

PART CC05
STEEL REINFORCEMENT

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1. GENERAL

- .1 This Part specifies the requirements for the supply and placement of reinforcing steel used for the reinforcement of concrete structures. Refer to Part S24 Pre-tensioned Concrete and Part S25 Post-tensioned Concrete for requirements for steel prestressing materials.
- .2 Documents referenced in this Part are listed below:
 - (a) AS 1554.3: Structural Steel Welding - Welding of Reinforcing Steel
 - (b) AS 4671: Steel Reinforcing Materials
 - (c) AS 3600: Concrete Structures
 - (d) AS 5100: Bridge Design

Australasian Certification Authority for Reinforcing and Structural Steels (ACRS), available from <http://www.acrs.net.au>

2. QUALITY REQUIREMENTS

- .1 The Contractor shall prepare and implement a Quality Plan that includes detailed procedures for:
 - (a) verifying that the reinforcing has been fabricated and placed within the specified tolerances and providing documentary evidence of conformance.
- .2 If not provided beforehand, the procedures shall be submitted at least 28 days prior to the commencement of site work. Provision of the procedures listed in this Clause shall constitute a **HOLD POINT**.

3. SUPPLY AND PLACEMENT OF REINFORCING**General**

- .1 The reinforcing shall comply with AS 4671 and shall be fabricated and installed in accordance with AS5100.1 (highway related structures) or AS 3600 (all other structures) as appropriate. The Contractor shall provide certification that the reinforcing complies with AS 4671.
- .2 Manufacturers and processors of steel reinforcement shall hold a valid certificate of approval issued by the Australasian Certification Authority for Reinforcing and Structural Steels (ACRS). Refer to <http://www.acrs.net.au>. Provision of this certification shall constitute a **HOLD POINT**.
- .3 If Bar Bending Schedules are not supplied by the Principal, the Contractor shall supply copies of the Bending Schedules at least 2 working days prior to delivery of bars to the site. Provision of the Contractor's Bending Schedules shall constitute a **HOLD POINT**.

Fabrication and Bending

- .4 Reinforcement which requires fabrication or bending to shape shall be supplied in the full length shown on the drawings. Reinforcement shall be cold bent to the specified shape. Bars shall not be bent after fabrication unless shown on the drawings.

Laps

- .5 Straight bars shall be supplied to the full lengths shown on the drawings. Where lapping of straight bars is unavoidable, such laps shall be staggered and a minimum of two wire ties placed at each lap.

Welding of Bars

- .6 Welding of reinforcement shall not be used unless prior approval has been obtained. If approved, the welding shall be in accordance with AS1554.3. Any permitted tack welding shall be performed such that no loss of section of bars occurs. High strength bolts or rods cast into concrete shall not be welded.
- .7 Submission of a proposal for any welding of reinforcement shall constitute a **HOLD POINT**. Where appropriate, the proposal shall be supported by evidence that the welding will not be detrimental to the performance of the structure.

Placing and Fastening

- .8 Steel spacers (including plastic coated or tipped) shall not be used to maintain cover. Parallel layers of reinforcement shall be held in their correct relative positions by steel spacers only. If mortar block spacers are used to maintain cover, the blocks shall have properties at least equal to that of the surrounding concrete as specified and their colour and cement type shall be the same as that of the surrounding concrete.
- .9 Provision of evidence that mortar block spacers comply with this Clause shall constitute a **HOLD POINT**.

Cover and Tolerances

- .10 The cover (or "clear cover") as stated on the drawings, shall be the clear distance from the face of any reinforcement, wire ties for fixing reinforcement, formwork fixings or similar metal work to the nearest concrete surface. Tolerances on the position of reinforcement controlled by cover in bridge deck slabs shall be 5 mm. The Contractor's Quality system shall provide documented evidence that the reinforcement has been placed within the specified cover and tolerances.

4. MEASUREMENT

- .1 If the reinforcement mass has been provided by the Principal in the Schedule of Rates or Bill of Quantities, it has been calculated from the net lengths shown on the drawings excluding laps, hooks, bends, cogs and wastage and from the nominal bar diameters.

5. HOLD POINTS

- .1 The following is a summary of Hold Points referenced in this Part:

CLAUSE REF.	HOLD POINT	RESPONSE TIME
.2.2	Submission of Procedures	7 days
3.2	Certification of compliance with AS4671 and ACRS	1 day
3.3	Provision of the Contractor's Bending Schedules	1 day
3.7	Proposal to weld reinforcing bars	3 days
3.9	Evidence of compliance of mortar block spacers	1 day

6. VERIFICATION REQUIREMENTS AND RECORDS

- .1 The Contractor shall supply the following records:

CLAUSE REF.	SUBJECT	RECORD TO BE PROVIDED
3.1	Compliance with AS 4671 and ACRS	Certificate of conformance to AS 4671 and ACRS
3.10	Cover and tolerances	Evidence of conformance

PART CC10
FORMWORK

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1. GENERAL
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4. HOLD POINTS

1. GENERAL

- .1 This Part specifies the requirements for the design, erection and stripping of formwork.
- .2 Documents referenced in this Part are listed below:

(a) AS 3610	Formwork for Concrete
(b) AS 3972	Portland and Blended Cements
- .3 Unless specified otherwise, formwork shall comply with AS 3610 and the definitions in AS 3610 shall apply to this Part (Note that the definition of "formwork" is inclusive of "falsework").

2. QUALITY REQUIREMENTS

General

- .1 The Contractor shall prepare and implement a Quality Plan that includes detailed procedures and documentation for:
 - (a) formwork - design and materials; and
 - (b) formwork documentation (refer AS 3610, Section 4).
- .2 If not provided beforehand, the procedures and documentation shall be submitted at least 14 days prior to the commencement of site work. The Contractor shall ensure that the formwork documentation (refer AS 3610, Section 4) is completed and available on site at all times during formwork construction, use and dismantling.
- .3 Provision of the procedures and documentation listed in this Clause shall constitute a **HOLD POINT**.

Formwork Design

- .4 This sub-clause applies to any formwork where there would be serious consequences (such as a risk to the safety of any person, a delay to work on the critical path or a compromise to the quality of the Works) in the event of the failure of the formwork to perform as intended.
- .5 The formwork design shall be certified by a design engineer that the design complies with the requirements of this Contract. The design engineer shall be a Chartered Professional Engineer with qualifications admitting to Corporate Membership of the Institution of Engineers and be experienced in the design of structures / formwork.
- .6 Provision of the formwork design shall constitute a **HOLD POINT**.

3. CONSTRUCTION REQUIREMENTS

General

- .1 The Contractor shall ensure that the formwork will achieve the requirements of Part CC25 Placement of Concrete, Clause 7 "Surface Finish" and Clause 8 "Tolerances".

Stripping Times

- .2 Minimum formwork stripping times for vertical faces shall be in accordance with AS 3610, Table 5.4.1. Table 5.4.1 may also be used for stripping times in the case of beam or slab soffits provided that there is compliance with the following conditions:

- (a) The ratio of span between supports (permanent and/or retained temporary) to the overall depth of the member is less than:

$$\frac{280}{\sqrt{(D + 100)}}$$

where D is the overall depth of the section in millimetres;

- (b) the concrete conforms with Part CC20 Supply of Concrete; and
- (c) the concrete has a cementitious component limited to cement type GP or SR complying with AS 3972, without mineral additions to the concrete mix.

- .3 Where cement types GB, HE or LH are a component of the concrete or where a percentage of type GP cement has been replaced by flyash in accordance with Part CC20 Supply of Concrete, Clause 1.3.1 "Cement", the stripping times given above shall be doubled.
- .4 For steam cured and hot water cured precast units, stripping times may be reduced in accordance with Part CC35 Low Pressure Steam Curing of Precast Units or Part CC36 Heat Accelerated Curing as appropriate. In these cases, forms may be removed at the completion of steam curing or hot water curing.

Superimposed Loads

- .5 Superimposed loads shall not be placed on concrete slabs cast on top of precast planks or spanning between steel or precast concrete girders until 0.75 x the characteristic compressive strength of the cast-in-place concrete at 28 days is achieved. Superimposed loads shall be limited to 2.0 kN/m² or a point load of 2.0 kN until the characteristic compressive strength of the cast-in-place concrete at 28 days is achieved and until the concrete is at least 14 days old. Unless shown otherwise on the drawings, bridge decks shall be poured in one continuous operation without construction joints.

Composite Construction

- .6 All deck formwork for composite construction shall be completely supported from the superstructure girders except at bearing locations where it may be supported from the sill.

4. HOLD POINTS

- .1 The following is a summary of Hold Points referenced in this Part:

CLAUSE REF	HOLD POINT	RESPONSE TIME
2.3	Submission of procedures and formwork documentation	5 working days
2.6	Certification of formwork design by Chartered Professional Engineer	5 working days

PART CC20
SUPPLY OF CONCRETE

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9. VERIFICATION REQUIREMENTS AND RECORDS

1. GENERAL

.1 This Part specifies the requirements for the design, supply, sampling and testing of special class concrete and normal class in excess of 32MPa. Refer to Part CC26 Normal Class Concrete for the supply of N20, N25 and N32 normal class concrete.

.2 Concrete and its constituent materials shall be supplied and tested in accordance with the following:

- (a) AS 1012 Methods of testing concrete
- (b) AS 1141 Methods of sampling and testing aggregates
- (c) AS 1379 Specification and supply of concrete
- (d) AS 1478 Chemical admixtures for concrete
- (e) AS 2758.1 Aggregates and rock for engineering purposes - Concrete aggregates
- (f) AS 3582 Supplementary cementations materials for use with portland and blended cement
- (g) AS 3972 Portland and blended cements
- (h) TP541 Rapid Determination of the Chloride Permeability of Concrete
- (i) ASTM C1621/ C1621M-09b

Standard Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring

Vicroads Technical Note 30: Alkali Silica Reaction in Concrete, available from
<https://www.vicroads.vic.gov.au/~media/files/technical-documents-new/technical-notes/technical-note-tn-030--alkali-silica-reaction-in-concrete.pdf>

Vicroads Technical Note 73: Self Compacting Concrete, available from
<https://www.vicroads.vic.gov.au/~media/files/technical-documents-new/technical-notes/technical-note-tn-073--self-compacting-concrete.pdf>

Annexure B80/G Self-Compacting Concrete of NSW Roads and Maritime Services QA Specification B80 "Concrete Work for Bridges", available from
<http://www.rta.nsw.gov.au/doingbusinesswithus/specifications/index.html>.

RTA QA Specification B80 Concrete Work for Bridges

Vicroads Standard Specification 610 Structural Concrete

Vicroads Code of Practice RC500.16, available from <http://www.vicroads.vic.gov.au>.

Unless specified otherwise, the definitions in AS 1379 apply to this Part.

2. QUALITY REQUIREMENTS

.1 At a minimum, the Contractor's Quality Plan shall include the following documents, procedures and instructions:

- (a) the concrete mix design, including:
 - i. the source, type and proportions of the constituent materials;
 - ii. aggregate gradings and saturated surface-dry densities;
 - iii. chemical admixtures details and manufacturer's recommended method of use;

- iv. the nominated slump and where a superplasticizer is used the final slump;
- v. if self compacting concrete is proposed, details of the mix, T₅₀₀ (measure of viscosity) and passing ability;
- vi. the maximum water content and maximum water/cementitious material ratio;
- vii. level of control, accuracy and method of determination of both the coarse and fine aggregate moisture content; and
- viii. documented evidence that the mix will comply with all requirements specified from either previous production of the mix (the test results shall not be more than 12 months old) or full details of a trial mix undertaken in accordance with AS 1012.2.

(b) detailed procedures for concrete production, delivery, material testing and concrete testing.

- .2 If not provided beforehand, the documentation shall be submitted at least 28 days prior to the commencement of site work.
- .3 Provision of the procedures and documentation listed in this Clause shall constitute a **HOLD POINT**.
- .4 The Contractor is responsible for ensuring that the concrete mix design will achieve all of the requirements specified for plastic and hardened concrete. In the event of any change to the mix design, the above documentation shall be resubmitted prior to manufacture of the changed mix.

3. CONCRETE MATERIALS

Cement

- .1 Cement shall comply with AS 3972. Cement for each batch of concrete shall be from one manufacturer and of one brand and type. Cement more than 3 months old shall not be used in the Works unless it is re-tested to demonstrate compliance with the requirements of AS 3972.

Admixtures

- .2 Admixtures shall:
 - (a) comply with AS 1478.1;
 - (b) be dispensed using equipment complying with Clause 3.4 “Liquid Dispensing Equipment” of AS 1379;
 - (c) not contain calcium chloride; and
 - (d) not contain any chemical in a concentration which could have a detrimental effect on the concrete durability or any other concrete property.

Aggregate

- .3 Fine and coarse aggregate for concrete shall comply with the requirements of AS 2758.1 unless otherwise specified. The maximum sizes of coarse aggregates used shall not exceed the values shown in Table 3.3.

TABLE 3.3 MAXIMUM AGGREGATE SIZE		
Type of Concrete	Location	Maximum Size of Coarse Aggregate Permissible
All cases	Clear cover	0.75 x clear cover
Prestressed Concrete	All cases	20 mm
Reinforced Concrete	All sections whose least dimension is up to 300 mm	20 mm
	All sections whose least dimension is greater than 300 mm	40 mm
	Piles and closely reinforced sections	20 mm or 0.66 x the minimum clear distance between parallel reinforcing bars whichever is the lesser
Unreinforced Concrete	All cases	55 mm

- .4 Particle shape shall comply with Clause 9 "Verification Requirements and Records".
- .5 The aggregate, when used in the proposed mix design, shall not be susceptible to alkali aggregate reactivity and the Contractor shall provide evidence to verify this. Refer Vicroads Technical Note 30: Alkali Silica Reaction in Concrete, available from: <https://www.vicroads.vic.gov.au/~media/files/technical-documents-new/technical-notes/technical-note-tn-030--alkali-silica-reaction-in-concrete.pdf>.

Soluble Salts

- .6 The acid-soluble chloride-ion content of concrete as placed (expressed as the percentage of the total mass of cementitious material in the concrete mix) shall not be greater than:
 - (a) 0.1% for prestressed concrete;
 - (b) 0.15% for reinforced concrete;
 - (c) 0.03% for post-tensioning grout.
- .7 The sulphate content of concrete as placed (expressed as the percentage by mass of acid-soluble SO₃ to the total cementitious material in the concrete mix) shall not be greater than 5%. Sulphate and chloride-ion content shall be determined by testing of hardened concrete in accordance with AS 1012.20.

Self Compacting Concrete

- .8 Self Compacting Concrete (SCC) (also called self-consolidating concrete or super-workable concrete) is concrete that is able to flow and consolidate under its own weight, completely fill the formwork or bore hole even in the presence of dense reinforcement, whilst maintaining homogeneity and without the need for additional compaction. For further information, refer to Vicroads Technical Note 73: Self Compacting Concrete, available from: <https://www.vicroads.vic.gov.au/~media/files/technical-documents-new/technical-notes/technical-note-tn-073--self-compacting-concrete.pdf>,
- .9 SCC shall incorporate the various cementitious materials, coarse and fine aggregate and any additional fine materials, water and chemical admixtures in such proportions as required, to achieve the rheological characteristics of flow and self-compaction and an absence of segregation. SCC shall be produced using high range polycarboxylate type water reducers or conventional superplasticizers with a viscosity modifying admixture which include a viscosity modifying capability.

4. CONCRETE PROPERTIES

Concrete Class

- .1 Unless specified otherwise, all concrete supplied in accordance with this Contract is Special-Class Concrete. The minimum cementitious content and the maximum water-cement ratio for each particular grade of concrete shall be accordance with Table 4.1.

TABLE 4.1 CEMENT AND WATER CONTENT		
CLASS OF CONCRETE	MINIMUM CEMENTITIOUS CONTENT (Kg) PER CUBIC METRE OF CONCRETE	MAXIMUM WATER-CEMENT RATIO BY MASS (SSD BASIS)
32	320	.58
40	380	.50
50	460	.40

- .2 The exposure classification shall be as shown on the drawings.

Self Compacting Concrete

- .3 SCC shall be homogeneous and free of balls of unmixed material. SCC shall only be used for the manufacture of precast concrete members and / or the construction of cast in-situ piles. The properties of fresh SCC shall comply with either:
 - (a) the requirements specified in Clause 9 "Verification Requirements and Records"; or
 - (b) Annexure B80/G – Self-Compacting Concrete of NSW Roads and Maritime Services QA Specification B80 "Concrete Work for Bridges", available from <http://www.rta.nsw.gov.au/doingbusinesswithus/specifications/index.html>.

5. SAMPLING AND TESTING

- .1 All concrete shall be subject to Project Assessment unless specified otherwise on the drawings.
- .2 For Project Assessment, the following sampling and testing shall be undertaken in addition to that specified in AS1379:
 - (a) A slump test (or Slump Flow if self compacting concrete is used) on each truck load of concrete delivered to site; and
- .3 sampling in accordance with Table 5.3

TABLE 5.3 SAMPLING FREQUENCY (per day)	
No. of batches (trucks) supplied to the Project	No. of samples to be taken
1	1
2 to 5	2
Greater than 5	For each additional 5 batches: One additional sample

- .4 Samples shall be selected randomly.
- .5 Three cylinder specimens shall be obtained from each sample, to be tested as follows:
 - (a) one tested at 7 days (to give an indication of the likely 28 strength only); and
 - (b) the remaining 2 cylinder specimens tested at 28 days (conformance testing).
- .6 If the Contractor proposes to conduct in-house testing for determination of concrete strength for lifting or transfer, evidence shall be provided showing that:
 - (a) the testing equipment is adequately calibrated and maintained;
 - (b) the testing processes are appropriate; and
 - (c) the testing personnel are adequately trained.

6. HIGH DURABILITY CONCRETE

- .1 This clause only applies where high durability concrete has been specified on the drawings. High durability concrete shall have a chloride permeability of less than 1 500 coulombs as measured by TP541 Rapid Determination of the Chloride Permeability of Concrete (refers AASHTO T277 and ASTM C1202).
- .2 The test acceptance of a concrete mix design shall be carried out on test specimens taken from a concrete sample of age 28 days, which has undergone standard moist curing. The sample shall consist of 2 cylinders and one test specimen shall be taken from the upper section of each cylinder. The value of chloride permeability shall be taken as the average of the results of the two tests. Frequency of sampling and testing shall be as Table 6.2:

TABLE 6.2 HIGH DURABILITY SAMPLING FREQUENCY	
COMPONENT	NO. OF SAMPLES TO BE TAKEN
Initial mix design	1 per mix design
Piles	1 from first concrete pour 1 in each subsequent 30 piles
Pile caps	1 from first concrete pour 1 from fourth pile cap pour
Skirts and fender beams	1 from first concrete pour for each element
Piers	1 from first concrete pour 1 from fourth pier pour

TABLE 6.2 HIGH DURABILITY SAMPLING FREQUENCY	
COMPONENT	NO. OF SAMPLES TO BE TAKEN
Abutments	1 from each abutment pour

- .3 The Contractor may propose an alternative testing regime using acceptance criteria of a standard not less than RTA QA Specification B80 Concrete Work for Bridges, Clause 3.2.1 "Durability Provisions A (performance)" or Vicroads Standard Specification 610 Structural Concrete, Clause 610.06. Any such testing regime is subject to prior approval in accordance with Special Conditions of Contract Clause 21 "Alternatives Proposed by the Contractor".

7. TEST PROCEDURES

- .1 The Contractor shall use the following test procedures (refer http://www.dpti.sa.gov.au/contractor_documents) to verify conformance with the Specification as Table 7.1:

Table 7.1 Test Procedures	
TEST	TEST PROCEDURE
Rapid determination of the chloride permeability of concrete	TP541 (refers AASHTO T277 and ASTM C1202)
Slump test	AS 1012.3
Compressive strength of concrete specimens	AS 1012.9
Self Compacting Concrete - Slump flow, T500 time (measure of viscosity) and passing ability	Vicroads Test Method 252.01 *
Standard Test Method for Passing Ability of Self-consolidating Concrete J-Ring	ASTM C1621/C1621M-09b

* Included in the Vicroads Code of Practice RC500.16, available from: <http://www.vicroads.vic.gov.au>.

8. HOLD POINTS

- .1 The following is a summary of Hold Points referenced in this Part:

CLAUSE REF.	HOLD POINT	RESPONSE TIME
2	Submission of mix designs and procedures	2 working days

9. VERIFICATION REQUIREMENTS AND RECORDS

Test Records

- .1 The Contractor shall undertake the testing specified in this Clause and supply written evidence of compliance with the lot package.

CLAUSE REF.	SUBJECT	PROPERTY	PROCEDURE	FREQUENCY	ACCEPTANCE LIMITS
3.3	Aggregate Properties (Project Assessment only)	Particle Shape	As specified in AS 2758.1, Clause 8.3	At least once for each aggregate type	As specified in AS 2758.1, Clause 8.3
		Water absorption	As specified in AS 2758.1, Clause 7.3	At least once for each aggregate type	< 2.5%
3.8	Self Compacting Concrete (if not using)	slump flow	Vicroads RC 252.01	Refer Clause 5 "Sampling and Testing"	550-750mm spread. Aggregate shall be evenly distributed throughout the concrete paste & shall not exhibit signs of segregation.

CLAUSE REF.	SUBJECT	PROPERTY	PROCEDURE	FREQUENCY	ACCEPTANCE LIMITS
	RMS B80 Specification)	T500 time (measure of viscosity)	Vicroads RC 252.01	Refer Clause 5 "Sampling and Testing"	A spread of 500 mm within 2 – 5 seconds. The final spread shall not exceed 750 mm diameter
		Passing Ability	Vicroads RC 252.01	Refer Clause 5 "Sampling and Testing"	The concrete shall not exhibit signs of segregation.
4 & 5	Concrete Properties	Cement and Water Content	Determined from identification certificate (refer AS1379 Clause 1.7.3)	Each truck load	Table 4.1
		Slump	Refer AS1379	Each truck load	Refer AS1379 Clause 5.2
		Compressive Strength– Production Assessment	Refer AS1379	Refer AS1379	Refer AS1379
		7 day Compressive Strength– Project Assessment	Refer AS1379	Refer Table 5.1 and Clause 5	Report Only
		28 day Compressive Strength– Project Assessment	Refer AS1379	Refer Table 5.1 and Clause 5	Refer AS1379
6	High Durability Concrete	Permeability Limit	TP541	Refer Table 6.1	< 1500 coulombs

Other Records

.2 The Contractor shall supply the following records:

CLAUSE REF.	SUBJECT	RECORD TO BE PROVIDED
5	In-house testing of concrete properties	Evidence of satisfactory equipment and processes and trained personnel
5	Concrete Delivery Information	Identification certificates in accordance with AS 1379: Clause 1.7.3 "Identification Certificate"
5	7 day compressive strength	If the result is < 65% of the specified 28 day compressive strength, a report outlining the Contractor's proposed disposition is to be provided within 2 days of completion of the test.

PART CC25
PLACEMENT OF CONCRETE

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10. FIGURE 1 - EVAPORATION RATE FROM FRESHLY PLACED CONCRETE

1. GENERAL

- .1 This Part specifies the requirements for the placement, curing and stripping of concrete and the properties of the finished product.
- .2 Documents referenced in this Part are listed below:
 - (a) AS 1379 The Specification and Manufacture of Concrete
 - (b) AS 1478.1 Admixtures for Concrete
 - (c) AS 2758.1 Concrete Aggregates
 - (d) AS 3610 Formwork for Concrete
 - (e) AS 3600 Concrete Structures
 - (f) AS 3799 Liquid Membrane - Forming Curing Compounds for Concrete
 - (g) AS 3972 Portland and Blended Cements
 - (h) HB64 Guide to Concrete Construction (joint publication of the Cement and Concrete Association of Australia and Standards Australia)

Microroads Standard Specification 687 Repair of Concrete Cracks and 689 Cementitious Patch Repair of Concrete, available from <http://webapps.vicroads.vic.gov.au/VRNE/csdspeci.nsf/>

2. QUALITY REQUIREMENTS

- .1 At a minimum, the Contractor's Quality Plan shall include the following documents, procedures and instructions:
 - (a) procedures describing the proposed method of placing, compacting, finishing and curing the concrete, including the rate of placement, the number of personnel required and their responsibilities and required competencies, and the plant and equipment to be used, including required standby equipment;
 - (b) procedures for set out and level control for bridge deck pours (where applicable);
 - (c) procedures describing the measures that will be taken to protect freshly placed concrete and prevent evaporative moisture loss during finishing operations of concrete slabs;
 - (d) details of the materials and measures to ensure compliance with the specified curing requirements;
 - (e) the type of curing compound; and
 - (f) procedures for precast abutment panel construction and installation (where applicable).
- .2 If not provided beforehand, the documentation shall be submitted at least 28 days prior to the commencement of site work.
- .3 Provision of the procedures and documentation listed in this Clause shall constitute a **HOLD POINT**.

3. CONCRETE PLACEMENT

General

- .1 Prior to placing concrete, a **HOLD POINT** shall apply. At least 24 hours notice shall be provided prior to placing concrete. If not previously provided, the Contractor shall submit evidence verifying that the reinforcement has been placed within the specified cover and tolerances (refer Part CC05 Steel Reinforcement, Clause 3.6 "Cover and Tolerance").
- .2 Except where amended or added to by this Contract, concrete shall be transported, handled, placed, compacted, finished and cured in accordance with AS 3600, using the recommended processes described in HB64. Hand mixing is not permitted.

Stand-By Mixing Plant

- .3 The Contractor shall ensure that alternative supplies of concrete from stand-by mixing plant(s) can be made available immediately in the event of breakdown.

Traceability of Concrete

- .4 All concrete batches (truckloads) used in the works shall be traceable from the batch plant to its general location in the structure by a unique identification number.

Temperature at Time of Delivery

- .5 Concrete when delivered at the acceptance point shall have a temperature not less than 5°C nor greater than 35°C (refer AS 1379, Clause 4.4.2).

Construction Joints

- .6 All mandatory joints are shown on the drawings. Any proposal for additional planned joints shall constitute a **HOLD POINT**. All construction joints, including those with keys or dowels, shall be roughened to expose aggregate to provide a bond between the new and old concrete.

Environmental Conditions for Placing Concrete

Requirements for Temperature and Other Adverse Conditions

- .7 Concrete shall not be placed if the air temperature at the site is below 5°C or the shade temperature at the site is over 35°C. Concreting in the open shall not be carried out during adverse conditions, such as rain, wind, dust or bushfires.

Additional Requirements for Elements with high Area to Volume Ratios

- .8 Concrete shall not be placed in decks, approach slabs and like elements with an area to volume ratio greater than or equal to 5 unless the rate of evaporation determined in accordance with Figure 1 at the end of this Part is less than 1 kg/square metre/hour. In addition, concrete shall not be placed when the rate of evaporation is between 0.5 kg/square metre/hour and 1 kg/square metre/hour unless precautionary measures are taken to ensure the concrete can be placed and finished without defects.

Self Compacting Concrete

- .9 SCC shall not be vibrated. The concrete shall not be subjected to any physical disturbance after deposition.

4. FINISHING OF UNFORMED CONCRETE SURFACES

General

- .1 Finish on unformed concrete surfaces are classified as follows:
 - (a) Finish U1 - Screeded Finish
 - (b) Finish U2 - Wood Floated Finish
 - (c) Finish U3 - Steel Floated Finish

Finish U1 - Screeded Finish

- .2 A screeded finish will be applied to bridge decks and other surfaces that will be later covered with a bituminous wearing surface or to walkways and other surfaces required to take pedestrian traffic. The surface

will be screeded, wood floated and then roughened by broom when the concrete has set sufficiently, to produce regular marks approximately 3 mm deep.

Finish U2 - Wood Floated Finish

- .3 A wood floated finish shall be applied to all surfaces that are not required to have either a U1 or U3 finish.

Finish U3 - Steel Floated Finish

- .4 Unless otherwise specified, a steel floated finish shall be applied to prominently exposed surfaces such as tops of wing walls, parapets, end walls, kerbs and the like. The steel floated finish shall provide a smooth uniform surface, true to line and level and free of marks.

5. CURING

- .1 All curing compounds shall comply with AS 3799. Concrete shall be cured for 7 days when the concrete contains cement Types GP or SR complying with AS 3972 without mineral additions to the concrete mix, except that decks, footways, approach slabs and like elements with an area to volume ratio greater than or equal to 5 shall be cured for 14 days. Unless otherwise specified all elements shall have an exposure classification of B1 (refer AS 3600, Clause 4.5).
- .2 Where cement Types GB or LH are a component of the concrete the curing times given above shall be doubled. Curing compounds shall not be applied to the upper surface of bridge decks unless approved otherwise.
- .3 For steam cured and hot water cured precast units, curing times may be reduced in accordance with Part CC35 Low Pressure Steam Curing of Precast Units or Part CC36 Heat Accelerated Curing as appropriate. In these cases, curing may be considered complete at the end of the curing cycle.

6. CRACKING OF CONCRETE

- .1 At all times after placement of the concrete, the width of any crack measured at the concrete surface shall not exceed:
- (a) pre-cast pre-stressed concrete: 0.10 mm;
- (b) all other concrete: the relevant value specified in Table 6.1

Exposure Classification	Maximum Acceptable Crack Widths (mm)
A	0.20
B1	0.20
B2	0.15
C, U	0.10

- .2 In the event that crack(s) exceed the values specified above, the Contractor shall:
- (a) undertake an assessment of the cracked concrete structure (prepared by a technical specialist with a minimum of 5 years practical experience in the diagnostic assessment and investigation of concrete structures) to evaluate the influence of cracks on the load bearing capacity, serviceability and durability;
- (b) establish the cause(s) of the cracks, crack width, the moisture condition of the crack and whether a crack is active or inactive;
- (c) prepare crack repair procedure / plan; and
- (d) repair the cracks to a standard not less than that specified in Vicroads Standard Specification 687 Repair of Concrete Cracks or 689 Cementitious Patch Repair of Concrete (as appropriate).
- .3 Submission of the crack repair procedure / plan shall constitute a **HOLD POINT**.

7. SURFACE FINISH

Class

- .1 The class of finish (as defined in AS3610) on formed concrete surfaces shall comply with the following:
- Totally concealed areas such as footings and foundation beams – Class 4.
 - All other surfaces concealed from view such as back faces of abutment walls, retaining walls and wing walls - Class 3.
 - Visible surfaces such as front faces of abutment walls, retaining walls and wing walls, and both faces of piers and underside of deck slabs - Class 2. Tie rods shall be installed in a regular pattern.
 - Visible surfaces such as kerbs, end walls and deck slab edges - Class 2. No tie rods will be permitted for these surfaces.

Test Panels

- .2 Notwithstanding the requirement of AS 3610 for Class 2 finishes, no test panels are required.

Acceptable Surface Defects and Deviations

- .3 In addition to the requirements of AS 3610, all fins and irregular projections shall be removed, and broken arises and edges repaired. All blowholes of greater depth than 10% of the specified cover shall be filled with an acceptable material.

8. TOLERANCES

- .1 The deviation between the specified position / dimensions shown on the drawings / documentation and the finished concrete work shall not exceed the lesser of the tolerances specified in this Clause and those specified in AS 3610, Table 3.4.2.
- .2 The soffits of arches, box girders, beams and deck edges shall be continuous curves or straight lines as shown on the drawings, free from all visible irregularities.
- .3 Cast in situ slipformed concrete kerbs and barriers and cast in situ off-structure concrete barriers shall comply with the tolerance requirements for precast concrete units as stated in Table 8.5. In addition, the vertical and horizontal alignment between adjacent segments shall not exceed 5 mm.
- .4 Unless specified otherwise, the tolerances in this Clause are specified in mm.

Item	Tolerance (mm)
Placing of reinforcement	5
Placing of post-tensioning sheathing	5
Concrete cover	0 to +5

Item	Tolerance (mm)
<p>(i) the reduced level of the inverts of cast-in-place open channel linings and culvert floors</p> <ul style="list-style-type: none"> * when the specified gradient is 0.10% or less: -5 to +5 * when the specified gradient is greater than 0.10% but not more than 0.20% -15 to +15 * when the specified gradient is greater than 0.20%: -25 to +25 <p>with the proviso that</p>	
Notwithstanding the above tolerances, the invert of the structure shall not impede the gravity flow of water into or from the structure	

TABLE 8.4: PRE-TENSIONED CONCRETE	
Item	Tolerance
* Dimension - < 2 m - > 2 m * Out of square - > 2 m	-3 to +3 -6 to +6 0.5 in 250, or Desirable 3, Maximum 5
(ii) Strand and Reinforcement * Placing of reinforcement * Placing of prestressing strand * Concrete cover	5 3 0 to +5
(iii) Squareness of Ends * Dimension - < 500 mm * - > 500 mm	Deviation from a plane perpendicular to the longitudinal axis of a member, or from the specified end plane: 3 6 mm per metre (10 mm maximum)
(iv) Length * Diagonal length for precast unit * Overall length or length centre to centre of bearings (for beams and slabs) * Centre to centre spacing of holes for transverse rods or both	5 0.06% x specified length (max 20) 5
(v) Profile in a Vertical Plane (Hog)	The deviation in hog of any unit from the mean hog of all units shall not vary by more than 0.07% of the length of the units. The absolute value for hog for any unit shall not be less than zero. Hog measurements shall be made at transfer of prestress.
(vi) Profile in a Horizontal Plane (Bow)	The deviation of a unit from the required profile shall not exceed 0.06% of the length of the unit or a maximum of 15 mm.
(vii) Twist	The angular rotation of any cross section relative to an end cross section shall not exceed 1 in 200.
(viii) Sole Plates	The plane of the sole plate or bearing surface shall not vary from that shown on the drawings by more than 1 in 200 in any direction.
(ix) Deviation * The distance of any point from a flat plane held against that surface.	3 mm in 2 m

TABLE 8.5: PRECAST CONCRETE UNITS	
Item	Tolerance
(i) General * Placing of reinforcement * Placing of sheathings for post-tensioned segmental components * Concrete cover	5 5 0 to +5
(ii) Cross Section * Dimension - < 2 m - > 2 m * Out of square	0 to +3 0 to +6 Maximum 5
(iii) Squareness of Ends * Dimension - < 500 mm * - > 500 mm	Deviation from a plane perpendicular to the longitudinal axis of a member, or from the specified end plane: 3 mm 6 mm per metre (10 mm maximum) For parapet units and new jersey barriers, the deviation from a plane perpendicular to the longitudinal axis shall not exceed 3 mm.

Item	Tolerance
(iv) Length * Diagonal length for precast unit * Overall length or length centre to centre of bearings (for beams and slabs) * Centre to centre spacing of holes for transverse rods or bolts * Overall length for parapets and new jersey barriers	5 0.06% x specified length (max 20) 5 3
(v) Profile in a Vertical Plane (Camber)	The deviation of a unit from the design camber, after allowance has been made for the deflection due to the mass of the member, shall not exceed 0.10% of the length of the unit with a maximum of 6 mm. Measurement of camber shall be made at the mid-point of the member which shall be supported at the bearing positions.
(vi) Profile in a Horizontal Plane (Bow)	The deviation of a unit from the required profile shall not exceed 6 mm or 0.10% of the length of the unit, whichever is the greater. Bow in precast parapet units and new jersey barriers shall not exceed 3 mm.

9. HOLD POINTS

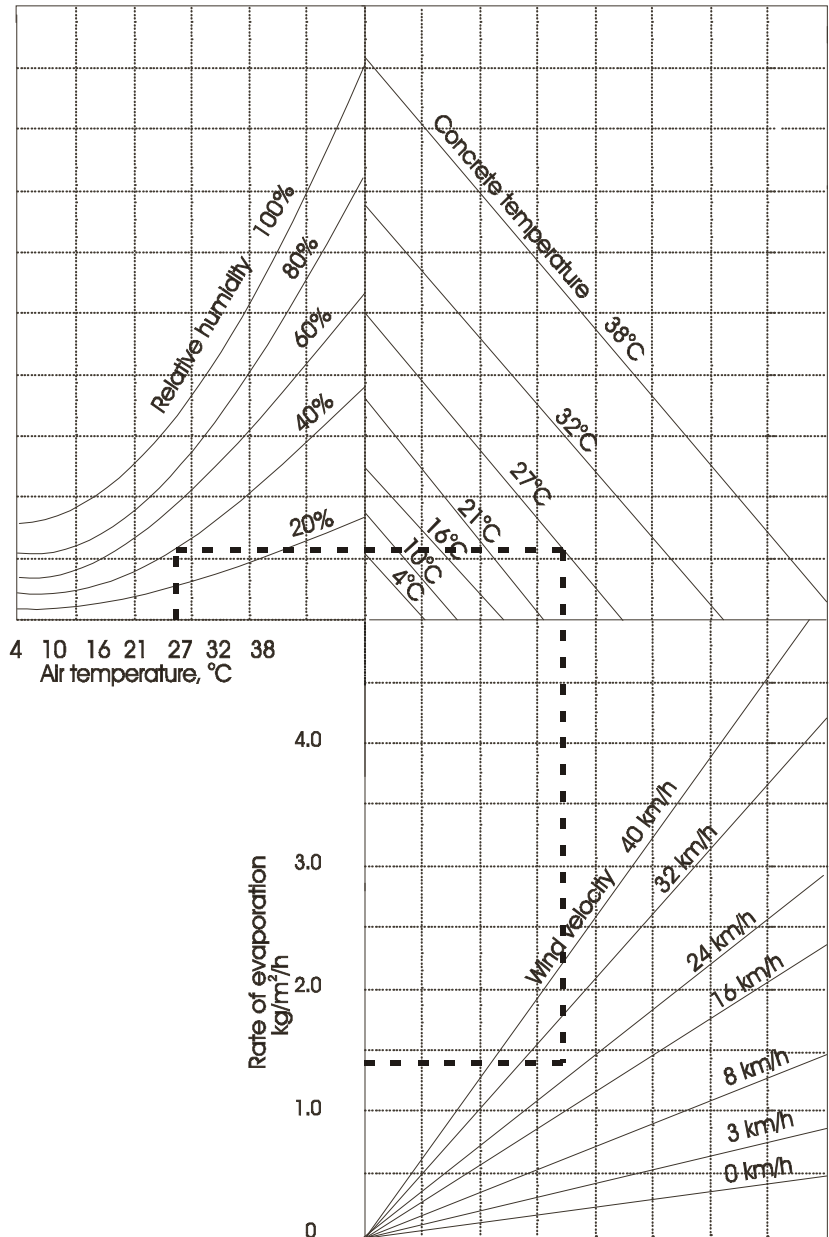
.1 The following is a summary of Hold Points referenced in this Part:

CLAUSE REF.	HOLD POINT	RESPONSE TIME
2.3	Submission of mix designs and procedures	2 working days
3.1	Prior to placing concrete	6 hours
3.6	Proposal for additional planned construction joints	5 working days
.3	Submission of Crack Repair Procedure / Plan	7 working days

10. **FIGURE 1 - EVAPORATION RATE FROM FRESHLY PLACED CONCRETE**

TO USE THIS CHART:

1. Enter with air temperature.
Move up to relative humidity.
2. Move right to concrete temperature.
3. Move down to wind velocity.
4. Move left read approximate rate of evaporation



Example:

- * with air temperature at 27°C
 - * with relative humidity at 40%
 - * with concrete temp. at 27°C
 - * with a wind velocity of 26 km/h
- rate of evaporation would be 1.4 kg/m²/h

The graph shows the effect of air temperature, humidity, concrete temperature and wind velocity together on the rate of evaporation of water from freshly placed and unprotected concrete.

Ref: American Concrete Institute, "Manual of Concrete Practice"