BRITISH STANDARD

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Bituminous mixtures — Test methods for hot mix asphalt

Part 12: Determination of the water sensitivity of bituminous specimens

ICS 93.080.20

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 12697-12:2008. It supersedes BS EN 12697-12:2003 which is withdrawn.

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Foreword

This document (EN 12697-12:2008) has been prepared by Technical Committee CEN/TC 227 “Road materials”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2008, and conflicting national standards shall be withdrawn at the latest by December 2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12697-12:2003.

This document is one of a series of standards as listed below:

EN 12697-1, *Bituminous mixtures – Test methods for hot mix asphalt – Part 1: Soluble binder content*

EN 12697-2, *Bituminous mixtures – Test methods for hot mix asphalt – Part 2: Determination of particle size distribution*

EN 12697-3, *Bituminous mixtures – Test methods for hot mix asphalt – Part 3: Bitumen recovery: Rotary evaporator*

EN 12697-4, *Bituminous mixtures – Test methods for hot mix asphalt – Part 4: Bitumen recovery: Fractionating column*

EN 12697-5, *Bituminous mixtures – Test methods for hot mix asphalt – Part 5: Determination of the maximum density*

EN 12697-6, *Bituminous mixtures – Test methods for hot mix asphalt – Part 6: Determination of bulk density of bituminous specimens*

EN 12697-7, *Bituminous mixtures – Test methods for hot mix asphalt – Part 7: Determination of bulk density of bituminous specimens by gamma rays*

EN 12697-8, *Bituminous mixtures – Test methods for hot mix asphalt – Part 8: Determination of void characteristics of bituminous specimens*

EN 12697-9, *Bituminous mixtures – Test methods for hot mix asphalt – Part 9: Determination of the reference density*

EN 12697-10, *Bituminous mixtures – Test methods for hot mix asphalt – Part 10: Compactibility*

EN 12697-11, *Bituminous mixtures – Test methods for hot mix asphalt – Part 11: Determination of the affinity between aggregate and bitumen*

EN 12697-12, *Bituminous mixtures – Test methods for hot mix asphalt – Part 12: Determination of the water sensitivity of bituminous specimens*

EN 12697-13, *Bituminous mixtures – Test methods for hot mix asphalt – Part 13: Temperature measurement*

EN 12697-14, *Bituminous mixtures – Test methods for hot mix asphalt – Part 14: Water content*

EN 12697-15, *Bituminous mixtures – Test methods for hot mix asphalt – Part 15: Determination of the segregation sensitivity*

EN 12697-16, *Bituminous mixtures – Test methods for hot mix asphalt – Part 16: Abrasion by studded tyres*

EN 12697-17, *Bituminous mixtures – Test methods for hot mix asphalt – Part 17: Particle loss of porous asphalt specimen*

EN 12697-18, *Bituminous mixtures – Test methods for hot mix asphalt – Part 18: Binder drainage*

EN 12697-19, *Bituminous mixtures – Test methods for hot mix asphalt – Part 19: Permeability of specimen*

EN 12697-20, *Bituminous mixtures – Test methods for hot mix asphalt – Part 20: Indentation using cube or Marshall specimens*

EN 12697-21, *Bituminous mixtures – Test methods for hot mix asphalt – Part 21: Indentation using plate specimens*

EN 12697-22, *Bituminous mixtures – Test methods for hot mix asphalt – Part 22: Wheel tracking*

EN 12697-23, *Bituminous mixtures – Test methods for hot mix asphalt – Part 23: Determination of the indirect tensile strength of bituminous specimens*

EN 12697-24, *Bituminous mixtures – Test methods for hot mix asphalt – Part 24: Resistance to fatigue*

EN 12697-25, *Bituminous mixtures – Test methods for hot mix asphalt – Part 25: Cyclic compression test*

EN 12697-26, *Bituminous mixtures – Test methods for hot mix asphalt – Part 26: Stiffness*

EN 12697-27, *Bituminous mixtures – Test methods for hot mix asphalt – Part 27: Sampling*

EN 12697-28, *Bituminous mixtures – Test methods for hot mix asphalt – Part 28: Preparation of samples for determining binder content, water content and grading*

EN 12697-29, *Bituminous mixtures – Test method for hot mix asphalt – Part 29: Determination of the dimensions of a bituminous specimen*

EN 12697-30, *Bituminous mixtures – Test methods for hot mix asphalt – Part 30: Specimen preparation by impact compactor*

EN 12697-31, *Bituminous mixtures – Test methods for hot mix asphalt – Part 31: Specimen preparation by gyratory compactor*

EN 12697-32, *Bituminous mixtures – Test methods for hot mix asphalt – Part 32: Laboratory compaction of bituminous mixtures by vibratory compactor*

EN 12697-33, *Bituminous mixtures – Test methods for hot mix asphalt – Part 33: Specimen prepared by roller compactor*

EN 12697-34, *Bituminous mixtures – Test methods for hot mix asphalt – Part 34: Marshall test*

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EN 12697-41, *Bituminous mixtures – Test methods for hot mix asphalt – Part 41: Resistance to de-icing fluids*

EN 12697-42, *Bituminous mixtures – Test methods for hot mix asphalt – Part 42: Amount of coarse foreign matters in reclaimed asphalt*

EN 12697-43, *Bituminous mixtures – Test methods for hot mix asphalt – Part 43: Resistance to fuel*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard describes three test methods for determining the effect of saturation and accelerated water conditioning.

These methods can be used to evaluate the effect of moisture with or without anti-stripping additives including liquids, such as amines, and fillers, such as hydrated lime or cement:

— method A uses the indirect tensile strength of cylindrical specimens of bituminous mixtures;

— method B uses the compression strength of cylindrical specimens of bituminous mixtures;

— method C defines the bonding value of soft asphalt mixtures 1 h after mixing, where the bonding of bitumen and aggregate can be equated to a bonding value.

Method A and method B give the same result on average. However, if the slenderness of the specimens is less than 0,5, method B is not suitable.

Method C is suitable for soft asphalt mixtures with bitumen of viscosity at 60 ºC of 4000 mm^2/s or less, for which methods A and B are not suitable.

NOTE Methods A and B are suitable for soft asphalt mixtures with bitumen of viscosity at 60 ºC greater than 4000 mm^2/s.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1426, *Bitumen and bituminous binders – Determination of needle penetration*

EN 12697-6, *Bituminous mixtures – Test methods for hot mix asphalt – Part 6: Determination of bulk density of bituminous specimens*

EN 12697-8, *Bituminous mixtures – Test methods for hot mix asphalt – Part 8: Determination of void characteristics of bituminous specimens*

EN 12697-23, *Bituminous mixtures – Test methods for hot mix asphalt – Part 23: Determination of the indirect tensile strength of bituminous specimens*

EN 12697-27, *Bituminous mixtures – Test methods for hot mix asphalt – Part 27: Sampling*

EN 12697-29, *Bituminous mixtures – Test method for hot mix asphalt – Part 29: Determination of the dimensions of a bituminous specimen*

EN 12697-30, *Bituminous mixtures – Test methods for hot mix asphalt – Part 30: Specimen preparation by impact compactor*

EN 12697-31, *Bituminous mixtures – Test methods for hot mix asphalt – Part 31: Specimen preparation by gyratory compactor*

EN 12697-32, *Bituminous mixtures – Test methods for hot mix asphalt – Part 32: Laboratory compaction of bituminous mixtures by vibratory compactor*

EN 12697-33, *Bituminous mixtures – Test methods for hot mix asphalt – Part 33: Specimen prepared by roller compactor*

EN 13108-1, *Bituminous mixtures – Material specification – Part 1: Asphalt concrete*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
cylindrical specimen
laboratory-made (e.g. gyratory- or impact-compacted) cylindrical moulded specimen or core taken from a bituminous layer or slab

3.2
water sensitivity (in accordance with method A)
the *ITSR* value obtained on compacted specimens of a bituminous mixture

3.3
water sensitivity (in accordance with method B)
the *i/C* value obtained on compacted specimens of wet (water conditioned) specimens to that of dry specimens of a bituminous mixture

3.4
indirect tensile strength ratio (ITSR)
ratio of the indirect tensile strength of wet (water conditioned) specimens to that of dry specimens, expressed in percent

3.5
indirect tensile strength (IST)
maximum tensile stress applied to a cylindrical specimen loaded at the specified test temperature and speed of displacement of the compression testing machine, determined in accordance with EN 12697-23

3.6
compressive strength ratio (*i/C*)
ratio of the strength of a specimen loaded in compression at the specified test temperature and speed of displacement of the press, of wet (water conditioned) specimens to that of dry specimens expressed in percent

3.7
bonding value
amount of aggregate fines and bitumen which comes loose from 1000 g sample of soft asphalt mixture when mixed with 1500 ml of water in a graduated glass beaker

3.8
precision
closeness of agreement between independent test results obtained under stipulated conditions.

NOTE 1: Precision depends only on the distribution of random errors and does not relate to the true value or the specified value.

NOTE 2: The measure of precision is usually expressed in terms of imprecision and computed as a standard deviation of the test results. Less precision is reflected by a larger standard deviation.

NOTE 3: "Independent test results" means results obtained in a manner not influenced by any previous result on the same or similar test object. Quantitative measures of precision depend critically on the stipulated conditions. Repeatability and reproducibility conditions are particular sets of extreme conditions.

4 Principle

Method A: A set of cylindrical test specimens is divided into two equally sized subsets and conditioned. One subset is maintained dry at room temperature while the other subset is saturated and stored in water at elevated conditioning temperature. After conditioning, the indirect tensile strength of each of the two subsets is determined in accordance with EN 12697-23 at the specified test temperature. The ratio of the indirect tensile strength of the water conditioned subset compared to that of the dry subset is determined and expressed in percent.

Method B: A set of cylindrical test specimens is divided into two equally sized subsets and conditioned. One subset is maintained at 18 ºC and 50 % humidity while the other subset is saturated and stored in water at 18 °C. After conditioning, the compression strength of each of the two subsets is determined at 18 °C. The ratio of the compression strength of the water conditioned subset compared to that of the dry subset is determined and expressed in percent.

Method C: 1 h old 1000 g sample of soft asphalt mixture and 1500 ml water is mixed in a graduated glass beaker. The amount of material that has come loose is measured by filtering. The bonding value is the amount of dried aggregate fines and bitumen left on the filtering paper measured in grams.

5 Apparatus

5.1 Method A

5.1.1 Compression testing machine, testing head with loading strips, thermostatically controlled water bath or air chamber for conditioning to test temperature, soft plastic bags or other suitable watertight protection (optional, for water bath test temperature conditioning only) and all other equipment required to perform the indirect tensile strength test in accordance with EN 12697-23.

5.1.2 Vacuum system (pump, gauge etc.). The vacuum system shall be capable of obtaining a residual pressure in the vacuum container of (6,7 ± 0,3) kPa within (10 ± 1) min and able to maintain the vacuum for (30 ± 5) min.

5.1.3 Water bath, thermostatically controlled, capable of maintaining a conditioning temperature of (40 ± 1) °C and (25 ± 2) °C in the vicinity of the specimens. The bath shall be equipped with a perforated shelf, placed on spacers above the bottom of the bath. The capacity of the bath shall be sufficient to ensure that the test specimens can be stored with upper surfaces more than 20 mm below the water surface.

5.1.4 Air chamber (optional), thermostatically controlled, capable of maintaining the test temperature of (25 ± 2) °C in the vicinity of the specimens.

5.2 Method B

5.2.1 Compression testing machine, capable to apply the requested load with a speed between 45 mm/min and 65 mm/min. The speed shall be constant for the dry and for the wet group to $\pm$ 2 mm/min.

5.2.2 Vacuum system, capable of obtaining a residual pressure in the vacuum container of (47 ± 3) kPa and able to maintain the vacuum for (120 ± 10) min. It shall be possible to insert water in the container maintaining the vacuum.

NOTE For method B, 5.1.2 is also suitable.

5.2.3 Vacuum container, with a perforated shelf, placed above the bottom.

5.2.4 Water bath, capable of maintaining a conditioning temperature of (18 ± 1) °C in the vicinity of the specimens. The bath shall be equipped with a perforated shelf, placed on spacers above the bottom of the

bath. The capacity of the bath shall be sufficient to ensure that the test specimens can be stored with upper surfaces more than 20 mm below the water surface.

5.2.5 Air chamber, device capable of maintaining the test temperature of (18 ± 1) °C and (50 ± 10) % humidity in the vicinity of the specimens.

5.3 Method C

5.3.1 Graduated glass beaker, diameter 80 mm, volume circa 2500 ml, scale 2000 ml.

5.3.2 Rubber plug, fitting the graduated glass beaker.

5.3.3 Filtering paper.

NOTE For example, filtering paper suitable for coffee machines.

5.3.4 Rack for holding the filtering paper.

5.3.5 Collecting container.

NOTE For example, 2000 ml graduated glass beaker.

5.3.6 Scale, capable of reading to ± 0,1 g.

5.3.7 Container for drying the filtering paper.

5.3.8 Heating chamber, capable of maintaining a temperature of (105 ± 5) ºC.

6 Specimen preparation

6.1 Method A

6.1.1 Specimens for test

6.1.1.1 At least six cylindrical test specimens shall be prepared for each sample to be tested.

6.1.1.2 The specimens shall visually be symmetrical with the curved side even and circular.

6.1.1.3 The specimens shall have a diameter of (80 ± 2) mm, (100 ± 3) mm, (120 ± 3) mm, (150 ± 3) mm or (160 ± 3) mm. For (80 ± 2) mm, the maximum aggregate upper sieve size shall not exceed 11 mm, for (100 ± 3) mm specimens, and the upper sieve aggregate size of the bituminous mixture shall not exceed 22 mm. The test specimens shall be laboratory-made cylindrical moulded specimen, produced in accordance with EN 12697-30, EN 12697-31 or EN 12697-32, or cores taken from a slab produced in accordance with EN 12697-33, or cores taken from a bituminous layer according to EN 12697-27.

6.1.1.4 The test specimens shall be compacted:

— either until their void content, determined according to EN 12697-8 and EN 12697-6, is greater or equal to the highest required value for local application, according to the relevant product standard in the EN 13108 series,

— or by using the following energy levels:

  — gyratory compaction (EN 12697-31): 50 gyrations,

— impact compaction (EN 12697-30): 2 x 35 blows,

— vibratory compaction (EN 12697-32): (80 ± 5) sec,

— slab compactor (EN 12697-33): 24 passes (pneumatic tyre compaction procedure).

6.1.1.5 The dimensions and bulk density of each of the test specimens shall be determined in accordance with EN 12697-29 and EN 12697-6, respectively.

6.1.1.6 The test specimens shall be divided into two subsets having approximately the same average length and average bulk density. The difference of the average lengths shall not exceed 5 mm. The difference of the average bulk densities shall not exceed 15 kg/m^3.

6.1.1.7 The test specimens (both subsets) shall be of the same age (prepared within one week). Allow 16 h to 24 h for curing before the start of the conditioning procedure.

6.1.2 Conditioning

6.1.2.1 Dry specimens

Store the dry subset of specimens on a flat surface at room temperature in the laboratory, within (20 ± 5) °C.

6.1.2.2 Wet specimens

6.1.2.2.1 Place the wet subset of specimens on the perforated shelf in the vacuum container filled with distilled water at (20 ± 5) °C to a level at least 20 mm above the upper surface of the test specimens.

NOTE The use of clear, drinkable tap water instead of distilled water is allowed provided that it has been demonstrated that the use of the local source gives the same results as when using distilled water.

6.1.2.2.2 Apply a vacuum to obtain an absolute (residual) pressure of (6,7 ± 0,3) kPa within (10 ± 1) min. Decrease the pressure slowly to avoid expansion damage of the specimens.

6.1.2.2.3 Maintain the vacuum for (30 ± 5) min. Then let the atmospheric pressure slowly into the vacuum container.

6.1.2.2.4 Leave the specimens submerged in water for another (30 ± 5) min.

6.1.2.2.5 Calculate the volume of the specimens in accordance with one of the methods in EN 12697-6. Reject any specimen which has increased by more than 2 % in volume.

6.1.2.2.6 Place the wet subset of specimens in a water bath at (40 ± 1) °C for a period of 68 h to 72 h.

NOTE Additional water conditioning and additional use of frost/thaw cycles can be specified for special purposes.

6.1.2.2.7 When using bitumen grades softer than 100/150 according to EN 1426, the water conditioning temperature shall be reduced to (30 ± 1) °C.

6.2 Method B

6.2.1 Specimens for test

6.2.1.1 At least eight cylindrical test specimens shall be prepared for each sample to be tested.

6.2.1.2 The specimens shall visually be symmetrical with the curved side even and circular.

6.2.1.3 The specimens shall have a diameter of (80 ± 2) mm, (100 ± 3) mm, (120 ± 3) mm, (150 ± 3) mm or (160 ± 3) mm. For (80 ± 2) mm, the maximum aggregate upper sieve size shall not exceed 11 mm, and for (100 ± 3) mm specimens, the upper sieve aggregate size of the bituminous mixture shall not exceed 22 mm. The test specimens shall be laboratory-made cylindrical moulded specimen, produced in accordance with EN 12697-30, EN 12697-31 or EN 12697-32, or cores taken from a slab produced in accordance with EN 12697-33, or cores taken from a bituminous layer according to EN 12697-27.

6.2.1.4 The test specimens shall be compacted:

— either until their void content, determined according to EN 12697-8 and EN 12697-6, is greater than or equal to the highest required value for local application, according to the relevant product standard in the EN 13108 series,

— or by using the following energy levels:

  — gyratory compaction (EN 12697-31): 50 gyrations,

  — impact compaction (EN 12697-30): 2 x 35 blows,

  — vibratory compaction (EN 12697-32): (80 ± 5) s,

  — slab compactor (EN 12697-33): 24 passes (pneumatic tyre compaction procedure),

  — compression by application of a load of 60 kN ± 0,5 % (for specimens of which the diameter is less than 100 mm) or 180 kN ± 0,5 % (for specimens of other dimensions) for (300 ± 5) s.

6.2.1.5 The slenderness of the specimens shall be at least 0,5.

6.2.1.6 The dimensions and bulk density of each of the test specimens shall be determined in accordance with EN 12697-29 and EN 12697-6 respectively.

6.2.1.7 The test specimens shall be divided into two subsets having approximately the same average length and average bulk density. The difference of the average lengths shall not exceed 5 mm. The difference of the average bulk densities shall not exceed 15 kg/m^3.

6.2.1.8 The test specimens (both subsets) shall be of the same age (prepared within one week). Allow 16 h to 24 h for curing before start of the conditioning procedure.

6.2.2 Conditioning

6.2.2.1 Dry specimens

Store the dry subset of specimens upright on a flat surface within (18 ± 1) °C and (50 ± 10) % humidity in the vicinity of the specimens.

6.2.2.2 Wet specimens

6.2.2.2.1 Place the wet subset of specimens on the perforated shelf in the vacuum. Apply a vacuum to obtain an absolute (residual) pressure of (47 ± 3) kPa.

6.2.2.2.2 Maintain the vacuum for (60 ± 5) min and let come water into the container with the pressure maintained until to a level at least 20 mm above the upper surface of the test specimens.

6.2.2.2.3 Leave the specimens submerged in water with the pressure maintained to (47 ± 3) kPa for another (120 ± 10) min.

NOTE The method described in 6.1.2.2.1 to 6.1.2.2.4 is considered as equivalent to 6.2.2.2.1 to 6.2.2.2.3.

6.2.2.2.4 Measure the dimensions of the specimens in accordance with EN 12697-29. Calculate the volume of the specimens. Note in test report any specimen which has increased more than 2 % in volume.

6.2.2.2.5 Place the wet subset of specimens in a water bath at (18 ± 1) °C for a period of 7 days ± 2 h.

6.2.2.2.6 Difference of temperature measured in the vicinity of the specimens between the wet and the dry set during the last two hours shall not exceed 1°C.

NOTE In order to comply with this specification, the dry subset of specimens could be stored in a waterproof bag in the bath.

6.3 Method C

Test portion:

— Take a sample of (1000 ± 10) g from a homogenous soft asphalt mixture at the age of 1 h (±10 min).

— Put the sample of (1000 ± 10) g into the graduated glass beaker.

7 Test procedure

7.1 Method A

7.1.1 Bring the test specimens to the test temperature in accordance with 7.1.2 and 7.1.3. The test temperature shall be selected in the range between 5 °C and 25 °C with a tolerance of ± 2 °C, where (25 ± 2) °C is the recommended standard test temperature.

NOTE To obtain maximum influence from binder adhesion and to minimise influence from broken aggregates in the break line surface, a standard test temperature of 25 °C is recommended.

7.1.2 Bring the dry subset of specimens to the test temperature by placing them:

- in a water bath, protecting the specimen from the water by a soft plastic bag or other suitable watertight protection and ensuring that the watertight protection is pressed closely to the surface of the specimen to allow adequate heat transmission, or
- in a thermostatically controlled air chamber.

7.1.3 Bring the wet subset of specimens to the test temperature by placing them:

— directly in the water bath, or

— in leak-proof, soft plastic bags filled with water, placed in a thermostatically controlled air chamber.

NOTE Other suitable watertight containers can be used provided effective heat transfer from the water bath or air chamber is ensured.

7.1.4 Store the specimens for at least 2 h in the water bath or air chamber for specimens with diameter less than 150 mm and for at least 4 h for specimens with diameter of 150 mm or larger. When using air chamber conditioning to test temperature, the temperature shall be controlled by placing the test specimens along with a dummy specimen having a built-in temperature indicator.

7.1.5 Dry the surfaces of the wet specimens with a towel and proceed immediately to 7.1.6.

7.1.6 Determine the indirect tensile strength on the test specimens in accordance with the procedure in EN 12697-23. The indirect tensile strength test shall be performed within 1 min after the specimen has been taken out of the conditioning water.

7.2 Method B

7.2.1 Dry the surfaces of the wet specimens with a towel and proceed immediately to 7.2.2.

7.2.2 Determine the compressive strength, C_w and C_D, on the specimens measuring the maximum force, F_w and $F_{D'}$ to ± 1 % for the wet set and for the dry set respectively. The compressive strength test shall be performed within 2 min after the specimen has been taken out of the temperature conditioning system.

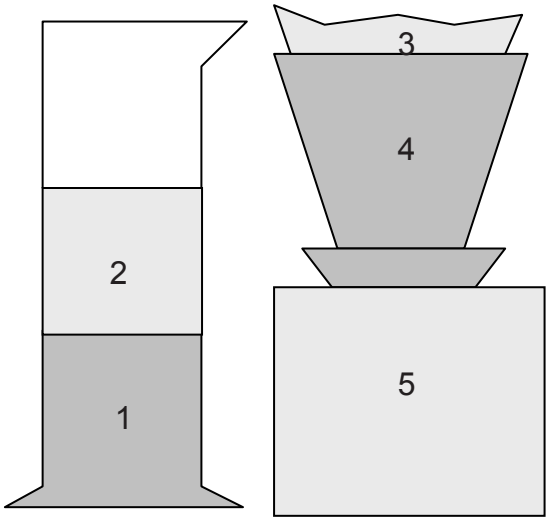
7.3 Method C (see Figure 1)

7.3.1 Dry a clean filtering paper in the oven at least 0,5 h in (105 ± 5) ºC. Weigh out the filtering paper W_1 to an accuracy of ± 0,1 g

7.3.2 Fold the bottom joint of the filtering paper twice. Place the filtering paper into the rack and the collecting container under the rack.

7.3.3 Pour (1500 ± 15) ml of water at a temperature (25 ± 3) ºC over the test sample in the graduated glass beaker. Seal the graduated glass beaker with the rubber plug. Turn the graduated glass beaker upside down and up again ten times fairly quickly so that the mass drops down to the bottom after every turning. Put the graduated glass beaker on a table for (60 ± 3) s. Repeat the series of ten turnings again.

7.3.4 Wave gently the graduated glass beaker so that all small particles of soft asphalt concrete left on the surface of water and on the inner surface of the graduated glass beaker will settle down. Remove the rubber plug and pour the liquid immediately on the filtering paper until the amount of liquid in the graduated glass beaker is 1000 ml. The particles of soft asphalt concrete shall not be poured with the liquid. The time used for the pouring is 15 s to 30 s.



Key

1 mixture
2 liquid
3 filtering paper
4 rack
5 container

Figure 1 — Test arrangement

7.3.5 Lift the filtering paper into the container for drying. Dry the filtering paper to constant mass at (105 ± 5) ºC. Weigh the mass W_2 to an accuracy of ± 0,1 g.

8 Calculation

8.1 Method A

Calculate the indirect tensile strength ratio, $ITSR$, according to the formula below:

$$ITSR = 100 \times \frac{ITS_{\mathrm{w}}}{ITS_{\mathrm{d}}}$$

where

$ITSR$ is the indirect tensile strength ratio, in percent (%);

ITS_w is the average indirect tensile strength of the wet group, in kilopascals (kPa);

ITS_d is the average indirect tensile strength of the dry group, in kilopascals (kPa).

8.2 Method B

Calculate the compressive strength ratio, *i/C*, according to the formulae below:

$$i/C = 100 \times \frac{C_w}{C_D}$$

where

C_{w} is the average compression strength of the wet group, in kilopascals (kPa);

C_{D} is the average compression strength of the dry group, in kilopascals (kPa).

8.3 Method C

Calculate the bonding value, *bv*, according to the formula below:

$$bv = W_2 - W_1$$

where

bv is the bonding value of soft asphalt mixture, expressed in grams (g);

W_2 is the dry mass of filtering paper and the loose material, expressed in grams (g);

W_1 is the dry mass of filtering paper, expressed in grams (g).

9 Test report

9.1 Methods A and B

The test report shall contain the following information:

a) identification number and type of mixture;

b) method used (A or B);

c) number of test specimens;

d) type of specimens (laboratory made, cut or moulded, or core from a pavement – refer to relevant EN standard), and storage time between mixing and testing;

e) average diameter, length and bulk density of specimens for each of the two (wet and dry) subsets;

f) test temperature (method A);

g) average indirect tensile strength (method A) or average compression strength (method B) in kilopascals (kPa) of each of the two (wet and dry) subsets of specimens;

h) indirect tensile strength ratio (method A) or *i*/*C* ratio (method B) in percent (%) to three significant figures;

i) type of failure (method A) (clear indirect tensile break line, deformation failure, or a combination), observation of binder coating on surface of exposed aggregate, and observations of fractured or crushed aggregate;

j) specification that the test has been carried out according to EN 12697-12.

9.2 Method C

The test report shall contain the following information:

a) identification number and type of mixture;

b) method used (C);

c) bonding value, to an accuracy of one decimal;

d) specification that the test has been carried out according to EN 12697-12.

10 Precision

10.1 Method A

Precision data has not yet been established.

According to a precision experiment carried out in the USA, using similar indirect tensile testing and the same test temperature, a multi-laboratory standard deviation of the indirect tensile strength ratio has been found to be 8 %. The maximum allowable difference in indirect tensile strength ratio between results of tests performed on samples of the same mixture by two different laboratories is 23 %.

— The following precision data are estimated from the above mentioned experience: Repeatability, r: approximately 15 %,

— Reproducibility, R: approximately 23 %.

It is expected that the precision of the test method will be improved when test temperature of 25 °C is generally used and experience by laboratory personnel is obtained.

10.2 Method B

— Repeatability and reproducibility have been determined on the i/C ratio. Repeatability (95 %) r = 7,8 % (variance V_r = 2,8 %);

— Reproducibility (95 %) R = 13,4 % (variance V_R = 4,7 %).

The study of repeatability and reproducibility of the moisture sensitivity using a compressive strength and 7 days conservation method was carried out by 14 laboratories in accordance with ISO 5725-2 under the following conditions:

— diameter of moulded specimens = 80 mm;

— bituminous mixture: Asphalt Concrete AC 10 according to EN 13108-1;

— average ratio i/C of the experiment: 73 %;

— number of replicates: 4.

10.3 Method C

When the bonding value is smaller than or equal to 2,0 g, the 95 % confidence interval of the value is smaller than or equal to 0,3 g.

Bibliography

[1] EN 13108 (all parts), *Bituminous mixtures – Material specifications*

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