Test method T106

Coarse particle size distribution of road construction materials (By dry sieving)

OCTOBER 2012

Revision Summary

Ed/Rev Number	Clause Number	Description of Revision	Authorisation	Date
		Reformatted and Revision Summary Added	D Dash	May 1999
		Date on Test Method Revised to Agree with Date on Revision Summary	D Dash	Feb 2001
Ed 2/Rev 0		Generally Revised – Title changed	G Donald	Nov 2007
Ed 2/Rev 1	1 Note, 2(a), 2(d), 5.1(c), 5.2(c), 5.3(a), (b), (c), (e), (f), 5.4(b), (d), (e), (g), 6.1(a), (b), 6.2(a), (b), 7(a).	Generally Revised – Revisions as indicated.	D Hazell	Sep 2008
Ed 3/Rev 0	All. New 6.1 and change to 6.2(a), 6.2(e)	New issue. Preliminary sieving not required. 6.7mm sieve not mandatory. Mass of sample corrected to be after drying. Tolerance on intermediate receiver.	D Hazell	Oct 2011
Ed 4/ 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 T106 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T106

Coarse particle size distribution of road construction materials (By dry sieving)

1. Scope

This Test Method sets out the procedure for determining the coarse particle size distribution by dry sieve analysis of road construction materials greater than 2.36 mm.

NOTE: The procedure is similar to AS 1289.3.6.1 'Standard method of analysis by sieving' except that only dry sieving is used and sieving stages are not defined.

2. General

(a) This method is used to determine the coarse particle size distribution. The sieves are defined in Step 3(a).

(b) Required pre-treatment's are carried out on the sample before using T106 unless otherwise specified.

(c) This method may be used in conjunction with T107 to determine a complete particle size distribution of the material. When both tests are required, T106 is carried out first.

NOTE: T107 is for determining the particle size distribution of material passing the 2.36 mm AS sieve.

(d) If required, the test portions for other tests may be prepared from the material passing the 2.36 mm AS sieve as described in T105.

(e) Reference to 'Constant Mass' is according to the procedure described in T120 or AS 1289.2.1.1 Clauses 4(b) to (g) except at the temperature stated in the test method.

(f) A large sample (i.e. over 40 kg) is time-consuming to dry to Constant Mass. Therefore, the method sieves:

(i) +19 mm material without further drying, except if porous and very moist

(ii) -19 mm material to be dried to Constant Mass

(g) The following documents are referred to in this Test Method:

(i) T105 Preparation of Samples for Testing (Soils)

(ii) T107 Fine Particle Size Distribution of Road Construction Materials

(iii) T120 Moisture Content of Road Construction Materials (Standard Method)

(iv) AS 1152 Test Sieves.

(v) AS 1289.2.1.1 Soil moisture content tests – Determination of the moisture content of a soil – Oven Drying method (standard method).

3. Apparatus

(a) Sieves of the following sizes or as required that conform to AS 1152:

(i) Coarse Sieves: 75.0 mm, 53.0 mm, 37.5 mm, 26.5 mm, 19.0 mm

(ii) Intermediate sieves: 13.2 mm, 9.5 mm, 4.75 mm, 2.36 mm.

NOTE: While the 6.70 mm sieve is not normally reported, it may be used to prevent overloading sieves.

Where other sieve sizes are specified, amend the sizes referred to in this method accordingly.

(b) A receiver and lid of suitable diameter

(c) Mechanical shaker (optional)

(d) An area with good air circulation with a temperature that does not exceed 50°C

(e) Dishes of suitable size to hold test portions

(f) A porcelain mortar with rubber pestle

(g) Brushes (wire or stiff bristle) and scoops as required

(h) A balance of suitable capacity with a limit of performance of not greater than ±5 g

4. Preparation

Prepare samples in accordance with T105.

5. Procedure

5.1 General

(a) The sample is sieved through the required sieves by hand or with a mechanical shaker:

NOTE: Sieves are fitted together in order of size with the coarsest sieve uppermost, and may be used at the same time provided the assembly is not too heavy.

(i) 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.

(ii) When using a mechanical shaker, set the timer to an appropriate time.

NOTE: Estimate the minimum sieving time based on the elapsed time for the first sample or from experience. Generally about 12 to 15 minutes sieving is required.
Periodically stopping and then starting the equipment after a pause may help the process.

(b) At the end of sieving, hand sieve each portion retained for about 1 min until the mass passing each sieve is less than 1% of the mass of material retained on that sieve.

(c) Take care not to overload the sieve(s). Check that the charge and mass retained complies with Table A.4 in T105.

NOTE: Overloading of sieves may affect the accuracy of results and damage the sieves. To overcome:
(a) Use sieves with a larger capacity, or
(b) Use additional sieves, or
(c) Divide the fraction retained on the sieve into two or more portions and pass separate portions through the sieve that was originally overloaded and the sieves that are finer.

5.2 Coarse Sieving

(a) Dry the sample at a temperature not to exceed 50°C so that aggregations of material can be easily separated when crumbled according to Process A1 in T105 to the extent required to pass the 19.0 mm sieve.

(b) Crumble the sample into aggregations smaller than about 19 mm.

(c) Determine the mass of the sample (M_S) to the nearest 1 g.

(d) Assemble the required coarse sieves in order from largest to smallest size with receiver at the bottom.

(e) Sieve the portion through the coarse sieves and continue sieving until the mass passing each sieve in one minute is less than 1% of the mass of material retained on that sieve.

NOTE: A wire or stiff bristle brush may be used to remove adhering particles.

(f) Determine the mass of the following fractions to the nearest 1 g:

(i) Material retained on each coarse sieve (M_c).

(ii) Material in the receiver (M_X) (i.e. passing the 19.0 mm sieve)

5.3 Intermediate Sieving

(a) Dry the material in the receiver to 'Constant Mass' at a temperature not to exceed 50°C according to Step 2(e).

(b) Determine the dry mass of the intermediate sample (M_I) to the nearest 1 g.

(c) Assemble the required intermediate sieves in order from largest to smallest size with a clean receiver at the bottom.

(d) Sieve the portion through the intermediate sieves and continue sieving until the mass passing each sieve in one minute is less than 1% of the mass of material retained on that sieve.

(e) Determine the mass of the following fractions to the nearest 1 g:

(i) Material retained on each sieve (M_i).

(ii) Material in the receiver (M_Y) (i.e. passing the 2.36 mm sieve).

6. Calculations

6.1 Adjusted mass of sample

(a) Calculate the adjusted mass of sample (M_A) to the nearest 1 g as follows:

NOTE: The original mass of the sample is not used as drying the -19 mm portion during the test changes the mass.

$$M_A = \sum M_c + M_I$$

Where:

M_A = Adjusted mass of sample to allow for drying (g).

M_c = Mass of portion retained on each coarse sieve (g).

M_I = Dry mass of portion for intermediate sieving (g).

6.2 Particle Size Distribution

(a) Calculate the percentage retained on each coarse sieve as follows:

NOTE: In the formulas the subscript 'c' stands for each coarse sieve.

$$R_c = \left(\frac{M_c}{M_A}\right) \times 100$$

Where:

R_c = Percentage retained on sieve 'c' (%) (i.e. R_{75}, R_{53}, $R_{37.5}$, $R_{26.5}$, R_{19}).

M_c = Mass of fraction retained on coarse sieve 'c' (g).

M_A = Adjusted mass of sample (g).

c = The coarse sieve.

(b) Calculate the percentage passing each coarse sieve as follows:

$$P_c = \left(100 - \sum R_c\right)$$

Where:

P_c = Percentage passing coarse sieve 'c' (%) (i.e. P_{75}, P_{53}, $P_{37.5}$, $P_{26.5}$, P_{19}).

$\sum R_c$ = Cumulative percentage retained on coarse sieves 'c' and coarser (%).

c = The coarse sieve.

(c) Calculate the percentage retained in each intermediate sieve as follows:

NOTE: In the formulas the subscript 'i' stands for each intermediate sieve. A 6.7 mm sieve is not reported unless otherwise required.

$$R_i = \left(\frac{M_i}{M_I}\right) \times 100$$

Where:

R_i = Percentage retained on sieve '*i*' (%) (i.e. $R_{13.2}$, $R_{9.5}$, $R_{4.75}$, $R_{2.36}$).

M_i = Mass of fraction retained on sieve 'i' (g).

M_I = Adjusted mass of sample (g).

i = The intermediate sieve.

(d) Calculate the percentage passing each intermediate sieve as follows:

$$P_i = \left(P_{19} - \sum R_i\right)$$

Where:

P_i = Percentage passing the particular sieve (%) (i.e. $P_{13.2}$, $P_{9.5}$, $P_{4.75}$, $P_{2.36}$).

P_{19} = The percentage passing the 19.0 mm sieve (%).

(If the whole sample passes the 19.0 mm sieve $P_{19}=100$, otherwise from Calculation (b)).

$\sum R_i$ = Cumulative percentage retained on intermediate sieve '*i*' and coarser (%).

i = The intermediate sieve.

(e) Calculate the percentage in the intermediate receiver (P_Y) as follows and check that this is within ± 0.5% of $P_{2.36}$.

$$P_Y = \left(\frac{M_Y}{M_I}\right) \times 100$$

Where:

P_Y = Percentage in the intermediate receiver (%)

M_Y = Mass of the fraction in the receiver (g)

M_I = Adjusted mass of sample (g).

7. Reporting

(a) Where the material is also to be tested using T107, the results from this test are to be reported according to T107.

(b) Where only the coarse particle size distribution is required, include the following results in the report:

(i) The percentages passing (P_c and P_i) each sieve used to the nearest 1% commencing with the smallest sieve size through which 100% of the material passes or the largest sieve size specified.

	Particle Size	% Passing
Coarse (P_c)	75.0 mm	
	53.0 mm	
	37.5 mm	
	26.5 mm	
	19.0 mm	
Intermediate (P_i)	13.2 mm	
	9.5 mm	
	4.75 mm	
	2.36 mm	

(ii) Where required, plot the results on semi-logarithmic axes with particle size as the 'x' axis and percentage passing as the 'y' axis.

(iii) Reference to this Test Method.