SOUTH AFRICAN STANDARD
STANDARD METHOD

SABS method 865:1994
First revision

Concrete tests — The drilling, preparation, and testing for compressive strength of cores taken from hardened concrete

Acknowledgement

The SABS wishes to acknowledge the valuable assistance derived from publications of the following organizations:

The American Society for Testing and Materials

The British Standards Institution

The Concrete Society of the United Kingdom

Notice

This standard was approved by the President of the South African Bureau of Standards on 31 October 1994.

NOTES

1 In terms of the Standards Act, 1993 (Act 29 of 1993), no person shall claim or declare that he or any other person complied with an SABS standard unless

a) such claim or declaration is true and accurate in all material respects, and

b) the identity of the person on whose authority such claim or declaration is made, is clear.

2 It is recommended that authorities who wish to incorporate any part of this standard into any legislation in the manner intended by section 31 of the Act consult the SABS regarding the implications.

This standard will be revised when necessary in order to keep abreast of progress. Comment will be welcome and will be considered when the standard is revised.

Foreword

This first revision cancels and replaces SABS method 865:1982.

While the procedures in this standard give good results with cores taken from normal concrete, special considerations are necessary if the core includes reinforcing bar material or excessive voids, or is of non-standard shape.

Annex A forms an integral part of this standard. Annex B is for information only.

1 Scope

This standard describes a method of taking cores from hardened concrete, preparing them for testing and determining their compressive strengths.

NOTE – Before drilling of cores for testing in compression is started, agreement should be reached by all parties on the necessity of the test, and its aims. Reference should be made to SABS 0100-2 and to specialist literature[1)].

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, parties to agreements based on this standard are encouraged to take steps to ensure the use of the most recent editions of the standards indicated below. Information on currently valid national and international standards may be obtained from the South African Bureau of Standards.

BS 915, *High alumina cement.*

SABS method 863, *Concrete tests – Compressive strength of hardened concrete.*

SABS 0100-2, *Structural use of concrete – Part 2: Materials and execution of work.*

3 Materials

3.1 High alumina cement, that complies with the requirements of BS 915.

3.2 Sand, clean, fine and siliceous, that passes through a sieve of nominal aperture size 300 µm and that is retained on a sieve of nominal aperture size 150 µm.

3.3 Sulfur, commercial grade.

3.4 Carbon black.

4 Apparatus

4.1 Concrete core drill, that is diamond-tipped, of the required diameter and capable of taking a core from hardened concrete.

4.2 Concrete saw, that is diamond-tipped, and capable of cutting the ends of a core square to the axis of the core to within 1°.

4.3 Grinder, that is capable of grinding the ends of a core plane to within 0,5 mm/m and square to the axis to within 0,5°.

4.4 Capping plates and collars, if the core ends are to be capped. The appropriate of the following will be required:

---

1) BS 6089, *Guide to assessment of concrete strength in existing structures.*
Concrete Society, Concrete core testing for strength. Technical Report No. 11.

4.4.1 For capping with high alumina cement mortar, a sufficiently rigid metal baseplate, and a glass capping plate of thickness at least 6 mm, each with a surface that is plane to within 0,5 mm/m, and a steel collar with a machined edge of diameter appropriate to the cores to be tested.

4.4.2 For capping with sulfur mortar, a sufficiently rigid metal plate of diameter slightly larger than the core diameter, with a surface that is plane to within 0,5 mm/m, and with a slightly bevelled rim of vertical height not exceeding 3 mm, to form a flat-bottomed dish.

NOTE — Other equipment may be used, provided that a cap of uniform thickness and of the specified planeness is obtained.

4.5 Melting pot, electrically heated, that is capable of heating the sulfur mortar to approximately 250 °C and preferably fitted with an automatic temperature control device.

4.6 All-metal thermometer, with a usable range of 220 °C to 260 °C, to determine the temperature of the sulfur mortar.

4.7 Compression testing machine, as described in SABS method 863.

5 Drilling of concrete cores

5.1 Core size and drilling position

Take cores in accordance with SABS 0100-2.

5.2 Orientation

The orientation of the cores will, to a large extent, be dictated by the shape, size and position of the member or section. Take the core perpendicular to the outer surface of the concrete and, where practicable, with the longitudinal axis of the core horizontal. If possible, take the core without cutting through reinforcement. (A cover meter may be used to determine the position of reinforcement, and in some cases it might be advisable to expose the steel by chipping away the concrete cover.)

5.3 Size of cores

The preferred core diameter is 100 mm, but cores of a smaller diameter may be used, provided that the diameter is at least 65 mm and at least three times the maximum size of the aggregate.

NOTE — If necessary, non-standard core sizes may be considered, to avoid cutting reinforcing steel. However, the diameter should be at least 65 mm or at least three times the maximum size of the aggregate.

5.4 Drilling

Ensure that the drilling machine is so firmly positioned that damage to the core by movement or vibration is prevented. Drill to a sufficient depth to ensure that after the outer 20 % (with a maximum of 50 mm) of the core length (i.e. the portion that contains the surface layer of the concrete member or section) has been cut off, the remaining length of core is sufficient for testing (see 6.1.2).

5.5 Marking

After extracting the cores, mark each core to indicate its position in the concrete member or section and note any unusual features such as honeycombing, segregation, reinforcement, signs of lateral stresses exerted during the drilling operation, etc.

6 Preparation of cores

6.1 Dimensions

6.1.1 Take as the diameter d_c of each core the average of six measurements, to the nearest 1 mm, taken in pairs at right angles to each other near the middle and near the quarter-points of the core length. The tolerance on the generatrix (i.e. the longitudinal surface plane parallel to the longitudinal axis) of each core should be within 2 % of the diameter d_c.

6.1.2 Measure the maximum and minimum length of each core to the nearest 1 mm and discard any cores that do not have a trimmed length/diameter ratio of at least 0,85 or a ground length/diameter ratio of at least 0,9.

6.2 Trimming

Using the concrete saw (see 4.2) cut off both ends perpendicular to the axis of the core, to obtain a trimmed core that

a) does not contain any concrete from the top 20 % (with a maximum of 50 mm) of the member or section, or any surface laitance;

b) has, in the case of cores to be capped, a length/diameter ratio of 0,85 to 1,05, and, in the case of cores to be ground, a length/diameter ratio of 0,9 to 1,1. Measure, to the nearest 1 mm, the length l_1 of the trimmed core and the distance s from the nearer end of the core to the axis of any reinforcement included in the core.

6.3 Preparation of core ends

Use any of the following three methods to prepare the core ends.

6.3.1 Grinding

Before grinding, ensure that the core is saturated with water. Grind both ends of the core plane to within 0,5 mm/m and square to the axis of the core, to within 0,5°, such that a ground length/diameter ratio of 0,9 to 1,1 is obtained. Before testing, immerse the core for 48 h in water at 22 °C to 25 °C.

6.3.2 Capping with high alumina cement

6.3.2.1 Mix three parts by mass of high alumina cement and one part by mass of sand with enough water to obtain a mortar with the consistence of putty.

6.3.2.2 Before capping, ensure that the core is saturated with water. Place the core on a horizontal capping plate. So attach a well-fitting metal collar (that has a machined upper end) to the end of the specimen to be capped that the upper edge is horizontal relative to the plate and that the collar extends approximately 2 mm to 4 mm above the surface of the core end.

6.3.2.3 So fill the collar with the capping material that it forms a convex surface above the edge of the collar.

6.3.2.4 Coat the glass capping plate with a thin film of oil and press the capping plate down onto the capping material with a rotary motion until the capping plate makes complete contact with the edge of the collar. Take care not to occlude any air in the mortar. Allow the cap to harden, ensuring that it is kept damp, before removing the capping plate and collar. Cap the other end of the core in the same way. Cap both ends of the core plane to within 0,5 mm/m and square to the axis of the core to within 0,5°.

6.3.2.5 Before testing, immerse the core for 48 h in water at 22 °C to 25 °C.

6.3.3 Capping with sulfur mortar

6.3.3.1 Before capping, dry the core at a temperature of approximately 50 °C for approximately 2 h.

6.3.3.2 Mix equal parts by mass of sulfur and sand and add 2 % to 3 % of carbon black. Carefully heat the sulfur mortar to 230 °C to 250 °C while stirring well.

NOTE – Alternatively, a mixture of sulfur and fly ash can be used in suitable proportions to provide a higher strength than that of the concrete.

6.3.3.3 Heat the flat-bottomed dish until it can just be comfortably handled with the bare hands, thinly coat the surface with paraffin or a suitable oil and pour a quantity of sulfur mortar into the dish. Immediately press one end of the dried core into the sulfur mortar and, by using a suitable guide arrangement, ensure that the surface of the cap is perpendicular to the axis of the core and that the cap thickness does not exceed 5 mm. Cut off the excess mortar after a few seconds and immediately cap the other end of the core in the same way. Cap both ends of the core plane to within 0,5 mm/m and square to the axis of the core to within 0,5°.

After cooling, immerse the core for 48 h in water at 22 °C to 25 °C before testing.

NOTES

1 The ends of the core must be dry, since any moisture will immediately form steam and damage the cap.

2 If, after prolonged capping, the sulfur mortar has overheated the dish, allow the dish to cool until it can just be comfortably handled with the bare hands before carrying out further capping.

3 The sulfur mortar must be heated carefully to ensure even melting of the sulfur, especially when reheating mortar that has cooled down and formed a crust on top. The sulfur fumes emitted could generate enough pressure to explode the mass and it is therefore recommended that a thick steel rod, touching the bottom of the pot, be left in the cooling mortar. Upon reheating, the rod will conduct the heat to melt a hole through the crust and thus prevent an explosion.

4 The thermometer (see 4.6) should be used continuously to check the temperature of the sulfur mortar.

5 Heating over an open flame is dangerous because sulfur has a flash point of approximately 230 °C. Heating must be done in a fume cupboard.

6 Discard the sulfur mortar after reheating it five times.

7 Test procedure

7.1 Test each core immediately after it has been removed from the water and whilst it is still wet. Do not test cores with cracked or loose caps. Remove surface water, grit and projecting fins, and, for each core under test, determine, to the nearest 1 mm, the length (l_2) of the ground core or of the capped core.

7.2 Wipe clean the closing-in surfaces of the platens of the compression testing machine and so position the core in the machine that the axis of the core is aligned with the centre of thrust of the spherically seated platen. Do not use any packing other than auxiliary steel platens. As the platen is brought to bear on the core, adjust the platen gently by hand to achieve uniform contact.

7.3 Apply the compression load without shock and increase it continuously at a uniform rate of 0,3 MPa/s ± 0,1 MPa/s until the specimen fails, i.e. until no greater load can be sustained by the specimen. Record the load at failure P, in newtons. Report any unusual feature in the type of failure.