



Quairading Sports Precinct - Netball Courts

TECHNICAL SPECIFICATION

Revision: A
Date: 11/11/2024
By: JCG
Approved: BWL
Reference: SE_12234_SPC_001

SPORTENG™

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100. Introduction

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100.1 General

Project particulars

- (a) This Specification has been developed specifically for the field of play and associated civil works on the following project / site:
- i. Project Name: Quairading Sports Precinct - Netball Courts
 - ii. Location: 10 Jennaberring Road, Quairading, WA, 6383, Australia
 - iii. Principal: Shire of Quairading
- (b) This document, the design drawings and all other referenced documentation describe the scope of works, minimum requirements, and assessment criteria.

Contract documents

- (c) This Specification is to be read in conjunction with:
- i. General conditions of contract
 - ii. Special conditions of contract and supplementary special conditions of contract
 - iii. Contract preliminaries
 - iv. Contract drawings
 - v. Any other referenced documentation.

100.2 Scope of Works

Quality management system

- (a) The Contractor shall implement a quality management system for all works under the Contract in accordance with *Section 400 Specification Preliminaries*.

Works under contract

- (b) The works documented consist of 2 no. acrylic netball courts.
- (c) Unless noted otherwise, provide all materials, labour, approvals, permits, verification, and testing as necessary to deliver the works in accordance with the drawings and specification.
- (d) The extent of works includes:
 - i. Construction preliminaries
 - ii. Site clearing
 - iii. Bulk earthworks
 - iv. Construction of stormwater drainage
 - v. Construction of pavements and ancillaries
 - vi. Installation of fencing
 - vii. Installation of acrylic court system including line markings
 - viii. Supply and installation of sports equipment
 - ix. Supply of maintenance and operation manuals, as-built drawings,
 - x. Defect rectification (during defined period).

200. Reference Documentation

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200.1 General

Order of precedence

- (a) All works shall comply with the requirements of:
 - i. This Specification and Contract drawings
 - ii. Shire of Quairading Specifications
 - iii. Main Roads Western Australia Specifications
 - iv. IDM Standard Drawings
 - v. Relevant Australian Standards
- (b) Applicable Australian Standards are referenced within the relevant work element sections.
- (c) Where requirements differ between referenced documents, the more onerous specification/ requirement applies unless otherwise directed by the Principal's Representative.

Contract drawings

- (d) Contract drawings (also called design drawings or the drawings) for this Specification are those shown in the Drawing List on Drawing Number SE_12234_F000.

Status

- (e) The information contained in the drawings and specifications may also be subject to certification or approval by statutory and regulatory authorities.

200.2 Legislation and Standards

General

- (a) All works shall be carried out by suitably qualified tradespeople to a high standard of workmanship.
- (b) All works shall conform to this Specification and the relevant legislations and standards referenced or as otherwise applicable.
- (c) Any works carried out not confirming to these criteria shall be deemed as non-conforming and rectification works required to achieve this standard shall be the responsibility of the Contractor at no extra cost to the Principal.

Legislation

- (d) The Contractor must carry out all the works in accordance with all relevant legislative provisions and standards including, but not limited to:
 - i. Work Health and Safety Act 2020
 - ii. Work Health and Safety (General) Regulations 2022
 - iii. Environmental Protection Act 1986
 - iv. Local Government Act 1995
 - v. Road Traffic Act 1974
 - vi. All relevant Australian Standards and Codes of Practice
 - vii. All other relevant State and Federal Acts and Regulations
 - viii. All Local Laws and relevant policies

Standards

- (e) All works shall adhere to the relevant Australian Standards, referenced within each section of this Specification.
- (f) All works shall adhere to the following sports governing body requirements:
NETBALL:
 - i. International Netball Federation (INF) Facilities and Equipment Requirements
 - ii. AS/NZ 4586: 2004 Slip Resistance Classifications of New Pedestrian Surface Materials
 - iii. AS/NZ 4633: 2004 Slip Resistance Classification of Existing Pedestrian Surface Materials

BASKETBALL:

- i. FIBA Official Basketball Rules 2018 – Basketball Rules
- ii. FIBA Official Basketball Rules 2018 - Basketball Equipment
- iii. AS/NZ 4586 Slip Resistance Classifications of New Pedestrian Surface Materials
- iv. AS/NZ 4633 Slip Resistance Classification of Existing Pedestrian Surface Materials

200.3 Existing Site Information

General

- (a) All existing site information is provided for information only, unless noted otherwise.
- (b) The Contractor must confirm the completeness and accuracy of all such information prior to commencing works.

Discrepancies

HOLD POINT

- (c) Any discrepancies between the information provided in the specifications and drawings with that encountered on site must be reported to the Principal's Representative without delay.

HOLD: Any works relating to or affected by the discrepancies until the HP has been released.

Status

- (d) The existing feature, level and services information provided on the drawings cannot be guaranteed. The Contractor must confirm the completeness and accuracy of all such information prior to commencement of works.

Site survey

- (e) Feature Survey-Model
Carabiner
Feature Survey-Model and Feature Survey- Greyscale Model
CAD file: ITCW13057 F01 R0 FOR GIS1

Geotechnical investigation

- (f) Geotechnical Investigation
Perth Geotechnics
30 September 2024
GI297824PG_Rev0
Geotechnical Report_ GI297824PG_Quairading Sports Precinct_light Poles & Netball
Courts_Shire of Quairading

400. Specification Preliminaries

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400.1 Conformance with Design

Quality management system

- (a) The Contractor shall develop and maintain a quality management system for all works under the Contract and shall comply with the requirements of AS/NZS ISO 9001.
- (b) Conformance of the works shall be demonstrated through systematic inspection and testing.
- (c) The requirements outlined in this section do not relieve the Contractor of the responsibility to conform with the Contract documents.
- (d) The Contractor is responsible for correcting all non-conformances.

Testing of materials and work

- (e) Compliance tests shall be carried out by the Contractor to ensure compliance with the specified requirements.
- (f) All compliance sampling and testing shall be carried out by laboratories accredited by NATA and certified for the appropriate tests, unless otherwise specified.
- (g) The frequency of testing for compliance shall not be less than the minimum specified.
- (h) Where a minimum testing frequency or minimum number of tests is not given, it shall be nominated by the Contractor and submitted to the Principal's Representative at least 14 days prior to the commencement of testing.
- (i) Test result submissions by the Contractor shall include a summary table listing all relevant specification requirements alongside the supplied test result(s), as well as noting whether the individual result is complying or non-complying.
- (j) Submissions that do not conform to the above will be rejected for re-submission.

Verification surveys

- (k) The Contractor shall undertake and submit verification surveys as specified in the Contract to demonstrate conformance with the drawings and specifications in relation to dimensions, tolerances and three-dimensional position.
- (l) Verification surveys shall be submitted with an accompanying survey conformance report where design levels, position and/or tolerances have been specified.
- (m) The report shall indicate the difference between actual and documented values for position and level (defined by co-ordinates or chainage and offset) and provide certification by the qualified surveyor responsible for the verification survey.

Non-conforming works

- (n) The Contractor is responsible for creating and maintaining a Non-Conformance Register.
- (o) Any works that depart from the documented requirements – whether identified by test result, verification survey, visual inspection or by any other means – shall be recorded

by the Contractor on a Non-Conformance Report (NCR) form and on the Contractor's NCR register within two working days of detection / identification.

- (p) The NCR shall indicate the Contractor's proposed action, which may include:
- i. Proposed additional works to bring the non-conforming works up to the documented standard.
 - ii. Proposed replacement of all or part of the non-conforming works to bring it up to the documented standard.
 - iii. For incidental defects, a request that the Principal's Representative accept the non-conforming works without alteration, as an exception with or without alteration to the respective contract sum.

MILESTONE:

- (q) At Practical Completion, or at any other time if requested by the Principal, provide a controlled copy of the Non-Conformance Register.

400.2 Inspection and Test Plans

General

- (a) The Contractor shall prepare an Inspection and Test Plan (ITP) for each element of work under the Contract.
- (b) ITPs must stipulate the type, frequency, and acceptance criteria for inspections and tests that must be conducted at key points in the construction process. They shall also stipulate the construction records that must be retained to demonstrate compliance with the specified requirements.
- (c) The ITP for each work element shall nominate:
 - i. Hold Points, Witness Points and Milestones, including time limits
 - ii. Proposed test methods, minimum frequencies and required construction records
 - iii. Specified acceptance criteria and tolerances
 - iv. Person responsible for carrying out in-progress and final inspections
 - v. Person responsible for reviewing inspection and test results, evaluating whether work conforms, determining future action when work does not conform.

Hold Point

- (d) A Hold Point is a point in the construction process beyond which the Contractor shall not proceed without written authorisation from the Principal's Representative.
- (e) Works to be held (i.e. that which the Contractor shall not proceed with until the Hold Point is released) are noted within each Hold Point. Where nothing is specified, all works are to be held.
- (f) Authorisation to proceed beyond a specified Hold Point, the Contractor shall provide evidence to the Principal's Representative that all applicable work has been completed, tested and inspected by the Contractor in accordance with the Contract.
- (g) The Principal's Representative's authorisation to proceed beyond the Hold Point does not relieve the Contractor of responsibility for satisfactory execution or performance of the work.

Witness Point

- (h) A Witness Point is a point in the construction process where the Contractor must provide prior notice to the Principal's Representative, who may exercise the option of attendance to witness those works.
- (i) Unless specified otherwise, the Contractor shall give the Principal's Representative notice of at least 48 hours of an approaching Witness Point. The notice period may only commence during working hours (i.e. 8:00am to 5:00pm, Monday – Friday, excluding Public Holidays).

- (j) The Contractor may proceed with the activity when the period of notice has expired whether or not the Principal's Representative elects to witness the activity.
- (k) The witnessing of an activity by the Principal's Representative or any delegate does not constitute approval or acceptance of the works.

Milestone

- (l) A Milestone is a point in the construction process where progress is verified by the submission of information.

Submission

HOLD POINT

- (m) The Contractor shall submit a controlled copy of the ITP relating to each and every element of the work under the Contract not less than 10 business days prior to the commencement of any work on the project, unless specified otherwise.

HOLD: All works.

- (n) The Contractor shall maintain the ITP as an up-to-date record as work on a given element progresses. The Principal's Representative may request to review the ITP at any stage during the works.

MILESTONE

- (o) Upon completion of each element of work under the Contract, the Contractor shall submit a controlled copy of the completed ITP.

400.3 Site Establishment

Site inception meeting

HOLD POINT

- (a) The Contractor shall give notice of the proposed date for possession of site so that the Principal's Representative and a representative of SPORTENG may be in attendance for a site inception meeting.

HOLD: All works.

Services

- (b) 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.

Site boundaries

- (c) Site boundaries shall be delineated according to circumstances and the nature of work being carried out. Such delineation may include fences, barricades, warning signs and/or lights, locked doors/gates, witches' hats, total enclosure of the work site or other agreed methods.
- (d) Work areas, which are designated as restricted, shall display notices in accordance with the applicable Australian Standards for warning signs.

Setting out the works

- (e) The supplied existing site surveys are available for information only.
- (f) Layouts of service lines, plant and equipment as shown on the drawings are schematic only, except where figured dimensions or setout points are provided. Before commencing work obtain measurements and other necessary information.
- (g) Works shall be set out by a licensed surveyor using the design setout data / digital model files provided.
- (h) The Contractor shall pay for any check surveys required to ensure that the works are set out in accordance with the Contract documents.
- (i) Notify the Principal's Representative of any omission or conflict in the drawings and their relation to Technical Specifications.

400.4 Operations and Maintenance Manuals

General

MILESTONE

- (j) Prior to Practical Completion, provide final Operation and Maintenance Manuals in accordance with the requirements of this section.

Objectives

- (k) The objectives of the Operations and Maintenance Manuals are to:
- i. Be of sufficient detail to enable the Principal's Representative to take over any maintenance, operation or use of the works and to do so in a safe, effective and efficient manner
 - ii. Enable progressive and timely development and checking of the Manuals in advance of any completion milestones
 - iii. Be fully completed and finalised prior to the Principal's Representative's occupation, use or acceptance of the works
 - iv. Be developed in standardised and fully electronic data format suitable for upload to the Principal's Representative's Asset and Data Management Systems
 - v. Enable complete financial reconciliation of the assets and works showing element and asset costs, life expectancy costs and the like.

Standard headings

- (l) Operations and Maintenance Manuals are to follow the standard headings shown below to ensure consistency for all elements of the works:
- i. Introduction & Scope - description of the systems, the approach taken and other relevant information to ensure maintenance staff understand the equipment and its intended purpose
 - ii. Assets - detailed schedule of all maintainable assets data, items, and locations
 - iii. Maintenance - detailed instructions and frequency to ensure proper function of the assets
 - iv. Operations Data - detailed instructions for safe and efficient operation of the equipment
 - v. Spare Parts - listed items or components required to complete maintenance or operation tasks or for replacements
 - vi. Warranty and Certificates - descriptions of all warranties (both contracted and procured through suppliers) for the assets and descriptions of any certificates issued as part of the works including attached copies of all relevant documents

- vii. Help and Contact - Details of any relevant contractors, suppliers and the like who may be used by the owner to support the operation and maintenance of the assets
 - viii. Drawings and Reference - lists of all final as-built drawings, specifications and other relevant documents forming the final contract scope and other relevant attachments - like product manuals, specifications and the like relevant to the proper operation and maintenance of the works.
- (m) Where a particular section is not relevant it may be left blank.

Draft submission

- (n) Collate all relevant information into a single report under the Standard Headings listed in this section.

MILESTONE:

- (o) Complete the draft Operations and Maintenance Manuals 28 days prior to proposed Practical Completion. Supply a draft for review by the Principal's Representative. The Principal's Representative may review Operation and Maintenance Manual and provide comments or directions for any corrections as needed.
- (p) Update the Operations and Maintenance Manuals for final submission prior to Practical Completion incorporating all comments or directions issued from the draft submission.

Compliance with laws, standards and specifications

- (q) Check and verify that all data and attached files and documents that form the completed Operations and Maintenance Manuals comply with the relevant Laws, Standards, Codes and Specifications applicable to the works to enable the proper operation and maintenance by the Principal's Representative and / or its appointed agents of the completed works.

400.5 Completion

As-constructed documentation

MILESTONE

- (a) Provide work-as-executed / as-constructed drawings in PDF and CAD formats showing the completed works as constructed and in accordance with the Specification requirements.
- (b) As-constructed documentation shall be produced from a survey of the completed works by a Licenced Surveyor using the Map Grid of Australia and Australian Height Datum.
- (c) As-constructed survey pick up is required for the line and layout of:
 - i. in-ground services, including irrigation, stormwater drainage
 - ii. pavements, kerbs, and edging
 - iii. fencing and sports equipment
 - iv. any other fixed elements or equipment.
- (d) Ensure the content, accuracy and level of detail of work-as-executed drawings are equivalent to those in the detail design drawings used for construction and are sufficient to describe the works adequate to enable future modifications or additions.
- (e) Where contract drawings are used as a base for production of the as-constructed documentation, all as-constructed details are to be clearly distinguishable from base / background information, e.g. via use of distinct colours, etc.
- (f) Any works backfilled without first being picked up by survey shall be uncovered to expose the top of the service, surveyed, and backfilled in accordance with the specification and the surface reinstated to the required condition.

Product warranty submissions

- (g) Where applicable, complete all documentation required by the manufacturer and submit those to the manufacturer to obtain the warranty and/or guarantee certificate(s).

Defects liability period

- (h) During the Defects Liability Period as defined in the Contract, the Contractor shall promptly rectify defects or omissions in the Contractor's works and are due to causes for which the Contractor is responsible.
- (i) The Contractor is not responsible for the repair, replacement or making good any defect or any damage to the works arising out of or resulting from any of the following causes:
 - i. Improper operation or maintenance of the works
 - ii. Use and operation of the works outside the Contract specifications.

600. Earthworks

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600.1 General

Scope

- (a) This section sets out the technical and verification requirements for earthworks to be executed under the Contract.
- (b) The scope of this section includes:
 - i. Earthworks materials
 - ii. Site clearing and stripping of topsoil
 - iii. General earthworks
 - iv. Capping material
 - v. Geotextiles
 - vi. Stabilisation
 - vii. Topsoil reinstatement.

Referenced standards

- (c) Refer to *Section 600.16* Standards.

Definitions

- (d) For the purposes of this Specification the definitions given below apply.

Bad Ground	Ground unsuitable for the purposes of the works, refer <i>Section 600.7(a)</i>
Batter	The uniform side slope of a cut or a fill.
Capping	Material of low permeability placed immediately over the subgrade to minimise changes in moisture content in the material below.
Design CBR	The California Bearing Ratio (CBR) nominated on the drawings for a particular pavement design.
Cut	Excavation below the natural surface level after removal of stripping.
Discrepancy	<p>A difference between contract information about the site and conditions encountered on the site, including but not limited to discrepancies concerning the following:</p> <ul style="list-style-type: none"> (a) The nature or quantity of the material to be excavated or placed. (b) Existing site levels. (c) Services or other obstructions beneath the site surface.

Fill	The compacted embankment placed above natural surface level after removal of topsoil.
Geotechnical inspection and testing authority (GITA)	Organisation with the necessary independence, equipment, and competence to be able to undertake all Earthworks inspections and testing, as defined by AS 3798, Clause 8.4. A GITA may also operate as a GTA.
Lot	A lot will consist of a single layer, batch or area of like work which has been constructed or produced under essentially uniform conditions and is essentially homogeneous with respect to material and appearance.
Pavement	Controlled materials placed above the subgrade (e.g. subbase, base, surfacing courses, etc.)
Rock	Monolithic material with volume greater than 0.5m ³ which is non-rippable by CAT D9 or equivalent.
Silt	A material with properties below the 'A line' on the Plasticity Index (PI) / Liquid Limit (LL) graph per Table A1 in AS 1726—2017.
Subgrade	The prepared surface upon which pavement and / or capping material is to be placed.
Topsoil	The layer of fertile, organic soil immediately below natural surface or placed to the finished surface` level outside areas to be paved.
Unsuitable Material	Material that is soft, excessively wet, unstable or otherwise not suitable for the specified use, as defined in <i>Section 600.3(e)</i> .

As-found site conditions

HOLD POINT AND WITNESS POINT

- (e) If any of the following are encountered, give notice immediately to the Principal's Representative:
- i. Discrepancies
 - ii. Bad Ground
 - iii. Rock
 - iv. Seepage / groundwater.
- (f) Where a discrepancy is encountered, provide sufficient evidence through survey report and/or other testing as necessary to allow verification of the reported discrepancy.

HOLD: All works within affected area(s) until HP has been released.

600.2 Conformance with Design

Quality management system

- (a) The Contractor shall implement a quality management system for all works under the Contract in accordance with *Section 400 Specification Preliminaries*.

Inspection and Test Plan

HOLD POINT

- (b) Submit Earthworks ITP 5 business days prior to commencement.

HOLD: All earthworks activity until HP has been released.

Standard Supervision and Testing

- (c) The Contractor is required to engage a Geotechnical Inspection and Testing Authority (GITA) to carry out all sampling and testing as specified or as otherwise required.
- (d) The Contractor's GITA shall attend site to undertake specified testing and observe all specified proof rolling.

MILESTONE

- (e) For all testing and for each site attendance, the Contractor's GITA shall supply a test report and / or site inspection report indicating whether the results comply with the specification and drawings.

- (f) Where Bad Ground is encountered (refer *Section 600.7 Bad Ground*), unless otherwise directed by the Principal's Representative, the Contractor's GITA shall attend site and provide a site inspection report or letter containing recommendations for remediation to achieve the design requirements.

Test methods

- (g) All testing to be in accordance with *Specification Appendix A Test Methods*.

Tolerances

- (h) Formed earthworks surfaces: +0, -20mm from design
- (i) Permanent batters: maximum 1:5 (vertical:horizontal), unless noted otherwise.

Verification survey

- (j) Conformance with design to be demonstrated through verification survey in accordance with *Section 600.12*.

600.3 Materials

Material types

(a) General fill:

	Requirement
Source	Site-won material
Maximum particle size	75 mm

(b) Select fill:

	Requirement
Source	Imported
Grading	Well-graded
Maximum particle size	75 mm
Fines content	≤ 25%-passing 0.075 mm sieve
California Bearing Ratio	≥ 2%
Swell	≤ 2.5%
Plasticity index	2 – 25

(c) Capping material:

	Requirement	
Source	Imported	
Permeability	≤ 5 x 10 ⁻⁹ m/s	
California Bearing Ratio	≥ 8%	
Swell	≤ 1.5%	
Plasticity index	6 – 25	
Weighted PI	≤ 1000 (= PI x %-passing 0.425mm)	
Limits of grading	Sieve Size (mm) to AS 1152	%-passing by mass
	37.5	100
	4.75	60 – 80
	0.425	20 – 80
	0.075	10 – 40

Imported materials

HOLD POINT

(d) Imported materials must be sampled at-source and tested prior to delivery to site. Tests must be current (i.e. performed within 3 months of the date supplied).

HOLD: Ordering and delivery of imported material until HP has been released.

Unsuitable materials

- (e) The following materials are unsuitable as fill or for fill to be constructed upon:
- i. organic materials, such as topsoils, severely root-affected subsoils and peat
 - ii. silts, or materials that have the deleterious engineering properties of silt
 - iii. material that contains boulders, wood, metal, plastic, or other deleterious material, in sufficient proportions to affect the required performance of the fill
 - iv. materials contaminated through past site usage
 - v. materials containing substances that can be dissolved or leached out in the presence of moisture (e.g. gypsum), or which undergo volume change or loss of strength when disturbed and exposed to moisture (e.g. shales, sandstones, etc.)
 - vi. other materials with properties that are unsuitable for the forming earthworks.

Material properties testing

- (f) Materials shall be tested to demonstrate compliance according to the following:

Material / Location	Test parameter	Minimum Test Frequency
Subgrade (pavement subject to vehicle traffic)	California Bearing Ratio (CBR) and Swell	1 test per 1,000m ² minimum 2 tests total per pavement type, per lot
Subgrade (pavement / profile not subject to vehicle traffic)	N/A	N/A
General Fill (site-won)	Unsuitable materials and maximum particle dimension	Visual inspection and assessment / measurement of larger rock particles
Select Fill (imported)	Soil classification tests (plasticity and grading)	1 test per 500 m ³
	California Bearing Ratio (CBR) and Swell	1 test per 500 m ³
Capping material (imported)	Soil classification tests (plasticity and grading)	1 test per 250 m ³
	California Bearing Ratio (CBR) and Swell	1 test per 250 m ³
	Permeability	1 test per 1000 m ³

600.4 Site Clearing

Extent

- (a) Unless otherwise specified in the Contract, the limits of clearing and grubbing shall be:
 - i. as shown on the drawings
 - ii. not more than as required for completion of the work under the Contract.
- (b) Clearing work or any type of disturbance outside of the specified limits of work shall not be undertaken unless approved by the Principal's Representative.

Protection of retained features

- (c) During site clearing operations, care shall be taken not to disturb any existing features to be retained, including structures, fences, vegetation, and survey marks.

Protection of trees and vegetation

- (d) Prior to commencement of any work, the Contractor and the Principal's Representative shall conduct a joint inspection of the site to identify vegetation to be retained and protected.
- (e) Existing trees, shrubs, and other areas of existing vegetation marked as 'to be protected and/or retained' on the drawings or as directed by the Principal's Representative shall be protected by temporary fencing and incorporated into the works by the Contractor.
 - i. Protective fencing for trees shall consist of minimum 1.8 m high rigid fence.
 - ii. Protective fencing for shrubs and vegetation shall consist of, as a minimum, star pickets with three strands of wire (top, middle and bottom) and barrier mesh.
- (f) No earthworks, travel of equipment, or storage compounds shall be established within 5 metres of the drip line of mature trees of trunk diameter greater than 200 mm.

Methodology

- (g) Remove everything on or above the site surface, including rubbish, vegetable matter and / organic debris, scrub, trees, timber, stumps, boulders and rubble. Remove standing grass to a depth sufficient to include the root zone. Strip surface grasses with the topsoil.
- (h) Grub out stumps and roots over 75 mm diameter to a minimum depth of 600 mm below subgrade level of buildings and pavements, or 300 mm below finished surface in other areas.
- (i) Remove redundant slabs, foundations, retaining walls, asphalt, paving, abandoned services and the like to a minimum depth of 300 mm below existing or finished surface, or 600 mm below subgrade level (whichever is greater).

- (j) Pits which are no longer required shall be removed completely when within the footprint of pavement works, or broken back to a depth not less than 600 mm below the finished surface level for all other areas. Remaining pipe openings shall be sealed with concrete.
- (k) Holes resulting from clearing or grubbing and remnants of pits shall be backfilled with Select Fill, placed and compacted in accordance with *Section 600.8* Fill Construction.

Disposal of materials

- (l) Unless otherwise specified, cleared materials shall become the property of the Contractor to transport to a place of legal disposal.
- (m) Disposal of material by burning on site or burying of materials on site is not permitted.
- (n) Tree trunks and large branches shall be removed from the site. Small tree branches, shrubs and leaves, excluding noxious weeds, shall be disposed of by chipping and mulching to form mulch.
- (o) Clean salvaged concrete and other pavement materials may be reused on site in locations permitted by the drawings and specification.

600.5 Stripping of Topsoil

Extent

- (a) Topsoil, severely root-affected soils, and / organic material shall be stripped from the areas shown on the drawings, and as otherwise required by the following:
 - i. areas on which fill is to be placed
 - ii. areas from which cut is to be removed
 - iii. areas on which pavement is to be constructed.

Methodology

- (b) Treat and manage site topsoil before stripping to remove and/or minimise the spread of weeds and other pathogens and pest organisms throughout the site.
- (c) Topsoil, severely root-affected soils, and / organic material shall be stripped as unsuitable material to be disposed off-site.
- (d) In areas specified, the full depth of topsoil shall be stripped.
- (e) Topsoil shall be stripped by a means which avoids contamination with subsoil and does not increase the extent of unstable areas.
- (f) Stripped surfaces shall be graded to an even self-draining surface.

Stockpiling

- (g) If shown on the drawings or as otherwise approved by the Principal's Representative, clean topsoil may be stockpiled in sufficient quantity as required for subsequent revegetation.
- (h) Stripped materials deposited in temporary stockpiles must be stored such that there is no possibility of the material being unintentionally covered by, or incorporated in, the earthworks.
- (i) Stockpiles shall be maintained in a neat, well-shaped state capable of shedding water.
- (j) Topsoil shall be re-spread as soon as practicable.

600.6 Excavation

General

- (a) Excavation includes all excavation within the limits of the batters, pavements, open and underground drainage and services, and shall include the handling of excavated material to the point of disposal.

Methodology

- (b) Excavate as required or as shown on the drawings, including but not limited to the following:
- i. Excavate to pavement subgrade formation level.
 - ii. Excavate for pits to the required sizes and depths.
 - iii. Excavate trenches for drainage and services (refer *Section 600.9 Service Trenching*).
 - iv. Excavate topsoil reinstatement areas sufficient to allow minimum topsoil depth to be placed to design FSL (refer *Section 600.15 Topsoil Reinstatement*)
- (c) Excavated material conforming to the relevant requirements of *Section 600.3 Materials* may be used for fill construction (refer *Section 600.8 Fill Construction*).
- (d) Where recovery of existing granular pavement materials is noted on the drawings, carefully excavate by a means which avoids contamination with subsoil. Materials deposited in temporary stockpiles must be stored such that there is no possibility of the material being unintentionally covered by, or incorporated in, the earthworks.
- (e) Dispose of excess material off-site.

Treatment of cut subgrade

- (f) Material within 300 mm of subgrade level in cut shall be prepared in accordance with the specification and drawings, including:
- i. Identify presence of any unsuitable materials (refer *Section 600.3(e)*)
 - ii. Verify Design CBR (only if nominated on the drawings, refer *Section 600.3(f)*)
 - iii. Compaction and moisture conditioning (*Section 600.10*)
 - iv. Proof roll (*Section 600.11*)
 - v. Verification survey (*Section 600.12*)
- (g) Where material within 300 mm of subgrade level in cut is not able to be prepared in accordance with the specification and drawings, refer to *Section 600.7 Bad Ground*.

600.7 Bad Ground

General

- (a) Bad ground includes any of the following:
- i. ground which is or becomes soft, wet or unstable
 - ii. ground containing Unsuitable Material (refer *Section 600.3(e)*)
 - iii. fill liable to subsidence
 - iv. ground containing cavities, faults or fissures
 - v. ground contaminated by harmful substances.
- (b) Bad ground or material otherwise unable to be prepared in accordance with the specification and drawings shall be treated in situ or excavated and replaced.
- (c) It is the responsibility of the Contractor and the Contractor's GITA to propose a methodology for remediation of bad ground.

HOLD POINT AND WITNESS POINT

- (d) Notify the Principal's Representative of the extent and nature of bad ground encountered, prior to remediation. Unless requested otherwise by the Principal's Representative, the Contractor's GITA shall attend site to inspect the bad ground and provide a written inspection report.

HOLD: Earthworks within the affected areas until HP has been released.

Subgrades affected by moisture

- (e) Where the subgrade is unable to support construction equipment, or unable to be compacted only because of a high moisture content, perform one or more of the following:
- i. Allow the subgrade to dry until it will support equipment and allow compaction
 - ii. Rip / tyne the subgrade to a depth of 200 mm, work as necessary to accelerate drying, and recompact when the moisture content is satisfactory (refer *Section 600.10 Compaction and Moisture Conditioning*)
 - iii. Excavate the wet material to a minimum depth of 300 mm and dispose off-site, and backfill excavated areas with general or select fill (refer *Section 600.8 Fill Construction*)

HOLD POINT

- (f) Submit the extent of proposed remediation and methodology, prior to the commencement of works.

HOLD: Earthworks within the affected areas until HP has been released.

Replacement of bad ground

- (g) Unless otherwise specified, material used to replace excavated unsuitable material shall be conforming General fill or Select fill (refer *Section 600.3 Materials*) and be placed in accordance with *Section 600.8 Fill Construction*.
- (h) Excavation of bad ground / unsuitable material shall be undertaken such that the extent of unstable areas is not increased.

HOLD POINT

- (i) Submit the proposed extent of replacement, the material type and material source, prior to the commencement of works.

HOLD: All works within the affected areas until HP has been released.

Treatment in situ

- (j) Treatment of bad ground in situ must not diminish the stability of the subgrade (i.e. ability to support the pavements within required tolerances) over the design life (20 years if none stated).
- (k) Treatment in situ may include, but is not limited to, any of the following:
- i. Stabilisation of in-situ material, design to be specified by the Contractor's GITA.
 - ii. Over-excavation and construction of a working platform specified by the Contractor's GITA.

HOLD POINT

- (l) Submit the proposed in situ treatment methodology, including the proposed material properties, proprietary product details, and construction methodology.

Where stabilisation is proposed, specify the:

Minimum depth of stabilisation: ___ mm

Minimum CBR strength: ___ %

Maximum swell: ___ %

Maximum permeability: ___ m/sec

HOLD: Earthworks within the affected areas until HP has been released.

600.8 Fill Construction

General

- (a) Fill construction includes the preparation of areas upon which fills are to be constructed and the selection, placement, and compaction of material.

Methodology

- (b) Prior to placement of fill material, areas upon which fills are to be constructed shall be:
- i. Moisture conditioned and compacted (in accordance with *Section 600.10*), and
 - ii. Proof rolled (in accordance with *Section 600.11*).
- (c) The method of excavation, transport and depositing of fill material should ensure that the fill is placed in a mixture as uniform as practicable.
- (d) Fill material shall be placed in near-horizontal layers of uniform thickness, deposited systematically across the fill area.
- (e) Fill material shall be placed in layers of maximum 200 mm loose thickness.
- (f) Before any loose layer of fill is compacted, the material and its moisture condition should be as uniform as practicable throughout its depth.
- (g) Each layer of fill shall be:
- i. Moisture conditioned and compacted (in accordance with *Section 600.10*), and
 - ii. Proof rolled (in accordance with *Section 600.11*).
- (h) If there is a delay in the placement of subsequent fill layers, previously accepted layers must conform with the specification before further fill is placed to avoid compaction issues and / or heaving of subsequent layers.

Treatment of fill subgrade

- (i) Material within 300 mm of subgrade level in fill shall be prepared in accordance with the specification and drawings, including:
- i. Verify Design CBR (only if nominated on the drawings, refer *Section 600.3(f)*)
 - ii. Compaction and moisture conditioning (*Section 600.10*)
 - iii. Proof roll (*Section 600.11*)
 - iv. Verification survey (*Section 600.12*)

600.9 Service Trenching

General

- (a) Any specific requirements for installation of in-ground services outside of this Earthworks specification (including on the drawings) supersede the requirements listed in this section.

Materials

- (b) Bedding (unless noted otherwise):
 - i. Compacted sand \geq 50 mm thickness.
- (c) Surround (unless noted otherwise):
 - i. Clean sharp sand to level \geq 150 mm above service.
- (d) Backfill service trenches to design subgrade level with:
 - i. Class 3 FCR or cement-stabilised sand, where the trench crosses and existing or proposed pavement or trafficable area.
 - ii. General fill, with no stones larger than 25 mm occurring within 150 mm of the service, for all other areas.

Methodology

- (e) Excavate to the lines, levels and grades as required for underground services specified in the relevant sections. Make the trenches straight between manholes, inspection pits, junctions and the like, with vertical side and uniform grades.
- (f) Excavate trenches in sections of suitable length to allow service installation and backfilling on the same working day, if possible.
- (g) Subject to regulatory authority requirements, keep trench widths to the minimum consistent with the laying and bedding of the relevant service, and the construction of manholes and pits.
- (h) If trench excavation exceeds the correct depth, reinstate to the correct depth and bearing value using compacted bedding material or grade N20 concrete.
- (i) Place backfill in layers no greater than 200mm thick when loose and compact to the density which applies to the location of the service trench.
- (j) Compact so that the pipe is buttressed by the walls of the trench.

600.10 Compaction and Moisture Condition

General

- (a) All earthworks surfaces and materials (except topsoil) shall be moisture conditioned, compacted, and tested.

Methodology

- (b) Adjust the moisture content of subgrade and fill at the time of compaction to $\pm 3\%$ of the optimum moisture content determined by AS 1289.5.1.1.
- (c) Protect the works from damage due to compaction operations. Where necessary, limit the size of compaction equipment or compact by hand.
- (d) Apply uniform and sufficient compactive effort by appropriate equipment consistently over the whole area to be compacted to achieve the required density.

Acceptance criteria and testing frequency

- (e) Test compacted surfaces in accordance with the following table:

Location / Material	Acceptance criteria	Testing frequency
Subgrade (and fill within 300 mm of subgrade)	98% S.M.D.D. (not greater than 102% S.M.D.D. in reactive clays)	Whichever requires the greater number of tests:
Fill (not within 300 mm of subgrade)	95% S.M.D.D.	<ul style="list-style-type: none"> 1 test per layer, per 2500 m² 1 test per layer, per tennis / netball court (where applicable) 3 tests per lot.
Areas upon which fill is to be placed	95% S.M.D.D.	
Drainage and service trenches	95% S.M.D.D.	1 test per 2 layers per 40 linear metres
Backfilling of grub holes	95% S.M.D.D.	N/A
Replacement of over-excavation	95% S.M.D.D.	N/A
Replacement of unsuitable material	95% S.M.D.D.	N/A
Cement treated subbase	98% S.M.D.D.	N/A

Final earthworks surfaces

- (f) Subgrade surfaces, top of capping, and top of fill material shall be prepared to level and shape within the tolerances specified in *Section 600.2 Conformance with Design* to produce a smooth, hard, tightly bound surface, free from depressions capable of holding water.
- (g) Material within 150 mm of subgrade shall be maintained such that its moisture content is not less than 70% of optimum moisture content prior to the placement of any pavement layer.

600.11 Proof Rolling

Extent

- (a) Areas upon which fills are to be constructed, all layers of fill, and subgrades should be compacted to be capable of withstanding proof rolling without visible deformation or springing.
- (b) Prior to placement of overlying material, proof roll areas upon which fills are to be constructed, all layers of fill, and materials within 150 mm of permanent subgrade level in cuttings to determine the extent of any bad ground.

HOLD POINT AND WITNESS POINT

- (c) The Contractor's GITA shall witness all proof rolling required under this specification. The GITA shall supply a test report and / or site inspection report indicating whether the proof rolling identified any areas of deformation or springing to be rectified.

HOLD: Any works on or within layers to be proof rolled until HP has been released.

Acceptable plant

- (d) Proof rolling shall be completed with any of the following plant:
 - i. Static smooth steel drummed rollers with a mass of not less than 12 tonnes and a load intensity under the drum of not less than 6 tonnes per metre width.
 - ii. Pneumatic tyre plant with a mass of not less than 20 tonnes and a ground contact pressure under either the front or rear wheels of not less than 450 kPa per tyre. The area over which this ground contact pressure is applied should be not less than 0.035 m² per tyre
 - iii. Highway truck with rear axle of axles loaded to not less than 8 tonnes each with tyres inflated to 550 kPa.

Methodology

- (e) Fill layers should be proof rolled immediately following completion of compaction. If further proof rolling is required at some later date, the surface should be moisture-conditioned, as required, and given not less than four coverages of the testing plant before proof rolling resumes.
- (f) Any areas where visible deformation or springing is detected by proof rolling are considered Bad Ground (refer *Section 600.7*) to be rectified before being presented for proof rolling again.
- (g) Where unstable areas exceed 20% of the area being considered by proof rolling, the whole of the area should be ripped, recompacted and re-presented for test rolling.

600.12 Verification Survey

Extent

- (a) All completed earthworks surfaces shall be surveyed to verify the completed earthworks comply with the design and tolerances (refer *Section 600.2 Conformance with Design*).

Methodology

- (b) Verification surveys shall comply with the general requirements of *Section 400.1 Conformance with Design*.
- (c) Earthworks survey measurements to be taken:
 - i. At all changes in grade, steps in formation level, and other features
 - ii. Spot levels on a grid with spacing not greater than 5 x 5 metres.

HOLD POINT

- (d) Submit a verification survey report comparing the as-built levels with design levels, including highlighting any points that exceed the tolerances (refer *Section 600.2 Conformance with Design*).

HOLD: Placement of overlying materials until HP has been released.

600.13 Geotextiles

Extent

- (a) Geotextiles to be installed where indicated on the design drawings or as otherwise proposed for remediation of bad ground (refer *Section 600.7 Bad Ground*)

Materials

- (b) Geocomposite membranes:
 - i. Geocomposite membranes shall consist of two layers of A24 grade geofabric (or similar) bonded to either side of a polyethylene/PVC liner (thickness 0.2mm to 0.75mm)
- (c) Geofabric:
 - i. Geofabrics shall be minimum A24 grade, unless noted otherwise.
- (d) Geogrid:
 - i. Geogrids shall be Tensar TriAx T160, or approved equivalent.

HOLD POINT

- (e) Supply a sample of the product and relevant technical data prior to ordering.

HOLD: Ordering products until HP has been released.

Methodology

- (f) All products to be installed in accordance with the manufacturer's requirements.
- (g) Geocomposite membranes shall be installed with:
 - i. Minimum lap of 300 mm
 - ii. The upper layer of laps at joints oriented to face down-grade
 - iii. All joints machine welded/glued.

600.14 Stabilisation

Extent

- (a) Stabilise in situ materials where indicated on the design drawings or as otherwise proposed for remediation of bad ground (refer *Section 600.7* Bad Ground)

Standard

- (b) Stabilisation to be undertaken in accordance with all the requirements of the following Main Roads Western Australia documentation:
 - i. Specification 515 – In-Situ Stabilisation of Pavement Materials.

Methodology

HOLD POINT

- (c) Submit proposed construction methodology.

HOLD: Stabilisation works until HP has been released.

600.15 Topsoil Reinstatement

Site-won topsoil

- (a) 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:
 - i. Stones >25mm diameter.
 - ii. Clay lumps >75mm diameter.
 - iii. Weeds and tree roots.
 - iv. Sticks and rubbish.
 - v. Material toxic to plants.

Methodology

- (b) Topsoil shall not be placed over cut and fill areas until such areas are verified to comply with the requirements in *Section 600.2 Conformance with Design*.
- (c) All unpaved cut and fill areas within the limits of works and any other area disturbed by activities associated with the works shall be topsoiled to the following thicknesses measured normal to the slope:
 - i. landscape / garden areas: 200 mm minimum
 - ii. all other areas: 100 mm minimum.
- (d) Topsoil shall be placed and levelled but not compacted.
- (e) Topsoil on batters shall be placed to prevent rilling.
- (f) The surface level of topsoil shall match the design finished surface level, or level of back of kerb or concrete edging, as appropriate.

600.16 Standards

AS 1289 (series)	Methods of testing soil for engineering purposes
AS 1289.2.1.1—2005	Soil moisture content tests—Determination of the moisture content of a soil—Oven drying method (standard method)
AS 1289.3.1.1—2009 /Amdt 1 2015	Soil classification tests—Determination of the liquid limit of a soil—Four point Casagrande method
AS 1289.3.1.2—2009 /Amdt 1 2015	Soil classification tests—Determination of the liquid limit of a soil—One point Casagrande method (subsidiary method)
AS 1289.3.2.1—2009	Soil classification tests—Determination of the plastic limit of a soil—Standard method
AS 1289.3.3.1—2009	Soil classification tests—Calculation of the plasticity index of a soil
AS 1289.3.6.1—2009	Soil classification tests—Determination of the particle size distribution of a soil—Standard method of analysis by sieving
AS 1289.3.8.1—2006	Soil classification tests—Dispersion—Determination of Emerson class number of a soil
AS 1289.4.1.1—2019	Soil chemical tests—Determination of the organic matter content of a soil—Normal method
AS 1289.4.3.1—1997	Soil chemical tests—Determination of the pH value of a soil— Electrometric method
AS 1289.4.4.1—1997	Soil chemical tests—Determination of the electrical resistivity of a soil—Method for sands and granular materials
AS 1289.5.1.1—2017	Soil compaction and density tests—Determination of the dry density/moisture content relation of a soil using standard compactive effort
AS 1289.5.2.1—2017	Soil compaction and density tests—Determination of the dry density/moisture content relation of a soil using modified compactive effort
AS 1289.5.3.1—2004	Soil compaction and density tests—Determination of the field dry density of a soil—Sand replacement method using a sand—cone pouring apparatus
AS 1289.5.3.5—1997	Soil compaction and density tests —Determination of the field dry density of a soil—Water replacement method
AS1289.5.4.1—2007	Soil compaction and density test - Compaction control tests - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.4.2—2007	Soil compaction and density tests—Compaction control test—Assignment of maximum dry density ratio and optimum moisture content values
AS 1289.5.6.1—1998	Soil compaction and density tests—Compaction control test —Density index method for a cohesionless material
AS 1289.5.7.1—2006	Soil compaction and density tests—Compaction control test—Hilf density ratio and Hilf moisture variation (rapid method)

AS 1289.5.8.1—2007	Soil compaction and density tests—Determination of field density and field moisture content of a soil using a nuclear surface moisture density gauge – Direct transmission mode
AS 1289.5.8.3—1998	Soil compaction and density tests—Calibration of nuclear surface moisture—density gauge for field use
AS 1289.5.8.4—2012	Soil compaction and density tests—Nuclear surface moisture— density gauge—Calibration using standard blocks
AS 1289.6.1.1—2014	Soil strength and consolidation tests—Determination of the California bearing ratio of a soil—Standard laboratory method for a remoulded specimen
AS 1289.6.1.2—1998	Soil strength and consolidation tests—Determination of the California bearing ratio of a soil—Standard laboratory method for an undisturbed specimen
AS 1289.6.1.3—1998	Soil strength and consolidation tests—Determination of the California bearing ratio of a soil—Standard field—in—place method
AS 1289.6.2.2—1998	Soil strength and consolidation tests—Determination of the shear strength of a soil—Direct shear test using a shear box
AS 1289.6.7.1—2001	Soil strength and consolidation tests—Determination of the permeability of a soil—Constant head method for a remoulded specimen
AS 1289.6.7.2—2001	Soil strength and consolidation tests—Determination of the permeability of a soil—Falling head method for a remoulded specimen
AS 1726—2017	Geotechnical site investigations
AS 3798—2007	Guidelines on earthworks for commercial and residential developments
AS 4419—2018	Soils for landscaping and garden use

900. Stormwater Drainage

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900.1 General

Scope

- (a) This section sets out the technical and verification requirements for stormwater drainage to be executed under the Contract.
- (b) The scope of this section includes:
 - i. Drainage structures
 - ii. Pipe drainage
 - iii. Subsurface drainage (general)
 - iv. Proprietary drainage systems.

Referenced Standards

- (c) Supply, install, test and commission the drainage systems specified in this section and the related documentation to the requirements of the regulatory authorities and the relevant provisions of AS 3500.3.
- (d) Refer to *Section 900.9* Standards.

As-found site conditions

HOLD POINT AND WITNESS POINT

- (e) If any of the following are encountered, give notice immediately to the Principal's Representative:
 - i. Discrepancies
 - ii. Bad Ground
 - iii. Rock
 - iv. Seepage / groundwater.
- (f) Where a discrepancy is encountered, provide sufficient evidence through survey report and/or other testing as necessary to allow verification of the reported discrepancy.

HOLD: All works within and upstream of affected area(s) until HP has been released.

900.2 Conformance with Design

Quality management system

- (a) The Contractor shall implement a quality management system for all works under the Contract in accordance with *Section 400 Specification Preliminaries*.

Inspection and Test Plan

<p>HOLD POINT</p> <p>(b) Submit Stormwater Drainage ITP 5 business days prior to commencement.</p> <p>HOLD: All stormwater drainage construction until HP has been released.</p>
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Test Methods

- (c) All testing to be in accordance with Specification *Appendix A Test Methods*.

Tolerances

- (d) Stormwater drainage shall be constructed to the following tolerances:

	Description	Tolerance
Structures	plan offset of structures required to match lines of kerbs/edges/pavements	±20 mm
	plan location of structures, any other location	±100 mm
	cover level at every point of the perimeter, and the line of the kerb	±10 mm
Pipes	invert level of pipes at pits	±50 mm
	departure from design grade of pipe runs	±0.1%
Subsurface drainage	invert level	+/-25 mm
	horizontal position	+/- 50 mm
	changes in grade	< 10 mm / 3 m

- (e) The specified tolerances are conditional on positive falls to outlets being maintained and no part of a pipeline having less than the minimum allowable gradient per AS 3500.3 Table 6.3.4, unless documented otherwise.

Verification survey

<p>MILESTONE</p> <p>(f) The location of each run of underground drainage shall be verified by survey prior to backfilling the pipes.</p>
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900.3 Materials

Filter material

- (a) Granular filter material shall consist of hard, durable and clean sand, gravel, or crushed rock screening, which is free from clay balls and / organic matter complying with the stated limits of grading:

Limits of grading	Sieve Size (mm) to AS 1152	Grade A3	Grade A4
		% -passing by mass	
	9.50	100	100
	4.75	90 - 100	70 - 100
	2.36	70 - 100	0 - 50
	1.18	40 - 65	0 - 10
	0.600	12 - 40	-
	0.300	0 - 16	0 - 5
	0.150	0 - 4	-
	0.075	0 - 3	0 - 3

No fines concrete

- (b) No fines concrete shall consist of Type GP cement (4.0% by volume), water and coarse aggregate.
- (c) Type GP Cement shall comply with AS 3972.
- (d) Coarse aggregate shall comply with the requirements of *Section 1500 In-situ Concrete*.
- (e) Coarse aggregate grading limits shall be:

Limits of grading	Sieve Size (mm) to AS 1152	% -passing by mass
	26.5	100
	19.0	70 - 100
	13.2	0 - 70
	9.50	0 - 25
	2.36	0 - 5
	0.075	0 - 3

- (f) The water/cement (W/C) ratio shall be in the range of 0.35 to 0.5.
- (g) The W/C ratio shall provide for complete cementitious paste coverage of the aggregate. The water and paste content shall be such that it does not cause the paste to flow during mixing, handling or placing.

Embedment materials

- (h) Pipe bedding, haunch, support, overlay, and/or embedment materials vary by pipe type, as specified in *Section 900.5 Pipe Drainage*.

Backfill materials

- (i) Drainage trench backfill shall be a 20 mm nom. size crushed rock lower subbase material, in accordance with Section 1600.3.
- (j) Where pipes are installed in topsoiled and/or hydroseeded reinstatement areas not subject to vehicular traffic, backfill material may be general fill (refer Section 600.3).

Cementitious mortar

- (k) Cementitious mortar shall be shrinkage compensating proprietary products with a consistency appropriate for the required use, and able to be placed and compacted to achieve full encapsulation.
- (l) Cementitious mortars shall have a minimum 28-day compressive strength of not less than 40 MPa.
- (m) Mortar shall be cured in accordance with the manufacturer’s requirements.

Material properties testing

- (n) Materials shall be tested to demonstrate compliance according to the following:

Material / Location	Test parameter(s)	Minimum Test Frequency
Filter material	Grading	1 test per 500 m ³ minimum 2 tests total
No fines concrete coarse aggregate	Grading	1 test per 500 m ³ minimum 2 tests total
Embedment materials	Grading Atterberg limits (if specified)	1 test per 500 m ³ minimum 2 tests total per material type
Backfill (imported crushed rock)	Grading	1 test per 1000 m ³ minimum 2 tests total
Backfill (site-won)	Unsuitable materials and maximum particle dimension	Visual inspection and assessment / measurement of larger rock particles

900.4 Drainage Structures

General

- (a) Provide drainage structures as documented including the following: junction pits, inlet (gully) pits, inspection openings, outlet structures, and other supplementary structures as shown on the drawings.

Materials

- (b) Drainage structures shall be precast reinforced concrete, unless specified otherwise.

Precast pits

- (c) Precast drainage pits shall be installed at the locations and to the dimensions shown on the drawings.
- (d) Precast concrete units for pits shall conform to all the following criteria of AS 4198:
 - i. Support, for a minimum of 30 seconds, without structural failure or significant cracking, the applicable pit lid design loads in accordance with AS 3996 (where a precast unit has knock-out panels, this requirement shall apply with the knock-out panels removed)
 - ii. Be classified and marked in accordance with the pit lid classification of AS 3996 for which they are designed.
- (e) Provision shall be made for the connection of all stormwater drainage, culverts and subsurface drains as shown on the drawings.
- (f) Weepholes of 50 mm diameter shall be provided in all precast pits and shall be placed between the midpoint and top of the stormwater drain in those walls which have openings for drains.
- (g) If a precast pit is cast in segments, each segment of the pit shall be rebated a minimum of 15 mm to ensure correct alignment and to prevent horizontal movement.

Step irons

- (h) Unless otherwise specified, step irons are to be installed in all pits with a depth in excess 900 mm.

Installation

- (i) Excavations for drainage structure shall provide 400 mm minimum clearance from all external faces of the pit to each face of the excavation.
- (j) Bedding of granular pavement base or equivalent material shall be placed and compacted to minimum thickness of 100 mm and compacted to minimum 95% modified maximum dry density.
- (k) Pipes shall be trimmed flush with the internal pit wall and the joint made watertight with a cementitious mortar to provide a smooth, seamless finish uniform with the inner surfaces of the structure.

- (l) Drainage pit floors shall be smoothly shaped from the inlets to the outlet for a height of one-third of the diameter of the outlet pipe with cementitious mortar, to provide a profile that will ensure smooth flow conditions between inlet and outlet pipes and prevent any snagging of debris.
- (m) Backfill the excavation in accordance with the requirements of *Section 600 Earthworks*.

Covers, grates, frames and lintels

- (n) Access covers, grates, and lintels shall be of the specified type and load class in accordance with AS 3996.
- (o) All grates located in a walking surface shall comply with AS 1428.2 Clause 9(c) for grate openings and alignment.
- (p) Frames for drainage structures shall be cast into the top of the drainage pit or bedded on fresh mortar, minimum 5 mm thick.
- (q) The level at every point of the perimeter shall be within 10 mm of the design level for that point, and the line of the cover shall be within 10 mm of the design setout line (kerb line or similar).

900.5 Pipe Drainage

General

- (a) Install pipe drainage as shown on the drawings and in accordance with AS3500.3 Sections 6 and 7.

Reinforced concrete pipes (RCP)

- (b) Reinforced concrete pipes shall be:
- i. Reinforced concrete pipe (RCP) conforming to AS 4058
 - ii. Class 2, unless specified otherwise.
- (c) RCP shall be rubber-ring jointed (RRJ), unless specified otherwise.
- (d) Installation shall be in accordance with AS3725 Design for installation of buried concrete pipes.
- (e) Install with HS2 bedding and support as shown on the drawings, unless specified otherwise.
- (f) Excavate slots for joint bells.

Flexible pipes (PVC-U, PP, HDPE)

- (g) Flexible pipes shall be either:
- i. PVC-U pipe conforming to AS 1260
 - ii. PP pipe conforming to AS 5065
 - iii. HDPE conforming to AS 5065.
- (h) All flexible pipes shall be stiffness SN8, unless noted otherwise.
- (i) Flexible pipes shall be jointed with:
- i. Rubber-ring joints (RRJ), for pipes with diameter ≥ 150 mm.
 - ii. Solvent cement joints (SCW), for pipes with diameter < 150 mm.
- (j) Installation shall be as shown on the drawings and in accordance with AS 2566.2 Buried flexible pipelines – Part 2: Installation.
- (k) Embedment material may consist of:
- i. selected cohesionless materials (as per AS 2566.2 Appendix G)
 - ii. controlled low-strength materials (CLSM, per AS 2566.2 Appendix K)
 - iii. stabilised soils (as per AS 2566.2 Appendix L).

Reinforced concrete box culverts (RCBC)

- (l) Supply and installation of precast reinforced concrete box culverts up to 1200 mm in width shall be in accordance with the requirements of AS 1597.1.

Backfill

- (m) Backfill material shall be as nominated in *Section 900.3 Materials*.
- (n) Backfill shall be placed and compacted in layers not exceeding 150 mm loose thickness.

Junctions

- (o) Junctions in stormwater drainage pipes, where no drainage structure is nominated, shall be made by means of pipe-to-pipe connection.
- (p) The connection type shall vary depending on the pipe materials:
- | | | |
|------|----------------------|---------------------------------------|
| i. | PVC-U to PVC-U: | PVC-U moulded fitting |
| ii. | PVC-U to PP: | grommet, saddle or PP moulded fitting |
| iii. | PP to PP: | PP moulded fitting |
| iv. | Subsurface to PVC-U: | PVC-U moulded fitting. |

Testing

HOLD POINT

- (q) Undertake compaction and moisture testing in accordance with *Section 600.10(e)*.

HOLD: Placement of material layers over drainage trenches until HP has been released.

WITNESS POINT

- (r) A flushing test shall be carried out on each drainage line after completion of the works.

- (s) Each drain shall be flushed with sufficient water to remove material that has entered the pipes during construction and to ensure that the drainage line is free from obstruction.

900.6 Subsurface Drainage

General

- (a) Subsurface drainage is shown on the drawings schematically and installation must comply with both the plan locations shown and the typical details provided.
- (b) The requirements of this section are not applicable for natural turf and synthetic turf subsurface drainage systems
- (c) Construct trenches and other necessary excavations and backfill in accordance with the relevant sections of the *Section 600 Earthworks*.

Subsurface drainage pipes

- (d) Subsurface drainage pipes shall be Class 400 (SN8) perforated drainage pipe complying with AS 2439.1.
- (e) Pipes shall be supplied fitted with filter sock, unless specified otherwise.

Installation

- (f) The grade of subsurface drainage pipes shall be not flatter than 1 in 250.
- (g) Pipe bedding shall be filter material, at least 50 mm thick after compaction.
- (h) Pipes shall be placed centrally in the trench on the prepared bedding and held firmly in place.
- (i) Slotted pipes shall be laid with the openings in the lower half of the pipe.
- (j) Filter material shall be placed moist and compacted with minimal disturbance to pipes, geotextiles and trench walls. The loose thickness of layers shall not exceed 300 mm.

Flushout risers

- (k) All subsurface drainage pipes shall be installed with access points at the beginning and end of the drainage run.
- (l) Where the upstream end of a subsurface pipe cannot be connected to a stormwater pit, a flushout riser shall be installed in accordance with the typical detail provided.

Flushing test

WITNESS POINT

- (m) A flushing test shall be carried out on each subsurface drainage line after completion of the works.
- (n) Each drain shall be flushed with sufficient water to remove material that has entered the pipes during construction and to ensure that the drainage line is free from obstruction.

900.7 Proprietary Drainage Systems

General

- (a) Proprietary drainage systems include grated trench drain systems, drainage cells, tank systems, stormwater treatment devices and the like.
- (b) Proprietary drainage systems shall be installed as shown on the drawings and in accordance with the manufacturer's requirements. Where conflicts exist, the more onerous requirement will apply.
- (c) Specified systems and products may only be varied if approved in writing by the Principal's Representative, following review by the designer.

900.8 Inspection

General

- (a) At the completion of all works, the Contractor shall flush out and undertake CCTV inspection of all new and existing drainage pipes within the scope of works boundary.
- (b) The CCTV inspection should demonstrate that the stormwater drainage system is:
 - i. constructed to a high standard in accordance with the drawings and specification
 - ii. clear of debris and sediment
 - iii. undamaged from any activities associated with the works.

MILESTONE

- (c) The Contractor shall provide CCTV inspection recordings (.mp4 file format) and inspection report (PDF file format).

Flushing

- (d) The Contractor shall flush clear all new and existing stormwater drainage conduits within the scope of works and physically remove all solid debris, litter and silt from conduits prior to commencing any CCTV inspection.

CCTV Requirements

- (e) CCTV inspection report shall be in accordance with the requirements of *WSA 05-2013 V3.1 Conduit Inspection Reporting Code of Australia*.
- (f) All reporting (including recorded videos files and inspection report) must be clearly labelled with the pit numbering system shown on the drawings.
- (g) Do not abandon any CCTV inspection due to any obstruction that could reasonably have been removed during flushing, refer *Clause 900.8(d)*.
- (h) In the event of encountering a blockage in the stormwater conduits which leads to abandoning the CCTV inspection, the must conduct the CCTV inspection from the other end of the pipe at least to the point where it was abandoned previously

Defects

- (i) Any debris, sediment, damage, or poor workmanship is considered a defect and shall be dealt with in accordance with *Section 400.1*.
- (j) If applicable, complete additional CCTV inspection to verify any identified defects are correctly rectified.

900.9 Standards

AS 1254—2010	PVC pipes and fittings for stormwater and surface water applications
AS 1428.2—1992	Design for access and mobility – Part 2: Enhanced and additional requirements—Buildings and facilities
AS 1597.1—2010	Precast reinforced concrete box culverts - Small culverts
AS 2032—2006	Installation of PVC pipe systems
AS 2033—2008	Installation of polyethylene pipe systems
AS 2566.1—1998	Buried flexible pipelines – Part 1: Structural design
AS 2566.2—2002	Buried flexible pipelines – Part 2: Installation
AS 3500.3—2018	Plumbing and drainage – Part 3: Stormwater drainage
AS 3725—2007	Design for installation of buried concrete pipes
AS 3972—2010	General purpose and blended cements
AS 3996—2019	Access covers and grates
AS 4058—2007	Precast concrete pipes (pressure and non-pressure)
AS 5065—2005	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

1500. In-situ Concrete

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1500.1 General

Scope

- (a) This section sets out the technical and verification requirements for in-situ concrete to be executed under the Contract.
- (b) The scope of this section includes:
 - i. Kerbs and edging
 - ii. Concrete pavements
 - iii. Footings.

Referenced Standards

- (c) Supply, install, and test in-situ concrete works specified in this section and the related documentation to the requirements of AS 1379.
- (d) Refer to *Section 1500.12* Standards.

1500.2 Conformance with Design

Quality management system

- (a) The Contractor shall implement a quality management system for all works under the Contract in accordance with *Section 400 Specification Preliminaries*.

Inspection and Test Plan

HOLD POINT

- (b) Submit Concrete ITP 5 business days prior to commencement.

HOLD: All concrete preparation and construction until HP has been released.

- (c) Record details of each placement of concrete, including the following:
- i. Date placed
 - ii. The portion or area of work
 - iii. Specified strength grade and source of concrete
 - iv. Slump measurements
 - v. Ambient temperature and concrete temperature (if applicable)
 - vi. Volume placed.

Testing requirements

- (d) All supplied concrete shall be subject to production assessment by the supplier in accordance with the relevant sections of AS 1379.

HOLD POINT

- (e) Register the project in accordance with AS 1379 clause 6.4.3 and apply to receive production assessment information from the concrete supplier.

HOLD: All concrete works until HP has been released.

MILESTONE

- (f) Provide production assessment reports received from the concrete supplier for each reporting period.

- (g) N32 grade concrete is subject to additional project assessment (refer to clause 1500.3(b)). Project assessment shall be in accordance with AS 1379 Section 6.5.

Test methods

(h) All testing to be in accordance with Specification *Appendix A Test Methods*.

Tolerances

(i) Concrete shall be constructed to the following tolerances from design:

Element	Description	Tolerance
Pavements	Surface level	±5 mm
	Thickness	+5 / -0 mm
	Flatness	No greater than 5 mm beneath a 3 m straight edge
Kerbs	Horizontal position	±10 mm
	Surface level	±10 mm
	Rate of change from line or level	10 mm in 10 metres
All other visible surfaces (e.g. hard landscape features, etc.)	Any specified height, and plan or cross-sectional dimension	±5 mm
Footings (concealed)	Any specified height, and plan or cross-sectional dimension	±5 mm, or 0.5% of the specified dimension, whichever is greater

(j) Notwithstanding clause 1500.2(i), all accessible paths of travel shall conform to the requirements of AS 1428.1 and AS 1428.2.

Verification survey

(k) Conformance with design to be demonstrated through verification survey in accordance with *Section 1500.11600.12*.

1500.3 Materials

Pre-mixed concrete

- (a) Portland cement-based concrete shall be either N20, N25, or N32 standard strength grade as specified, complying with the requirements of AS 1379.
- (b) Standard concrete parameters, in accordance with AS 1379, are:

	Grade Designation		
	N20	N25	N32
Slump	80 mm ± 15 mm		
Maximum nominal size of aggregate	20 mm		
Intended method of placement	Pump, or as specified by Contractor		
Project assessment (per AS 1379 Clause 6.5)	Not required		Required
Air entrainment	N/A	2% ± 1.5%	

- (c) No additional water shall be added to the concrete mix after batching.
- (d) No additives are to be placed in concrete mix when acrylic surfacing is intended to be installed on the slab.

Concrete testing on site

- (e) The frequency of sampling shall be minimum one sample from each 50 m³ of concrete.
- (f) Test slump for at least one sample from each batch before placing concrete from that batch in the work. Take the samples at the point of discharge on site.
- (g) N32 grade concrete is subject to additional strength assessment:
- i. From each sample intended for strength grade assessment, at least two standard cylinder specimens shall be made and cured in accordance with AS 1012.8.1 and AS 1012.8.2.
 - ii. The compressive strength of each cylinder specimen shall be determined, recorded and reported in accordance with AS 1012.9.
 - iii. The test strength of the sample is as per AS 1379 Clause 6.2.5.
 - iv. Acceptance criteria is as per AS 1379 Clauses 6.5.2(c), for three or more samples, or 6.5.2(d), for less than three samples.

Aggregates

- (h) Concrete aggregates shall comply with the requirements of AS 2758.1.

Steel reinforcement

- (i) Steel reinforcement shall comply with the requirements of AS 4671.

- (j) Galvanising, where specified, shall be in accordance with the requirements of AS 4680.

Vapour barrier

- (k) The material for vapour barriers shall be 200 µm (0.2 mm) thick polyethylene film, medium impact resistance, complying with the requirements of AS 2870 Section 5.3.3.

1500.4 Preparation

Excavation

- (a) Any necessary excavations and disposal of excavated material to be in accordance with *Section 600 Earthworks*.
- (b) Box out to a sufficient depth to allow for the required compacted thickness of bedding material under the full width of concrete paving or edging, allowing not less than 150 mm extension beyond edge of concrete, unless documented otherwise on the drawings.
- (c) Where it is necessary to excavate existing pavement, the excavation shall not extend more than 150mm from the edge of the adjacent face.
- (d) Existing asphalt or bituminous surfacing shall be saw cut for a sufficient depth to produce a neat vertical face.

Bedding

- (e) Unless shown otherwise on the drawings, bedding material used for cast in place concrete works shall be compacted 20 mm Class 3 crushed rock, in accordance with *Section 901 Flexible Pavements*.
- (f) Unless shown otherwise on the drawings, bedding shall be not less than:
 - i. 100 mm compacted thickness for edging.
 - ii. 150 mm compacted thickness for pavements and other concrete.
- (g) Compacted bedding shall extend not less than 150 mm beyond the edge of concrete, unless documented otherwise on the drawings.
- (h) Where edgings are constructed over pavement layers, the edging shall be thickened to match the pavement layer, or bedding shall be provided between the pavement layer and the underside of the edging.
- (i) Bedding shall be trimmed to the appropriate levels, moistened as necessary, and firmly compacted.
- (j) Immediately before concrete is placed, the bedding shall be moist but shall have no free water on the surface.

Formwork

- (k) The materials, design, construction and stripping of formwork shall comply with the relevant requirements of AS 3610.
- (l) Joints in formwork shall be constructed such that loss of mortar is prevented.
- (m) Prior to placing concrete in an earth excavation, formwork shall be erected so that fresh concrete is not placed directly against the sides of the excavation.

- (n) Formwork shall not be stripped until the minimum times specified in AS 3610 Table 5.4.1 have elapsed from the time of completion of the placing of concrete. The minimum time shall also not be less than:
 - i. 2 days for vertical formwork on external surfaces
 - ii. 1 day for vertical forms on permanently hidden surfaces.

Underlay

- (o) Under slabs on ground, provide a vapour barrier underlay.
- (p) The material shall be placed beneath the slab so that the bottom surface of the slab is entirely underlaid.
- (q) The material shall extend under the formwork, beyond the extent of slab.
- (r) Lapping for continuity at joints shall be not less than 200 mm.

Steel reinforcement

- (s) The minimum cover of any steel reinforcement to the nearest concrete surface shall be 50 mm unless shown on the drawings.
- (t) Reinforcement shall be supported using either concrete or plastic chairs.
- (u) Mesh reinforcement shall be nested when lapped to minimise the overall depth of lapped section (i.e. alternative sheets of mesh turned over and wires nested between adjoining sheets).

Embedded elements

- (v) For elements to be fixed to or supported on the concrete (e.g. steelwork and the like), provide embedded elements for the required fixings.
- (w) Fix embedded items to prevent movement during concrete placing.
- (x) In locating embedded items, do not cut or displace reinforcement, or cut hardened concrete.

Inspection

WITNESS POINT

- (y) Complete all necessary works under this section (*Section 1500.4 Preparation*) for inspection prior to placing concrete.

1500.5 Placement and Compaction

General

- (a) Use placing methods which minimise segregation, plastic settlement, and shrinkage cracking.
- (b) Commence placing from the lowest corner or edge of the formwork.
- (c) Place concrete uniformly over the width of the slab so that the face is generally vertical and normal to the direction of placing.
- (d) Deposit concrete into the face of that already placed.
- (e) If placing in multiple layers, place concrete in uniform layers no greater than 300 mm and blend each layer into the preceding one through the compaction process.

Kerb and channel

- (f) Kerb and channel and other edgings shall comply with the requirements of AS 2876.

Avoid segregation

- (g) Concrete should be placed vertically and from as near as possible to its final position.
- (h) Concrete should not be made to flow into position.
- (i) Where concrete must be moved it should be shovelled into position.

Compaction

- (j) Remove air bubbles and fully compact the mix.
- (k) Use immersion and screed vibrators accompanied by hand methods as appropriate.
- (l) Limit the forward speed of screed vibrators to between 0.5 m / min. and 1.0 m / min.
- (m) Avoid under-vibration, which may adversely affect strength and durability.
- (n) Avoid over-vibration, which may cause segregation.

Transitions and matching existing

- (o) Match surface levels and grades at abutting pavement slabs and other traversable surfaces (including any existing pavements or surfaces) such that a continuous surface is formed.
- (p) Kerbs transitions shall be made smoothly at a rate of 10 to 20 mm per metre, unless noted otherwise on the drawings.
- (q) Concrete walkways and ramps shall be constructed with sharply defined grade transitions perpendicular to the direction of travel, in compliance with AS 1428.

1500.6 Hot Weather Concreting

General

- (a) Concrete shall not be placed when the air temperature measured at the point of placement is above 30°C, unless special precautions as detailed in the following clauses are implemented to reduce the concrete temperature and facilitate hot weather concreting works.

Methodology

- (b) Mix, transport, place and compact the concrete as rapidly as possible to prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses.
- (c) Before and during placing, maintain the formwork and reinforcement at $\leq 30^{\circ}\text{C}$ using shade protection, cold water spraying, or other effective means.
- (d) When being placed in the forms, the temperature of the concrete must not exceed:
- i. Normal concrete in footings and slabs: 30°C
 - ii. Concrete of strength ≥ 40 MPa, exceeding 600 mm in thickness: 27°C
- (e) Select one or more of the following methods of maintaining the specified temperature of the placed concrete:
- i. use chilled mixing water
 - ii. spray the coarse aggregate using cold water
 - iii. cover the container in which the concrete is transported to the forms
 - iv. cool the concrete using liquid nitrogen injection before placing.

1500.7 Cold Weather Concreting

General

- (a) Maintain the temperature of the freshly mixed concrete within the following limits:

Air temperature measured at the point of placement	Temperature of concrete	
	Minimum	Maximum
≥ 5°C	10°C	30°C
< 5°C	18°C	30°C

Methodology

- (b) Heat the concrete materials, other than cement, to the minimum temperature necessary to ensure that the temperature of the placed concrete is within the limits specified.
- (c) Maximum temperature of water: 60°C when it is placed in the mixer.
- (d) Do not provide calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete.
- (e) Do not allow frozen materials or materials containing ice to enter the mixer, and keep free of frost and ice any forms, materials, and equipment coming in contact with the concrete.
- (f) Maintain concrete temperature until safe strength reached by means of form insulation, insulated covers or heated enclosures.
- (g) Delay striking of formwork for as long as possible.
- (h) Avoid thermal shocks and temperature variations within the concrete element. This includes not using cold water for curing and removing thermal protection measures gradually.

High early strength concrete

- (i) Use high early strength concrete in severe weather conditions to enable the concrete to develop sufficient strength to permit formwork removal within the specified time.
- (j) Do not use high early strength concrete as a substitute for the heating of materials or for adequate protection of placed concrete against low temperatures.
- (k) Do not provide high alumina cement.

1500.8 Joints

General

- (a) Provide the joints where nominated on the drawings or as otherwise required:

Construction joints

- (b) Do not relocate or eliminate construction joints or make construction joints not shown on the drawings. This includes emergency construction joints made necessary by unforeseen interruptions to the concrete pour.
- (c) 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.
- (d) Butt join the surfaces of adjoining pours. In visually important surfaces make the joint straight and true, and free from impermissible blemishes relevant to its surface finish class.

Expansion joints

- (e) All dowels used in expansion joints shall be galvanised.

Isolation joints

- (f) Isolation joints consisting of 10 mm expansion foam to the full depth of slab, sealed with polyurethane, shall be constructed at all interfaces with rigid structures such as buildings, pits, hard landscaping, and the like.

Contraction (saw-cut) joints

- (g) Saw-cut joints in concrete pavements shall be made within 12 – 24 hours of the concrete being placed.

Kerbs and edging

- (h) Shrinkage-control joints shall be formed at spacings of 2.5 m to 3.0 m.
- (i) Expansion joints shall be provided where kerbs abut rigid structures, including pits, pavements, and the like.
- (j) For kerbs adjacent rigid pavements, expansion joints shall coincide with expansion joints in the pavement.

Sealing joints

- (k) All concrete joints shall be sealed with polyurethane sealant in accordance with the manufacturer's requirements, unless noted otherwise.
- (l) Where acrylic surfacing or synthetic grass is to be placed over the concrete, use a sealant which has been approved by the manufacturer for that application.

1500.9 Surface Finishes

General

- (a) Screed, float and apply surface treatment as necessary to achieve the design levels and grades, as well as the specified surface finishes.
- (b) After finishing, all work shall present a consistently neat appearance of uniform colour.
- (c) All edges shall be sharp and clean, and bullnoses shall be regular and of uniform radius.
- (d) All discoloured concrete shall be cleaned or replaced.

Edgings

- (e) All edgings shall be rendered and have a steel trowel finish:
 - i. Rendering shall be applied within 30 minutes of placing or extruding concrete.
 - ii. The mortar used shall consist of two parts of fine aggregate, one part of cement, and sufficient water to produce a mix of suitable consistency.
 - iii. The thickness of rendering shall not exceed 3 mm.

Pavements and other surfaces

- (f) Unless otherwise required by the proprietary product supplier, concrete pavements upon which sports surfacing is to be installed shall have the following finish:
 - i. synthetic grass: dense steel trowelled finish
 - ii. acrylic surfaces: stippled finish (approx. 2 mm texture).
- (g) General concrete pavements and other trafficable surfaces shall have a stippled or lightly broomed finish to produce a lightly textured, non-slip surface.
- (h) All outside edges of slabs and all joints shall be finished with a suitable edging tool.

Other visible surfaces

- (i) All other visible concrete surfaces shall have a Class 2 surface finish in accordance with AS 3610.

Hidden surfaces

WITNESS POINT

- (j) Permanently hidden concrete surfaces shall have a Class 4 surface finish in accordance with AS 3610.

HOLD: Concealment of concrete elements until WP is released.

1500.10 Curing

General

- (a) Protect fresh concrete, during the curing period, from premature drying and from excessively hot or cold temperatures.
- (b) Freshly finished exposed concrete surfaces shall be effectively protected from rain or damage from other sources, until hard set has occurred.

Methodology

- (c) Concrete shall be cured either by water curing, wet hessian, polyethylene sheeting which is adequately sealed, or a combination of these.
- (d) The curing of exposed concrete surfaces shall commence immediately after finishing operations are progressively completed and shall continue uninterrupted for a period of not less than:
 - i. 3 days after placing the concrete, for concrete edgings and fully enclosed internal surfaces.
 - ii. 7 days after placing the concrete, for all other concrete.
- (e) At the end of the curing period, concrete paving and shared use paths shall provide a dense, hard-wearing surface.

Curing compounds

- (f) Curing compounds shall not be used for curing pavement slabs and other flat surfaces.
- (g) Where permitted for us, curing compounds shall comply with AS 3799.
- (h) The curing compound shall be applied in two coats using a fine spray at the rate stated on the certificate of compliance.
- (i) The curing membrane shall be maintained intact for not less than the specified period of curing.
- (j) Any damage to the curing membrane during the period of curing shall be repaired immediately at the original rate of application.

Hot weather curing

- (k) Where ambient temperatures are expected to exceed 35 degrees:
 - i. Do not use curing compounds.
 - ii. Cover the concrete using an impervious membrane or wet hessian immediately after placement.
 - iii. For pavement slabs, use water curing for at least the first 24 hours.

1500.11 Verification Survey

Extent

- (a) The finished surfaces of all in-situ concrete shall be surveyed to verify the completed works comply with the design and tolerances (refer *Section 1500.2 Conformance with Design*).

Methodology

- (b) Verification surveys shall comply with the general requirements of *Section 400.1 Conformance with Design*.
- (c) In-situ concrete survey measurements to be taken:
- i. Along lines of kerb, edging, pavement edges, steps, ramps, and the like, at spacing not greater than 3 metres.
 - ii. Pavement spot levels on a grid with spacing not greater than 3 x 3 metres
 - iii. At all changes in direction, changes in grade, steps, and other features.

HOLD POINT

- (d) Submit a verification survey report comparing the as-built levels with design levels, including highlighting any points that exceed the tolerances (refer *Section 1500.2 Conformance with Design*).

HOLD: Flood testing (where applicable), placement of pavement materials adjacent concrete, and installation of acrylic or synthetic surfacing (where applicable) until HP has been released.

1500.12 Standards

AS 1012.8.1—2014	Methods of testing concrete – Method 8.1: Method for making and curing concrete – Compression and indirect tensile test specimens
AS 1012.8.2—2014	Methods of testing concrete – Method 8.2: Method for making and curing concrete – Flexure test specimens
AS 1012.9—2014	Methods of testing concrete – Method 9: Compressive strength tests – Concrete, mortar and grout specimens
AS 1379—2007	Specification and supply of concrete
AS 1428.1—2021	Design for access and mobility General requirements for access – New building work
AS 1428.2—1992	Design for access and mobility Enhanced and additional requirements – Buildings and facilities
AS 2758.1—2014	Aggregates and rock for engineering purposes – Part 1: Concrete aggregates
AS 2870—2011	Residential slabs and footings
AS 2876—2000	Concrete kerbs and channels (gutters) – Manually or machine placed
AS 3610—1995	Formwork for concrete
AS 3799—1998	Liquid membrane-forming curing compounds for concrete
AS 3972—2010	General purpose and blended cements
AS 4671—2019	Steel for the reinforcement of concrete
AS 4680—2006	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

1600. Flexible Pavements

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1600.1 General

Scope

- (a) This section sets out the technical and verification requirements for flexible pavements work to be executed under the Contract.
- (b) The scope of this section includes:
- i. Gravel, crushed rock or crushed concrete pavement materials.
 - ii. Placement of pavement materials.

Referenced standards

- (c) The following state road authority specifications are referenced:
- i. Main Roads Western Australia Specification 501 - Pavements

Definitions

- (d) For the purposes of this specification the definitions given below apply.

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.
Gravel	Naturally occurring mixture of angular or rounded rock fragments substantially retained on a 4.75 mm AS sieve, with or without some finer material, and all passing a 75 mm AS sieve.
Sand	Product of rock weathering substantially passing a 4.75 mm AS sieve, and is generally siliceous and free from appreciable quantities of clay and silt.
Segregation	Uneven distribution of particle sizes in a given material layer.
Subbase	Material laid on the subgrade, 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.

1600.2 Conformance with Design

Quality Management System

- (a) The Contractor shall implement a quality management system for all works under the Contract in accordance with *Section 400 Specification Preliminaries*.

Inspection and Test Plan

HOLD POINT

- (b) Submit Flexible Pavements ITP 5 business days prior to commencement.

HOLD: All pavement works until HP has been released.

- (c) Record details of each placement of pavement material, including the following:
- i. Date placed
 - ii. The portion or area of work
 - iii. Specified material
 - iv. Volume placed
 - v. Delivery docket.

Test Methods

- (d) All testing to be in accordance with Specification *Appendix A Test Methods*.

Tolerances

- (e) Flexible pavement layers shall be constructed to the following tolerances from design:

Element	Description	Tolerance
Base	Surface level	+0 / -10 mm
	Thickness	+5 / -0 mm
	Flatness	No greater than 5 mm beneath a 3 m straight edge
Subbase	Surface level	±5 mm
	Thickness	+5 / -0 mm

Verification survey

- (f) Conformance with design to be demonstrated through verification survey in accordance with *Section 1600.7*

1600.3 Materials

General

- (a) Specified materials shall conform with all the requirements of the state road authority documentation referenced in this section.

Flexible pavement materials

- (b) Material designations:
- i. Gravel Subbase
 - ii. Crushed Limestone Subbase
 - iii. Crushed Rock Base (CRB) Subbase
 - iv. Gravel Basecourse
 - v. Crush Rock Base (CRB) Basecourse
- (c) Materials shall be supplied in accordance with all the requirements of the following Main Roads Western Australia documentation:
- i. Specification 501 – Pavements (Sections 501.06 – 501.14).

Material properties testing

- (d) The Contractor shall the materials at such a frequency to ensure that the supplied material consistently complies with the specified requirements.
- (e) Testing requirements, including type and minimum frequency of testing, shall be as per the specified state road authority documentation.

MILESTONE

- (f) Submit material source details including material properties test results.

1600.4 Placement

General

- (a) Prior to placing any pavement material, the area shall be cleared, stripped of topsoil, and the subgrade prepared in accordance with *Section 600 Earthworks*.
- (b) Place flexible pavement materials as indicated on the design drawings.
- (c) Do not place material on a surface which has been so weakened by moisture that it will not support, without damage, the construction plant required to perform the work.

Methodology

- (d) Spread material in uniform layers as near as practicable to the required thickness by direct tipping from suitable vehicles or using a mechanical spreader.
- (e) Avoid segregation of material during tipping and spreading.
- (f) Avoid tipping materials in heaps and then spreading by grader.
- (g) If material becomes segregated, remix as directed using a rotary hoe or other suitable equipment.

Moisture control

- (h) Moisten prepared subgrades and preceding layers of subbase immediately before spreading subbase or base material.
- (i) Keep leading edges of subbase or base material moist until new material is added.
- (j) 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.
- (k) Maintain wet-mixed materials at the required moisture content until completion.

Layer thicknesses

- (l) Compacted layer thicknesses shall be no less than 75 mm and no greater than 200 mm.

Joints

- (m) Plan delivery and spreading to minimise the number of joints.
- (n) Offset joints in successive layers by at least 300 mm.

Delivery Dockets

MILESTONE

- (o) Provide delivery docket for each load of pavement material delivered to site.

1600.5 Compaction and Moisture Condition

General

- (a) Apply uniform and sufficient compactive effort by appropriate equipment over the whole area to be compacted, to achieve the required densities.

Methodology

- (b) Maintain the specified moisture content during compaction and until proof rolling.
- (c) Apply uniform and sufficient compactive effort by appropriate equipment consistently over the whole area to be compacted to achieve the required density.
- (d) Protect the works from damage due to compaction operations. Where necessary, limit the size of compaction equipment or compact by hand.
- (e) If a section of pavement material fails to meet the required density or moisture content, remove the non-complying material, replace with new material, and recompact.

Acceptance criteria and testing frequency

- (f) Test compacted surfaces in accordance with the following table:

Layer / Location	Acceptance criteria	Testing frequency
Base	98% M.M.D.D. 85% of OMC Degree of Saturation < 70%	Whichever requires the greater number of tests: <ul style="list-style-type: none"> • 1 test per material layer, per 2,000 m² • 3 tests per layer.
Subbase	98% M.M.D.D. 85% of OMC Degree of Saturation < 70%	Whichever requires the greater number of tests: <ul style="list-style-type: none"> • 1 test per 100 lineal metres • 1 test per 6 m³ material.
Other crushed rock materials, e.g. bedding for kerbs, pits, backfill, etc.	95% M.M.D.D. unless noted otherwise on the drawings	Whichever requires the greater number of tests: <ul style="list-style-type: none"> • 1 test per 100 lineal metres • 1 test per 6 m³ material.

Finishing surfaces

- (g) Granular materials shall be prepared to level and shape within the tolerances specified in *Section 1600.2 Conformance with Design* to produce a smooth, hard, tightly bound surface, free from depressions capable of holding water.
- (h) Any material that has been compacted and then trimmed from the compacted surface to conform to the correct level or thickness as shown on the drawings shall not be re-used in the pavement construction without the approval of the Superintendent.

HOLD POINT

- (i) Submit complying compaction and moisture content test results.

HOLD: Any works on or within layers to be proof rolled until HP has been released.

1600.6 Proof Rolling

Extent

- (a) All pavement layers should be compacted to be capable of withstanding proof rolling without visible deformation or springing.
- (b) Prior to priming and / or placement of overlying material, proof roll flexible pavement layers to determine the extent of any bad ground.

HOLD POINT AND WITNESS POINT

- (c) The Contractor's GITA shall witness all proof rolling required under this specification. The GITA shall supply a test report and / or site inspection report indicating whether the proof rolling identified any areas of deformation or springing to be rectified.

HOLD: Any works on or within layers to be proof rolled until HP has been released.

Methodology

- (d) Proof rolling shall be carried out in accordance with *Section 600.11 Proof Rolling*.

1600.7 Verification Survey

Extent

- (a) The surfaces of all pavement layers shall be surveyed to verify the completed works comply with the design and tolerances (refer *Section 1600.2 Conformance with Design*).

Methodology

- (b) Verification surveys shall comply with the general requirements of *Section 400.1 Conformance with Design*.
- (c) Pavement layer survey measurements to be taken:
- i. Along lines of kerb, edging, pavement edges, steps, ramps, and the like, at spacing not greater than 3 metres.
 - ii. Pavement spot levels on a grid with spacing not greater than 3 x 3 metres
 - iii. At all changes in direction, changes in grade, steps, and other features.

HOLD POINT

- (d) Submit a verification survey report comparing the as-built levels with design levels, including highlighting any points that exceed the tolerances (refer *Section 1500.2 Conformance with Design*).

HOLD: Priming, placement of overlying pavement layers, and construction of concrete kerbs and edging (where applicable) until HP has been released.

1700. Asphalt

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1700.7	Flood Test	1700-8

1700.1 General

Scope

- (a) This section sets out the technical and verification requirements for asphalt and bituminous surfacing work to be executed under the Contract.
- (b) The scope of this section includes:
 - i. Preparation for asphalt surfacing (dry back and priming)
 - ii. Placement of thin asphalt surfacing.

Referenced standards

- (c) Works under this section shall be constructed in accordance with all the requirements of the following Main Roads Western Australia documentation:
 - i. Specification 503 – Bituminous Surfacing
 - ii. Specification 504 – Asphalt Wearing Course
 - iii. Specification 511 – Materials for Bituminous Treatments.

Definitions

- (d) For the purposes of this specification the definitions given below apply.

Asphalt	Asphalt is a designed and controlled mixture of coarse and fine aggregates, filler, binder and other additives which is mixed, spread and compacted to a uniform layer while hot.
Binder	Binder is bitumen or polymer modified binder (PMB) used to hold a mixture of aggregates together as a cohesive mass.
Prime	The application of a bituminous primer to a prepared granular pavement base or concrete surface without cover aggregate.
Reclaimed Asphalt Pavement (RAP)	Reclaimed asphalt pavement is asphalt removed from an existing asphalt pavement/plant returns that is re-processed by crushing and/or screening for recycling into new asphalt.
Tack Coat	The light application of a bituminous material to promote adhesion between an existing surface and a new asphalt layer.

1700.2 Conformance with Design

Quality management system

- (a) The Contractor shall implement a quality management system for all works under the Contract in accordance with *Section 400 Specification Preliminaries*.

Inspection and Test Plan

<p>HOLD POINT</p> <p>(b) Submit Asphalt ITP 5 business days prior to commencement.</p> <p>HOLD: All asphalt and bituminous surfacing works, including preparation until HP has been released.</p>

Test methods

- (c) All testing to be in accordance with *Specification Appendix A Test Methods*.

Tolerances

- (d) Asphalt and bituminous surfaces shall adhere to the following tolerances from design:

Element	Description	Tolerance
Asphalt layer (field of play surface)	Surface level	±5 mm
	Thickness	+5 / -0 mm
	Flatness	No greater than 4 mm beneath a 3 m straight edge in all directions. No greater than 2 mm under a 1 m straight edge in all directions. No step like irregularities greater than 1 mm. Surface to be free draining (i.e. no ponding).
Asphalt layer (general)	All tolerances and measures of conformance as per the state road authority documents referenced in <i>Clause 1700.1 (c)</i>	

Verification survey

- (e) Conformance with design to be demonstrated through verification survey in accordance with *Section 1700.6*.

1700.3 Materials

General

- (a) Specified materials shall conform with all the requirements of the state road authority documentation referenced in this section.
- (b) All bituminous binders shall be Class 320.

Pyrites

- (c) If asphalt forms part of an acrylic surface pavement, the aggregate within the asphalt mix shall be free of pyrites and any other foreign substances that could lead to staining, blister sports, or other defects in the acrylic surface system.

HOLD POINT:

- (d) Submit evidence from a local asphalt supplier that the geographical source of their product is known to be free of ferrous bearing contaminants (i.e. pyrites).

HOLD: Delivery and placement of asphalt until HP has been released.

Asphalt and bituminous materials

- (e) Materials shall be supplied in accordance with the state road authority documents referenced in *Clause 1700.1(c)*.

Material properties testing

- (f) The Contractor shall the materials at such a frequency to ensure that the supplied material consistently complies with the specified requirements.
- (g) Testing requirements, including type and minimum frequency of testing, shall be as per the specified state road authority documentation.

MILESTONE

- (h) Submit material source details including material properties test results.

1700.4 Preparation

General

- (a) The pavement base shall be prepared to produce a surface that is:
- i. constructed to meet specified shape and level requirements
 - ii. uniform in texture
 - iii. free of loose and foreign materials
 - iv. free of lamination on or within 75 mm of the finished surface
 - v. a hard dense and tight surface capable of being swept with a rotary road broom or similar
 - vi. dried back to the moisture content requirements specified in Clause 1700.4(b).

Drying back

WITNESS POINT

- (b) After preparation of the surface and prior to priming, the uppermost 10 mm of granular material shall be allowed to dry back to a moisture content less than 60% of OMC.

Priming

- (c) Unbound granular bases shall be primed prior to placement of asphalt.
- (d) Primer shall be AMC0 or AMC00 cutback bitumen complying with AS 2157.
- (e) Apply uniformly with a machine sprayer at a typical rate of 1.0 L/m² (measured at 15°C), or as otherwise necessary to achieve consistent penetration of primer into the base.
- (f) Allow prime to cure for at least 72 hours prior to asphaltting.
- (g) Complete placement of asphalt layer(s) within four weeks of priming.

1700.5 Placement and Compaction

General

- (a) Place and compact asphalt in locations as indicated on the drawings and in accordance with the requirements of the state road authority documents referenced in *Clause 1700.1(c)*.

HOLD POINT

- (b) Any Hold Points, Witness Points and Milestones in the referenced state road authority documentation shall be treated as Hold Points, Witness Points and Milestones in this specification.

HOLD: (as per state road authority documentation).

Asphalt Stains

- (c) If staining of the asphalt surface be witnessed after the asphalt has been laid – due to pyrites, or any other foreign materials – perform one or more of the following:
- i. Remove and replace the affected asphalt (minimum depth 25 mm)
 - ii. Apply stain blocker across the entire asphalt surface.

HOLD POINT

- (d) Submit the extent of proposed remediation and methodology, prior to the commencement of works.

HOLD: Verification survey and flood test (if applicable) until HP has been released.

1700.6 Verification Survey

Extent

- (a) The surfaces of all asphalt layers shall be surveyed to verify the completed works comply with the design and tolerances (refer *Section 1700.2 Conformance with Design*).

Methodology

- (b) Verification surveys shall comply with the general requirements of *Section 400.1 Conformance with Design*.
- (c) Pavement layer survey measurements to be taken:
- i. Along lines of kerb, edging, pavement edges, steps, ramps, and the like, at spacing not greater than 3 metres.
 - ii. Pavement spot levels on a grid with spacing not greater than 3 x 3 metres
 - iii. At all changes in direction, changes in grade, steps, and other features.

HOLD POINT

- (d) Submit a verification survey report comparing the as-built levels with design levels, including highlighting any points that exceed the tolerances (refer *Section 1700.2 Conformance with Design*).

HOLD: Works on or associated with the given asphalt layer subject to verification until HP has been released.

1700.7 Flood Test

General

HOLD POINT

- (a) Following completion of the asphalt layer and prior to any additional surfacing works, a flood test shall be undertaken.

HOLD: Any further works on asphalt surface until HP has been released.

Methodology

WITNESS POINT

- (b) Flood the entire asphalt surface with potable water by any appropriate means in the presence of the Principal's Representative.

- (c) Identify and document any defects visible on the flooded surface including the following:

- i. Depressions that may hold water
- ii. High-points, ridges or similar that may divert and / or prevent surface water run-off.

Remedial works

- (d) Undertake remedial works if any of the defects are identified.

HOLD POINT

- (e) Provide the proposed remediation methodology prior to works commencing.

HOLD: Remedial works until HP has been released.

- (f) Repeat the flood test following remedial works.

6000. Acrylic Surfacing

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6000.1 General

Scope

- (a) This section sets out the technical and verification requirements for acrylic surfacing to be executed under the Contract.
- (b) The scope of this section includes:
 - i. Installation of a multi-layered acrylic court surfacing system to meet all requirements of the relevant sports governing body standards.

Standards

- (c) Works shall meet all quality and performance requirements of the following documents:
 - i. AS 4586—2004 Slip Resistance Classifications of New Pedestrian Surface Materials
 - ii. AS 4633—2004 Slip Resistance Classification of Existing Pedestrian Surface Materials
 - iii. International Netball Federation (INF), Facilities and Equipment Requirements, July 2015
 - iv. Netball Australia, National Facilities Policy, Version 02 March 2016

Project particulars

- (d) The colour scheme shall be:
 - i. court surface: two-tone blue as shown on the drawings
 - ii. line marking: white.

6000.2 Conformance with Design

Quality Management System

- (a) The Contractor shall implement a quality management system for all works under the Contract in accordance with *Section 400 Specification Preliminaries*.

Inspection and Test Plan

HOLD POINT

- (b) Submit Acrylic Surfacing ITP 5 business days prior to commencement.

HOLD: All Acrylic Surfacing works until HP has been released.

Acceptance criteria

- (c) Acceptance of the acrylic surface is subject to:
- i. visual inspection, exhibiting a high quality of workmanship
 - ii. performance testing (refer *Section 6000.5*)
 - iii. verification survey (refer *Section 6000.6*)
 - iv. flood test (refer *Section 6000.7*).

Tolerances

- (d) Acrylic surfaces shall adhere to the following tolerances from design:
- i. Surface level: ± 5 mm
 - ii. Flatness: No greater than 4 mm beneath a 3 m straight edge in all directions.
No greater than 2 mm under a 1 m straight edge in all directions.
No step like irregularities greater than 1 mm.
Surface to be free draining (i.e. no ponding from flood test, refer to *Section 6000.7 Flood Test*).
- (e) Line marking in the acrylic surface shall adhere to the following tolerances from design:
- i. Straightness: ± 5 mm over any 10m length
No horizontal step-like irregularities greater than 0.5 mm
 - ii. Location: ± 5 mm

6000.3 Materials

General

HOLD POINT

- (a) Provide technical details, including product technical and safety data sheets, for all elements of the proposed acrylic court system.
- (b) Provide physical samples for the nominated colours, 100 x 100 mm minimum size.

HOLD: Installation of acrylic products until HP has been released.

Acrylic surface system

- (c) The surface shall be:
 - i. a multi-layer acrylic resin system (minimum 3 layers)
 - ii. suitable for the climatic conditions and environment of the proposed site
 - iii. able to comply with all sports governing body requirements for outdoor netball courts for all categories of competition and training
 - iv. able to sustain regular and intensive use
 - v. selected to avoid delamination from either the base strata (asphalt/concrete) or between acrylic layers.
- (d) All products shall be delivered to site in sealed, clearly identified containers.
- (e) Containers shall be stored in a dry, shaded location (e.g. site shed, under awning, etc.) not subject to rainfall.
- (f) The colour scheme for the acrylic surface shall be as specified in the project particulars, refer *Section 6000.1*.

6000.4 Installation

General

HOLD POINT

- (a) Provide layout plan showing dimensions and colours of all areas, lines, and marks.

HOLD: Preparation and application of acrylic surface until HP has been released.

Surface application

- (a) The installation methods shall ensure the resulting acrylic surface is of the highest standard and quality possible.
- (b) Repair any cracks in the base (if required), provide methodology for crack repair for approval prior to commencement.
- (c) Prepare the surface by cleaning, filling, and priming as required.
- (d) Throughout installation, ensure the base surface remains clean and clear of debris.
- (e) Apply the acrylic products in accordance with the product manufacturer's recommendations and requirements to ensure uniformity and quality.
- (f) Do not apply in adverse weather conditions that may affect the installation quality.

WITNESS POINT

- (g) Each layer of the acrylic surface shall be applied to a high standard and be free of streaks, patches, and visible squeegee applicator directions.

Lines and marks

- (h) Lines and marks shall be in accordance with the drawings and relevant sports governing body standards.
- (i) Set out of the lines shall be undertaken by a licensed surveyor.
- (j) All lines and marks shall be:
- i. 50 mm wide, unbroken lines
 - ii. coloured as specified in the project particulars, refer *Section 6000.1 General*
 - iii. painted with approved acrylic material compatible with the acrylic surface
 - iv. applied according to the manufacturer's recommendations, flush with the surface of the court, with distinct edges and without overspray or bleeding of the paint.
- (k) Lines and marks shall be repainted at the end of the Defects Liability Period.

6000.5 Performance Testing

General

- (a) The completed court surface must be fit for purpose, which includes 'all weather' use in outdoor settings.

Slip resistance testing for INF compliance

- (b) The following tests shall be undertaken by a NATA accredited testing company.
- (c) A minimum of 5 individual locations shall be slip resistance tested on each court, in both wet and dry conditions, and using both slider 55 and slider 96 (a total of 4 tests in each location).
- (d) The acrylic surface shall meet one of the following performance standards:
- i. A temperature correction value (TCV) for a mean British Pendulum Number (BPN) of at least 75 for wet slip resistance testing - in line with AS 4663:2004 Slip Resistance measurement of existing pedestrian surfaces.
 - ii. AS 4586-2013 Slip Resistance Classification of New Pedestrian Surface Materials: Appendix A (Wet Pendulum Test Method) achieving a P5 Classification as a minimum.

MILESTONE

- (e) Provide test results demonstrating compliance with the performance requirements.

6000.6 Verification Survey

Extent

- (a) The completed acrylic surface(s) shall be surveyed to verify the completed works comply with the design and tolerances (refer *Section 6000.2 Conformance with Design*).

Methodology

- (a) Surface survey measurements to be taken:
- i. At the start, end, and at maximum 3 metre intervals along all lines and marks
 - ii. At all changes in grade, edges of pavement, and other features
 - iii. Spot levels on a grid with spacing not greater than 3 x 3 metres.
- (b) The survey shall incorporate any additional measurements required to demonstrate compliance with the relevant sports governing body standards.

MILESTONE

- (c) Submit a verification survey report comparing the as-built levels and grades with design, including highlighting any points that exceed the tolerances (refer *Section 6000.2 Conformance with Design*).
- (d) Provide the survey as an as-built plan of linemarking and acrylic court layouts.

6000.7 Flood Test

General

MILESTONE

- (a) A flood test shall be undertaken at completion of the acrylic surfacing works.

Methodology

WITNESS POINT

- (b) Flood the entire surface with potable water by any appropriate means.
- (c) Identify and document any defects visible on the flooded surface including the following:
- i. Depressions that may hold water
 - ii. High-points, ridges or similar that may divert and / or prevent surface water run-off.

Remedial works

- (d) Undertake remedial works if any of the defects are identified.

HOLD POINT

- (e) Provide the proposed remediation methodology prior to works commencing.

HOLD: Remedial works until HP has been released.

- (f) Repeat the flood test following remedial works.

6000.8 Maintenance Manuals and Warranty

Maintenance Manuals

MILESTONE

- (a) Provide electronic (PDF format) maintenance manuals for the acrylic surface(s) installed under the Contract prior to Practical Completion.
- (b) Maintenance manuals must specify:
 - i. all routine and periodic maintenance procedures
 - ii. limitations of use / intended uses for preservation of warranty.

Instructional session

WITNESS POINT

- (c) Provide a single instructional session for the acrylic court system attended by up to two people as nominated by the Principal's Representative, to outline and demonstrate key elements of the maintenance manuals.

Warranty

MILESTONE

- (d) The Contractor shall provide a 7-year warranty in favour of the Principal.
- (e) The following shall be warranted:
 - i. The acrylic surface shall remain compliant with the tolerances and performance requirements of the nominated sports governing body throughout the warranty period.

8000. Fencing, Netting, and Enclosures

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8000.1 General

Scope

- (a) This section sets out the technical and verification requirements for fencing, netting, and chain mesh enclosure works to be executed under the Contract.
- (b) The scope of this section includes:
 - i. installation of fencing, netting, enclosures, gates, and all associated equipment
 - ii. detailed design of 1.05m and 1.8m High Chain Mesh Fence (including footings) in accordance with the reference design drawings(s) and specified performance requirements
- (c) Where works are within the scope of the National Construction Code (NCC), all permits and certifications in accordance with local laws and regulations is the responsibility of the Contractor.

Referenced standards

- (d) AS 1627.4-1989 Metal finishing - Preparation and pre-treatment of surfaces
- (e) AS 1725.1-2010 Security fences and gates – General requirements
- (f) AS 1725.2-2010 Tennis court Fencing – Commercial
- (g) AS 1725.4-2010 Chain link fabric fencing – Cricket net fencing enclosures
- (h) AS 1725.5-2010 Sports ground fencing – General requirements
- (i) AS 4100-2020 Steel structures
- (j) AS 4506-2005 Metal finishing – Thermoset powder coatings

8000.2 Conformance with Design

Quality Management System

- (a) The Contractor shall implement a quality management system for all works under the Contract in accordance with *Section 400 Specification Preliminaries*.

Inspection and Test Plan

HOLD POINT

- (b) Submit Fencing ITP 5 business days prior to commencement.

HOLD: All fencing works until HP has been released.

Tolerances

- (c) Works shall be constructed to the following tolerances from design:

Element	Description	Tolerance
Posts	Horizontal position	± 20 mm
	Height	± 10 mm
	Straightness	≤ 2 mm per metre from true vertical
Rails	Vertical position	± 50 mm
	Straightness	≤ 3 mm per metre from true horizontal
Suspended netting	Support height	± 20 mm
Tension Cables	Sag	≤ 100mm from a straight line between cable supports
Clearance	Fence to ground-level and / or adjacent structures	20 – 40 mm, unless noted otherwise on the drawings

- (d) Notwithstanding the above tolerances, no part of the fencing, netting, enclosure, or associated equipment shall encroach into the minimum specified unobstructed areas surrounding fields of play (i.e. run-off zones).

8000.3 Materials

General

- (a) All materials to comply with the referenced Australian Standard(s).
- (b) Fencing, netting, enclosures, and associated equipment shall have a functional life of:
 - i. 10 years for chain link fabric (including tie wires)
 - ii. 15 years for netting fabric and suspension cables
 - iii. 20 years for structural components (footings, posts, rails, brackets, and fixings)

Footings

- (c) All concrete post footings shall be normal class (N class) with a standard strength grade of 25 MPa (28-day compressive strength) and maximum aggregate size of 20 mm.

Steel

- (a) All steel components shall comply with AS 4100 Steel Structures.
- (b) All fittings and fixtures shall be galvanised or stainless steel.

Posts and Rails

- (c) All posts, rails and associated fittings shall be black powder-coated galvanised steel, or otherwise shall be stainless steel.
- (d) All elements must be powder coated (or painted if specified) prior to installation.

Chain Link Fabric

- (e) Chain link fabric to be heavy duty fabric made from 3.15mm black fuse-bonded polymer-coated wire
- (f) Chain link fabric pitch shall be:
 - i. 40 mm for the rear of all cricket practice net enclosures
 - ii. 45 mm for facilities containing tennis court(s)
 - iii. 50 mm pitch for all other installations.

Netting Fabric

- (g) Netting fabric shall be black-coloured nylon with the following properties:
 - i. Construction: Raschel Knitted (knotless)
 - ii. UV Stability: High
 - iii. Mesh Dimensions: 100 mm X 100 mm

- | | | |
|------|--------------------|----------------------|
| iv. | Twine: | 96 ply (2.5 mm) |
| v. | Strand Break Load: | 88 kg |
| vi. | Weight: | 120 g/m ² |
| vii. | Porosity: | 91% |

Painted Elements

- (h) Elements noted as 'painted' shall be prepared as follows:
- i. Surface preparation: Class 2.5 blast to AS 1627.4.
 - ii. Single coat Dulux: Durebuild STE to a minimum dry thickness of 125 micron.
 - iii. Single coat Dulux: Weathermax HBR to a minimum dry thickness of 100 micron.

8000.4 Installation

General

- (a) Construct fencing, netting, enclosures, and associated equipment in locations and for the extent shown on the drawings.
- (b) Construct pedestrian and vehicle access gates in locations shown on the drawings.

WITNESS POINT

- (c) All installations to comply with the referenced Australian Standard(s), the drawings and this specification.

8000.5 Maintenance Manuals and Warranty

Maintenance Manuals

MILESTONE

- (a) Provide electronic (PDF format) maintenance manuals for all installed fencing, netting, enclosures, and associated equipment prior to Practical Completion.
- (b) Maintenance manuals must specify:
 - i. all routine and periodic maintenance procedures
 - ii. limitations of use / intended uses for preservation of warranty.

Warranty

MILESTONE

- (c) The Contractor shall provide documentation of all necessary warranties prior to Practical Completion.
- (d) All fencing, netting, enclosures, and associated equipment shall be warranted in favour of the Principal for the following minimum timeframes:
 - i. fencing, netting, enclosures, and associated equipment: 5 years
- (e) The following shall be warranted:
 - i. performance of the equipment to satisfy the Principal's requirements
 - ii. any faults due to poor workmanship in the manufacture and installation of the equipment.

9650. Sports Equipment – Combined Basketball and Netball

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9650.1 General

Scope

- (a) This section sets out the technical and verification requirements for Sports Equipment – Combined Basketball and Netball works to be executed under the Contract.
- (b) The scope of this section includes:
 - i. Supply and installation of sports equipment as nominated on the drawings.
 - ii. Provision of maintenance manuals and warranty documentation for the sports equipment.

Standards

- (c) International Netball Federation (INF) Facilities and Equipment Requirement
- (d) FIBA 2022 Official Basketball Rules – Basketball Equipment.

Quality Management System

- (e) The Contractor shall implement a quality management system for all works under the Contract in accordance with *Section 400 Specification Preliminaries*.

Tolerances

- (f) All installed products must meet the comply with and/or pass the relevant test methods issued by the sport governing body.

9650.2 Products and Materials

General

HOLD POINT

- (a) Provide product details including manufacturer, product name/number, and samples if required, for each element to be installed under the contract.

HOLD: Ordering and installation of sports equipment until HP has been released.

Combined Basketball and Netball goals

- (b) Combined basketball and netball goals shall be supplied as specified on the drawings, and complying with the following:
- i. 3.05 m high basketball ring and backboard and netball ring for proposed courts
 - ii. 2.4 m outreach for basketball to enable 1.0 m (minimum) clearance from the basketball baseline to the pole face
 - iii. Hot dipped galvanised post and arm
 - iv. 300 kg (min.) load rating ring
 - v. Base cast into concrete footing.
- (c) Safety padding shall be supplied with all posts:
- i. 3.0 m min. height, 50 mm thickness.
- (d) Example products meeting the above requirements (in alphabetical order):
- i. Play Hard Sports S125R Rotating Basketball / Netball Tower – 2.4m Outreach
 - ii. Approved equivalent.

9650.3 Installation

General

- (a) All equipment shall be installed in accordance with the manufacturer's requirements.
- (b) Site-specific design of structural footings is the responsibility of the Contractor.
- (c) Where works are within the scope of the National Construction Code (i.e. Class 10b structures), it is the responsibility of the Contractor to obtain permits and certifications in accordance with local laws and regulations.

HOLD POINT

- (d) Provide shop drawings and building permit documentation (if required) prior to ordering and installation of equipment.

HOLD: Ordering of products and materials until HP has been released.

9650.4 Maintenance Manuals and Warranty

Maintenance Manuals

MILESTONE

- (a) Provide electronic (PDF format) maintenance manuals for all sports equipment supplied and/or installed under the Contract prior to Practical Completion.
- (b) Maintenance manuals must specify:
 - i. all routine and periodic maintenance procedures
 - ii. limitations of use / intended uses for preservation of warranty.

Warranty

MILESTONE

- (c) The Contractor shall provide a minimum 10-year warranty in favour of the Principal.
- (d) The following shall be warranted:
 - i. Equipment shall remain fit for the intended purpose and comply with the relevant **sport governing body** requirements (current at time of installation) for the duration of the warranty period.
 - ii. Faults due to poor workmanship in the manufacture and / or installation of the equipment.

Appendix A - Test Methods

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A1. General

Introduction

- (a) The test methods contained in this section are to be used for all works under the Sections listed below, unless otherwise varied by specific clauses elsewhere in the specification:
- i. Section 600 Earthworks*
 - ii. Section 900 Drainage*
 - iii. Section 1500 In-situ concrete*
 - iv. Section 1600 Flexible pavements*
 - v. Section 1700 Asphalt*
- (b) Wherever possible, the specification makes use of Australian Standard test methods and classifications.

Accreditation of testing

- (c) All testing to be undertaken by a NATA-accredited laboratory.

Acceptance of results

- (d) Unless otherwise specified (e.g. 'Assigned' value, 'Characteristic' value, or otherwise), acceptance of a test shall require all specified test results to comply with the relevant requirement.

Test lots

- (e) Unless otherwise specified, acceptance of material and work will be based on testing of the material or work in lots.
- (f) A lot will consist of a single layer, batch or area of like work which has been constructed or produced under essentially uniform conditions and is essentially homogeneous with respect to material and appearance.
- (g) Unless otherwise specified, a lot shall be one day's production or 10,000 m² in a single layer, whichever is the lesser.
- (h) Discrete portions of a lot which are non-homogeneous with respect to material and appearance shall be excluded from the lot and shall be either treated as separate lots, or reworked. Where the areas excluded from a lot as non-homogeneous exceed 10% of the total lot area or at other specified percentages of the total lot area, the whole of the lot shall be rejected.

A2. Soils and crushed rock

Material sampling and preparation

- (a) All sampling of materials shall be carried out in accordance with the appropriate Australian Standards
- (b) Soils shall be prepared in accordance with AS 1289.1.1.
- (c) Unless otherwise specified, Standard compactive effort shall be used for soils and earthworks materials (including General Fill, Select Fill and Capping material), and Modified compactive effort shall be used for all pavement materials.

Compaction and moisture content

- (d) Relative compaction shall be determined using the minimum dry density ratio (cohesive soils) or minimum density index (cohesionless materials).
- (e) Dry Density Ratio (cohesive soils) shall be determined using:
 - i. AS 1289.5.4.1-2007 (R2016) Soil compaction and density tests – Compaction control test – Dry density ratio, moisture variation and moisture ratio
- (f) Density Index (cohesionless materials) shall be determined using:
 - i. AS 1289.5.6.1-1998 (R2016) – Soil compaction and density tests – Compaction control test – Density index method for a cohesionless material
- (g) Field Dry Density shall be determined using either:
 - i. AS 1289.5.3.5-1997 (R2013) Soil compaction and density tests – Determination of the field dry density of a soil – Water replacement method
 - ii. AS 1289.5.8.1-2007 Soil compaction and density tests – Determination of field density and field moisture content of a soil using a nuclear surface moisture – Density gauge – Direct transmission mode
- (h) Reference Maximum Dry Density shall be determined using either:
 - i. AS 1289.5.1.1-2017 Soil compaction and density tests – Determination of the dry density/moisture content relation of a soil using standard compactive effort
 - ii. AS 1289.5.7.1-2006 Soil compaction and density tests – Compaction control test – Hilf density ration and Hilf moisture variation (rapid method)

Soil classification tests

- (i) Soil to be tested for plasticity tests shall be prepared in accordance with AS 1289.1.1, Clause 5.3.3, and classified in accordance with AS 1726 Appendix A.
- (j) Liquid Limit tests on pavement materials such as Class 1 to Class 4 crushed rocks and granular Type A fills shall be in accordance with AS 1289.3.1.1.

- (k) When testing soils or crushed rock for particle size distribution, samples shall be washed as detailed in the test methods. Particle size distribution tests shall be performed in accordance with AS 1289.3.6.1; however, tests for crushed rock and aggregates may also be performed in accordance with AS 1141.11.1.
- (l) When testing crushed rock for flakiness index, AS 1141.11.1 and AS 1141.15 shall be used.

Permeability

- (m) Permeability tests are to be performed on the fraction of material passing the 19.0 mm sieve. Material retained on the 19.0 mm sieve shall be discarded and not crushed and returned to the sample.
- (n) Soil classification tests (plasticity index and grading) shall be performed for each sample to be tested for permeability.
- (o) Permeability shall be determined using either:
 - i. AS 1289.6.7.1 Soil strength and consolidation tests – Determination of permeability of a soil – Constant head method for a remoulded specimen.
 - ii. AS 1289.6.7.2 Soil strength and consolidation tests – Determination of permeability of a soil – Falling head method for a remoulded specimen.

California bearing ratio and swell

- (p) The determination of the CBR and Swell of a soil shall be in accordance with AS 1289.6.1.1 Soil strength and consolidation tests – Determination of the California bearing ratio of a soil – Standard laboratory method for a remoulded specimen.
- (q) Soil classification tests (plasticity index and grading) shall be performed for each sample to be tested for CBR and Swell.
- (r) Specimens for CBR testing shall be re-moulded in the laboratory in accordance with the following requirements:
 - i. Density Ratio at 98 % \pm 1 % of the MDD for the material; and
 - ii. Moisture Ratio within the range 95 % to 105 % of the OMC for the material.

Porosity

- (s) Material porosity = Void volume / Total volume.

A3. Aggregates

General

- (a) Aggregates shall be tested in accordance with the relevant methods listed in AS 1141.

Unsound and marginal particles

- (b) AS 1141.30.1 (changes as per VicRoads RC 372.01 for works in Victoria) shall be used to determine the amount of unsound and marginal particles in aggregates.

Alkali Aggregate Reactivity (AAR)

- (c) Petrographic examination of aggregate, where required, is to be carried out in accordance with ASTM C295 - Petrographic Examination of Aggregates for Concrete.
- (d) Potential Alkali-Silica Reactivity (ASR) of concrete aggregates shall be determined using RC 376.03 (for works in Victoria).
- (e) Alkali Aggregate Reactivity (AAR), shall be determined using AS 1012.14 (changes as per VicRoads RC 376.04 for works in Victoria).
- (f) Note: for works in Victoria, VicRoads RC 376.04 can also be used to measure Aggregate Carbonate Reactivity (ACR).

Sealing aggregates

- (g) Code of Practice RC 500.09 details test methods to be used for testing sealing aggregates.

A4. Concrete

Sampling

- (a) The method of sampling shall be in accordance with AS 1012.1.

Testing

- (b) Slump of concrete shall be determined in accordance with AS 1012.3.1.
- (c) Entrained air in freshly mixed concrete shall be determined in accordance with AS 1012.4.
- (d) Test specimens used to test for compressive, indirect tensile or flexural strength shall be made and cured in accordance with AS 1012.8.1 or AS 1012.8.2.
- (e) Compressive strength of concrete specimens shall be determined in accordance with AS 1012.9.
- (f) The drying shrinkage of concrete shall be determined in accordance with AS 1012.13.
- (g) The compressive and tensile strength of concrete cores extracted from hardened concrete shall be determined in accordance with AS 1012.14.
- (h) The chloride and sulphate in hardened concrete and concrete aggregates shall be determined in accordance with AS 1012.20.1 or AS 1012.20.2.
- (i) The VPV (volume of permeable voids) of either concrete cylinders or concrete cores shall be determined in accordance with AS 1012.21.
- (j) The slump flow, T500 time and passing ability of Self Compacting Concrete (SCC) shall be in accordance with AS 1012.3.5.
- (k) Other relevant test methods in the series AS 1012 – Methods of Testing Concrete shall be used to test concrete as required.

A5. Asphalt and Bituminous Products

Sampling

- (a) Sampling of loose asphalt shall comply with AS 2891.1.

Binder content and particle size distribution

- (b) Tests shall be performed in accordance with either:
 - i. Austroads AGPT/T234, or
 - ii. AS 2891.3.3.

Asphalt performance testing

- (c) AS 2891.13.1 shall be used to determine resilient modulus of asphalt using repeated load indirect tensile techniques.
- (d) Austroads AGPT/T232 shall be used to determine wet and dry strength and tensile strength ratio.
- (e) Austroads AGPT/T233 shall be used to determine resistance to fatigue by repeated flexural bending.

Field compaction.

- (f) Use a thin-layer asphalt gauge, with the probe at the test position, set the reading thickness at nominal layer thickness.
- (g) When using a thin-layer gauge, one four-minute count shall be taken at each site.
- (h) Testing shall be performed in accordance with:
 - i. AS 2891.14.1.1 for direct transmission mode
 - ii. AS 2891.14.1.2 for backscatter mode
 - iii. AS 2891.14.2 when using a thin-layer gauge.

Bituminous products

- (i) Australian Standards and Austroads Test Methods shall be used.
- (j) Viscosity at 135°C shall be determined in accordance with ASTM D88.