0310P DINCEL IN CONCRETE – COMBINED

Branded worksection

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Worksection abstract

This branded worksection *Template* is applicable to the use of concrete for buildings and associated structures together with specialist permanent polymer formwork system products by Dincel for external and internal concrete walls, retaining walls, storage tanks and other specialist uses. It combines relevant clauses from the following worksections: *0311 Concrete formwork*, *0312 Concrete reinforcement*, *0313 Concrete post-tensioned*, *0314 Concrete in situ* and *0315 Concrete finishes*.

How to use this worksection

Customise this worksection *Template* for each project. See A guide to NATSPEC worksections (www.natspec.com.au) for information on *Template* structure, word styles, and completing a worksection.

Related material located elsewhere in NATSPEC

If a listed worksection is not part of your subscription package and you wish to purchase it, contact NATSPEC.

Related material may be found in other worksections. See for example:

- *0311 Concrete formwork*.
- *0312 Concrete reinforcement*.
- *0313 Concrete post-tensioned*.
- *0314 Concrete in situ*.
- *0315 Concrete finishes*.
- *0318 Shotcrete*.
- *0321 Precast concrete*.
- *0322 Tilt-up concrete*.
- *0612 Cementitious toppings*.
- *0613 Terrazzo in situ*.

Material not provided by DINCEL

This branded worksection *Template* includes generic material which may not be provided by the Product Partner including:

- Concrete.
- Formwork other than Dincel Wall.
- Reinforcement.
- Post-tensioning.

Documenting this and related work

You may document this and related work as follows:

- Either fully detail the work in the structural drawings or define performance criteria (loading, deflection, exposure, fire-resistance) for any anticipated contractor design. For design by contractor, independent certification by a professional engineer of the design and documentation, and of the erected structure/structural element, is appropriate.
- Show any special requirements on the drawings.
- Show on the drawings the required reinforcement including the location, type, size and spacing of bars, any special requirement for types of supports, and the concrete cover. Show the location and minimum length for lapped splices.
- See AS 2870 (2011) and CCAA T49 (2003) for design and construction requirements for residential slabs and footings. The *ABCB Housing Provisions (2022)* contains a table of site classifications that are the basis for requirements for footing design. Show the details on the drawings. Slabs on ground may be used as part of a termite management system installation – coordinate with *0184 Termite management*.

See NATSPEC TECHnote DES 006 on specifying concrete.

Refer to CCAA Briefing 18 (2011) for information on design of concrete slabs for housing in flood-prone areas.

Refer to www.ptia.org.au for further information on post-tensioning.

The *Normal* style text of this worksection may refer to items as being documented elsewhere in the contract documentation. Make sure they are documented.

For example:

- Formwork procedures and loadings.
- Applied finishes.
- Reinforcement layout, details, splice locations and concrete cover.
- Colour requirements.
- Dimensions and loadings.
- PT duct locations and fixing methods.
- PT anti-burst reinforcement.
- PT stressing stages.
- Joint locations and types.

Search acumen.architecture.com.au, the Australian Institute of Architects' practice advisory subscription service, for notes on the following:

- Thermal mass in building design.
- Life cycle energy analysis.

Specifying ESD

The following may be specified by retaining default text:

- Profiled steel sheeting composite formwork.
- Pre-consumer supplementary cementitious materials (SCM) as partial replacement for general purpose cement. e.g. fly ash, slag cement and amorphous silica.

The following may be specified by including additional text:

- Re-usable formwork.
- Engineered wood form panels.
- Timber forms from a sustainable source, e.g. plantation.
- Other permanent formwork, e.g. unfinished or prefinished fibre cement, polymer formwork, aluminium composite panels and insulating formwork.
- Fabric formwork to reduce formwork material weight.
- Reinforcing with recycled steel content.
- Fibre-reinforced bars and grids.
- Recycled plastic in fibre-reinforced concrete.
- High-grade reinforcing to reduce the amount of reinforcement and/or concrete required to achieve the same performance.
- Reinforcement with improved corrosion resistance for enhanced concrete durability.
- Reinforcement manufactured using electric arc furnace instead of basic oxygen steel to reduce required energy input.
- Recycled concrete aggregate.
- Admixtures to reduce the embodied carbon of the concrete.
- Exposed concrete slab to reduce finish materials required, e.g. polished or honed concrete floor, off-form walls and ceilings.
- Low odour and low VOC emitting sealers and stains, e.g. water-based dyes and sealers.

Refer to NATSPEC TECHreport TR 01 on specifying ESD and the following for further information:

- Climate-responsive house design using concrete: CCAA T58 (2007).
- Sustainable concrete buildings: CCAA Briefing 13 (2010).
- Sustainable concrete materials: CCAA Briefing 11 (2010).
- Thermal mass benefits for housing: CCAA Briefing 12 (2010).

1 GENERAL

Dincel Structural Walling is a lightweight, ‘snap together’ modular polymer formwork, which is filled with concrete. It is suitable for constructing virtually any type of load bearing structural wall. Architects and building designers can enjoy complete creative freedom by specifying Dincel to build straight or curved concrete walls, which can be beautifully finished. Dincel walls are also tested by NATA Accredited laboratories, CSIRO and Warringtonfire as being waterproof and fire safe. For further information, visit www.dincel.com.au.

1.1 RESPONSIBILITIES

General

Requirement: Provide cast in situ reinforced concrete, as documented.

Documented is defined in *0171 General requirements* as meaning contained in the contract documents.

Dincel: Provide Dincel wall polymer formwork systems, as documented.

Performance

Requirements:

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

It is the designer's responsibility to select surface finish methods that are appropriate for the following trades and finishes.

1.2 DESIGN

This worksection can be used to document the contractor's design and documentation responsibilities in addition to those set out in DESIGN in *0171 General requirements*. If the design, or completion of the design, is not the responsibility of the contractor, delete this clause and associated requirements.

Refer to NATSPEC TECHreport TR 03 on specifying design and construct for mechanical services. It discusses some of the issues and presents a range of approaches for preparing design and construct specifications that can be applied more generally.

General

Formwork: The design of formwork, other than permanent composite form systems, is the contractor's responsibility. Allow for dimensional changes, deflections and cambers resulting from the following:

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

This applies to all formwork types, including conventional, proprietary (non composite formwork) or purpose-made formwork.

Structural design: To AS 3600 (2018).

Dincel wall system: To the following:

- AS 3600 (2018).
- The *Dincel Structural Engineering Design Manual (2014)*.
- The *Dincel Construction Manual (2023)*.

Post-tensioned concrete: To AS 3600 (2018).

Concrete structures retaining liquids: To AS 3735 (2001).

Requirements

General: To DESIGN in *0171 General requirements*.

Responsibility: [complete/delete]

For example, responsibility for design coordination.

Authority requirements: [complete/delete]

In particular, draw attention to any specific requirements of the DA and other regulatory bodies. Consider attaching DA conditions, if appropriate.

Requirements in addition to AS 3600 (2018): [complete/delete]

Draw attention to any specific requirements for post-tensioned concrete in addition to AS 3600 (2018).

1.3 COMPANY CONTACTS

Dincel technical contacts

Website: www.dincel.com.au. Follow the Contact tab on the home page.

1.4 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

0171 General requirements contains umbrella requirements for all building and services worksections.

List the worksections cross referenced by this worksection. *0171 General requirements* references the *018 Common requirements* subgroup of worksections. It is not necessary to repeat them here. However, you may also wish to direct the contractor to other worksections where there may be work that is closely associated with this work.

NATSPEC uses generic worksection titles, whether or not there are branded equivalents. If you use a branded worksection, change the cross reference here.

1.5 STANDARDS

General

Formwork design and construction: To AS 3610.1 (2018).

CIA Z36 (2016) provides guidance on the safe design and construction of formwork.

Plywood formwork: To AS 6669 (2016).

Composite steel-concrete construction, including profiled steel sheeting and shear connectors: To AS/NZS 2327 (2017).

Reinforced concrete construction: To AS 3600 (2018).

AS 3600 Supp 1 (2022) provides background reference material to AS 3600 (2018), indicates the origin of particular requirements and departures from previous practice, and explains the application of certain clauses.

SA HB 84 (2018) gives guidance on concrete repair and protection. CIA Z13 (2001) provides performance criteria for concrete in marine environments. On fibres in concrete, see CIA CPN35 (2003). Concrete is Deemed-to-Satisfy to the NCC for fire hazard properties. For super-workable concrete refer to CIA Z40 (2005).

For guidance on design and detailing for seismic conditions refer to the SRIA *Guide to seismic design and detailing of reinforced concrete buildings in Australia (2016)*.

Specification and supply of concrete: To AS 1379 (2007).

Concrete structures for retaining liquids: To AS 3735 (2001).

For concrete structures for retaining liquids, AS 3735 (2001) and AS 3735 Supp 1 (2001) take precedence over the requirements of AS 3600 (2018). For watertight concrete structures refer to CIA CPN28 (2005).

Residential ground slabs and footings: To AS 2870 (2011).

Post-tensioned concrete: To AS 3600 (2018).

The technical requirements for post-tensioning are covered generally in AS 3600 (2018) but depending on the application, you may need to specify other matters such as calculations, certificates, prestressing records, shop drawings, and tests in the appropriate clauses.

Strand, bar and wire: To AS 4672.1 (2007).

For information on the causes of failures in anchorage zones and examples of detailing of reinforcement, see CIA CPN29 (1996). For anchorage requirements, refer to AS/NZS 1314 (2003).

Design, installation and testing of post-installed and cast-in fastenings: To AS 5216 (2021).

Formed surfaces: To AS 3610.1 (2018).

See CCAA T57 (2006) for guidance on how to achieve good quality off-form finishes. It discusses the factors influencing the quality of off-form concrete finishes from planning and design to construction and maintenance.

See CCAA T59 (2008) for guidance on the various options for colouring and finishing the concrete surface and related construction issues. It has been prepared to assist designers, specifiers and contractors with the important aspects of particular flatwork finishes and their detailing, specification and construction to make sure that the element provides a high level of performance and serviceability during its design life.

Delete standards not applicable to the works.

Slip resistance

Classification: To AS 4586 (2013).

See NATSPEC TECHnote DES 001 on slip resistance performance.

1.6 MANUFACTURER'S DOCUMENTS

Technical manuals

Website: Visit www.dincel.com.au to login and access the Dincel manuals and design resources.

1.7 INTERPRETATION

Definitions

General: For the purposes of this worksection, the definitions given in AS/NZS 1314 (2003), AS 1379 (2007), AS 3600 (2018), AS 3610.1 (2018) and the following apply:

- Ambient temperature: The air temperature at the time of mixing and placing of concrete.
- Anti-burst reinforcement: Reinforcement cage surrounding anchorages to control the tensile bursting stresses.
- Dincel wall: Polymer based permanent formwork system for concrete walling for external and internal walls, retaining walls, storage tanks and other specialist uses.
- Early age strength: A mean compressive strength at 7 days exceeding the values shown in AS 1379 (2007) Table 1.2.
- Green concrete: Concrete that has recently set but has not achieved any design strength.
- Sample: A physical example that illustrates workmanship, materials or equipment, and establishes standards by which the work will be judged. It includes samples and sample panels.
- Specimen: A portion of a sample that is submitted for testing.
- Weather – cold: Ambient shade temperature less than 10°C.
- Weather – hot: Ambient shade temperature greater than 30°C.

Edit the **Definitions** subclause to suit the project or delete if not required. List alphabetically.

AS 3610.1 (2018) clause 1.5 includes definitions and Appendix E includes a glossary of terms.

1.8 TOLERANCES

Formwork

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

Plumb of elements ≤ 8 m high: To AS 3610.1 (2018).

Position: Construct formwork so that finished concrete conforms to AS 3600 (2018) clause 17.5, AS 3610.1 (2018) clause 3.3 and as documented.

Document formwork tolerances in the **Formwork dimensional deviation schedule**.

The tolerances in AS 3600 (2018) clause 17.5.2 are required for achieving conformance to the strength requirements of the standard. They are not intended as building tolerances. More stringent tolerances may be suitable.

Reinforcement

Fabrication: To AS 3600 (2018) clause 17.2.

Reinforcement and tendon position: To AS 3600 (2018) clause 17.5.3.

Formed surfaces

Form face deflections: To AS 3610.1 (2018) Table 3.3.4.1.

Straight elements: To AS 3610.1 (2018) Table 3.3.5.1.

Document required surface finish class in the **Formed surface finishes schedule**.

Unformed surfaces

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

Flatness tolerance class table

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

These classes have been adopted by NATSPEC in the absence of such in Australian Standards. It has been assumed that smoothness and projection tolerances form part of substrate preparation for the applicable floor finishes. The straightedge does not consider the frequency of surface undulations or waves. Consequently a Class B finish containing one wave under the straightedge may be more effective than a Class A finish with multiple waves.

For further information refer to the *CCAA Data Sheet Tolerances for concrete surfaces (2018).*

Typical applied finishes for each flatness tolerance class are:

- A: Resilient finishes.
- B: Unfinished (plantrooms), carpet, substrates for bituminous coatings.
- C: Floor tiles (scored finish).

Flatness tolerance class C is specifically stated for areas where the local flatness (600 mm) is not critical to the applied finishes. This varies from the minimum standard for flatness in AS 3600 (2018) clause 17.5.2.4.

Dincel wall

Position: Install Dincel wall components so that completed walls conform to AS 3600 (2018) clause 17.5.

The surface finish for Dincel wall components does not need to be specified in the concrete worksection as the finish is provided by the external face of the Dincel wall component. However, the final quality of the finished wall needs to be specified in later *06 FINISH* worksections. Contact Dincel for further information on suitable finishes.

AS 3610.1 (2018) Section 3 tolerances do not apply to permanent form systems. See AS 3610.1 (2018) clause 4.6.3 note 1.

1.9 SUBMISSIONS

Certification

Formwork design certification: For all formwork other than permanent composite form systems, submit certification by a professional engineer experienced in formwork design verifying conformance of the design.

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

Design documentation

If design or completion of design is the responsibility of the contractor include this *Optional* style text by changing to *Normal* style text.

Structural concrete calculations: Submit structural performance calculations.

Formwork calculations: Submit calculations by a professional engineer experienced in formwork design to show that allowable concrete stresses will not be exceeded and if proposed, formwork designed for the following:

- Formwork procedures or loadings that differ from those documented.
- Props above a floor that do not coincide with the props below.
- Undocumented formwork shoring or stripping procedures.
- Loadings from stacked materials.

Post-tensioned calculations: Submit the following:

- Calculations of tendon jacking forces, theoretical extensions and losses for each stressing stage and at final stressing, before stressing operations begin.
- Expected loss of prestress due to friction in the jack and anchorage, and along the tendon including the friction curvature coefficient and the angular deviation due to wobble effects.

The magnitude of friction due to duct curvature and wobble needs to be verified on site during the stressing operation. See AS 3600 (2018) clause 3.4.2.4.

- Expected draw-in during anchorage.

The expected value of draw-in used to determine the loss of prestress during anchorage needs to be verified on site. See AS 3600 (2018) clause 3.4.2.5. The draw-in for wedge anchored strand post-tensioning may be as high as 6 mm.

Execution details

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

- Table form and climbing formwork: Proposed method and sequence of moving the formwork to provide concrete of the documented quality and surface finish.
- Continuously climbing formwork (Slipform): The average rate of movement.

Reshoring: Submit details of any proposed reshoring.

Dincel wall: If early removal of any installed bracing is required, submit structural engineer's approval in writing. Dincel wall components are core-filled and supported by roof framing or floor above. Removing braces prior to this or within 24 hours of pouring slab over constitutes early removal of bracing.

Dincel wall modifications: Submit proposals of any modifications to the Dincel wall components, including cutting or removal of webs. Proposals to conform to the *Dincel Construction Manual (2023)*.

Dincel product acceptance: Submit a copy, signed by the installer, of Dincel's product acceptance criteria.

A proforma of the product acceptance criteria can be found in the *Dincel Construction Manual (2023)*.

Reinforcement: Submit the following:

- General: Details of any proposed changes to documented reinforcement.
- Damaged galvanizing: Details of proposed repair to AS/NZS 4680 (2006) Section 8.
- Mechanical bar splices: Details and test certificates for each size and type of bar to be spliced.
- Provision for concrete placement: Details of spacing or cover to reinforcement that does not conform to AS 3600 (2018).
- Splicing: Details of any proposed changes to documented requirements.
- Welding: Details of any proposed welding of reinforcement to AS/NZS 1554.3 (2014).

Delete if welding is not acceptable. Do not weld reinforcement less than 3 bar diameters in length from any part of a bar that has been bent or re-straightened.

Post-tensioning: Submit the following:

- Details of the proposed post-tensioning system tested and certified to AS/NZS 1314 (2003).
- Safe work method statement (SWMS) including the name and contact details of the subcontractor.

A post-tensioned strand, when tensioned, contains a considerable amount of stored energy. In the rare event of a strand breaking, the sudden release of energy may cause serious injury to persons and damage to equipment. Reasonable precautions need to be taken when working with or near strands that have been or are in process of being tensioned but are not yet grouted. Include site specific precautions in the safe work method statement.

- Details of proposed gauging, stressing and grouting equipment including current calibration certificates from an Accredited Testing Laboratory.

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

- Changes to the concrete mix.
- Changes to documented joint locations.
- Curing and protection methods.
- Cutting or displacing reinforcement, or cutting or coring hardened concrete.
- Handling, placement, compaction and finishing methods and equipment, including pumping.
- Placement under water.
- Sequence and times for concrete placement, and construction joint locations. Include any proposed sequential placement of slab segments.
- Site storage, mixing and transport methods and equipment, if applicable.
- Temperature control methods to suit hot or cold atmospheric conditions during concrete placement.
- Sawn joints: Submit details of proposed methods, timing and sequence of sawing joints.

Loading: Submit details of proposed construction systems, loads and procedures, including propping, re-shoring and any proposals for early application of superimposed loads.

Consider back propping delay times for appropriate structural element.

Formwork removal: Submit formwork removal procedures.

Surface repairs: If surface repairs are required, submit proposed methods.

Surface repairs may not be permitted depending on which surface finish class is selected.

Products and materials

Void formers: Submit type-test results as evidence of conformity to requirements of **FORMWORK**, **Error! Reference source not found.**.

Reinforcement strength and ductility: Submit type-test reports as evidence of conformity to AS 3600 (2018) Table 3.2.1 for each reinforcement type.

Post-tensioning: Submit the following:

- Grout: Proposed grout mix (including grading, proportions, compressive strength, shrinkage and additives if any).

- Epoxy grout: If required, proposed formulation.
- Duct-forming material: Samples of proposed material.

Post-tensioning type tests: Submit test reports for the following:

- Anchorage.
- Anchorage assemblies and couplings.
- Post-tensioning steel: Test certificates for every delivery of strand, bar or wire proposed.

Concrete product conformity: Submit evidence of conformity, as appropriate, as follows:

- Certification by a JASANZ accredited third party.
- Report by an Accredited Testing Laboratory describing tests and giving results that demonstrate that the product conforms.

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

Pre-mixed supply delivery dockets: For each batch, submit a docket listing the information required by AS 1379 (2007), and the following:

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

For information on typical requirements for contractor submissions for special-class concrete, see CCAA T41 (2020), Part XI Section 9.

- Fibre reinforcement type and dosage.

Delete if fibre reinforcement is not used on the project.

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

Curing compounds: Submit details of any proposed curing compounds, including the following:

- Dosage rates.
- Certified type-test results by an Accredited Testing Laboratory for water retention to AS 3799 (1998) Appendix B for liquid membrane-forming compounds.

Polyvinyl acetate (PVA-based) products may not conform to water retention requirements, refer to AS 3799 (1998) Informative Appendix D clause D5.5.2.

- Evidence of compatibility with concrete, and with applied finishes including toppings and render, if any, including methods of obtaining the required adhesion.
- For visually important surfaces, evidence that an acceptable final surface colour will be obtained.

Admixtures: Submit details of any proposed admixtures, including the following:

- Brand name.
- Place of manufacture.
- Basic chemical composition.

Only use admixtures that are not corrosive to steel and do not encourage other detrimental effects such as cracking and spalling.

Dincel wall: Submit the following, all of which are available by contacting Dincel:

- CodeMark Certificate of Conformity by SAI Global – Certificate number: CM20242.

The date of expiry of this CodeMark Certificate of Conformity is 15/06/2026.

See CodeMark Certificate of Conformity for conditions and limitations. To confirm it has not been withdrawn, suspended or superseded by later issue, see register.jasanz.org/codemark-register for the CodeMark Register of Certificates of Conformity.

Dincel Wall also has a BRAC Certificate of Accrediation - Certificate number: V20/01. This has been issued by the Victoria State Government Building Regulations Advisory Committee and is relevant for projects within Victoria. It may also be accepted as evidence of NCC compliance in other states. The date of expiry of this BRAC Certificate of Accreditation is 10/06/2026.

- Warringtonfire Classification Report to AS 5637.1 (2015) – Report number: ASCRRTF180310.

Dincel wall components have been tested by Warringtonfire, with the following results:

- Group number = 1. Refer to BCA (2022) Table S7C4.
- Smoke Growth Rate Index ($SMOGRA_{RC}$) = 14.0. Refer to BCA (2022) S7C4.

- CSIRO fire resistance assessment report to AS 1530.4 (2014) – Assessment number: FCO-2674.

200 mm thick Dincel wall components, filled with concrete, have been subjected to a fire resistance test to AS 1530.4 (2005) by the CSIRO. The results of that test were assessed again by the CSIRO for confirmation of performance when tested to AS 1530.4 (2014), with the following opinion:

- 200 mm thick Dincel wall FRL: 240/240/240. Refer to BCA (2022) Spec 5.

The Dincel wall fire resistance performance for structural adequacy is to be designed by the structural engineer to AS 3600 (2018), meeting the FRL criteria of the project. Similar to conventional concrete walls, this is required to take into account project specific factors such as wall height, wall loading, wall thickness and steel reinforcement.

Further guidance on the fire resistance performance of Dincel wall systems can be found in the *Dincel - Grove and Wynn-Jones Report (2023)*.

Warringtonfire assessment letter FAS190305 notes that the polymer webs of Dincel walls do not burn or melt away to create holes when subjected to fire conditions. Therefore, the presence of polymer webs will not adversely affect the fire resistance performance of Dincel walls tested or otherwise assessed to achieve a particular FRL.

Refer to NATSPEC TECHnote DES 020 on fire behaviour of building materials and assemblies, for further information.

- CSIRO report on watertightness – Report number: 5091-RevB.

Dincel panel joints, when filled with concrete, have been tested and verified by CSIRO to be waterproof for up to 6 m of water head pressure. In addition, Dincel wall components, filled with concrete, have been tested and meet the waterproofing requirements of AS 3740 (2021).

For waterproofing the cold joint between the Dincel wall and footing or slab, a Dincel Water Stop and a re-injectable hose system is required. See the *Dincel Construction Manual (2023)* and contact Dincel for further information regarding Dincel Waterproof System Warranty.

- Day Design acoustic reports – Numbers: 5880-1.1RC, 5880-3.1RB & 5880-4.1RB.

Dincel wall components, filled with concrete have the following acoustic properties:

- 110 mm thick Dincel wall - R_W / R_W+Ctr = 48 / 43.
- 155 mm thick Dincel wall - R_W / R_W+Ctr = 51 / 45.
- 200 mm thick Dincel wall - R_W / R_W+Ctr = 53 / 48.
- 275 mm thick Dincel wall - R_W / R_W+Ctr = 53 / 48.

The above values are based on nil, painted or rendered finishes on both sides of the wall. Contact Dincel for additional acoustic properties based on different applied finishes to the wall. Acoustic performance may be increased through the use of additional layers such as insulation, cavities and plasterboard.

Prototypes

Test panels: Provide test panels to AS 3610.1 (2018) clause 3.7 and as documented.

Document requirements in the **Test panels schedule**.

Unless there is work involving colour control, test panels are optional for Class 3 surface finish. Test panels are generally not required for Class 4 or 5 surface finish. Test panels for colour control are not used for comparison with the completed work. See clause AS 3610.1 (2018) clause 3.4.7.

Manufacture: Cast the panels using the form, concrete, compaction equipment, form release agents, curing and formwork removal methods that are to be used in the final work.

Storage: Once accepted, maintain the panels on site undamaged and protected from the weather, as reference prototypes for evaluation of completed work.

Surface treatment: Do not proceed with the related work until the acceptable range of surface treatments have been determined.

Records

Post-tensioning: Submit the following:

- Tendon installation record.
- Post-tensioning stressing schedule.
- Post-tensioning grouting record.

Samples

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

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

Shop drawings

Formwork: Submit shop drawings including details of proposed forms, falsework, form liners, bolt positions, release agents and, where applicable, re-use of formwork.

Dincel wall drawings: For walls with openings and varying heights, submit shop drawings of the Dincel works before starting on site, showing details of the following:

- Facade walls incorporating window and door openings.
- Estimated m^3 of concrete required for each wall.
- Location of all penetrations.
- Location of any cast in elements.
- Panel dimensions.
- Panel elevations.
- Plan layout with wall numbers.
- Slab set-downs along wall line.

Shop drawings are not necessarily required for straight walls such as basements and party walls. If necessary, detail the requirements of the shop drawings here. In the absence of shop drawings, an installer can utilise the architectural consultant drawings, structural consultant drawings and a components list (which is either generated by Dincel or others) to make this submission.

Shop drawings are required if Dincel's Waterproof System Warranty has been applied for.

Post-tensioned drawings: Submit shop drawings showing the following:

- Concrete profiles.
- Reinforcement.
- Profiles, sizes and details of tendons, tendon numbers, anchorages, ducts, duct formers, splicing, sheathing, end block reinforcement and other associated components.
- Stressing requirements including sequence of stressing, jacking forces and the basis of assumed loss calculations.
- Number, size and position of grout openings, vents and drain holes in the ducts.

Theoretical extensions should not be shown on shop drawings.

Cores, fixings and embedded items: Submit the proposed locations, clearances and cover and show any proposed repositioning of reinforcement.

Subcontractors

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

Delete if supplier details are not required.

Tests

Detail the tests required in PRODUCTS or EXECUTION, as appropriate, and list the submissions required here.

Requirement: Submit test results of the following:

- Concrete:
  - . Early age compressive strength.
  - . Other concrete properties, as documented.

Document requirements in the **Tests schedule**.

- Grout:
  - . Fluidity.
  - . Bleeding.
  - . Early expansion.
  - . Compressive strength.

Grouting is usually done with a standard mix, method and equipment. Previous results are often accepted as sufficient, especially for smaller projects.

- Special-class concrete: Submit trial mix results to AS 1379 (2007), including drying shrinkage, creep and durability testing.

If extensive performance data is not available for special-class concrete mix design, consider including this *Optional* style text by changing to *Normal* style text.

- Slip resistance test of completed installations.

1.10 INSPECTION

Notice

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

- Used forms, after cleaning and before re-use.
- Base or subgrade before covering.
- Membrane or film underlay installed on the base or subgrade.
- Completed formwork with all dust and debris removed from forms and reinforcement, tendons, cores, fixings and embedded items fixed in place before placing concrete.
- Concealed surfaces or elements before covering.
- Commencement of concrete placement and compaction.
- Finishing and curing of concrete.
- Evaluation of the off-form finishes.
- Evaluation of surface finish.
- Commencing initial, incremental or final stressing of tendons.
- Grouting and cutting tendons.

Edit to suit the project, adding critical stage inspections required.

The party responsible for the structural design of the element is usually responsible for the inspection.

Normal practice for post-tensioned concrete is for at least one inspection to be made after tendons are fixed in place and before concreting. Inspection is usually not made of initial, incremental, final stressing or grouting, unless required for particular elements to address specific concerns in the case of non-conformance or for quality assurance.

Hold points

General:

- Approval of proposed post-tensioning system tested to AS/NZS 1314 (2003), before work begins.
- Approval of actual post-tensioning extensions, before tendons are cut off or made inaccessible for stressing.

Insert hold points here. If required, consider including this *Optional* style text by changing to *Normal* style text.

Approval of the proposed post-tensioning system before work begins is essential to make sure anchorages meet AS/NZS 1314 (2003).

Comparison of theoretical and actual extensions is a fundamental quality assurance requirement for virtually all post-tensioning. Post-tensioned steels are not weldable. After cutting off there is usually insufficient length to mechanically couple on or to de-stress the tendon in a controlled manner. To allow tendons to be re-stressed and/or de-stressed and/or tendon force re-verified, tendons should not be cut off, or otherwise made inaccessible for stressing, until approved by the responsible party.

Compare theoretical and actual extensions promptly (within 24 hours of submission) to maintain integrity and credibility of the process and to avoid delays and additional costs.

Add the approving party and any approval time constraints, if known.

2 PRODUCTS

2.1 GENERAL

Product substitution

Other products: Conform to **SUBSTITUTIONS** in *0171 General requirements*.

SUBSTITUTIONS in *0171 General requirements* sets out the submissions required if the contractor proposes alternative products. Refer also to NATSPEC TECHnote GEN 006 for more information on proprietary specification.

2.2 DINCEL WALL

General

Description: Polymer based permanent formwork system for concrete walling for external and internal walls, retaining walls, storage tanks and other specialist uses.

Products: Visit www.dincel.com.au for more information.

Dincel wall is a waterproof polymer formwork for walls and columns. The Dincel wall profiles can be installed vertically or horizontally to form a wall or column and the profiles are joined together using the integrated custom snap joint, before reinforcement (if required) being placed and the Dincel wall being filled with concrete.

Wall Profile

Wall thickness: [complete delete]

Select the product(s) to be used from the following available Dincel wall range:

- 110 mm Series. Available in stock lengths of 2.85 m, 3 m, and 4 m, and custom lengths from 1.8 m to 7.95 m.
- 155 mm Series. Available in stock lengths of 2.85 m, 3 m, and 3.3 m, and custom lengths from 1.8 m to 7.95 m.
- 200 mm Series. Available in stock lengths of 2.85 m, 3 m, 3.15 m, 3.3 m, 3.45 m, and 3.6 m, and custom lengths from 1.8 m to 7.95 m.
- 275 mm Series. Available in stock lengths of 2.85 m, 3 m and 3.6 m, and custom lengths from 1.8 m to 6.525 m.
- Special order lengths of 1.2 m to 1.65 m are available for all the above products. However these will be special request orders.

Note: The 110 mm and 155 mm Series can accommodate a central layer of horizontal steel reinforcement if required by design. The 200 mm and 275 mm Series can accommodate a front and back layer of horizontal reinforcement if required by design. It is also available with an additional central web hole to allow for closed ties to be inserted for columns and blade walls.

Storage and handling

Delivery and handling: Dincel wall components are delivered in packs with timber collars. Use the following techniques when moving the packs to the storage area to avoid damage to the components:

- Use wide flat lifting slings and not chains or round ropes when lifting the packs.
- Do not lift more than two packs at a time unless lifting bars are used.
- Place packs softly onto the site storage area without any dropping of the packs.

Damage to the component surfaces or the webs of the components may cause bulging to occur when the components are filled with concrete.

Storage: Store Dincel wall components on site as follows:

- On a clean flat surface.
- Place timber sleepers under the timber collars of the packs.
- Do not stack packs more than 2 high.
- Where daily temperatures on site are likely to be consistently above 30°C, store the packs under cover without restriction of air flow around the crates.

The Dincel wall components may have a tendency to deform if they are stored with uneven and inappropriate support.

Sealant/adhesive

Fire resistant sealants/adhesives are generally only necessary where an FRL is required and where Dincel walling meets another type of fire-rated walling (e.g. AAC block wall, masonry wall or any other type of fire rated wall. If fire rated sealants or waterproofing sealants are required, consider the inclusion of this *Optional* style text by changing to *Normal* style text.

Fire resistant sealant/adhesive: HILTI CP611A Firestop.

Fire resistance testing has been carried out by Warringtonfire between Dincel walling and various other fire-rated walling types such as masonry, AAC blocks, concrete, and fire-rated plasterboard. To seal these types of junctions between the wall types, Hilti CP611A was applied directly onto the Dincel polymer formwork substrate. Refer to Warringtonfire report FAS190067, which lists various walling junction arrangements and the FRL achievable. If a different fire-rated sealant product is required, contact Dincel or the project fire engineer for guidance.

Waterproofing sealant/adhesive: [complete/delete]

Dincel recommend to confirm with the sealant/adhesive manufacturer on the compatibility of the proposed product with the polymer formwork substrate. Nominate the compatible sealant here if waterproofing is required.

Dincel recommend obtaining Dincel's Waterproof System Warranty for basement walls. Refer to the *Dincel Construction Manual (2023)* Addendum section for further details.

Provide a bandage at joints where panels have been cut and spliced together.

Dincel recommend the use of the Dincel Water Stop waterproofing system at cold joints between the base of the wall and the footing or slab. Refer to the *Dincel Construction Manual (2023)* Addendum section for further details.

2.3 FORMWORK

General

Form face, linings and release agents: Compatible with documented concrete surface finish and any proposed applied finishes to concrete.

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

Void formers

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

Laboratory testing: Use void formers tested under laboratory conditions for conformance with the following:

- Deflection during placing and compaction of the concrete does not exceed beam or slab span/1000.
- Additional deflection between initial set and 7 days does not exceed span/400.

Test method: Place formers on damp sand and load with a mass of wet concrete at least equal to the mass of the beams or slabs to be supported.

Profiled steel sheeting composite forms

Material: Hot-dipped zinc-coated sheet steel to AS 1397 (2021).

Refer to BlueScope TB-14 (2022) guide on standards for steel sheet and strip products.

Minimum steel grade: G550.

Amend if appropriate.

Zinc coating mass: [complete/delete]

Nominate one of the following two levels of protection:

- Z350: 350 g/m^2 zinc coating mass is recommended for use in non-aggressive areas.
- Z450: 450 g/m^2 zinc coating mass is recommended for severe and aggressive environment where a build-up of airborne corrosive contaminants can affect the coating.

Make sure that the product documented has the level of galvanizing selected. See NATSPEC TECHnote DES 010 for information on atmospheric corrosivity categories.

Accessories: Use materials and corrosion protection compatible with the profiled steel sheeting.

Plywood forms

Material: To AS 6669 (2016).

AS 6669 (2016) does not cover off-form surface finish Class 1.

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

Refer to AS 6669 (2016) for information on surface quality, veneer qualities, and stress grades.

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

Tolerances: To AS 3610.1 (2018) Section 3.

Document any special requirements.

2.4 REINFORCEMENT

Fibre reinforcement

Steel fibres: To AS 3600 (2018) clause 16.7.1.

Synthetic fibres: To EN 14889-2 (2006).

For further information on the properties and use of fibre reinforcement in concrete, refer to CCAA T41 (2020), Part II Section 7.

Storage: Store in a dry environment. Do not stack.

Steel reinforcement

Standard: To AS/NZS 4671 (2019).

Although AS 3600 (2018) Table 3.2.1 includes stainless steel reinforcement to BS 6744 (2023), AS 3600 (2018) later states in clause 17.2.1.1 that all reinforcement shall conform with AS/NZS 4671 (2019).

Bars: Profile, strength grade and ductility class: [complete/delete]

List relevant combinations. e.g. R250N, D500N.

Profile: R (round), D (deformed ribbed) or I (deformed indented).

Strength grade: To AS/NZS 4671 (2019) clauses 5.2 and 5.3(b).

Ductility class: To AS/NZS 4671 (2019) clauses 5.2 and 5.3(c).

Show reinforcement sizes on drawings. If there is more than one strength grade and ductility class specified for each type of profile, the full reinforcement designators need to be called up on drawings to avoid any ambiguity. See AS/NZS 4671 (2019) clause 5.3 for more information.

See AS 3600 (2018) clause 17.2 for material and construction requirements.

Welded mesh: Profile, strength grade, configuration, ductility class: [complete/delete]

List relevant combinations. e.g. D500RL, D500SL.

Profile: R (round), D (deformed ribbed) or I (deformed indented).

Strength grade: To AS/NZS 4671 (2019) clauses 5.2 and 5.4(b).

Configuration: S (square) or R (rectangular).

Ductility class: To AS/NZS 4671 (2019) clauses 5.2 and 5.3(d).

Show reinforcement sizes and spacing on drawings. If there is more than one strength grade and ductility class specified for each type of profile, the full reinforcement designators need to be called up on drawings to avoid any ambiguity. See AS/NZS 4671 (2019) clause 5.4 for more information.

Fabrication tolerances: To AS 3600 (2018) clause 17.2.2.

Surface condition: Provide surfaces conforming to the following:

- Free of loose or flaking mill scale and rust.
- Clean from oil, grease, mud or other material that would reduce the bond between the reinforcement and concrete.

See AS 3600 (2018) clause 17.2.4. AS 3600 Supp 1 (2022) notes that rust and mill scale has little effect on bond, and that moderate rusting has been shown to improve bond.

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

See www.steelcertification.com for information on the Australasian Certification Authority for Reinforcing and Structural Steels (ACRS) certification scheme for steel reinforcement. If certification to this (or any alternative) scheme is a project requirement, document requirements here and in **SUBMISSIONS**.

Protective coating

Standard: To AS 3600 (2018) clause 17.2.1.2.

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

Epoxy coating: High-build, high solids, chemically resistant coating to AS/NZS 3750.14 (1997).

- Thickness: 200 µm minimum.

The average ultimate bond stress between the reinforcement bar and concrete is significantly reduced when the bars are epoxy coated. To determine the development length for deformed bars in tension, see AS 3600 (2018) clause 13.1.2. Document additional requirements on drawings.

Galvanizing: To AS/NZS 4680 (2006), and as follows:

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

Consider whether passivation of the galvanizing needs to be documented. Refer to CIA CPN17 (2008) on the use of galvanized reinforcement in concrete to assess whether the default thickness is appropriate. Do not mix galvanized reinforcement with uncoated steel as adverse galvanic action can result in the wrong conditions.

Tie wire

General: Annealed steel 1.25 mm diameter (minimum).

External and corrosive applications: Galvanized.

Supports

Standard: To AS/NZS 2425 (2015).

2.5 POST-TENSIONING

Grout properties

Standard: To AS 3600 (2018) clause 17.1.8.

Fluidity: Efflux times as follows:

- Immediately after mixing: 15 to 20 seconds.
- At the end of grouting or 45 minutes after mixing, whichever occurs first: Within ±3 seconds of the efflux time recorded immediately after mixing.

Maximum bleed: 0.5% final bleeding.

Maximum early expansion: 0.5% at 3 hours.

Maximum shrinkage: 1% by volume after 24 hours.

Maximum water:cement ratio: 0.4 (by mass).

Compressive strength: 32 MPa at 7 days.

Grout mixes for post-tensioned tendon ducts are usually determined by the contractor. Performance and testing requirements, if any, may be documented here if not shown on the drawings. Test frequency is dependent on the size of the project.

Grout materials

Fine aggregates: Maximum nominal aggregate size of 1 mm. Do not use aggregates for post-tensioning grout when the cross-sectional area of the duct is less than 5 times the cross-sectional area of the tendon.

Aggregates are rarely used for grouting of post-tensioning.

Cement: To AS 3972 (2010), free from calcium chloride and less than two months old.

The use of GB cements for grouting is now accepted practice.

Admixtures: To AS 1478.1 (2000). Include an anti-bleed additive.

If expansive admixtures are proposed, see CIA Z3 (2007) for considerations.

Fly ash: To AS/NZS 3582.1 (2016), proportioned according to obtain early strength requirements.

Water: To AS 1379 (2007). Clean, free from oil, acid, alkali, organic or vegetable matter and including not more than 500 mg/L of chloride ions.

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

Ducts

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

Profile: [complete/delete]

For example, corrugated steel or plastic. Document here or show on the drawings.

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

Size: To allow feeding of tendons and grouting.

Tendon material

Prestressing steel: Provide the following:

- Type and grade of strand, wire or bar, to AS 4672.1 (2007).
- Testing to AS/NZS 4672.2 (2007).

Strand type: 7 wire, stress relieved, high tensile steel.

Show size designations, ductility and diameters on the drawings.

Quality: Make sure tendons are not galvanized, have no nicks, pitting, indents, damage or foreign matter such as mud and dirt. Inspect at delivery and store the prestressing steel on supports clear of the ground.

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

High tensile steel bars: Inspect individually and reject any bars with surface imperfections.

Anchorage, coupling or anchorage assembly

General: To AS/NZS 1314 (2003).

Anchor plates: Hot-dip galvanized to AS/NZS 4680 (2006).

Anchorage: Stressing anchorage efficiency to AS/NZS 1314 (2003) Appendix C and non-stressing anchorage efficiency to AS/NZS 1314 (2003) Appendix D.

Anchorage assemblies and couplings: Gripping efficiency to AS/NZS 1314 (2003) Appendix B and non-stressing anchorage efficiency to AS/NZS 1314 (2003) Appendix D.

2.6 CONCRETE

General

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

Dincel

Concrete mix: Conform to the *Dincel Construction Manual (2023)* Section B.20.1.

Provide concrete mixes that suit project requirements. Make sure the concrete mix has a high degree of workability and flow so that air voids do not occur. The use of self-compacting concrete has been tested with Dincel and is recommended. High-slump conventional concrete conforming with the concrete mix specification in Section B.20.1 of the *Dincel Construction Manual (2023)* and vibrated adequately can also be used.

Requirement for all Dincel profiles:

- Nominal 220 mm slump ±40. Minimum 180 mm slump (at the point of truck discharge), maximum 10 mm aggregate, and compacted with use of vibration.

OR

- Self-compacting concrete with no additional vibration. Maximum 10 mm aggregate. If wall requires multiple concrete passes, slightly agitate the top 400 mm of concrete between each lift. A supplied concrete spread of more than 600 mm can have water added onsite (to the instructions of the supplier) in order to achieve the target 680 mm to 730 mm spread. A minimum 670 mm spread after adding water is required for placing self-compacting concrete into Dincel wall profiles.

Properties

Concrete mix and supply: Conform to the following:

- Normal-class: To AS 1379 (2007) clause 1.5.3.
  . Properties: As documented.

AS 1379 (2007) clause 1.5.3.2 nominates basic parameters including strength grade, slump and aggregate size that are to be documented on the structural drawings or in the **Concrete properties schedule – performance**.

- Special-class: To AS 1379 (2007) clause 1.5.4.
  . Performance properties: As documented.
  . Prescription properties: As documented.

Document the properties of special-class performance concrete on the structural drawings or in the **Concrete properties schedule – performance**.

Document the properties of special-class prescription concrete on the structural drawings or in the **Concrete properties schedule – prescription**.

Edit this subclause as appropriate.

Aggregates

Standard: To AS 2758.1 (2014).

Storage: Store in silos or on a hardstand located away from surface and ground water runoff. Allow for free drainage of rainwater and prevent contamination and intermixing of aggregates.

Cement

Standard: To AS 3972 (2010).

Refer to CCAA TN59 (2017). If considering the use of geopolymer cement, refer to CIA Z16 (2011) for further information. See SA TS 199 (2023) for design of geopolymer and alkali-activated binder concrete structures.

Age: Less than 6 months old.

Storage: Store cement bags in a dry, under cover and above ground environment.

Supplementary cementitious materials:

- Fly ash: To AS/NZS 3582.1 (2016).
- Slag: To AS 3582.2 (2016).
- Amorphous silica: To AS/NZS 3582.3 (2016).
- Manufactured pozzolans: To AS 3582.4 (2022).

Water
Standard: To AS 1379 (2007) clause 2.4.

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

Concrete colour
Standard: To AS 3610.1 (2018).

Chemical admixtures
Standard: To AS 1478.1 (2000), used to manufacturer's recommendations and free from chlorides, and other substances detrimental to concrete or reinforcing steel.

Special-purpose admixtures are covered in AS 1478.1 (2000) Informative Appendix B clause B11.

Early strength
For post-tensioned concrete:

- Initial stressing stage: [complete/delete]
- Final stressing stage: [complete/delete]

List the early concrete strength requirements here, if not shown on the drawings.

2.7 MISCELLANEOUS

Polymeric film underlay
Vapour barriers and damp-proofing membranes: To AS 2870 (2011) clause 5.3.3.

Curing compounds
Liquid membrane-forming compounds: To AS 3799 (1998).

Curing compounds are not required for concrete being used in Dincel walls due to the encapsulating polymer skin.

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

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

Surface modifiers
Hardeners, sealants and protectors: If documented, proprietary products conforming to the manufacturer’s recommendations.

Slip resistance treatment: If documented, proprietary products conforming to the manufacturer's recommendations.

3 EXECUTION

3.1 POLYMERIC FILM UNDERLAY

Location
Vapour barrier: Under slabs on ground, including integral ground beams and footings.

Note: For NSW and SA damp-proofing membranes are required. See BCA (2022) F1D7 and BCA (2022) H1D4.

Damp-proofing membrane: Areas prone to rising damp or salt attack.

Provision of a vapour barrier for external slabs on ground prevents water loss to the subgrade and may reduce slab curling at edges and corners.

AS 2870 (2011) clause 5.5 provides additional requirements and detailing of damp-proofing membranes for concrete slabs and footings exposed to either saline or acid sulfate soils. AS 2870 (2011) clause C5.5 and CCAA T56 (2018) provide information on concrete exposed to saline soils.

Base preparation
Requirement: Conform to base type, as follows:

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

Installation
Standard: To AS 2870 (2011) clause 5.3.3.

Requirement: Lay underlay over the base, as follows:

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

3.2 FORMWORK

General
Requirement: As documented.

Document requirements in the **Error! Reference source not found.**.

Bolt holes
Formwork tie bolts left in the concrete: Position to achieve minimum 50 mm concrete cover to bolt.

Corners
Work above ground: Bevel with a chamfer at re-entrant angles, and a fillet at corners.

Face of bevel: 25 mm.

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

Joints
Requirement: Provide joints that prevent loss of grout.

Openings
Vertical forms: Provide openings or removable panels for inspection and cleaning, at the base of columns, walls and deep beams.

Access: For thin walls and columns, provide access panels for placing concrete.

Release agents
Application: Before placing reinforcement, apply a release agent to form face and linings. Spread the coating uniformly in a thin film and remove any surplus before placing concrete.

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

Unlined timber forms: Thoroughly wet timber before oiling.

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

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

Steel linings
Rust: Clean off any rust and apply rust inhibiting agent prior to re-use.

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

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

3.3 DINCEL WALL

Component preparation
Cutting: If any Dincel wall components require cutting on site to suit design dimensions, refer to the *Dincel Construction Manual (2023)* for cutting and installation requirements.

Checking and cleaning: Check that all web-links within modules are undamaged, before installing any Dincel wall components. Where dust or dirt has accumulated on panels during storage, wash the panels clean, making sure that no dirt is remaining on the snap joint of each component.

Substrate preparation

Requirement: Before placing concrete confirm concrete finish requirements at wall locations with Dincel wall installer. Make sure concrete surfaces are level, free from irregularities and swept clean.

Installation

110 mm, 155 mm, 200 mm and 275 mm series: To the *Dincel Construction Manual (2023)*.

Refer to the *Dincel Construction Manual (2023)* for important installation requirements.

Wall guide or angle: Confirm set out of the wall positions before fixing the wall guide or angle to the concrete slab. Secure guide or angle to concrete slab using concrete nails.

The Guide can be used under walls and vertically at wall T-junctions. The use of the Guide is not recommended under walls unless the internal profile webs are removed following the Guide profile installation. This profile must not be used under basement walls at the wall/footing-slab junctions. Instead, it is recommended to use D-ANG50 PVC angles on either side of the walls (both sides for SCC) to maximise full concrete to concrete bearing surfaces.

Module orientation: For Dincel wall modules that are being placed vertically, place the end of the module with the half size web hole at the bottom of the wall.

This will align all web holes of adjacent modules, which will assist with the free flow of concrete. This is essential to avoid air voids and bulging, and maximises concrete to concrete bonding, resulting in better water tightness capabilities.

Bracing: Brace Dincel wall modules securely by fixing to formwork deck or by using horizontal metal angles or walers, fixed to the face of the Dincel wall module joints with a minimum 2 mm diameter coarse thread screw, braced diagonally to ground with standard timber or metal braces at maximum 4 m centres. Position horizontal waler 1.2 m or less from the top of the Dincel wall modules.

Bracing design: By a temporary works or structural engineer to suit the site conditions.

Tolerance: Install to achieve an alignment of ± 4 mm over any 1.8 m vertical or horizontal plane.

Reinforcement: Place reinforcement as documented.

Refer to the *Dincel Construction Manual (2023)* for guidance on placement of reinforcement services within Dincel walls. Document the requirements here if required.

Concrete placement: To **PLACING AND COMPACTION**.

Fire resistant sealant/adhesive:

- Apply at wall joints/junctions between Dincel and other fire rated wall types, as documented.
- Applied to the manufacturer's recommendations and the Warringtonfire report FAS190067.

Waterproofing sealant/adhesive:

- Apply at wall joints/junctions, as documented.
- Applied to the manufacturer's recommendations.

If the *Optional* style PRODUCTS, **DINCEL WALL**, **Sealant/adhesive** subclause is included, also include this *Optional* style text by changing to *Normal* style text.

3.4 REINFORCEMENT

General

Fixing: To AS 3600 (2018) clause 17.2.5 and as documented.

Dowels

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

Tolerances:

- Alignment: 1:100.
- Location: ± half the diameter of the dowel.

Grade: 250N.

Edit this default if required.

Cover

Generally: As documented, to AS 3600 (2018) clause 4.10.

Structures for retaining liquids: As documented, to AS 3735 (2001) clause 4.4.

Residential ground slabs and footings: As documented, to AS 2870 (2011).

Show concrete cover on the structural drawings.

Supports

Concrete, metal or plastic supports: Provide as follows:

- Able to withstand construction and traffic loads.
- With a protective coating if they are ferrous metal, located within the concrete cover zone, or are used with galvanized or zinc-coated reinforcement.

For special soffit finish, avoid metal chairs.

Spacing:

- Bars: ≤ 60 bar diameters.
- Mesh: ≤ 600 mm.

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

Projecting reinforcement

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

Bending

Restriction: Use only bars with bends as documented.

Site bending: If required to bend or straighten bars on site, conform to AS 3600 (2018) clause 17.2.3.2. Do not use heat, and only use methods that will not damage the steel and its structural properties.

Protective coatings: Repair coatings damaged by cutting or bending.

Tying

Dincel wall works: Tying of reinforcement within the Dincel wall components is not required. Place reinforcement as documented. Use the Dincel Reo-Clip to locate vertical reinforcement in either face or centrally within the 200 mm series walls. For other Dincel wall profiles, refer to the *Dincel Construction Manual (2023)*.

Non-Dincel wall works: Secure the reinforcement against displacement at intersections with wire ties or clips. Bend the ends of wire ties to prevent the ties projecting into the concrete cover.

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

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

Refer to AS 3600 (2018) clause 8.3.1.7 for requirements on the use of bundled bars. If possible, avoid the use of bundled bars.

Columns: Secure longitudinal column reinforcement to all fitments (or helical reinforcement) at every intersection.

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

Splices

Requirement: Provide splices, as documented.

Splices include lapped, mechanical or welded splices. See AS 3600 (2018) clause 13.2. Consider the placement and compaction of concrete when selecting the type and location of the splice.

Welding: Do not weld reinforcement less than 3 bar diameters in length from any part of a bar that has been bent or re-straightened.

Delete if welding is not acceptable.

Fibre-reinforced concrete

Steel fibres: To AS 3600 (2018) Section 16.

Synthetic fibres: To EN 14889-2 (2006).

3.5 POST-TENSIONING

See *0313 Concrete post-tensioned* for further information on grouting pumps, concreting, post-tensioning, measurement of site extensions, cutting tendons, grouting, grout openings and grout pressure.

General

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

Tolerances: To AS 3600 (2018) clause 17.5.3.

Concrete cover: As documented.

Show on the drawings.

Anchorages, ducts and tendons: To AS 3600 (2018) clause 17.3.

Ducts

Placement: Locate and secure to positions, as documented.

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

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

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

AS 3600 (2018) clause 17.3.4.4 assumes tendons are in place before concreting. It is not standard practice to install tendons after the placement of concrete.

Damage: If damaged, repair ducts as follows:

- Small holes: Waterproof adhesive tape.
- Larger holes: Metal strips wrapped around the duct, with 100 mm overlap and sealed by a waterproof adhesive tape.

Crossover points: If ducts running in opposite directions clash, consult the professional engineer. Do not relocate ducts without approval.

Anchorages

Anti-burst reinforcement: As documented.

The structural designer is responsible for documenting requirements for anti-burst reinforcement. The post-tensioning contractor may be consulted for the system specifics.

Tendons

The technical requirements for prestressing tendons are generally covered by AS 3600 (2018) clause 17.3.

Conformance: Provide tendons, as documented.

Document material and size in the **Tendon schedule** or delete schedule if information shown on drawings.

Care: Do not weld tendons. Do not expose tendons to sparks, ground current or excessive temperatures. Cut to length using mechanical means.

Grout fittings and ducts: Protect from collapse and other damage. Prevent ingress from concrete slurry.

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

Slab marking: If there is possibility for future slab penetrations, mark the tendon locations, either on the slab surface or the soffit.

Before casting the slab, stainless steel staples may be used to secure the ducts to formwork. When the formwork is removed the tendon locations are obvious.

Alternately, chalk lines may be marked on the slab top surface to aid in the location of post-tensioning tendons. These procedures will assist in locating future openings away from tendons.

Tendon installation record: Provide details of the following:

- Date.
- Strand source.
- Coil number.
- Heat or cast number.
- Anchorage, duct and wedge batch numbers.
- Operator and supervisor names.
- Locations products are installed.
- Drawing number and revision.

Grout openings

Provision: Provide grout openings, vents and drain holes as documented, including at each end, and at high points except where the tendon curvature is small and the tendon is relatively level.

Vents are generally provided at high points where the tendon drape exceeds 500 mm. Vents are typically provided at a spacing of 30 to 70 m, up to a maximum of 100 m.

Gauges and jacks

General: To AS 1349 (1986).

Accuracy: Use equipment capable of establishing loads within 3% accuracy.

Calibration period: Calibrate gauges and jacks at intervals not exceeding 100 operations or 6 months, whichever is earlier, or if any inaccuracy in the gauges is suspected.

A particular gauge and jack, often of the same number, are usually used and calibrated together.

Gauges are sensitive to rough handling. Digital gauges providing equivalent accuracy may be used.

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

Stressing

Requirement: To the approved SWMS.

Tensioning: To AS 3600 (2018) clause 17.3.4.5.

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

Achieving sufficient concrete strength before each stage of stressing is critical to avoid failures of concrete in anchorages.

Stressing stages: As documented.

Generally carried out in 2 stages:

- Initial stressing stage: 25% of the stressing force is applied when the concrete strength reaches 7 to 9 MPa.
- Final stressing stage: 100% of stressing force is applied when the concrete strength reaches 22 MPa for 12.7 mm diameter strands and 25 MPa for 15.2 mm diameter strands. (Usually between 4 and 7 days based on site cured test cylinders).

If a particular stressing system is required, document the system and the technical requirements either here or on the drawings. If tendons are to be stressed in a particular sequence or in stages, show on the drawings.

Concrete strength at initial stressing stage is sometimes referred to as transfer strength.

Required transfer strength is critical for safety and structural adequacy. Required transfer strength is governed by avoiding failure of concrete at anchorages and may be separately governed by structural adequacy.

Marking: Mark strands after wedges are installed and before initial stress.

Slip: Check markings whilst stressing to make sure there is no slip of strands.

Site extensions: Submit the site extensions on the same day as measured for review and approval by a professional engineer.

Non-conformance: If the difference between theoretical and measured extensions is greater than 10%, provide an explanation of the cause.

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

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

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

- Date.
- Early age concrete compressive strength results.
- Operator and supervisor names.
- Equipment calibration date, including the identification number of dynamometers, gauges, pumps and jacks.
- Tendon identification.
- Initial and final stressing force (or pressure).
- Theoretical and actual extensions for each stressing stage.
- Non-conformance including tendon breakage.
- Drawing number and revision.

Grouting

Grout mixing and preparation: To AS 3600 (2018) clause 17.1.8.2 or to the manufacturer's recommendations for prebagged grout. Use grout as soon as possible and within 45 minutes of adding cement to mixing water.

Ambient air temperature: Do not grout, if the surrounding air temperature is lower or expected to be lower than 5°C.

Timing: Grout tendons as soon as practicable after stressing and within the time limits applicable to the atmospheric corrosivity category, as documented:

- C1 or C2: Three weeks.
- C3: Two weeks.
- C4: One week.
- C5 or CX: Seek specialist advice.

Exterior and interior corrosivity categories: To **CORROSION RESISTANCE**, **Atmospheric corrosivity category** in *0171 General requirements*.

Atmospheric corrosivity categories are defined in AS 4312 (2019) and nominated in *0171 General requirements*.

Consider including advice from corrosion specialist here for categories C5 and CX.

Equipment: Do not use manually powered grouting machines.

Procedure: Prevent damage to grout vents and fittings during grouting. Completely fill the duct during grouting. Inject grout into voids between tendons, ducts and anchorages, until grout flows from vents without air bubbles. Close vents as they fill, progressively in the direction of flow. If there is a blockage or interruption, completely flush grout from the duct using water.

Grout caps: Provide at each anchorage and seal for grouting and venting operations.

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

- Date and time.
- Composition of the grout (water:cement ratio, admixtures) and batch numbers.
- Ambient temperature.
- Operator and supervisor names.
- Duct and tendon identification.
- Grout properties.
- Details of grouting interruptions including pumping or supply interruptions, blockages or loss of grout.

Protection

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

Permanent protection

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

3.6 CONCRETE SUPPLY

Elapsed delivery time

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

Elapsed delivery time table

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

AS 1379 (2007) nominates a limit of 90 minutes, which can be waived by agreement between the customer and supplier, if, after that period, the consistency of the concrete allows placing without the addition of more water to the mixer.

The **Elapsed delivery time table** above table applies for conventional concrete mixes. A longer elapsed time may be considered for Self-Compacting Concrete (SCC) mixes or those which utilise retarder admixtures.

Pre-mixed supply

Addition of water: To AS 1379 (2007) clause 4.2.3.

Consult supplier before adding water.

Transport method: Select to prevent segregation, loss of material and contamination of the environment, and not to adversely affect placing or compaction.

Site mixed supply

Emergencies: If mixing by hand, provide details.

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

3.7 TESTING

0171 General requirements defines different tests in **INTERPRETATION**, **Definitions** and calls for an inspection and testing plan in **TESTING - GENERALLY**, **Inspection and testing plan**.

General

Test authority: Concrete supplier or an Accredited Testing Laboratory.

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

Assessment process of test results

Standard: To AS 1379 (2007).

Method of assessment: Project assessment.

Consider changing the default to Production assessment, if satisfactory for the particular project and document the requirement for the concrete supplier to provide a Production Assessment report in conformance with AS 1379 (2007) for verification. Document also the method of assessment in the **Concrete properties schedule – performance**. If the method of assessment is not documented, production assessment will be carried out by the concrete production plant.

Sampling

Sampling method: To AS 1012.1 (2014).

Sampling locations: To AS 1012.1 (2014) and the following:

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

Sampling frequency: To AS 1379 (2007) Sections 5 and 6 and the following:

- Slump and spread tests: Take at least one sample from each batch.

Edit the slump and spread test sampling requirements to reflect the quality control and accepted level of risk deemed suitable for the project. Dincel recommends one sample from the first batch and subsequently one sample from every 25 m^3 of concrete.

- Compressive strength tests: To the **Project assessment strength grade sampling table**.

Project assessment strength grade sampling table

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

For project assessment, AS 1379 (2007) clause 6.5.2 requires one sample from each 50 m^3 of concrete. For columns and load bearing walls, one sample from each batch is recommended, and for all other elements, sampling to the per day defaults of the table is recommended. The table default values are considered good practice but specifiers may amend the table to reflect the quality control and accepted level of risk they deem suitable for the project.

Making and curing of specimens

General: To AS 1012.8.1 (2014), AS 1012.8.2 (2014) and AS 1012.8.4 (2015).

Test methods

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

Typical test methods part of the AS 1012 series include:

- Slump test to AS 1012.3.1 (2014).
- Spread test to AS 1012.3.5 (2015) for high flowable mixes with a slump greater than 250 mm. Typically used for self-compacting concrete where high flowable mixes are required for pumping tall columns and heavily reinforcement structural elements.

Compressive strength: To AS 1012.9 (2014).

Flexural strength: To AS 1012.11 (2000).

Acceptance criteria:

- Concrete properties: As documented.

Document concrete properties in the **Concrete properties schedule – performance**.

- Early age compressive strength: As documented.

Document the early age compressive strength in the **Error! Reference source not found.**.

Drying shrinkage at 56 days: To AS 1012.13 (2015).

For shrinkage sensitive structures the duration of air drying should be 56 days.

Other concrete properties: As documented.

If other tests are required, complete the **Tests schedule** in SELECTIONS by nominating the required frequency of sampling. If no other tests are required, delete this text and the **Tests schedule**.

If deleting this text, remove submission requirement from **SUBMISSIONS**.

Early age concrete compressive strength for post-tensioning

The testing of concrete before each stage of stressing is critical to avoid concrete failures at anchorages.

Sampling frequency: For each post-tensioned element, take at least 3 samples for testing at the age of each intended stage of stressing plus at least 3 reserve samples. Take at least one sample every 2 batches.

The frequency of testing is as warranted by the size of the project.

Sampling locations: Distribute sampling locations randomly, include anchorage areas and the final concrete placement area. Reference the structural element from which the sample is taken.

Making and curing of specimens: To AS 1012.8.1 (2014) and the following:

- Site cure all test cylinders for early age testing.
- For slab samples, maintain exposure to the same weather and temperature by curing the samples on the adjacent deck.
- Retain test cylinders on site until the morning of the test.

Samples cured in laboratory conditions are generally not suitable. In most climate conditions they will produce unconservative results leading to potential failures of concrete at anchorages.

Grout properties

Fluidity: To ASTM C939/C939M (2022) for each grout batch.

Bleeding and early expansion: To ASTM C940 (2022), modified to simulate the wicking of strands and tested once every 20 m^3.

See CIA Z3 (2007) for more information on the modification of ASTM C940 (2022).

Compressive strength: To AS 1478.2 (2005) at a frequency of 3 cubes per grouting session.

Liquid retaining structures

Testing for liquid tightness: To AS 3735 (2001) Section 7.

Slip resistance tests

Slip resistance of completed installation: To AS 4663 (2013).

Site testing is expensive. Delete if not required. See NATSPEC TECHnote DES 001 on slip resistance.

3.8 CORES, FIXINGS AND EMBEDDED ITEMS

General

Requirement: Install fasteners to manufacturer's recommendations and the assumptions of AS 5216 (2021) Appendix G.

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

Protection
General: Protect embedded and projecting items against damage.

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

Corrosion protection: In external or exposed locations, galvanize anchor bolts and embedded fixings as follows:

- All threaded products: To AS/NZS 1214 (2016).
- All non-threaded products: To AS/NZS 4680 (2006).

Grease: Grease threads that will project from the concrete.

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

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

Tolerances
General: Maximum deviation from correct positions:

- Anchor bolt groups for structural steel: To AS/NZS 5131 (2016) Appendix F.
- Cores and embedded items generally: 10 mm.
- Other fixing bolts: 3 mm.

Edit as necessary to suit project requirements.

3.9 CONCRETE WORKING BASE

Finish
Membrane support: Wood float finish or equivalent.

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

Surface flatness tolerance
Maximum deviation: 6 mm from a 3 m straightedge.

This is equivalent to flatness tolerance class B for unformed surfaces.

3.10 PLACING AND COMPACTION

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

Placing
Dincel wall specific requirements: To the *Dincel Construction Manual (2023)*, **Dincel wall vertical pour rate tables** and the following:

- Kinked hose: Discharge and dispose segregated concrete at the bottom of the kinked hose (0.1 m^3) before placing concrete in the Dincel wall modules.

Other concrete works:

- Horizontal transport:
  - . Use suitable conveyors, clean chutes, troughs, hoppers or pipes.
  - . Minimise jolting and vibration of concrete whilst transporting around site.
  - . Discharge vertically in a controlled manner into forms or further distribution equipment.
  - . Methods: Avoid segregation and loss of concrete, and minimise plastic settlement. Maintain a nominally vertical and plastic concrete edge during placement.

Note self-compacting concrete has a greater risk of segregation. Attention to appropriate concrete mix design, placement control methods and good control of admixture use will lower the risk of segregation with high-workability mixes.

- Horizontal elements: Place concrete in layers not more than 300 mm thick. Compact the following layer into previous layer before previous layer has taken initial set.
- Vertical elements: Limit the free fall of concrete to maximum of 2 m.

For Dincel walls, free fall can be considered limited if the pump hose is directed towards an internal web.

Fibre-reinforced concrete: For pumped concrete, use a 100 to 150 mm mesh screen on the pump hopper to catch fibre balls.

CIA CPN35 (2003) provides a list of additional pumping considerations for fibre-reinforced concrete as follows:

- Use of large diameter lines typically greater than 100 mm.
- Generally fibres should not be longer than 70% of the internal diameter.
- Avoid long lengths of flexible hose.
- Do not pump SFRC that is too wet or has been had water added to avoid a fibre plug.

Reinforcement: Maintain the documented concrete cover to reinforcement.

Dincel wall vertical pour rate table for high slump conventional concrete (min 180 mm slump at truck discharge) with vibration

Dincel Profile	Wall Height (m)	1st concrete lift (m)	Minimum waiting time (hour)	2nd concrete lift (m)	Minimum waiting time (hour)	3rd concrete lift (m)
110	Up to 3.0	3.0	-	-	-	-
	4.0	2.5	1.0	1.5	-	-
155	Up to 3.0	1.8	1.0	1.2	-	-
	3.6	2.0	1.0	1.6	-	-
	4.0	2.0	1.0	2.0	-	-
	4.5	2.0	1.0	1.5	1.0	1.0
	5.0	2.0	1.0	2.0	1.0	1.0
200	5.5	2.0	1.0	2.0	1.0	1.5
	6.0 and above	2.0	1.0	2.0	1.0	2.0
275	Up to 3.0	3.0	-	-	-	-
	3.6	2.0	1.0	1.6	-	-
	4.0	2.5	1.0	1.5	-	-
	5.0	2.5	1.0	2.5	-	-
	6.0 and above	2.5	1.0	2.0	1.0	1.5

Dincel wall vertical pour rate table for self-compacting concrete (680 mm spread ±50 mm)

Dincel Profile	Wall Height (m)	1st concrete lift (m)	Waiting time (hours)		2nd concrete lift (m)	Waiting time (hours)		3rd concrete lift (m)
155 200			Min	Max		Min	Max	
	Up to 3.0	1.8	1.0	3.0	1.2	-	-	-
	3.6	2.0	1.0	3.0	1.6	-	-	-
	4.0	2.0	1.0	3.0	2.0	-	-	-
	4.5	2.0	1.0	3.0	1.5	1.0	3.0	1.0
	5.0	2.0	1.0	3.0	2.0	1.0	3.0	1.0
	5.5	2.0	1.0	3.0	2.0	1.0	3.0	1.5
	6.0 and above	2.0	1.0	3.0	2.0	1.0	3.0	2.0
275	Up to 3.0	3.0	-	-	-	-	-	-
	3.6	2.0	1.0	3.0	1.6	-	-	-
	4.0	2.5	1.0	3.0	1.5	-	-	-

Dincel Profile	Wall Height (m)	1st concrete lift (m)	Waiting time (hours)		2nd concrete lift (m)	Waiting time (hours)		3rd concrete lift (m)
	5.0	2.5	1.0	3.0	2.5	-	-	-
	6.0 and above	2.5	1.0	3.0	2.0	1.0	3.0	1.5

These tables are applicable for use with self-compacting concrete and conventional concrete where aesthetics are critical. For project specific advice, contact Dincel.

The time between each concrete lift is based upon when the concrete achieves initial set. Consult the concrete manufacturer for confirmation of initial setting times. The initial setting time for self-compacting concrete (SCC) is generally 2 to 3 hours from the time of dispatch. The design engineer needs to account for any possible cold joints that may occur at pour breaks, particularly if the cold joint is below the permanent water table.

Dincel 275 profiles are available in standard lengths of up to 6.525 m. For taller walls, longer profiles can be specially ordered or alternatively use multiple profiles spliced together.

For Conventional concrete pours, vibrating is required. For SCC, no vibration is required besides shuffling between layers/concrete lifts.

Faster concrete placement, or placement with less layers, can be considered. However, this will increase the amount of surface deviation of the wall after concreting. Such placement may need to be considered with SCC mixes. If such placement is required contact Dincel for placement guidance. For SCC mixes, provide additional bracing and carefully seal formwork to resist the larger lateral pressures. Concrete pressure in large walls may result in a wavy finish unless multiple concrete lifts are considered.

See the *Dincel Construction Manual (2023)* for more information.

Dincel wall concrete placement monitoring

Thermal scanning: Inspect Dincel walls during placement of concrete to detect voiding and honeycombing.

Thermographic inspection is a common method for detecting voids and honeycombing in vertical elements during a pour such as walls and columns. Consider the inclusion of this *Optional* style text by changing to *Normal* style text, to include this additional quality control measure.

If not using this *Optional* style text, consider specifying a physical ‘knock’ test to detect possible areas of voids and/or honeycombing behind the permanent composite form systems. This can be considered an additional quality control measure and is typically undertaken by a structural engineer on-site.

Compaction

Dincel wall specific requirements:

- Conventional concrete: Use a 25 mm diameter pocket vibrator as appropriate to remove entrapped air and to fully compact the mix. Take care when using the vibrator not to damage the web-links of the Dincel wall modules and keep vibrator a minimum of 500 mm away from wall/column ends. Vibrate horizontal reinforcement bars to disperse surrounding concrete and to help eliminate voids.
- Self-compacting concrete: No vibration to be used. If wall requires multiple concrete passes, slightly agitate the top 400 mm of concrete between each lift.

Other concrete works:

- Methods: Use immersion and screed vibrators accompanied by hand methods as appropriate to remove entrapped air and to fully compact the mix.
- Vibrators: Do not allow vibrators to contact set concrete, reinforcement or items embedded in concrete including pipes and conduits. Do not use vibrators to move concrete along the formwork. Avoid causing segregation by over-vibration.

Placing records

Logbook: Keep on site and make available for inspection a logbook recording each placement of concrete, including the following:

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

Rain

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

Time between adjacent placements

Minimum time delay: As documented.

Document requirements in the **Minimum time delay schedule**.

Placing in cold weather

The *CCAA Data Sheet Cold-weather concreting (2004)* recommends taking precautions when the air temperature falls below 10°C. The effects on placing concrete in cold weather include:

- Extended setting times.
- Slower strength gain.
- Increased risk of cracking.
- Freezing.

Actions to reduce the risk of damage from cold weather include protecting the concrete from cold winds and reduced temperature.

Cement: Do not use high alumina cement.

Temperature limits: Maintain the following:

- Freshly mixed concrete: ≥ 5°C.
- Forms and reinforcement before and during placing: ≥ 5°C.
- Water: Maximum 60°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 ≥ 5°C.

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

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

Freezing: Prevent concrete from freezing.

Placing in hot weather

The *CCAA Data Sheet Hot-weather concreting (2017)* recommends taking precautions when the air temperature rises above 30°C, particularly when coupled with hot dry winds. The effects on placing concrete in hot weather include:

- Reduced setting time.
- Reduced workability and slump.
- Reduced compressive strength.
- Poor surface appearance.
- Increased tendency for plastic shrinkage and thermal cracking, decreasing the durability.

Actions to reduce the risk of damage from hot, dry and windy weather include:

- If hot weather is a known factor during design, plan for it. e.g. Consider the effect of complex reinforcement arrangements on concrete placing and compaction, and the spacing and location of joints.
- Reducing the temperature of aggregate stockpiles by wetting or shading and placing during cooler times of the day.
- Selecting the appropriate chemical admixtures and cement type.
- Minimising delays.
- Controlling the loss of water through evaporation by the use of aliphatic alcohol. Note aliphatic alcohol does not replace curing compounds.
- Protection of the concrete from wind.
- Proper curing.

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

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

Evaporation rate limit: ≤ 0.50 kg/m^2/h.

If this evaporation rate limit is exceeded during curing, there is an increased risk of plastic shrinkage cracking. Make sure both the temperature and evaporation rate limits are not exceeded during placement and curing.

For further information on how to estimate the evaporation rate on-site, refer to CCAA T41 (2020), Part XI Section 13.

Temperature control: Select one or more of the following methods to make sure the temperature of the concrete mix does not exceed 35°C:

- Cool the concrete using liquid nitrogen injection before placing.
- Cover horizontal transport containers.
- Forms and reinforcement before and during placing: ≤ 35°C.
- Spray the coarse aggregate using cold water before mixing.
- Use chilled mixing water.

In some high strength or special-class concrete, and particularly in concrete that is placed at thicknesses greater than 500 mm, the temperature differential between the core and surface of the concrete element may require consideration. Actions to minimise the risk of damage in such situations include:

- Reducing the maximum allowable temperature of concrete for delivery to site.
- Modifying the mix constituents to control the temperature rise in forms.
- Designing higher reinforcement ratios in the structure where there is a concern about cracking.
- A combination of all these methods to control the risks that have been identified.

Document here any additional requirements here.

Placing under water

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

3.11 JOINTS

Construction joints

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

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

Joint preparation: Scabble hardened concrete joint surface to a minimum 3 mm amplitude. Do not damage projecting reinforcing steel. Remove loose or soft material, foreign matter and laitance. Dampen the surface just before placing the fresh concrete and coat with a neat cement slurry.

Additional joint preparation for marine and aggressive environments:

- Wash the prepared joint surface and any projecting steel with clean fresh water to remove any salt deposits or other contaminants. Protect from further contamination and allow to dry naturally or blow dry with oil-free air.
- Coat the dried prepared joint surface with an approved wet-to-dry epoxy resin. Place the fresh concrete before the epoxy resin hardens.

Consider the inclusion of this *Optional* style text by changing to *Normal* style text for documenting additional requirements for construction joint preparation in marine or other aggressive environments.

Expansion and isolation joints

Expansion joint dowels: Make sure the location and alignment of installed dowels match the documented requirements. Make sure dowels are not displaced during concrete placement.

The installation of dowels are covered in *0312 Concrete reinforcement*.

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

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

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

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

Slip joints

General: Provide slip joints, as documented.

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

Slab-on-grade control joints

General: Provide control joints, as documented.

Tooled and sawn joints: Form joints within the concrete surface with either a grooving tool or a mechanical circular saw.

Typically for pavements using a top reinforcement mesh every second cross bar of the mesh is cut to provide a plane of weakness. Document requirements on the structural drawings.

Timing: Form joints as early as possible after placement of concrete. Make sure the concrete has hardened sufficiently to prevent dislodging aggregate.

Timing of saw cuts are very important as the concrete should not be too green that aggregates are dislodged during the process and not at a stage of setting that stress cracks are already forming before the joint has been formed. Joints are typically formed within the first 6 to 18 hours, provided that the ambient air temperature does not drop below 10°C during that period, and no more than 24 hours after placing the concrete, to avoid uncontrolled cracking.

Joint width: 3 to 5 mm wide.

Joint depth: A minimum of (0.25 - 0.33) x depth of the concrete.

3.12 SURFACE MODIFIERS

General

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

3.13 FORMED SURFACES

General

Surface finish: To AS 3610.1 (2018) Table 3.3.3.1 and as documented.

Document requirements in the **Surface finish class schedule** and the **Formed surface finishes schedule**.

Damage: Do not strip formwork prematurely if damage to the concrete may be caused.

It is difficult to repair damage from formwork stripping well enough to meet surface finish criteria. See AS 3610.1 (2018) Commentary C3.4.1 for more information.

Curing

Requirement: If formwork is stripped before the minimum curing period for the concrete has elapsed, continue curing the exposed faces as soon as the stripping is completed, and within an hour of exposure.

Evaluation of formed surfaces

General: If evaluation of a formed surface is required, complete the evaluation before surface treatment.

Finishing methods

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

Form removal: If vertical face formwork needs to be removed for finishing methods while the concrete is green, make sure the concrete has sufficiently set to prevent slump.

Blasted finishes:

- Abrasive: Blast the cured surface using hard, sharp graded abrasive particles until the coarse aggregate is in uniform relief.
- Light abrasive: Blast the cured surface using hard, sharp graded abrasive particles to provide a uniform matt finish without exposing the coarse aggregate.

Document the type of abrasive particles in SELECTIONS.

Bush hammered finish: Remove the minimum matrix using bush hammering to expose the coarse aggregate, recessing the matrix no deeper than half the aggregate size, to give a uniform texture.

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

See CCAA Briefing 02 (2007) for information on exposed aggregate finishes for flatwork.

Floated finishes:

- Sand floated finish: While the concrete is green, wet the surface and rub using a wood float. Rub fine sand into the surface until a uniform colour and texture is produced.

- Grout floated finish: While the concrete is green, dampen the surface and spread a slurry, using hessian pads or sponge rubber floats. Remove surplus slurry and work until a uniform colour and texture is produced.

Smooth rubbed finish: While the concrete is green, wet the surface and rub using a carborundum or similar abrasive brick until a uniform colour and texture is produced.

Only the more common finishing methods are listed. Add other project specific requirements (e.g. polished, coloured).

Dincel wall finish: As documented.

Dincel walls can be left raw, or alternatively a paint, render or cladding finish can be applied. Refer to the *Dincel Construction Manual (2023)* for allowable finishes and any required methods for applying finish to the Dincel wall components. Document the required finish and any requirements for such in the relevant *06 FINISH* worksection.

3.14 UNFORMED SURFACES

General

Surface finish: As documented.

Document requirements in the **Unformed surface finishes schedule**.

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

Finishing methods – primary finish

Machine float finish:

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

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

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

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

For burnished concrete finishes see the following publications:

- CCAA Briefing 05 (2006).
- *CCAA Data Sheet The specification of burnished concrete finish (2010)*.

The data sheet provides suggested specification clauses, which may be considered for inclusion by the engineer in the appropriate concrete worksections.

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

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

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

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

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

See CCAA Briefing 02 (2007) for information on exposed aggregate finishes.

Finishing methods – supplementary finish

Abrasive blast: After steel trowelling, abrasive blast the cured surface to provide texture or to form patterns without exposing the coarse aggregate, using hard, sharp graded abrasive particles.

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

Stamped and coloured pattern finish: Provide a proprietary finishing system.

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

For polished or honed concrete finishes see the following publications:

- CCAA Briefing 05 (2006).
- *CCAA Data Sheet The specification of honed or polished concrete finishes (2010)*.

The data sheet provides suggested specification clauses, which may be considered for inclusion by the engineer in the appropriate concrete worksections. The range of treatments to achieve and to embellish polished concrete surfaces is large, and includes colouring, texturing, patterning by saw cutting or inlaying of metal or timber strips or of tiles or pavers. The effect required should be comprehensively documented by the architect.

For slip resistance, a number of the unformed surface finishes listed satisfy the requirements, to differing degrees. Refer to *CCAA Data Sheet Slip resistance of polished concrete surfaces (2006)* and *CCAA Data Sheet Slip resistance of residential concrete paving surfaces (2003)*.

3.15 CURING

General

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

- Curing: Cure continuously from completion of finishing, when the concrete has set sufficiently not to be damaged by the curing process.
- Minimum curing period: Total cumulative number of days or fractions of days, during which the air temperature in contact with the concrete is above 10°C, conforms to AS 3600 (2018) clause 17.1.5 and the following, unless accelerated curing is adopted:
  - . Fully enclosed internal surfaces/Early age strength concrete: 3 days.
  - . Other concrete surfaces: 7 days.
- End of curing period: Prevent rapid drying out at the end of the curing period.
- Protection: Maintain at a reasonably constant temperature with minimum moisture loss, during the curing period.

Curing method: [complete/delete]

To limit early age shrinkage, consider using an aliphatic alcohol before the application of a curing compound.

Curing compounds

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

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

Self-levelling toppings: If also used as curing compounds, conform to AS 3799 (1998).

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

Water curing

Method: Select a method of ponding or continuous sprinkling that does not damage the concrete surface during the required curing period.

Wet hessian curing

Method: Place wet hessian sheets/bags over concrete surface. Keep hessian wet during the required curing period by regularly sprinkling with water. Protect from wind and traffic.

Impermeable sheet curing

Method: Place impermeable sheets, to ASTM C171 (2020), over concrete surface. Anchor down and tape joints in material to retain concrete moisture. Keep the concrete surface covered for the required curing period.

Cold weather curing

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

Hot weather curing

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

Dincel wall

Requirement: No additional curing methods required.

Use of Dincel wall allows for ideal curing conditions to the concrete via the polymer encapsulation.

3.16 TRAINING

General

Dincel training: Training for the installation of Dincel wall components can be provided by joining schedules sessions, and upon request from Dincel. Contact Dincel or visit the website for further information and to book a time.

3.17 COMPLETION

Early loading

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

Formwork removal

Extent: Remove formwork, other than permanent forms and trapped forms, including formwork in concealed locations.

Timing: Do not disturb formwork until concrete has reached sufficient hardness to withstand formwork movements and removal without damage.

Stripping:

- General: To AS 3600 (2018) where it is more stringent than AS 3610.1 (2018).
- Vertical formwork: To AS 3610.1 (2018) Appendix C Table C2.
- Multi-storey work: Remove formwork without disturbing props supporting succeeding floors.
- Post-tensioned concrete: Remove formwork supporting post-tensioned concrete members to AS 3600 (2018) clause 17.6.2.7.
- Dincel walls: No stripping of polymer permanent formwork required.

Removable bolts: Remove tie bolts without damaging the concrete.

Bolt hole filling: Provide material with durability and colour matching the concrete.

Recessed filling: Fill or plug the hole to 6 mm below the finished surface.

Curing: If formwork is stripped before the minimum curing period for the concrete has elapsed, continue curing the exposed faces as soon as the stripping is completed, within an hour of exposure.

Dincel wall bracing removal

General: Do not remove any installed bracing to Dincel wall components within 24 hours of pouring slab above or until roof has been attached. If early bracing removal is desired, submit proposals to the structural engineer for approval.

Protection

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

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

4 SELECTIONS

Schedules are a tool to specify properties required for products or systems. If the principal permits documentation of the product or system by proprietary name, some of the properties may be unnecessary and can be deleted. Document the product or system's location or application here and/or on the drawings with a matching project code. Refer to NATSPEC TECHnote GEN 024 for guidance on using and editing schedules.

4.1 SCHEDULES

Formwork dimensional deviation schedule

Dimension or measurement	Location or element	Deviation (mm)

Dimension or measurement: e.g. Absolute position.

Location or element: e.g. Class 2 surface, Class 3 surface.

Deviation (mm): e.g. 15. 20, 25.

Steel fibre reinforcement schedule

	A	B	C
Product			
Dosage (kg/m^3)			
Shape			
Tensile strength (MPa)			
Type/Group			
Diameter (mm)			
Length (mm)			
Aspect ratio			
Coating			

The codes in the header row of the schedule designate each application or location of the item scheduled. Edit the codes to match those in other contract documents.

Steel fibre reinforcement may be adequately specified by nominating the product and dosage. If nominating the product and dosage, the remaining properties in the schedule may not need to be completed.

Product: Nominate the product.

Dosage (kg/m^3): The amount of steel fibres required for the concrete mix measured.

Shape: Plain, Hook ends 1, Hook ends 2, Hook ends 3, crimped and enlarged end.

Tensile strength (MPa): Typically ranges between 1000 to 2300 MPa.

Type/Group: Depending on the standard used there are five different types/groups of steel fibres as follows:

- Cold-drawn wire.
- Cut sheet.
- Melt extracted.
- Shaved cold drawn wire.
- Milled from blocks.

Diameter (mm): Diameter of the steel fibre.

Length (mm): Length of the steel fibre.

Aspect ratio: The ratio of the length to the steel fibre diameter. Ratios typically vary between 30 and 80.

Coating: Galvanized or no coating.

Tendon schedule

Structural element	Tendon material	Tendon size (mm)

It is preferable for the tendon material and size to be shown on the drawings. If not, it may be scheduled here (do not duplicate).

Tendon material: Specify the type and grade of strand, wire or bar. See AS 4672.1 (2007) and AS/NZS 4672.2 (2007).

Tendon size: State the number and nominal diameter of strands, wires or bars in each tendon.

Concrete properties schedule – performance

Use this schedule if normal-class or special-class performance concrete is specified. Otherwise delete.

	A	B	C
Normal and special-class			
Air entrainment – air volume (%)			
Maximum aggregate			

	A	B	C
size (mm)			
Slump (mm)			
Strength grade/characteristic compressive strength f'_c (MPa)			
Special-class			
Bleed rate (mL/mm^2)			
Cement type			
Spread (mm)			
Density of hardened concrete (kg/m^3)			
Density of plastic concrete (kg/m^3)			
Early age strength (MPa)			
Flexural strength (MPa)			
Indirect tensile strength (MPa)			
Water:cement ratio maximum			
Drying shrinkage			
Duration of air drying			

The codes in the header row of the schedule designate each application or location of the item scheduled. Edit the codes to match those in other contract documents.

Concrete for all Dincel profiles

Requirement:

- Nominate 220 mm ± 40 slump. Minimum 180 mm slump (at the point of truck discharge) and compacted with use of vibration

OR

- Self-compacting concrete with no additional vibration. If wall requires multiple concrete passes, slightly agitate the top 400 mm of concrete between each lift. A supplied concrete spread of more than 600 mm can have water added onsite (to the instructions of the supplier) in order to achieve the target 680 mm to 730 mm spread. A minimum 670 mm spread after adding water is required for placing self-compacting concrete into Dincel wall profiles.

Concrete for Dincel wall 110 mm, 155 mm, 200 mm and 275 mm Series

Nominate the concrete mix to suit the design requirements. Refer to the concrete mix specification detailed in the *Dincel Construction Manual (2023)*.

General

Air entrainment – air volume (%): In climates subjected to freezing and thawing, air-entraining admixtures are recommended to improve the durability of the exposed concrete surfaces. Target air content is typically up to 5% for freeze/thaw durability.

Cement type: Typically GP (General Purpose Cement) or GB (General Purpose Blend). However, other special-class cement types such as HE (High Early Strength), LH (Low Heat), GL (General Purpose, Limestone Blend), SR (Sulfate Resisting) and SL (Shrinkage Limited) are available.

Spread (mm): For concrete mixes with a slump greater than 250 mm. Usually for high flowable mixes or self-compacting concrete. Delete if slump is less than 200 mm.

Drying shrinkage: Generally between 500 to 800 με and not more than 1000 με.

- Specifying unrealistically low standard 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 (2012) - *Specifying low drying shrinkage ≠ crack control*.
- If the concrete is special-class only because of the documentation of a drying shrinkage less than 1000 με, delete the special-class section of the schedule and simply document the required drying shrinkage on drawings.

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

Concrete properties schedule – prescription

Use this schedule if special-class prescription concrete is specified. Otherwise delete.

	A	B	C
Aggregate water absorption, maximum (%)			
Admixtures: Proportions			
Admixtures: Types			
Coarse aggregate: Proportions			
Coarse aggregate: Size (mm)			
Coarse aggregate: Types			
Coarse aggregate: Colour			
Fine aggregate: Proportions			
Fine aggregate: Types			
Minimum cement content (kg/m^3)			
Mix type			
Water:cement ratio, maximum			

The codes in the header row of the schedule designate each application or location of the item scheduled. Edit the codes to match those in other contract documents.

Tests schedule

Use this schedule if referenced in **TESTING**. Add in or substitute properties for which frequency of test sampling is different from that given in AS 1379 (2007), otherwise nominate to AS 1379 (2007). Delete this schedule if not referenced.

Property	Test method	Test/sampling frequency
Bleeding	AS 1012.6 (2014)	
Density of hardened concrete	AS 1012.12.1 (1998) or AS 1012.12.2 (1998)	
Density of plastic concrete	AS 1012.5 (2014)	
Indirect tensile strength	AS 1012.10 (2000)	
Modulus of rupture (flexural strength)	AS 1012.11 (2000)	

Control tests schedule

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

Special-class concrete testing schedule

Mix designation	Test	Compliance criteria	Frequency of special testing

Mix designation	Test	Compliance criteria	Frequency of special testing

Mix designation: Strength grade/Max Aggregate size/Target slump/Placing method to the CCAA T41 (2020) Part XI Section 6.1. For example S40/10/180/P denotes compressive strength grade of 40 MPa, 10 mm max aggregate size, target slump 180 mm and placed by concrete pump (P).

Test: State the test required including the method of testing. For example Drying Shrinkage to AS 1012.13 (2015).

Compliance criteria: State the compliance criteria. For example, maximum average drying shrinkage of samples to be below 850 micro-strain.

Frequency of special testing: State the test frequency. For example, trial mix only, or to the same frequency of compressive strength testing, or 1 sample per x m^3, etc.

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	

Test panels schedule

Application	Incorporated features	Panel size

Formed surface finishes schedule

	A	B	C
Surface finish class to AS 3610.1 (2018)			
Formwork lining type			
Bolt hole filling			
Evaluation			
Surface finishing method			
Abrasive particle type			

The codes in the header row of the schedule designate each application or location of the item scheduled. Edit the codes to match those in other contract documents.

Surface finish class to AS 3610.1 (2018): For applicability of surface classes, see AS 3610.1 (2018) Table 3.2.3.

Evaluation: Nominate if required. If required, carry out evaluation before application of surface treatment or coatings. Delete if not required.

Abrasive particle type: e.g. Steel shot or Fine aggregates.

Surface finish class schedule

	Class 1	Class 2	Class 3
Colour control			
Critical faces of elements			

	Class 1	Class 2	Class 3
Distance between face steps (mm)			
Form face span and direction of span			
Repairs	Not permitted		
Liner details, pattern and accuracy			
Surface pattern details and accuracy			
Surface treatment pattern			
Tie rod pattern			

Unformed surface finishes schedule

	A	B	C
Flatness tolerance class			
Primary finish			
Supplementary finish			
Slip resistance treatment			
Slip resistance classification			
Surface modifier			

The codes in the header row of the schedule designate each application or location of the item scheduled. Edit the codes to match those in other contract documents.

Flatness tolerance class: Class A, B or C. See **Flatness tolerance class table**.

Primary finish: e.g. Machine float, Steel trowel, Burnished, Wood float, Broom, Scored or scratch, Sponge or Exposed aggregate.

Suggested primary finish and flatness tolerance class for typical applied finishes:

- Carpet: Machine float finish, tolerance Class B.
- Floor tiles: Scored finish, tolerance Class C.
- Resilient finishes: Steel trowelled finish, tolerance Class A.
- Substrates for bitumen membranes: Wood float or light broom finish, tolerance Class B.
- Unfinished (plantrooms): Machine float, tolerance Class B.

Supplementary finish: e.g. Steel shot abrasive blast, Fine aggregate abrasive blast, Coloured applied, Stamped and coloured faux paved or cobblestone finish, Polished. Add product, method, colour, pattern and texture as required.

Slip resistance treatment: Select to manufacturer's recommendations.

Slip resistance classification: For selections refer to NATSPEC TECHnote DES 001, SA HB 197 (1999) and SA HB 198 (2014), and *CCAA Data Sheet Slip resistance of residential concrete paving surfaces (2003)*. Select the slip resistance test and classification to suit the location and application.

Surface modifier: Select to manufacturer's recommendations.

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 1012.5	2014	Determination of mass per unit volume of freshly mixed concrete
AS 1012.6	2014	Determination of bleeding of concrete
AS 1012.8.1	2014	Method for making and curing concrete - Compression and indirect tensile test specimens
AS 1012.8.2	2014	Method for making and curing concrete - Flexure 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 1012.10	2000	Determination of indirect tensile strength of concrete cylinders ('Brazil' or splitting test)
AS 1012.11	2000	Determination of the modulus of rupture
AS 1012.12.1	1998	Determination of mass per unit volume of hardened concrete - Rapid measuring method
AS 1012.12.2	1998	Determination of mass per unit volume of hardened concrete - Water displacement method

AS 1012.13	2015	Determination of the drying shrinkage of concrete for samples prepared in the field or in the laboratory
AS/NZS 1214	2016	Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series) (ISO 10684:2004, MOD)
AS/NZS 1314	2003	Prestressing anchorages
AS 1349	1986	Bourdon tube pressure and vacuum gauges
AS 1379	2007	Specification and supply of concrete
AS 1397	2021	Continuous hot-dip metallic coated steel sheet and strip - Coatings of zinc and zinc alloyed with aluminium and magnesium
AS 1478		Chemical admixtures for concrete, mortar and grout
AS 1478.1	2000	Admixtures for concrete
AS 1478.2	2005	Methods of sampling and testing admixtures for concrete, mortar and grout
AS 1530		Methods for fire tests on building materials, components and structures
AS 1530.4	2014	Fire-resistance tests for elements of construction
AS/NZS 1554		Structural steel welding
AS/NZS 1554.3	2014	Welding of reinforcing steel
AS/NZS 2327	2017	Composite structures - Composite steel-concrete construction in buildings
AS/NZS 2425	2015	Bar chairs in reinforced concrete - Product requirements and test methods
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 3582.4	2022	Pozzolans - Manufactured
AS 3600	2018	Concrete structures
AS 3610		Formwork for concrete
AS 3610.1	2018	Specifications
AS 3735	2001	Concrete structures for retaining liquids
AS/NZS 3750		Paints for steel structures
AS/NZS 3750.14	1997	High-build epoxy (two-pack)
AS 3799	1998	Liquid membrane-forming curing compounds for concrete
AS 3972	2010	General purpose and blended cements
AS 4586	2013	Slip resistance classification of new pedestrian surface materials
AS 4663	2013	Slip resistance measurement of existing pedestrian surfaces
AS/NZS 4671	2019	Steel for the reinforcement of concrete
AS 4672		Steel prestressing materials
AS 4672.1	2007	General requirements
AS/NZS 4672.2	2007	Testing requirements
AS/NZS 4680	2006	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 5131	2016	Structural steelwork - Fabrication and erection
AS 5216	2021	Design of post-installed and cast-in fastenings in concrete
AS 5637		Determination of fire hazard properties
AS 5637.1	2015	Wall and ceiling linings
AS 6669	2016	Plywood - Formwork
CM20242	2022	Dincel Wall
Dincel CM	2023	Construction manual
Dincel DM	2014	Dincel 3S Structural engineering manual - Revision 5
ASTM C171	2020	Standard specification for sheet materials for curing concrete
ASTM C939/C939M	2022	Standard test method for flow of grout for preplaced-aggregate concrete (Flow cone method)
ASTM C940	2022	Standard test method for expansion and bleeding of freshly mixed grouts for preplaced-aggregate concrete in the laboratory
EN 14889		Fibres for concrete
EN 14889-2	2006	Polymer fibres - Definitions, specifications and conformity

The following documents are mentioned only in the *Guidance* text:

AS 1012		Methods of testing concrete
AS 1012.3.1	2014	Determination of properties related to the consistency of concrete - Slump test
AS 1012.3.5	2015	Determination of properties related to the consistency of concrete - Slump flow, T_{500} and J-ring test
AS 1530		Methods for fire tests on building materials, components and structures
AS 1530.4	2005	Fire-resistance test of elements of construction
AS 3600 Supp 1	2022	Concrete structures - Commentary (supplement 1 to AS 3600:2018)
AS 3735 Supp 1	2001	Concrete structures for retaining liquids - Commentary
AS 3740	2021	Waterproofing of domestic wet areas
AS 4312	2019	Atmospheric corrosivity zones in Australia
SA HB 84	2018	Guide to concrete repair and protection
SA HB 197	1999	An introductory guide to the slip resistance of pedestrian surface materials
SA HB 198	2014	Guide to the specification and testing of slip resistance of pedestrian surfaces
SA TS 199	2023	Design of geopolymer and alkali-activated binder concrete structures
BCA F1D7	2022	Health and amenity - Surface water management, rising damp and external waterproofing - Damp-proofing of floors on the ground
BCA H1D4	2022	Class 1 and 10 buildings - Structure - Footings and slabs
BCA Spec 5	2022	Fire resistance - Fire-resisting construction

BCA S7C4	2022	Fire resistance - Fire hazard properties - Wall and ceiling linings
BCA Table S7C4	2022	Fire resistance - Fire hazard properties - Wall and ceiling linings - Wall and ceiling lining materials (material groups permitted)
ABCB HP	2022	ABCB Housing Provisions
BlueScope TB-14	2022	Professional's guide to Australian Standards for steel sheet and strip products
BRAC V20/01	2022	BRAC Certificate of Accrediation - Certificate number: V20/01
CCAA Briefing 02	2007	Exposed-aggregate finishes for flatwork
CCAA Briefing 05	2006	Polished concrete floors
CCAA Briefing 11	2010	Sustainable concrete materials
CCAA Briefing 12	2010	Thermal mass benefits for housing
CCAA Briefing 13	2010	Sustainable concrete buildings
CCAA Briefing 18	2011	Houses for flood-prone areas
CCAA Data Sheet BCF	2010	The specification of burnished concrete finish
CCAA Data Sheet CWC	2004	Cold-weather concreting
CCAA Data Sheet HPC	2010	The specification of honed or polished concrete finishes
CCAA Data Sheet HWC	2017	Hot-weather concreting
CCAA Data Sheet SRP	2006	Slip resistance of polished concrete surfaces
CCAA Data Sheet SRR	2003	Slip resistance of residential concrete paving surfaces
CCAA Data Sheet TCS	2018	Tolerances for concrete surfaces
CCAA Fact Sheet	2012	Specifying low drying shrinkage ≠ crack control
CCAA T41	2020	Guide to concrete construction
CCAA T49	2003	Guide to residential floors
CCAA T56	2018	Guide to residential slabs and footings in saline environments
CCAA T57	2006	Guide to off-form concrete finishes
CCAA T58	2007	Climate-responsive house design with concrete
CCAA T59	2008	Guide to concrete flatwork finishes
CCAA TN59	2017	Cements - manufacture, characterisation and use - The requirements of AS 3972 - 2010
CIA CPN17	2008	The use of galvanized reinforcement in concrete
CIA CPN28	2005	Watertight concrete structures
CIA CPN29	1996	Prestressed concrete anchorage zones
CIA CPN35	2003	Fibres in concrete
CIA Z3	2007	Grouting of prestressing ducts
CIA Z13	2001	Performance criteria for concrete in marine environments
CIA Z16	2011	Geopolymer recommended practice handbook
CIA Z36	2016	Formwork handbook
CIA Z40	2005	Super-workable concrete
Dincel GWJ Report	2023	Opinion with respect to Dincel wall and compliance with Section C (fire resistance) of the BCA
NATSPEC DES 001		Slip resistance performance
NATSPEC DES 006		Specifying concrete
NATSPEC DES 010		Atmospheric corrosivity categories for ferrous products
NATSPEC DES 020		Fire behaviour of building materials and assemblies
NATSPEC GEN 006		Product specifying and substitution
NATSPEC GEN 024		Using NATSPEC selections schedules
NATSPEC TR 01		Specifying ESD
NATSPEC TR 03		Specifying design and construct for mechanical services
SRIA Seismic Guide	2016	Guide to seismic design and detailing of reinforced concrete buildings in Australia
BS 6744	2023	Stainless steel bars - Reinforcement of concrete - Requirements and test methods