

# Structures

## Master Specification

### ST-SC-C4 Sprayed Concrete Work

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## ST-SC-C4 Sprayed Concrete Work

### 1 General

- 1.1 This Part specifies the requirements for the application of sprayed concrete. Sprayed concrete must only be used where shown on the drawings.
- 1.2 Unless specified otherwise, all design and / or documentation must comply with the most recent revisions (including published amendments) of the following design standards and / or specifications:
- a) AS 1012.14                      Method for Securing and Testing Cores from hardened Concrete for Compressive Strength.
  - b) AS 3610-1995                  Formwork for Concrete.
  - c) AS 3799                          Liquid Membrane – Forming Curing Compounds for Concrete.
  - d) CIA.Z5-2010                   Recommended Practice – Shotcreting in Australia.

### 2 Quality Requirements

- 2.1 At a minimum, the Contractor's Quality Plan must include the following documents, procedures and / or instructions:
- a) evidence of sustainability of proposed equipment; and
  - b) evidence of competence of personnel applying concrete.
- 2.2 If not submitted beforehand, this documentation must be submitted at least 28 days prior to the commencement of site work.
- 2.3 Provisions of the procedures listed in this Clause shall constitute a **Hold Point**.

### 3 Mix Design and Placement Method

- 3.1 Concrete must comply with ST-SC-S7 "Supply of Concrete". The Contractor must provide certified evidence of the strength gain characteristics and that the sprayed concrete mix will reach the required characteristic compressive strength.
- 3.2 In addition, the Contractor must spray a test panel of dimensions 1000x1000x250 mm, and provide reinforcing over half of the area of the panel. The test panel must be sprayed in the same position, with the same equipment, placing crew, concrete mix and reinforcement as proposed for the work.
- 3.3 In accordance with AS 1012.14, the Contractor must secure two cores from the unreinforced section of the panel. Cores must be dry conditioned and tested for 7 day compressive strengths, which must be compared with strength gain data from the documentary evidence for acceptance of the mix design. A further two cores must be secured from the reinforced section of the panel at age 7 days for assessment, by the Contractor, of the placement of the concrete adjacent to the reinforcement, and hence qualification of placing equipment and operators.
- 3.4 Cores must be 100mm diameter and must maintain a 2:1 length:diameter ratio. The reinforced cores must be retained by the contractor for the duration of the Contract and must be made available on request.
- 3.5 Provision of evidence of the concrete strength characteristics and test results shall constitute a **Hold Point**.

### 4 Project Assessment

- 4.1 As the work progresses, the Contractor must spray unreinforced production test panels of dimensions 500x500x250mm. The panels must be sprayed in the same position as the work using the same operators and must be produced at the rate of one panel per 10m<sup>3</sup> of concrete, or two

- panels per day, whichever is greater. Panels must be cured by the same method as the work, and stored on site.
- 4.2 Three cores must be taken from each test panel in accordance with AS 1012.14 for testing for compressive strength. Cores must be 100mm diameter and must maintain a 2:1 length:diameter ratio. Cores must be dry conditioned and compressive strengths of cores must be used for acceptance of the concrete in the work.

## 5 Applications of Sprayed Concrete

### General

- 5.1 Following placement of reinforcement and surface preparation and prior to spraying of concrete a **Hold Point** shall apply. The Contractor must arrange a joint inspection.
- 5.2 The delivery equipment and placement procedures must comply with the requirements of the document "Recommended Practice – Shotcreting in Australia" published by the Concrete Institute of Australia.
- 5.3 Where sprayed work is approved using fibre reinforcement only, reinforcement crossing construction joints will be required.

### Placement of Sprayed Concrete

#### Equipment and Techniques

- 5.4 The equipment used must be capable of delivering materials to the nozzle at a uniform rate at a velocity of discharge which will produce a dense coating with maximum adherence of material, minimum rebound and with no sloughing or sagging.
- 5.5 Equipment provided must allow the nozzle at all times to be maintained at a distance of 1m normal to the surface on which sprayed concrete is to be applied. Spraying must be discontinued, or sufficient screening of the nozzle stream must be provided, if wind or air current causes separation of the nozzle stream during placement.
- 5.6 Only personnel, who have successfully demonstrated their competency, by the production of test sections of sprayed concrete in both horizontal and vertical positions, must be employed.

#### Bonding to Existing Surface

- 5.7 Absorptive substrate surfaces must be dampened prior to placement of the sprayed concrete to facilitate bond and to reduce possibility of shrinkage cracking development from premature loss of the mixture water. The surface must be sufficiently cohesive to prevent erosion when sprayed concrete is applied.

#### Initial Process

- 5.8 All corners and any area where rebound cannot escape or be blown free must be filled with sound material.

#### Air Supply

- 5.9 Air supplied must be clean, dry and oil free. Air must be supplied in sufficient volumes and at pressures adequate for maintaining sufficient nozzle velocity to all parts of the work, and if required, for simultaneous operation of a suitable blow pipe for cleaning away rebound material.

#### Placement around Reinforcement

- 5.10 The nozzle must be held at such a distance and angle to place material behind the reinforcement before any material is allowed to accumulate on its face. Sprayed concrete must not be placed through more than one layer of reinforcing rods or mesh in one application.

### Line and Thickness Control

- 5.11 The methods to establish and control the thickness, surface planes and finish line of the sprayed concrete must be documented in the Quality Plan. For sprayed concrete between piles the surface deviation must not exceed 1/200.

### Precautions

- 5.12 Sprayed concrete must not be placed if drying or stiffening of the mix takes place at any time prior to delivery to the nozzle. Rebound or previously expended material must not be used in the sprayed concrete mix. Before placement of sprayed concrete onto adjacent surfaces, all overspray or rebound must be removed. Any overspray or rebound on finished surfaces must be immediately removed before initial set has occurred.

### Finishing

- 5.13 Where the sprayed concrete surface is to be covered by other suspended surface treatments an off-nozzle finish will be suitable.
- 5.14 In all other applications where better alignment, appearance and smoothness are required the sprayed concrete must be placed between guides to allow screeding. The tolerance on the finished surface must be as specified for a Class 3 finish in Table 3.4.2 in AS 3610-1995. Following screeding, floating to the finish specified on the drawings must be carried out.
- 5.15 Unless specified otherwise, the finishing of the sprayed concrete must be:
- a) Permanent Work: Steel Float.
  - b) Temporary Structure: Wood Float.

### Joints

- 5.16 The recommended practice for end-of-day, construction and expansion joints is given in CIA.Z5-2010: Recommended Practice - Shotcreting in Australia and must be followed. The unformed joint (Figure 9.12(a)) is not recommended and the screed joint (Figure 9.12(b)) or full depth construction or expansion joints must be used to terminate any section of spraying.

### Curing

- 5.17 Any curing compound used must comply with AS 3799.
- 5.18 Surfaces which are to be bonded to further concrete must be cured by means which will preserve the bonding properties at the interface, unless grit blasting or scabbling is employed prior to concreting.

## 6 Hold Points

- 6.1 The following is a summary of hold Points referenced in this Part:

Document Ref.	Hold Point	Response Time
2.3	Submission of Procedures	7 days
3.5	Evidence of concrete strength and test results	2 days
5.1	Prior to spraying concrete	6 hours