

**TECHNICAL STANDARD****SUPPLY AND DELIVERY OF LEAN MIX, NO  
FINES, GRADE 20 OR 25 CONCRETE**

Issued by:                      Manager Engineering

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## APPROVAL TO DEVIATE FROM THIS STANDARD

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Approval may be granted by the Asset Owner to deviate from the requirements as stipulated in this Standard if the functional requirements (e.g. Asset Life) for the asset differs from those stated in the Standard, but is assessed as still being acceptable by the Asset Owner's nominated representative.

Any approval to deviate from the stated requirements of this Standard will not be seen as creating a precedent for future like project. Any request to deviate from this Standard must be carried out on a project by project basis where each alternate proposal will be individually assessed on its own merit.

## NO CHANGES REQUIRED IN THE JANUARY 2012 EDITION

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The following lists the major changes to the July 1995 and published in the October 2004 edition of TS 1a:

1. Reformatted from DS to TS (Departmental Standard to Technical Standard), and updated referenced Australian Standards.
2. Conversion to a technical standard by removal of contractual conditions (to be included in the contract that references this standard).

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## REFERENCED DOCUMENTS

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<b>AS 1012:</b>	Methods of testing concrete
<b>AS 1141:</b>	Methods for sampling and testing aggregates
<b>AS 1289:</b>	Methods of testing soils for engineering purposes
<b>AS 1379:</b>	Specification and supply of concrete
<b>AS 1478:</b>	Chemical admixtures for concrete, mortar and grout
<b>AS 3600:</b>	Concrete structures
<b>AS/NZS 3905:</b>	Quality system guidelines
<b>AS/NZS ISO 9001:</b>	Quality management systems – Requirements
<b>TS 3a</b>	Fine and coarse aggregates for concrete in mild exposure conditions (Excluding Lightweight Aggregates)
<b>TS 3c</b>	Fine and coarse calcareous aggregates (Marble) for concrete sewage structures (Excluding Lightweight Aggregates)

## SECTION 1: SCOPE

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This Technical Standard (TS) is for the supply and delivery of concrete. The grade or grades of concrete shall be as specified in Table 4.1.

The “Supplier” shall be a concrete supplier that has a certificated Quality Assurance System for the supply of concrete.

The “Concrete Placer” shall be responsible for the placement of concrete and has a certificated Quality Assurance System for the placement of concrete.

The concrete shall be made in accordance with an 'Approved Mix' as specified in Clause 5.2 from materials which are identical, within specified limits, to samples supplied by the Supplier and approved by SA Water’s Representative before the delivery of the concrete.

The mix design, materials and expected variations in grading, quality etc. for all concrete supplied to this standard shall all be specified by the Supplier and approved by SA Water’s Representative prior to the production of any such concrete. No variations outside the accepted limits will be permitted without SA Water’s Representative’s written approval.

The concrete, unless specified otherwise, shall be in accordance with AS 1379 and all other applicable Australian Standards.

## SECTION 2: SA WATER’S REPRESENTATIVE

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SA Water’s Representative in this Technical Standard will be nominated by SA Water.

## SECTION 3: CONTROL AND QUALITY ASSURANCE

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The Supplier shall implement and maintain an approved quality control/quality assurance system covering all testing and manufacturing equipment, materials and workmanship used in the manufacture of the concrete.

Approved quality assurance and control systems shall, as a minimum, comply with the requirements of AS/NZS ISO 9001. Proof of a certified quality assurance system shall be provided to SA Water’s Representative before production of concrete to this standard commences.

Preference will be given to using Suppliers that have an acceptable third party certified quality assurance system. SA Water’s Representative may carry out a quality audit of a Supplier’s quality system if there is no third party certification.

The Supplier shall supply to SA Water’s Representative NATA certified test certificates for the concrete which has been tested in accordance with Production Assessment Clauses of AS 1379.

The Concrete Placer shall be responsible for scheduling quality assurance audits of the concrete supplied during the period of construction, as directed and in the presence of SA Water's Representative.

The Concrete Placer shall provide SA Water's Representative at all times with access to the Supplier's quality procedures and records to enable monitoring and quality auditing. Random sampling and/or testing will also be carried out on the job site as specified in Clause 4.5.

Auditing and proof testing by SA Water's Representative shall in no way relieve the Supplier of any of the obligations under this standard.

## SECTION 4: GRADES OF CONCRETE

### 4.1 Class

Concrete shall be Special Class and in accordance with AS 1379 except where specified otherwise in this Technical Standard.

The required grade or grades of concrete to be supplied are shown in Table 4.1 below.

**Table 4.1: Grades of Concrete**

Standard Grades	Minimum Cement Content (kg/m)	Max. w/c Ratio	Max. size of Aggregate (mm)	Slump and Tolerance (mm)	Characteristic Compressive Strength at 28 days F'c (MPa)
25	300	0.60	20	80 ± 15	25
20	280	0.68	20	90 ± 20	20
Non Std Grades					
Lean No-Fines	220 180	0.90 0.40	20 20	100 ± 35 -	10 6.0

### 4.2 Lean Mix Concrete

The concrete shall have a minimum strength of 10 MPa. The lean mix concrete will not be required to meet acceptance criteria as specified in Clause 4.5.3.

### 4.3 No Fines Concrete

The water content of no fines concrete shall be the minimum necessary to ensure that each particle of aggregate is coated with a shining film of cement paste. The maximum water cement ratio specified in Table 4.1 shall not be exceeded.

The no fines concrete shall be proportioned to ensure a cement:aggregate ratio in the range of 1:6 to 1:8 by weight. The total aggregate shall consist of equal parts of 10 mm and 20 mm single sized aggregates.

The flakiness index of the aggregate as tested in accordance with AS 1141 shall be 30 maximum. This is in addition to the requirements specified in TS 3a. (See Clause 4.1).

Concrete density shall be within the range 1600 - 1900 kg/m<sup>3</sup>.

The permeability shall be such as to allow free drainage of water.

To test for permeability, a rubber membrane shall be stretched around the walls of the no fines test specimen and held under a slow dripping tap. If water passes through the test specimen it shall be deemed to be free draining.

#### **4.4 Making of Test Cylinders for No Fines Concrete**

The method for making the no fines test cylinders shall be in accordance with AS 1012.8 - amended as follows:

- (1) The moulds shall be cylindrical, having a nominal diameter of 150 mm and in accordance with AS 1012.8.
- (2) The no fines shall be tamped into the mould by use of a standard compaction hammer (in accordance with AS 1289).
- (3) Tamping shall be carried out in 4 equal layers and 7 blows of the hammer per layer.
- (4) The hammer base shall drop onto a hammer guide bearing plate as shown in Appendix B.

After the bottom layer has been tamped the plate shall be removed to accommodate the second layer and so on for the third and top layer.

Sufficient material shall be placed into the top layer to ensure that the final height is within 8 mm maximum of being over or under the height of the mould. (NB: To avoid unnecessary disturbance of the sample, do not scrape excess material above the height of the mould).

- (5) Curing of the no fines cylinders shall be in accordance with AS 1012.8.

#### **4.5 Testing**

##### **4.5.1 General**

Testing of concrete supplied to this standard shall be subject to Project Assessment requirements in accordance with AS 1379 unless specified otherwise.

#### 4.5.2 Slump

Slump testing of concrete shall be in accordance with AS 1012.3. Variations in slump over those values specified or shown will be considered as an immediate indication of departure from the approved mix.

Slump testing is mandatory for concrete in which test cylinders are taken. SA Water's Representative may slump test any other concrete which SA Water's Representative deems to be outside the specified limits.

Any batch of concrete at delivery that falls outside the specified limits for slump as shown in Table 4.1 will be liable for rejection. To avoid possible rejection the Supplier is advised to target the lower end of the slump range. Any concrete in which the slump is in less than the lower limit shown in Table 4.1 may be 'rescued' by use of a superplasticiser. Concrete in which the slump is 25 mm and lower shall be rejected.

Concrete in which the slump is greater than the limiting tolerances shown in Table 4.1 shall be rejected.

If SA Water's Representative allows the addition of a superplasticiser at the project site then the Supplier shall add that superplasticiser at a predetermined dosage to achieve the required consistency. The upper slump limit for superplasticised concrete shall be 130 mm.

Water shall not be added to the transit mixer once it has left the plant.

#### 4.5.3 Acceptance Criteria

The strength of concrete shall be deemed to comply with this standard if it is in accordance with AS 1379.

In addition each sample tested shall have a minimum compressive strength as shown on Table 4.1.

#### 4.6 Review of Acceptance

If, at anytime, the concrete delivered from a plant is not in accordance with Clause 4.5 SA Water's Representative may withdraw the supply of concrete from that plant. The Supplier shall then supply concrete from another plant at no extra cost.

## SECTION 5: ACCEPTABILITY OF CONCRETE

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### 5.1 Materials

Unless specified otherwise, all materials shall be in accordance with the relevant Australian Standards. The fine and coarse aggregate shall be in accordance with TS 3a or TS 3c as applicable.

SA Water's Representative shall have the right to take any samples of the materials and test them in accordance with the relevant Australian Standard at any time during supply of concrete to this standard.

The Supplier shall state the proposed sources of supply of the materials for each plant and shall not vary these without the written approval of SA Water's Representative.

Samples of the proposed aggregate shall be supplied as directed by SA Water's Representative in accordance with TS 3a or TS 3c as applicable. The Supplier will not be required to submit 'contract samples' as specified in TS 3a or TS 3c.

### 5.2 Mix Acceptance

#### 5.2.1 Approved Mix

A concrete mix approved by both SA Water's Representative and the Concrete Placer shall become the **Approved Mix** for the period of construction. It shall not be altered without the written approval of SA Water's Representative. The Supplier shall supply from each mixing plant, for the approval by SA Water's Representative, details of the mix to which the production assessment data applies. The Supplier shall show the basis for the design of that mix along with the anticipated total aggregate grading envelope.

#### 5.2.2 Variation of Approved Mix

If the Supplier requires to vary the approved mix they are required to notify SA Water's Representative in writing, the reason for the proposed variation, the proposed mix details together with compressive strength and slump test results conducted on trial mixes showing that the concrete mix proposed shall be in accordance with this standard. The Supplier shall not vary the concrete mix until he/she receives the approval of SA Water's Representative in writing. Any approval variation of the approved mix shall be referenced in numerical order with the date when the approval was given to vary the mix.

Example: Approved Mix – Variation No. 2  
Approval 10.6.92

### **5.3 Admixtures**

#### **5.3.1 Water-reducing**

The Supplier may use a water-reducing admixture in the concrete. The water-reducing admixture shall be in accordance with AS 1478 and shall be approved by SA Water's Representative. Suitable water-reducing admixtures shall be an essential ingredient of the approved mix design. Suppliers shall submit details of the manufacture and type they intend to use for approval.

#### **5.3.2 Superplasticisers**

SA Water's Representative may permit the use of approved high range water-reducing admixtures (superplasticisers) in special circumstances (see Clause 4.5.2) but they shall not constitute an essential ingredient of the approved mix design. Additions shall only be made at the site. Dosage rates shall be predetermined and controlled to avoid overshooting the slump and to eliminate possible segregation.

#### **5.3.3 Other Admixtures**

No other admixtures shall be used unless approved or requested in writing by SA Water's Representative.

Addition sequences and dosage rates of all admixtures shall be as per Manufacturer's instructions.

### **5.4 Slump**

The slump and tolerances shall be as specified in Table 4.1.

Day to day consistency of the concrete will be determined on the slump tests carried out at the worksite in accordance with AS 1012.3 (see also Clause 4.5.2).

### **5.5 Mixing and Delivery**

All mixing water shall be added to the concrete mix only at the plant.

Plant mixed concrete will not be accepted if it is transported to the worksite in non-agitating equipment. The transporting units shall be in accordance with AS 1379. The transporting units and any associated equipment shall be kept clean and in good mechanical repair.

The re-tempering of concrete which has partially hardened, that is the re-mixing of concrete with or without additional cement, aggregate, or water will not be allowed, and any concrete subjected to this treatment will be rejected.

The Supplier shall keep a record of each batch of concrete supplied, providing relevant information of the wet concrete such as total water addition, slump, water/cement ratio etc, and also indicating the adjustments in the batch weights as a consequence of corrections made due to variations in moisture conditions and absorptive characteristics of the aggregates. Appendix A is an attached blank pro-forma sheet exemplifying what is required to be kept as a record.

## 5.6 Testing by SA Water's Representative

All aggregate and concrete testing by SA Water's Representative (see also Clauses 4.5 and 5.1) will be carried out at a NATA registered laboratory.

## SECTION 6: REJECTION

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Concrete that does not comply with this Standard will be rejected by SA Water's Representative. In particular, SA Water's Representative will reject a load of concrete if:

- (1) Significant variations to the current nominated mix are found by SA Water's Representative, or the slump measured at delivery as specified in Clause 4.5 are outside the specified limits in Table 4.1,
- (2) One and a half hours have elapsed since water was first added to the dry ingredients,
- (3) Delivered to worksite in non agitating transport equipment or by a method not in accordance with AS 1379,
- (4) The temperature of the concrete exceeds 32°C,
- (5) Statement of Compliance and Cartnote is not provided at time of delivery.

If 28 day characteristic compressive strength tests done by SA Water's Representative indicate that hardened concrete (ie: concrete that has been laid) is not in accordance with the standard SA Water's Representative will examine all concrete structures affected in accordance with methods specified in AS 3600. If SA Water's Representative deems that the structure is inadequate, the cost of any demolition and replacement, or any remedial work shall be borne by the Supplier.

The certification of plant and/or transporting units may be withdrawn by SA Water's Representative for non-compliance with this standard.

## SECTION 7: STATEMENT OF COMPLIANCE

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The Supplier shall provide to SA Water's Representative at time of delivery a statement of compliance with each load of concrete delivered which shall state that the batch delivered is in compliance with the approved design mix.

## SECTION 8: CARTNOTES

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The Supplier shall provide a cartnote with each load of concrete delivered, on which the following information shall be recorded:

- (1) Cartnote identification number
- (2) Date of delivery
- (3) Grade of concrete and nominal slump
- (4) Cement type and cement content (kg/m<sup>3</sup>)
- (5) Water cement ratio  
(free water after allowing absorption of aggregates)
- (6) Plant at which concrete mix was batched
- (7) Quantity of concrete in delivery vehicle
- (8) Time water was added to the aggregate and cement
- (9) Time vehicle left batching plant
- (10) Time vehicle started unloading concrete at worksite  
(by SA Water's Representative or his nominated Inspecting Officer)
- (11) Time discharge of load was completed  
(by SA Water's Representative or his nominated Inspecting Officer)
- (12) Place concrete was delivered.

Note (8) and (9) are required separately if the time difference is appreciable.

SA Water's Representative or his nominated Inspecting Officer will sign for the concrete delivered and keep one copy of the cartnote.

# APPENDIX A: PROFORMA SHEET CONCRETE PRODUCTION

## PROFORMA SHEET CONCRETE PRODUCTION

PROJECT..... DATE: / /20

### AGGREGATE CONDITION

AGGREGATE	MOISTURE CONTENT %	ABSORPTION %	CORRECTED DIFFERENCE
20 mm			
10 mm			
Sand			

### BATCH WEIGHTS

SSD WEIGHTS	1 m <sup>3</sup>	5 m <sup>3</sup>	ACTUAL WEIGHTS	CUMULATIVE WEIGHTS	CORRECTED MIX WATER
Cement					
20 mm					
10 mm					
Sand					
Water					
Admixture					

### CONCRETE POUR

Truck No.									
Sample No.	1	2	3	4	5	6	7	8	9
Time Batched									
Left Plant									
Time Arrived									
Progressive Total									
Slump (mm)									
Slump After S/P									
Total Water Added									
Effective Water									
W/C Ratio									
Superplasticiser Dosage									

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Supplier's Signature

Date

# APPENDIX B: HAMMER GUIDE BEARING PLATE

