



Test method T279

Flow time and voids content of fine aggregate by flow cone

OCTOBER 2012



Revision Summary

Ed/Rev Number	Clause Number	Description of Revision	Authorisation	Date
Ed 1/Rev 0	All	New Method	D. Hazell	April 2009
Ed 2/ Rev 0	All	Reformatted RMS template	J Friedrich	October 2012

Note that Roads and Maritime Services is hereafter referred to as 'RMS'.

The most recent revision to Test method T279 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T279

Flow time and voids content of fine aggregate by flow cone

1. Scope

This test method sets out the procedure to determine the flow time and voids content of loose poured, oven dried fine aggregate.

NOTE: The method is adapted from NZS 3111:1986

2. General

(a) The test indicates the suitability of fine aggregate blends with regard to workability. Two measures are used (a) The time taken for a 1 kg sample to flow through the cone, and (b) the uncompacted voids content of the sample levelled in the receiving can. These measures relate to the fine aggregate grading, shape and surface texture

(b) The method is applicable to materials having a particle dry density between 2,500 and 2,800 kg/m³

NOTE: Particle densities tested outside this range should be determined and will require careful consideration, particularly in regard to the flow time achieved.

(c) The method uses the portion passing a 4.75 mm AS sieve

3. Apparatus

(a) A sand flow assembly complying with Figure 1 and comprising a sand flow cone with a stainless steel orifice, a stand, a calibrated receiving can and an overflow container

NOTE: Manufacturing drawings may be obtained from RMS Chemical and Materials Laboratory, St Hilliers Road, Auburn, NSW.

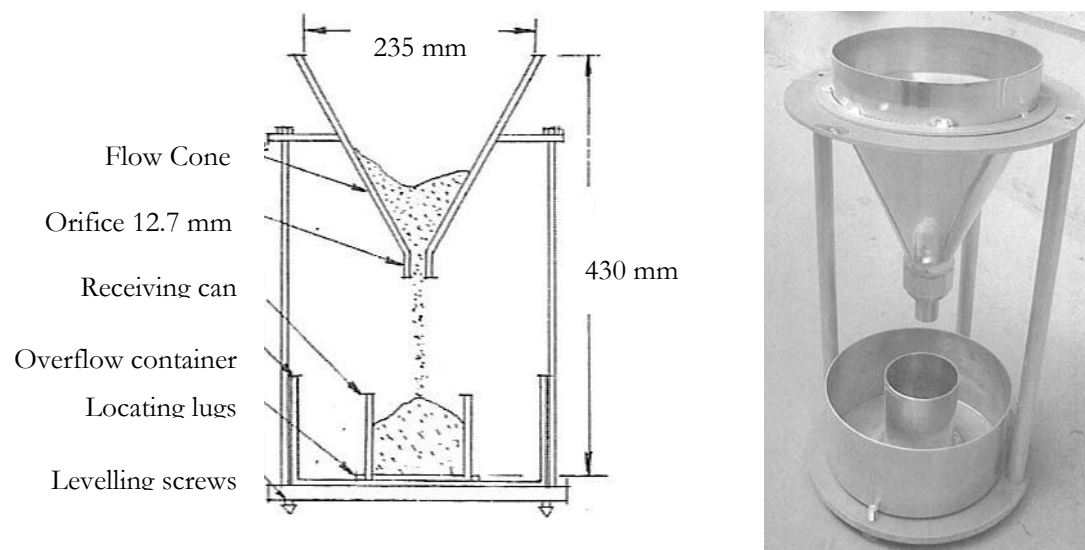


Figure 1 Flow Cone Apparatus

(b) A small spirit level at least 250 mm in length

(c) A 4.75 mm sieve that conforms to AS 1152 and a matching receiving pan

(d) Mechanical shaker (optional)

(e) A balance of suitable capacity with a limit of performance of ± 0.5 g

(f) A thermostatically controlled oven with good air circulation, which is maintained at a temperature from 105°C to 110°C

(g) A clean, round container of capacity 1 L that can be sealed to be dust tight

- (h) A metal screeding bar approximately 125 mm by 37.5 mm by 1.5 mm thick
- (i) A timing device readable to 0.1 s and accurate to ± 0.1 s
- (j) A soft bristled brush, approximately 20 mm head width
- (k) A metal spatula, approximately 20 mm in blade width

4. Preparation

- (a) Determine the dry density of the sample (DD) in accordance with AS 1141.5,
- (b) In accordance with AS 1141.3.1, divide the sample by riffing to provide a dry sample mass of at least 4,000 g
- (c) Dry the sample to constant mass
- (d) Allow the sample to cool to room temperature. Determine the mass of the sample (M_4) to the nearest 1 g
- (e) Sieve the sample using a 4.75 mm AS sieve
 - (i) Continue sieving until the mass passing the sieve in one minute is less than 1% of the mass of material retained on that sieve
 - (ii) When sieving by hand, use a lateral and vertical motion of the sieve accompanied by a jarring action.

NOTE: Pause the motion periodically to assist the process.

- (f) Determine the mass of material retained on the 4.75 mm sieve (M_0) to the nearest 1 g
- (g) From the portion passing the 4.75 mm sieve, prepare 4 sub-samples weighing $1,000 \pm 0.5$ g by quartering in accordance with AS 1141.3.1
- (h) Place each of the 4 sub-samples in a clean container, seal and label

NOTE: One sub-sample is a spare.

5. Procedure

- (a) Seat the flow cone snugly into the stand with the overflow container and receiving can situated centrally under the orifice of the cone. Ensure that the top plane of flow cone rim is level using a spirit level

NOTE: Clamp the cone in place if necessary.

If the volume of the receiving can has not been determined previously, determine the mass (V_R) of water to the nearest 0.1 g at $21 \pm 2^\circ\text{C}$ required to fill the receiving can so that no meniscus is present above the rim.

- (b) Take the sub-sample in the sealed container and shake vigorously for 30 seconds
- (c) After shaking in the container, gently fold any large aggregate particles evenly back into the mix using the spatula
- (d) Place a finger over the orifice of the cone. Do not dislodge the flow cone from its stand
- (e) Pour the test sub-sample slowly into the cone from a height of no more than 20 mm, to form a level surface and avoid segregation. Level the surface with the spatula with minimal disturbance so as not to induce settling
- (f) Quickly remove the finger from the orifice and simultaneously start timing
- (g) Record the time taken to the nearest 0.1 s for the fine aggregate to empty the cone and clear the orifice. Do not assist the flow or dislodge blocked material while the test is in progress
- (h) If a sub-sample does not flow through the orifice of the cone, record “*Did Not Flow*”
- (i) Gently screed off excess fine aggregate collected in the receiving can to form a flat surface without compacting the sub-sample. Use short horizontal strokes of the screeding bar and keep the face of the bar vertical and the can steady to avoid settling. Collect any excess in the overflow container
- (j) After the surface of the material in the receiving can is level, gently tap the can so the material settles in the can to avoid spillage

- (k) Determine the mass (M_R) of fine aggregate in the receiving can to the nearest 0.1 g
- (l) On completion of each test, use the small brush to thoroughly clean the wall of the flow cone into the overflow container and avoid scratching any surface. Collect the fines in the overflow container. Tip the fines and portion tested back into the empty 1 L container. Replace the overflow container
- (m) Repeat the procedure (a) to (l) until three sets of measurements have been recorded

NOTE: On completion of each series of tests, use the small brush to thoroughly clean the whole of the flow cone apparatus and avoid scratching any surface of the cone.

6. Calculations

- (a) Calculate the percentage oversize material (P_O) of the fine aggregate as follows:

$$P_O = \frac{M_O}{M_4} \times 100\%$$

Where:

P_O = Proportion of oversize material (%)

M_O = Mass of material (g) retained on the 4.75 mm sieve to the nearest 1 g

M_4 = Mass of sample (g) to the nearest 1 g

- (b) Calculate the Uncompacted Voids (AV) content as follows:

$$AV = \left(1 - \frac{1000M_R}{V_R \times DD} \right) \times 100\%$$

Where:

AV = Air voids Content (%)

V_R = Volume of the receiving can (mL)

M_R = Mass of fine aggregate in the receiving can (g)

DD = Dry density of the fine aggregate (kg/m^3)

7. Reporting

Include the following data and results in the report:

- (c) A description of the material
- (d) The Dry Density (DD) of the material
- (e) The percentage oversize material (P_O) to the nearest 1 percent
- (f) Flow time of each test and the average flow time of the three tests to the nearest 0.1 second. Report "Did Not Flow" for any sub-sample that did not flow
- (g) The Uncompacted Void Content (AV) to the nearest 0.5 percent
- (h) Reference to this test method