Test method T152

Stability of mixtures of road materials and bituminous materials (Hubbard-Field)

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	D.Dash	Feb 2001
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 T152 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T152

Stability of mixtures of road materials and bituminous materials (Hubbard-Field)

1. Scope

This test method sets out the procedure for the preparation, curing and determination of the Hubbard-Field stability of specimens of soil, gravel or crushed rock material stabilised or modified by the addition of bitumen, cut back bitumen, bitumen emulsion, or tar. The procedure is derived from American Society for Testing Materials, Standard Designation D915-61.
This method is applicable to materials passing a 4.75 mm AS sieve.

2. Apparatus

(a) Mixing apparatus such as a steel tray, trowel, spatula and scoop

(b) Quartering apparatus such as metal plates approximately 400 mm x 125 mm and 200 mm x 125 mm or sample dividers (riffle boxes) of appropriate size opening, e.g. the multiple slot type similar to that shown in Australian Standard 1289

(c) Metal mixing dishes, approximately 350 mm diameter at the top, depth 60 mm and with sloping sides and smooth surface finish

(d) Steel moulds, having an internal diameter and depth of 50.8 mm machined on the inside to a smooth surface

(e) A machined steel base plate 300 mm x 200 mm x 25 mm thick

(f) A compaction stand or bench of heavy wooden construction secured to a solid concrete floor or slab

(g) A tamper and tamper plunger as described in ASTM Test Method D915-61

(h) A compression machine, capable of applying a load of 44.5 kN to the compacted specimen

(i) A balance of not less than 2 kg capacity, accurate and readable to 0.5 g within the operating range and a balance of not less than 500 g capacity, accurate and readable to 0.05 g within the operating range

(j) A Hubbard-Field Type stability testing machine capable of applying a total force of 44.5 kN at a uniform rate of head or platen movement of 25 mm/min as described in ASTM Test Method D915-61

(k) A testing mould assembly consisting of a mould diameter 52.58 mm and height 114.30 mm slightly tapered at one end, fitted to a shear ring and ring base, as described in ASTM Test Method D915-61

(l) A thermostatically controlled oven with good air circulation, capable of maintaining a temperature within the range of 105^{O}C and 110^{O}C

(m) 37.5 mm, 19.0 mm and 4.75 mm AS sieves

(n) A bowl suitable for thoroughly mixing increments of water with the test sample. A mixing machine (11 litre capacity) may be used

(o) Moisture measurement tins, at least 500 mL capacity, with press-on lids or other suitable seal

(p) A measuring cylinder, 100 mL

(q) A steel straightedge, a suitable size being 300 mm long, 25 mm wide and 3 mm thick, preferably with a bevelled edge

(r) A 300 mm rule

(s) A porcelain mortar, approximately 180 mm diameter, and a rubber pestle

3. Preparation of Sample

(a) Allow the sample to dry sufficiently to enable it to be crumbled. If necessary, dry the sample at a temperature not exceeding 50°C

(b) Break up any aggregations of particles in such a way as to avoid crushing any discrete particles. All aggregations of particles are to be broken down so that, if the sample was screened on a 4.75 mm AS sieve only discrete, uncrushed particles would be retained. A rubber pestle should be used to avoid breaking down sound pieces of mineral matter. Adhering material should be brushed from coarse pieces. When in doubt as to whether lumps are to be broken, place some in water and boil. If slaking occurs, the material should be broken further with a rubber pestle

(c) Screen the sample on a 4.75 mm AS sieve. Discard material retained

(d) Thoroughly mix all material in the portion passing the 4.75 mm AS sieve and reduce by quartering or riffling to provide not less than 500 g of material for preparation of duplicate test specimens

4. Bituminous Materials

(a) Bituminous materials used in laboratory investigations should be the same type from the same source of supply or manufacture as the materials proposed for use in the field. Unless otherwise specified or approved the bituminous materials should comply with the requirements of the appropriate Australian Standard (Bitumen, Cut Back Bitumen, Bitumen Emulsion, or Tar)

(b) Where bitumen emulsion is specified or approved for use in investigations in relation to stabilisation or modification of road materials, the water used in the test should be from the same source as that proposed for use in the field

5. Preparation and Curing of Test Cylinders

(a) Obtain by quartering or riffling two portions, each of about 250 g mass, from the sample prepared in *Preparation of Sample (d)*

(b) Weigh the mould and record the mass (M_2) to the nearest 0.5 g. Assemble the mould, collar and base plate and place the assembly on the rigid foundation. The interior of the mould should be oiled with a light application of castor oil. Wipe off any excess oil

(c) Take one of the 250 g portions and determine the mass to the nearest 0.05 g. Calculate the required amount of bituminous material as a percentage by mass. Weigh out the calculated amount to the nearest 0.05 g. Add the bituminous additive to the materials at the appropriate moisture content as determined by Test Method T150 for the particular additive content and thoroughly mix to a uniform colour. Add the quantity of water necessary to provide the optimum moisture content, appropriate for the intended compactive effort as determined by Test Method T150. Thoroughly mix. Allow the mixture to stand for 5-10 minutes. Remix the material and break up any lumps that may have formed

(d) Insert the short compaction plunger approximately 25 mm into the bottom of the compaction mould, suitably supported to maintain its position during initial compaction

(e) Place a portion of the material in the mould so as to form a specimen 50 mm in diameter by 50 mm in height

(f) Obtain initial compaction by 25 blows with the tamper. Allow the tamper to fall freely from a height of 152.4 mm above the bottom of the specimen being formed, and rotate it between application of the blows. Then insert the long compaction plunger into the top of the compaction mould, remove the support for the mould, and place the entire assembly in the compression testing machine

(g) Obtain final compaction by compressing the specimen at a constant rate of 25 mm/min until a total load of 27 kN is indicated. Maintain this load for two minutes. Remove the specimen from the mould, mark the top of the specimen as tamped, and weigh and measure the specimen for average height and diameter. The average height of the specimen shall be 50 ± 2 mm. Discard any specimens not conforming to the specified tolerance

(h) Remove the base plate, eject the compacted specimen from the mould and record the mass of the specimen (M) to the nearest 0.5 g

(i) Dry the samples to constant mass in an oven 55-60^{O}C. Record the (M_1) after drying and determine the average diameter of the bottom of test specimen to the nearest 0.5 mm from several diameters (D_1) measured at right angles to each other

(j) Determine the moisture content (w) of the mix from that portion of material remaining after the preparation of the test specimen

(k) Place the specimen in water at room temperature to a depth of 10 mm for 72 hours

(l) Remove the specimen from the water, surface dry and record the mass (M_2)

6. Determination of Stability

(a) Assemble the testing cylinder, testing ring and ring support

(b) Place the cylinder in the test mould with the face downwards that was down during curing

(c) Insert the specimen into the large end of the testing cylinder until seated against the testing ring, gradually forcing it, if necessary, by use of the compaction plunger. Insert the testing plunger and guide into the large end of the test mould until resting on top of the test specimen

(d) Centre the entire test assembly on the platform of the stability testing machine. Apply load to the test specimen through the testing plunger, at a constant rate of movement of 25 mm/min. Record the stability, as the maximum total load required to cause failure of the test specimen, to the nearest 0.5 kN

7. Calculations

(a) Calculate the mass of dry soil (M_d) in the compacted specimen as follows:

$$M_d = \frac{100\,M}{100 + w}\ \text{g}$$

Where

M = mass of compacted specimen in grams.

w = moisture content of soil portion as a percentage by mass.

(b) Calculate the water absorption (A), as a percentage by mass, as follows:

$$A = \frac{M_2 - M_1}{M_d} \times 100\ \%$$

Where

M_1 = mass of specimen before curing.

M_2 = mass of specimen after curing.

M_d = calculated mass of dry soil in compacted specimen as determined in *Calculations (a)*.

8. Reporting

Report the following details for each pair of test specimens as appropriate:

(a) Type and source of additive

(b) Additive content

(c) Quantity of cutter used (if any) and moisture content at which binder was added

(d) Moisture content at which specimens were compacted

(e) Source of water if bitumen emulsion was used

(f) Water absorption

(g) Stability (Hubbard-Field) to the nearest 0.5 kN

9. Technique

Difficulties may be experienced in the use of cut back bitumen when mixed with road materials because of the slow rate of evaporation of cutter oil. In such cases the amount of cutter added should be kept to a minimum.