SLOVENSKI STANDARD
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Bitumenske zmesi - Preskusne metode - 22. del: Preskus nastajanja kolesnic

Bituminous mixtures - Test methods - Part 22: Wheel tracking

Asphalt - Prüfverfahren - Teil 22: Spurbildungstest

Mélanges bitumineux - Méthodes d'essai - Partie 22 : Essai d'orniérage

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Bituminous mixtures - Test methods - Part 22: Wheel tracking

Mélanges bitumineux - Méthodes d'essai - Partie 22 : Essai d'orniérage

Asphalt - Prüfverfahren - Teil 22: Spurbildungstest

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

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European foreword

This document (EN 12697-22:2020) has been prepared by Technical Committee CEN/TC 227 “Road materials”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by August 2020, and conflicting national standards shall be withdrawn at the latest by August 2020.

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

This document supersedes EN 12697-22:2003+A1:2007.

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;

— [Clause 2] ISO 48, Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD), replaced by: ISO 48-2, Rubber, vulcanized or thermoplastic — Determination of hardness — Part 2: Hardness between 10 IRHD and 100 IRHD; ISO 7619, Rubber, vulcanized or thermoplastic — Determination of indentation hardness, replaced by: ISO 48-5, Rubber, vulcanized or thermoplastic — Determination of hardness — Part 5: Indentation hardness by IRHD pocket meter method;

— [3.5] Table 1 deleted;

— [Clause 4] symbols for properties in the different methods made more consistent and corrected through the whole document. Table 2 replaced by new Table 1;

— [Clause 6] moulds added to the list of equipment. Modifications for clarity;

— [6.3.1.2] ISO 7619 and ISO 48 replaced by: ISO 48-5 and 48-2;

— [7.1] new clause added and the order of clauses changed;

— [7.2.1.1] vibratory compactor excluded as a method of sample preparation;

— [7.2.1.2] thickness for mixtures with upper sieve size larger than 22 changed to 80 mm;

— [7.5.1] the text has been modified for clarity. “Plaster of Paris” amended to holding medium;

— [7.6] storage time amended to max 42 days and requirement added for storing samples on a flat surface;

— [8.1.7] deleted;

— [9.2.1] Formula (2) corrected;

— [9.3.1.2] Formula (7) corrected;

— [9.3.2.2] required rounding of WTS_{AIR} values specified;

— [9.3.3.2] required rounding of WTS_W values specified;

— [10.1.2] type of roller compactor required to be reported;

— [11.4] precision data for small device, procedure B (air) added;

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

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

1 Scope

This document describes test methods for determining the susceptibility of bituminous materials to deform under load. The test is applicable to mixtures with upper sieve size less than or equal to 32 mm.

The tests are applicable to specimens prepared from asphalt mixtures that have either been manufactured in a laboratory or cut from a pavement; test specimens are held in a mould with their surface flush with the upper edge of the mould.

The susceptibility of bituminous materials to deform is assessed by the rut formed by repeated passes of a loaded wheel at constant temperature. Three alternative types of device can be used according to this standard: large-size devices, extra large-size devices and small-size devices. With large-size devices and extra large-size devices, the specimens are conditioned in air during testing. With small-size devices, specimens are conditioned, in either air or water.

NOTE Large-size and extra large-size devices are not suitable for use with cylindrical cores.

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 — 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 12697-27, *Bituminous mixtures — Test methods — Part 27: Sampling*

EN 12697-33, *Bituminous mixtures — Test method — Part 33: Specimen prepared by roller compactor*

EN 12697-35, *Bituminous mixtures — Test methods — Part 35: Laboratory mixing*

ISO 48-2, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 2: Hardness between 10 IRHD and 100 IRHD*

ISO 48-5, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 5: Indentation hardness by IRHD pocket meter method*

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 https://www.iso.org/obp/ui

3.1
nominal thickness
for laboratory prepared specimens, the target thickness, in millimetres, to which the specimens are to be prepared

Note 1 to entry: The target thickness is the required thickness that is targeted when making the specimen.

3.2
rut depth
reduction in the thickness of a test specimen, in millimetres, caused by repeated passes of a loaded wheel

3.3
test surface
surface of the test specimen on which the loaded wheel runs

3.4
single test result
value obtained by applying this document, once, to a single test portion

3.5
test portion
number of samples that are required to be tested for a single test result

3.6
tyre track
impression of the tyre on a flat surface when a vertical load is applied

3.7
load cycle
two passes (outward and return) of the loaded wheel

3.8
measurement sequence
test phase corresponding to the completion of *n* load cycles

4 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviations given in Table 1 apply.

Table 1 — Symbols and abbreviated terms

Symbol	Definition	Unit
d_{ij}	local distance between a reference plane and the j predetermined location on the test surface at the i measurement sequence with multiple measurement points NOTE j varies between 1 and 15 and is used for Large Size device	mm
d_{0j}	local distance between a reference plane and the j predetermined location on the test surface before the start of the test (i=0)	mm
d_n	is the vertical displacement after n load cycles	mm
d_0	is the vertical displacement initially after 0 load cycles	mm
h	specimen thickness equal to the thickness of the course or courses of the test piece in which a rut can form	mm
L	load applied	N
n	number of cycles	—
n_{15}	number of load cycles for rut depth to reach 15 mm using small size device, procedure A	—

Symbol	Definition	Unit
P_i	measured proportional rut depth calculated as the average depth of a rut at the i measurement cycle for one specimen	%
$P_{i\mathrm{LD}}$	mean value of P_i obtained on two or more specimens using large size device	%
$P_{i\mathrm{XL}}$	mean value of P_i obtained on two or more specimens using extra-large size device	%
PRD_{AIR}	mean proportional rut depth for the material using a small size device in air	%
PRD_{W}	mean proportional rut depth for the material using a small size device in water	%
RD	the rut depth of the specimen i using a small size device	mm
RD_{AIR}	mean rut depth for the material using a small size device in air	mm
RD_{W}	mean rut depth for the material using a small size device in water	mm
r_{i}	mean rut depth at the i-th measurement sequence	mm
S	number of measured cross-sections for extra-large device	—
TR	mean rate of increase of track depth	µm/cycle
TR_{m}	mean value of the determinations of TR	µm/cycle
w	width of the tyre applying the load	mm
WTR	wheel-tracking rate calculated as the mean rate at which the rut depth increases with time under repeated passes of a loaded wheel of a small size device model A in air	µm/cycle
WTS_{W}	wheel-tracking slope, calculated as the mean rate at which the rut depth increases with repeated passes of a loaded wheel of a small size device model B in water	mm/1 000 load cycles
WTS_{AIR}	wheel-tracking slope, calculated as the mean rate at which the rut depth increases with repeated passes of a loaded wheel of a small size device model B in air	µm/1 000 load cycles

5 Principle

The susceptibility of a bituminous material to deform is assessed by measuring the rut depth formed by repeated passes of a loaded wheel at a fixed temperature.

6 Apparatus

6.1 Large size devices

6.1.1 Device simulating a rolling load which shall include

6.1.1.1 Wheel fitted with a 400 × 8 pneumatic tyre without tread pattern and having a track width of (80 ± 5) mm. The pneumatic tyre pressure shall be (600 ± 30) kPa.

NOTE The Trelleborg T522 BV Extra or Special 6-ply type pneumatic tyre is suitable for this test.

6.1.1.2 The travel of pneumatic tyre relative to the specimen shall be (410 ± 5) mm.

6.1.1.3 The frequency of travel (outward and return) shall be (1,0 ± 0,1) Hz.

6.1.1.4 The rolling load applied to the test specimen shall be (5 000 ± 50) N at the centre of the test specimen, measured at least when the device is static.

6.1.1.5 The centre line of the tyre track shall be not more than 5 mm from the theoretical centre of the test specimen.

6.1.1.6 The angle of skew of the wheel shall be (0,0 ± 0,5)°.

6.1.2 Mould(s)

Mould(s) of internal dimensions (500 × 180 × 50) mm or (500 × 180 × 100) mm, all dimensions ± 2 mm, capable of withstanding the test conditions without distortion.

6.1.3 Depth gauge

Depth gauge to measure local distance from the reference plane, d_{ij}, to within ± 0,2 mm and with a square, rectangle or circular measurement area of between 5 mm^2 and 10 mm^2. A contact-free sensor can be used if it leads to the same result.

6.1.4 Ventilated enclosure

Ventilated enclosure with a set temperature that is regulated by a probe installed within the test specimen such that the temperature within the specimen is maintained at the set temperature ± 2 °C (see Figure 1)

6.1.5 Temperature sensors

Temperature sensor(s) suitable for installation within a compacted bituminous test specimen and for the measurement of air temperature.

6.1.6 Temperature monitoring indicator

Temperature monitoring indicator to record the temperature within the test specimen, as shown in Figure 1.

6.1.7 Steel supporting plate

Steel supporting plate with a surface unevenness of less than 1 mm when checked with a steel rule across the diagonals and of a thickness such that the deflection under test conditions of this document shall not exceed 0,5 mm.

6.1.8 Non-stick chemical

Non-stick chemical, such as glycerized sodium oleate.

6.2 Extra large devices

6.2.1 Device simulating a rolling load which shall include

6.2.1.1 General

Wheel fitted with a 6.00-R9 pneumatic tyre without tread pattern and having a track width of (110 ± 5) mm.

6.2.1.2 The travel of pneumatic tyre relative to the specimen shall be (700 ± 5) mm.

6.2.1.3 The time of travel (outward and return) shall be (2,5 ± 0,5) s.

6.2.1.4 The rolling load applied to the test specimen shall be (10 000 ± 100) N at the centre of the test specimen, measured at least when the device is static.

6.2.1.5 The centre line of the tyre track shall be not more than 20 mm from the theoretical centre of the test specimen.

6.2.1.6 The angle of skew of the wheel shall be (0,0 ± 0,5)°.

6.2.2 Moulds

Mould(s) of internal dimensions (700 × 500) mm, all dimensions ± 5 mm, capable of withstanding the test conditions without distortion. The height of the mould corresponds to the nominal thickness of the test specimen at the ends. The height of the side edges correspond to the nominal thickness of the specimen or exceed it by a maximum of 20 mm.

6.2.3 Depth gauge

Laser sensors to measure local deformation within ± 0,2 mm. Laser sensors shall be capable to measure rut depth with interval maximum 2 mm at least in 3 cross-sections as indicated in Figure 2.

6.2.4 Ventilated enclosure

Ventilated enclosure with a set temperature that is regulated by a probe installed within the test specimen such that the temperature within the specimen is maintained at ± 3 °C of the test temperature (see Figure 2).

6.2.5 Temperature sensors

Temperature sensor(s) suitable for installation within a compacted bituminous test specimen and for the measurement of air temperature.

6.2.6 Temperature monitoring indicator

Temperature monitoring indicator to record the temperature within the test specimen, as shown in Figure 2.

6.3 Small size devices for use with rectangular plates

6.3.1 Wheel-tracking apparatus

6.3.1.1 General

Wheel-tracking apparatus consisting of a loaded wheel that bears on a sample held securely on a table. The table beneath the wheel or the wheel above the table moves backwards and forwards while a device provided monitors the rate at which a rut develops in the surface of the test specimen. Vertical play in the loaded wheel mechanism shall be less than 0,25 mm. The apparatus shall include 6.3.1.2 to 6.3.1.7.

6.3.1.2 Tyre of outside diameter between 200 mm and 205 mm fitted to the wheel. The tyre shall be treadless and have a rectangular cross profile with a width of w where w = (50 ± 5) mm. The tyre thickness shall be (20 ± 2) mm. The tyre shall be of solid rubber with a hardness number of (80 ± 5) IRHD units when measured in accordance with ISO 48-5 and ISO 48-2.

NOTE A steel wheel has also been used with the small-size device, but the test will be more severe and the result will not be comparable with that from a compliant test.

6.3.1.3 Means of applying a load to the wheel: The wheel load under standard test conditions shall be $\left[\left(700 \times \frac{w}{50}\right) \pm 10\right]$ N, measured at the level of the top of the test specimen and normal to the plane of the sample table.

This loading may conveniently be achieved by the use of a weighted cantilever arm.

6.3.1.4 Sample table, constructed so as to enable a rectangular laboratory-prepared test specimen to be held firmly in place with its upper surface horizontal and in the required tracking plane and with its centre positioned to ensure symmetrical tracking motion.

6.3.1.5 Wheel-tracking machine, constructed so as to enable the test specimen in its cradle to be moved backwards and forwards under the loaded wheel in a fixed horizontal plane or the loaded wheel to be moved backwards and forwards on the fixed specimen. The centre-line of the tyre track shall be not more than 5 mm from the theoretical centre of the specimen. The centre of the contact area of the tyre shall describe simple harmonic motion with respect to the centre of the top surface of the test specimen with a total distance of travel of (230 ± 10) mm and a frequency of (26,5 ± 1,0) load cycles per 60 s for the test device.

NOTE This form of motion is most readily achieved by a reciprocating drive from a flywheel but alternative drive mechanisms are satisfactory as long as the motion conforms to the above requirements.

6.3.1.6 Carriage and frame of steel with minimum inside dimensions of 260 mm × 300 mm. Vertical play in the carriage shall be less than 0,25 mm when measured at the four corners of the carriage with the carriage being subjected to the operating load, and the thickness of its bottom plate shall be not less than 8 mm.

6.3.1.7 Device to measure the vertical position of the loaded wheel to ± 0,2 mm with a range of not less than 20,0 mm.

6.3.2 Means for temperature control

Means for temperature control such that the temperature of the test specimen during testing is uniform and maintained constant at the specified temperature ± 1 °C.

NOTE A constant temperature room enclosing the machine or a water bath are two methods of meeting this requirement.

6.3.3 Straightedge

Straightedge, at least 300 mm long.

6.3.4 Callipers

Callipers capable of measuring the thickness of a test specimen to an accuracy of ± 1 mm.

6.3.5 Talc or steatite

6.3.6 Moulds

Mould(s) with internal dimensions of at least 260 mm by 300 mm and depth, after placing packing plates if necessary, of the nominal thickness ± 5 mm. The mould(s) shall be capable of withstanding the test conditions without distortion.

NOTE The width of the mould can have an influence on the deformation due to shear.