location: Do not relocate or eliminate construction joints, or form undocumented construction joints. If emergency construction joints are made necessary by unforeseen interruptions to the concrete pour, submit a report on the action taken.

Finish: Butt join the surfaces of adjoining pours. In visually important surfaces make the joint straight and true, and free from blemishes impermissible for its surface finish class.

Preparation: Roughen and clean the hardened concrete joint surface. Remove loose or soft material, free water, foreign matter and laitance. Dampen the surface just before placing the fresh concrete and coat with a neat cement slurry.

Expansion joints

Joint filling: Fill with jointing materials as documented. Finish visible jointing material neatly flush with adjoining surfaces.

Preparation: Before filling, dry and clean the joint surfaces, and prime.

Watertightness: Apply the jointing material so that joints subject to ingress of water are made watertight.

Jointing materials: Provide jointing materials compatible with each other, and non-staining to concrete in visible locations.

Bond breaking: Provide back-up materials for sealants, including backing rods, which do not adhere to the sealant.

Foamed materials (in compressible fillers): Closed-cell or impregnated, not water absorbing.

3.10 SURFACE MODIFIERS

General

Application: Apply to clean surfaces to the manufacturer's specifications.

3.11 FORMED SURFACES

General

Surface finish: As documented on the Surfaces Treatment plan

Damage: Do not damage concrete works through premature removal of formwork.

Curing

General: If formwork is stripped before the minimum curing period, for the concrete has elapsed, continue curing the exposed faces as soon as the stripping is completed.

Evaluation of formed surfaces

General: If evaluation of formed surface tolerance or colour is required, complete the evaluation before surface treatment.

Surface repairs

Method: If surface repairs are required, submit proposals.

HOLD POINT [Surface Finishes]

- **Principal to inspect and approve a sample panel of each nominated surface finish**
- **Principal to inspect and approve a sample panel of each nominated concrete colour**

Finishing methods

Details: If soffits of concrete elements or faces of concrete columns are to have a finish other than an off-form finish, provide finishes as documented.

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.
- Type of abrasive particles: Fine 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: Remove the vertical face formwork while the concrete is green. Wet the surface and scrub using stiff fibre or wire brushes, using clean water freely, until the aggregate is uniformly exposed. Do not use acid etching. Rinse the surface with clean water.

Floated finishes:

- Steel float finish: Remove the vertical face formwork while the concrete is green. Wet the surface and rub using a steel float followed by a timber float.
- Grout floated finish: Remove the vertical face formwork while the concrete is green. Dampen the surface and spread a slurry, using hessian pads or sponge rubber floats. Remove surplus slurry and work until a uniform colour and texture are produced.

3.12 UNFORMED SURFACES**General**

Surface finish: As documented on the Surfaces Treatment plan.

Finished levels: Strike off, screed and level slab surfaces to finished levels and to the flatness tolerance class documented.

Surface repairs

Method: If surface repairs are required, submit proposals.

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.

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.

- Type of abrasive particles: Fine aggregate

Coloured applied finish: After machine floating, apply a proprietary liquid or dry shake material to the manufacturer's specifications and trowel to achieve the required appearance.

Colour: Refer to Surface Treatment plan

Exposed aggregate: After steel trowelling, grind the cured surface of the concrete to expose the coarse aggregate.

3.13 COMPLETION

Formwork removal

Extent: Remove formwork, other than profiled steel sheeting composite formwork and lost formwork, including formwork in concealed locations.

Timing: Do not disturb formwork until concrete is hardened enough to withstand formwork movements and removal without damage.

Stripping:

- General: To AS 3600 where it is more stringent than AS 3610.1.
- Vertical formwork: To AS 3610.1 Appendix B Table B1.
- Post-tensioned concrete: Remove formwork supporting post-tensioned concrete members to AS 3600 clause 17.6.2.7.

Protection

General: Protect the concrete from damage due to construction loads, physical and thermal shocks, and excessive vibrations, particularly during the curing period.

Surface protection: Protect finished concrete surfaces and applied finishes from damage.

0311 CONCRETE FORMWORK**1 GENERAL****1.1 RESPONSIBILITIES****General**

General: Provide formwork, as documented.

Design

Designer: Enlocus

Authority requirements: Hindmarsh Shire Council

Formwork: The design of formwork, other than profiled steel sheeting composite formwork, 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).

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*
- *Concrete finishes.*

1.3 STANDARDS**General**

Formwork design and construction: To AS 3610 and AS 3610.1.

Plywood formwork: To AS 6669.

Profiled steel sheeting, including shear connectors: To AS 2327.1.

Concrete materials and construction: To AS 3600.

1.4 INTERPRETATION**Definitions**

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

- Formwork:
 - . Jump formwork: Incrementally moved formwork.
 - . Lost formwork: Sacrificial formwork left in place.
 - . Slip formwork: Continuously slipped or moving formwork.
 - . Table forms: Prefabricated and reusable formwork systems for slabs and beams.

1.5 INSPECTION**Notice****HOLD POINT [Formwork]**

- **Completed formwork before placing concrete.**

1.6 TOLERANCES

Formwork

Plumb of elements > 8 m high: 1:1000.

Plumb of elements ≤ 8 m high: To AS 3610.1.

Position: Construct formwork so that finished concrete conforms to AS 3600 clause 17.5.3 and as documented in the **Dimensional deviations schedule**.

1.7 SUBMISSIONS

Execution details

Moveable formwork: Provide the following details on the formwork drawings:

- Table, slip and jump forms: Proposed method and sequence of moving the formwork to provide concrete of the documented quality and surface finish.
- Slip forms: The average rate of movement.

Re-shoring: Submit details of any proposed re-shoring.

Surface repair method: Submit details of any proposed surface method before starting repairs.

Materials

Void formers: Use void formers tested under laboratory conditions. 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. Submit certified test results to verify conformance with the following requirements:

- 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.
- Collapse and loss of load carrying capacity occurs not more than 48 hours after flooding with water, creating a void at least 60% of the original depth of the void former.

2 PRODUCTS

2.1 MATERIALS

General

Form linings, facings and release agents: Compatible with finishes applied to concrete.

Lost formwork: Free of timber or chlorides and not to impair the structural performance of the concrete members.

Void formers: Material capable of maintaining rigidity and shape until the concrete has set, capable of withstanding construction loads and non-collapsible on absorption of moisture.

Profiled steel sheeting composite formwork

Material: Hot-dipped zinc-coated sheet steel to AS 1397.

Minimum steel grade: G550.

Zinc coating weight: Z350: 350 g/m² zinc

Accessories: Adopt material and corrosion protection to match the profiled steel sheeting.

Plywood formwork

Material: Plywood sheeting to AS 6669.

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 Section 3.

3 EXECUTION

3.1 PREPARATION

Cleaning: Before placing concrete remove free water, dust, debris and stains from the formwork and the formed space.

3.2 CONSTRUCTION

General

Requirement: Conform to the *Concrete finishes* worksection.

Bolt hole filling

Removable bolts: Remove tie bolts without damaging the concrete.

Formwork tie bolts left in the concrete: Position more than 50 mm from the finished surface.

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.

Corners

Work above ground: Chamfer at re-entrant angles, and 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.

Openings

General: In vertical forms provide form 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 linings and facings.

Slip formwork

Provision for inspection: Provide access below the movable formwork, from which surface treatment and inspection may be carried out.

Steel linings

Rust: Clean off any rust and apply rust inhibiting agent prior to reuse.

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 COMPLETION

Formwork removal

Extent: Remove formwork, other than profiled steel sheeting composite formwork and lost formwork, including formwork in concealed locations.

Timing: Do not disturb formwork until concrete is hardened enough to withstand formwork movements and removal without damage.

Stripping:

- General: To AS 3600 where it is more stringent than AS 3610.1.
- Vertical formwork: To AS 3610.1 Appendix B Table B1.
- Post-tensioned concrete: Remove formwork supporting post-tensioned concrete members to AS 3600 clause 17.6.2.7.

0312 CONCRETE REINFORCEMENT**1 GENERAL****1.1 RESPONSIBILITIES****General**

General: Provide concrete reinforcement, as documented.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*
- *Concrete in situ.*

1.3 STANDARDS**General**

Concrete materials and construction: To AS 3600.

1.4 INSPECTION**HOLD POINT [Concrete reinforcement]**

- **Reinforcement fixed in place, with formwork completed.**

1.5 TOLERANCES**General**

Fabrication and fixing: To AS 3600 clause 17.2.

Reinforcement position: To AS 3600 clause 17.5.3.

1.6 SUBMISSIONS**Execution details**

Reinforcement: Submit the following:

- General: Details of any proposed changes to documented reinforcement.
- Damaged galvanizing: Details of proposed repair to AS/NZS 4680 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.
- Splicing: Details of any proposed changes to documented requirements.
- Welding: Details of any proposed welding of reinforcement.

Materials

Reinforcement strength and ductility: Submit type-test reports to verify conformance to AS 3600 Table 3.2.1 for each reinforcement type.

2 PRODUCTS**2.1 MATERIALS****Fibre reinforcement**

Standard: To CIA CPN35.

Steel reinforcement

Standard: To AS/NZS 4671:

Shape: R, N and welded wire mesh

Ductility class: To AS/NZS 4671 clause 5.2(c): L (low), N (normal)

Strength grade and ductility class: AS/NZS 4671 considers only 3 strength grades 250 MPa, 300 MPa and 500 MPa

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

Protective coating

Standard: To AS 3600 clause 17.2.1.2.

General: 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: Provide a high build, high solids, chemically resistant coating.

- Thickness: 200 µm minimum.

Galvanizing: To AS/NZS 4680, as follows:

- Sequence: If fabricating after galvanizing, repair damaged galvanizing and coat cut ends.
- Zinc-coating (minimum): 600 g/m².

Tie wire

General: Annealed steel 1.25 mm diameter (minimum).

External and corrosive applications: Galvanized.

3 EXECUTION

3.1 CONSTRUCTION

Dowels

Fixing: If a dowel has an unpainted half, embed in the concrete placed first.

Tolerances:

- Alignment: 1:150.
- Location: ± half the diameter of the dowel.

Grade: 250 N.

Cover

Concrete cover generally: To AS 3600 clause 4.10.

Concrete cover for residential ground slabs and footings: To AS 2870.

Supports

Proprietary concrete, metal or plastic supports: Provide chairs, spacers, stools, hangers and ties, 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: ≤ 60 diameters.
 - . Mesh: ≤ 800 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.

Tying

General: 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.

Beams: Tie stirrups to bars in each corner of each stirrup. Fix other longitudinal bars to stirrups at 1 m maximum intervals.

Bundled bars: 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 ties at every intersection.

Mats: For bar reinforcement in the form of a mat, secure each bar at alternate intersections

0314 CONCRETE IN SITU**1 GENERAL****1.1 RESPONSIBILITIES****General**

General: Provide concrete in situ, as documented and as follows:

- Conforming to the design details and performance criteria.
- Satisfying the quality and inspection requirements.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*
- *Concrete formwork.*
- *Concrete reinforcement.*
- *Concrete finishes.*

1.3 STANDARDS**General**

Concrete materials and construction: To AS 3600.

Specification and supply of concrete: AS 1379.

Concrete structures for retaining liquids: To AS 3735.

1.4 INTERPRETATION

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.
- Average ambient temperature: Average value of the daily maximum and minimum ambient temperatures over the relevant period at a site.
- Batch: A quantity of concrete containing a fixed quantity of ingredients and produced in a discrete operation.
- Concrete class:
 - . Normal: Concrete which is specified primarily by a standard compressive strength grade and otherwise conforming to with AS 1379 clause 1.5.3.
 - . Special: Concrete which is specified to have certain properties or characteristics different from, or additional to, those of normal-class concrete and otherwise conforming to with AS 1379 clause 1.5.4.
- Early age strength: A mean compressive strength at 7 days exceeding the values shown in AS 1379 Table 1.2.
- Green concrete: Concrete which has set but not appreciably hardened.
- Production assessment: An assessment procedure for concrete specified by strength grade, carried out by the supplier on concrete produced by a specific supplying plant and based on the statistical assessment of standard compressive strength tests on concrete.
- Project assessment: An assessment procedure for concrete specified by strength grade, specified at the customer's option, which provides additional test data for the statistical assessment of concrete supplied to a specific project.
- Sample: A portion of the material used in the works, or to take such a sample.
- Specimen: A portion of a sample which is submitted for testing.

- Weather:
 - . Cold: Ambient shade temperature < 10°C.
 - . Hot: Ambient shade temperature > 30°C.

1.5 INSPECTION

HOLD POINT [Concrete reinforcement]

- **Base or subgrade before covering.**
- **Membrane or film underlay installed on the base or subgrade.**
- **Completed formwork and reinforcement, tendons, cores, fixings and embedded items fixed in place.**
- **Concealed surfaces or elements before covering.**
- **Commencement of concrete placing.**

1.6 SUBMISSIONS

Design

Loading: Submit details of proposed construction systems, loads and procedures, including propping and re-shoring.

Execution details

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

- Changes to the concrete mix.
- Curing and protection methods.
- Curing period for low-pressure steam curing.
- Cutting or displacing reinforcement, or cutting or coring hardened concrete.
- Handling, placing, compaction and finishing methods and equipment, including pumping.
- Sequence and times for concrete placement, and construction joint locations and relocations.
- Site storage, mixing and transport methods and equipment, if applicable.
- Temperature control methods.
- Sequence of concrete placement: Submit details of any proposed sequential placement of slab segments.
- Sawn joints: Submit details of proposed methods, timing and sequence of sawing joints.

Pre-mixed supply delivery docket: For each batch, submit a docket listing the information required by AS 1379, and the following:

- For special class performance concrete: Documented performance and type of cement binder.
- For special class prescription concrete: Details of mix, additives, and type of cement binder.
- Method of placement and climate conditions during pour.
- Name of concrete delivery supervisor.
- Project assessment carried out each day.
- The concrete element or part of the works for which the concrete was ordered, and where it was placed.
- The total amount of water added at the plant and the maximum amount permitted to be added at the site.

Materials

Product conformity: Submit current assessments of conformity, as appropriate, as follows:

- Certificate of conformity by a JAS-ANZ accredited third party.

Concrete mixes: Submit details, for each grade and type of concrete including any proposed use of special-purpose cement types.

Curing compounds: Submit details of any proposed liquid membrane-forming curing compound, including the following:

- Certified test results for water retention to AS 3799 Appendix B.
- 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.

HOLD POINT [Concrete - colour samples]

Coloured concrete: Submit sample blocks of coloured concrete produced using the proposed mix and method before casting final concrete as follows:

- **Number: 1.**
- **Size (nominal): 300 x 300 x 50 mm.**

Subcontractors

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

Tests

Site tests: Submit results, as follows:

- Concrete compressive strength test results to AS 1012.9.
- Other concrete properties. .

2 PRODUCTS

2.1 MATERIALS

General

Stockpile: If uniform, consistent colour is documented, stockpile sand, cement and aggregates.

Aggregates

Standard: To AS 2758.1.

Aggregate properties: As documented in the plans.

Cement

Standard: To AS 3972.

Age: Less than 6 months old.

Storage: Store cement bags under cover and above ground.

Water

Standard: To AS 1379 clause 2.4.

Requirement: Clean, free from oil, acid, alkali, organic or vegetable matter and including not more than 500 mg/l of chloride ions.

Polymeric film underlay

Vapour barriers and damp-proofing membranes: To AS 2870 clause 5.3.3.

Chemical admixtures

Standard: To AS 1478.1.

Contents: Free of chlorides, fluorides and nitrates.

Curing compounds

Standard: To AS 3799.

2.2 CONCRETE

Properties

Concrete mix and supply: Conform to the following:

- Normal-class: To AS 1379 clause 1.5.3.
 - . Properties: As documented in the plans.
- Special-class: To AS 1379 clause 1.5.4.
 - . Properties: As documented in the plans.

Coloured concrete

Standard: To AS 3610.1.

2.3 TESTING

General

Test authority: Concrete supplier or NATA registered laboratory.

Reports and records of test results: To the relevant parts of the AS 1012 series. Keep results on site.

Assessment process of test results

Standard: To AS 1379.

Method of assessment: Project assessment.

Sampling

Method of sampling: AS 1012.1.

Sampling locations: To AS 1012.1 and the following:

- Slump tests: On site, at the point of discharge from the agitator.
- Compressive strength tests: Spread the site sampling evenly throughout the pour.

Frequency of sampling: To AS 1379 Sections 5 and 6 and the following:

- Slump tests: Take at least one sample from each batch.
- Compressive strength tests: To the **Project assessment strength grade sampling table**.

Project assessment strength grade sampling table

Number of batches for each type and grade of concrete per day	Minimum number of samples Columns and load bearing wall elements (per batch)	Minimum number of samples Other elements (per day)
1	1	1
2-5	1	2
6-10	1	3
11-20	1	4
each additional 10	1	1 additional

Making and curing of specimens

General: To AS 1012.8.1 and AS 1012.8.2.

Specimen size:

- Aggregate size \leq 20 mm: Nominally 200 x 100 mm diameter.
- Aggregate size $>$ 20 mm: Nominally 300 x 150 mm diameter.

Test methods

General: To the relevant parts of the AS 1012 series.

Acceptance criteria:

- General: As documented in the **Concrete properties schedule – performance**.
- Early age compressive strength

Slump tests: Assess slump for every batch. Perform slump test on each strength sample.

Drying shrinkage at 56 days: To AS 1012.13.

Embedded pressure pipes

General: Complete leak tests before embedding pipes.

Liquid retaining structures

Testing for liquid tightness: To AS 3735.

3 EXECUTION

3.1 POLYMERIC FILM UNDERLAY

Location

General: Under slabs on ground, including integral ground beams and footings, provide a vapour barrier or, in areas prone to rising damp or salt attack, a damp-proofing membrane.

Base preparation

General: Conforming to base type, as follows:

- Concrete working base: Remove projections above the plane surface, and loose material.
- Graded prepared subgrade: Blind with sand to create a smooth surface free from hard projections. Lightly wet the sand just before laying the underlay.

Installation

Standard: To AS 2870 clause 5.3.3.

General: Lay underlay over the base as follows:

- Lap joints at least 200 mm and seal the laps and penetrations with waterproof adhesive tape.
- Face the laps away from the direction of concrete pour.
- Continue up vertical faces past the damp-proof course where applicable, and tape fix at the top.
- Patch or seal punctures or tears before placing concrete.
- Cut back as required after concrete has gained strength and formwork has been removed.

3.2 CONCRETE

General

Performance properties: As documented in the **Concrete properties schedule – performance**.

Elapsed delivery time

General: Make sure the elapsed time between the wetting of the mix and the discharge of the mix at the site conforms to 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)
10 – 24	120
24 – 27	90
27 – 30	60
30 – 32	45

Pre-mixed supply

Addition of water: To AS 1379 clause 4.2.3.

Transport method: Prevent segregation, loss of material and contamination of the environment, and do not adversely affect placing or compaction.

Site mixed supply

Emergencies: If mixing by hand, provide details.

Plant: Mix concrete in plant located on the construction site.

3.3 CORES, FIXINGS AND EMBEDDED ITEMS

Adjoining elements

Fixings: Provide fixings for adjoining elements. If required, provide temporary support to the adjoining elements during concreting, to prevent movement.

Protection

General: Grease threads. Protect embedded items against damage.

Compatibility: Provide inserts, fixings and embedded items that are compatible with each other, with the reinforcement and with the documented concrete mix and the documented surface finish.

Corrosion: In external or exposed locations, galvanize anchor bolts and embedded fixings or submit proposed alternate materials.

Structural integrity

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.

Tolerances

General: Maximum deviation from correct positions:

- Anchor bolt groups for structural steel: To AS 4100.
- Cores and embedded items generally: 10 mm.
- Other fixing bolts: 3 mm.

3.4 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 tolerance

Deviation: Flatness tolerance Class B.

3.5 PLACING AND COMPACTION

Placing

Horizontal transport: Use suitable conveyors, clean chutes, troughs, hoppers or pipes.

Methods: Avoid segregation and loss of concrete, and minimise plastic settlement. Maintain a nominally vertical and plastic concrete edge during placement.

Layers: Place concrete in layers not more than 300 mm thick. Compact the following layer into previous layer before previous layer has taken initial set.

Compaction

Methods: Use immersion and screed vibrators accompanied by hand methods as appropriate to remove entrapped air and to fully compact the mix.

Vibrators: Do not allow vibrators to contact set concrete, reinforcement or items including pipes and conduits embedded in concrete. Do not use vibrators to move concrete along the formwork. Avoid causing segregation by over-vibration.

Placing records

Log book: Keep on site and make available for inspection a log book recording each placement of concrete, including the following:

- Date.
- Specified grade and source of concrete.
- Slump measurements.
- The portion of work.
- Volume placed.

Rain

Protection: During placement and before setting, protect the surface from damage.

Vertical elements

Placement: Limit the free fall of concrete to maximum of 2000 mm.

Placing in cold weather

Cement: Do not use high alumina cement.

Placing concrete: Maintain temperature of the freshly mixed concrete at 5°C or more.

Formwork and reinforcement: Before and during placing maintain temperature at 5°C or more.

Severe weather: If severe 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 within the documented limits.

Admixtures: Do not use calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete.

Frozen materials: Do not allow frozen materials or materials containing ice to enter the mixer, and keep free of frost and ice any formwork, materials, and equipment coming in contact with the concrete.

Maximum temperature of water: 60°C when placed in the mixer.

Freezing: Prevent concrete from freezing.

Placing in hot weather

Handling: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses. Mix, transport, place and compact the concrete conforming to the **Elapsed delivery time table**.

Placing concrete: Maintain the temperature of the freshly mixed concrete conforming to the **Hot weather placing table**.

Evaporation control barriers: Erect barriers to protect freshly placed concrete from drying winds.

Formwork and reinforcement: Before and during placing, maintain temperature at 35°C or less.

Temperature control: Select one or more of the following methods of maintaining the temperature of the placed concrete at 35°C or less:

- Cool the concrete using liquid nitrogen injection before placing.
- Cover horizontal transport containers.
- Spray the coarse aggregate using cold water before mixing.
- Use chilled mixing water.

Hot weather placing table

Concrete element	Temperature limit
Normal concrete in footings, beams, columns, walls and slabs	35°C
Concrete in sections 1 m or more in all dimensions except for concrete of strength 40 MPa or more, in	27°C

Concrete element	Temperature limit
sections exceeding 600 mm in thickness	

3.6 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 until the total cumulative number of days or fractions of days, during which the air temperature in contact with the concrete is above 10°C, conforms to the following, unless accelerated curing is adopted:
 - . Fully enclosed internal surfaces/Early age 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 method: To be nominated by Contractor and approved by the Superintendent.

Curing compounds

Application: Provide a uniform continuous flexible coating without visible breaks or pinholes, which remains unbroken at least for the required curing period after application.

Substrates: Do not use wax-based or chlorinated rubber-based curing compounds on surfaces forming substrates to applied finishes, concrete toppings and cement-based render.

Self levelling toppings: If used also as curing compounds, conform to AS 3799.

Visually important surfaces: Apply curing compounds to produce uniform colour on adjacent surfaces.

Cold weather curing

Temperature: Maintain concrete surface temperatures above 5°C for the duration of the curing period.

Hot weather curing

Curing compounds: If curing compounds are proposed, provide details.

Protection: Select a protection method from the following:

- If the concrete temperature is more than 25°C or if not protected against drying winds, protect the concrete using a fog spray application of aliphatic alcohol evaporation retardant.
- If ambient shade temperature is more than 35°C, protect from wind and sun using an evaporative retarder until curing is commenced.
- Immediately after finishing, either cover exposed surfaces using an impervious membrane or hessian kept wet until curing begins, or apply a curing compound.

Water curing

Method: Select a method of ponding or continuously sprinkling to prevent damage to the concrete surface during the required curing period.

3.7 JOINTS

Sawn Joints

The location of sawn joints shall be as shown on the plans. Sawing shall commence within 6-18 hours after pour, regardless of time or weather conditions. The line of the joint shall be without any discontinuities. Neither edge shall deviate from a 3m straight edge by more than 10 mm.

Sawcuts are to be machine cut only at - 4mm wide and 30mm deep - following approved chalked line.

The joint surface shall not exhibit any horizontal edge dislodging of aggregate particles. Saw debris shall be washed from the joint and pavement immediately after sawing.

Construction joints

Location: Do not relocate or eliminate construction joints, or form undocumented construction joints. If emergency construction joints are made necessary by unforeseen interruptions to the concrete pour, submit a report on the action taken.

Finish: Butt join the surfaces of adjoining pours. In visually important surfaces make the joint straight and true, and free from blemishes impermissible for its surface finish class.

Preparation: Roughen and clean the hardened concrete joint surface. Remove loose or soft material, free water, foreign matter and laitance. Dampen the surface just before placing the fresh concrete and coat with a neat cement slurry.

Expansion joints

Joint filling: Fill with jointing materials as documented. Finish visible jointing material neatly, flush with adjoining surfaces.

Preparation: Before filling, dry and clean the joint surfaces, and prime.

Watertightness: Apply the jointing material so that joints subject to ingress of water are made watertight.

Jointing materials: Provide jointing materials compatible with each other, and non-staining to concrete in visible locations.

Bond breaking: Provide back-up materials for sealants, including backing rods, which do not adhere to the sealant.

Foamed materials (in compressible fillers): Closed-cell or impregnated, not water absorbing.

Slip joints

Requirement: If concrete slabs are supported on masonry, provide proprietary slip joints.

3.8 COMPLETION

Protection

General: Protect the concrete from damage due to construction load, physical and thermal shocks, and excessive vibrations, particularly during the curing period.

Surface protection: Protect finished concrete surfaces and applied finishes from damage.

0315 CONCRETE – SKATEPARK WORKS**1 GENERAL****1.1 RESPONSIBILITIES****General**

General: Provide cast concrete, as documented and as follows:

- Conforming to the design details and performance criteria.
- Satisfying quality and inspection requirements.
- Compatible with documented finishes.

Design

Designer: Enlocus

Formwork: The design of formwork, other than profiled steel sheeting composite formwork, 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.

Post-tensioning: To AS 3600.

1.2 DESCRIPTION

This section relates to ALL areas of concrete deemed as 'Skatepark' and that are shown in the Contract Documentation sections including elements marked as transitions, flat banks, ledges, roll-overs and kickers. Although to be read in collaboration with Section - Concrete all notes below are to be the preferred method for skatepark works.

ALL works are to be undertaken only by approved personal with skatepark construction experience, as approved by the Superintendent.

1.3 SITE CONDITIONS

It is the Contractor's duty to verify measurements and ensure the accuracy of forms before concrete material is ordered. Discrepancies must be immediately submitted in writing to the Superintendent for review before proceeding with the associated work. No extra charge or compensation will be approved on account of difference between actual dimensions and the dimensions indicated on the drawings.

The Contractor will be responsible for taking the required measures to protect the work and the materials stored on site against fire, storm, theft, vandalism and other losses.

1.4 DELIVERY AND HANDLING

The Contractor will be responsible for ensuring a safe, clear path of access for concrete delivery. Penalty fees associated with on-site delays of concrete delivery will be at the sole expense of the Contractor. Ultimately methods of delivery and handling must meet the proposed methodology and programme of work in order to achieve the specified strength and quality requirements.

Shot-creting shall be the object of particular care in mix design and in the preparatory work such as the fixing of reinforcement and embedded items.

1.5 WARRANTY

At the request of the Superintendent, the Contractor is to provide concrete delivery dockets as proof that mix designs meet specified requirements.

1.6 MATERIALS

(a) Concrete Materials

Unless otherwise specified or shown on the drawings or directed by the Superintendent, concrete materials and ready mix concrete shall be supplied by an approved manufacturer and comply with the following Australian Standards:

Portland and Blended Cements - AS 3972

Concrete Aggregates - AS 2758

Chemical Admixtures for Use in Concrete - AS 1478

Code of Practice for the Use of Chemical Admixtures in Concrete - AS 1479

Ready Mixed Concrete - AS 1379

The quality of mixing water used in the concrete mix shall comply with AS 1379 – 1991. However, the amounts of chloride and chlorine in the water shall not be greater than 0.03%. The maximum size of aggregate to be used shall be 20 mm.

Refer to drawings for location, colour and finish for all concrete skatepark items.

(b) Formwork

Formwork shall conform to the shape, lines and dimensions required in the finished concrete. Formwork shall be rigid, watertight and braced and fixed so that it will remain in position and shape during the casting of the concrete. Formwork shall be constructed so that it can be removed without damage to the concrete. Formwork Classes shall comply with AS 3610, and as follows;

Class 1 Formwork for concrete surfaces visually of the highest attainable quality, best uniformity of texture. Excellent quality of edge and joint details.

Class 2 Formwork for concrete with uniform quality and texture over large areas. Built to close tolerances. Consistently good quality of edge and joint details.

Class 3 Formwork for concrete surfaces to be painted and concrete surfaces not otherwise specified or shown on the drawings.

Class 4 Formwork for concrete surfaces to be rendered, tiled or concealed by other finishes and concrete surfaces permanently concealed in ducts, shafts and above false ceilings.

Class 5 Formwork for footings, concrete surfaces in the ground and rear surfaces of retaining walls, piers, etc.

Formwork shall be constructed of one of the following:

Seasoned or kiln -dried timber;

Metal shutters with joints flush fitting and adequately sealed;

Pressed wood or plywood supported with timber of size and spacing approved by the Superintendent.

All exposed edges shall be chamfered not less than 20 mm x 20 mm to prevent mortar runs and to preserve smooth, straight lines. Internal angles shall be filleted where shown on the drawings.

Timber formwork shall be in long lengths free from loose knots and surface defects and uniform in thickness. Form materials before reuse shall have all protruding nails withdrawn, holes and surfaces to be in contact with concrete thoroughly cleaned. Forms shall not be reused if bulged or warped. All inside surfaces of formwork shall be coated with non-staining mineral oil, grease or other approved agent to ensure non-adhesion of the mortar.

All dirt, sawdust, shavings or other debris must be removed from the inside of forms before placing concrete.

HOLD POINT [FORMWORK SKATEPARK - materials]

Placing of concrete will not be permitted to commence until the formwork has been checked and approved by the Superintendent. Such approval will not relieve the Contractor of responsibility for any defects in the works which may become apparent during or after placing of concrete.

1.7 STRENGTH

The concrete used shall be a dense uniformly graded mix, and when tested in a N.A.T.A. Registered Laboratory, shall develop the following strengths:

At 7 days -Not less than 18 mPa

At 28 days -Not less than 32 mPa (Where 32 mPa is specified)

Always provide **32 mPa** concrete in skatepark construction (unless otherwise nominated). Refer to Drawings for specified mPa, as required strengths may vary from each construction component.

1.8 PREPARATION FOR PLACING OF CONCRETE

Immediately before placing concrete in excavation, ensure that it is free from water, mud and debris. Remove any other extraneous materials or objects in contact with the forms. Ensure approval has been granted by the Superintendent for all relevant hold points and check expansion joint material, anchors, and other embedded items are in position.

1.9 PLACING OF CONCRETE AND FINISHES

Place concrete in compliance with AS 3600 and. Unless otherwise specified or shown on the drawings or directed by the Superintendent, **Concrete Skatepark Finishes shall be Class 1.**

(a) Surface Hardener

All concrete surfaces are to be treated with Ashford Formula Surface Hardener, (preparation and installation as specified by manufacturer).

(b) Colour Oxides

In areas specified on the drawings, coloured concrete is to include the following colour oxides. Pigments shall be in the form of dry mineral oxide pigment and shall be mixed according to the manufacturers recommendation. All concrete used shall be from the one plant. The proportion of

cement used shall be not less than 380 kg/cu.m of the mix. Refer below and on drawings for colour oxide mix. Colour oxide to be used as per manufacturers specification or approved equivalent.

HOLD POINT [PLACING OF CONCRETE AND FINISHES - test panels]

The Contractor, witnessed by the Superintendent is to provide test panels for each pavement surface finish type including full reinforcement content and treated with Ashford Formula Surface Hardener or approved equivalent . Written approval and acceptance of surface tolerance, colour, finish type etc by superintendent required prior proceeding with works. If approval is not granted, further test panels must be provided at the Contractors expense until the Superintendent grants approval to proceed with works. Only test panels approved by superintendent can form part of final works.

1.10 TEMPLATES

Securely fixed, laser cut, marine ply and/or steel template sections are to be fabricated to the approval of the Superintendent for use on all curved surfaces to match radiuses as shown on drawings.

1.11 TOLERANCES

The Contractor is responsible for all skatepark flat surfaces and radii meeting the following tolerances along with any specified dimensions detailed on the drawings.

Radius skate elements in concrete

+/- 4 mm over a 2 metre long machine rolled steel radius.

Flat skate elements in concrete

+/- 4mm over a 2 metre straight edge

The contractor is to ensure all skatepark concrete finishes meet the above listed tolerances. If approval is not granted by the Superintendent after testing (see below section) reconstruction of nonconforming sections and elements will be conducted at the Contractors expense.

1.12 TOLERANCE TESTING

The Contractor shall provide the Superintendent with a suitable tolerance template measuring tool for the purposes of confirming specified tolerances on radii and concrete surfaces. This maybe the template used to form the concrete curves.

1.13 BLEND COMPONENTS

Where complex concrete blends are specified within a skatepark in instances featuring a difference in radius and/or height as a transition between sections the Contractor must ensure a consistent even surface that meets required tolerances.

HOLD POINT [BLEND - formwork and finishes]

All blend areas are to be approved by the Superintendent including the set up and methodology prior to concrete pouring and upon completion. Any blend areas deemed non-complying i.e uneven finish and consistency between sections shall be demolished and redone at the Contractor's expense.

1.14 CONCRETE TESTING

General

Test authority: Concrete supplier or NATA registered laboratory.

Reports and records of test results: To the relevant parts of the AS 1012 series. Keep results on site.

Assessment process of test results

Standard: To AS 1379.

Method of assessment: Project assessment.

Consider changing the default to Production assessment, if satisfactory for the particular project. Document also the method of assessment in the **Concrete properties schedule - performance**. If the method of assessment is not documented, production assessment will be carried out by the concrete production plant.

Sampling

Method of sampling: AS 1012.1.

Sampling locations: To AS 1012.1 and the following:

- Slump tests: On site, at the point of discharge from the agitator.
- Compressive strength tests: Spread the site sampling evenly throughout the pour.

Frequency of sampling: To AS 1379 Sections 5 and 6 and the following:

- Slump tests: Take at least one sample from each batch.
- Compressive strength tests: To the **Project assessment strength grade sampling table**.

Project assessment strength grade sampling table

Number of batches for each type and grade of concrete per day	Minimum number of samples: Columns and load bearing wall elements (per batch)	Minimum number of samples: Other elements (per day)
1	1	1
2-5	1	2
6-10	1	3
11-20	1	4
each additional 10	1	1 additional

Making and curing of specimens

General: To AS 1012.8.1 and AS 1012.8.2.

Specimens for compressive strength tests: Make and cure at least two specimens from the sample of each grade.

Specimen size:

- Aggregate size \leq 20 mm: Nominally 200 x 100 mm diameter.
- Aggregate size $>$ 20 mm: Nominally 300 x 150 mm diameter.

Test methods

General: To the relevant parts of the AS 1012 series.

Acceptance criteria:

- Early age compressive strength
- Slump tests: Assess slump for every batch. Perform slump test on each strength sample.

1.15 COMPACTION OF CONCRETE

(a) General

During and immediately after placing, the concrete shall be thoroughly compacted by means of continuous tamping, spading, slicing and vibration.

Care shall be taken to fill every part of the forms, to force the concrete under and around the reinforcement without displacing it, to work coarse aggregate back from the face and to remove air bubbles and voids.

Workers employed in compacting concrete shall be competent and experienced in this work. Any worker who is deemed by the Superintendent to be unsatisfactory, shall be replaced immediately at the request of the Superintendent.

(b) Vibration

Vibration shall be applied at the point of deposit and in the areas of freshly deposited concrete. The vibrators shall be inserted and withdrawn out of the concrete slowly. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but shall not be continued so as to cause segregation or allow localised areas of grout to form at any point. Application of vibrators shall be at points uniformly spaced and not further apart than twice the radius over which the vibration is visibly effective.

Vibration shall not be applied directly or through the reinforcement to sections or layers of concrete which have hardened to the degree that the concrete ceases to be plastic under vibration. It shall not be used to make concrete flow in the forms over distances so great as to cause segregation, and vibrators shall not be used to transport concrete in the forms.

Vibrators (internal and external) shall have a minimum frequency of vibration such that the intensity of vibration will visibly affect a mass of concrete of 25 mm slump over a radius of at least 500 mm.

Vibration shall be supplemented by such hand tamping as is necessary to ensure smooth surface and dense concrete along surfaces and in corners and locations impossible to reach with the vibrators.

Do not leave vibrators, when in action, lying unattended on formwork, reinforcing or in concrete. Keep vibrator heads clean and free of mud or other deleterious matter prior to inserting the concrete.

Do not vibrate shot-creted concrete but finish profiling using steel floats and suitable templates as indicated previously.

1.16 JOINTS

(a) Construction Joints

Location: Do not relocate or eliminate construction joints, or form undocumented construction joints. If emergency construction joints are made necessary by unforeseen interruptions to the concrete pour, submit a report on the action taken.

Finish: Butt join the surfaces of adjoining pours. In visually important surfaces make the joint straight and true, and free from blemishes impermissible for its surface finish class.

Preparation: Roughen and clean the hardened concrete joint surface. Remove loose or soft material, free water, foreign matter and laitance. Dampen the surface just before placing the fresh concrete and coat with a neat cement slurry.

(b) Sawn Joints

The location of sawn joints shall be as shown on the plans. Sawing shall commence within 6-18 hours after pour, regardless of time or weather conditions.

The line of the joint shall be without any discontinuities. Neither edge shall deviate from a 3m straight edge by more than 10 mm.

Sawcuts are to be machine cut only at - 4mm wide and 30mm deep - following approved chalked line.

The joint surface shall not exhibit any horizontal edge dislodging of aggregate particles. Saw debris shall be washed from the joint and pavement immediately after sawing.

1.17 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 until the total cumulative number of days or fractions of days, during which the air temperature in contact with the concrete is above 10°C, conforms to the following, unless accelerated curing is adopted:

Fully enclosed internal surfaces/Early age 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 method: To be nominated by Contractor and approved by the Superintendent.

0316 CONCRETE FINISHES

1 GENERAL

1.1 RESPONSIBILITIES

General

General: Provide finishes to formed and unformed concrete surfaces, as documented and as follows:

- Compatible with documented finishes - Refer to Surface Finishes plan.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

- *General requirements.*

1.3 STANDARDS

General

Formed surfaces: To AS 3610.1.

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definition applies:

- Green concrete: Concrete which has set but not appreciably hardened.

1.5 TOLERANCES

Formed surfaces

Quality of the surface finish: To AS 3610.1 Table 3.3.2.

Unformed surfaces

Flatness: To the **Flatness tolerance class table**, for the documented class of finish, using a straightedge placed anywhere on the surface in any direction.

Flatness tolerance class table

Class	Measurement	Maximum deviation (mm)
A	2 m straightedge	4
B	3 m straightedge	6
C	600 mm straightedge	6

2 PRODUCTS

2.1 MATERIALS

Surface hardeners, sealants and protectors

Supply: If documented, provide proprietary products to the manufacturer's specifications.

Slip resistance treatment

Slip resistance classification: To AS/NZS 4586.

3 EXECUTION

3.1 SURFACE MODIFIERS

General

Application: Apply to clean surfaces to the manufacturer's specifications.

3.2 FORMED SURFACES

General

Surface finish: Provide formed concrete finishes as documented in the **Formed surface finishes schedule**.

Damage: Do not damage concrete works through premature removal of formwork.

Curing

General: If formwork is stripped before the minimum curing period for the concrete has elapsed, continue curing the exposed faces as soon as the stripping is completed.

Evaluation of formed surfaces

General: If evaluation of formed surface tolerance or colour is required, complete the evaluation before surface treatment.

Surface repairs

Method: If surface repairs are required, submit proposals.

Finishing methods

Details: If soffits of concrete elements or faces of concrete columns are to have a finish other than an off-form finish, provide finishes as documented.

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.
- Type of abrasive particles: Fine 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: Remove the vertical face formwork while the concrete is green. Wet the surface and scrub using stiff fibre or wire brushes, using clean water freely, until the aggregate is uniformly exposed. Do not use acid etching. Rinse the surface with clean water.

Floated finishes:

- Sand floated finish: Remove the vertical face formwork while the concrete is green. Wet the surface and rub using a wood float. Rub fine sand into the surface until a uniform colour and texture are produced.
- Grout floated finish: Remove the vertical face formwork while the concrete is green. Dampen the surface and spread a slurry, using hessian pads or sponge rubber floats. Remove surplus slurry and work until a uniform colour and texture are produced.

Smooth rubbed finish: Remove the vertical face formwork while the concrete is green. Wet the surface and rub using a carborundum or similar abrasive brick until a uniform colour and texture are produced.

3.3 UNFORMED SURFACES

General

Surface finish: As documented in the plans.

Finished levels: Strike off, screed and level slab surfaces to finished levels and to the flatness tolerance class documented.

Surface repairs

Method: If surface repairs are required, submit proposals.

Finishing methods – primary finish

Machine float finish:

- After levelling, consolidate the surface using a machine float.
- Cut and fill and refloat immediately to a uniform, smooth, granular texture.
- Hand float in locations inaccessible to the machine float.

Steel trowel finish: After machine floating, finish as follows:

- Use power or hand steel trowels to produce a smooth surface relatively free from defects.
- When the surface has hardened sufficiently, re-trowel to produce the final consolidated finish free of trowel marks and uniform in texture and appearance.

Burnished finish: Continue steel trowelling until the concrete surface attains a polished or glossy finish, uniform in texture and appearance, and free of trowel marks and defects.

Wood float finish: After machine floating use wood or plastic hand floats to produce the final consolidated finish free of float marks and uniform in texture and appearance.

Broom finish: After machine floating and steel trowelling use a broom or hessian belt drawn across the surface to produce a coarse even-textured transverse-scored surface.

Scored or scratch finish: After screeding, use a stiff brush or rake drawn across the surface before final set, to produce a coarse scored texture.

Sponge finish: After machine floating and steel trowelling, use a damp sponge to wipe the surface to produce an even textured sand finish.

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.

- Type of abrasive particles: Fine aggregate

Coloured applied finish: After machine floating, apply a proprietary liquid or dry shake material to the manufacturer's specifications and trowel to achieve the required appearance.

Exposed aggregate: After steel trowelling, grind the cured surface of the concrete to expose the coarse aggregate.

0318 SHOTCRETE**1 GENERAL****1.1 RESPONSIBILITIES****General**

General: Provide shotcrete, as documented and as follows:

- Conforming to design details and performance criteria.
- Satisfying quality and inspection requirements.
- Compatible with documented finishes.
- Readily sprayable into corners and around reinforcement and built-in items without segregation, vertical slumping or sag.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*

1.3 STANDARDS**General**

Specification and supply of concrete: To AS 1379.

Concrete materials and construction: To AS 3600.

Concrete structures for retaining liquids: To AS 3735.

1.4 INTERPRETATION**Abbreviations**

General: For the purposes of this worksection the following abbreviation applies:

- MSDS: Material Safety Data Sheets.

Definitions

General: For the purposes of this worksection the definitions given in CIA Z5 and the following apply:

- Ambient temperature: The air temperature at the time of mixing and placing of concrete.
- Average ambient temperature: Average value of the daily maximum and minimum ambient temperatures over the relevant period at a site.
- Batch: A quantity of concrete containing a fixed quantity of ingredients and produced in a discrete operation.
- Sample: A portion of the material used in the works, or to take such a sample.
- Shotcrete: Concrete, containing aggregate up to 13 mm in size, applied from a spray nozzle by means of compressed air.
- Specimen: A portion of a sample which is submitted for testing.
- Weather:
 - . Cold: Ambient shade temperature < 10°C.
 - . Hot: Ambient shade temperature > 30°C.

1.5 INSPECTION**HOLD POINT**

- **Any excavated or exposed face before covering.**
- **Any membrane or drainage strips installed against the excavated or exposed face.**

- Any embedments and reinforcement fixed in place.
- Concealed surfaces or elements before covering.
- Commencement of shotcreting.

1.6 TOLERANCES

Reinforcement

Fabrication and fixing: To AS 3600 clause 17.2.

Reinforcement position: To AS 3600 clause 17.5.3.

Finishes

Unformed surfaces flatness: To the **Flatness tolerance class table**, for the documented class of finish, using a straightedge placed anywhere on the surface in any direction.

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

Execution details

General: Submit proposals for placing, finishing and curing shotcrete including the following:

- Changes to concrete mix.
- Cutting or displacing reinforcement, or cutting hardened concrete.
- Finishing methods and shotcreting equipment.
- Name, contact details and experience of proposed sprayers.

Reinforcement: Submit the following:

- General: Details of any proposed changes to documented reinforcement.
- Damaged galvanizing: Details of proposed repair to AS/NZS 4680 Section 8.
- Welding: Details of any proposed welding of reinforcement.

Pre-mixed concrete supply delivery docket: For each batch, submit a docket listing the information required by AS 1379, and the following:

- Name of concrete delivery supervisor.
- The concrete element or part of the works for which the concrete was ordered, and where it was placed.

Materials

General: Submit details of proposed sources of materials.

Alternative supply: Submit an alternate source in the event of breakdown of supply.

Mix: Submit proposed concrete mix for shotcrete.

Curing compounds: Submit details of any proposed liquid membrane-forming curing compound, including the following:

- Certified test results for water retention to AS 3799 Appendix B.
- Evidence of compatibility with shotcrete, and with applied finishes including toppings and render, if any, including methods of obtaining the required adhesion.

Admixtures: Submit details of any proposed admixtures, including the following:

- Brand name.

- Place of manufacture.
- Basic chemical composition.
- Accelerating admixture initial set time.
- Accelerating admixture final set time.

Reinforcement: Submit details of any fibre reinforcement proposed for use.

Safety

Plan: Submit a full safety plan to include the following minimum requirements:

- Equipment prestart checks and maintenance.
- Housekeeping.
- Job safety and environmental analysis.
- Moving equipment.
- Product MSDS requirements.
- Risk assessments.
- Safe work method statements.
- Toolbox talks.
- Unsupported ground work procedures.
- Work place inspections.

Tests

Site tests: Submit results, as follows:

- Concrete test results: Submit compressive strength test results to AS 1012.9.

2 PRODUCTS

2.1 MATERIALS

Aggregates

Standard: To AS 2758.1.

Individual aggregates in mix: Consistent grading within allowable variation to AS 2758.1 clause 8.

Cement

Standard: To AS 3972.

Age: Less than 6 months old.

Storage: Store cement bags under cover and above ground.

Supplementary cementitious materials: Fly ash to AS 3582.1.

Water

Standard: To AS 1379 clause 2.4.

Requirement: Clean, free from oil, acid, alkali, organic or vegetable matter and including not more than 500 mg/l of chloride ions.

Accelerating admixture

Standard: To AS 1478.1.

Purpose: Use where required to develop quick set and high early strength to suit site requirements and finishing. Do not use calcium chloride based accelerators.

Other chemical admixtures

Standard: To AS 1478.1.

Contents: Free of chlorides, fluorides and nitrates.

Curing compounds

Curing compounds: To AS 3799.

2.2 CONCRETE

Properties

General: Provide concrete as documented in the **Shotcrete wet-mix design table**.

Shotcrete wet-mix design table

Constituent materials	Mix design per cubic metre
Cement (kg)	335
Fly ash (kg)	85
Coarse aggregate (kg)	610
Coarse sand (kg)	585
Fine sand (kg)	530
Water reducer (litres)	1.6
Superplasticiser (litres)	1.0
Air entraining agent (litres)	0.1
Water (litres)	200
Slump (mm)	60

2.3 TESTING

General

Test authority: Concrete supplier or NATA registered laboratory.

Reports and records of test results: To the relevant parts of the AS 1012 series. Keep results on site.

Sampling

Method of sampling: AS 1012.1.

Sampling locations: To AS 1012.1 and the following:

- Slump tests: On site, at the point of discharge from the agitator.
- Compressive strength tests: Spread the site sampling evenly throughout the spray.

Frequency of sampling: To AS 1379 Sections 5 and 6, and the following:

- Slump tests: Take at least one sample from each batch.
- Compressive strength tests: Sample as documented in the **Strength grade assessment sampling table**.

Strength grade assessment sampling table

Number of batches for each type and grade of concrete per day	Minimum number of samples per day
1	1
2-5	2
6-10	3
11-20	4
each additional 10	1 additional

Making and curing of specimens

General: To AS 1012.8.1 and AS 1012.8.2.

Specimens for compressive strength tests: Make and cure at least two specimens from the sample of each grade.

Specimen size: Nominally 200 x 100 mm diameter.

Test methods

General: To the relevant parts of the AS 1012 series.

Acceptance criteria:

- Average strength of all samples must equal or exceed the required value.
- Strength of any one sample must be at least 0.85 of the required value.

Slump tests: Assess slump for every batch. Perform slump test on each strength sample.

2.4 REINFORCEMENT

Fibre reinforcement

Standard: To CIA CPN35.

Steel reinforcement

Standard: To AS/NZS 4671.

Shape: R, N and welded wire mesh

Ductility class: To AS/NZS 4671 clause 5.2(c): L (low), N (normal)

Strength grade and ductility class: AS/NZS 4671 considers only 3 strength grades 250 MPa, 300 MPa and 500 MPa

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

Protective coating

Standard: To AS 3600 clause 17.2.1.2.

General: 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.

- Thickness: 200 µm minimum.

Galvanizing: To AS/NZS 4680, as follows:

- Sequence: If fabricating after galvanizing, repair damaged galvanizing and coat cut ends.
- Zinc-coating (minimum): 600 g/m².

Tie wire

General: Annealed steel 1.25 mm diameter (minimum).

External and corrosive applications: Galvanized.

3 EXECUTION

3.1 MIXING

General

Time: Use mixed materials within 60 minutes of the addition of cement to the mix.

Admixture: Add the accelerating admixture at the nozzle of delivery hose immediately before placing shotcrete.

3.2 REINFORCEMENT

Cover

Concrete cover generally: To AS 3600 clause 4.10.

Concrete cover for structures for retaining liquids: To AS 3735.

Supports

Proprietary concrete, metal or plastic supports: Provide chairs, spacers, stools, hangers and ties, 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: ≤ 60 diameters.
- Mesh: ≤ 800 mm.

Projecting reinforcement

Protection: If starter or other bars extend beyond reinforcement mats or cages or from cast concrete, provide a plastic protective cap to each bar until it is cast into later work.

Tying

General: Secure the reinforcement against displacement at intersections with either wire ties, or clips. Bend the ends of wire ties to prevent the ties projecting into the concrete cover.

3.3 CORES, FIXINGS AND EMBEDDED ITEMS

Inserted fixings

Installation: To manufacturer's specifications.

Methods: Do not insert fixings using explosive tools.

Protection

General: Grease any threads. Protect embedded items against damage.

Compatibility: Provide inserts, fixings and embedded items that are compatible with each other, with the reinforcement, with the documented concrete mix and with the documented surface finish.

Corrosion: In external or exposed locations, galvanize anchor bolts and embedded fixings.

Structural integrity

Position: Fix cores and embedded items to prevent movement during shotcreting. In locating cores, fixings and embedded items, displace but do not cut reinforcement, and maintain cover to reinforcement.

Tolerances

General: Maximum deviation from correct positions:

- Anchor bolt groups for structural steel: To AS 4100.
- Cores and embedded items generally: 10 mm.
- Other fixing bolts: 3 mm.

3.4 APPLICATION

Preparation

Preparation: Clean loose material and other foreign matter from surfaces to receive shotcrete and compact earth surfaces.

Equipment: Use clean delivery hoses and provide back-up equipment to allow continuous application of shotcrete to all surfaces in the event of equipment breakdown.

Spraying

Technique: Minimise rebound by directing the nozzle perpendicular to the surface to be covered at all times, unless varying angle to encapsulate reinforcement. Apply shotcrete in a circular motion to build up the required thickness in layers, starting at the lower sections and moving upwards.

Sprayer: Use a sprayer with previous experience in the application of coarse aggregate shotcrete, or they must work under the immediate supervision of a sprayer or instructor with such experience.

Joints: Provide construction or control joints as required, or as documented, to the details shown in CIA Z5 clause 9.5.3.

Adverse weather

Rain: Do not place shotcrete during rain, unless adequate shelter can be provided. Protect all exposed faces of fresh shotcrete from rain.

Strong winds: Provide for screening of nozzle, jet and surface if shotcreting in windy conditions. Protect all exposed faces of fresh shotcrete with screening.

Control of water

General: If water flows and seepage occur, submit proposals for their control, to avoid detrimental effects.

Acceptance

General: Provide dense uniform shotcrete without discernible weakness of bond (between layers).

Consistency: Provide a uniform consistency in order to maximise binding, bonding, cohesion and density, minimise rebound and prevent sagging of the applied shotcrete.

Soundness: Remove all laitance, loose material and rebound. Sound the surface with a hammer to locate any voids, aggregate pockets or unbonded areas.

Defective work: If drummy areas are found or if probing, drilling or other observations indicate non-conformance with thickness or strength requirements, core to determine and replace such defective areas.

Removal: Remove defective shotcrete from site.

3.5 SHOTCRETING IN COLD WEATHER**Cement**

- General: Do not use high alumina cement.

Placing

Concrete: Maintain temperature of the freshly mixed concrete at 5°C or more.

Embedments and reinforcement: Before and during placing maintain temperature at 5°C or more.

Temperature control

General: Heat the concrete materials, other than cement, to the minimum temperature necessary so that the temperature of the shotcrete is within the documented limits.

Admixtures: Do not use calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete.

Maximum temperature of water: 60°C when placed in the mixer.

Freezing: Prevent shotcrete from freezing.

3.6 SHOTCRETING IN HOT WEATHER**Handling**

General: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses.

Placing

Concrete: Maintain temperature at 35°C or less.

Embedments and reinforcement: Before and during placing maintain temperature at 35°C or less.

Temperature control

General: Select one or more of the following methods of maintaining the temperature of the placed shotcrete at 35°C or less:

- Cool the concrete using liquid nitrogen injection before placing.
- Spray the coarse aggregate using cold water before mixing.
- Use chilled mixing water.

3.7 FINISHING

General

Surface finish: As documented in the plans.

Finished surface: Unless an off-nozzle finish has been documented, strike off, screed and level surfaces to the documented position or level and the flatness tolerance class documented.

Surface repairs

Method: If surface repairs are required, submit proposals.

Finishing methods

Off-nozzle finish: No additional finishing required to the natural textured surface left by spraying.

Screed finish: Trim, slice or screed surface to a true line and grade to produce a surface which may exhibit defects such as drag marks from aggregate.

Steel trowel finish: After screeding 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 screeding, 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 screeding and steel trowelling use a broom or hessian belt drawn across the surface to produce a coarse even-textured transverse-scored surface.

3.8 CURING

General

Requirements: Taking into account the average ambient temperature at site over the relevant period affecting the curing, adopt procedures to make sure of the following:

- Curing: Cure continuously from completion of finishing until the total cumulative number of days or fractions of days, during which the air temperature in contact with the shotcrete is above 10°C, is 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 method: To be nominated by Contractor and approved by Superintendent.

Curing compounds

Application: Provide a uniform continuous flexible coating without visible breaks or pinholes, which remains unbroken for at least 7 days after application.

Substrates: Do not use wax-based or chlorinated rubber-based curing compounds on surfaces forming substrates to subsequent shotcrete layers, applied finishes, concrete toppings and cement-based render.

Cold weather curing

Temperature: Maintain shotcrete surface temperature above 5°C for the duration of the curing period.

Hot weather curing

Curing compounds: If curing compounds are proposed, provide details.

Protection: Select a protection method from the following:

- If the shotcrete temperature is more than 25°C or if not protected against drying winds, protect the shotcrete using a fog spray application of aliphatic alcohol evaporation retardant.
- If ambient shade temperature is more than 35°C, protect the shotcrete from wind and sun using an evaporative retarder until curing is commenced.

- Immediately after finishing, either cover exposed surfaces using an impervious membrane or hessian kept wet until curing begins, or apply a curing compound.

Water curing

Method: Select a method of ponding or continuously sprinkling to prevent damage to the shotcrete surface during the required curing period.

0344 STEEL – HOT-DIP GALVANIZED COATINGS**1 GENERAL****1.1 RESPONSIBILITIES****General**

General: Provide hot-dip galvanized coatings, as documented and as follows:

- Controls atmospheric corrosion to structural steelwork or steel products in the time to first maintenance.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*

1.3 STANDARDS**General**

Coating: To AS/NZS 4680.

Coating on fasteners: To AS 1214.

Durability: To AS 2309 and AS/NZS 2312.

Metal finishing

Steel preparation methods: To AS 1627.

Coating mass/thickness minimum: To AS/NZS 4680.

Threaded fasteners coating mass/thickness minimum: To AS 1214 Table 2.

1.4 INSPECTION**HOLD POINT [Concrete - Finishes]**

- **Coating appearance and thickness, at the galvanizing plant.**

1.5 SUBMISSIONS**Execution details**

Holes and lifting lugs: If holes and lifting lugs are required to facilitate handling, filling, venting and draining during galvanizing, submit details on size and location.

Detailing features:

2 EXECUTION**2.1 GENERAL****Care**

Dimensional change: If design and fabrication features of items to be galvanized are likely to lead to dimensional change or distortion, identify these and submit proposals for its minimisation.

Embrittlement: Take due care to avoid embrittlement of susceptible steels.

Mechanical properties: Avoid mechanical damage. Make sure that mechanical properties of the base metal do not change.

Surface preparation

Surface contaminants and coatings generally: Chemical clean, then acid pickle.

Chemical cleaning: To AS 1627.1.

Acid pickling: To AS 1627.5.

- Inhibitor: Required.

Abrasive blast cleaning: Refer to AS/NZS 4680 Appendix D

- Grade: AS 1627.9

Post treatment

General: Passivate.

Drilling after completion of hot-dip galvanizing

Repair: Prime drill hole surfaces to AS/NZS 4680 clause 8 before the surfaces begin to corrode.

Coating

Threaded fasteners: To AS 1214.

Structural sections

Cold worked items: Except for hollow sections, anneal to 650°C before galvanizing.

Hollow sections: Provide seal plates with breather holes.

Surface finish

Standard: To AS/NZS 4680 clause 7.

Coating quality: Continuous, adherent, smooth or evenly textured and uniform, free from defects detrimental to the end use of the finished article, such as lumps, blisters, gritty areas, uncoated spots, acids and black spots, dross and flux.

- Silicon killed steels: Dull grey is acceptable.

Friction-type bolted connections: Treat coated contact surfaces to achieve the required design slip factor, without removing excessive coating thickness.

- Contact surface preparation: To GAA After-fabrication hot dip galvanizing Chapter 4.

Slip factor test: To AS 4100 Appendix J.

Surplus zinc on fastener threads: Remove.

Coating repair

Rejection: If uncoated surfaces or areas damaged by handling at the galvanizing plant exceed the limits specified for repair in AS/NZS 4680 clause 8, reject the galvanizing.

Extent and methods: To AS/NZS 4680 clause 8.

Preparation for paint finishes

Coarse preparation: Remove spikes, and make sure edges are free from lumps and runs.

Light sweep blasting before painting: Required.

- Maximum zinc removal: 10 µm.
- Abrasive grade (range): 150 – 180 µm.
- Abrasive type - clean ilmenite or garnet.
- Blasting angle to surface: 45° maximum.
- Blast pressure (maximum): 275 kPa.
- Distance of nozzle from surface (range): 350 – 400 mm.
- Nozzle type: 10 – 13 mm minimum diameter venturi type.

2.2 TESTING

Galvanizing tests

Coating mass tests: To AS/NZS 4680 Appendix G.

Magnetic method: To AS 2331.1.3.

Coating thickness tests: To AS/NZS 4680 Appendix G.

- Test method: To AS/NZS 4680 clause 9 and AS/NZS 4680 Appendix G.

Test method: To AS/NZS 4680 Appendix G.

- Frequency of tests: To AS/NZS 4680 clause 9.2.

Sampling plan: As per recommendations in AS 1214 Appendix B

- Method: To AS/NZS 4680 Appendix G clause G5.

Testing authority: NATA registered galvanizing plant.

2.3 TESTING

Galvanizing tests

Coating mass tests: To AS/NZS 4680 Appendix G.

Magnetic method: To AS 2331.1.3.

Coating thickness tests: To AS/NZS 4680 Appendix G.

- Test method: To AS/NZS 4680 clause 9 and AS/NZS 4680 Appendix G.

Test method: To AS/NZS 4680 Appendix G.

- Frequency of tests: To AS/NZS 4680 clause 9.2.

Sampling plan: As per recommendations of AS 1214 Appendix B

- Method: To AS/NZS 4680 Appendix G clause G5.

Testing authority: NATA registered galvanizing plant.

2.4 SITE WORK

Site welding

Grinding of edges: Permitted.

Weld areas: Reinstate coating to AS/NZS 4680 clause 8.

Site coating reinstatement

Rejection: If any item has damaged areas exceeding the limits specified for repair in AS/NZS 4680 clause 8.1, reject the object.

Extent: Areas damaged by transport, site welding, site flame cutting, site handling, or erection.

Method: To AS/NZS 4680 clause 8.

0345 STEEL – PROTECTIVE PAINT COATINGS**1 GENERAL****1.1 RESPONSIBILITIES****General**

General: Provide protective paint coatings, as documented and as follows:

- Control corrosion to structural steelwork and steel products in the time to first scheduled maintenance.

Time to first scheduled maintenance: As per product's specifications.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- *General requirements.*

1.3 STANDARDS**General**

Surface preparation and coating: Conform to the recommendations of AS/NZS 2312.

Site testing of protective coatings

Test methods: To AS 3894.

1.4 INTERPRETATION**Abbreviations**

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

- DFT: Dry Film Thickness.
- ITP: Inspection and Test Plan.
- μm : micron (10^{-6}m).

Definitions

General: For the purposes of this worksection the definitions given in AS/NZS 2310 and those below apply.

- Coating contractor: The protective coatings application contractor conducting the on or off site coating application works.
- Coating manufacturer: The supplier and/or manufacturer of the protective coating materials used.
- ITP: A series of formal Inspection and Test Plans, prepared by the coating contractor to reflect the specific inspection and testing that will be carried out on the surface preparation, coating application and the record keeping tasks to be undertaken.
- MSDS: The formal Material Safety Data Sheet, prepared in conformance with Worksafe Australia's requirements and distributed by the coating manufacturer to provide information on the safe handling, storage, personal protective equipment requirements, use and disposal of a coating product.

1.5 INSPECTION**HOLD POINT [Steel - Protective Paint Coating]**

- . **After application of primer or seal coats.**
- . **After application of each subsequent coat.**

1.6 SUBMISSIONS

Execution details

Detailing of structural steelwork: If design and fabrication features of the items to be coated may lead to difficulties, advise before commencing surface preparation.

Removal of deleterious materials: Submit advice on suitability of marking paints, and removal of materials deleterious to coating processes such as grease, oil and paint.

Repair of coating damage: If the protective coating is damaged, submit a repair coating proposal, based on the coating manufacturer's technical data sheet, that will make sure that the full corrosion protection ability of the system is reinstated.

Final coat reinstatement: If required due to variance, submit proposals for reinstatement of the visible final coating system to match the original coating system samples.

Maintenance paint coating systems

Existing systems: Itemise areas of corrosion, damage and other degradation.

Recoating systems: Supply coating systems for maintenance painting of previously coated items and structural elements, including surface preparation, as documented in the plans.

Quality

ITPs: Submit for each proposed coating system.

Quality supervisor: Submit the name and the experience record of the person nominated to oversee the implementation of the ITPs.

Records

General: Prepare and maintain records of all surface preparation and coating application works as follows:

- Standard: To AS 3894.10, AS 3894.11, AS 3894.12, AS 3894.13 and AS 3894.14.
- Reference the relevant parts of the ITPs, and record conformance.

Subcontractors

Requirement: Submit proof of currency of the applicator's Environmental Operating Licence.

Warranties

General: Submit details of the proposed warranty terms, form and period. If separate warranties are offered by the manufacturer and the applicator, make sure they are interlocking.

Form of warranty: As per manufacturers specifications.

2 PRODUCTS

2.1 GENERAL

General

Care: Handle, store, mix and apply all protective coatings in conformance with the manufacturer's specifications.

Original containers: Provide coating products in unopened containers bearing the brand name and name of the manufacturer with a clearly legible batch number.

Ambient temperature range for storage: 15°C to 25°C.

Use-by-date: Use products with limited shelf life before their use-by-date unless written authorisation from the coating manufacturer's technical services section is provided.

Proprietary products

Requirement: Provide all products from the one manufacturer's supply.

Material safety data sheets (MSDS)

Requirement: Keep on site copies of all relevant MSDSs.

3 EXECUTION

3.1 GENERAL

General

Product warnings: Conform to the requirements and recommendations of product MSDS's.

3.2 PROTECTION

Surroundings

Protection: Prevent the release of abrasive, overspray or paint waste debris to air, ground or to any watercourse. Repair or clean affected surrounding areas.

Damage: Prevent damage to other assets, services or equipment.

Contamination

Coating contamination: Prevent contamination of coatings contaminated from abrasive or other foreign matter.

Surfaces: Prevent contamination of coated surfaces which are not yet dry from blasting dust, abrasive or surface preparation debris.

On site storage

General: Deliver coatings to site in the original unopened containers coatings and store in a cool shady place.

Sunlight: Protect coating materials from direct sunlight before mixing or adding the converter (catalyst).

Post application care

General: Provide protection to the coating against physical, chemical, or atmospheric damage until all components are fully cured.

Care: Stack and handle all coated items using fabric slings or padded chains. Adopt soft packaging, carpet strips or other deformable materials between all coated items.

Water ponding: Stack coated items to prevent water ponding.

3.3 SURFACE PREPARATION

General

Defects: Remove all surface defects, including cracks, laminations, deep pitting, weld spatter slag, burrs, fins, sharp edges and other defects before the preparation of the surface to be coated.

Temporary welds: Grind flush temporary welds.

Site welding: Where possible avoid site welding.

Porous, skip or stitch welds: Not acceptable.

Edges: De-burr and round all edges to a 2 mm radius.

Surface contaminants: Remove surface contaminants such as oil, grease, dirt and loose particles, using an alkaline oil emulsifier/degreaser to AS 1627.1.

Surface preparation: Prepare surfaces to the required finish to AS 1627.1, AS 1627.2, AS 1627.4, AS 1627.5, AS 1627.6 and AS 1627.9.

Surface cleaning: Remove spent abrasive from the surface by blowing with clean, dry air and/or by vacuum cleaning.

Bolts: Provide washers at heads and nuts at replacement bolts.

Surface preparation for atmospheric steel

General: Conform to the following requirements:

- Wash and degrease all surfaces to be coated in conformance with AS 1627.1 with a free-rinsing, alkaline detergent, in conformance with the manufacturer's specifications and all safety warnings.
- Wash with fresh potable water and remove all soluble salts in conformance with AS 3894.6 Methods A and D.
- Grind all sharp edges with a power tool to a minimum radius of 2 mm.

- Power tool clean welds to AS 1627.2 Class 2 to remove roughness. Remove filings, preferably by vacuum or compressed air.
- Abrasive blast clean all steel surfaces to be painted in conformance with AS 1627.4 to visual standard AS 1627.9 Class 2.5 (equivalent to ISO 8501-1, Sa 2.5: Very Thorough Blast-Cleaning). Use a non-metallic medium that will generate a surface profile of 35 to 65 microns (as tested to AS 3894.5 Method A.).
- Commence application within 4 hours of abrasive blast cleaning or before surface becomes contaminated, otherwise repeat abrasive blasting step.
- Stripe coat welds, bolts, boltholes and all edges with primer before application of full primer coat nominated in the **PROTECTIVE PAINT COATING SYSTEMS**.
- Before application, make sure that the surface is free of contaminants including oil, grease, dirt, dust, salt and any other deleterious materials that will interfere with coating performance.

Treatment of on-site welding

On-site welding: If on site welding is performed, adopt the following procedures:

- Remove weld spatter.
- Power tool clean welds to AS 1627.2 Class 2 to remove roughness. Remove filings, preferably by vacuum or compressed air.
- Prime welds immediately with the nominated primer before contamination can reoccur. Make sure that the primer overlaps the sound adjacent coating by between 25 mm and 50 mm.
- Apply intermediate and topcoats over the primed welds to match the surrounding coating system, overlapping the sound adjacent coating by between 25 mm and 50 mm.

Preparing galvanized and aluminium surfaces

Remove grease, oil and other solvent-soluble contaminants by wiping with mineral turpentine or white spirit. Finally wipe with a clean solvent. Allow to dry and proceed with the next operation immediately. Abrade surfaces to a medium coarse type finish to provide an adhesion key.

Primed zinc primed surfaces

If present, remove zinc salts from zinc primers. Remove grease, oil and other solvent-soluble contaminants by wiping with mineral turpentine or white spirit. Finally wipe with a clean solvent. Allow to dry and proceed with the next operation immediately.

Shop priming

Dust off and apply a coat of primer, according to the technical specification.

Site coating

General: High pressure fresh water wash down all surfaces. Lightly sand down primer/intermediate coats, which have been shop applied, before site application of next coat.

3.4 PREPARATION ASSESSMENT

General

Conformance: All areas of any item must meet the required cleanliness standard.

Abrasive blast cleaning

Assessment: To AS 1627.4 and ISO 8501-1.

Power tool cleaning

Assessment: To AS 1627.2 and ISO 8501-2.

- Class 2.5.

Hand tool cleaning

Visual assessment: To ISO 8501-2.

- Class 2.5.

Surface profile

General: To AS 3894.5.

Profile grade: To AS 3894.5 Method A.

Surface dust from abrasion

General: To AS 3894.6 Method C.

Wet film thickness

Method of measurement: To AS 3894.3, Appendix C using an approved wet film gauge continuously during application.

Dry film thickness

Method of measurement: To AS 3894.3, clause 10.

Extent: All surfaces at the completion of each of the prime, intermediate and finish coats, in particular include areas of the structure which are difficult to paint, are masked by structure, or areas where double coating or light coating is likely due to the shape of the substrate.

Number of measurements: Perform a sufficient number of readings to make sure a representative account for the DFT compliance of the coated areas tested.

Deduction: If testing the DFT of coatings 150 µm and less, deduct the effect of the measured surface profile from all DFT readings.

Single readings: Single reading requirements are as follows:

- Check any single reading that is less than 80% of the specified DFT with three additional readings within 50 mm of the original reading. If these three readings average not less than 90% of the specified DFT, take the averaged readings as the point reading. If less than 90%, reject the DFT in that area.
- Check any single reading that is greater than 150% of the specified DFT with three additional readings within 50 mm of the original reading. If these three readings average not greater than 150% of the specified DFT, take the averaged readings as the point reading. If greater than 150%, reject the DFT in that area.

Rectification: Re-work areas rejected, using surface preparation and coatings in the same manner and order as the original work.

Defects including underthickness and overthickness : Mark with school grade chalk, adhesive inspection labels or masking tape. Do not use crayon, paint or spirit based ink pens.

3.5 MIXING

General

Mixing: Mix coatings thoroughly. Mix package sizes larger than 4 litres using powered agitators driven by air motors.

Multi-component coatings: Combine multi-component coatings as whole pack units. If partial mixing is proposed, submit details.

Thinners: If addition of thinners is proposed, conform to the Coating Manufacturers Technical Data Sheet for the specified product.

Colour consistency: If colour consistency is required, before the addition of the curing agent or converter and before coating application, pre-mix the components of coating products that have been tinted to make sure colour uniformity.

3.6 COATING APPLICATION

General

General: Conform to the Product Data Sheets.

Painting and coating colour: Verify all project finish colours with the retained samples.

Final surface preparation or coating application

Limits: If the following climatic/substrate conditions are present do not apply coating:

- The relative humidity is above 85%.
- The substrate temperature is less than 3C° above the dewpoint.
- The ambient air temperature is below 5°C or above 40°C.

- The substrate temperature is below 10°C or above 45°C.
- The surface to be coated is wet or damp.
- Where the full prime coat application cannot be carried out before the specified cleanliness of the surface deteriorates.
- For external or site applied coatings:
 - . The weather is clearly deteriorating or unfavourable for application or curing.
 - . High wind conditions.
- The surface preparation standard has not been achieved.
- The time between surface blast cleaning and the commencement of coating exceed 4 hours.
- Visual tarnishing or black spots develop on the surface of the metal.

Exception: Preliminary blast or other surface preparations may be performed in conditions that are outside the limits, providing the final surface preparation and all coating applications are undertaken under the limit conditions.

Prior coating: Before the spray application of each coating stripe coat by brush method all edges, welds, seams, rivets bolts and boltholes (including slots). Prime the underlying surfaces of replacement bolting, washers and nuts before installation.

Procedure: Conform to the order shown in the **PROTECTIVE PAINT COATING SYSTEMS**.

Timing: Conform to the minimum and maximum recoat intervals and curing times.

Detail: Stripe coat all welds, bolt holes, corners and difficult to spray areas by brushing in with the prime coat and intermediate coat material before the full coating application.

Subsequent coats: Make sure that before any subsequent coating layer is applied, the surface condition of the preceding coat is complete and correct in all respects, including its DFT achievement, cleanliness, freedom from defects.

Correction: Correct any defect in a coating layer before the subsequent coating layer is applied.

Protection

General: Perform all painting under cover and/or protected from rain, condensation, dew, excessive wind, overspray or wind-blown dust.

Period: Continue protection where any of these conditions exist before the coating has cured to a sufficient degree so as to be unaffected.

3.7 COATING REPAIR

Repair of coating damage

Preparation: Feather back by hand or machine sanding all leading edges of intact coating adjacent to the repair, to remove any sharp edge.

Surface contamination: Remove by dusting or blowing down before applying the first coat of paint.

Sequence: Apply the repair coating in the same sequence and manner as the original coating.

Areas damaged without exposing the primer: Wash with a proprietary detergent solution and rinse with fresh water, followed by abrading and ensuring that edges of sound paint are feathered. Then coat the area with the appropriate intermediate and finishing coat materials.

Areas damaged to the primer or steel surface: Blast clean to the original standard. Prepare at least 50 mm into the sound coating and to a further feathering zone of approximately 50 mm. Recoat with the specified system to restore the film thickness and integrity over the whole prepared surface including the feathered zone.

Aesthetic reinstatement: If required, repaint to a physical or discernable boundary line.

Defects: If corrosion pitting or areas of significant metal loss and defects are exposed by the blasting process, advise for inspection and have areas passed as being fit for service before proceeding with the coating system.

Timing: Apply the Protective Coating system within 4 hours of blast cleaning or in any case before visual tarnishing of the steel occurs.

3.8 COMPLETION

General

Joints: On completion, seal all joints and mating surfaces with a compatible polyurethane sealant.

Warranty

General: Provide the approved manufacturer's warranty.

4 SELECTIONS

4.1 PROTECTIVE PAINT COATING SYSTEMS

Polyurethane – AS/NZS 2312 Category A and B table

Location	Primer	Second Coat	Third Coat
External non-decorative conforming to AS/NZS 2312 PUR2	75 µm Epoxy Zinc phosphate conforming to AS/NZS 3750.13	50 µm High Solids Polyurethane conforming to AS/NZS 3750.6	Nil
External decorative conforming to AS/NZS 2312 PUR2	75 µm Epoxy zinc phosphate conforming to AS/NZS 3750.13	50 µm High Solids Polyurethane conforming to AS/NZS 3750.6	Nil

Polyurethane – AS/NZS 2312 Category C, D and E table

Location	Primer	Second Coat	Third Coat
External non-decorative conforming to AS/NZS 2312 EHB4	75 µm Zinc rich epoxy conforming to AS/NZS 3750.9 Type 2	200 µm High-Build Epoxy MIO conforming to AS/NZS 3750.14	Nil
External decorative conforming to AS/NZS 2312 PUR 5	75 µm Zinc rich epoxy conforming to AS/NZS 3750.9 Type 2	200 µm High-Build Epoxy MIO conforming to AS/NZS 3750.14	75 µm High Solids Polyurethane conforming to AS/NZS 3750.6

Micaceous Iron Oxide – AS/NZS 2312 Category A and B table

Location	Primer	Second Coat	Third Coat
External non-decorative conforming to AS/NZS 2312 ALK2	75 µm Alkyd zinc phosphate containing MIO and Aluminium pigment conforming to AS/NZS 3750.19 Type 2	Nil	Nil
External decorative conforming to AS/NZS 2312 ALK6	75 µm Alkyd zinc phosphate containing MIO and Aluminium pigment conforming to AS/NZS 3750.19 type 2	40 µm Alkyd MIO finish conforming to AS/NZS 3750.12	40 µm Alkyd MIO finish conforming to AS/NZS 3750.12

Micaceous Iron Oxide – AS/NZS 2312 Category C, D and E table

Location	Primer	Second Coat	Third Coat
External non-decorative conforming to AS/NZS 2312 EHB4	75 µm Zinc rich epoxy conforming to AS/NZS 3750.9 Type 2	200 µm High-Build Epoxy MIO conforming to AS/NZS 3750.14	Nil

Location	Primer	Second Coat	Third Coat
External decorative conforming to AS/NZS 2312 EHB6	75 µm Zinc rich epoxy conforming to AS/NZS 3750.9 Type 2	125 µm Epoxy MIO conforming to AS/NZS 3750.14	125 µm Epoxy MIO conforming to AS/NZS 3750.14

Epoxy Acrylic – AS/NZS 2312 Category A and B table

Location	Primer	Second Coat	Third Coat
External non-decorative conforming to AS/NZS 2312 ACC2	75 µm Epoxy zinc phosphate conforming to AS/NZS 3750.13	50 µm Epoxy Acrylic conforming to AS/NZS 3750.5	Nil
External decorative conforming to AS/NZS 2312 ACC2	75 µm Epoxy zinc phosphate conforming to AS/NZS 3750.13	50 µm Epoxy Acrylic conforming to AS/NZS 3750.5	Nil

Epoxy Acrylic – AS/NZS 2312 Category C, D and E table

Location	Primer	Second Coat	Third Coat
External non-decorative conforming to AS/NZS 2312 EHB4	75 µm Zinc rich epoxy conforming to AS/NZS 3750.9 Type 2	200 µm High-Build Epoxy MIO conforming to AS/NZS 3750.14	Nil
External decorative conforming to AS/NZS 2312 ACC6	75 µm Zinc rich epoxy conforming to AS/NZS 3750.9 Type 2	200 µm High-Build Epoxy MIO conforming to AS/NZS 3750.14	50 µm Epoxy Acrylic conforming to AS/NZS 3750.5

Steel protection and decoration for green buildings - AS/NZS 2312 Category A and B table

Location	Primer	Second Coat	Third Coat
External non-decorative conforming to AS/NZS 2312 IZS2	75 µm waterborne inorganic zinc conforming to AS/NZS 3750.15 Type 3 VOC < 15 g/L	Nil	Nil
External decorative exceeding AS/NZS 2312 IZS2	75 µm waterborne inorganic zinc conforming to AS/NZS 3750.15 Type 3 VOC < 15 g/L	40 µm waterborne Acrylic conforming to AS/NZS 3750.16 VOC < 75 g/L	Nil

Steel protection and decoration for 'green buildings' – AS/NZS 2312 Category C, D and E table

Location	Primer	Second Coat	Third Coat
External non-decorative conforming to AS/NZS 2312 IZS2	75 µm waterborne inorganic zinc conforming to AS/NZS 3750.15 Type 3 VOC < 15 g/L	Nil	Nil
External decorative exceeding AS/NZS 2312 IZS2	75 µm waterborne inorganic zinc conforming to AS/NZS 3750.15 Type 3	50 µm waterborne epoxy conforming to AS/NZS 3750.13 VOC < 20 g/L	40 µm waterborne Acrylic conforming to AS/NZS 3750.16 VOC < 75 g/L

Location	Primer	Second Coat	Third Coat
	VOC < 15 g/L		

Industrial silicone enamel – AS/NZS 2312 Category A and B table

Location	Primer	Second Coat	Third Coat
External non-decorative conforming to AS/NZS 2312 ALK2	75 µm Alkyd zinc phosphate containing MIO and Aluminium pigment conforming to AS/NZS 3750.19 Type 2	Nil	Nil
External decorative conforming to AS/NZS 2312 ALK4	75 µm Alkyd zinc phosphate containing MIO and Aluminium pigment conforming to AS/NZS 3750.19 Type 2	50 µm Silicone Enamel conforming to AS/NZS 3750.22	Nil