Australian Standard®

Methods of testing concrete

Method 13: Determination of the drying shrinkage of concrete for samples prepared in the field or in the laboratory

PREFACE

This Standard was prepared by the Standards Australia Committee on Methods of Testing Concrete, to supersede AS 1012, *Methods of testing concrete*, Part 13—1970, *Determination of drying shrinkage of concrete*.

The format of the Standard has been rearranged to comply with AS 2929, *Test methods — Guide to the format, style and content* and with Standards Australia Format B, which is the preferred format for a series of test methods as it reduces the amount of common content and precludes the need for separate covers.

The technical content of this edition is generally unchanged from the 1970 edition, except that —

(a) the differences between laboratory sampling/standard initial curing and field sampling/non-standard initial curing have been acknowledged with the inclusion of a requirement that samples prepared in the field be treated separately and reported as such;

(b) provision for the rejection of obviously incorrect specimens has been added; and

(c) a precision statement for laboratory prepared samples has been added.

(d) Provision has been made for the testing of concrete with aggregate up to a nominal 40 mm in size.

CONTENTS

METHOD

1 SCOPE This Standard sets out a method for preparing and curing of concrete shrinkage specimens, and for determining the length changes of these specimens due to drying in air. It provides for testing of specimens prepared in the laboratory or in the field, in which the nominal size of aggregate in the concrete, in accordance with AS 2758.1, does not exceed 40 mm.

The precision statement in Clause 9 does not apply to specimens which have had non-standard initial curing (normally field-prepared specimens). In addition this Standard requires that field-prepared specimens are marked, recorded and reported as such.

NOTES:

1 This test method is not always suitable for very low slump concrete (less than 20 mm), primarily due to the difficulties in obtaining adequate compaction. Provided adequate compaction is obtained, the method is applicable.

2 The method is specifically designed for measurement of drying shrinkage of concrete, but it is capable of adaptation for measurement of length changes of specimens subjected to a variety of environmental conditions.

2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS		
1012	Methods of testing concrete	
1012.1	Part 1:	Method for sampling fresh concrete
1012.2	Part 2:	Method for preparation of concrete mixes in the laboratory
1012.3	Part 3:	Methods for the determination of properties related to the consistence of concrete
1012.4	Part 4:	Methods for the determination of air content of freshly mixed concrete
1012.8	Part 8:	Method for making and curing concrete compression, indirect tensile and flexure test specimens in the laboratory or in the field
2758	Aggregates and rock for engineering purposes	
2758.1	Part 1:	Concrete aggregates

3 DEFINITIONS For the purpose of this Standard, the definitions below apply.

3.1 Standard moist curing conditions—as required by AS 1012.8 for lime-saturated water.

NOTE: Standard temperate conditions are required for a minimum of 24 h prior to initial measurement(see Clause 7.3.3).

3.2 Preparing laboratory—the laboratory responsible for sampling of concrete, moulding of specimens, initial curing in moulds, demoulding, initial moist curing, transport to measuring laboratory (if required).

3.3 Measuring laboratory—the laboratory responsible for completion of initial moist curing, storage in drying room, measurement of specimens.

NOTE: In some instances the preparing and measuring laboratories will be the same.

3.4 Micrometer—a linear measuring system.

NOTE: Typical examples include dial gauges and digital readout systems.

4 PRINCIPLE Specimens are cured and air dried for a specified time and the change in length is measured.

5 APPARATUS

5.1 General The apparatus shall consist of—

(a) a drying room for drying the specimens and in which they can be measured; and

(b) equipment for making and measuring the test specimens.

5.2 Drying room A drying room with suitably controlled temperature, humidity and air circulation shall be provided for storing specimens in air in accordance with the following requirements:

(a) Air shall be circulated through the room in a uniform manner so that the specified conditions are attained adjacent to all specimens under test.

(b) The temperature in the drying room shall be maintained at 23 ±1°C for 90% of each 24 h period, at all times remaining within the range 23 ±2°C.

(c) The relative humidity in the drying room shall be maintained at 50 ±5% at all times.

(d) The temperatures and relative humidities shall be recorded at all times by a recording device which is capable of rapid response to changes in room conditions.

The recording detectors shall be verified against a standardized Assmann hygrometer at least once per week.

NOTES:

1 A suitable rapid response device for recording temperature and humidity uses a combined detector with a thin-film capacitor for humidity and a platinum resistance thermocouple for temperature measurement. Response time for this type of detector is measured in seconds, and is virtually instantaneous within the narrow range required for this test method.

The detector is used in conjunction with a suitably matched chart recorder.

2 Most thermohygrographs are unsuitable for the purpose as the response is too slow to detect the full extent of fluctuations, particularly with the hair type of humidity detector.

(e) The rate of air movement in the drying room shall be such that the rate of evaporation is 12 ±5 mL per 24 h, with a minimum value of 7 mL per 24 h. The evaporation rates shall be determined by measuring the loss in weight of water in 400 mL low-form beakers of internal diameter 78 ±5 mm, initially containing approximately 375 g of water at a temperature of 23 ±2°C. The weight of water in the beaker shall not fall below 325 g. Each beaker shall be placed midway between test specimens on the storage racks with the water level at approximately the same height as the top of the specimens. Systematic checks on the evaporation rates shall be carried out by varying the location of the beakers within the drying room at least monthly or where conditions have changed and the results recorded.

NOTE: The rate of evaporation should be maintained as close to 12 mL per 24 h as possible.

(f) The requirements for temperature, humidity and evaporation rate apply to each storage position. Positions which do not comply shall not be used for storage of test specimens.

(g) The drying room shall be fitted with suitable racks for storing specimens. The racks shall provide free circulation of air around specimens, except for necessary supports, and shall be so situated with respect to the nearest wall or other obstruction that air circulation is not restricted in the intervening space. The horizontal supports shall consist of non-absorptive members having a total bearing width supporting the specimen of not more than 25 mm. All storage positions shall be kept occupied at all times, with dummy specimens if necessary.

NOTE: It is recommended that dummy specimens be concrete prisms with the same dimensions as the test specimens.

5.3 Moulds

5.3.1 *General* Moulds shall be made of non-absorbent material which does not react with cement paste and their internal surfaces shall have a smooth finish. The moulds shall be substantial enough to hold their form without distortion and shall be substantially leak-proof.

Each mould shall be provided with a base plate to which two end plates are securely fastened by screws, two side plates which are fastened to the end plates by screws, and two partially loose end plates which act as gauge stud holders. Each gauge stud holder shall fit inside the end of the mould and shall locate and secure a gauge stud during the setting period of the concrete. Each gauge stud holder shall be held in position against the end plate by a retaining screw and shall be capable of release after compaction of the concrete. The opposite side plates shall be parallel and the distance between them shall be 75 ±1 mm. The inside height shall be 75 ±1 mm.

5.3.2 *Construction of the mould* The construction of the mould shall be aligned coaxially along the central axis of the moulded specimen, with the distance between the inner ends of the two studs being 250 ±0.5 mm, and that between the outer ends 295 ±1 mm. Gauge studs shall protrude from the gauge stud holders to a distance of 15 ±1 mm. A suitable form of construction of the moulds is shown in Figure 1.

5.4 Gauge studs Gauge studs shall be of stainless steel and shall comply with dimensions shown in Figure 2. The radius of the gauge stud end shall be as follows:

(a) Horizontal comparator: 147.5 ±7.5 mm.

(b) Vertical comparator: Approximately 5 mm.

Gauge studs for horizontal and vertical comparators shall not be interchanged.

NOTE: As gauge studs are not interchangeable, it is recommended that the preparing laboratory confirm that the proposed gauge studs are compatible with the measuring laboratory's equipment.

5.5 Length gauge A length gauge shall be provided for checking the nominal length between gauge studs. The length gauge shall be made of metal and shall have a diameter of at least 6 mm and a length of 250 ±0.2 mm. The ends of the bar shall be flat and perpendicular to its length.

5.6 Tamping bar (hand compaction) The bar used for compacting concrete in the moulds shall be a straight metal rectangular bar having nominal dimensions of 25 mm × 10 mm × 300 mm long with a ramming face square with the axis.