BS 1881 : Part 103 :1983
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British Standard

# Testing concrete

## Part 103. Method for determination of compacting factor

**Essais du béton**
**Partie 103. Méthode de détermination du degré de compactibilité**

**Prüfverfailren für Beton**
**Teil 103. Verfahren zur Bestimmung des Verdichtungsfaktors**

British Standards Institution

## 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 3 of BS 1881 : Part 2 : 1970. Together with Parts 102, 104, 106 and 107, this Part of BS 1881 supersedes BS 1881 : Part 2 : 1970, which is withdrawn. An alternative method for determination of compacting factor is given in DD 90".

In the conventional method described in this Part, the compacting factor is determined from the masses of the partially compacted and fully compacted concrete. In the methodt given in DD 90, the compacting factor is determined by measuring the depth of the concrete which falls through the hoppers into the cylinder after it has been compacted by vibration.

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 workability 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 compacting factor less than 0.70 nor more than 0.98.

No estimate of repeatability or reproducibility is given in this Part of this British Standard. Reference should be made to BS 5497 : Part l-for further information on the determination of repeatability and reproducibility.

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

'In course of preparation.

†TAM C.T. Compactins facts of concrete 10, No. 5. May 1976. pp 27 and 30.

British Standard

# Testing concrete

## Part 103. Method for determination of compacting factor

## 1. Scope

This Part of this British Standard describes a method for determination of compacting factor of concrete of low, medium and 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, no-fines concrete and concrete which cannot be compacted by vibration alone.

**NOTE. The titles of the publications referred to in this standard are listed** on **the** inside back cover.

## 2. Definitions

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

## 3. Apparatus

3.1 *Compacting factor apparatus.* Compacting factor apparatus consisting of two conical hoppers mounted above a cylinder; its essential dimensions are shown in table 1 and figure 1.

The hopper and cylinder shall be of rigid construction made of metal not readily attacked by cement paste. The interior surfaces shall be smooth and free from projections such as protruding rivets and shall be free from dents. The rim of the cylinder shall be machined to a p!ane surface at right angles to its axis. The lower ends of the hoppers shall have tightly fitting hinged trap doors made of rigid non-corrodable metal plate, 3 mm thick. The doors shall have quick release catches which allow them to swing rapidly to a position at which they are caught by retaining catches which hold them clear of concrete falling through the bottom of the hopper.

The frame in which the hoppers and cylinder are mounted shall be of rigid construction and shall firmly locate them in the relative positions indicated in table 1. The cylinder shall be easiiy detachable from the frame.

3.2 Steel *floats* Two plasterer's steel floats.

3.3 Scoop, as described in 3.1 of BS 1881 : Part 101 : 1583.

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

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

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

*3.7 Scales or balance,* capable of weighing up to 25 kg to an accuracy of 10 g or better.

*3.8 Compacting bar or vibrating hammer or table.* Compacting bar made out of steel bar weighing 1.8 kg, 380 mm long and having a ramming face 25 mm square, or suitable vibrating hammer or table.

## 4. Sampling

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

### Table 1. Essential dimensions of the compacting factor apparatus

| Detail | Dimension | |
|---|---|---|
| | Preferred apparatus | Al ternative apparatus |
| | mm | mm |
| Upper hopper A: | | |
| Top internal diameter, *D* | 260 ± 2 | 254 ± 2 |
| bottom internal diameter, *E* | 130±2 | 127±2 |
| Internal height, *F* | 280 ± 2 | 279 ± 2 |
| Lower hopper 3: | | |
| Top internal diameter, G | 240 ± 2 | 229 ± 2 |
| Bottom internal diameter, ***H*** | 1 3 0 ± 2 | 127 ± 2 |
| Internal height, *J* | 240 ± 2 | 229 ± 2 |
| Distance between bottom of upper hopper A and top of lower hopper B, *K* | 200 ± 5 | 203± 5 |
| Distance between bottom of tower hopper 8 and top of cyiinder C, *L* | 200 ± 5 | 203 ± 5 |
| **Cylinder C:** | | |
| External diameter, *M* | 150 ±1 | 152±1 |
| Internal height, N | 285 ± 1 | 305 ± 1 |
| Radius between wall and base, *P** | *20* | – |

***Owing to current availability, apparatus having the dimensions given in this column may be used until 31 January 1985. The column will then be deleted by amendment and the use of such apparatus will no longer comply with the standard.**

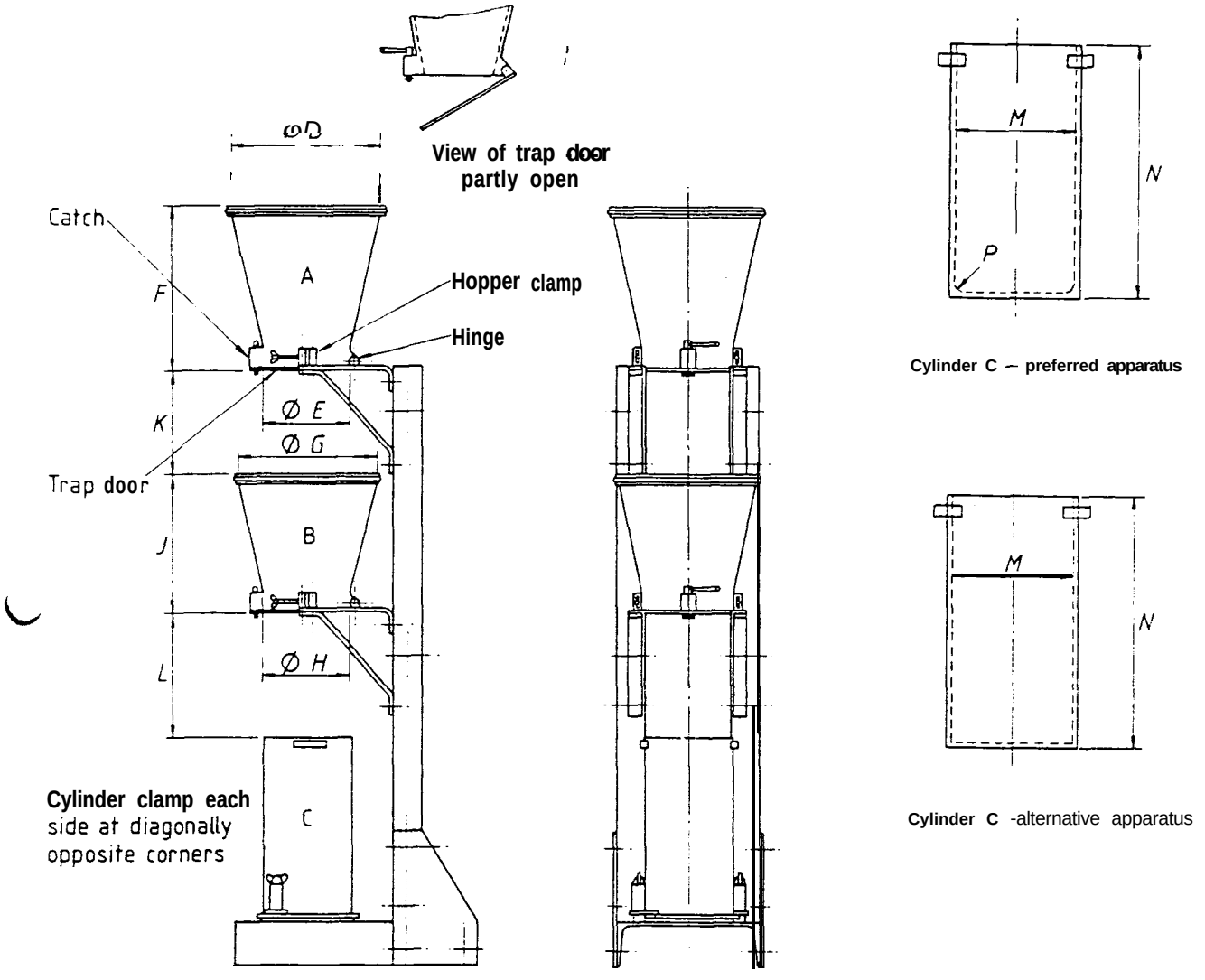


**Figure 1. Compacting factor apparatus**

## 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

**6.1 Procedure.** Ensure that the internal surfaces of the hoppers and cylinder are smooth, clean and damp but free from superfluous moisture. Place the frame in a position free from vibration or shock in such a manner that it is stable with the axes of the hoppers and the cylinder all lying on the same vertical line. Close the two trap doors and place the two floats on the cylinder so as to cover its top.

Place the sample of concrete gently in the upper hopper using the scoop until the hopper is filled to the level of the rim. Open the upper trap door so that the concrete falls into the lower hopper. Immediately after the concrete has come to rest, remove the floats from the top of the cylinder, open the trap door of the lower hopper and allow the concrete to fall into the cylinder.

Certain mixes have a tendency to stick in one or both of the hoppers.

If this occurs, help the concrete through by pushing the tamping rod gently into the concrete from the top until the lower end emerges from the bottom of the hopper. If this does not dislodge the concrete, raise the rod and repeat the process until the concrete falls through the hopper. Count the number of times the concrete is rodded as this provides a guide to the cohesiveness of the concrete.

Cut off the excess of concrete remaining above the level of the top of the cylinder by holding a float in each hand, with the piane of the blades horizontal, and moving them simultaneously one from each side across the top of the cylinder, at the same time keeping them pressed on the top edge of the cylinder. Wipe clean the outside of the cylinder.

Weigh the partially-compacted concrete in the cylinder and record its mass to the nearest 10 g, this mass being measured within 150 s of commencing the test.

Empty the partially-compacted concrete from the cylinder and re-fill it with concrete from the same sample in such a way as to remove as much entrapped air as possible (without significantly reducing the amount of entrained air, if present) and to produce full compaction of the concrete with neither excessive segregation nor laitance. For this purpose, by means of the scoop, place the concrete in the cylinder in six layers approximately equal in depth and compact each layer by using either the compacting bar or the vibrator in the manner described below in 6.2 or 6.3. After the top layer has been compacted, smooth it level with the top of the cylinder using the plasterer's float, and wipe clean the outside of the cylinder. Weigh the cylinder and its contents to the nearest 10 g, and by subtracting the mass of the empty cylinder, calculate and record the mass of the fully-compacted concrete to the nearest 10 g.

**6.2 Compacting with compacting bar.** When compacting each layer with the compacting bar, distribute the strokes of the compacting bar in a uniform manner over the cross-section of the cylinder, and ensure that the compacting bar does not penetrate significantly any previous layer nor forcibly stroke the bottom of the cylinder when compacting the first layer. Tne number of strokes per layer required to produce full compaction will depend upon the consistence of the concrete but in no case shall the concrete be subjected to fewer than 30 strokes per layer. Record the number of strokes.

**6.3 Compacting with vibrator.** When compacting each layer by means of the hammer or vibrating table use applied vibration of the minimum duration necessary to achieve full compaction of the concrete. Over-vibration may cause excessive segregation and laitance or loss of entrained air, if present. The required duration of vibration will depend upon the workability of the concrete and the effectiveness of the vibrator and vibration shall cease as soon as the surface of the concrete becomes relatively smooth and has a glazed appearance. Record the duration of vibration.

**NOTE. Workability of a concrete mix changes with time owing 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. Calculation and expression of results

Calculate the compacting factor from the formula:

$$\text{compacting factor} = \frac{m_p}{m_f}$$

**where**

$m_p$ is the mass of the partially-compacted concrete (in g);

$m_f$ is the mass of the fully compacted concrete (in g).

Express the results to two decimal places.

## 8. Report

**8.1 General.** The report shall affirm that the compacting factor was determined in accordance with this Part of this British Standard. The report shall state whether or not a certificate of sampling is available. Ii 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 and place of sampling and sample identity number;

(b) time and place of test:

(c) type of apparatus (see table 1);

(d) number of times concrete was rodded whilst in each hopper;

(e) compacting factor;

(f) method of compaction (hand or vibration) including type ot equipment used, the number of strokes of tne compacting bar or the duration of vibration:

(g) name of person carrying out the 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).

*blank*

## Publications referred to

BS 1881 Testing concrete
Part 101 Method of sampling fresh concrete on site
'Part 102 Method for determination of slump
*Part 104 Method for determination of Vebe time
'Part 106 Methods for determination of air content of fresh concrete
'Parr 107 Method for determination of density of compacted fresh concrete
BS 3388 Forks, shovels and spades
. BS 5328 Methods for specifying concrete, including ready-mixed concrete
BS 5497' Precision of test methods
Part 1 Guide for the determination of repeatability and reproducibility for a standard test method
DD 90' Volumetric method for determination of compacting factor of fresh concrete

*Referred to in the foreword only.

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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

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)
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tnstitution *of* Water Engineers and Scientists
Yational Federation of Building Trades Employers
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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

## Amendments issued since publication

| Amd. No. | Date of issue | Text affected |
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