SLOVENSKI STANDARD
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Bitumenske zmesi - Preskusne metode - 6. del: Ugotavljanje prostorninske gostote bitumenskih preskušancev

Bituminous mixtures - Test methods - Part 6: Determination of bulk density of bituminous specimens

Asphalt - Prüfverfahren - Teil 6: Bestimmung der Raumdichte von Asphalt-Probekörpern

Matériaux enrobés - Méthodes d'essai - Partie 6 : Détermination de la masse volumique apparente des éprouvettes bitumineuses

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Bituminous mixtures - Test methods - Part 6: Determination of bulk density of bituminous specimens

Matériaux enrobés - Méthodes d'essai - Partie 6 : Détermination de la masse volumique apparente des éprouvettes bitumineuses

Asphalt - Prüfverfahren - Teil 6: Bestimmung der Raumdichte von Asphalt-Probekörpern

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 12697-6:2018) 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 12697-6:2012.

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;

— [6.1.1] Description of accuracy for balance amended to; “With an accuracy of at least 0,1 g for masses up to 5 kg, and 1 g for masses over 5 kg. (Ref. 12697-38).

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

1 Scope

This document describes test methods for determining the bulk density of a compacted bituminous specimen. The test methods are intended for use with laboratory compacted specimens or specimens from the pavement after placement and compacting, either by coring or sawing.

This document describes the following four procedures, the choice of which is used being dependent on the estimated content and accessibility of voids in the specimen:

a) bulk density — dry (for specimens with a very closed surface);

b) bulk density — saturated surface dry (SSD) (for specimens with a closed surface);

c) bulk density — sealed specimen (for specimens with an open or coarse surface);

d) bulk density by dimensions (for specimens with a regular surface and with geometric shapes, i.e. squares, rectangles, cylinders, etc.).

NOTE Annex A (informative) gives general guidance on selecting the appropriate procedure.

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

EN 13108-20, *Bituminous mixtures - Material specifications - Part 20: Type Testing*

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
bulk density
mass per unit volume, including the air voids, of a specimen at known test temperature

3.2
maximum density
mass per unit volume, without air voids, of a bituminous mixture at known test temperature

4 Principle

The bulk density of an intact compacted bituminous specimen is determined from the mass of the specimen and its volume. The mass of the specimen is obtained by weighing the dry specimen in air.

For the first three procedures, the volume of the specimen is obtained from its mass in air and its mass in water. In the dry procedure, the mass in water is determined without pre-treatment. In the SSD-procedure, the specimen is first saturated with water, after which its surface is blotted dry with a damp Chamois. In the sealed specimen procedure, the specimen is sealed before immersion in water to prevent access of water to the voids in the specimen. In the fourth procedure, by dimensions, the volume of the specimen is obtained by measurement of the dimensions.

5 Materials

5.1 General

Calculate the density of water at the test temperature in megagram per cubic metre (Mg/m³) to the nearest 0,000 1 Mg/m³ as follows:

$$\rho_w = 1,000\ 252\ 05 + \left(\frac{7,59 \times t - 5,32 \times t^2}{10^6} \right) \quad (1)$$

where

t is the temperature of the water, in degrees Celsius (°C);

ρ_W is the density of the water at test temperature, in megagram per cubic metre (Mg/m³).

5.2 Additional materials for the sealed specimen procedure

Material to seal the specimen, in such a way, that inclusion of voids (being no part of the specimen) between seal and specimen is prevented. The density of the sealing material at test temperature shall be known to the nearest 0,010 Mg/m³.

The material used can be paraffin wax, shrinkage foil, latex emulsion etc. The procedure to apply such materials should be such that the specimen is not damaged. It is very important that the seal exactly covers the specimen including the voids which technologically form part of its volume: when applying the seal penetration of the internal voids belonging to the material is prevented, as well as inclusion of extra voids between seal and specimen or in seal folds.

6 Apparatus

6.1 General

6.1.1 Balance, with sufficient capacity for weighing the specimen in air and under water (e.g. via a wire basket, the mass and water displacement of which are taken into account by taring), with an accuracy of at least 0,1 g for masses up to 5 kg, and 1 g for masses over 5 kg.

6.2 Additional apparatus for the dry, SSD and sealed specimen procedures

6.2.1 Water-bath, maintained at a uniform temperature within ± 1,0 °C in the vicinity of the test specimen(s).

It shall be provided with a grid to ensure the water circulation around the test specimen. The bath shall have a capacity of at least three times that of the volume of the specimen.

6.2.2 Thermometer.

6.3 Additional apparatus for the SSD-procedure

6.3.1 Chamois, damp, for blotting and wiping the specimen.

The Chamois shall be damp enough to ensure that the moisture at the specimen surface is removed when wiping without withdrawing moisture from the internal voids.

6.4 Additional apparatus for the dimensions procedure

6.4.1 Calliper gauge, or other suitable apparatus for measuring the dimensions of the specimen to at least ± 0,1 mm (see EN 12697-29:2002).

7 Sample sizes and sample handling

The minimum thickness of the specimen shall be 20 mm or two times the maximum nominal size of the aggregate, whichever is largest.

Care shall be taken to ensure that the specimens are not disturbed during handling. The specimens shall be stored in a cool place at a temperature not exceeding 25 °C.

8 Preparation of sample

Specimens shall be cleaned if necessary by brushing or washing, as required.

The specimens shall be dry, have a known water content, or be allowed to dry to constant mass.

NOTE Constant mass is defined as successive weighings after drying at least 1 h apart not differing more than 0,1 %.

9 Procedure

9.1 General

All masses shall be determined in gram to the nearest 0,1 g. All measurements shall be determined in millimetre to the nearest 0,1 mm.

NOTE General guidance on determining the required procedure related to the specific bituminous material is given in Annex A.

9.2 Procedure A: Bulk density — dry

Carry out the procedure as follows:

a) Determine the mass of the dry specimen (m_1). When testing damp specimens, step a) shall be carried out after steps b) to d).

b) Determine the density of the water at test temperature at the nearest 0,000 1 Mg/m³ (ρ_W) according to 5.1.

c) Immerse the specimen in the water-bath kept at known test temperature.

d) Determine the mass of the specimen immediately the water has settled after immersion (m_2).

9.3 Procedure B: Bulk Density — Saturated surface dry (SSD)

Carry out the procedure as follows:

a) Determine the mass of the dry specimen (m_1). When testing damp specimens, step a) shall be carried out after steps b) to g).

b) Determine the density of the water at test temperature to the nearest 0,000 1 Mg/m³ (ρ_w) according to 5.1.

c) Immerse the specimen in the water-bath at known test temperature. Allow the water to saturate the specimen sufficiently long enough for the mass of the specimen not to change.

In general, the required saturation period is 30 min but should not be more than 3 h.

d) Determine the mass of the saturated specimen when immersed (m_2), taking care no air bubbles adhere to the surface of the specimen or leave the specimen when weighing.

e) Remove the specimen from the water, dry the surface from adhered drops by wiping with a damp Chamois.

f) If water continues to drain from the sample, discontinue the measurement by Procedure B, saturated surface dry, and undertake the measurement by Procedure C, sealed specimen.

g) Determine the mass of the saturated, surface wiped specimen in air immediately after drying (m_3).

9.4 Procedure C: Bulk Density — Sealed specimen

Carry out the procedure as follows:

a) Determine the mass of the dry specimen (m_1).

b) Determine the density of the water at test temperature to the nearest 0,000 1 Mg/m³ (ρ_w) according to 5.1.

c) Seal the specimen in such a way, that the internal voids in the specimen being part of the volumetric material composition are not penetrated and that no extra voids are included between seal and specimen or in seal folds. After sealing, the specimen shall be inaccessible to water when submerged.

   When using paraffin wax, obtain sealing using the following procedure:

   1) Bring the paraffin wax to its melting temperature + 10 °C and maintain this temperature at ± 5 °C.

   2) Immerse the specimen partially in the paraffin wax for less than 5 s, agitating the specimen to make the air balls free. After cooling and solidification of the paraffin wax on this part of the specimen, repeat the same procedure on the other part. Repeat these procedures until a continuous film of paraffin wax is obtained, which totally cover the specimen.

d) Determine the mass of the dry sealed specimen (m_2).

e) Immerse the specimen in the water-bath kept at known test temperature.

f) Determine the mass of the sealed specimen under water (m_3), taking care no air bubbles adhere to the sealing when weighing.

9.5 Procedure D: Bulk density by dimensions

Carry out the procedure as follows:

a) Determine the dimensions of the specimen in millimetre in accordance with EN 12697-29.

b) Determine the mass of the dry specimen (m_1).

10 Calculation

10.1 Procedure A: Bulk density — dry

Calculate the bulk density dry of the specimen (ρ_{bdry}) to the nearest 0,001 Mg/m³ as follows:

$$\rho_{bdry} = \frac{m_1}{m_1 - m_2} \times \rho_w \quad (2)$$

where

ρ_{bdry} is the bulk density dry, in megagram per cubic metre (Mg/m³);

m_1 is the mass of the dry specimen, in gram (g);

m_2 is the mass of the specimen in water, in gram (g);

ρ_w is the density of the water at test temperature, in megagram per cubic metre (Mg/m³).

10.2 Procedure B: Bulk density — SSD

Calculate the bulk density (SSD) of the specimen (ρ_{bssd}) to the nearest 0,001 Mg/m³ as follows:

$$\rho_{bssd} = \frac{m_1}{m_3 - m_2} \times \rho_w \quad (3)$$

where

ρ_{bssd} is the bulk density (SSD), in megagram per cubic metre (Mg/m³);

m_1 is the mass of the dry specimen, in gram (g);

m_2 is the mass of the specimen in water, in gram (g);

m_3 is the mass of the saturated surface-dried specimen, in gram (g);

ρ_w is the density of the water at test temperature, in megagram per cubic metre (Mg/m³).