

British Standard

# Testing concrete

Part 102. Method for determination of slump

Essais du b&amp;on

Partie 102. Méthode de d&amp;termination de l'affaissement

Prüfverfahren für Beton

Teil 102. Verfahren zur Bestimmung des Ausbreitmaßes

## Foreword

This Part of this British Standard, prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Committee, is a revision of clause 2 of **BS 1881 : Part 2 : 1970**. Minor modifications have been made to the method for the determination of slump, in particular the number of layers in the test has been reduced from four to three.

Testing in accordance with this Part of this standard will comply with **ISO 4109**. Together with Parts **103**, **104**, **106** and **107**, this Part of **BS 1881** supersedes **BS 1881 : Part 2 : 1970**, which is withdrawn.

Reference is made to **BS 1881 :-Part 101** for sampling. An alternative method of sampling is permitted for the measurement of slump of concrete delivered in a truck. This alternative method is only permitted for the slump test as no data are available at the present time for its use for the methods of test given in other Parts of this standard.

Four methods of determining the workability of concrete are given in **BS 1881**, these being the slump, compacting factor, **Vebe** and flow. The methods are appropriate to concrete mixes of different workabilities as follows:

Workability	Method
Very low	Vebe time
Low	Vebe time, compacting factor
Medium	Compacting factor, slump
High	Compacting factor, slump, flow*
Very high	Flow'

\*In course of preparation.

There are no unique relationships between the values yielded by the four tests. Relationships depend upon such factors as the **shape** of the aggregate, the sand fraction and the presence of entrained air. This test is not suitable for concrete having a measured slump less than 5 mm or more than **175** mm.

An estimate is given for repeatability but not for reproducibility. Reference should be made to **BS 5497 : Part 1** for further information on the determination of repeatability and reproducibility.

**Compliance** with a British Standard does not of itself confer immunity from legal obligations.

## 1. Scope

This Part of this British Standard describes a method for determination of slump of cohesive concrete of medium to high workability. The method applies to plain and air-entrained concrete, made with lightweight, normal weight or heavy aggregates having a nominal maximum size of **40** mm or less but not to aerated concrete and no-fines concrete.

NOTE. The titles of the publications referred to in this standard are listed on **page 3**.

## 2. Definitions

For the purposes of this Part of this British Standard the definitions given in **BS 5328**, **BS 1881 : Part 101** and **BS 5497 : Part 1** apply.

### 3. Apparatus

**3.1 Mould.** Mould made of metal\* not readily attacked by cement paste and not thinner than 1.5 mm. The interior of the mould shall be smooth and free from projections such as protruding rivets and shall be free from dents. The mould shall be in the form of a hollow frustum of a cone having the following internal dimensions:

diameter of base:  $200 \pm 2$  mm  
 diameter of top:  $100 \pm 2$  mm  
 height  $300 \pm 2$  mm

The base and the top shall be open and parallel to each other and at right angles to the axis of the cone. The mould shall be provided with two handles at two-thirds of the height, and with foot pieces to enable it to be held steady. A mould which can be clamped to a baseplate is acceptable as an alternative if the clamping arrangement can be released without movement of the mould.

**3.2 Scoop,** approximately 100 mm wide.

**3.3 Sampling tray,** 1.2 m x 1.2 m x 50 mm deep made from minimum 1.6 mm. thick non-corrodible metal.

**3.4 Square mouthed shovel,** size 2 in accordance with BS 3388.

**3.5 Tamping rod,** made out of straight steel bar of circular cross section, 16 mm diameter, 600 mm long with both ends hemispherical.

**3.6 Rule,** graduated from 0 mm to 300 mm at 5 mm intervals, the zero point being at one end of the rule.

**3.7 Funnel (optional).** Funnel made of metal\* not readily attacked by cement paste. The funnel shall comprise two co-axial conical frustums having a common diameter of 100 mm, the ends being of greater diameter, one frustum to act as a filling funnel and the other as a collar to enable the funnel to be located on the outer surface of the mould.

### 4. Sampling

**4.1 General method.** Obtain the sample of fresh concrete by the procedure given in BS 1881 : Part 101. Commence the determination of slump as soon as possible after sampling.

**4.2 Alternative method.** If the concrete is delivered in a mixing or agitating truck, the slump may be measured using a sample obtained from the initial discharge. When this is done take a sample, after allowing a discharge of approximately  $0.3 \text{ m}^3$ , of six standard scoopfulls, collected from the moving stream in a bucket or other suitable container. Remix the sample on a non-absorbent surface and sub-divide into two parts. Test each part for slump.

### 5. Preparing the sample for test

Empty the sample from the container(s) onto the sampling tray. Ensure that no more than a light covering of slurry is left adhering to the container(s).

Thoroughly mix the sample by shovelling it to form a cone on the sampling tray and turning this over with the shovel to form a new cone, the operation being carried out three times. When forming the cones deposit each shovelful of the material on the apex of the cone so that the portions which slide down the sides are distributed as evenly as possible and so that the centre of the cone is not displaced.

Flatten the third cone by repeated vertical insertion of the shovel across the apex of the cone, lifting the shovel clear of the concrete after each insertion.

### 6. Procedure

Ensure that the internal surface of the mould is clean and damp but free from superfluous moisture before commencing the test. Place the mould on a smooth, horizontal, rigid and non-absorbent surface free from vibration and shock†.

Hold the mould firmly against the surface below with the funnel, if used, in position at the top whilst it is filled in three layers, each approximately one-third of the height of the mould when tamped. Tamp each layer with 25 strokes of the tamping rod, the strokes being distributed uniformly over the cross-section of the layer. Tamp each layer to its full depth, ensuring that the tamping rod does not forcibly strike the surface below when tamping the first layer and just passes through the second and top layers into the layers immediately below. Heap the concrete above the mould before the top layer is tamped. If necessary, add further concrete to maintain an excess above the top of the mould throughout the tamping operation. After the top layer has been tamped, remove the funnel, if fitted, and strike off the concrete level with the top of the mould with a sawing and rolling motion of the tamping rod. With the mould still held down, clean from the surface below any concrete which may have fallen onto it or leaked from the lower edge of the mould.

Remove the mould from the concrete by raising it vertically, slowly and carefully, in 5 s to 10 s, in such a manner as to impart minimum lateral or torsional movement to the concrete. The entire operation from the start of filling to the removal of the mould shall be carried out without interruption and shall be completed within 150 s.

Immediately after the mould is removed, measure the slump to the nearest 5 mm by using the rule to determine the difference between the height of the mould and of the highest point of the specimen being tested.

NOTE 1. Some indication of the cohesiveness and workability of the mix can be obtained if, after the slump measurement has been completed, the side of the concrete is tapped gently with the tamping rod. A well proportioned concrete which has an appreciable slump will gradually slump further, but a badly proportioned mix is likely to fall apart.

NOTE 2. The workability of a concrete mix changes with time due to the hydration of the cement and, possibly, loss of moisture. Tests on different samples should, therefore, be carried out at a constant time interval after mixing if strictly comparable results are to be obtained.

### 7. Expression of results

**7.1 General.** The test is only valid if it yields a true slump, this being a slump in which the concrete remains substantially intact and symmetrical as shown in figure 1 (a).

If the specimen shears, as shown in figure 1 (b), or collapses, as shown in figure 1 (c), take another sample and repeat the procedure.

Record the true slump to the nearest 5 mm.

**7.2 Precision.** For slump measurements made on concrete taken from the same sample, the repeatability is 15 mm at the 95 % probability level, for normal concrete having a

\*Galvanized steel is suitable.

†A carefully levelled metal plate, of adequate size to support the slumped concrete placed on a bed of sand is suitable.

Amendment No. 1  
published and effective from **31 July 1989**  
to **BS 1881 : Part 102 : 1983**

Testing concrete  
**Part 102. Method for determination of slump**

Revised text

AMD 6090  
July 1989

Foreword

In the table delete the asterisks and the associated footnote.

AMD 6090  
July 1989

Clause 3.3 Sampling tray

Delete this clause and substitute the following.

**'3.3 Sampling tray, minimum dimensions 900 mm x 900 mm x 50 mm deep, of rigid construction and made from a non-absorbent material not readily attacked by cement paste.'**

AMD 6090  
July 1989

Clause 3.5 Tamping rod

Delete this clause and substitute the following.

**'3.5 Tamping rod, made out of straight iron or steel bar of circular cross section,  $16 \pm 1$  mm diameter and  $600 \pm 5$  mm long, with both ends hemispherical.'**

AMD 6090  
July 1989

Clause 3.7 Funnel (optional)

In line 1 delete 'of metal' and substitute 'from a non-absorbent material'.

AMD 6090  
July 1989

Clause 4.1 General method

In line 2 after 'Part 101' add 'or Part 125'.

AMD 6090  
July 1989

Clause 5. Preparing the sample for test

At the end of this clause insert the following.

**'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.'**

AMD 6090  
July 1989

Clause 7.2 Precision

Delete line 5 and substitute 'For further information see BS 5497 : Part 1.'

*blank*

AMD **6090**  
July **1989**

Publications referred to  
Under BS **1881** insert in order

'Part **125** Methods for mixing and **sampling** fresh concrete in the **laboratory**'.



\* S \*

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Amendment No. 2  
published and effective from **31 July 1991**  
to **BS 1881 : Part 102 : 1983**

Testing concrete  
Part **102**. Method for determination of slump

**Revised text**

AMD 6727  
July 1991

**Clause 7.2 Precision (as amended by Amendment NO. 1)**

Delete this clause and substitute the following.

**7.2 Precision.** Precision data are given in table 1. These apply to slump measurements made on concrete from the same sample and when each test result is obtained from a single slump determination. The values which apply when each test result is obtained as the average of duplicate determinations are given in table 2.

**Table 1. Precision data for slump measurements (single determination)**

Range	Repeatability conditions		Reproducibility conditions	
	$s_r$	$r$	$s_R$	$R$
mm	mm	mm	mm	mm
50 to 80	5.8	16	9.0	25

**Table 2. Precision data for slump measurements (duplicate determinations)**

Range	Repeatability conditions		Reproducibility conditions	
	$s_r$	$r$	$s_R$	$R$
mm	mm	mm	mm	mm
50 to 80	4.1	11	8.0	22

**NOTE 1.** The precision data were determined as part of an experiment carried out in 1987 in which precision data were obtained for several of the tests described in BS 1881. The experiment involved 16 operators. The concretes were made using an ordinary Portland cement, Thames Valley sand, and Thames Valley 10 mm and 20 mm coarse aggregates.

**NOTE 2.** The difference between two test results from the same sample by one operator using the same apparatus within the shortest feasible time interval will exceed the repeatability value  $r$  on average not more than once in 20 cases in the normal and correct operation of the method.

**NOTE 3.** Test results on the same sample obtained within the shortest feasible time interval by two operators each using their own apparatus will differ by the reproducibility value  $R$  on average not more than once in 20 cases in the normal and correct operation of the method.

**NOTE 4.** For further information on precision, and for definitions of the statistical terms used in connection with precision, see BS 5497 : Part 1.

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measured slump within the range of 50 mm to 75 mm.  
For further information see BS 5497 : Part 1

## 8. Report

**8.1 General.** The report shall affirm that the test was made in accordance with this Part of this standard. The report shall state whether or not a certificate of sampling is available. If available a copy of the certificate shall be provided.

**8.2 Information to be included in the test report**

**8.2.1 Mandatory information.** The following information shall be included in the test report:

(a) date, time of completion, place and method (general or alternative) of sampling and sample identity number;

(b) time and place of test;

(c) time lapse from sampling to commencement of test;

(d) form of slump, whether true, shear or collapse;

(a) measured true slump;

(f) name of person carrying out test.

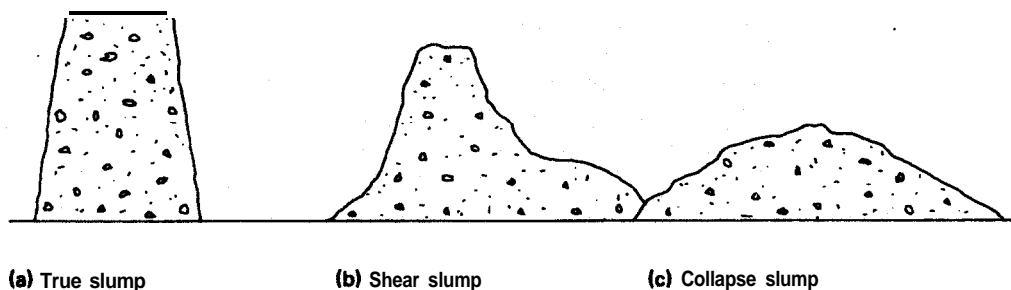
**8.2.2 Optional information.** If requested the following information shall be included in the test report:

(a) name of project and place concrete used;

(b) name of supplier and source of concrete;

(c) date and time of production of concrete or delivery to site;

(d) specification of concrete mix (e.g. strength grade).



(a) True slump

(b) Shear slump

(c) Collapse slump

Figure 1. Forms of slump

## Publications referred to

- BS 1881** Testing concrete  
Part 101 Method of sampling fresh concrete on site  
\*Part 103 Method for determination of compacting factor  
\*Part 104 Method for determination of Vebe time  
\*Part 106 Methods for determination of air content of fresh concrete  
\*Part 107 Method for determination of compacted fresh concrete
- BS 3388** Forks, shovels and spades
- BS 5328** Methods for specifying concrete, including reedy-mixed concrete.
- BS 5497** Precision of test methods  
Part 1 Guide for the determination of repeatability and reproducibility for a standard test method
- ISO 4109\*** Fresh concrete — Determination of the consistency — Slump test

\*Referred to in the foreword only.

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# BS 1881 : Part 102 : 1983

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The following BSI references relate to the work on this standard: Committee reference CAB/4 Draft for comment 81/12319 DC

## Committees responsible for this British Standard

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British Aggregate Construction Materials Industries  
British Precast Concrete Federation Ltd.  
British Ready Mixed Concrete Association  
Cement Admixtures Association  
Cement and Concrete Association  
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## Amendments issued since publication

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