



CONCRETE WORKS 10

MUNICIPAL
INFRASTRUCTURE
TECHNICAL
SPECIFICATION
10 - CONCRETE WORKS

Transport Canberra and
City Services

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1 CONCRETE WORKS

1.1 General

1.1.1 Responsibilities

1.1.1.1 General

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

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

1.1.1.2 Design

Formwork: To AS 3610. The design of formwork, other than profiled steel sheeting composite formwork, is the contractor's responsibility. Allow for dimensional changes, deflections and cambers resulting from the following:

- > Imposed actions.
- > Concrete shrinkage and creep.
- > Temperature changes.
- > The application of pre-stressing forces (if any).

Structural design: To AS 3600.

Post-tensioning: To AS 3600.

1.1.2 Cross references

General: The following documents are related to this Specification:

1.1.2.1 ACT Legislation

Waste Minimisation Act

Work Health and Safety Act

1.1.2.2 Specifications

Requirement: Conform to the following:

MITS 00	Preliminaries
MITS 01	Traffic Management
MITS 02	Earthworks
MITS 03	Underground services
MITS 04	Flexible pavement construction
MITS 06A	Concrete kerbs & open drains
MITS 06B	Concrete paths driveways and medians
MITS 09	Landscape

1.1.2.3 Design Standards

General: The following Design Standards are related to this Specification:

MIS 03 Pavement design

MIS 08 Stormwater

1.1.2.4 TCCS reference documents

General: The following TCCS reference documents are related to this Specification:

Reference document 4 Protection of public landscape assets

Reference document 10 Landscape consolidation

1.1.3 Referenced documents

1.1.3.1 Standards

General: The following documents are incorporated into this Specification by reference:

Australian standards

AS 1012 Methods of testing concrete

AS 1012.3.1 Determination of properties related to the consistency of concrete—Slump test

AS 1012.14 Method for securing and testing cores from hardened concrete for compressive strength

AS 1141 Methods for sampling and testing aggregates

AS 1141.11.1 Particle size distribution – Sieving method

AS 1141.14 Particle shape by proportional calliper

AS 1141.21 Aggregate crushing value

AS 1141.23 Los Angeles value

AS 1141.24 Aggregate soundness—Evaluation by exposure to sodium sulphate solution

AS 1348 Glossary of terms - Roads and traffic engineering

AS 1379 Specification and supply of concrete

AS 1397 Continuous hot dip metallic coated steel sheet and strip – Coating of zinc and zinc alloyed with aluminium and magnesium

AS 1478 Chemical admixtures for concrete, mortar and grout

AS 1478.1 Admixtures for concrete

AS 1554 Structural steel welding

AS 1554.3 Welding of reinforcing steel

AS 2327 Composite structures

AS 2327.1 Simply supported beams

AS 2550 Cranes, hoist and winches – Safe use

AS 2550.1 General requirements

AS 2758 Aggregates and rock for engineering purposes

AS 2758.1 Concrete aggregates

AS 2870 Residential slabs and footings
 AS 3600 Concrete structures
 AS 3610 Formwork for concrete
 AS 3610.1 Documentation and surface finish
 AS 3735 Concrete structures retaining liquids
 AS 3799 Liquid membrane-forming curing compounds for concrete
 AS 3850 Tilt-up concrete construction
 AS 3972 General purpose and blended cements
 AS/NZS 4671 Steel reinforcing materials
 AS/NZS 4680 Hot-dipped galvanized (zinc) coatings on fabricated ferrous articles
 AS 6669 Plywood – Formwork

1.1.3.2 Other publications

CIA CPN35 Fibres in concrete
 NP:PCH Precast concrete handbook

National Code of Practice for Precast, Tilt-up and Concrete Elements in Building Construction

1.1.4 Standards

1.1.4.1 General

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

Plywood formwork: To AS 6669.

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

Specification and supply of concrete: To AS 1379.

Concrete materials and construction: To AS 3600.

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

Proprietary products: To *TCCS Products previously considered for use list*

1.1.4.2 Methods and equipment

Precast elements: Comply with the recommendations of NP:PCH.

1.1.5 Interpretation

1.1.5.1 Abbreviations

General: For the purposes of this work section the following abbreviations apply:

TCCS: Transport Canberra and City Services, ACT Government and its successors

1.1.5.2 Definitions

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

Ambient temperature: The air temperature at the time of placing of concrete.

Anti-burst reinforcement: Reinforcement cage surrounding anchorages to control the tensile bursting stresses.

Authorised Person: The Authorised Person as defined by the contract.

Average ambient temperature: Average value of the daily maximum and minimum ambient temperatures over the relevant period at a site.

Batch: A quantity of concrete containing a fixed quantity of ingredients and produced in a discrete operation.

Concrete class:

Normal: Concrete which is specified primarily by a standard compressive strength grade and otherwise conforming to *AS 1379 clause 1.5.3*.

Special: Concrete which is specified to have certain properties or characteristics different from, or additional to, those of normal-class concrete and conforming to *AS 1379 clause 1.5.4*.

Early age strength: A mean compressive strength at 7 days exceeding the values shown in *AS 1379 Table 1.2*.

Formwork:

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

Green concrete: Concrete which has set but not appreciably hardened.

Production assessment: An assessment procedure for concrete specified by strength grade, carried out by the supplier on concrete produced by a specific supplying plant and based on the statistical assessment of standard compressive strength tests on concrete.

Project assessment: An assessment procedure for concrete specified by strength grade, specified at the customer's option, which provides additional test data for the statistical assessment of concrete supplied to a specific project.

Sample: A physical example that illustrates workmanship, materials or equipment, and establishes standards by which the work will be judged. It includes samples, prototypes and sample panels.

Specimen: A portion of a sample which is submitted for testing.

Weather:

- > **Cold:** Ambient shade temperature less than 10°C.
- > **Hot:** Ambient shade temperature greater than 30°C

1.1.6 Submissions

1.1.6.1 Approval

Submissions: To the Authorised Person's approval.

1.1.6.2 Construction proposals

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

- > Changes to the plastic concrete mix.
- > Curing and protection methods.
- > Handling, placing, compaction and finishing methods and equipment, including pumping.
- > Site storage, mixing and transport methods and equipment, if applicable.
- > Temperature control methods.

1.1.7 Hold points and witness points

1.1.7.1 Notice

General: Give written notice to the Authorised person so that the documented inspection and submissions may be made to the **Hold point table** and the **Witness point table**.

Table 10-1 Hold point table

Item	Clause title	Requirement	Notice for inspection	Release by
Pre-construction planning				
10.1	Loading - Loads on minor concrete structures	Approval for early loading of the structure by design strength in situ tests	3 working days	Authorised Person
10.2	Design documentation - Formwork	Formwork design certificates	3 working days	Authorised Person
10.3	Design documentation - Formwork	Proposed loading schedule	3 working days	Authorised Person
Execution				
10.4	Formwork - General	Certification of installed formwork and inspection	1 working day prior to covering	Authorised Person
10.5	Steel reinforcement placement – Approval	Inspect reinforcement placement	2 working day prior to covering	Authorised Person
10.6	Cores, fixings and embedded items - General	Shop drawings for cores, fixings and embedded items	10 working days prior to casting	Authorised Person

Table 10-2 Witness point table

Item	Clause title	Requirement	Notice for inspection
Pre-construction planning			
10.1	Product conformity - Requirement	Submit current assessment of conformity	5 working days prior to ordering
Execution			
10.2	Formwork – Void formers	Test certificates for void formers	5 working days prior to ordering
10.3	Steel reinforcement placement – Delivery and receipt of reinforcement	Submit notice for test inspection	5 working days prior to ordering
10.4	Mixing of concrete – Pre-mixed supply	Submit delivery dockets	Progressive
10.5	Mixing of concrete – Pre-mixed supply	Submit subcontractors details	2 working days prior to the works
10.6	Concrete placing and compaction - Placing	Proposed sequence of concrete placement	5 working days prior to the works
10.7	Joints - General	Submit proposal for sawn joints	2 working days prior to the works
10.8	Formed surfaces - General	Proposed method of surface repair	2 working days prior to the works
10.9	Sprayed concrete – Method statement	Submit proposal for sprayed concrete	10 working days prior to the works

1.1.8 Tolerances

1.1.8.1 Formwork

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

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

Position: Construct formwork so that finished concrete conforms to AS 3600 clause 17.5 and as documented in **Annexure A, Formwork dimensional deviation schedule**.

1.1.8.2 Reinforcement

Fabrication and fixing: To AS 3600 clause 17.2.

Reinforcement and tendon position: To AS 3600 clause 17.5.3.

1.1.8.3 Finishes

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

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

Table 10-3 Flatness tolerance class table

Class	Measurement	Maximum deviation (mm)
A	2m straightedge	4
B	3m straightedge	6
C	600mm straightedge	6

1.2 Pre-construction planning

1.2.1 Loading

1.2.1.1 Loads on minor concrete structures

Prohibition: Avoid application of superimposed load on any part of what will become a load bearing structure within 28 days after placing concrete unless the structure is effectively and independently supported to the satisfaction of the Authorised Person or until the Contractor can demonstrate that the design strength of the concrete has been achieved.

This is a **HOLD POINT**.

1.2.2 Product conformity

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

- > Certificate of conformity by a JAS-ANZ accredited third party.
- > Report by a NATA accredited laboratory describing tests and giving results which demonstrate that the product conforms.
- > Curing compounds: Submit details of any proposed liquid membrane-forming curing compound, including the following:
 - Certified test results for water retention to *AS 3799 Appendix B*.
 - Evidence of compatibility with concrete, and with applied finishes including toppings and render, if any, including methods of obtaining the required adhesion.
- > For visually important surfaces, evidence that an acceptable final surface colour will be obtained.

This is a **WITNESS POINT**.

1.2.3 Design documentation

1.2.3.1 Formwork

Formwork design: Conform to *AS 3610.1*.

Certification: For other than profiled steel sheeting composite formwork, submit certification by a professional structural engineer experienced in formwork design verifying conformance of the design.

This is a **HOLD POINT**.

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

This is a **HOLD POINT**.

1.3 Materials

1.3.1 General

1.3.1.1 Aggregates

Standard: To AS 2758.1.

Aggregate properties: As documented in **Annexure A, Aggregate property schedule**.

1.3.1.2 Cement

Standard: To AS 3972.

Age: Less than 6 months old.

Storage: Store cement bags under cover and above ground.

1.3.1.3 Water

Standard: To AS 1379 *clause 2.4*.

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

1.3.1.4 Polymeric film underlay

Polymeric film underlay and curing membranes: To AS 2870 *clause 5.3.3*.

1.3.1.5 Chemical admixtures

Standard: To AS 1478.1.

1.3.1.6 Curing compounds

Curing compounds: To AS 3799.

1.3.2 Concrete

1.3.2.1 Properties

Concrete mix and supply: Conform to the following:

- > Normal-class: To AS 1379 *clause 1.5.3*.
 - Properties: As documented in **Annexure A, Concrete properties schedule - performance**.
- > Special-class: To AS 1379 *clause 1.5.4*.
 - Properties: As documented in **Annexure A, Concrete properties schedule - performance**.

1.3.2.2 Coloured concrete

Standard: To AS 3610.1.

1.3.3 Formwork

1.3.3.1 General

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

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

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

1.3.3.2 Profiled steel sheeting composite formwork

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

Minimum steel grade: G550.

Zinc coating weight: Z350: 350g/m²

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

1.3.3.3 Plywood formwork

Material: Plywood sheeting to AS 6669.

Grade: Use appropriate grade for the documented design dimensions, loading and surface quality.

Joints: Seal the joints consistent with the documented surface finish class.

Tolerances: To AS 3610.1 Section 3.

1.3.4 Reinforcement

1.3.4.1 Fibre reinforcement

Standard: To CIA CPN35.

1.3.4.2 Steel reinforcement

Standard: To AS/NZS 4671.

Surface condition: The surface shall be clean and free of loose mill scale, loose rust, oil, grease, mud or other material which would reduce the bond between the reinforcement and concrete.

1.3.4.3 Protective coating

Standard: To AS 3600 clause 17.2.1.2.

General: For concrete elements containing protective coated reinforcement, provide the same coating type to all that element's reinforcement and embedded ferrous metal items, including tie wires, stools, spacers, stirrups, plates and ferrules, and protect other embedded metals with a suitable coating.

Epoxy coating: High build, high solids, chemically resistant coating.

- > Thickness: 200µm minimum.

Galvanizing: To AS/NZS 4680, as follows:

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

1.3.4.4 Tie wire

General: Annealed steel 1.25mm diameter (minimum).

External and corrosive applications: Galvanized.

1.3.5 Post-tensioning

1.3.5.1 Grout properties

Standard: To *AS 3600 clause 17.1.8*.

Maximum shrinkage: 1% by volume after 24 hours.

Maximum water: cement ratio: 0.45 (by weight).

Compressive strength: 32MPa at 7 days.

1.3.5.2 Grout materials

Cement: To *AS 3972* and free from calcium chloride and less than two months old.

Admixtures: To *AS 1478.1*. Include an anti-bleed additive.

Fly ash: To *AS 3582.1* and proportioned according to early strength requirements.

Water: To *AS 1379*. Potable, free from oil, acid, alkali, organic or vegetable matter and including not more than 500mg/l of chloride ions.

Epoxy grout type: Commercial epoxy formulation of compressive strength exceeding 40MPa.

1.3.5.3 Ducts

Robustness: Provide ducts with sufficient strength to retain their shape, resist damage during construction, and prevent deterioration or electrolytic action by the entrance of cement paste or water from the concrete.

Wall thickness: To allow for abrasion during stressing of the tendon.

Size: To allow feeding of tendons and grouting.

1.3.5.4 Tendon material

Prestressing steel: Type and grade of strand, wire or bar to *AS/NZS 4672.1*.

Type: 7 wire, stress relieved, high tensile steel and strand.

Quality: Make sure tendons have no nicks, damage or foreign matter such as mud and dirt. Inspect at delivery and store the prestressing steel on supports clear of the ground.

Straightening of tendons: Not permitted. Supply tendons in coils large enough to self straighten.

High tensile steel bars: Inspect individually and reject any bars with surface imperfections more than 0.40mm deep.

1.3.5.5 Other steel

Anchor plates: Hot-dip galvanized to *AS/NZS 4680*.

Anchorage: To *AS/NZS 1314*.

Reinforcement: To *AS/NZS 4671*.

1.3.6 Miscellaneous

1.3.6.1 Coloured concrete

Standard: To *AS 3610.1*.

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

- > Number: 4.
- > Size (nominal): 300 x 300 x 50mm.

1.3.6.2 Surface hardeners, sealants and protectors

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

1.3.6.3 Slip resistance treatment

Slip resistance classification: To *AS 4586*.

1.3.7 Precast units

1.3.7.1 Marking

Identification: Identify units by marks which are as follows:

- > Remain legible until after the unit has been fixed in place.
- > Show the manufacturer and date of casting.
- > Show the correct orientation of the unit.
- > On other than units manufactured as a standard product, indicate the locations within the structure conforming to the marking plan.

1.3.7.2 Tolerances

Fixings and embedded items in precast units: To *AS 3610.1*, as applicable.

1.3.7.3 Attachments

Sealing: Recess lifting attachments such as ferrules, or other types of cast-in fixings, and provide plugs for sealing.

1.3.7.4 Welding of connections

Standard: To *AS/NZS 1554.3*.

1.4 Execution

1.4.1 Site establishment

1.4.1.1 Survey

Requirement: Confirm site surface and benchmarks. Conform to *MITS 00 Preliminaries*.

1.4.1.2 Site Preparation

Erosion and Sediment Control: Conform to *MITS 02A Clearing and grubbing*.

1.4.2 Provision for traffic

1.4.2.1 General

Requirement: Conform to *MITS 01 Traffic Management*.

1.4.3 Polymeric film underlay

1.4.3.1 Location

Polymeric film underlay: Where specified on the drawings under slabs on ground, including integral ground beams and footings, provide a vapour barrier or, in areas prone to rising damp or salt attack, a damp-proofing membrane. Do not provide polymeric film underlays under retaining walls.

1.4.3.2 Base preparation

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

1.4.3.3 Installation

Standard: To *AS 2870 clause 5.3.3*.

1.4.3.4 Mass concrete bedding on earth foundations (concrete blinding slab)

Concrete walls: Prior to the construction of footings for cast-in-situ concrete walls on earth foundations, cover the latter with a mass concrete blinding slab.

Restriction: Place neither forms nor other materials on the bedding layer until the blinding layer has developed sufficient strength.

1.4.4 Formwork

1.4.4.1 General

Requirement: As documented in **Annexure A, Formed surface finishes schedule**.

Certification and inspection: Submit certification by a professional structural engineer experienced in formwork design and construction verifying conformance of the completed formwork, including the suitability of the formwork for the documented surface finish class.

This is a **HOLD POINT**.

1.4.4.2 Preparation

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

1.4.4.3 Bolt holes

Removable bolts: Remove tie bolts without damaging the concrete.

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

Bolt hole filling: Provide material with minimum 25Mpa compressive strength, that will not crack, pit or leak and colour matching the concrete where specified on the drawings.

Recessed filling: Fill or plug the hole to 6mm below the finished surface where specified on the drawings.

1.4.4.4 Corners

Work above ground: Chamfer at re-entrant angles, and fillet at corners where specified on the drawings.

Face of bevel: 25mm.

1.4.4.5 Embedments

Fixing: Fix embedments through formwork to prevent movement, or loss of slurry or concrete, during concrete placement.

1.4.4.6 Profiled steel sheeting composite formwork

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

1.4.4.7 Steel linings

Rust: Clean off any rust and apply rust inhibiting agent before re-use.

1.4.4.8 Visually important surfaces

Surface finish classes 1, 2 or 3: Set out the formwork to give a regular arrangement of panels, joints, bolt holes, and similar visible elements in the formed surface.

1.4.4.9 Void formers

Protection: Keep void formers dry until use, install on a firm level surface and place reinforcement and concrete with minimum delay.

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

This is a **WITNESS POINT**.

1.4.5 Reinforcement

1.4.5.1 Dowels

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

Tolerances:

- > Alignment: 1:150.
- > Location: \pm half the diameter of the dowel.

1.4.5.2 Cover

Concrete cover generally: To AS 3600 clause 4.10.

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

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

1.4.5.3 Supports

Proprietary concrete, metal or plastic supports: Provide chairs, spacers, stools, hangers and ties, as follows:

- > With a protective coating if they are ferrous metal, located within the concrete cover zone, or are used with galvanized or zinc-coated reinforcement.

Spacing:

- > Bars: ≤ 60 diameters.
- > Mesh: $\leq 800\text{mm}$.

Supports over membranes: Prevent damage to waterproofing membranes or vapour barriers. If appropriate, place a metal or plastic plate under each support.

1.4.5.4 Projecting reinforcement

Protection: If starter or other bars extend beyond reinforcement mats or cages, through formwork or from cast concrete, provide a plastic protective cap to each bar until it is cast into later work.

1.4.5.5 Tying

General: Secure the reinforcement against displacement at intersections with either wire ties, or clips. Bend the ends of wire ties away from nearby faces of formwork or unformed faces to prevent the ties projecting into the concrete cover.

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

Bundled bars: Tie bundled bars in closest possible contact. Provide tie wire of at least 2.5mm diameter and spaced not more than 24 times the diameter of the smallest bar in the bundle.

Columns: Secure longitudinal column reinforcement to all ties at every intersection.

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

1.4.5.6 Bending

General: Do not bend or straighten in a manner that will damage the material. Do not provide bars with kinks or bends not documented.

Heating: Do not use heat to bend or straighten reinforcement.

1.4.5.7 Splicing

Plan lengths: Provide all reinforcement in the lengths documented. If splicing is required conform to *AS/NZS 4671*.

Testing of splices not as shown on the drawings: Costs to the Contractor.

Lapped splices: Provide laps in reinforcing bars, wire or fabric as shown on the drawing or as follows:

Plain bars, Grade 250: Minimum 40 bar diameters.

Deformed bars, Grade 400: Minimum 35 bar diameters.

Hard-drawn wire: Minimum 50 bar diameters.

Securely wired together in at least two places, unless welded.

Splicing in reinforcing fabric: Provide an overlap, measured between outermost transverse wires of each sheet of fabric of not less than the spacing of those wires.

Staggering: Stagger splices as shown on the drawings or submit proposal for approval.

1.4.5.8 Marking

Bundles: Bundle bars of identical shape in bundles of three and securely tie together by soft iron wire.

Label: Provide each bundle with a stout metal label of not less than 40mm diameter.

Marking: Make sure that each metal label has been punched with the appropriate marking conforming to the documented steel list.

Prefix: If documented, make sure that the marking incorporates a prefix. Store bars with different prefixes separately.

1.4.5.9 Delivery and receipt of reinforcement

Test before delivery: If it is proposed to have the reinforcement tested off-site, obtain the approval before reinforcement is delivered to site.

This is a **WITNESS POINT**.

1.4.5.10 Placing

Reinforcement position: Place reinforcement as documented and hold securely by blocking from the forms, by supporting on concrete or plastic chairs, or metal hangers, and by wiring together at all intersections or at 0.5m centres, whichever is the greater distance, using annealed iron wire of diameter not less than 1.25mm.

Prohibition: Do not support steel on metal supports which extend to the surface of concrete, on wooden supports, or on pieces of coarse aggregate.

Reinforcement: If changes are proposed to reinforcement shown on the drawings, submit details.

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

Provision for concrete placement: If spacing, splicing, welding or cover of reinforcement does not comply give notice.

1.4.5.11 Approval

General: Submit the approval for the reinforcement in each section of the work before any concrete is deposited in that section. Allow adequate time for inspections and any corrective work.

This is a **HOLD POINT**.

1.4.6 Post-tensioning

1.4.6.1 General

Protection: Protect post-tensioning tendons, anchorages, ducts, supports and grout from damage and contaminants, including swarf, loose grease, oil and paint.

Tolerances: To *AS 3600 clause 17.5.3*.

Minimum concrete cover: As documented.

Post-tensioning record: Provide details of the following:

- > Concrete mix.
- > Concrete placing and curing, including dates.
- > Placing of reinforcement and tendons.
- > Dates of post-tensioning operations.
- > Name of operator.
- > Identification of tendons.
- > Stressing method (single or double end, monostrand or multistrand).
- > Early age test results for strength.
- > Tendon breakage and non-conformance reports.

1.4.6.2 Ducts

Standard: To *AS 3600 clause 17.3*.

Placement: Locate and secure to positions, as documented.

Supports: Support and fix at regular intervals. Protect from collapse and other damage.

Sheathing: If ducts are formed with sheaths, provide sheathing material capable of transferring the tendon stresses into the body of the concrete.

Sequence: Assemble tendons on site by installing strand, bar or wire within the duct before concreting.

1.4.6.3 Tendons

Care: Do not weld tendons. Do not expose tendons to sparks, ground current or excessive temperatures such as flame or oxyacetylene cutting.

Grout fittings and ducts: For bonded construction, protect from collapse and other damage.

Conformance: Provide tendons as documented in **Annexure A, Tendon schedule**.

Protection: Make sure tendons are not displaced by heavy and prolonged vibration, the pressure of the concrete being placed, workmen or construction traffic.

Temperature: Maintain concrete around grouted tendons at 5°C or more for at least 3 days after grouting.

1.4.6.4 Couplers

Standard: To AS/NZS 1314 Section 5.

Cover: Position and fix couplers to provide adequate cover.

Laying: Give coupled strands the same lay to prevent rotation.

1.4.6.5 Gauges and jacks

Standard: To AS 1349.

Maximum error in pressure indication: 1% of the maximum scale (concentric) value.

Period: Calibrate gauges and jacks at intervals not exceeding 6 months, after re-sealing of jack or gauge, or if any inaccuracy in the gauges is suspected at any time.

Sets: Calibrate and use jacks and gauges as a set.

1.4.6.6 Stressing

Post-tensioning: To AS 3600 clause 17.3.4.5.

Concrete strength: Complete early age tests before stressing.

Stressing procedure: Carry out stressing after age test results indicate concrete has attained the required strength.

Stressing stages: As documented.

Initial Force: If tendons are not marked at nil load, apply initial force or pressure if tendons are marked for measurement of elongations.

Cutting tendons: Do not cut tendons until the actual extensions are approved.

Re-stress or de-stress: Adjust stress in tendons if necessary, after the theoretical and site extensions have been compared.

Post-tensioning stressing schedule: Provide a stressing schedule, including the following information:

- > Setting out, elongation and jacking forces.
- > Identification number of dynamometers, gauges, pumps and jacks.
- > Initial stressing force (or pressure) when tendons are marked for measurement of elongation.
- > Force applied (dynamometers).
- > Pump or jack pressure and area of the piston.
- > Elongation before anchoring.
- > Elongation remaining after anchoring.

1.4.6.7 Grouting

Timing: Grout tendons as soon as practicable after stressing and for corrosive environments within 3 weeks or as documented.

Procedure: Prevent damage to grout vents and fittings during grouting. Do not use manually powered grouting machines. Completely fill the duct during grouting. Inject grout into voids between tendons, ducts and anchorages, until grout flows from vents without air bubbles. Close vents as they fill, progressively in the direction of flow. If there is a blockage or interruption, completely flush grout from the duct using water.

Post-tensioning grouting record: For each duct grouted, provide the following:

- > Duct and tendon identification.
- > Grouting date.
- > Composition of the grout (water: cement ratio, admixtures).
- > Grout tests, including air tests of ducts.
- > Details of grouting (including pumping or supply interruptions, topping up).

1.4.6.8 Protection

Grout ducts: Do not subject grouted ducts to shock, vibration, construction traffic or similar loads until 24 hours after completion of grouting.

1.4.6.9 Permanent protection

Tendons and anchorages: On completion of stressing and grouting, permanently protect anchorage and tendons. Provide at least 40mm of cover over the cut tendons when the recesses are concreted. Keep anchorages free of foreign matter (rust, grease, oil, paint).

1.4.7 Concrete

1.4.7.1 General

Conformance: As documented in **Annexure A, Concrete properties schedule – performance** and the **Minimum concrete strength requirements table**.

Table 10-4 Minimum concrete strength requirements table

Use	MPa
Foundations, mass retaining walls	20
Mass concrete footings, pitching, linings etc.	20
Drainage structures, driveways, footpaths, miscellaneous minor concrete work	20
Reinforced concrete culverts, headwalls, base slabs, sign structure large footings, retaining walls	32
Safety barriers	40
Extruded concrete	20

1.4.7.2 Elapsed delivery time

General: Make sure the elapsed time between the wetting of the mix and the discharge of the mix at the site conforms to the **Elapsed delivery time table**. Do not discharge at ambient temperature below 10°C or above 30°C unless approved heating or cooling measures are taken to deliver concrete within the range 5°C to 35°C.

Table 10-5 Elapsed delivery time table

Concrete temperature at time of discharge (°C)	Maximum elapsed time (minutes)
10 – 24	120
24 – 27	90
27 – 30	60
30 – 32	45

1.4.7.3 Pre-mixed supply

Addition of water: To *AS 1379 clause 4.2.3*.

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

Delivery docket: For each batch, submit a docket listing the information required by *AS 1379*, and the following information:

- > For special class performance concrete and specified performance.
- > For special class prescription concrete, details of mix and additives.
- > Method of placement and climate conditions during pour.
- > Name of concrete delivery supervisor.
- > The amount of water, if any, added at the site.
- > The concrete element or part of the works for which the concrete was ordered, and where it was placed.
- > The total amount of water added at the plant and the maximum amount permitted to be added at the site.

This is a **WITNESS POINT**.

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

This is a **WITNESS POINT**.

1.4.8 Cores, fixings and embedded items

1.4.8.1 General

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

Cores, fixings and embedded items: Submit shop drawings showing the proposed locations, clearances and cover, and indicating proposed repositioning of reinforcement.

This is a **HOLD POINT**.

1.4.8.2 Adjoining elements

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

1.4.8.3 Protection

General: Grease threads. Protect embedded items against damage.

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

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

1.4.8.4 Structural integrity

Position: Fix cores and embedded items to prevent movement during concrete placing. In locating cores, fixings and embedded items, displace but do not cut reinforcement, and maintain cover to reinforcement.

Isolation: Isolate embedded items to prevent water tracking to concrete providing minimum cover to reinforcement.

1.4.8.5 Tolerances

General: Maximum deviation from correct positions:

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

1.4.9 Concrete working base

1.4.9.1 Finish

Membrane support: Wood float finish or equivalent.

1.4.9.2 Installation

General: Lay over the base or subgrade and screed to the required level.

1.4.9.3 Surface tolerance

Deviation: Flatness tolerance Class B.

1.4.10 Placing and compaction

1.4.10.1 Placing

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

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

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

Sequence of placement: If sequential placement of slab segments is proposed, provide details.

This is a **WITNESS POINT**.

1.4.10.2 Compaction

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

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

1.4.10.3 Placing records

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

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

1.4.10.4 Rain

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

1.4.10.5 Time between adjacent placements

General: As documented in the Minimum time delay schedule.

1.4.10.6 Vertical elements

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

1.4.10.7 Placing in cold weather

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

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

Severe weather: If severe weather conditions are predicted, reschedule the works. Where directed by the Authorised Person, use high early strength cement.

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

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

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

Freezing: Prevent concrete from freezing.

1.4.10.8 Placing in hot weather

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

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

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

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

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

- > Cover horizontal transport containers.
- > Spray the coarse aggregate using cold water before mixing.
- > Use chilled mixing water.

Table 10-6 Hot weather placing table

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

1.4.11 Curing

1.4.11.1 General

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

- > Curing: Cure continuously immediately after the completion of finishing until the total cumulative number of days or fractions of days, during which the air temperature in contact with the concrete is above 10°C, conforms to the following, unless otherwise specified:
 - Concrete mixes containing Portland cement: 7 days.
 - Concrete mixes containing supplementary cementitious materials: 14 days.
- > End of curing period: Prevent rapid drying out at the end of the curing period.
- > Protection: Maintain at a reasonably constant temperature with minimum moisture loss, during the curing period.

1.4.11.2 Curing compounds

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

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

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

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

1.4.11.3 Cold weather curing

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

1.4.11.4 Hot weather curing

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

Protection: Select a protection method from the following:

- > Immediately after finishing, either cover exposed surfaces using an impervious membrane or hessian kept wet until curing begins, or apply a curing compound.

1.4.11.5 Water curing

Method: Select a method of ponding or continuously sprinkling to prevent damage to the concrete surface during the required curing period.

1.4.12 Joints

1.4.12.1 Weakened plane joints

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

This is a **WITNESS POINT**.

1.4.12.2 Construction joints

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

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

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

1.4.12.3 Expansion joints

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

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

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

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

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

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

1.4.12.4 Slip joints

Requirement: If concrete slabs are supported on masonry, provide proprietary slip joints.

1.4.13 Surface modifiers

1.4.13.1 General

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

1.4.14 Formed surfaces

1.4.14.1 General

Surface finish: Provide formed concrete finishes as documented in the Formed surface finishes schedule.

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

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

This is a **WITNESS POINT**

1.4.14.2 Evaluation of formed surfaces

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

1.4.14.3 Surface repairs

Method: If surface repairs are required, submit proposals.

1.4.14.4 Finishing methods

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

Exposed aggregate finish: Remove the vertical face formwork while the concrete is green. Wet the surface and scrub with stiff fibre or wire brushes, flushing continuously with clean water, until the aggregate is uniformly exposed. Do not use acid etching. Rinse the surface with water.

Floated finishes:

- > Sand floated finish: Remove the vertical face formwork while the concrete is green. Wet the surface and rub using a wood float. Rub fine sand into the surface until a uniform colour and texture are produced.
- > Grout floated finish: Remove the vertical face formwork while the concrete is green. Dampen the surface and spread a slurry, using hessian pads or sponge rubber floats. Remove surplus slurry and work until a uniform colour and texture are produced.

1.4.14.5 Formwork removal

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

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

Stripping:

- > General: To AS 3600 where it is more stringent than AS 3610.1.
- > Vertical formwork: To AS 3610.1 Appendix B Table B1.
- > Multi-storey work: Remove formwork without disturbing props supporting succeeding floors.
- > Post-tensioned concrete: Remove formwork supporting post-tensioned concrete members to AS 3600 clause 17.6.2.7.

1.4.14.6 Protection

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

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

1.4.15 Unformed surfaces

1.4.15.1 General

Surface finish: As documented in **Annexure A, Unformed surface finishes schedule**.

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

1.4.15.2 Surface repairs

Method: If surface repairs are required, submit proposals.

1.4.15.3 Finishing methods – primary finish

Machine float finish:

- > After levelling, consolidate the surface using a machine float.
- > Cut and fill and refloat immediately to a uniform, smooth, granular texture.
- > Hand float in locations inaccessible to the machine float.

Steel trowel finish: After machine floating finish, as follows:

- > Use power or hand steel trowels to produce a smooth surface relatively free from defects.
- > When the surface has hardened sufficiently, re-trowel to produce the final consolidated finish free of trowel marks and uniform in texture and appearance.

Burnished finish: Continue steel trowelling until the concrete surface attains a polished or glossy finish, uniform in texture and appearance, and free of trowel marks and defects.

Wood float finish: After machine floating, use wood or plastic hand floats to produce the final consolidated finish free of float marks and uniform in texture and appearance.

Broom finish: After machine floating and steel trowelling use a broom or hessian belt drawn across the surface to produce a coarse even-textured transverse-scored surface.

Scored or scratch finish: After screeding, use a stiff brush or rake drawn across the surface before final set, to produce a coarse scored texture.

Sponge finish: After machine floating and steel trowelling, use a damp sponge to wipe the surface to produce an even textured sand finish.

Exposed aggregate finish: After floating and when concrete has stiffened, wet the surface and scrub with stiff fibre or wire brushes, flushing continuously with clean water, until the aggregate is uniformly exposed. Rinse the surface with water.

1.4.15.4 Finishing methods – supplementary finish

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

Stamped and coloured faux paved or cobblestone finish: Provide a proprietary finishing system.

Polished finish: After steel trowelling, grind the cured surface of the concrete.

1.4.15.5 Protection

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

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

1.4.16 Precast units

1.4.16.1 Handling

Lifting: Lift or support units only at designated or other approved points. Use handling methods which do not overstress, warp or damage the units.

1.4.16.2 Attachments

Remove temporary attachments after erection. Seal and make good residual recesses.

1.4.16.3 Installation

Fixing: Fix the units securely and accurately in their final positions.

Ancillaries: Provide components and materials, including fasteners, braces, shims, jointing strips, sealant, flashings, grout and mortar, necessary for the installation of the units.

1.4.16.4 Protection

General: Protect the units against staining, discolouration and other damage until they are installed in their final location.

1.4.16.5 Storage

Support points: Store elements at designated storage points.

Prevent damage: Adequately store units to prevent warping, twisting, crushing, cracking and staining.

1.4.16.6 Lifting and handling

Lifting and handling: Conform to the *National code* and *AS 3850*.

Site conditions: Make sure the wind and temperature conditions allow handling and fixing consistent with structural capability and geometry of the element.

Cranes: To *AS 2550.1*.

Temporary bracing and propping: To *AS 3850*.

1.4.17 Sprayed concrete

1.4.17.1 Materials

Standard to AS 3600.

1.4.17.2 Detail

Minimum depth: 75mm.

Colour: Spray coloured concrete lining in open drains to match the adjoining rock colour.

1.4.17.3 Strength

Minimum cement content: 380kg/m³ as discharged from the nozzle.

Minimum compressive strength: 25MPa at 28 days when tested by means of 75mm diameter cores taken from in-place sprayed concrete.

1.4.17.4 Method statement

General: Submit at least 14 days prior to applying any sprayed concrete including details of the proposed procedure, plant, materials, nozzle operator and mix proportions.

This is a **WITNESS POINT**.

1.4.17.5 Surface preparation

Earth: Grade, trim, compact and dampen earth surfaces prior to applying the sprayed concrete. Take any necessary precautions to prevent erosion when the sprayed concrete is applied.

Rock: Clean off loose material, mud and other foreign matter that might prevent bonding of the sprayed concrete onto the rock surface. Dampen the rock surfaces prior to applying the sprayed concrete.

Steel pipes: Corrugated steel pipes are cleaned of loose material, mud and any other foreign matter.

Water flow: Remove free water and prevent the flow of water which could adversely affect the quality of the sprayed concrete.

1.4.17.6 Application of sprayed concrete

Procedure: Begin application at the bottom of the area being sprayed and build up making several passes of the nozzle over the working area.

Technique: Hold the nozzle so that the stream of material impinges as nearly as possible perpendicularly to the surface being coated.

Spraying around reinforcement: If spraying around reinforcement, spray concrete behind the reinforcement before concrete can accumulate on the face of the reinforcement.

Protection of adjoining surfaces: Protect adjoining surfaces not requiring sprayed concrete from splash and spray rebound.

Regulation: Regulate the velocity of discharge from the nozzle, the distance of the nozzle from the surface and the amount of water in the mix so as to produce a dense coating with minimum rebound of the material and no sagging.

Rebound: Remove and dispose of splash and rebound material from the surface after the initial set as work proceeds by air-water jet or other suitable means. Protect the works to ensure that additional water is not incorporated into the sprayed concrete.

Wind problems: If wind causes separation of the nozzle stream, discontinue spraying.

Air temperature: If air temperature is less than 5°C, do not spray.

1.4.17.7 Construction joints

General: Keep construction joints to a minimum.

Forming: Form joint by placing or trimming the sprayed concrete to an angle between 30° and 45° to the sprayed concrete surface.

Preparation: Clean and wet by air-water jet the joint edge before recommencing concrete spraying.

1.4.17.8 Curing

Commencement: Commence curing within one hour of the application of sprayed concrete with water or colourless wax emulsion curing compound conforming to AS 3799 and applied to conform to manufacturer's specifications.

Water curing: If water curing, keep the surface of the sprayed concrete continuously wet for at least seven days.

1.5 Completion

1.5.1 Submissions

Work as Executed Records: To *MIT 00B Quality Requirements*.

2 MEASUREMENT AND PAYMENT

2.1 Measurement

2.1.1.1 General

Payments made to the Bill of Quantities: To *MIT 00A General requirements*, this Specification, the drawings and **Pay items**.

2.1.1.2 Methodology

The following methodology will be applied for measurement and payment:

- > Allow for all work, materials, testing and quality assurance requirements in each Pay Item.
- > Concrete payment rates: At the scheduled rates provided the concrete meets the strength requirements shown in the Concrete strength requirements table or as otherwise documented.
- > Reduction in payment rates: Where any concrete does not reach the strength specified in the Concrete strength requirements table, at the scheduled rate of payment reduced by 2% for each 1%, or fraction thereof, by which the strength of the specimen fails to reach the specified strength, up to a maximum deficiency of 10%.
- > Rejection: If the deficiency in strength exceeds 10%, the concrete represented by the specimens may be rejected, in which case no payment will be made for the work nor for any remedial work to rectify the deficiency or for disposal of the rejected components.

2.2 Pay items

Table 10-7 Pay items table

Item No	Pay items	Unit of measurement	Schedule of rates scope
10.1	Sprayed Concrete	m ² of sprayed concrete in place.	<p>All activities associated with construction of sprayed concrete including surface preparation, spraying, jointing, supply and placement of reinforcement, removal of splash and rebound material and curing.</p> <p>A separate pay item shall be included in the contract for each design thickness.</p>
10.2	Concrete Works	m ³ of concrete placed	<p>All activities associated with construction of concrete including forming, compaction of subgrade and concrete, curing, embedments, cores and fixings, jointing and conformance testing.</p> <p>A separate pay item shall be included in the Contract for each grade of concrete specified.</p>
10.3	Reinforcement	Tonnes	All activities extra over Concrete works for the supply, placement and fixing of reinforcement.
10.4	Precast Units	Number of precast units constructed.	<p>All activities associated with the construction of precast units including manufacture, supply of all materials, delivery to site and installation of precast units.</p> <p>A separate pay item shall be included in the Contract for each type of unit specified.</p>

ANNEXURE A

Selections

Table 10-8 Aggregate property schedule

Aggregate property	Tests	Limits
Particle density		
Water absorption		
Particle size		
Durability		

Table 10-9 Tendon schedule

Structural element	Tendon material	Tendon size (mm)

Table 10-10 Formwork dimensional deviation schedule

Dimension or measurement	Location or element	Deviation (mm)

Table 10-11 Formed surface finishes schedule

Property	A	B	C
Location			
Surface finish class to AS 3610.1			
Form lining type			
Colour control			
Bolt hole filling			
Surface finish type			

Table 10-12 Concrete properties schedule – performance

	A	B	C
Normal and special class			
Air entrainment – air volume (%)			
Maximum aggregate size (mm)			
Assessment process			
Slump (mm)			
Strength grade/characteristic compressive strength f'_c (MPa)	Refer to the Concrete strength requirements table		
Special class			
Bleeding (mL/mm ²)			
Cement type			
Density of hardened concrete (kg/m ³)			
Density of plastic concrete (kg/m ³)			
Drying shrinkage			
Duration of air drying			
Early age strength (MPa)			
Flexural strength (MPa)			
Indirect tensile strength (MPa)			
Mineral oxide content			
Mix type			
Water: cement ratio maximum			

Table 10-13 Control tests schedule

Concrete element	28 day strength	Transfer strength (MPa)	Days after pouring	Early strength (MPa)	Days after pouring

Table 10-14 Minimum time delay schedule

Between (pour locations)	Minimum period between adjacent pours (days)
Adjacent pours abutting horizontal construction joints in walls	
Adjacent pours abutting vertical construction joints in walls	
Floor slab construction joints	
“Pour strips” and adjacent concrete	
Retaining wall construction joints	

Table 10-15 Minimum time delay schedule

Between (pour locations)	Minimum period between adjacent pours (days)
Adjacent pours abutting horizontal construction joints in walls or columns	
Adjacent pours abutting vertical construction joints in walls	
Columns and slabs	
Floor slab construction joints	
Pour strips and adjacent concrete	
Retaining wall construction joints	

Table 10-16 Unformed surface finishes schedule

	A	B	C
Location			
Flatness tolerance class			
Primary finish			
Supplementary finish			
Slip resistance treatment			
Slip resistance classification			
Slip resistance site test of completed installation			
Surface modifier			



Transport Canberra and
City Services

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