BS EN 12697-44:2010

BSI Standards Publication

Bituminous mixtures — Test methods for hot mix asphalt

Part 44: Crack propagation by semi-circular bending test

raising standards worldwide™

National foreword

This British Standard is the UK implementation of EN 12697-44:2010.

The UK participation in its preparation was entrusted to Technical Committee B/510/1, Asphalt products.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 63150 4

ICS 93.080.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2010.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12697-44

September 2010

ICS 93.080.20

English Version

Bituminous mixtures - Test methods for hot mix asphalt - Part 44: Crack propagation by semi-circular bending test

Mélanges bitumineux - Méthodes d'essai pour mélange hydrocarboné à chaud - Partie 44 : Propagation de fissure par essai de flexion d'un bloc semi-circulaire

Asphalt - Prüfverfahren für Heißasphalt - Teil 44: Bestimmung der Rissausbreitung mittels Halbzylinder-Biegeversuch

This European Standard was approved by CEN on 28 August 2010.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 12697-44:2010: E

Contents

Page

Foreword

This document (EN 12697-44:2010) 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 March 2011, and conflicting national standards shall be withdrawn at the latest by March 2011.

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 European Standard 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: Compactability*

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 measuremen*t

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 methods 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 a 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*

EN 12697-35, *Bituminous mixtures — Test methods for hot mix asphalt — Part 35: Laboratory mixing*

EN 12697-36, *Bituminous mixtures — Test methods for hot mix asphalt — Part 36: Determination of the thickness of a bituminous pavement*

EN 12697-37, *Bituminous mixtures — Test methods for hot mix asphalt — Part 37: Hot sand test for the adhesivity of binder on precoated chippings for HRA*

EN 12697-38, *Bituminous mixtures — Test methods for hot mix asphalt — Part 38: Common equipment and calibration*

EN 12697-39, *Bituminous mixtures — Test methods for hot mix asphalt — Part 39: Binder content by ignition*

EN 12697-40, *Bituminous mixtures — Test methods for hot mix asphalt — Part 40: In situ drainability*

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 matter in reclaimed asphalt*

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

EN 12697-44, *Bituminous mixtures — Test methods for hot mix asphalt — Part 44: Crack propagation by semi-circular bending test*

prEN 12697-45, *Bituminous mixtures — Test methods for hot mix asphalt — Part 45: Saturation Ageing Tensile Stiffness (SATS) Conditioning Test*

prEN 12697-46, *Bituminous mixtures — Test methods for hot mix asphalt — Part 46: Low Temperature Cracking and Properties by Uniaxial Tension Tests*

EN 12697-47, *Bituminous mixtures — Test methods for hot mix asphalt — Part 47: Determination of the ash content of natural asphalts*

prEN 12697-48, *Bituminous mixtures — Test methods for hot mix asphalt — Part 48: Inter-layer bond strength* (in preparation)

prEN 12697-49, *Bituminous mixtures — Test methods for hot mix asphalt — Part 49: Skid resistance of asphalt in the laboratory* (in preparation)

prEN 12697-50, *Bituminous mixtures — Test methods for hot mix asphalt — Part 50: Scuffing resistance of surface course* (in preparation)

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, Croatia, 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 specifies the Semi-Circular Bending (SCB) test method to determine the tensile strength or fracture toughness of an asphalt mixture for the assessment of the potential for crack propagation. The results of the test can be used to calculate:

— the maximum load that the material containing a notch (crack) can resist before failure;

— when the presence of a notch is critical.

It should be noted that the test only describes a method to determine the resistance to crack propagation of an asphalt mixture. The crack propagation phase describes the second part of failure mechanism during dynamic loading. The first phase, which is the crack initiation phase, is mainly covered by the fatigue test (EN 12697-24).

2 Normative references

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

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

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

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

EN 12697-35, *Bituminous mixtures — Test methods for hot mix asphalt — Part 35: Laboratory mixing*

3 Terms and definitions

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

3.1
test piece
sample obtained by sawing an asphalt cylinder through a diameter

3.2
strain
relative deformation of the test piece

3.3
stress
force per unit area

3.4
horizontal stress
tensile stress prevailing at the base of the test piece

3.5
tensile strength
strength of the material under tensile loading

3.6
fracture toughness
resistance to failure of the test piece by breaking

4 Symbols

a	Notch depth in millimetres (mm)
D	Diameter in millimetres (mm)
$f(a/W)$	Geometric factor
F	Force in newtons (N)
F_{max}	Maximum force in newtons (N)
K_{Ic}	Fracture toughness in newtons per millimetre to the power of 1,5 ($N/mm^{1,5}$)
t	Thickness in millimetres (mm)
ΔW	Vertical displacement at maximum force in millimetres (mm)
ε_{max}	Strain at maximum force in percent (%)
σ	Stress in newtons per square millimetre (N/mm^2)
σ_{hor}	Horizontal stress in newtons per square millimetre (N/mm^2)
σ_{max}	Maximum stress at failure in newtons per square millimetre (N/mm^2)

5 Principle

A half cylinder test piece with a centre crack is loaded in three-point bending in such a way that the middle of the base of the test piece is subjected to a tensile stress. During the test, the deformation increases at a constant rate of 5 mm/min. The corresponding load increases to a maximum value, F_{max}, that is directly related to the fracture toughness of the test sample. In Figure 1 an example of the test frame and specimen is given.

Dimensions in millimetres

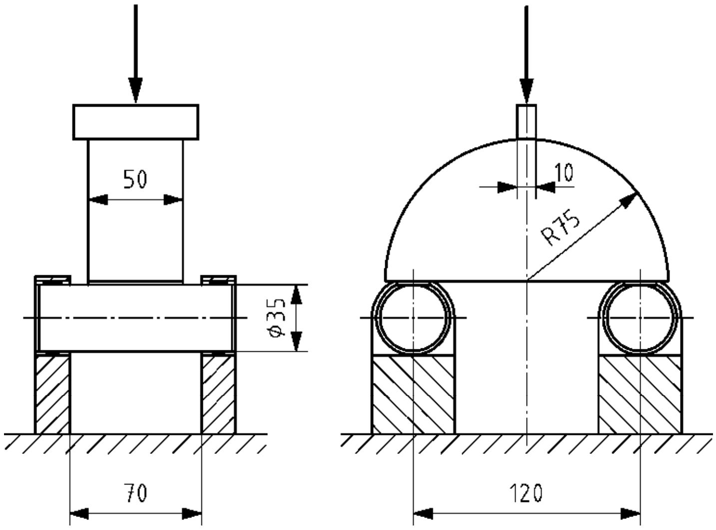


Figure 1 — Example of the test frame and specimen for the SCB-test

6 Apparatus

6.1 Test Machine

The machine should have a range of at least 50 kN and have a drive with which a constant deformation rate of (5,0 ± 0,2) mm/min is maintained during the test.

6.2 Load cell or other force-measuring gauge

Capable of measuring the load with an accuracy of ± 0,2 kN.

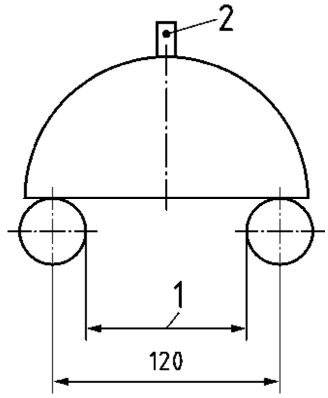
6.3 Deformation gauge

Capable of measuring the deformation to an accuracy of ± 0,01 mm.

6.4 Roller bearings

Capable of rotating on its axis with a support length (centre to centre) of (120,0 ± 0,5) mm and a diameter of (35,0 ± 0,5) mm, as shown in Figure 2.

Dimensions in millimetres



Key

1 Roller bearings

2 Loading strip

Figure 2 — Schematic of semi-circular bend test

6.5 Specimen bearing strips

Between specimen and roller bearing, a metal specimen bearing strip (two per specimen) of dimensions (52 ± 1) mm by (20 ± 1) mm by (1,0 ± 0,2) mm (L × W × H) shall be placed. The centre of each bearing strip shall be directly above the centre of the each roller bearing.

6.6 Metal loading strip L

With a length of at least the thickness of the specimen, a width of (10,0 ± 0,2) mm and a height of (20,0 ± 0,5) mm, as shown in Figure 1.

6.7 Monitoring equipment

Capable of continuously logging the loading and the vertical deformation of the test piece.

6.8 Sliding callipers

Capable of measuring the dimensions of the specimens with an accuracy of ± 0,1 mm.

6.9 Climatic chamber

Capable to maintain the test temperature in the vicinity of the specimen to ± 1 °C.

6.10 Cutting machine

Capable to cut a notch in the specimen with a width of (0,35 ± 0,10) mm and a depth of (10,0 ± 1,0) mm.

NOTE The dimensions of the notch can be checked using high accurate metal strips with various thicknesses and lengths.

7 Sample preparation

7.1 Manufacture

7.1.1 Prepare asphalt cylinders in accordance with either 7.1.2, 7.1.3 or 7.1.4.

NOTE If the cylinders are cored, it is important that they are drilled as near perpendicular to the surface of the asphalt as practicable.

7.1.2 Prepare asphalt slabs by either:

— manufacturing sufficient asphalt in the laboratory in accordance with EN 12697-35 and compacting the asphalt into slabs at least 50 mm thick by roller compactor in accordance with EN 12697-33;

— manufacturing sufficient asphalt from the asphalt plant and compacting the asphalt into slabs at least 50 mm thick by roller compactor in accordance with EN 12697-33.

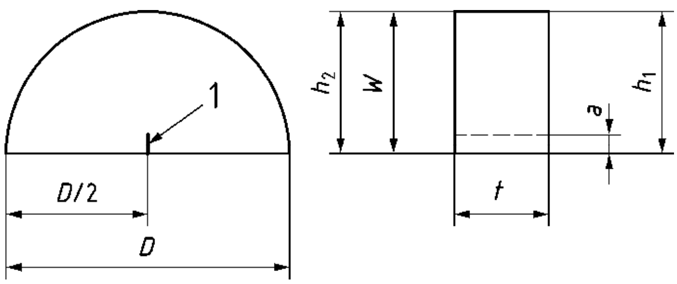
Cut (150 ± 1) mm diameter by (50 ± 3) mm thick cores from the slabs in accordance with EN 12697-27.

7.1.3 Cut (150 ± 1) mm diameter cores from site-compacted asphalt in accordance with EN 12697-27. Reduce the thickness of the specimen to (50 ± 3) mm by cutting. Ensure that the top and bottom surfaces of the specimen are flat and parallel by slicing if required.

7.1.4 Compact specimens with a diameter of (150 ± 1) mm in a gyratory according to EN 12697-31. The thickness of the specimen should be (50 ± 3) mm. Ensure that the top and bottom surfaces of the specimen are flat and parallel by slicing if required.

7.1.5 Cut each core into two equal semi-circular specimens through the middle (see Figure 2).

7.1.6 Cut in the middle of the specimen a notch N nominally to a width of (0,35 ± 0,10) mm and a depth of (10,0 ± 1,0) mm (see Figure 3).



Key

1 Notch

Figure 3 — Specimen dimensions (with the nominal dimensions for a standard test)

7.1.7 Glue the metal bearing strips to the specimens where they rest on the rollers.

7.2 Dimensional check

7.2.1 Ensure that the specimen is dry. Constant mass is obtained when the change in mass between two determinations at an interval of at least 30 min is less than 0,1 % (m/m).

7.2.2 Measure the diameter of the specimen with the callipers at two places along the longest side of the piece. Record the average diameter, *D*, to an accuracy of 0,1 mm.

7.2.3 Measure the height of the specimen with the callipers on each side, h_1 and h_2. Discard any specimen for which $(h_1 - h_2) \geq 0,5$ mm. Record the average height, *W*, to an accuracy of 0,1 mm.

7.2.4 Measure the thickness of the specimen with the callipers at the two ends of the base (t_1 and t_2) and once at the top (under the loading strip; t_3). Discard any specimen for which the difference in thickness between the three thickness values is larger than 0,5 mm. Record the average thickness, *t*, to an accuracy of 0,1 mm.

7.2.5 Measure the depth of the notch, *a*, to an accuracy of 0,1 mm.

7.3 Storage

Specimens that are not to be tested directly shall be stored on a flat surface in a cool area at less than 15 °C.

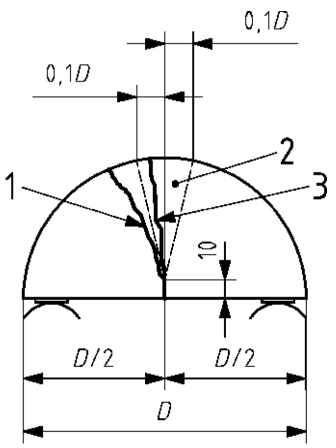
8 Procedure

8.1 If the specimens are tested at a temperature Θ, than before testing the specimens shall be placed in the climatic chamber (Θ ± 1) °C for at least 4 h.

NOTE In most cases this test is carried out at a test temperature Θ of 0 °C.

8.2 Position the load cell and loading strip on upper beam and the roller bearings on the lower beam of the test machine.

8.3 Remove the specimen from the climatic chamber and install in the universal test machine between the loading strip and the roller bearings (see Figure 1) in as short a time as practicably. Be sure that the specimen is positioned in the centre of the test frame. This can be accomplished by putting marks on the surface of the specimen where the rollers shall touch the specimen.



Key

1 Invalid test
2 Zone for valid test result
3 Valid Test

Figure 4 — Criterion for a valid test result

8.4 As soon as the specimen is in place, raise the lower beam of the test machine until the specimen just touches the top load strip. Set the vertical deformation at zero and then apply a load to the specimen sufficient to produce a deformation rate of (5,0 ± 0,2) mm/min. Record the force to an accuracy of 1 N and the vertical displacement to an accuracy of 0,01 mm.

8.5 The time between the removal of the sample from the climatic chamber and the sample failing shall be less than 60 s.

8.6 Plot both the force, *F*, and the vertical displacement against time from the start of the test.

8.7 A valid test is carried out if the crack ends in a zone ± 15 mm (= 10 % of the diameter of the specimen) from the centre of the loading strip. If the crack ends outside this area, then an extra specimen should be tested (see Figure 4).

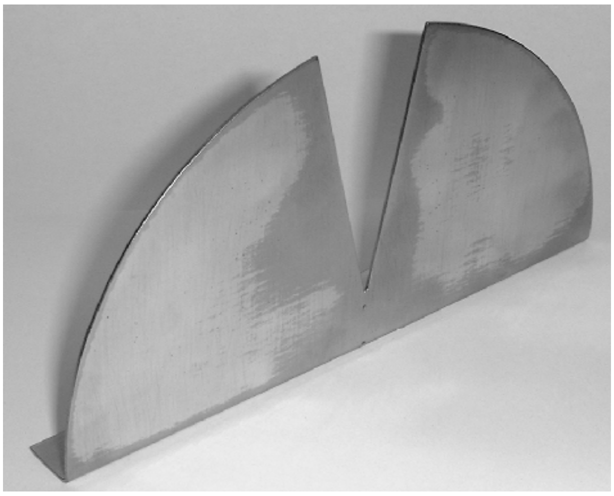


Figure 5 — Optional piece of equipment to facilitate the determination of a valid test

NOTE 1 The definition of a valid zone is necessary to eliminate the possibility to have a large variations in test results. The variation in test results increases with the nominal aggregate size. This is caused by the fact that in specimens with a large nominal aggregate size, the changes of having a notch in an aggregate particle is rather high. To limit the variation in test results, the valid test criterion is introduced.

NOTE 2 It is advised to prepare more specimens than necessary for testing because of the possibility that one or more test results are not valid because the crack ends outside the valid crack zone.

NOTE 3 The determination of a valid test can be facilitated with an optional piece of equipment as shown in Figure 5.

8.8 The test shall be carried out on at least four specimens with valid results.

9 Calculations

9.1 For each specimen i (i = 1, 2, 3, 4) the steps 9.2 to 9.6 shall be carried out.

9.2 Determine the maximum load, $F_{max,i}$, and the vertical deformation, ΔW_i, from the plot.

9.3 Calculate the strain at maximum force, $\varepsilon_{max,i}$, in accordance with Equation (1).

$$\varepsilon_{max,i} = \frac{\Delta W_i}{W_i} \times 100\ \% \qquad (1)$$

where

W_i is the height of specimen i (i = 1, 2, 3, 4) in millimetres;

ΔW_i is the vertical displacement at maximum force of specimen i (i = 1, 2, 3, 4), in millimetres.

9.4 Calculate the maximum stress at failure, $\sigma_{max,i}$, in accordance with Equation (2).

$$\sigma_{max,i} = \frac{4{,}263 \times F_{max,i}}{D_i \times t_i} \; N/mm^2 \quad (2)$$

where

D_i is the diameter of specimen i (i = 1, 2, 3, 4), in millimetres;

t_i is the thickness of specimen i (i = 1, 2, 3, 4), in millimetres;

$F_{max,i}$ is the maximum force of specimen i (i = 1, 2, 3, 4), in newtons.

9.5 Calculate the fracture toughness, $K_{Ic,i}$, of specimen i (i=1,2,3,4) in accordance with Equation 3:

$$K_{Ic,i} = \sigma_{max,i} \cdot f\left(\frac{a_i}{W_i}\right) \; N/mm^{3/2} \quad (3)$$

where:

W_i Height of specimen i (i=1,2,3,4) in millimetres (mm)

a_i Notch depth of specimen i (i=1,2,3,4) in millimetres (mm)

$\sigma_{max,i}$ Stress at failure of specimen i (i=1,2,3,4) in newtons per metre squared (N/mm²)

$f(a_i/W_i)$ Geometric factor of specimen i (i=1,2,3,4) in accordance with Equation 4. This geometric factor has no unit and shall be rounded off at three digits.

For 9 < a_i < 11 mm and 70 < W_i < 75 mm, then:

$$f\left(\frac{a_i}{W_i}\right) = 5{,}956 \quad (4)$$

NOTE 1 For other a_i or W_i values, the following equation can be used to calculate the geometric factor $f(a_i/W_i)$:

$$f\left(\frac{a_i}{W_i}\right) = -4{,}9965 + 155{,}58\left(\frac{a_i}{W_i}\right) - 799{,}94\left(\frac{a_i}{W_i}\right)^2 + 2141{,}9\left(\frac{a_i}{W_i}\right)^3 - 2709{,}1\left(\frac{a_i}{W_i}\right)^4 + 1398{,}6\left(\frac{a_i}{W_i}\right)^5 \quad (5)$$

The accuracy of the $K_{Ic,i}$-values is 0,1 N/mm^{1,5}.

NOTE 2 For un-notched specimens, the tensile strength is equal to the maximum stress according to Equation (3).

9.6 Calculate the fracture toughness, K_{Ic}, of the material as an average of the $K_{Ic,i}$-values according to Equation (6).

$$K_{Ic} = \frac{\sum_{i=1}^{4} K_{Ic,i}}{4} \; N/mm^{3/2} \quad (6)$$

The accuracy of the K_{Ic}-value is 0,1 N/mm^{1,5}.

10 Test report

The test report shall include the mean fracture toughness and the following information for each specimen:

a) identification number, type of mixture and composition;

b) date and time of testing and name of operator;

c) reference to this document;

d) sample code;

e) date sample was taken;

f) test temperature;

g) average sample diameter, D_i of specimen i (i = 1, 2, 3, 4), to an accuracy of 0,1 mm;

h) average sample height, W_i of specimen i (i = 1, 2, 3, 4), to an accuracy of 0,1 mm;

i) average sample thickness, t_i of specimen i (i = 1, 2, 3, 4), to an accuracy of 0,1 mm;

j) notch depth, a_i of specimen i (i = 1, 2, 3, 4), to an accuracy of 0,1 mm;

k) maximum force, $F_{max,i}$ of specimen i (i = 1, 2, 3, 4), to an accuracy of 1 N;

l) displacement ΔW_i at maximum force of specimen i (i = 1, 2, 3, 4) to an accuracy of 0,01 mm;

m) maximum stress at failure, $\sigma_{max,I}$ of specimen i (i = 1, 2, 3, 4), to an accuracy of 0,1 N/mm²;

n) strain at the maximum force $\varepsilon_{max,i}$ of specimen i (i = 1, 2, 3, 4), to an accuracy of 0,1 %;

o) fracture toughness, $K_{Ic,I}$ of specimen i (i = 1, 2, 3, 4) to an accuracy of 0,1 N/mm^{1,5};

p) overall fracture toughness, K_{Ic} of the material to an accuracy of 0,1 N/mm^{1,5};

q) any observation which may have an influence on the evaluation.

11 Precision data

In July 2001 a large round-robin test has been organized in the Netherlands (TNO-report FSP-RPT-010048, July 2001). In this test, nine various AC 16 surf mixtures with 20/30, 40/60 and 70/100 bitumen have been tested at 0 °C by three laboratories. Each laboratory tested ten specimens (cored from two different slabs, prepared by two laboratories) of each mix. The average K_{Ic}-value is 30,6 N/mm^{1,5}; the repeatability r of the test is 2,44 N/mm^{1,5} and the reproducibility R is 2,49 N/mm^{1,5}.

Bibliography

[1] EN 12697-24, *Bituminous mixtures — Test methods for hot mix asphalt — Part 24: Resistance to fatigue*

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the independent national body responsible for preparing British Standards and other standards-related publications, information and services.
It presents the UK view on standards in Europe and at the international level.

It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001

BSI offers Members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Tel: +44 (0)20 8996 7669 Fax: +44 (0)20 8996 7001
Email: plus@bsigroup.com

Buying standards

You may buy PDF and hard copy versions of standards directly using a credit card from the BSI Shop on the website **www.bsigroup.com/shop.** In addition all orders for BSI, international and foreign standards publications can be addressed to BSI Customer Services.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001
Email: orders@bsigroup.com

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Knowledge Centre.

Tel: +44 (0)20 8996 7004 Fax: +44 (0)20 8996 7005
Email: knowledgecentre@bsigroup.com

Various BSI electronic information services are also available which give details on all its products and services.

Tel: +44 (0)20 8996 7111 Fax: +44 (0)20 8996 7048
Email: info@bsigroup.com

BSI Subscribing Members are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.

Tel: +44 (0)20 8996 7002 Fax: +44 (0)20 8996 7001
Email: membership@bsigroup.com

Information regarding online access to British Standards via British Standards Online can be found at **www.bsigroup.com/BSOL**

Further information about BSI is available on the BSI website at **www.bsigroup.com/standards**

Copyright

Tel: +44 (0)20 8996 7070
Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Tel +44 (0)20 8996 9001
Fax +44 (0)20 8996 7001
www.bsigroup.com/standards

raising standards worldwide™