



Specification and supply of concrete



This Australian Standard® was prepared by Committee BD-049, Manufacture of Concrete. It was approved on behalf of the Council of Standards Australia on 19 April 2007. This Standard was published on 20 September 2007.

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 - Association of Consulting Engineers Australia
 - Australasian Slag Association
 - Cement Concrete and Aggregates Australia—Cement
 - Cement Concrete and Aggregates Australia—Concrete
 - Concrete Institute of Australia
 - National Precast Concrete Association Australia
-

This Standard was issued in draft form for comment as DR 05253.

Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

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STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 1379—2007

Specification and supply of concrete

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Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 04 December 2017.

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National Precast Concrete Association Australia

NOTES

Australian Standard[®]

Specification and supply of concrete

Originated as AS (E)A502—1941.
Revised and redesignated as AS 1379—1991.
Second edition 1997.
Third edition 2007.
Reissued incorporating Amendment No. 1 (June 2009).
Reissued incorporating Amendment No. 2 (March 2015).

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Published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001, Australia

ISBN 0 7337 8395 3

PREFACE

This Standard was prepared by the Standards Australia Committee BD-049, Manufacture of Concrete, to supersede AS 1379—1997.

This Standard incorporates Amendment No. 1 (June 2009) and Amendment No. 2 (March 2015). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this Standard is to update the 1997 edition, align with modifications to the revision of AS 3600 and to improve clarity of requirements and commentary.

This edition incorporates the following major changes to the previous edition:

- (a) Extension of standard concrete grades from 50 MPa to 100 MPa.
- (b) Introduction of new clause covering chemical admixtures and chemical content of concrete.
- (c) Introduction of new special class concrete designations, which recognize the exposure classification.
- (d) Provides transparency of cement and aggregates required for durability.
- (e) Introduction of reportable chemical properties of mixing water.
- (f) Modification of acceptable variation between test specimens.
- (g) Reformatting of Table B1 to make it more user friendly.

The term ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard
Specification and supply of concrete

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out the minimum requirements for—

- (a) the materials, plant and equipment used in the supply of concrete;
- (b) the production and, if applicable, the delivery of concrete in the plastic state;
- (c) specifying, sampling, testing and compliance with specified properties of plastic and hardened concrete; and
- (d) the uniformity of mixing.

This Standard applies to the supply of all concrete. It is not intended to apply to mortars or grouts.

NOTES:

- 1 Requirements for mortars for masonry construction are given in AS 3700 and the methods for sampling and testing mortars in AS 2701.
- 2 Requirements for grouts to be used for the grouting of prestressing tendons in ducts are given in AS 3600.
- 3 It is not intended that this Standard take precedence over existing Australian Standards for the manufacture of specific concrete products.
- 4 For additional requirements specified by the customer, the applicable contract documents should be consulted.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

1012	Methods of testing concrete
1012.1	Method 1: Sampling of fresh concrete
1012.2	Method 2: Preparation of concrete mixes in the laboratory
1012.3.1	Method 3.1: Determination of properties related to the consistency of concrete—Slump test
1012.4.1	Method 4.1: Determination of air content of freshly mixed concrete—Measuring reduction in concrete volume with increased air pressure
1012.5	Method 5: Determination of mass per unit volume of freshly mixed concrete
1012.8.1	Method 8.1: Method of making and curing concrete—Compression and indirect tensile test specimens
1012.8.2	Method 8.2: Method of making and curing concrete—Flexure test specimens
1012.9	Method 9: Determination of the compressive strength of concrete specimens
1012.10	Method 10: Determination of indirect tensile strength of concrete cylinders ('Brasil' or splitting test)

AS

1012.11	Method 11:	Determination of the modulus of rupture
1012.12.1	Method 12.1:	Determination of mass per unit volume of hardened concrete—Rapid measuring method
1012.13	Method 13:	Determination of the drying shrinkage of concrete for samples prepared in the field or in the laboratory
1012.18	Method 18:	Determination of setting time of fresh concrete, mortar and grout by penetration resistance
1012.20	Method 20:	Determination of chloride and sulfate in hardened concrete and concrete aggregates
1141	Methods for sampling and testing aggregates	
1141.6.1	Method 6.1:	Particle density and water absorption of coarse aggregate—Weighing-in-water method
1141.35	Method 35:	Sugar
1199	Sampling procedures for inspection by attributes	
1199.0	Part 0:	Introduction to the ISO 2859 attribute sampling system
1199.1	Part 1:	Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
1289	Methods of testing soils for engineering purposes	
1289.4	Method 4:	Soil chemical tests
1289.4.2	Method 4.2:	Determination of the sulfate content of a natural soil and the sulfate content of the groundwater
1289.4.2.1	Method 4.2.1:	Normal method
1478	Chemical admixtures for concrete, mortar and grout	
1478.1	Part 1:	Admixtures for concrete
2701	Methods of sampling and testing mortar for masonry construction	
2758	Aggregates and rock for engineering purposes	
2758.1	Part 1:	Concrete aggregates
3550	Methods for the analysis of waters	
3550.4	Part 4:	Determination of solids—Gravimetric method
3582	Supplementary cementitious materials for use with portland and blended cement	
3582.1	Part 1:	Fly ash
3582.2	Part 2:	Slag—Ground granulated iron blast-furnace
3582.3	Part 3:	Amorphous silica
3600	Concrete structures	
3700	Masonry structures	
3972	Portland and blended cements	
AS/NZS		
1580	Paints and related materials—Methods of test	
1580.505.1	pH of water-based paints	
AS/NZS ISO		
9001	Quantity management systems—Requirements	
9004	Quantity management systems—Guidelines for performance improvements	

APHA	
APHA	Standard Methods for the Examination of Water and Wastewater: APHA-AWWA-WEF
APHA 3500	Na Sodium
APHA 4500	Cl ₂ Chloride
APHA 5520	Oil and grease
HB 18	Conformity assessment
HB 18.28	Part 28: Guidance on a third party certification system for products
HB 79	Alkali Aggregate Reaction—Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia

1.3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.3.1 Agitator

An item of plant or equipment that maintains the plastic concrete in a mixed state.

1.3.2 Aggregate-cement ratio

The ratio of saturated surface dry (SSD) mass of aggregate to the mass of cement (as defined in Clause 1.3.6) in the batch.

1.3.3 Batch

A quantity of concrete containing a fixed amount of ingredients and produced in a discrete operation.

1.3.4 Batching

The process of combining the concrete ingredients in fixed proportions by weight or by volume.

1.3.5 Blended cement

A hydraulic cement as defined in AS 3972.

1.3.6 Cement

A hydraulic binder composed of portland or blended cement used alone or combined with one or more supplementary cementitious materials.

1.3.7 Characteristic strength

That value of the concrete strength, as assessed by standard test, which is exceeded by 95% of the concrete.

1.3.8 Concrete

A mixture of cement, aggregates, and water with or without the addition of chemical admixtures or other materials and defined as follows:

- (a) *Plastic concrete* Concrete in the state between completion of mixing and initial set as defined in AS 1012.18.
- (b) *Hardened concrete* Concrete after initial set, as represented by test specimens that have been subjected to a specified process and duration of curing.
- (c) *Normal-class concrete* Concrete that is specified primarily by a standard compressive strength grade up to 50 MPa and otherwise in accordance with Clause 1.5.3.

- (d) *Special-class concrete* Concrete that is specified to have certain properties or characteristics different from, or additional to, those of normal-class concrete and otherwise in accordance with Clause 1.5.4.

1.3.9 Customer

The person, persons or corporate body to whom the supplier supplies, or supplies and delivers a quantity of plastic concrete.

1.3.10 Mean grade strength

The arithmetical mean of all relevant 28 day sample strengths taken in a production interval for the particular strength grade.

1.3.11 Mixing

The mechanical process of combining the constituent ingredients of concrete.

1.3.12 Point of acceptance

The point of discharge from the supplier's equipment or an otherwise agreed point at which the customer accepts the plastic concrete from the supplier.

1.3.13 Portland cement

A hydraulic cement as defined in AS 3972.

1.3.14 Production assessment

An assessment procedure for concrete defined by strength grade, carried out by the supplier and based on the statistical assessment of standard compressive strength tests on concrete, specified by compressive strength and produced by a specific supplying plant.

1.3.15 Project assessment

An assessment procedure for concrete defined by strength grade, specified at the customer's option, which provides additional test data for the statistical assessment of concrete supplied to a specific project.

1.3.16 Standard strength grade

One of the strength grades given in Table 1 (see Clause 1.5.2).

1.3.17 Strength grade

The specified value of the characteristic compressive strength of the concrete at 28 days (f'_c).

1.3.18 Supplementary cementitious material (SCM)

Material as defined in the relevant Part of the AS 3582 series.

1.3.19 Supplier

The person, persons or corporate body responsible for the supply of the concrete.

1.3.20 Supply

The process whereby the concrete ingredients are stored, batched, mixed, delivered if applicable, and discharged and sampled in the plastic state.

1.3.21 Total free water

The mass or volume of water contained in liquid admixtures and batch aggregates, in excess of their SSD condition, plus the mass or volume of all water added to the batch before commencement of discharge.

1.3.22 Water-cement ratio (w/c)

The ratio of the mass of total free water in a batch to the mass of cement (as defined in Clause 1.3.6) in the batch.

1.4 NOTATION

Unless a contrary intention appears, the following applies:

- (a) Where non-dimensional ratios are involved, both the numerator and denominator are expressed in consistent units.
- (b) Dimensional units used in expressions or equations shall be consistent, unless otherwise specified.
- (c) The notations used in this Standard shall have the following meanings with respect to the structure or member or element or condition to which a clause is applied:

f'_c = characteristic compressive strength of concrete at 28 days

f_{cm} = mean value of the compressive strength of concrete at the relevant age

k_c = an assessment factor corresponding to the number of samples used to determine f_{cm} (see Clause 6.3.1.4)

m_c = mass per unit volume of the plastic concrete in the sample (see Paragraph A3.4 of Appendix A)

m_{ac} = oven dry mass of the retained coarse aggregate (see Paragraph A3.5 of Appendix A)

m_{ma} = mass per unit volume of the air free mortar (see Paragraph A3.6 of Appendix A)

n = number of samples used in the calculation of standard deviation (see Clauses 6.3.5.1)

n_c = number of samples used in the production interval for the controlled grade (see Clause 6.3.1.2)

p = percentage air content in the concrete of the sample (see Paragraph A3.3 of Appendix A)

P = mass per unit volume of the other hardened cylinders in kg/m^3 (see Clause 5.5.2)

s_a = standard deviation of the sample strengths of an associated grade (see Clause 6.3.5.3)

s_c = standard deviation of the sample strengths of a controlled grade (see Clause 6.3.5.1)

s = standard deviation for the grade being assessed (s_c or s_a) (see Clause 6.3.1.5)

Q = volume of plastic concrete produced from the batched ingredients (see Clause 4.2.1.1)

V = volume of concrete used in calculating m_c (see Paragraph A3.5 of Appendix A)

w/c = water-cement ratio; as defined in Clause 1.3.22

$\bar{x}$ = mean strength (see Clause 6.3.5.1)

x = sample strength (see Clause 6.3.5.1)

β_{ac} = mass of coarse aggregate per unit volume of the sample (see Paragraph A3.5 of Appendix A)

ρ = density of the coarse aggregate particles (see Paragraph A3.5 of Appendix A)

1.5 SPECIFICATION OF CONCRETE

1.5.1 General

Concrete shall be specified—

- (a) as either—
 - (i) normal-class, in accordance with Clause 1.5.3; or
 - (ii) special-class, in accordance with Clause 1.5.4; or
- (b) by strength grade or other readily verifiable parameter by which compliance with the specification can be assessed.

NOTE: Standard strength grades should be specified wherever possible.

1.5.2 Standard strength grades

The standard strength grades are compressive strength grades and their corresponding design characteristic strengths shall be as given in Table 1.1.

For concrete strength up to 50 MPa, it shall be permissible to specify strength grades other than the standard grades, in which case the concrete shall be special-class and Clause 1.5.4 shall then apply. For concrete strength greater than 50 MPa, the concrete shall be of special-class concrete.

TABLE 1.1
STANDARD STRENGTH GRADE

Standard grade	Design characteristic compressive strength after 28 days of standard curing (f'_c) MPa
20	20
25	25
32	32
40	40
50	50
65	65
80	80
100	100

1.5.3 Normal-class concrete

1.5.3.1 General

Normal-class concrete shall be specified only by the parameters given in Clause 1.5.3.2, and shall have the following attributes:

- (a) A mass per unit volume in the range 2100 kg/m³ to 2800 kg/m³ when determined in accordance with AS 1012.12.1 in the saturated, surface-dry condition.
- (b) Acid-soluble chloride and sulfate contents within the limits given in Clause 2.7, when determined in accordance with Clause 5.5.2.

- (c) A shrinkage strain not exceeding 1000×10^{-6} , when determined in accordance with Clause 5.6 after 56 days drying.
NOTE: This maximum value of 1000×10^{-6} is consistent with the use for design purposes of a median basic shrinkage strain value of 850×10^{-6} .
- (d) A mean compressive strength at 7 days, assessed in accordance with Clause 5.7, of not less than the values shown in Table 1.2.
- (e) A cement complying with AS 3972 alone or in combination with one or more supplementary cementitious materials.
- (f) No lightweight aggregate as defined in AS 2758.1.

1.5.3.2 Basic parameters

The following basic parameters shall be specified by the customer:

- (a) A standard strength grade selected from Table 1.1 and designated as one of N20, N25, N32, N40 or N50.
- (b) The slump at the point of acceptance, selected as one of 20 mm, 30 mm, 40 mm, 50 mm, 60 mm, 70 mm, 80 mm, 90 mm, 100 mm, 110 mm or 120 mm.

NOTES:

- 1 The customer should carefully consider that the specified slump of concrete suits the placement method.
 - 2 For residential slabs and footings, if the slump is not specified by the customer, the specified slump should be considered to be 100 mm.
- (c) The maximum nominal size of aggregate, selected as one of 10 mm, 14 mm or 20 mm. Unless otherwise specified, the default value shall be taken as 20 mm.
 - (d) The intended method of placement, including relevant details of equipment.
 - (e) If project assessment is required to be carried out by the supplier (see Note).
NOTE: If unspecified, it will be assumed that project assessment is *not* required.
 - (f) If required, a level of air entrainment up to a maximum of 5.0%.

TABLE 1.2
MEAN 7 DAY COMPRESSIVE STRENGTHS

Grade designation	Mean 7 day strength (MPa)
N20	9
N25	12
N32	16
N40	20
N50	25

1.5.4 Special-class concrete

Concrete other than normal-class concrete shall be specified by the customer as special-class and, if applicable, by strength-grade.

Where concrete is specified as special-class and a strength-grade is applicable, the following shall be used as prefixes to the strength grade:

- (a) S, where compressive strength testing is required.
- (b) SF, where flexural strength testing is required.
- (c) ST, where indirect-tensile strength is required.

Where concrete is specified a special class and one of the exposure classifications B1, B2, C1, C2 or U specified in AS 3600 is applicable, the following shall be used as prefixes to the strength grade:

- (i) SB, for concrete in exposure classification B2.
- (ii) SC, for concrete in exposure classification C1 or C2.
- (iii) SU, for concrete in exposure classification U.

For concretes designated as SB, SC or SU, the properties specified shall include—

- (A) the aggregate durability class in accordance with AS 2758.1; and
- (B) the relevant requirements of AS 3600.

For concrete strength greater than 50 MPa, the concrete shall be special class and shall be subject to the provisions of this Clause.

Where concrete is specified as special-class and any property other than strength grade is specified as the principal criterion, or the proportions of the mix are specified, it shall be designated by an appropriate alphanumeric code, agreed between the supplier and the customer to indicate the criterion.

Any departures from the parameters or composition, or both, of normal-class concrete and any other criteria or limitations shall be specified by the customer in consultation with the supplier.

NOTE: A summary list of several such parameters, some or all of which may be specified for the production of special-class concrete for a project, is given in Appendix B.

Other requirements additional to these parameters may be specified.

1.6 METHODS OF ORDERING

Concrete shall be ordered as normal-class or special-class, as appropriate to its intended use and, if ordered as special-class, shall be further qualified as a performance order or a prescription order. The order shall specify the parameters given in Clauses 1.5.3.2 or 1.5.4, as appropriate.

1.7 BASIS OF SUPPLY

1.7.1 General

The basis of supply shall be as follows:

- (a) Where normal-class or special-class performance concrete has been ordered—
 - (i) the volume of plastic concrete, determined in accordance with Clause 1.7.2; and
 - (ii) the quality of the supplied concrete, determined in accordance with the relevant clauses of Section 5.
- (b) Where special-class prescription concrete has been ordered—
 - (i) the volume of the plastic concrete, determined in accordance with Clause 1.7.2; and
 - (ii) a warranty that the specified prescription has been met.
- (c) Where the customer or his agent adds ingredients to the concrete, the basis of supply and any performance requirements shall be agreed between the parties concerned and the appropriate requirements of Item (a) or (b) shall apply. In the absence of such agreement, the basis of supply shall be that the proposed mix constituents be complied with.

1.7.2 Volume of plastic concrete

The volume, in cubic metres, of plastic concrete supplied shall be determined from the total mass of the concrete divided by the average mass per cubic metre. If the volume so determined is not less than 98% of the volume specified on the identification certificate, the specified volume shall be deemed to have been supplied.

When three or more deliveries are made and testing for volume has been specified, the average mass per cubic metre shall be calculated as the mean of the values of the mass per unit volume of at least three samples of the concrete, where each sample is taken from a different delivery and the mass per unit volume of each sample is determined in accordance with AS 1012.5.

If less than three deliveries are made the average mass per cubic metre shall be calculated as the mean of the values of the mass per unit volume of samples.

NOTES:

- 1 The method of determining the total mass will need to be specified if the supplied volume is intended to be verified at any time.
- 2 The in situ measured volume may differ from the volume of plastic concrete as determined above, as a result of handling and compaction and the effects of hardening, temperature changes, formwork deflection, spillage and other relevant factors.

1.7.3 Identification certificate

The customer shall be furnished with an identification certificate, pertaining to the particular quantity of concrete supplied, on which the following information is recorded as appropriate:

- (a) Name of supplier, and place of manufacture.
- (b) Serial number of certificate.
- (c) Date of supply.
- (d) Name of customer.
- (e) Project name and location.
- (f) Delivery vehicle identification, if applicable.
- (g) Quantity of concrete covered by the certificate.
- (h) Specified class and strength grade, or other mix identification.
- (i) Specified slump, if applicable.
- (j) Maximum nominal size of aggregate.
- (k) Time of commencement of mixing.
- (l) For concrete specified by water-cement ratio, the estimate of the quantity of water, if any, added after completion of batching and whether the addition occurred before, or after, commencement of discharge; or for concrete specified by slump, the estimate of quantity of water added after commencement of discharge.
- (m) Any other detail that may be agreed between the customer and the supplier.

SECTION 2 CONCRETE CONSTITUENTS

2.1 GENERAL

The materials used in the production of concrete shall comply with the appropriate clauses of this Section.

2.2 CEMENT CONSTITUENTS

2.2.1 Portland cement

Portland cement shall comply with AS 3972.

2.2.2 Blended cement

Blended cement shall comply with AS 3972.

2.2.3 Fly ash

Fly ash shall comply with AS 3582.1.

2.2.4 Ground slag

Ground slag shall comply with AS 3582.2.

2.2.5 Amorphous silica

Amorphous silica shall comply with AS 3582.3.

2.3 AGGREGATES

A2

Aggregates shall comply with AS 2758.1 and any durability requirements that may need to be specified, as provided in AS 2758.1 for a particular use or performance. Where risk of expansion due to alkali aggregate reaction has been identified, action shall be taken to minimize potential expansion as stated in Clause 2.8.

2.4 MIXING WATER

Mixing water shall be drawn from a source of acceptable quality.

Mixing water shall be deemed to be of acceptable quality if—

- (a) test result and service records of concrete made with that water indicate that it is not injurious to the strength or durability of the concrete or of the materials embedded in it; or
- (b) it has been suitably tested in a laboratory and the test results are within the limits given in Table 2.1 or Table 2.2.

In Table 2.1, the samples for comparison of properties shall be taken from two separate batches of concrete manufactured from identical weights and proportions of ingredients drawn from the same sources, except that the water used in the batch from which the control sample is taken shall be drawn from a stable reticulated drinking water supply.

Water recycled from mixer washout operations may be used as mixing water if it is first stored in accordance with Clause 3.2.3 and the water drawn from the storage outlet is of acceptable quality.

For sources other than water drawn from a stable reticulated drinking water supply, mixing water may contribute significant levels of undesirable dissolved salts such as chlorides and sulfates. Mandatory testing for reportable properties, when needed to calculate levels of chlorides and sulfates in accordance with Clause 2.7, are given in Table 2.3. The test result shall be valid for a period of 6 months after tests.