Australian Standard®

Methods of testing concrete

Method 3.5: Determination of properties related to the consistency of concrete—Slump flow, T_{500} and J-ring test

1 SCOPE

This Standard sets out the method for determining the slump flow of self compacting concrete (SCC) with a measurable diameter of spread of the flowing concrete in excess of 500 mm when the nominal size of aggregate does not exceed 20 mm. The Standard also sets out the method of determining the time it takes for the slumping and flowing SCC to reach a diameter of 500 mm (T_{500} time). It sets out the measurement of the J-ring passing ability and the assessment of the stability and resistance to segregation of SCC.

NOTE: This Standard may involve hazardous materials, operations, and equipment. This Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS
1012 Methods of testing concrete
1012.1 Method 1: Sampling of concrete
1012.2 Method 2: Preparing concrete mixes in the laboratory

3 DEFINITIONS

For the purpose of this Standard the definitions below apply.

3.1 J-ring passing ability

The passing ability of SCC.

3.2 Self compacting concrete (SCC)

Concrete that is able to flow and consolidate under its own weight, completely fill the formwork or bore hole even in the presence of dense reinforcement, whilst maintaining homogeneity and without the need for additional compaction. SCC is also known as ‘self-consolidating concrete’ and ‘super-workable concrete’.

3.3 Slump flow

The horizontal flow of the concrete that occurs, when the slump cone is lifted.

3.4 T_{500} time

The time (in seconds) that it takes for the outer edge of the flowing concrete to reach an average diameter of 500 mm.

4 PRINCIPLE

A slump cone is filled with fresh SCC then the support given to the concrete by the slump cone is removed by raising the slump cone vertically upwards away from the concrete.

J-ring passing ability is measured by flow through tight openings such as the spaces between various configurations of vertical steel reinforcement formed by a J-ring assembly as prescribed in this Standard, without segregation or blocking.

NOTE: The slump-flow, T_{500} time and J-ring passing ability are tests that assess the flowability, the flow rate and passing ability of SCC. The result is an indication of the filling ability, resistance to segregation and/or susceptibility to blockage of SCC. The T_{500} time is also a measure of the speed of flow and hence the viscosity (cohesion) of the SCC.

5 APPARATUS

5.1 Mould

The slump cone mould shall be a hollow frustum of a cone made of non-reactive rigid material at least 1.5 mm thick which will hold its shape under the weighted collar, if used, and the internal surface shall be smooth. The bottom and the top of the slump cone shall be open and at right-angles to the axis of the cone. The slump cone shall be provided with a means of holding in place during filling and lifting the slump cone when filled. The internal dimensions of the slump cone shall be as follows:

(a) Bottom diameter (see Figure 2).....200 ±5 mm.

(b) Top diameter .....100 ±5 mm.

(c) Vertical height.....300 ±5 mm.

NOTES:

1 A suitable slump cone is illustrated in Figures 1 to 3.

2 Attachments to the slump cone preferably should be welded. If rivets are used in the construction of the slump cone, they have to be countersunk flush on the inside of the cone.

3 To facilitate holding of the slump cone in place during filling it is possible to place an additional mass onto the slump cone above the handles provided that the mass is sufficient to not allow the concrete to escape from the slump cone during filling and does not interfere with filling the slump cone or lifting operations.

5.2 Rod

The rod used for striking off concrete from the top of the slump cone shall be a metal rod of 16 ±1 mm in diameter, approximately 600 mm long and having at least one end tapered for a distance of approximately 25 mm to a spherical shape having a radius of approximately 5 mm.

5.3 Scoop

The scoop shall be made from non-absorbent material not readily attacked by cement paste of capacity not less than 1 L and suitable for taking increments of the concrete.

5.4 Base plate

The base plate shall be a non-reactive rigid flat plate with smooth, non-absorbent surface, at least 100 mm greater in diameter than the maximum slump flow expected, marked with a circle of 200 mm diameter indicating the central location of the slump cone, and a further concentric circle of 500 mm diameter (see Figures 2, 3 and 4). The base plate shall be constructed in a manner that prevents distortion and does not have a deviation from flatness exceeding 3 mm at any point when a straight edge is placed between the centres of opposing sides.

NOTE: A suitable base plate should be at least 900 mm 900 mm on which concrete can be placed (see Figures 2, 3 and 4).

5.5 Ruler

A 1 m steel ruler or measuring tape capable of measuring to 1 mm accuracy.

NOTE: A 300 mm ruler capable of measuring to the nearest 1 mm accuracy is suitable for measurements for the J-ring passing ability tests.

5.6 Stopwatch

An appropriate stopwatch capable of recording time to 0.1 second.

5.7 J-ring assembly

A ring assembly capable of rigidly fixing standard steel reinforcement vertical in a 300 mm diameter circle, at standard intervals (see Figure 3). Standard steel reinforcement at least 100 mm in length and spacing intervals based on the SCC ranking required, as follows:

(a) Rank 1—18 12 mm reinforcement at 40 ±2 mm spacing.

(b) Rank 2—15 12 mm reinforcement at 50 ±2 mm spacing.

(c) Rank 3—12 12 mm reinforcement at 66 ±2 mm spacing.

NOTE: The choice of SCC ranking required is influenced by the spacing of the steel bars and the density or congestion of the steel reinforcement in the concrete member.

5.8 Weighted collar

Weighted collar (optional), having a mass of at least 9 kg, to fit slump cone [see Figure 3(b)].

NOTE: The weighted collar allows the test to be carried out by one person.

5.9 Spirit level

Suitable to check that the base plate is level.

5.10 Buckets and funnel (collar)

To obtain, remix and pour the concrete into the mould.

6 SAMPLING

6.1 Field sampling

For concrete sampled in the field, the test sample shall be obtained in accordance with the requirements of AS 1012.1.

6.2 Laboratory sampling

For concrete made in the laboratory, the test sample shall be prepared in accordance with AS 1012.2.

7 PROCEDURE

The procedure shall be as follows:

(a) For concrete sampled in the field and in the laboratory commence the test immediately following the completion of mixing the test sample.

(b) Remix samples of concrete prior to testing by transferring from initial sub-sample buckets into other buckets of equivalent size to ensure a homogenous sample.

(c) Ensure that the internal surface of the slump cone is clean and free from set concrete.

(d) Moisten the internal surfaces of the sample bucket, funnel and slump cone and the base plate by wiping with a damp cloth immediately before commencing each test.

(e) If required, place the specified J-ring assembly in the centre of the 200 mm diameter circle marked on the base plate.