ANMERKUNG Die Temperaturabhängigkeit der Haftzugfestigkeit beeinflusst das Prüfergebnis. Nach dem Prüfverfahren der Quebec-Norm LC25-010 kann bei der Vor-Ort-Prüfung eine Korrektur angewendet werden, die die Prüftemperatur (T °C) berücksichtigt. Der Anwendbarkeitsbereich des Korrekturfaktors reicht von 10 °C bis 25 °C. Bei vor Ort durchgeführten Prüfungen kann die bei T °C erhaltene höchste Haftzugfestigkeit unter Verwendung folgender Gleichung (D.2) auf 20 °C korrigiert werden:

$$\sigma_{LAMI} \text{ auf 20 °C korrigiert} = \sigma_{LAMI} \text{ bei T °C} + [0{,}02 \times (\text{T °C} - 20\text{ °C})] \quad \text{(D.2)}$$

D.5.3 Das arithmetische Mittel der an den sechs Probekörpern gemessenen Haftfestigkeit ist in MPa zu berechnen, auf 0,01 MPa.

D.6 Kalibrierung der LAMI

Eine mit einer 10-kN-Lastmessdose ausgestattete Hydraulikpresse wird für die Kalibrierung der LAMI-Einrichtung verwendet. Der Kolben des Ziehkopfes wird in eine etwa 1 mm von der Dose entfernte Position gebracht (Bild D.6). Eine bei der Durchführung des Zugversuchs mit der LAMI-Einrichtung verwendete, fünfmal langsamere Geschwindigkeit (48 N/s) wird aktiviert und die Newton-Werte der Presse, die Intervallen entsprechen, die nicht größer sind als 345 kPa, sind aufzuzeichnen (Beispiel in Tabelle D.1). Dieses Verfahren wird dreimal durchgeführt und eine Kalibrierkurve, die die gemessene Kraft (in N) gegenüber der Druckablesung auf dem Präzisionsmanometer (in kPa) darstellt, wird berechnet (Bild D.7).

ANMERKUNG Die beim Kalibrieren der Einrichtung zu verwendende Geschwindigkeit von 48 N/s wurde gewählt, um eine einfachere Ablesung der Messungen am Manometer zu ermöglichen.

$$\beta_{\mathrm{T}} = \frac{F_{\max}}{\Pi x (\frac{d}{2})^2} \quad \text{(D.3)}$$

Bild D.6 — Illustration des Kalibrierprozesses des LAMI mit einer Hydraulikpresse, die mit einer 10-kN-Lastmessdose ausgestattet ist

Tabelle D.1 — Beispiel für bei der LAMI-Kalibrierung gesammelte Daten

Zugdruck P_{LAMI} kPa	**Zugkraft** F_{LAMI}(N) N
345	487
689	1 018
1 034	1 588
1 379	2 165
1 724	2 752
2 068	3 348
2 413	3 928
2 758	4 509
3 103	5 122
3 447	5 709
3 792	6 321
4 137	6 960

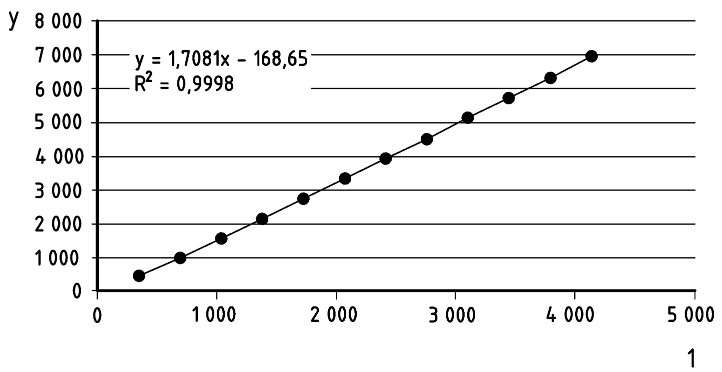

Bild D.7 — Verhältnis zwischen der gemessenen Kraft F_{LAMI} (N) und dem Druck P_{LAMI} (kPa), abgelesen am Präzisionsmanometer des LAMI mit den Daten aus Tabelle D.1

Die Gleichung dieser Kalibrierkurve (Formel D.4), die für jede LAMI-Einrichtung spezifisch ist, macht es dann möglich, den in kPa (P_{LAMI}) auf dem Präzisionsmanometer abgelesenen Höchstdruck nach jedem mit der LAMI-Einrichtung durchgeführten Zugversuch in eine in N (F_{LAMI}) ausgedrückte Höchstkraft umzuwandeln.

ANMERKUNG In diesem Beispiel auf der in Bild D.7 gezeichneten Kalibrierkurve basierend.

$$F_{LAMI} \text{ (in N)} = [(1{,}708\,1 \times P_{LAMI} \text{ (in kPa)}) - 168{,}65] \quad \text{(D.4)}$$

Unter Verwendung der jeder Einrichtung eigenen Kalibrierdaten und auf Grundlage der Formel (D.4) ist es dann möglich, die höchste Zugbelastung in Übereinstimmung mit D.5 zu bestimmen.

D.7 Prüfbericht

Der Prüfbericht muss die folgenden Angaben enthalten:

a) Name der Organisation, die die Prüfung durchgeführt hat;

b) Bezeichnung der Baustelle oder des Bauvorhabens;

c) Beschreibung sowohl von Deckschicht als auch von unterer Schicht;

d) Prüfdatum;

e) Temperatur der Oberflächenschicht, in °C;

f) Temperatur der gebrochenen Oberflächen, in °C (wenn anwendbar);

g) Nummer des Bohrkerns und Entnahmestelle;

h) Durchmesser *D* des Prüfkörpers, in mm;

i) Höchstzugdruck P_{LAMI}, in kPa;

j) Höchstzugkraft F_{LAMI}, in N;

k) Haftzugfestigkeit σ_{LAMI} bei der Temperatur der Fahrbahnbefestigung, in MPa;

l) Versagensart (a, b, c, d, e oder „kein Bruch“);

m) Tiefe der gebrochenen Grenzfläche von der Oberfläche der Fahrbahnbefestigung, in mm (wenn anwendbar).

D.8 Präzision

Die Präzision dieses Prüfverfahrens wurde noch nicht ermittelt.

– Entwurf –

EUROPEAN STANDARD

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Bituminous mixtures - Test methods - Part 48: Interlayer Bonding

Mélanges bitumineux - Méthodes d'essai - Partie 48: Lien de couches

Asphalt - Prüfverfahren für Heißasphalt - Teil 48: Schichtenverbund

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

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN 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-CENELEC Management Centre has the same status as the official versions.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European Foreword

This document (prEN 12697-48:2019) 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 CEN Enquiry.

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

1 Scope

This document specifies test methods for determining the bond strength between an asphalt layer and other newly constructed construction layers or existing substrates in road or airfield pavements. The tests can also be applied on laboratory prepared interlayers.

The normative tests described in this document are:

— Torque Bond Test (TBT), generally applicable to any layer thicknesses;

— Shear Bond Test (SBT), generally applicable to layer thicknesses ≥ 15 mm;

— Tensile Adhesion Test (TAT), generally applicable to layer thicknesses < 15 mm;

NOTE 1 Further non normative test methods are described in informative annexes:

— Annex A (informative) - Compressed shear bond test (CSBT)

— Annex B (informative) - Cyclic compressed shear bond test (CCSBT)

— Annex C (informative) - Alternative Shear bond test (ASBT)

— Annex D (informative) - Layer Adhesion Measuring Instrument (LAMI)

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

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

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

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
peak shear stress of the interface
τSBT,max
maximum value of shear stress [MPa], determined as the maximum force F divided by the initial cross sectional area A, of a specimen when tested as described in this document

3.2
displacement at peak shear stress
δSBT,max
displacement at the maximum value of shear stress, of a specimen when tested as described in this document

3.3
shear stiffness modulus
kSBT,max
slope of the shear stress versus displacement - graph, determined from the linear part of the graph

3.4
effective cross sectional area
value of the effective contact area between the two layers of the specimen

Note 1 to entry: This area can be express as a function of the relative displacement of the two portions of the specimen as shown in Figure A.3.

3.5
dilatancy
ratio between the difference of the last two current recorded values of the vertical and the horizontal displacement [$d = (\eta_i - \eta_{i-1})/(\delta_i - \delta_{i-1})$], of a specimen when tested as described in Annex A

3.9
normal stress
ratio between the normal load and the effective cross sectional area, of a specimen when tested as described in Annex A

3.10
critical condition
shearing of the interface in residual (pure friction) condition at constant volume, of a specimen when tested as described in Annex A

4 Principle

4.1 General

The described test methods simulate different loading conditions and are applicable on different bonds between road construction layers. The methods give different results because they measure different failure modes.

4.2 Torque Bond Test (TBT)

The torque bond test assesses the resistance to horizontal shear stress:

- The torque bond test is suitable for testing the bond strength between road layers in laboratory and *in situ*;
- The torque bond test assesses the resistance to the stresses generated primarily by traffic accelerating or braking, but also by different thermal movements when the layers are of different materials;
- The torque bond test can be carried out immediately after laying;
- The torque bond test can be applied to assess the capability of bond coats or tack coats.

When the thickness of the top layer above the interlayer assessed is less than 15 mm, the torque bond test can be applied for evaluating the durability of the top layer.

The torque bond test is carried out either *in situ* or in the laboratory using cores. A circular steel plate is glued to the top road surface *in situ* or on top of a core in a laboratory. A rotational horizontal force is applied to the steel plate and the torque moment is measured. For a top layer with a thickness < 15 mm, the steel plate is glued on top of the surface or a – for the laboratory test method – a core that is larger than the plate diameter. For a top layer with a thickness ≥ 15 mm, a cylindrical groove of the same dimension as the plate is cut through the upper layer down into the bottom layer.

4.3 Shear Bond Test (SBT)

The shear bond test assesses the resistance to horizontal shear stresses in the interlayer of two road construction layers.

- The shear bond test assesses the resistance to the stresses generated primarily by traffic accelerating or braking, but also by different thermal movements when the layers are of different materials.

- The shear bond test can be applied to assess the capability of bond coats or tack coats.

- The shear bond test is suitable to evaluate the shear bond strength of construction layers with a thickness ≥ 15 mm.

Cylindrical test specimens are subjected to direct shear loading at controlled temperature with constant shear rate. The development of shear deformation and force is recorded and the maximum recorded shear stress is determined as shear strength (in MPa) at the interface between layers. The thickness of the layer above the interlayer of interest shall be ≥ 20 mm. The core shall have a (remaining) thickness of at least 70 mm below the interface. For thinner layers than 20 mm, a grooved metal plate extension can be affixed to the specimen to minimize bulging in the top layer.

4.4 Tensile Adhesion Test (TAT)

The tensile adhesion test assesses the tensile bond strength between two road construction layers.

- The test method is applicable for thin surface layers;

- The tensile adhesion test can be applied to assess the capability of bond coats or tack coats as well as the internal cohesion of the two road construction layers.

The tensile adhesion test determines the adhesion between a surface layer and the bottom layer, perpendicular to the plane of the specimen. A test-plunger is glued on the incised and ground surface of the top layer and is pulled off with a suitable tension testing device at constant test temperature and strain rate. The maximum force related to the tension area is the adhesive tension strength in MPa.

5 Specimens

The test methods to assess the interlayer bonding are either conducted on site or on specimens cored from the pavement. The interlayer bonding conditions changes after laying with time, temperature and traffic loading. Therefore, the time span between laying and testing for site tests or coring of laboratory specimens shall be considered. The time span shall be reported in the test report.

The cores shall be stored fully supported. The support on which the cores rest shall be flat and clean. Cores shall not be stacked on top of each other. Cores shall be stored in a dry room at a temperature between 15 °C and 25 °C.

NOTE The relative humidity in the storage room typically would not exceed 80 %.