

Testing concrete —

Part 127: Method of verifying the performance of a concrete cube compression machine using the comparative cube test

UDC 666.972.017:691.32:620.1

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The preparation of this British Standard was entrusted by the Cement, Gypsum, Aggregates and Quarry Products Standards Policy Committee (CAB/–) to Technical Committee CAB/4, upon which the following bodies were represented:

- Association of Lightweight Aggregate Manufacturers
- Association of Metropolitan Authorities
- Association of Quality Pulverised Fuel Ash Suppliers
- British Aggregate Construction Materials Industries
- British Cement Association
- British Civil Engineering Test Equipment Manufacturers' Association
- British Precast Concrete Federation
- British Ready Mixed Concrete Association
- Building Employers' Confederation
- Cement Admixtures Association
- Cementitious Slag Makers Association
- Concrete Society
- County Surveyors' Society
- Department of the Environment (Building Research Establishment)
- Department of the Environment (Property Services Agency)
- Department of Transport
- Department of Transport (Transport and Road Research Laboratory)
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- Federation of Civil Engineering Contractors
- Institute of Concrete Technology
- Institution of Civil Engineers
- Institution of Highways and Transportation
- Institution of Structural Engineers
- Institution of Water and Environmental Management (IWEM)
- Royal Institution of Chartered Surveyors
- Sand and Gravel Association
- Society of Chemical Industry

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

- Association of Independent Testing Laboratories
- Department of Trade and Industry (National Measurement Accreditation Service)

This British Standard, having been prepared under the direction of the the Cement, Gypsum, Aggregates and Quarry Products Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 31 May 1990

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The following BSI references relate to the work on this standard:
Committee reference CAB/4
Draft for comment 88/10572 DC

ISBN 0 580 17886 2

Amendments issued since publication

Amd. No.	Date	Comments

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Foreword

This Part of BS 1881 has been prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Policy Committee to describe a method for verifying the performance in operation of compression testing machines used for testing concrete cubes in accordance with BS 1881-116. BS 1881-115 specifies the requirements relating to control and measurement of the force applied to the specimen, the geometry and hardness of the machine platens and the means of alignment that ensure correct application of the applied force.

This Part of BS 1881 gives a procedure for verifying the overall performance of a concrete cube testing machine in normal operation as described in BS 1881-116, by comparing the cube test results obtained on the machine with those obtained on a reference machine. This procedure is referred to as a comparative cube test. A comparative cube test service was introduced in 1970, approved by the British Calibration Service¹⁾ in 1981 and operated to the criteria laid down in BCS Publication 0407. The committee introduced the comparative cube test in clause 9 of BS 1881-115:1986 as an alternative method to the use of the proving device described in appendix A of that standard. Both methods provide means of establishing compliance with the requirements of 9.1 a), b) and c) of BS 1881-115:1986. Where the results of a comparative cube test satisfy the criteria given in this Part of BS 1881, an assurance is obtained that the machine can be operated satisfactorily to test cubes. Where the results of a comparative cube test fail to satisfy the criteria, the cause(s) should be sought and deficiencies rectified. For this purpose it may be necessary to seek advice from the testing machine manufacturer or other specialist.

The combination of cube sizes and nominal strengths used in the comparative cube test is necessary to provide an effective test of performance.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, 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⁾ The British Calibration Service is now part of the National Measurement Accreditation Service (NAMAS).

0 Introduction

The objective of the comparative cube test is to provide an effective verification of a concrete cube testing machine in operation. This is done by comparing the cube test results obtained on the testing machine with those obtained on a reference machine. Cost considerations limit the number of cubes that can be used for this purpose so a combination of cube sizes and strength levels has been chosen which will be particularly sensitive to deficiencies in machine performance. The method is based upon obtaining, in the long term, coefficients of variation of lower than 1.5 % between the strengths of cubes from a batch. The cube making is controlled to achieve this level of uniformity.

There are several possible sources of error in cube testing. Relative tilting of the testing machine platens during loading (non-compliance with 9.1 c) of BS 1881-115:1986) affects results throughout the strength range but the effect is greatest for 150 mm cubes of very high strength concrete. Compliance with 9.1 c) is most efficiently tested using such cubes and experience has shown that six 150 mm cubes of 70 N/mm² mean strength are sufficient to provide an adequate test. Similar considerations determine the choice of six 100 mm cubes of 70 N/mm² mean strength and six 100 mm cubes of 14 N/mm² mean strength for testing compliance with 9.1 a) and 9.1 b) of BS 1881-115:1986 respectively. Experience has shown that each of these cube sets will also reveal other common deficiencies in machine performance. Together the three sets of cubes provide a very effective test of performance covering the force range of concrete testing using only eighteen cubes on each machine.

For comparative cube testing, which is concerned only with comparison between sets of cubes from the same batch, the actual strength level of the concrete and any variability between nominally similar batches are quite unimportant, but low variability between cubes made from a single batch and absence of bias between sets used on different machines are of the utmost importance. For these reasons the procedures for making cubes given in this Part of BS 1881 differ from those given in BS 1881-108 and BS 1881-125. For example, strict temperature control of the curing environment would only increase the cost of the test unnecessarily. On the other hand, because even small reductions in variability between cubes from a batch improve the effectiveness of the test, expenditure on controlling moulds to tighter tolerances than required by BS 1881-108 and the elimination of water leakage at mould bases is justified.

The management responsible for the machine being verified and also the operator are required to affirm compliance with the operational procedures of this Part of BS 1881 to minimize operational variations that non-compliance with the procedures could add.

1 Scope

This Part of BS 1881 describes the method of comparative cube testing for verifying the performance in normal operation of compression testing machines of at least 2 000 kN force capacity for testing 100 mm and 150 mm concrete cubes in accordance with BS 1881-116.

It describes the reference machine, cube-making and storage, test procedure and certification of the concrete cube testing machine.

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 BS 1881 the definitions given in BS 882, BS 1610-1 and BS 1610-2, BS 1881-101 and BS 5328 apply, together with the following.

2.1

reference laboratory

organization accredited by the National Measurement Accreditation Service (NAMAS) to provide concrete cubes made under controlled conditions and to undertake the comparative cube test

2.2

reference machine

compression testing machine used by the reference laboratory for comparative cube testing and used only for reference purposes

2.3

batch

quantity of concrete mixed in one cycle of operations of the mixer

2.4

group

total number of cubes of one size produced from the same batch in moulds filled and vibrated together (see 4.4)

2.5

set

six cubes of one size and produced from the same batch, but from six different groups (see 4.1)