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Testing concrete —

Part 125: Methods for mixing and sampling fresh concrete in the laboratory

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Summary of pages

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Foreword

Publishing information

This part of BS 1881 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 April 2013. It was prepared by Subcommittee B/517/1, *Concrete production and testing*, under the authority of Technical Committee B/517, *Concrete*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 1881 supersedes BS 1881-125:1986, which is withdrawn.

Relationship with other publications

BS 1881 is published in the following parts:

- BS 1881-113, *Method for making and curing no-fines cubes*;
- BS 1881-119, *Method for determination of compressive strength using portions of beams broken in flexure (equivalent cube method);*
- BS 1881-122, *Method for determination of water absorption*;
- BS 1881-124, *Methods for analysis of hardened concrete*;
- BS 1881-125, *Method for mixing and sampling fresh concrete in the laboratory*;
- BS 1881-128, *Method for analysis of fresh concrete*;
- BS 1881-129, *Method for the determination of density of partially compacted semi-dry fresh concrete*;
- BS 1881-130, *Method for temperature matched curing of concrete specimens*;
- BS 1881-131, *Methods for testing cement in a reference concrete*;
- BS 1881-201, *Guide to the use of non-destructive methods of test for hardened concrete*;
- BS 1881-204, *Recommendations on the use of electromagnetic covermeters*;
- BS 1881-206, *Recommendations for determination of strain in concrete*;
- BS 1881-207, *Recommendations for the assessment of concrete strength by near-to-surface tests*;
- BS 1881-208, *Recommendations for the initial surface absorption of concrete*;
- BS 1881-209, *Recommendations for the measurement of dynamic modulus of elasticity of concrete*;
- DD 216, *Determination of chloride content of fresh concrete*.

Information about this document

This part of BS 1881 complements BS EN 12350-1 which covers the sampling of concrete on site.

It is recognized that a wide range of concrete mixes are prepared in the laboratory so provision is made for modifications to the standard procedure and their detailed reporting [see **8.2.1**e)].

CAUTION. When cement is mixed with water, alkali is released. Take precautions to avoid dry cement entering the eyes, mouth and nose when mixing concrete. Prevent skin contact with wet cement or concrete by wearing suitable protective clothing. If cement or concrete enters the eye, immediately wash it out thoroughly with clean water and seek medical treatment without delay. Wash wet concrete off the skin immediately.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Requirements in this standard are drafted in accordance with *The BSI guide to standardization – Section 2: Rules for the structure, drafting and presentation of British Standards*, subclause **11.3.1**, which states, "Requirements should be expressed using wording such as: 'When tested as described in Annex A, the product shall ...'". This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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1 Scope

This part of BS 1881 describes basic methods for the preparation of materials and the batching, mixing and sampling of fresh concrete in the laboratory, where accurate controls of the quantities of materials and of test conditions are possible. The procedures are applicable when assessing the suitability of materials or determining suitable mix proportions for concrete for general use on site.

This part of BS 1881 is not applicable to special concrete mixes prepared for research, where the mixing procedure is determined by the properties of the constituents or of the resulting concretes that are being studied.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 8500 (all parts), *Concrete – Complementary British Standard to BS EN 206-1*

BS EN 196-7, *Methods of testing cement – Part 7: Methods of taking and preparing samples of cement*

BS EN 206-1, *Concrete – Part 1: Specification, performance, production and conformity*

BS EN 932-1, *Tests for general properties of aggregates – Part 1: Methods for sampling*

BS EN 1097-6, *Tests for mechanical and physical properties of aggregates – Part 6: Determination of particle density and water absorption*

BS EN 12350, (all parts) *Testing fresh concrete*

3 Terms and definitions

For the purpose of this part of BS 1881, the definitions given in BS EN 206-1 and BS 8500 (all parts) apply.

4 Apparatus

4.1 *Mixer,* rotating pan or tilting drum type of a capacity 10% to 50% greater than the maximum batch of concrete required to provide samples for the tests to be carried out.

4.2 *Scoop*, or similar sampling device, made from non-absorbent material not readily attacked by cement paste, suitable for taking increments of concrete.

4.3 *Hand tool*, suitable for turning mixed concrete.

5 Constituent materials

5.1 Sampling

If bulk samples are supplied, take subsamples for the test portions in accordance with BS EN 196-7 for cement and BS EN 932-1 for aggregate, ensuring that the materials used in each batch of concrete are representative of the bulk materials.

Otherwise, use the materials in the proportions supplied or specified for the mix.

5.2 Cement, ground granulated blastfurnace slag and fly ash

5.2.1 Store the separate materials in individual airtight containers of appropriate size in a dry place.

5.2.2 Before use, thoroughly stir each separate material, either using a hand tool or in a suitable mixer, in a manner that ensures the greatest possible uniformity, avoiding the intrusion of foreign matter or loss of material.

5.3 Aggregate

5.3.1 Ensure the aggregates are in one of the following conditions:

a) oven-dry in accordance with BS EN 1097-6;

b) air dried at (20 ±5) °C;

c) saturated surface-dry as described in BS EN 1097-6; or

d) saturated by soaking in water for at least 24 h.

5.3.2 When necessary, determine the moisture content (as a percentage of the oven dry mass) of the aggregates by an appropriate method given in BS EN 1097-6. The aggregates for each concrete batch may be used either in separate size fractions or with an all-in grading.

5.4 Temperature

Allow all materials to reach a temperature of (20 ±5) °C before mixing the concrete.

6 Batching

6.1 Ensure that the quantity of concrete for each batch is at least 10% more than that required for the proposed tests.

6.2 For each concrete batch, weigh the cement, any ground granulated blastfurnace slag or fly ash and the water to an accuracy of ±0.5% and the aggregate to an accuracy ±1%.

6.3 If an admixture is to be incorporated, measure the amount to an accuracy of ±5% of the specified dosage and follow the manufacturer's instructions for use.

NOTE When preparing concrete to have a given property, such as workability or air content, it might be necessary to prepare and test trial mixes of varying composition to establish the required mix quantities.

7 Mixing

7.1 General

7.1.1 Mix the concrete in a room having an ambient temperature of (20 ±5) °C and a relative humidity of not less than 50%.

7.1.2 If the aggregate is dry [in accordance with **5.3** a) or **5.3** b)], allow it to soak with some of the mixing water before adding other materials until it has taken up most of the water it would eventually absorb. Avoid water loss by evaporation while soaking.

7.1.3 After weighing out liquid admixtures, dilute with some of the mixing water prior to addition to the mix and/or flush the measuring container with further mixing water after addition to the mix.

NOTE 1 Addition should always be according to the manufacturer's instructions but is normally with the last half of the mixing water and after the cement is fully wetted out. Powder admixtures should always be added in accordance with the manufacturer's instructions.

7.1.4 Mix the concrete, preferably by machine or alternatively using a hand tool, in such a manner as to avoid loss of water or other materials.

NOTE 2 Different methods of mixing can lead to different results.

7.2 Machine mixing

7.2.1 General

7.2.2 To avoid both incomplete mixing and spillage, ensure that the mixer conforms to **4.1**.

7.2.3 Before using the mixer, clean off any fresh concrete remaining from a previous batch.

7.2.4 Ensure that no free water remains in the mixer.

7.2.5 If the mixer is dry, wipe it with a damp cloth.

7.2.6 When using a tilting drum mixer, mix a small preliminary batch, of similar proportions to the main batch, immediately before the main batch in order to coat the mixer.

7.2.7 Pan mixer

7.2.7.1 Using dry aggregates

7.2.7.1.1 Add an all-in aggregate as one amount.

7.2.7.1.2 If separate fine and coarse aggregates are used, add them in the following order:

1) approximately half the coarse aggregate;
2) the fine aggregate;
3) the remaining coarse aggregate;

by spreading them evenly over the pan.

7.2.7.1.3 Start the mixer and run it for between 15 s and 30 s.

7.2.7.1.4 Continue mixing and add about half the water during the next 15 s.

7.2.7.1.5 After mixing for 2 min to 3 min, stop the mixer and leave the contents covered for 5 min to 15 min.

7.2.7.1.6 Add the cement and any ground granulated blastfurnace slag, fly ash, pigment or other powder or other materials, e.g. fibres, by spreading them in an even layer over the aggregate.

7.2.7.1.7 Mix for 30 s.

7.2.7.1.8 Stop the mixer and immediately clean off into the pan any material adhering to the mixer blades.

7.2.7.1.9 Immediately recommence mixing and add the remaining mixing water over the next 30 s.

7.2.7.1.10 Continue mixing for 2 min to 3 min.

7.2.7.1.11 After completion of mixing in a pan mixer without a discharging gate, turn the concrete over in the pan a few times using a hand tool to ensure uniformity before sampling.

7.2.7.2 Using saturated aggregates

7.2.7.2.1 If an all-in aggregate is used, add approximately half of it before adding the other materials and the remainder of it after this.

7.2.7.2.2 If separate fine and coarse aggregates are used, add them in the following order:

1) approximately half the coarse aggregate;
2) the fine aggregate;
3) the cement;
4) any ground granulated blastfurnace slag, fly ash, pigment or other powder or other materials, e.g. fibres;
5) the remaining coarse aggregate;

by spreading them evenly over the pan.

7.2.7.2.3 Start the mixer and add all the water during the first 30 s of mixing.

7.2.7.2.4 After all the materials have been added mix for 2 min to 3 min.

7.2.7.2.5 After completion of mixing in a pan mixer without a discharging gate, turn the concrete over in the pan a few times using a hand tool to ensure uniformity before sampling.

7.2.8 Drum mixer

7.2.8.1 Using dry aggregates

7.2.8.1.1 If an all-in aggregate is used, add it as one amount.

7.2.8.1.2 If separate fine and coarse aggregates are used, add them in the following order:

1) approximately half the coarse aggregate;
2) the fine aggregate;
3) the remaining coarse aggregate.

7.2.8.1.3 Start the mixer and run it for between 15 s and 30 s.

7.2.8.1.4 Continue mixing and add approximately half the water over the next 15 s.

7.2.8.1.5 After mixing for 2 min to 3 min, stop the mixer and leave the contents covered for 5 min to 15 min.

7.2.8.1.6 Add the cement and any ground granulated blastfurnace slag, fly ash, pigment or other powder on top of the aggregate.

7.2.8.1.7 Start the mixer and mix for 30 s.

7.2.8.1.8 Over the next 30 s add the remaining water.

7.2.8.1.9 After all the materials have been added, mix for 2 min to 3 min.

7.2.8.1.10 After completion of mixing, discharge the concrete onto a clean non-absorbent surface and turn it over using a hand tool to ensure uniformity before sampling.

7.2.8.2 Using saturated aggregates

7.2.8.2.1 If an all-in aggregate is used, add approximately half of it before adding the other materials and the remainder of it after this.

7.2.8.2.2 If separate fine and coarse aggregates are used, add the in the following order:

a) about half the coarse aggregate;

b) the fine aggregate;

c) the cement and any ground granulated blastfurnace slag, fly ash, pigment or other powder; and

d) the remaining coarse aggregate.

7.2.8.2.3 Add all the water during the first 30 s of mixing.

7.2.8.2.4 After all the materials have been added, continue mixing for between 2 min and 3 min.

7.2.8.2.5 After completion of mixing, discharge the concrete onto a clean non-absorbent surface and turn it over using a hand tool to ensure uniformity before sampling.

7.3 Hand-mixing

7.3.1 General

Mix the concrete batch on a non-absorbent surface using a shovel, trowel or similar tool.

NOTE Hand-mixing is unlikely to produce a fully homogeneous and adequately dispersed mix. Admixtures and some additions might not perform to their full potential and performance is likely to vary between mixes.

7.3.2 Using dry aggregates

7.3.2.1 If an all-in aggregate is used, add it as one amount.

7.3.2.2 If separate fine and coarse aggregates are used, add them in the following order:

1) approximately half the coarse aggregate;

2) the fine aggregate;

3) the remaining coarse aggregate.

7.3.2.3 Gradually add approximately one-fifth of the water, sufficient to dampen the aggregate, and mix until uniform.

7.3.2.4 Allow to stand for 5 min to 15 min.

7.3.2.5 Add the cement and any ground granulated blastfurnace slag, fly ash, pigment or other powder mixing all the materials until uniform.

7.3.2.6 Continue mixing and gradually add the remaining water.

7.3.2.7 Mix the whole batch for at least 3 min or until the concrete appears homogeneous.

7.3.3 Using saturated aggregates

7.3.3.1 If an all-in aggregate is used, add approximately half of it before the other materials and the remainder after them.

7.3.3.2 If separate fine and coarse aggregates are used, add them in the following order:

1) approximately half the coarse aggregate;
2) the fine aggregate;
3) the cement and any ground granulated blastfurnace slag, fly ash, pigment or other powder; and
4) the remaining coarse aggregate.

7.3.3.3 Mix all the materials until uniform.

7.3.3.4 Continue mixing and gradually add the remaining water.

7.3.3.5 Mix the whole batch for at least 3 min or until the concrete appears homogeneous.

8 Sampling and testing the concrete

8.1 Start the sampling of the concrete as soon as possible after completion of mixing.

NOTE The remixing specified in BS EN 12350-1 is not required.

8.2 Perform the test in accordance with the relevant part of BS EN 12350 within 1 h from the addition of the water to the cement.

8.3 For each test on the fresh concrete and for making any specimens for hardened concrete tests, use the scoop (**4.2**) to obtain suitable amounts of concrete from the concrete batch heaped together either in the mixer or on a non-absorbent surface, ensuring that each sample is representative of the concrete batch.

8.4 When not sampled immediately, prevent the fresh concrete from gaining or losing water.

NOTE Provided that no water or other material is lost, the concrete used in workability and density tests may be remixed with the remainder of the batch before making any specimens for testing hardened concrete. The period of remixing should be as short as possible yet sufficient to produce a homogeneous mass.

9 Report

9.1 General

State that preparation of materials, batching, mixing and sampling were carried out in accordance with this part of BS 1881 in the test report unless modifications to the basic methods have been made, in which case report these in full.

9.2 Information to be included in the test report

Include the following in the test report:

a) date, time and place of mixing and batch identity number;

b) description of materials, including moisture content and condition of the aggregates, as in **4.3** a), b), c) or d);

c) specification of concrete mix (quantities or proportions) and any other requirements, e.g. workability;

d) method of mixing, type and rated capacity of mixer with time of starting and details of the procedure followed;

e) any modifications or deviations from the basic methods;

f) list of samples taken and specimens made; and

g) documentation of sampling method.

NOTE The test report may also include the following:

1) results of any tests on the fresh concrete;

2) actual quantities or proportions of materials batched;

3) any observations on the appearance of the fresh concrete, e.g. segregation and bleeding.

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