SLOVENSKI STANDARD
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Bitumenske zmesi - Preskusne metode - 34. del: Preskus po Marshallu

Bituminous mixtures - Test methods - Part 34: Marshall test

Asphalt - Prüfverfahren - Teil 34: Marshall-Prüfung

Mélanges bitumineux - Méthodes d'essai - Partie 34 : Essai Marshall

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Bituminous mixtures - Test methods - Part 34: Marshall test

Mélanges bitumineux - Méthodes d'essai - Partie 34 : Essai Marshall

Asphalt - Prüfverfahren - Teil 34: Marshall-Prüfung

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 227.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 12697-34:2018) has been prepared by Technical Committee CEN/TC 227 “Road materials”, the secretariat of which is held by BSI.

This document is currently submitted to the enquiry.

This document will supersede EN 12697-34:2012.

The following is a list of significant technical changes since the previous edition:

— The title no longer makes the method exclusively for hot mix asphalt;

— [ge] Editorial update according to current standard template;

A list of all parts in the EN 12697 series can be found on the CEN website.

1 Scope

This document specifies a test method for determining the stability, flow and the Marshall Quotient values of specimens of bituminous mixtures mixed according to EN 12697-35 and prepared using the impact compactor method of test EN 12697-30. It is limited to dense graded asphalt concrete and hot rolled asphalt.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 12697-6, *Bituminous mixtures - Test methods for hot mix asphalt - Part 6: Determination of bulk density of bituminous specimens*

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 ISO 7500-1:2018, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system (ISO 7500-1:2018)*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
stability
S
maximum load, in kilonewtons (kN), of a moulded asphalt specimen

3.2
flow
F
deformation of the moulded specimen in millimetres (mm) at maximum load less the nominal deformation obtained by extrapolation of the tangent of the graph of load against deformation back to zero load (A to M' in Figure A.1)

3.3
tangential flow
F_t
nominal deformation of the moulded specimen, in millimetres (mm) obtained by extrapolation of the tangent of the graph of load against deformation forward to the stability load less the nominal deformation obtained by extrapolation of the tangent back to zero load (A to B' in Figure A.1)

3.4
total flow
F_T
deformation of the moulded specimen in millimetres (mm) at maximum load (0 to M' in Figure A.1)

3.5
Marshall quotient
ratio of the stability, *S*, to the flow, *F*, *S*/*F*

Note 1 to entry: See Annex A.

4 Principle

Marshall specimens are compacted in accordance with EN 12697-30. The Marshall stability, flow and quotient are subsequently determined on these specimens using defined procedures and reported along with the bulk density of the specimen.

5 Apparatus

5.1 Compression testing machine of Class 2 or better according to EN ISO 7500-1:2018, Clause 7, having a recommended minimum capacity of 28 kN and capable of applying loads to test specimens at a constant rate of deformation of (50 ± 2) mm/min after a transitory period less than 20 % of the loading time.

The rate of deformation is to be maintained.

5.2 Flow measuring device, capable of determining deformation to an accuracy of ± 0,1 mm.

5.3 Graphical plotter, for evaluating the curve of force versus deformation, e.g. graphical plotter, strip recorder or software program.

A graphical plotter is required to obtain a test result by this test method. If dial gauges are used, they should be checked and zeroed prior to each measurement. In these cases, only the total flow can be recorded.

5.4 Testing head, comprised of upper and lower breaking heads with the dimensions given in Figure B.1.

5.5 Water bath, at least 150 mm deep and capable of thermostatically maintaining the water at a temperature of (60 ± 1) °C.

This bath shall have a perforated false bottom or shelf that can suspend the test specimens at least 25 mm above the bottom of the bath, and allow at least 25 mm depth of water above the specimens. The size of the bath shall allow specimens to be placed face down and not in contact with one another. A device to ensure continuous circulation of water shall also be fitted.

5.6 Thermometer, capable of measuring a temperature of 60 °C accurate to 0,5 °C.

5.7 Oven, capable of maintaining temperatures of (110 ± 5) °C.

6 Procedure

6.1 Specimen preparation

6.1.1 Specimens shall be compacted in accordance with EN 12697-30, ensuring that 50 blows are applied to each side within the acceptable temperature range given.

NOTE A different number of blows may be selected; for example, 35 blows for light traffic and 75 blows for heavy duty pavements.

6.1.2 The compacted specimens shall be de-moulded, ensuring that they are cooled in air to avoid any danger of deformation and then tested in accordance with 6.1.1 and 6.1.3. After de-moulding, wait at least 4 h before further testing begins. All tests shall be completed within 32 h of de-moulding. Specimens shall not be stacked prior to testing.

Specimens of rolled asphalt may be left in the moulds and immersed in cold water to facilitate rapid cooling. The cooled specimens should be extruded from their moulds with the minimum of force and using an extractor of suitable design so that they are ejected without distortion or shock.

The bulk density of each specimen shall be determined in accordance with EN 12697-6.

6.1.3 The height of each specimen shall be measured in accordance with EN 12697-29; or the volume shall be calculated from the bulk density measurement.

6.1.4 Immerse the cylindrical specimens on their flat surface in the water bath for at least 40 min and not longer than 60 min. Maintain the temperature of the water in the bath at (60 ± 1) °C.

6.2 Test procedure

6.2.1 Thoroughly clean the guide rods and the inside surfaces of the test heads. Lubricate the guide rods to ensure that the upper test head slides freely over them.

6.2.2 Prepare the test head by preheating for at least 30 min at (60 ± 1) °C in the water bath, or for 1 h in the oven.

This action shall be undertaken at the start of testing of a batch of specimens not greater than twelve in number. In the event of a delay of more than 3 min between the testing of each specimen, the test head shall be heated in a suitable oven or water-bath maintained at the specified test temperature. The minimum reheating period shall be the lesser of the delay encountered and 30 min when heated in a water bath, or double that when heated in an oven.

6.2.3 Remove the test specimen from the water bath and place it centrally on its side in the test head, ensuring good surface contact between the specimen and the test head. Place the complete assembly centrally on the testing machine.

Prior to testing each specimen, the test head shall be cleaned as required. An environmentally suitable solvent may be used for cleaning and a silicone spray applied to prevent specimens adhering to the test head.

6.2.4 Apply the load to the test specimen to achieve a constant rate of deformation of (50 ± 2) mm/min allowing for the transitory period. Continue the application of this load until the maximum reading is obtained on the load-measuring device. Record the load indicated. This section of the test shall be carried out within 40 s of removal of the test specimen from the water bath.

Measure the flow (see 7.2).

NOTE If dial gauges are used, record the movement of the top of the testing head from the instant of application of the load to the point when maximum load is reached (F_T).

Carry out the stability and flow tests on a set of four specimens.

7 Expression of results

7.1 The maximum load attained represents the stability of the mix only if the specimen height equals the required 63,5 mm. A corrected stability shall be reported by multiplying the maximum load with the correction factor calculated from the following equations using the volume of the specimen as determined in accordance with 6.1:

$$c = 5{,}2\ e\ -0{,}025\ 9\ h = 5{,}2\ e\ -3{,}2 \cdot 10^{(-6)}\ v \quad (1)$$

where

c is the correction factor;

h is the height of the specimen (in millimetres);

v is the volume of the specimen determined in 6.1 (in cubic millimetres).

The stability, S, is reported to the nearest 0,1 kN.

NOTE Corrections outside the range of specimen heights from 60,5 mm to 66,5 mm can lead to inaccurate results.

7.2 To obtain the flow value F, measure on the graph of force versus deformation the distance from the intersection of the tangent and the base line, A, to the point where the maximum load is achieved, M. The flow values F_t and F_T are similarly obtained.

Record the flow values, F, F_t and F_T, to the nearest 0,1 mm.

7.3 Test results shall be considered reliable if both the variation in stability between specimens, V_S, is less than 15 % and the variation in flow between specimens, V_f, is less than 20 %. Reject the test specimen with the largest variation and obtain the average value of the other specimens if either:

— the stability value from one or more specimens differs from the average stability by more than 15 %, or

— the flow value from one or more specimens differs from the average flow by more than 20 %.

Furthermore, if any value differs from the new average by more than 15 % for stability or 20 % for flow, repeat the test.

7.4 The Marshall quotient shall be obtained by the calculation of S/F and reporting the value obtained to 0,1 kN/mm.

8 Test report

The test report shall include the following information:

a) the average results F, F_t, F_T, S and Marshall quotient for each set of specimens;

b) the average bulk density of the specimen set;

c) the number and date of this European Standard.

9 Precision (see Table 1 and Table 2)

Table 1 — Asphalt concrete

Marshall	Repeatability		Reproducibility	
	Standard deviation, σ_r	Repeatability, r	Standard deviation, σ_R	Reproducibility, R
Stability (kN)	0,61	1,7	0,78	2,2
Flow (mm)	0,25	0,7	0,29	0,8
NOTE The precision data are estimated from DIN 1996/11 [2] and NL-Standard for asphalt concrete — 2000 Standard RAW Bepalingen [3].				

Table 2 — Hot rolled asphalt

Marshall	Repeatability		Reproducibility	
	Standard deviation, σ_r	Repeatability, r	Standard deviation, σ_R	Reproducibility, R
Stability (kN)	0,36	1,0	0,78	2,2
Flow (mm)	0,21	0,6	0,46	1,3
NOTE The precision data are estimated from TRRL Research report 281 [4].				