# British Standard

BRITISH STANDARD

**BS 1881-102: 1983**

*Incorporating Amendment Nos. 1 and 2*

# Testing concrete —

## Part 102: Method for determination of slump

UDC 666.972.017:691.32:620.1

# Committees responsible for this British Standard

This British Standard was published under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Committee CAB/—. Its preparation was entrusted to Technical Committee CAB/4 upon which the following bodies were represented:

British Aggregate Construction Materials Industries
British Precast Concrete Federation Ltd.
British Ready Mixed Concrete Association
Cement Admixtures Association
Cement and Concrete Association
Cement Makers' Federation
Concrete Society Limited
County Surveyor's Society
Department of the Environment (PSA)
Department of the Environment (Building Research Establishment)
Department of the Environment (Transport and Road Research Laboratory)
Department of Transport
Electricity Supply Industry in England and Wales
Federation of Civil Engineering Contractors
Greater London Council
Institute of Concrete Technology
Institution of Civil Engineers
Institution of Highway Engineers
Institution of Municipal Engineers
Institution of Structural Engineers
Institution of Water Engineers and Scientists
National Federation of Building Trades Employers
Royal Institute of British Architects
Royal Institution of Chartered Surveyors
Sand and Gravel Association Limited
Society of Chemical Industry

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

British Civil Engineering Test Equipment Manufacturers' Association
Coopted members

This British Standard, having been prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Committee, was published under the authority of the Board of BSI and comes into effect on
31 May 1983



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

**ISBN 0 580 11922 X**

**Amendments issued since publication**

| Amd. No. | Date of issue | Comments |
|---|---|---|
| 6090 | July 1989 | |
| 6727 | July 1991 | Indicated by a sideline in the margin |
| | | |
| | | |

# Contents

# 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 1881-2:1970. 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 1881-2:1970, which is withdrawn.

Reference is made to BS 1881-101 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 |

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 5497-1 for further information on the determination of repeatability and reproducibility.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

**Summary of pages**

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 4, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

## 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 an inside back cover.

## 2 Definitions

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

## 3 Apparatus

**3.1** *Mould.* Mould made of metal[1)] 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 ± 2 mm |
| diameter of top: | 100 ± 2 mm |
| height | 300 ± 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,* minimum dimensions 900 mm × 900 mm × 50 mm deep, of rigid construction and made from a non-absorbent material not readily attacked by cement paste.

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

**3.5** *Tamping rod*, made out of straight iron or steel bar of circular cross section, 16 ± 1 mm diameter and 600 ± 5 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 from a non-absorbent material[1)] 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 1881-101 or BS 1881-125. 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 $m^3$, 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.

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.

[1)] Galvanized steel is suitable

## 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[2)].

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**. 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 5497-1.

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

## 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;

e) 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).

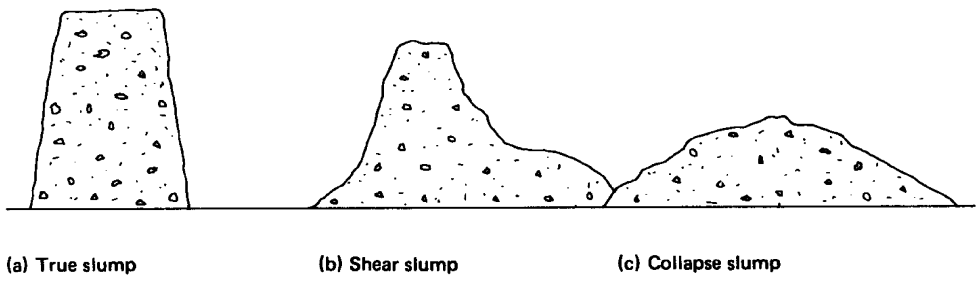


**Figure 1 — Forms of slump**

*blank*

# Publications referred to

BS 1881, *Testing concrete.*
BS 1881-101, *Method of sampling fresh concrete on site.*
BS 1881-103, *Method for determination of compacting factor*[3)].
BS 1881-104, *Method for determination of Vebe time*[3)].
BS 1881-106, *Methods for determination of air content of fresh concrete*[3)].
BS 1881-107, *Method for determination of compacted fresh concrete.*
BS 1881-125, *Methods for mixing and sampling fresh concrete in the laboratory.*
BS 3388, *Forks, shovels and spades.*
BS 5328, *Methods for specifying concrete, including ready-mixed concrete.*
BS 5497, *Precision of test methods.*
BS 5497-1, *Guide for the determination of repeatability and reproducibility for a standard test method.*
ISO 4109, *Fresh concrete — Determination of the consistency — Slump test*[3)].

[3)] Referred to in the foreword only.

# BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

**Revisions**

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

**Buying standards**

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

**Information on standards**

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

**Copyright**



BSI
389 Chiswick High Road
London
W4 4AL