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Road and airfield surface characteristics - Part 3: Procedure for determining the skid resistance of a pavement surface using a device with longitudinal controlled slip (LFCA): The ADHERA

Verfahren zur Bestimmung der Griffigkeit von Fahrbahndecken durch Verwendung eines Geräts mit geregeltem Schlupf in Längsrichtung (LFCA): das ADHERA-Gerät

Caractéristiques de surface des routes et aéroports - Partie 3: Mode opératoire de détermination de l'adhérence d'un revêtement de chaussée à l'aide d'un dispositif à frottement longitudinal contrôlé (CFLA): l'ADHERA

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Road and airfield surface characteristics - Part 3: Procedure for determining the skid resistance of a pavement surface using a device with longitudinal controlled slip (LFCA): The ADHERA

Caractéristiques de surface des routes et aéroports - Partie 3 : Mode opératoire de détermination de l'adhérence d'un revêtement de chaussée à l'aide d'un dispositif à frottement longitudinal contrôlé (CFLA): l'ADHERA

Oberflächeneigenschaften von Straßen und Flugplätzen - Teil 3: Verfahren zur Bestimmung der Griffigkeit von Fahrbahndecken durch Verwendung eines Geräts mit geregeltem Schlupf in Längsrichtung (LFCA): das ADHERA-Gerät

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The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

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Foreword

This document (CEN/TS 15901-3:2009) has been prepared by Technical Committee CEN/TC 227 “Road materials”, the secretariat of which is held by DIN.

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.

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1 Scope

This Technical Specification describes a method for determining the skid resistance of pavements by measurement of the longitudinal friction coefficient LFCA.

The method provides a measure of the wet skid resistance properties of a bound surface by measurement of the longitudinal friction coefficient using a locked wheel trailer with a slip ratio of 100 % (locked wheel: standard), or a variable slip between 0 % to 100 % (for research measurements). Within this method the steady-state friction on a braked test wheel is measured.

The test tyre is dragged over a pre-wetted pavement under controlled load and constant speed conditions while the test tyre is parallel to the direction of motion and perpendicular to the pavement.

This technical specification covers the operation of the ADHERA device.

NOTE The research measurements are not yet measured by all the ADHERA but with only one called “ADHERA research”.

In addition to friction measurements, to determine the macrotexture of the pavement surface a laser system is used (mlpc device named RUGO). This system is placed just before the test wheel in order to measure the macrotexture (mean profile depth – MPD) on dry pavements and on the same path as the skid resistance measurement is done. The standard for this measurement and the device is described in EN ISO 13473-1.

The skid resistance of a pavement is determined by friction measurements and measurements of pavement texture. The skid resistance may be reported either as friction measurement or as a combination of friction and texture measurements.

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 ISO 13473-1, *Characterization of pavement texture by use of surface profiles – Part 1: Determination of Mean Profile Depth (ISO 13473-1:1997)*

ISO 13473-2, *Characterization of pavement texture by use of surface profiles – Part 2: Terminology and basic requirements related to pavement texture profile analysis*

3 Recommended uses

The ADHERA is used in the following fields of application:

— monitoring of networks (Pavement Management);

— approval of new surfacing;

— investigation of surface skid resistance;

— measurements on project-level compliance;

— comparative measurements among different devices;

— research measurements.

4 Terms and definitions

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

4.1
contact area
overall area of the road surface instantaneously in contact with a tyre

NOTE This term describes the overall area generally covered by the tyre. Due to the effects of surface texture or any tyre tread pattern, not all of the tyre or road surface in the contact area can be in contact at any instant.

4.2
friction
resistance to relative motion between two bodies in contact, the frictional force being the force which acts tangentially in the contact area

4.3
vertical force
load
force applied by the wheel assembly on the contact area

NOTE Some devices use an assumed load based on the static load.

4.4
horizontal force
drag
horizontal force acting tangentially on the test wheel in line with the direction of travel

4.5
slip ratio
slip speed divided by the operating speed

4.6
longitudinal friction coefficient
LFC
ratio between horizontal force (drag) and vertical load (load) for a braked wheel in controlled conditions, which is normally a decimal number quoted to two significant figures

NOTE LFC varies depending on the slip ratio of the device and the operational speed.

4.7
skid resistance
characterisation of the friction of a road surface when measured in accordance with a standardised method

4.8
wet road skid resistance
property of a trafficked surface that limits relative movement between the surface and the part of a vehicle tyre in contact with the surface, when lubricated with a film of water

NOTE Factors that contribute to skid resistance include the tyre pressure, contact area, tread pattern, and rubber composition; the alignment, texture, surface contamination, and characteristics of the road surface; the vehicle speed; and the weather conditions.

The skid resistance of a road surface in Europe varies seasonally. Generally, wet skid resistance is higher in winter as a result of the effects of wet detritus and the effects of frost and wear by tyres on microtexture and macrotexture. Wet skid resistance is lower in summer as a result of dry polishing by tyres in the presence of fine detritus.

The change in skid resistance of a surface in service is affected by the volume of traffic and the composition of the traffic, i.e. cars, buses, commercial vehicles of different sizes, as the tyres of these vehicles polish and/or wear away the

surfacing material in different ways. The geometry of the road will affect the change in skid resistance. Generally, tyres polish less on straight roads than on bends.

Where the surface contains aggregate with a coating of binder, e.g. bitumen, resin or Portland cement, the skid resistance will change as the coating is worn away by tyres.

4.9
fixed slip
condition in which a braking system forces the test wheel to roll at a fixed reduction of its operating speed

4.10
fixed slip friction
friction between a test tyre and a road surface when the wheel is controlled to move at a fixed proportion of its natural speed

4.11
Longitudinal friction coefficient ADHERA
LFCA
ratio between the horizontal force in the direction of the motion that can be activated between the test wheel and the wet pavement and the vertical wheel load accomplished under controlled slipping conditions

NOTE The controlled slipping condition is achieved by a full brake for locked wheel measurements for the ADHERA or a progressive brake for the ADHERA research. If the vehicle is in motion, the test wheel slides or slips in the forward direction.

4.12
sampling length
sampling interval
distance over which responses of the sensors are sampled to determine a single measurement of the recorded variables

NOTE 1 The sampling length depends upon the detailed operation of device and its recording system; a number of samples may be combined to determine a measurement for a subsection.

NOTE 2 This should not be confused with horizontal resolution which is the shortest distance over which a change in the measured parameter can be detected.

4.13
microtexture
deviation of a pavement from a true planar pavement with characteristic dimensions along the pavement of less than 0,5 mm, corresponding to texture wavelengths with one-third-octave bands and up to 0,5 mm centre wavelengths

NOTE 1 Peak to peak amplitudes normally vary in the range 0,001 mm to 0,5 mm.

NOTE 2 Microtexture is a primary component in skid resistance at low speeds. Those devices that utilize a relatively low slip speed primarily measure the component of friction affected by microtexture.

4.14
macrotexture
deviation of a pavement from a true planar pavement with characteristic dimensions along the pavement of 0,5 mm to 50 mm, corresponding to texture wavelengths with one-third-octave bands including the range 0,63 mm to 50 mm centre wavelengths

NOTE 1 Peak to peak amplitudes normally vary in the range 0,1 mm to 20 mm.

NOTE 2 Macrotexture is a major factor influencing skid resistance at high speeds but it also has an effect at low speeds.

4.15
mean profile depth
descriptor of macrotexture, obtained from a texture profile measurement as defined in EN ISO 13473-1 and ISO 13473-2

4.16
calibration
periodic adjustment of the offset, the gain and the linearity of the output of a measurement method so that all the calibrated devices of a particular type deliver the same value within a known and accepted range of uncertainty, when measuring under identical conditions within given boundaries or parameters

NOTE The calibration method for ADHERA is given in Clause 10.

4.17
repeatability
r
maximum difference expected between two measurements made by the same machine, with the same tyre, operated by the same crew on the same section of road in a short space of time, with a probability of 95 %

4.18
reproducibility
R
maximum difference expected between two measurements made by different machines with different tyres using different crews on the same section of road in a short space of time, with a probability of 95 %

4.19
ADHERA
acronym applying to a device, developed by the "CECP de Rouen" in France in cooperation with the "LRPC de Lyon", to perform routine, continuous measurements (one value each 20 m) of friction for long road-sections or punctual measurements at different speeds to characterise a particular section, and which is manufactured under license and can be ordered to the French VECTRA company

NOTE A device conforming to the general characteristics of the ADHERA and the specific provisions of this Technical Specification should be used for the tests.

4.20
operating speed
speed at which the device traverses the test surface, with the ADHERA normally working to test speeds between 40 km/h and 120 km/h

4.21
slip speed
relative speed between the tyre and the travelled surface in the contact area

4.22
wheelpath
parts of the pavement surface where the majority of vehicle wheel passes are concentrated

NOTE The wheelpath is not a fixed location on a pavement surface. On a worn pavement, the wheelpath is usually easily identified visually. On a newly laid surface, the position of the wheelpath needs to be estimated by experienced operators.

For special circumstances such as acceptance tests, a particular path may be defined, for example (700 ± 150) mm from the edge of the running lane of a road.

4.23
nearside wheelpath
wheelpath that is closest to the edge of the road in the normal direction of travel and which, for countries that normally drive on the right, is the right-hand side, and, for countries that normally drive on the left, the left-hand side