



## AUS-SPEC

### Infrastructure Specifications

### 0319 Auxiliary Concrete Works



## 0319 AUXILIARY CONCRETE WORKS

IMPORTANT: This document has been adapted from the NATSPEC suite of specification templates for use in the MidCoast Council area by both Council and industry. NATSPEC regularly updates the base templates (currently in April and October each year), and Council may incorporate changes into its version of AUS-SPEC from time to time. To assist in highlighting any changes made by Council to the NATSPEC templates, the following conventions are used.

- See ANNEXURE M at the end of this document which contains (where practical) MidCoast Council customisations (also known as 'office master' text). References to the Annexure are to also be inserted at relevant clauses in the main body of the document.
- Where content is added to the main body of the document, it is to be shown **in brown text like this**.
- Where content is deleted or excluded from the main body of the document, it is to be shown ~~struck through like this~~. Such clauses are to have no effect.

Where there is a conflict between main body text and MidCoast Council specific clauses, Council's specific clauses shall prevail.

## 1 GENERAL

### 1.1 RESPONSIBILITIES

#### General

Requirement: Provide cast, pre-cast and sprayed concrete, as documented.

### 1.2 CROSS REFERENCES

#### General

Requirement: This worksection is not a self-contained specification. In addition to the requirements of this worksection, conform to the following:

- 0136 *General requirements (Construction)*.
- 0152 *Schedule of rates (Construction)*.
- 0161 *Quality management (Construction)*.
- 1101 *Traffic management*.

### 1.3 STANDARDS

#### General

Specification and supply of concrete: To AS 1379.

Concrete materials, design and construction: To AS 3600.

Concrete structures for retaining liquids: To AS 3735.

Design, installation and testing of post-installed and cast-in fastenings: To AS 5216.

### 1.4 INTERPRETATION

#### Definitions

General: For the purposes of this worksection the definitions given in AS 1379, AS 3600 and the following apply:

- Ambient temperature: The air temperature at the time of mixing and placing of concrete.
- Early age strength: A mean compressive strength at 7 days exceeding the values shown in AS 1379 Table 1.2.
- Expansion joint: A closing control joint with the joint surfaces separated by a compressible filler to allow axial movement due to thermal expansion or contraction with changes in temperature or creep. It may include unbound dowels to assist vertical deflection control.
- Geopolymer binder: Polymeric binder formed by reacting alumina-silicate pre-cursors with alkaline activator(s).

- Geopolymer concrete: Geopolymer binder aggregates, water and additives.
- Sprayed concrete: Concrete pneumatically applied at high velocity on to a surface. Application may be either a wet or dry process, to produce a sound homogeneous product with a surface finish reasonably uniform in texture and free from blemishes. Sprayed concrete is also called Shotcrete.
- Weather – cold: Ambient shade temperature less than 10°C.
- Weather – hot: Ambient shade temperature greater than 30°C.

## **1.5 SUBMISSIONS**

### **Certification**

Design: Submit certification verifying conformance of the formwork design for in-situ box culverts and retaining walls.

Completed formwork: Submit certification verifying conformance of completed formwork, including the suitability of the formwork for the documented surface finish class.

### **Execution details**

Modifications: Submit details of any proposed on-site modifications to the documented reinforcement.

Welding: Submit details of any proposed welding of steel reinforcement.

Splicing: Submit details of any proposed mechanical splicing of steel reinforcement.

Galvanizing repair: Submit proposals for any repair to damaged galvanizing of steel reinforcement.

Coring: Submit details of any proposed cutting or coring required in hardened concrete.

Elapsed delivery time: Submit details of any proposed methods for cooling or heating wet concrete before placement.

Measurement of materials: Submit proposal to measure materials by volume for on-site mixing for minor concrete works.

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

- Changes to the 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.
- Details of any proposed sequential placement of slabs.

Placing under water: Submit detailed method statement for proposed placement of concrete under water.

Construction joints: Submit details of any emergency construction joints included in the works.

Repair of defects: Submit details of the proposed method of defect repair.

Surface repairs: Submit details of the proposed method of surface repair.

Method statement: Submit method statement for all sprayed concrete works.

### **Products and materials**

Curing compounds: Submit details of any proposed liquid membrane forming curing compound, including evidence of conformance to the documented requirements.

Machine mixing: Submit details of proposed concrete mix when on-site machine mixing is proposed.

### **Samples**

Coloured concrete: Submit sample blocks of coloured concrete before casting final concrete.

Sprayed concrete sample panels: Submit 3 sample panels for each mix proposed.

### **Shop drawings**

Submit shop drawings to a scale that best describes the detail, showing the following:

- Location: The location of any cores, anchors, fixings or embedded items, including any requirement to displace reinforcement.

### **Subcontractors**

Pre-mixed subcontractors: Submit details of proposed pre-mixed concrete suppliers.

### **Tests**

Quality: Submit results of testing to **ANNEXURE – MAXIMUM LOT SIZE AND MINIMUM TEST FREQUENCIES**.

Cores and test acceptance: Submit proposed locations of test cores.

Other tests: Submit results, as follows:

- Loading: If applying superimposed loads to a future load bearing concrete structure, within 21 days of placing concrete, complete tests to demonstrate that 95% of the concrete design strength has been achieved.

## **1.6 INSPECTIONS**

### **Notice**

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

- Base preparation: Completed and prepared base before laying underlay or placing concrete.
- Completed formwork: Completed formwork following certification by professional engineer.
- Steel reinforcement placement: Completed steel reinforcement placement before placing concrete.
- Galvanizing repair: Any repaired galvanizing of steel reinforcement before placing concrete.
- Emergency hand mixing: Emergency hand mixing of concrete due to mechanical failure.
- Sprayed concrete sample panels: Concrete spraying of sample panels.

## **2 MATERIALS**

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### **2.1 CONCRETE**

#### **Properties**

Concrete mix and supply: Conform to the following:

- Normal-class: To AS 1379 clause 1.5.3.
  - . Properties: As documented in the **Normal-class concrete properties schedule**.
- Special-class: To AS 1379 clause 1.5.4.
  - . Properties: As documented in the **Special-class concrete properties schedule**.

#### **Consistency**

Stockpile: If uniform, consistent colour is documented, stockpile sand, cement and aggregates at the beginning of the project to minimise colour variations.

#### **Aggregates**

Standard: To AS 2758.1.

#### **Cement**

Standard: To AS 3972.

Age: Less than 6 months old.

Geopolymer concrete: Supply of geopolymer concrete to Austroads ATS 5330.

Storage: Store cement bags under cover and above ground.

#### **Supplementary cementitious materials**

Fly ash: To AS/NZS 3582.1.

Slag: To AS 3582.2.

Amorphous silica: To AS/NZS 3582.3.

#### **Water**

Standard: To AS 1379 clause 2.4.

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

#### **Coloured concrete**

Manufacture: Produce 4 sample blocks of each coloured concrete using the proposed mix and method before casting final concrete.

Sample block size (nominal): 300 x 300 x 50 mm.

### **Chemical admixtures**

Standard: To AS 1478.1, used to the manufacturer's recommendations.

## **2.2 FORMWORK**

### **General**

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

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

### **Plywood formwork**

Material: To AS 6669.

Grade: To suit the documented design dimensions, loading and surface quality.

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

Tolerances: To AS 3610.1 Table 3.3.5.1.

## **2.3 REINFORCEMENT**

### **Fibre reinforcement**

Standard: To AS 3600 Section 16 and CIA CPN35.

Steel fibres: To ISO 13270 or EN 14889-1.

### **Steel reinforcement**

Standard: To AS/NZS 4671.

Properties: To the **Steel reinforcement properties schedule**.

Fabrication tolerances: To AS 3600 clause 17.2.2.

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

Storage: Store reinforcement above the surface of the ground and protect from damage and from deterioration by exposure.

### **Protective coating**

Standard: To AS 3600 clause 17.2.1.2.

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

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

- Thickness: 200 µm minimum.

Galvanizing: To AS/NZS 4680:

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

### **Accessories**

Reinforcement supports: To AS/NZS 2425.

Tie wire: Galvanized annealed steel 1.25 mm diameter minimum.

## **2.4 PRECAST UNITS**

### **General**

Requirement: Provide proprietary precast units as documented.

Materials, components and equipment for manufacture: To AS 3850.1.

Planning, design, construction, transportation, erection and installation: To AS 3850.2.

### **Marking**

Identification: Identify all units with easily visible markings that will be hidden once the unit is installed, including the following:

- Date of manufacture.
- Manufacturer's name or registered mark and location of manufacture.
- Maximum mass of unit in kg.

- Batch number.
- Correct orientation of unit.

## **2.5 MISCELLANEOUS**

### **Surface hardeners, sealants and protectors**

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

### **Polymeric film underlay**

Standard: To AS 2870 clause 5.3.3.2.

### **Curing compounds**

Standard: To AS 3799.

Liquid membrane-forming curing compound: Compatible with the following:

- The water retention requirements of AS 3799.
- The concrete, and any applied finishes, including toppings and render.
- The surface colour required for visually important surfaces.

## **2.6 TESTING**

### **Quality**

Requirement: Test for all characteristics in conformance with **ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES**.

Quality verification: If material/product quality verification can be obtained from the supplier, documented tests need not be repeated.

## **3 EXECUTION**

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### **3.1 GROUND PREPARATION**

#### **Rock foundations**

Minimum depth: Excavate a minimum depth of 150 mm, or as documented, into the rock for retaining walls, headwalls and wingwalls.

#### **Mass concrete blinding**

In situ walls: Place a mass concrete blinding slab on the prepared subgrade before constructing wall footings.

Blinding thickness:

- Earth foundation: Minimum 50 mm.
- Rock foundation: Minimum 50 mm above the highest point of rock.

Restriction: Do not place forms or other materials on the blinding within 48 hours of the blinding being placed.

#### **Base preparation**

Requirement: Prepare base, as follows:

- Graded prepared subgrade: Blind with sand to create a smooth surface free from hard projections. Wet the sand just before laying the underlay, where documented.
- Concrete blinding: Remove projections above the plane surface, and any loose material.

#### **Polymeric film underlay installation**

General: Where documented, lay underlay over the base, as follows:

- Lap joints at least 200 mm and seal the laps and penetrations with waterproof adhesive tape.
- Face the laps away from the direction of concrete pour.
- Patch or seal punctures or tears before placing concrete.
- Cut back as required after concrete has gained strength and formwork has been removed.

### **3.2 FORMWORK**

#### **General**

Standard: To AS 3610.1.

**Robustness:** Provide formwork of adequate strength to carry all applied loads, including the pressure of fresh concrete, vibration loads, weight of workers and equipment, without loss of shape.

**Stripping:** Provide forms that can be removed without causing damage to the completed structure.

**Side forms:** In earth excavations, provide side forms to prevent contact between concrete and the in situ earth.

**Corners above ground:** Provide 25 mm bevelled fillet at re-entrant angles, and chamfer at corners.

**Steel linings:** Clean off any rust and apply rust inhibiting agent before use.

### **Design**

**General:** The design of formwork is the contractor's responsibility.

**Certification:** For in situ box culverts and retaining walls, obtain certification by a professional structural engineer, experienced in formwork design, verifying conformance of the design.

### **Fittings and embedments**

**Requirement:** Make provision for the accurate location and firm support of fittings, bolts, anchorages and formers of holes and recesses, as documented.

**Temporary fittings for the support of the formwork:** Arrange to allow removal without damage to the concrete.

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

### **Openings**

**Inspection:** In vertical forms, provide form openings or removable panels for inspection and cleaning at the base of columns, walls and deep beams.

**Access:** For thin walls provide access hatches for placing concrete so that concrete does not fall a distance greater than 2 m.

### **Release agents**

**Application:** Before placing reinforcement, apply a release agent to form linings and facings.

**Staining:** If commercial quality form oil or grease is used, make sure that surfaces to be exposed will not become stained or discoloured.

**Application:** Spread the coating uniformly in a thin film and remove any surplus before placing concrete.

**Unlined timber forms:** Wet the timber thoroughly before oiling.

### **Visually important surfaces**

**Surface finish classes 2 or 3 (AS 3610.1):** Set out the formwork to give a regular and symmetrical arrangement of panels, joints, bolt holes, and similar visible elements in the formed surface.

**Formwork panels:** Provide formwork for exposed surfaces from panels having uniform widths of not less than 1 m and uniform lengths of not less than 2 m, except where the dimensions of the member formed are less than these dimensions.

**Plywood panels:** Conform to the following:

- **Orientation:** Grain of the outer plies perpendicular to the studding or joists.
- **Thickness:** Not less than 15 mm thick, where attached directly to the studding or joists.
- **Variations:** If plywood less than 15 mm thick is used, provide a continuous backing of dressed material of 20 mm minimum thickness.

**Mild steel form surfaces:** Counter-sink all bolt and rivet heads and grind back all welds to an even and smooth surface.

### **Completed formwork**

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

## **3.3 STEEL REINFORCEMENT PLACEMENT**

### **General**

**Fixing:** To AS 3600 clause 17.2.5 and as documented.

### **Modifications**

Requirement: Record any on-site modifications to the documented reinforcement, including position, splice location, spacing or cover, to accommodate concrete placement or the requirements of AS 3600.

### **Dowels**

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

Grade: 250 N.

### **Cover**

Concrete cover generally: To AS 3600 clause 4.10.

Concrete cover for structures retaining liquids: To AS 3735 clause 4.4.

### **Supports**

Requirement: Provide reinforcement supports, as follows:

- Able to withstand construction and traffic loads and maintain the concrete cover, as documented.
- With a protective coating if they are ferrous metal extending to the surface of the concrete.
- Use plastic or concrete supports with galvanized or zinc-coated reinforcement.

Spacing:

- Bars:  $\leq 60$  bar diameters.
- Mesh:  $\leq 600$  mm.

Supports over underlay: Prevent damage to polymeric film underlays. If appropriate, place a metal or plastic plate under each support.

### **Projecting reinforcement**

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

### **Tying**

Requirement: 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.

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

Fibre reinforced concrete: To AS 3600 Section 16.

### **Welding**

General: If welding of reinforcement is proposed, conform to AS/NZS 1554.3.

### **Bending**

Restriction: Use only bars with bends as documented. If required to bend or straighten bars do not use heat and use only methods that will not damage the steel.

### **Splicing**

Standard: To AS 3600 clause 13.2.

Lapped splices: Provide laps in reinforcing bars as documented and securely tie together in a minimum of two places.

Lapping of reinforcing mesh: Overlap each sheet of reinforcing mesh a minimum length of the spacing of the wires running perpendicular to the edge of the sheet, plus 25 mm.

Staggering: Stagger splices as documented.

### **Galvanizing repair**

Damaged galvanizing: If galvanizing is damaged, propose repairs to AS/NZS 4680 Section 8.

## **3.4 CORES, FIXINGS AND EMBEDDED ITEMS**

### **Fasteners**

General: Install fasteners to manufacturers' recommendations and AS 5216 Appendix D.



### **Location**

Requirement: Produce shop drawings showing the proposed locations, clearances and cover of any cores, fixings or embedded items, indicating any proposed repositioning or displacement of reinforcement.

### **Coring**

Requirement: If cutting or coring of hardened concrete is proposed, prepare details.

### **Adjoining elements**

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

### **Protection**

General: Grease threads. Protect embedded items against damage.

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

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

### **Structural integrity**

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

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

### **Tolerances**

Requirement: Maximum deviation from correct positions:

- Anchor bolt groups for structural steel: To AS/NZS 5131.
- Cores and embedded items generally: 10 mm.
- Other fixing bolts: 3 mm.

## **3.5 PRE-MIXED CONCRETE SUPPLY**

### **General**

Addition of water: To AS 1379 clause 4.2.3.

Transport and production equipment: Use equipment which:

- Prevents segregation or loss of materials.
- Supplies a homogenous product suitable for placing and compaction.

Delivery information: For each batch, obtain a delivery docket and keep a record of the information required by AS 1379, and the following:

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

### **Pre-mixed concrete subcontractors**

Requirement: Compile a list of 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.

### **Elapsed delivery time**

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

**Elapsed delivery time table**

Concrete temperature at time of discharge (°C)	Maximum elapsed time (minutes)
5 – 24	120
24 – 27	90
27 – 30	60
30 – 35	45

**3.6 ON-SITE MIXING**

**Machine mixing**

Requirement: Mix all materials by machine, conforming to the following:

- Mixer requirements: Use a mixer which will uniformly distribute the materials throughout the batch.
- Mixer capacity: Use a mixer with capacity for one or more whole bags of cement to be used per batch of concrete. Do not exceed the manufacturer's rated capacity of the mixer with the volume of the mixed material.
- Mixing time: Allow a mixing time for each batch of not less than 1.5 minutes after all ingredients are assembled in the mixer, and before any portion of the batch is removed.
- Total mix discharge: Discharge the entire contents of a batch from the mixer before placing any new materials in the mixer for the next batch.

**Emergency hand mixing**

Restrictions: Hand mixing is only permitted if there is a breakdown of mechanical mixing equipment.

Provide notice if hand mixing is required and conform to the following:

- Hand mix in small quantities no greater than 0.25 m<sup>3</sup> per batch, to complete a section of the work or reach a suitable construction joint. Do not start a new section of work.
- Hand mix on a water-tight platform of sufficient size to allow the mixing of at least two batches simultaneously. Use an amount of cement 10% more than required for machine mixed concrete.

Procedure: Conform to the following:

- First mix the fine aggregate and cement until a uniform colour is obtained, and then spread on the mixing platform in a thin layer.
- Spread the coarse aggregate, previously drenched with water, over the fine aggregate and cement in a uniform layer, and turn the whole mass over as further water is added with a rose sprinkler.
- After the water is added, turn the mass at least three times, not including shovelling into barrows or forms, until the mixture is uniform in colour and appearance.

**Measurement of materials**

General: Measure all materials by weight, except if necessary:

- Water: Measure by volume with an approved adjustable water-measuring and discharging device.
- Cement: Measure by bags as packed by the manufacturer. Proportion batches on the basis of one or more unbroken bags of cement, assumed to weigh 40 kg per bag.

Bulk cement: Weigh in an individual hopper and keep separate from the aggregates until the components of the batch are discharged from the batching hopper.

Measurement by volume for minor works: Not permitted, without approval.

**Measuring by volume: Minor concrete works only**

Mixing by volume on site: If measurement by volume is approved, proportion the materials to produce a mix free of voids and having the documented strength at 28 days.

Volume batching: Use the nominal proportions documented in the **Volume batching table**.

**Volume batch table**

MPa	Parts by volume		
	Cement	Fine aggregate	Coarse aggregate
20	1	2	3

Fine aggregate bulking: If the fine aggregate contains sufficient moisture to produce 'bulking' in excess of 10%, increase the volume of fine aggregate by a corresponding amount.

Batch measurement: Measure the volumes of fine and coarse aggregates for each batch in boxes or bins, as follows:

- Measure the aggregates loose (i.e. without compaction) in the boxes and strike off level.
- Do not undertake measurements by shovels or like methods.
- Arrange batch proportions for each batch to contain 1 bag of cement. Assume one 40 kg bag of cement to have a volume of 27.5 litres.

### **3.7 PLACING AND COMPACTION**

#### **Preparation**

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

Water: Moisten the area before placing concrete: Remove any ponding water.

#### **Placing**

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

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

Vertical elements: Limit the free fall of concrete to a maximum of 2 m.

#### **Compaction**

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

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

#### **Placing records**

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

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

#### **Rain**

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

#### **Time between adjacent placements**

General: As documented in the **Minimum time delay schedule**.

#### **Placing in cold weather**

Cement: Do not use high alumina cement.

Temperature limits: Maintain the following temperature limits:

- Freshly mixed concrete:  $\geq 5^{\circ}\text{C}$ .
- Formwork and reinforcement before and during placing:  $\geq 5^{\circ}\text{C}$ .
- Water: Maximum  $60^{\circ}\text{C}$  when placed in the mixer.

High early strength cement: If deteriorating weather conditions are predicted, use high early strength cement.

Temperature control: Heat the concrete materials, other than cement, to the minimum temperature necessary so that the temperature of the placed concrete is  $\geq 5^{\circ}\text{C}$ .

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

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

Freezing: Prevent concrete from freezing.

#### **Placing in hot weather**

Handling: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses.

Temperature limits: Maintain freshly mixed concrete at the following temperature limits:

- Normal concrete in footings, walls, slabs, culverts and drainage structures:  $\leq 35^{\circ}\text{C}$ .
- For concrete strength grade less than 40 MPa, with section thickness  $\geq 1$  m in all dimensions:  $\leq 27^{\circ}\text{C}$ .
- For concrete strength grade 40 MPa or greater, with section thickness  $\geq 600$  mm in all dimensions:  $\leq 27^{\circ}\text{C}$ .
- Formwork and reinforcement before and during placing:  $\leq 35^{\circ}\text{C}$ .

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

Temperature control: Select one or more of the following methods of maintaining the temperature of the placed concrete at  $35^{\circ}\text{C}$  or less:

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

#### **Placing under water**

General: Do not place under water unless conditions prevent dewatering.

Minimum cement content for the mix: Increase by 25%.

Method: Prepare a detailed method statement if proposing to place concrete under water.

#### **Extruded concrete**

Surface slurry: Where the extrusion machine is equipped with a slurry receptacle place small quantities of cement-sand slurry, comprising two parts plasterer's sand and one part cement (by volume), together with sufficient water to bring it to a semi-fluid condition, and feed onto the surface of the concrete at a rate sufficient to produce a smooth and uniform finish.

### **3.8 CURING**

#### **General**

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

- Curing: Cure continuously from completion of finishing when the concrete has set sufficiently not to be damaged by the curing process, until the total cumulative number of days or fractions of days, during which the air temperature in contact with the concrete is above  $10^{\circ}\text{C}$ , conforms to the following, unless accelerated curing is adopted:
  - . High early strength concrete: 3 days.
  - . Other concrete: 7 days.
- End of curing period: Prevent rapid drying out at the end of the curing period.
- Protection: Maintain at a reasonably constant temperature with minimum moisture loss, during the curing period.

Curing method: ~~[complete/delete]~~

#### **Curing compounds**

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

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

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

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

#### **Cold weather curing**

Temperature: Maintain concrete surface temperatures above  $5^{\circ}\text{C}$  for the duration of the curing period.

### **Hot weather curing**

Requirement: If the concrete temperature exceeds 25°C, or the ambient shade temperature exceeds 30°C, protect from drying winds and sun by using an evaporative retarder until curing is commenced.

### **Water curing**

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

## **3.9 JOINTS**

### **Construction joints**

Location: Do not relocate or eliminate construction joints, or form undocumented construction joints. If emergency construction joints are made necessary by unforeseen interruptions to the concrete pour, provide details of the action taken.

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

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

### **Expansion joints**

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

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

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

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

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

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

## **3.10 FORMED SURFACES**

### **General**

Surface finish: Provide formed concrete finishes as documented in the **Formed surface finishes schedule** and conforming to AS 3610.1 Table 3.3.2.

### **Formwork removal**

Extent: Remove all formwork, including formwork in concealed locations, but excepting lost formwork.

Timing: Do not damage concrete works through premature removal of formwork. Do not disturb forms until concrete is hardened enough to withstand formwork movements and removal without damage. It is recommended to maintain all formwork in place, after placement of concrete, for the following minimum periods, provided that the ambient air temperature does not drop below 10°C during that period:

- Mass concrete retaining walls, headwalls, wingwalls, gully pits, sumps and similar drainage structures: 2 days.
- Reinforced concrete walls when height of pour each day is:
  - . Under 0.6 m: 1 day.
  - . 0.6 m to 3 m: 2 days.
  - . 3 m to 6 m: 3 days.
  - . 6 m to 9 m: 5 days.
- Supporting forms under deck slabs of culverts: 10 days.

Concrete containing special additives: In case of concrete containing special additives, confirm that the recommended stripping times are still appropriate.

Protection of concrete during form removal: Remove forms so that the concrete will not be cracked, chipped or otherwise damaged. Do not use crowbars or other levering devices for exerting pressure on the fresh concrete to loosen the forms.

Removal of hole formers: Remove hole formers such as pipes and bars as soon as the concrete has hardened sufficiently to prevent damage to the concrete.

### **Curing**

General: If formwork is stripped before the minimum curing period continue curing the exposed faces until the curing period elapses.

### **Repair of defects**

Physical quality evaluation: To AS 3610.1 clause 3.3.

Repair method: If defect repair is required, obtain approval of the proposed method before commencing repairs.

## **3.11 UNFORMED SURFACES**

### **General**

Surface finish: To be compatible with any documented applied finish, as documented.

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

### **Finishing methods – surfaces other than wearing surfaces**

General: Compact and tamp, screed off and finally dress with a wooden float to an even surface, also:

- Drain or otherwise promptly remove any water which comes to the surface.
- Roughen all future contact surfaces, so that the coarse aggregate at the surface is firmly embedded but not forced below the surface.

### **Finishing methods – wearing surfaces**

General: Compact then screed off the surface with a vibrating screed, or hand screed if the distance between forms perpendicular to the direction of screed is no greater than 2 m.

Correction: Immediately following compaction and screeding test and correct for high or low spots.

Final finish: Finish the surface true and uniform and free of any glazed or trowelling finish and finally dress with a wooden template or float.

Surface to receive asphalt: After compacting, screeding and correcting, dress with a wooden float and finally broom to produce a rough surface.

Textured patterned surface: Finish coloured, textured or patterned surfaces, as documented.

### **Tolerances**

Finished surface: Conform to the following maximum deviations from documented values:

- Concrete structures not adjacent to road pavements:
  - . Absolute level:  $\pm 25$  mm.
  - . Alignment: 25 mm.
- Concrete structures adjacent to road pavements (e.g. drainage pits):
  - . Absolute level:  $\pm 10$  mm.
  - . Alignment: 10 mm.
- Longitudinal surfaces greater than 10 m in length: 5 mm from a 3 m straightedge, subject to any necessary allowances for vertical and horizontal curves.

### **Surface repairs**

Method: If surface repairs are required, obtain approval of the proposed method before commencing repairs.

## **3.12 PRECAST UNITS**

### **Lifting and handling**

General: Conform to the handling and installation requirements of the ASCC National code and AS 3850.2.

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

Site conditions: Only lift units when the wind and temperature conditions allow handling and fixing consistent with the structural capability and geometry of the unit.

Cranes: To AS 2550.1.

Temporary bracing and propping: To AS 3850.2 Section 5.

#### **Attachments**

Requirement: Remove temporary attachments after erection. Seal and rectify residual recesses.

#### **Installation**

Fixing: Fix the units securely and accurately in their final positions to AS 3850.2 Section 6.

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

#### **Storage**

Support points: When storing elements support units only at designated support points.

Protection: Adequately store and protect units to prevent warping, twisting, crushing, cracking, discolouration, staining and any other damage, until they are installed in their final location.

### **3.13 SPRAYED CONCRETE**

#### **Detail**

Minimum thickness: 75 mm.

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

#### **Strength**

Minimum cement content: 380 kg/m<sup>3</sup> as discharged from the nozzle.

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

#### **Method statement**

Requirement: Prepare **and submit** a method statement for all sprayed concrete works to include details of the proposed procedure, plant, materials and mix proportions. **This is a WITNESS POINT.**

#### **Sprayed concrete sample panels**

Requirement: Prepare sample sprayed concrete test panels on 750 mm square hardboard panels as follows:

- Quantity: 3 panels for each mix proposed.
- Thickness: 75 mm.
- Conditions: Similar to those where works will take place.
- Method: Apply concrete in the same manner, using materials including steel reinforcing fabric, equipment, pressures and curing that will be used in the works.

#### **Sample test cores**

Securing, accepting and preparing test specimens: To AS 1012.9.

Testing: To AS 1012.14.

Cores: Cut four 75 mm diameter cores from one test panel for each proposed mix approximately 48 hours after the panel has been sprayed and test as follows:

- As for cores from in situ sprayed concrete. One core compression test at 3 days, one core at 7 days and the remaining two cores at 28 days.

Defective core: If any of the cores reveals defects such as lack of compaction, dry patches, voids or sand pockets or exhibits an unacceptable surface finish, modify the mix design and/or method of placement and prepare fresh test panels for testing and inspection.

#### **Surface preparation**

Earth: Grade, trim, compact and dampen earth surfaces before 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 before applying the sprayed concrete.

Corrugated steel pipes: Clean off loose material, mud and any other foreign matter that might prevent bonding of the sprayed concrete to the steel.

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

### **Application for 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 is as near as possible to perpendicular 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: After the initial set, as work proceeds, remove and dispose of splash and rebound material from the surface by air-water jet or other suitable means.

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.

### **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.

### **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.

## **3.14 TESTING**

### **Quality**

Requirement: Test for all characteristics in conformance with **ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES**.

### **Concrete tests**

Slump: To AS 1379 clause 5.2.

Test sample location: Spread the site sampling evenly throughout the concrete placement.

Sampling frequency: Provide a minimum of one sample from each 50 m<sup>3</sup> of concrete.

### **Cores and test acceptance**

General: If test specimens fail to achieve the documented 28 day strength, arrange for cores to be taken from the corresponding concrete to AS 3600 clause B6 and nominate proposed core locations.

Acceptance: For acceptance, demonstrate conformance of the average strength of cores with the documented 28 day strength requirements to AS 3600 clause B6.

### **Failure of cores**

Deduction: If cores taken fail to satisfy the strength requirements, apply the deduction provisions in **ANNEXURE – DEDUCTIONS**.

### **Completion tests**

Liquid retaining structures: Liquid tightness to AS 3735.

## **3.15 COMPLETION**

### **Loading**

Prohibition: Do not apply any superimposed load to any part of what will become a load bearing structure within 21 days of placing concrete, unless it can be demonstrated that 95% of the design strength of the concrete has been achieved.



**Protection**

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

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

**4 ANNEXURES**

**4.1 ANNEXURE - SELECTIONS**

**Normal-class concrete properties schedule**

Property	Foundations, mass concrete retaining walls	Drainage structures, mass concrete footings, pitching, linings, miscellaneous minor concrete work	Reinforced culverts, headwalls, base slabs, large sign structure footings, reinforced retaining walls	Safety barriers	Extruded concrete
Strength grade/characteristic compressive strength $f'_c$ (MPa)	20	20	32	40	20
Maximum aggregate size (mm)	40	20	20	20	14
Slump (mm)					
Air entrainment - air volume (%)					
Assessment process					

**Notes to schedule:**

Slump: Nominate a value for slump at the point of acceptance, suitable to the proposed method of placement. For safety barriers refer to the 1195 Rigid concrete safety barrier systems worksection.

Air entrainment: If required, nominate a value up to a maximum of 5.0%. Delete if not required.

Assessment process: Nominate if production assessment or project assessment is required.

If high durability is of significant importance, consider also specifying the minimum cement content in  $\text{kg/m}^3$ .

**Special-class concrete properties schedule**

Property	A	B	C
Strength grade/characteristic compressive strength $f'_c$ (MPa)			
Maximum aggregate size (mm)			
Slump (mm)			
Air entrainment - air volume (%)			
Assessment process			
Drying shrinkage			

Property	A	B	C
Bleeding (mL/mm <sup>2</sup> )			
Cement type			
Density of hardened concrete (kg/m <sup>3</sup> )			
Density of plastic concrete (kg/m <sup>3</sup> )			
Duration of air drying			
Early age strength (MPa)			
Flexural strength (MPa)			
Indirect tensile strength (MPa)			
Mineral oxide content			
Mix type			
Water:cement ratio maximum			

Notes to schedule:

A, B, C: These designate each instance or type or location of the item scheduled. Edit to align with the project's codes or tags.

Coordinate codes in the Schedule with those that appear on drawings.

Drying shrinkage: Generally between 500 to 800 µε and not more than 1000 µε. For example, drying shrinkage at 56 days for the following are:

- A water tight structure is normally between 500 to 550 µε.
- Concrete up to and including strength grade 32 is 650 µε and for higher strength grades is 700 µε.

Specifying unrealistically low drying shrinkage could potentially be difficult to achieve with locally available aggregates and can adversely affect the workability of the concrete, both factors could increase costs.

See CCAA Fact Sheet - Specifying low drying shrinkage ≠ crack control.

If the concrete is special class only because of the specification of a drying shrinkage less than 1000 µε, only complete the first 6 items (rows) of the above schedule.

Duration of air drying: Standard drying period is 56 days.

#### Steel reinforcement properties schedule

Property	A	B	C
Shape			
Ductility class			
Strength grade			

Notes to schedule:

A, B, C: These designate each instance or type or location of the item scheduled. Edit to align with the project's codes or tags.

Coordinate codes in the Schedule with those that appear on drawings.

Shape: R (round), D (deformed ribbed), I (deformed indented) or welded wire mesh.

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

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

See AS 3600 clause 17.2 for materials and construction requirements.

**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	

**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			

Notes to schedule:

A, B, C: These designate each instance or type or location of the item scheduled. Edit to align with the project's codes or tags.

Coordinate codes in the Schedule with those that appear on drawings.

Formed concrete surfaces shall have finishes conforming to the classes of surface finish in AS 3610.1 as follows:

- Non-visible surfaces: Class 4.
- Visible surfaces: Class 2.

**4.2 ANNEXURE - SUMMARY OF HOLD AND WITNESS POINTS**

For private developments, certain Hold and Witness Points where specifically noted below require representatives of both the Superintendent and the Principal Certifier (e.g. Council) to authorise release.

Clause and description	Type*	Submission/Inspection details	Submission/Notice times	Process held
SUBMISSIONS, Certification Design	H	Certification of formwork design conformance	3 days before erecting formwork	Erection of formwork
SUBMISSIONS, Certification Completed formwork	H	Certification of completed formwork conformance	1 day before placing concrete	Placement of concrete
SUBMISSIONS, Tests Loading	H	Results to show that concrete has achieved 95% of its design strength	1 day before applying superimposed load	Application of super-imposed load
SUBMISSIONS,	H	Details of any proposed	3 days before coring	Concrete coring

Clause and description	Type*	Submission/Inspection details	Submission/Notice times	Process held
Execution details Coring		cutting or coring required in hardened concrete	concrete	
SUBMISSIONS, Products and materials Machine mixing	H	Details of proposed concrete mix for on-site machine mixing of concrete	7 days before on-site concrete mixing	On-site concrete mixing
SUBMISSIONS, Execution details Measurement of materials	H	Proposal to measure materials by volume for on-site mixing for minor concrete works	7 days before on-site concrete mixing	On-site concrete mixing
SUBMISSIONS, Execution details Repair of defects	H – Superintendent and Principal Certifier	Details of the proposed method of defect repair	3 days before repairing defect	Repair of defect
SUBMISSIONS, Execution details Surface repairs	H	Details of the proposed method of surface repair	3 days before repairing surface	Repair of surface
SUBMISSIONS, Execution details Method statement	H	Detailed method statement for sprayed concrete works	14 days before spraying concrete	Sprayed concrete works
SUBMISSIONS, Samples Sprayed concrete	H	3 sample panels for each proposed mix	10 days before spraying concrete for works	Sprayed concrete works
INSPECTIONS, Notice Base preparation	W – Superintendent and Principal Certifier	Completed and prepared base	1 day before laying underlay or placing concrete	-
INSPECTIONS, Notice Completed formwork	W	Completed formwork	1 day before placing concrete	-
INSPECTIONS, Notice Steel reinforcement placement	W – Superintendent and Principal Certifier	Completed installed steel reinforcement, including cores fixings and embedded items fixed in place.	1 day before placing concrete	-
INSPECTIONS, Notice Galvanizing repair	W	Repairs to damaged galvanizing of steel reinforcement	1 day before placing concrete	-
INSPECTIONS, Notice Emergency hand mixing	W	Emergency hand mixing of concrete due to mechanical failure	Immediately after mechanical failure	-

Clause and description	Type*	Submission/Inspection details	Submission/Notice times	Process held
INSPECTIONS, Notice  Sprayed concrete sample panels	W	Concrete spraying of sample panels	3 days before spraying sample panels	-

\*H = Hold Point, W = Witness Point

#### 4.3 ANNEXURE – MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
Concrete constituent materials	Material quality – Supplier's documentary evidence and certification of:			
	Cement	1 mth's prod'n	1 per week	AS 3972
	Fly ash	1 mth's prod'n	1 per month	AS 3582.1
	Water	1 contract	1 per contract	AS 3583.13, AS 1289.4.2.1
	Admixtures	1 mth's prod'n	1 per month	AS 1478.1
	Steel reinforcement	1 delivery	1 per production batch	AS/NZS 4671
	<b>Fine aggregates</b>			
	Grading	1 wk's prod'n	1 per 200 m <sup>3</sup> concrete*	AS 1141.11.1
	Moisture content	N/A	1 per day	
	Sulphate soundness	1 contract	1 per contract	AS 1141.24
	Bulk density	1 contract	1 per contract	AS 2758.1
	Unit mass (Particle density)	1 contract	1 per contract	AS 2758.1
	Water absorption	1 contract	1 per contract	AS 2758.1
	Material finer 2 m	1 contract	1 per contract	AS 2758.1
	Deleterious material (impurities/reactive)	1 contract	1 per contract	AS 2758.1
	<b>Coarse aggregates</b>			
	Grading	1 wk's prod'n	1 per 200 m <sup>3</sup> concrete*	AS 1141.11.1
	Moisture content	N/A	1 per day	
	Wet strength	1 contract	1 per contract	AS 1141.22
	Wet/dry strength variation	1 contract	1 per contract	AS 1141.22
	Wear	1 contract	1 per contract	AS 1141.23
	Crushing value	1 contract	1 per contract	AS 1141.21
	Sulphate soundness	1 contract	1 per contract	AS 1141.24
	Particle shape	1 contract	1 per contract	AS 1141.14
	Fractured faces	1 contract	1 per contract	AS 1141.18
	Bulk density	1 contract	1 per contract	AS 2758.1
	Unit mass (Particle density)	1 contract	1 per contract	AS 2758.1
	Water absorption	1 contract	1 per contract	AS 2758.1

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
	Material finer 75 m	1 contract	1 per contract	AS 2758.1
	Weak particles	1 contract	1 per contract	AS 2758.1
	Light particles	1 contract	1 per contract	AS 2758.1
	Deleterious materials (impurities/reactive)	1 contract	1 per contract	AS 2758.1
	Iron unsoundness	1 contract	1 per contract	AS 2758.1
	Falling/dusting unsoundness	1 contract	1 per contract	AS 2758.1
Mix design	Compressive strength	1 contract mix	1 per mix per contract	AS 1012.9
	Aggregate moisture content	1 contract mix	1 per mix per contract	
	Consistency – slump	1 contract mix	1 per mix per contract	AS 1012.3.1
	Air content	1 contract mix	1 per mix per contract	AS 1012.4.2 Method 2
	Shrinkage	1 contract mix	1 per mix per contract	AS 1012.8.4AS 1012.13
Concrete	Consistency – slump	15 m <sup>3</sup>	1 per batch	AS 1012.3.1
	Compressive strength (7 and 28 day)	15 m <sup>3</sup>	As per the <b>Project assessment strength grade sampling table</b>	AS 1012.1 AS 1012.8.1 AS 1012.9
Concrete placement	Finished levels	15 m <sup>3</sup>	1 per element or 1 per 15 m length	Survey and 3 m straightedge
	Surface dimensions	Single fabrication	As required to confirm design dimensions	Measure
Sprayed concrete	Test panels and cores	1 contract	4 cores from 1 test panel of each mix design	AS 1012.9 AS 1012.14
	Compressive strength cores	15 m <sup>3</sup>	2 per 15 m <sup>3</sup>	AS 1012.9 AS 1012.14

\* Note: or part thereof, per lot.

#### 4.4 ANNEXURE - PAY ITEMS

This schedule assumes the contract is tendered on a Schedule of Rates basis. For private development works use of this schedule is optional, at the Superintendent's discretion.

Pay items	Unit of measurement	Schedule rate scope
<b>0319.1 20 MPa Concrete works</b>	m <sup>3</sup> of concrete supplied and placed	Include all operations involved in ground preparation, formwork, concrete supply, placement, compaction, joints, finishing, curing and testing. Where documented, include the supply and placement of reinforcing steel.

Pay items	Unit of measurement	Schedule rate scope
<b>0319.2 32 MPa Concrete works</b>	m <sup>3</sup> of concrete supplied and placed	Include all operations involved in ground preparation, formwork, concrete supply, placement, compaction, joints, finishing, curing and testing. Where documented, include the supply and placement of reinforcing steel.
<b>0319.3 40 MPa Concrete works</b>	m <sup>3</sup> of concrete supplied and placed	Include all operations involved in ground preparation, formwork, concrete supply, placement, compaction, joints, finishing, curing and testing. Where documented, include the supply and placement of reinforcing steel.
<b>0319.4 Precast units</b>	'Each' precast unit, as documented	All costs associated with the supply and installation of the precast unit.
<b>0319.5 Sprayed concrete</b>	m <sup>2</sup> of sprayed concrete in place	Include all the operations involved in the surface preparation, spraying, jointing, removal of splash and rebound material, curing and testing.

#### 4.5 ANNEXURE - DEDUCTIONS

##### General

Deductions: Conform to the following:

- Concrete payment rates: At the scheduled rates provided the concrete meets the documented strength requirements.
- Reduction in payment rates: Where any concrete does not reach the documented strength, 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 documented 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.

#### 4.6 ANNEXURE - REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

AS 1012		Methods of testing concrete
AS 1012.1	2014	Sampling of concrete
AS 1012.3.1	2014	Determination of properties related to the consistency of concrete - Slump test
AS 1012.4.2	2014	Determination of air content of freshly mixed concrete - Measuring reduction in air pressure in chamber above concrete
AS 1012.8.1	2014	Method for making and curing concrete - Compression and indirect tensile test specimens
AS 1012.8.4	2015	Method for making and curing concrete - Drying shrinkage specimens prepared in the field or in the laboratory
AS 1012.9	2014	Compressive strength tests - Concrete, mortar and grout specimens
AS 1012.13	2015	Determination of the drying shrinkage of concrete for samples prepared in the field or in the laboratory

AS 1012.14	2018	Method for securing and testing cores from hardened concrete for compressive strength and mass per unit volume
AS 1141		Methods for sampling and testing aggregates
AS 1141.11.1	2009	Particle size distribution - Sieving method
AS 1141.14	2007	Particle shape, by proportional caliper
AS 1141.18	1996	Crushed particles in coarse aggregate derived from gravel
AS 1141.21	1997	Aggregate crushing value
AS 1141.22	2019	Wet/dry strength variation
AS 1141.23	2009	Los Angeles value
AS 1141.24	2018	Aggregate soundness - Evaluation by exposure to sodium sulfate solution
AS 1289		Methods of testing soils for engineering purposes
AS 1289.4.2.1	2020	Soil chemical tests - Determination of the sulfate content of a natural soil and the sulfate content of the groundwater - Normal method
AS 1379	2007	Specification and supply of concrete
AS 1478		Chemical admixtures for concrete, mortar and grout
AS 1478.1	2000	Admixtures for concrete
AS/NZS 1554		Structural steel welding
AS/NZS 1554.3	2014	Welding of reinforcing steel
AS/NZS 2425	2015	Bar chairs in reinforced concrete - Product requirements and test methods
AS 2550		Cranes, hoists and winches - Safe use
AS 2550.1	2011	General requirements
AS 2758		Aggregates and rock for engineering purposes
AS 2758.1	2014	Concrete aggregates
AS 2870	2011	Residential slabs and footings
AS/NZS 3582		Supplementary cementitious materials
AS/NZS 3582.1	2016	Fly ash
AS 3582.2	2016	Slag - Ground granulated blast-furnace
AS/NZS 3582.3	2016	Amorphous silica
AS 3583		Methods of test for supplementary cementitious materials for use with portland cement
AS 3583.13	1991	Determination of chloride ion content
AS 3600	2018	Concrete structures
AS 3610		Formwork for concrete
AS 3610.1	2018	Specifications
AS 3735	2001	Concrete structures retaining liquids
AS 3799	1998	Liquid membrane-forming curing compounds for concrete
AS 3850		Prefabricated concrete elements
AS 3850.1	2015	General requirements
AS 3850.2	2015	Building construction
AS 3972	2010	General purpose and blended cements
AS/NZS 4671	2001	Steel reinforcing materials
AS/NZS 4680	2006	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 5131	2016	Structural steelwork - Fabrication and erection
AS 5216	2018	Design of post-installed and cast-in fastenings in concrete
AS 6669	2016	Plywood - Formwork
ASCC	2008	National Code of Practice for Precast, Tilt-up and Concrete Elements in Building Construction
Austrroads ATS 5330	2020	Supply of Geopolymer Concrete
CCAA Fact Sheet	2012	Specifying low drying shrinkage ≠ crack control
CIA CPN35	2003	Fibres in concrete
BS EN 14889		Fibres for concrete
EN 14889-1	2006	Steel fibres. Definitions, specifications and conformity
ISO 13270	2013	Steel fibres for concrete - Definitions and specifications



**5 ANNEXURE M – MIDCOAST COUNCIL SPECIFIC CLAUSES**

M1.	Variations to or non-conformances with Council's AUS-SPEC are to be evaluated with reference to the procedure in Council's <i>Development Engineering Handbook</i> . Acceptance is to be obtained in writing from: <ul style="list-style-type: none"> <li>a) an authorised representative of Council's Director of Infrastructure and Engineering Services, or</li> <li>b) an accredited certifier where they are the Principal Certifier and hold the relevant accreditation category for the type of work.</li> </ul>	<b>Variation procedure</b>
M2.	This specification applies in addition to any development consent (DA) conditions. If there is any inconsistency, the conditions of consent shall prevail.	<b>DA conditions</b>
M3.	Refer to the MidCoast Council <i>Development Engineering Handbook</i> for final inspection, works-as-executed and handover requirements.	<b>Completion</b>

**6 AMENDMENT HISTORY**

0	14/12/2020	First Published
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