



SLOVENSKI STANDARD
SIST EN 12697-24:2004
01-september-2004

6]li a Ybg_Y'na Ygj'É'DfYg_i gbY'a YfcXY'nUj fc Y'UgZJHbY'na Ygj'É' & "XY.
CXdcfbcghdfch'i fci 'Ub'1

Bituminous mixtures - Test methods for hot mix asphalt - Part 24: Resistance to fatigue

Asphalt - Prüfverfahren für Heißasphalt - Teil 24: Beständigkeit gegen Ermüdung

Mélanges bitumineux - Méthodes d'essai pour mélange hydrocarboné a chaud - Partie
24: Résistance a la fatigue

(standards.iteh.ai)

Ta slovenski standard je istoveten z: EN 12697-24:2004

<https://standards.iteh.ai/catalog/standards/sist/2b9f6b1c-0f5f-4fe0-b46c-0a8a901aa105/sist-en-12697-24-2004>

ICS:

93.080.20 Materiali za gradnjo cest Road construction materials

SIST EN 12697-24:2004

en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 12697-24:2004

<https://standards.iteh.ai/catalog/standards/sist/2b9f6b1c-0f5f-4fe0-b46c-0a8a901aa105/sist-en-12697-24-2004>

ICS 93.080.20

English version

Bituminous mixtures - Test methods for hot mix asphalt - Part
24: Resistance to fatigue

Mélanges bitumineux - Méthodes d'essai pour enrobés à
chaud - Partie 24: Résistance à la fatigue

Asphalt - Prüfverfahren für Heiasphalt - Teil 24:
Bestndigkeit gegen Ermdung

This European Standard was approved by CEN on 2 March 2004.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

[SIST EN 12697-24:2004](https://standards.iteh.ai/catalog/standards/sist/2b9f6b1c-0f5f-4fe0-b46c-0a8a901aa105/sist-en-12697-24-2004)

<https://standards.iteh.ai/catalog/standards/sist/2b9f6b1c-0f5f-4fe0-b46c-0a8a901aa105/sist-en-12697-24-2004>



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

	page
Foreword.....	5
1 Scope	8
2 Normative references	8
3 Terms, definitions, symbols and abbreviations	8
3.1 General.....	8
3.2 Two-point bending test on trapezoidal specimens	9
3.3 Two-point bending test on prismatic shaped specimens	10
3.4 Three-point bending test on prismatic shaped specimens.....	13
3.5 Four-point bending test on prismatic shaped specimens	14
3.6 Indirect tensile test on cylindrical shaped specimens	19
3.6.1 Symbols	19
4 Failure	20
5 Calculations.....	20
6 Summary of the procedures	20
6.1 Two-point bending test on trapezoidal specimens	20
6.2 Two-point bending test on prismatic shaped specimens	20
6.3 Three-point bending test on prismatic shaped specimens	20
6.4 Four-point bending test on prismatic shaped specimens	20
6.5 Indirect tensile test on cylindrical shaped specimens	21
7 Test report	21
Annex A (normative) Two-point bending test on trapezoidal shaped specimens	22
A.1 Principle	22
A.1.1 General.....	22
A.1.2 Element test.....	22
A.1.3 Fatigue line	23
A.2 Equipment	23
A.2.1 Test machine	23
A.2.2 Thermostatic chamber	23
A.2.3 Measuring equipment.....	24
A.3 Specimen preparation	24
A.3.1 Sawing and storing.....	24
A.3.2 Characteristics of the specimens	25
A.3.3 Embedding Check.....	25
A.3.4 Stabilisation of the specimens	26
A.3.5 Gluing the ends.....	26
A.4 Procedure	27
A.4.1 Preparing the test equipment.....	27
A.4.2 Carrying out the fatigue test.....	27
A.4.3 Choice of the strain	27
A.4.4 Number of element tests.....	28
A.5 Calculation and expression of results.....	28
A.6 Test report	30
A.7 Precision.....	30
Annex B (normative) Two-point bending test on prismatic shaped specimens	31
B.1 Principle.....	31

B.2	Equipment	31
B.2.1	Test machine.....	31
B.2.2	Thermostatic chamber.....	31
B.2.3	Measuring equipment	31
B.3	Specimen preparation.....	32
B.3.1	Sawing and storing	32
B.3.2	Characteristics of the specimens	32
B.3.3	Stabilisation of the specimens.....	32
B.3.4	Gluing the ends	32
B.4	Procedure	32
B.4.1	Preparing the test equipment.....	32
B.4.2	Carrying out the fatigue test.....	33
B.4.3	Choice of the tension	33
B.5	Calculation and expression of results	33
B.6	Test report.....	35
B.7	Precision.....	36
Annex C	(normative) Three-point bending test on prismatic shaped specimens	37
C.1	Principle.....	37
C.1.1	General	37
C.1.2	Element test	37
C.1.3	Fatigue line.....	37
C.2	Equipment	37
C.2.1	Test machine.....	37
C.2.2	Load cell	37
C.2.3	Extensometer and displacement sensor	37
C.2.4	Clamping device.....	38
C.2.5	Data acquisition equipment	38
C.2.6	Thermostatic chamber.....	38
C.2.7	Other general equipment.....	38
C.2.8	Check on the operation of the complete equipment and the mounting of the specimen.....	38
C.3	Specimen preparation.....	38
C.3.1	Manufacturing and sawing.....	38
C.3.2	Bulk density	38
C.3.3	Storing	38
C.3.4	Clamping devices preparation	39
C.4	Procedure	39
C.4.1	Preparing the test equipment.....	39
C.4.2	Carrying out the fatigue test.....	39
C.4.3	Load function, extensometer signal function, and displacement function recording	39
C.4.4	End of test	40
C.5	Calculation and expression of results	40
C.5.1	Calculation of the stress function and the strain function at a cycle	40
C.5.2	Calculation of the dynamic modulus, phase difference angle, and density of dissipated energy at one cycle	41
C.5.3	Determination of the fatigue law and energy law.....	42
C.6	Test report.....	43
C.7	Precision.....	43
Annex D	(normative) Four-point bending test on prismatic shaped specimens	44
D.1	Principle.....	44
D.1.1	General	44
D.1.2	Element test	44
D.1.3	Fatigue line.....	45
D.2	Equipment	46
D.2.1	Test machine.....	46
D.2.2	Clamping device	46
D.2.3	Thermostatic chamber.....	46
D.2.4	Electronic data registration equipment.....	46
D.2.5	Check on the operation of the complete equipment and the mounting of the specimen.....	47

D.3	Specimen preparation	47
D.3.1	Dimensions	47
D.3.2	Sawing	48
D.3.3	Drying	48
D.3.4	Storage	48
D.3.5	Condition	48
D.3.6	Mounting	48
D.4	Procedure	48
D.4.1	Preparing the test equipment	48
D.4.2	Carrying out the fatigue test	49
D.4.3	Choice of test conditions	49
D.4.4	Data processing	50
D.5	Calculation and expression of results	50
D.6	Test report	51
D.7	Precision	51
Annex E	(normative) Indirect tensile test on cylindrical shaped specimens	52
E.1	Principle	52
E.2	Equipment	52
E.2.1	Test machine	52
E.2.2	Loading	52
E.2.3	Displacement	52
E.2.4	Thermostatic chamber	52
E.2.5	Recording and measuring system	52
E.2.6	Loading frame	53
E.2.7	Positioning rig	54
E.2.8	Glue	54
E.3	Specimen preparation	55
E.3.1	Test specimen	55
E.3.2	Specimen dimensions	55
E.3.3	Position of the deformation and loading strips	55
E.3.4	Conditioning	55
E.4	Procedure	56
E.5	Calculation and reporting of results	56
E.6	Test report	59
E.7	Precision	59
Bibliography	60

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 12697-24:2004

<https://standards.iteh.ai/catalog/standards/sist/2b9f6b1c-015f-41e0-b46c->

<https://standards.iteh.ai/catalog/standards/sist/2b9f6b1c-015f-41e0-b46c-01aa901aa105/sist-en-12697-24-2004>

Foreword

This document (EN 12697-24:2004) 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 January 2005, and conflicting national standards shall be withdrawn at the latest by August 2005.

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: Binder recovery: Rotary evaporator.*

EN 12697-4, *Bituminous mixtures — Test methods for hot mix asphalt — Part 4: Binder 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 12697-24:2004 (E)

EN 12697-17, *Bituminous mixtures — Test methods for hot mix asphalt — Part 17: Partial 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.*

prEN 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, impact compactor.*

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

prEN 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.*

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

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

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

prEN 12697-42, *Bituminous mixtures — Test methods for hot mix asphalt — Part 42: Amount of foreign matters in reclaimed asphalt.*

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

No existing European Standard is superseded.

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

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 12697-24:2004](https://standards.iteh.ai/catalog/standards/sist/2b9f6b1c-0f5f-4fe0-b46c-0a8a901aa105/sist-en-12697-24-2004)

<https://standards.iteh.ai/catalog/standards/sist/2b9f6b1c-0f5f-4fe0-b46c-0a8a901aa105/sist-en-12697-24-2004>

1 Scope

This document specifies the methods for characterising the fatigue of bituminous mixtures by alternative tests, including bending tests and direct and indirect tensile tests. The tests are performed on compacted bituminous material under a sinusoidal loading or other controlled loading, using different types of specimens and supports.

The procedure is used to rank bituminous mixtures on the basis of resistance to fatigue, as a guide to relative performance in the pavement, to obtain data for estimating the structural behaviour in the road and to judge test data according to specifications for bituminous mixtures.

Because this document does not impose a particular type of testing device, the precise choice of the test conditions depends on the possibilities and the working range of the used device. For the choice of specific test conditions, the requirements of the product standards for bituminous mixtures shall be respected. The applicability of this document is described in the product standards for bituminous mixtures. Results obtained from different test methods are not assured to be comparable.

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 12697-6, *Bituminous mixtures — Test methods for hot mix asphalt — Part 6: Determination of bulk density of bituminous specimen.*

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

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

EN 12967-33, *Bituminous mixtures — Test methods for hot mix asphalt — Part 33: Specimen preparation by roller compactor.*

3 Terms, definitions, symbols and abbreviations

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

3.1 General

3.1.1

fatigue

reduction of strength of a material under repeated loading when compared to the strength under a single load

3.1.2

conventional criteria of failure (constant displacement)

number of load applications, $N_{f/50}$, when the complex stiffness modulus has decreased to half its initial value

3.1.3**initial complex stiffness modulus**

complex stiffness modulus, $S_{\text{mix},0}$, after 100 load applications

3.1.4**conventional criteria of fatigue (constant force)**

when the displacement of a specimen under constant strength at the head has increased to the double that at the start of the test

3.1.5**fatigue life of a specimen**

number of cycles $N_{i,j,k}$ corresponding with the conventional failure criterion at the set of test conditions k (temperature, frequency and loading mode; e.g. constant deflection level, or constant force level, and or any other constant loading condition)

3.2 Two-point bending test on trapezoidal specimens**3.2.1****constant relative to maximum strain**

constant that enables the head displacement z of the trapezoidal specimen of dimensions $[B, b, e, h]$, to which a bending strain level ε is applied, to be converted into maximum strain

NOTE K_ε and its relationship with the parameters mentioned above is the following:

$$K_\varepsilon \times z = \varepsilon \quad \text{iTeh STANDARD PREVIEW} \quad (1)$$

$$K_\varepsilon = \frac{B^2 \times (B-b)^2}{4b \times h^2 \times \left[(b-B) \times (3B-b) + 2B^2 \times \ln\left(\frac{B}{b}\right) \right]} \quad \text{(standards.iteh.ai)} \quad (2)$$

SIST EN 12697-24:2004
<https://standards.iteh.ai/catalog/standards/sist/2b9f6b1c-0f5f-4fe0-b46c-0a8a901aa105/sist-en-12697-24-2004>

3.2.2 Symbols

The symbols are as follows, with a strain of 1 microstrain (μstrain) being equal to 10^{-6} by convention:

- i is the Index of the specimen for an element test (varies from 1 to n)
- h_i is the height, in metres (m)
- B_i is the large base, in metres (m)
- b_i is the small base, in metres (m)
- e_i is the thickness, in metres (m)
- v_i is the void content of the specimen i by geometric method, in per cent (%)
- K_{ϵ} is the constant, relative to the maximum strain, in inverse metres (m^{-1})
- z_i is the amplitude of displacement imposed at the head of specimen i , in metres (m)
- ϵ_i is the maximum relative strain of specimen i corresponding with the displacement imposed at the head
- N_i is the conventional fatigue life of specimen i
- a is the ordinate of the fatigue line according to the equation $\log(N) = a + (1/b) \log(\epsilon)$
- r_2 is the linear correlation coefficient ($\log(N_i), \log(\epsilon_i)$)
- $1/b$ is the slope of the fatigue line
- $\log(\epsilon)$ is the average value of $\log(\epsilon_i)$
- $S_{\log(\epsilon)}$ is the standard deviation of $\log(\epsilon_i)$
- $S_{\log(N)}$ is the standard deviation of $\log(N_i)$
- ϵ_6 is the strain corresponding with 10^6 cycles
- s_N is the estimation of the residual standard deviation of the decimal logarithms of fatigue lives
- $\Delta\epsilon_6$ is the quality index of the test
- n is the number of specimens

3.3 Two-point bending test on prismatic shaped specimens

3.3.1 average fatigue life of a series of specimens

average from a series of n specimens at the level of tension $\sigma_{j \max}$ given by equation (3)

$$N_{j \max} = \frac{e}{n} \times \sum_{i=1}^n \ln(N_{ij}) \quad (3)$$

where

- $N_{j\max}$ is the average number of cycles obtained at the level of tension $\sigma_{j\max}$;
- N_{ij} is the fatigue life of the specimen i at the level of tension $\sigma_{j\max}$;
- J is the number at the level of tension $\sigma_{j\max}$;
- n is the number of specimens at the level of tension $\sigma_{j\max}$;
- l is the thickness, in millimetre (mm).

3.3.2

standard deviation of the fatigue life of a series of specimens

standard deviation of the natural logarithm of the fatigue life obtained at the level of tension $\sigma_{j\max}$ for n repetitions given by equation (4)

$$S_{j\max} = \frac{1}{(n-1)} \times \sqrt{\sum_{i=1}^n (\ln(N_{ij}) - \ln(N_{\varepsilon j\max}))^2} \quad (4)$$

where

- $s_{j\max}$ is the estimation of the standard deviation;
- j is the number of the tension level $\sigma_{j\max}$;
- N_{ij} is the conventional fatigue life at the level of tension $\sigma_{j\max}$;
- $N_{j\max}$ is the average number of cycles obtained at the level of tension $\sigma_{j\max}$;
- n is the number of specimens at the level of tension $\sigma_{j\max}$.

3.3.3

constants for consideration of the geometry of specimen

constants that enable the strength of the head P_{ij} of the specimen i of dimensions b_i, e_i and h_i , to which a bending strength is applied, to be converted to a maximum tension

NOTE $K_{\varepsilon i}$, and its relationship with the parameters mentioned above, is as follows:

$$K_{\sigma i} \times P_{ij} = \sigma_{j\max} \quad (5)$$

where

- $K_{\sigma i}$ is the constants for consideration of the geometry of specimen at constant strength;
- P_{ij} is the amplitude of the strength, with which the head is applied, in Newton (N);
- $\varepsilon_{j\max}$ is the maximum relative strain of the specimen corresponding with the displacement imposed at the head;
- $\sigma_{j\max}$ the greatest relative tension of the specimen, corresponding to the strength, with which the head is applied.

$$K_{\sigma i} = \frac{6 h_i}{b_i^2 \times e_i} \quad (6)$$

where

- K_{σ} is the constant for consideration of the geometry of specimen at constant strength (factor in accordance to EN 12697-26);
- b_i is the base, in millimetre (mm);
- h_i is the height, in millimetre (mm);
- e_i is the width, in millimetre (mm).

3.3.4 Symbols

The symbols are as follows, with a strain of 1 microstrain (μ strain) being equal to 10^{-6} by convention:

3.3.4.1 Sample i

- h_i is the height, in millimetres (mm)
- b_i is (A) small base or (B) base, in millimetres (mm)
- e_i is the thickness, in millimetres (mm)
- m_i is the mass, in grams (g)
- $v_i\%$ is the vacuum achieved by the geometric method as a proportion of atmospheric pressure, in per cent (%)
- K_{σ} is the constant for consideration of the geometry of specimen at constant strength, in inverse millimetres (mm^{-1})

ITeCh STANDARD PREVIEW

(standards.iteh.ai)

SIST EN 12697-24:2004

<https://standards.iteh.ai/catalog/standards/sist/2b9f6b1c-0f5f-4fe0-b46c-3a890a1063e9/en-12697-24-2004>

3.3.4.2 Strength at head and greatest tension at specimen i at level of tension $\sigma_{j \max}$

- P_{ij} is the amplitude of the strength with which the head is applied, in Newtons (N)
- $\sigma_{j \max}$ is the greatest relative tension of the specimen, corresponding to the strength, with which the head is applied

3.3.4.3 Fatigue life of a specimen i at the level of tension $\sigma_{j \max}$

- N_{ij} is the fatigue life.

3.3.4.4 Fatigue life relative to sample i at the strain level ε_j

- N_{ij} is the conventional fatigue life.

3.3.4.5 Fatigue line

- p_{σ} is the slope of fatigue line $\ln(\sigma_{j \max}) = f(\ln(N_{ij}))$
- $\hat{\sigma}_6$ is the tension corresponding with 10^6 cycles, in megapascals (MPa)
- $s_{\sigma_x/y}$ is the estimation of the residual standard deviation of the natural logarithms of fatigue lives
- $\Delta \hat{\sigma}_6$ is the confidence of $\hat{\sigma}_6$ for a probability of 95 %

N is the number of element tests (number of specimens at the level of tension $\sigma_{j \max}$ times the number of levels) where $N = n * l$

s_N is the estimation of the standard deviation of $\ln(N_{ij})$

3.3.4.6 Fatigue life of a series of n specimens (A) at a strain level $\varepsilon_{j \max}$ or (B) at the level of tension $\sigma_{j \max}$

$N_{\varepsilon_{j \max}}$ is the average number of cycles obtained at the level of tension $\sigma_{j \max}$

l is the number at the level of tension $\sigma_{j \max}$

n is the number of specimens at the level of tension $\sigma_{j \max}$

3.4 Three-point bending test on prismatic shaped specimens

3.4.1 Symbols

The symbols are as follows:

$2A_t$ is the amplitude of the approximate stress function, in megapascals (MPa)

$2A_\varepsilon$ is the amplitude of the approximate strain function

B is the measuring base of the extensometer, in millimetres (mm)

B_t is the phase angle of the approximate stress function, in radians (rad)

B_ε is the phase angle of the approximate strain function, in radians (rad)

D_c is the displacement at instant t , in microns (μm)

$2D_0$ is the total amplitude of displacement function, in microns (μm)

DDE is the density of dissipated energy, in megapascals (MPa) or megajoules per cubic metre (MJ/m^3)

$DE(\text{total})$ is the total density of dissipated energy throughout the whole test, in megajoules per cubic metre (MJ/m^3)

$DDE(x)$ is the density of dissipated energy at cycle x , in megajoules per cubic metre (MJ/m^3)

EXT is the instant extensometer signal, in millimetres (mm)

L is the distance between supports, in millimetres (mm)

MD is the dynamic modulus, in megapascals (MPa)

N is the number of cycle at end of test

P is the instant load, in megapascals (MPa)

W is the total density of dissipated energy throughout the whole test, in megajoules per cubic metre (MJ/m^3)

b is the width of specimen, in millimetres (mm)

e is the thickness of specimen, in millimetres (mm)