

Australian Standard®

Methods of testing concrete

Method 2: Preparing concrete mixes in the laboratory

1 SCOPE

This Standard sets out a method for the preparation of concrete mixes in the laboratory.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- 1012 Methods of testing concrete
- 1012.1 Method 1: Method for sampling fresh concrete
- 1012.3.1 Method 3.1: Methods for the determination of properties related to the consistency of concrete—Slump test
- 1012.3.2 Method 3.2: Methods for the determination of properties related to the consistency of concrete—Compacting factor test
- 1012.3.3 Method 3.3: Methods for the determination of properties related to the consistency of concrete—Vebe test
- 1012.3.4 Method 3.4: Methods for the determination of properties related to the consistency of concrete—Compactibility index
- 1012.4.1 Method 4.1: Determination of air content of freshly mixed concrete—Measuring reduction in concrete volume with increased air pressure
- 1012.4.2 Method 4.2: Determination of air content of freshly mixed concrete—Measuring reduction in air pressure in chamber above concrete
- 1012.4.3 Method 4.3: Determination of air content of freshly mixed concrete—Measuring air volume when concrete dispersed in water
- 1012.5 Method 5: Method for determination of mass per unit volume of freshly mixed concrete
- 1012.6 Method 6: Method for the determination of bleeding of concrete
- 1012.8.1 Method 8.1: Method for making and curing concrete—Compression and indirect tensile test specimens
- 1012.8.2 Method 8.2: Method for making and curing concrete—Flexure test specimens
- 1012.13 Method 13: Determination of the drying shrinkage of concrete for samples prepared in the field or in the laboratory
- 1012.16 Method 16: Method for the determination of creep of concrete cylinders in compression (metric units)
- 1012.17 Method 17: Methods for the determination of the static chord modulus of elasticity and Poisson's ratio of concrete specimens
- 1012.18 Method 18: Method for the determination of setting time of fresh concrete, mortar and grout by penetration resistance (metric units)
- 1141 Methods for sampling and testing aggregates
- 1141.3.1 Method 3.1: Sampling of aggregates

AS

- 1141.5 Method 5: Particle density and water absorption of fine aggregate
- 1141.6.1 Method 6.1: Particle density and water absorption of coarse aggregate – Weighing-in-water method
- 1141.6.2 Method 6.2: Particle density and water absorption of coarse aggregate—Pycnometer method
- 1478 Chemical admixtures for concrete
- 2758 Aggregates and rock for engineering purposes
- 2758.1 Part 1: Concrete aggregates
- 3582 Supplementary cementitious materials for use with portland cement
- 3582.1 Part 1: Fly ash
- 3582.2 Part 2: Slag—Ground granulated iron blast-furnace
- 3582.3 Part 3: Silica fume
- 3972 Portland and blended cements

3 DEFINITIONS

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

3.1 Absorption

As follows:

- (a) *Fine aggregates*—in accordance with the requirements for particle density and water absorption of fine aggregate of AS 1141.5.
- (b) *Coarse aggregates*—in accordance with the requirements for particle density and water absorption of coarse aggregate of AS 1141.6.1 or AS 1141.6.2.

3.2 Cement

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

3.3 Supplementary cementitious material (SCM)

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

3.4 Self compacting concrete (SCC)

Self compacting concrete (SCC) 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. SCC is also known as ‘self-consolidating concrete’ or ‘super-workable concrete’.

4 APPARATUS

A motor-driven mixer shall be used which complies with the requirements for mixing efficiency as specified in Appendix A. The maximum and minimum size of the batch for a specific mixer shall be established by this test. The size of all subsequent test mixes shall fall within this range.

A mixer uniformity test shall be carried out on the mixer in accordance with Appendix A and—

- (a) when the mixer is installed;
- (b) after every 750 mixes or after 5 years elapses whichever occurs first;
- (c) whenever the mixing mechanism is repaired; and

- (d) whenever there is an apparent lack of mixing identified.

NOTE: A mixer efficiency test using an intense coloured pigment followed by a 'streak test' as with paint mixing could indicate inadequate mixing.

5 BATCH MASSES

The concrete mix shall be based upon a set of predetermined batch masses calculated for saturated surface dry (SSD) aggregates. The aggregate may be used in the mix in any moisture condition, provided that the batch masses are adjusted accordingly.

NOTE: The preferred condition is SSD or slightly above, but not free draining. Aggregate which is too dry may cause loss of slump.

6 STORAGE OF SAMPLES

On arrival at the laboratory, samples of aggregate shall be stored in such a manner that their properties, such as gradation and volume stability, remain unchanged. Samples of cement shall be stored in a dry place in airtight containers.

Each container shall be as full as possible. Admixtures shall be stored in accordance with the manufacturer's recommendations and in any case for not longer than 12 months.

7 REPRESENTATIVE SAMPLES

7.1 General

Where the volume of the sample is substantially greater than that required for the mix, representative subsamples of that material need to be obtained. These subsamples shall be either prepared prior to delivery to the laboratory, or obtained in the laboratory from samples which have been provided for this purpose.

7.2 Aggregates

Representative subsamples shall be obtained from each aggregate required for the mix except that, if separate size fractions are required for special purposes (e.g. if unusual gradings are being studied), relevant aggregates shall be separated into appropriate different size fractions which shall be then treated as separate materials. If the samples of coarse aggregate are graded, every care shall be taken to avoid segregation of different sizes, and to obtain a truly representative subsample for the concrete batch.

The representative subsample of fine aggregate shall be obtained so as to avoid segregation or loss of different size fractions, e.g. fines.

NOTE: Guidance on obtaining representative subsamples of aggregate may be obtained from AS 1141.3.1.

7.3 Cement and supplementary cementitious material

A representative subsample of the cement (see Clause 3.2) and when required of supplementary cementitious material (see Clause 3.3) needed for the mix shall be obtained.

7.4 Water

Where the quality of mixing water proposed for use is to be assessed, a representative sample shall be obtained and used as the mixing water, and, where applicable, for any pre-wetting of the aggregates, otherwise potable water shall be used.

7.5 Admixtures

Where applicable, admixtures shall be representative of current production.

8 PREPARATION OF MATERIALS

8.1 General

All materials, including water, shall be brought to room temperature before beginning operations. The preferred temperature range is 20°C to 26°C unless the effect of a particular temperature on a specific property is being assessed.

8.2 Moisture condition of aggregates

As a basis for the batch masses, a decision shall be made as to the moisture condition in which the aggregates are to be used in the concrete, having regard to the limitations detailed in Clause 5. The most common moisture conditions are field moisture condition and saturated surface dry (SSD). Prior to batching, each aggregate used shall be of uniform moisture condition, determined to an accuracy of 0.1% by oven drying to constant mass. Oven temperatures shall be in the range of 105°C to 110°C.

NOTE: It is difficult to bring a large batch of coarse aggregate to the SSD condition. The materials should be soaked for 24 h and then dried to the specified surface condition in a minimum of time. Care should be taken to retain the fines during this process. Fine aggregate is even more difficult and time consuming. A method often adopted is to place the fine aggregate in the mixer, add the calculated mass of water required to bring the batch to the SSD condition, mix thoroughly, and then store in filled, sealed plastic bags for 24 h prior to use.

8.3 Admixtures

Admixtures shall be prepared in accordance with the manufacturer's or supplier's recommendations.

9 MEASUREMENT OF MATERIALS

Materials for each batch shall be measured by mass or volume as appropriate to an accuracy of—

- (a) cement, supplementary cementitious materials and water—0.2%;
- (b) each aggregate—0.2%; and
- (c) admixtures—0.5%.

Where liquid admixtures are added, the total volume of solution used for this purpose shall be included in the calculated amount of mixing water to be added.

NOTES:

- 1 Because of the small quantities of some liquid admixtures required per batch, it is advisable to prepare larger quantities of dilute solutions to ensure the specified accuracy.
- 2 A suggested method for setting out the trial batch proportions prior to preparing the concrete mix is given in Appendix B.

10 MIXING CONCRETE

10.1 General

The charging and mixing procedures stated in this Clause shall be followed, unless otherwise specified, in order to ensure reproducibility of the mix. If a different sequence is followed, it shall be reported.

10.2 Batch size

The batch size shall exceed that required for test purposes and moulding of test specimens by at least 10%.

NOTE: A summary of minimum working volumes for each test of AS 1012, is given in Appendix C.

10.3 Preliminary batch

Where a tilting drum type of mixer is used, a small preliminary batch proportioned to simulate either the trial batch or the mortar component of the trial batch only, shall be mixed and discarded just prior to mixing the trial batch.

NOTE: The mortar adhering to the mixer after discharging this preliminary batch is intended to compensate for the mortar left from the trial batch.

Where a pan type mixer is used and the concrete is transferred directly to the moulds, the preliminary batch may be omitted, but the inside of the pan shall be moistened and the pan cleaned out between batches.

10.4 Charging and mixing sequence

10.4.1 General

The mixer shall be charged with materials in the order set out in Clauses 10.4.4 and 10.4.5, unless a different procedure is better adapted to the mixer being used, or to the purpose of the particular investigation. Any departure from this procedure shall be recorded and reported.

10.4.2 Incorporation of admixtures

Where admixtures are used, care shall be taken to ensure that they are uniformly distributed throughout the concrete. Where applicable, admixtures shall be added in accordance with the manufacturer's or supplier's specifications. Each admixture shall be added separately. Admixtures may be added at other times where specific effects of additions are being assessed.

Unless otherwise specified, powdered admixtures that are insoluble or nearly insoluble in water, shall be mixed with a portion of the cement before its introduction into the mixer. Water soluble admixtures shall be dissolved in part of the balance of the mixing water to be added. Any such solutions shall be counted as part of the mixing water.

Powdered materials used in amounts exceeding about 10% by mass of the cement shall be handled, weighed and added to the batch in the same manner as cement.

10.4.3 Measurement of slump

Unless otherwise specified, the following tolerances on the nominated slump, measured in accordance with AS 1012.3.1, shall apply:

Nominated slump mm	Range mm
<60	±5
≥60 ≤110	±10
>110	±15

10.4.4 Hand loading

The procedure for hand loading is as follows:

- Charge the mixer with the coarse aggregate, then the fine aggregate, before adding a sufficient quantity of the mixing water to wet the aggregate.
- Operate the mixer for ½ min and stop.
- Add the cement. Where the cement comprises more than one component (see Clause 3.2) all components, together with any insoluble admixtures (see Clause 10.4.2) shall be added to the mixer together.

To prevent loss of powdered materials, cover the cement with some of the aggregate in the mixer prior to commencing mixing.

- (d) Commence mixing as set out in Figure 1.

Any variation to the procedure specified in Figure 1 shall be recorded.

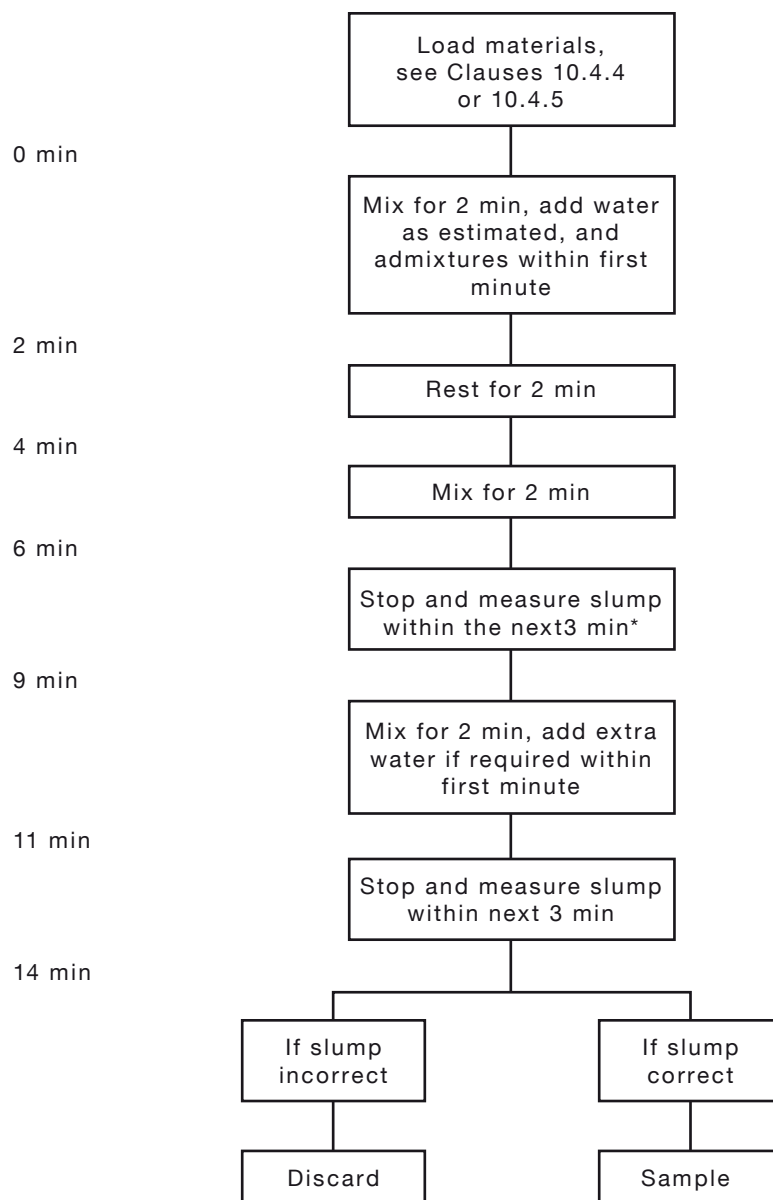
10.4.5 *Power loading*

The procedure for power loading is as follows:

- (a) Load the skip with approximately half of the coarse aggregate, then with the fine aggregate, then the cement, followed by the remainder of the coarse aggregate (and admixtures where applicable, in accordance with Clause 10.4.2).
- (b) Add the mixing water to the operating mixer in accordance with the requirements for the particular mixer in use.

NOTE: If other charging sequences are adopted, they should ensure minimum segregation and build-up of fines on the drum or blades of the mixer.

- (c) Add any admixtures in accordance with Clause 10.4.2.
- (d) Commence mixing as set out in Figure 1.



* The concrete used in the slump test needs to be returned to the mixer.

FIGURE 1 MIXING PROCEDURE

11 SAMPLING

The trial batch, prepared in accordance with Clause 10, shall be regarded as the sample for all subsequent tests.

Where pan mixers not fitted with discharging gates are used, the concrete shall be sampled directly from the pan, care being taken to avoid segregation. Where other types of mixers are used, the concrete shall be discharged onto a smooth clean damp non-absorbent surface, briefly remixed with a shovel or scoop, and heaped together to ensure uniformity.

Where a delay is anticipated between the completion of mixing and commencement of testing, the sample shall be covered to prevent evaporation.