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Značilnosti cestnih in vzletnih površin - 1. del: Postopek določanja torne sposobnosti vozne površine z opremo za vzdolžne meritve s kontroliranim zdrsnim zaostankom kolesa (LFCS): RoadSTAR

Road and airfield surface characteristics - Part 1: Procedure for determining the skid resistance of a pavement surface using a device with longitudinal fixed slip ratio (LFCS): RoadSTAR

Verfahren zur Bestimmung der Griffigkeit von Fahrbahndecken durch Verwendung eines Geräts mit festgelegtem Schlupf in Längsrichtung (LFCS): das RoadSTAR-Gerät

Caractéristiques de surface des routes et aéroports - Partie 1: Mode opératoire de détermination de l'adhérence d'un revêtement de chaussée à l'aide d'un dispositif à coefficient de frottement longitudinal fixe (CFLS): le RoadSTAR

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Oberflächeneigenschaften von Straßen und Flugplätzen - Teil 1: Verfahren zur Bestimmung der Griffigkeit von Fahrbahndecken durch Verwendung eines Geräts mit festgelegtem Schlupf in Längsrichtung (LFCS): das RoadSTAR-Gerät

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Foreword

This document (CEN/TS 15901-1:2009) has been prepared by Technical Committee CEN/TC 227 “Road materials”, the secretariat of which is held by DIN.

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1 Scope

This Technical Specification describes a method for determining the skid resistance of a paved surface by measurement of the longitudinal friction coefficient LFCS. This Technical Specification covers the operation of the Road Surface Tester of arsenal research (RoadSTAR).

The method "RoadSTAR" provides a measure of the skid resistance properties of a bound surface by measurement of the longitudinal friction coefficient using a continuous reading car-sized braked wheel fixed-slip device.

The method "RoadSTAR" provides skid resistance measurements of pavements by using the modified Stuttgart skiddometer (Stuttgarter Reibungsmesser). RoadSTAR utilizes a measurement representing the steady-state friction on a braked test wheel at a slip ratio of 82 % (for standard conditions), 37,5 %, 50 %, 75 % (for comparison measurements), with locked wheel or under ABS-braking conditions (for research measurements). The test wheel is dragged over a pre wetted pavement surface under controlled load and speed conditions while the test tyre is parallel to the direction of motion and perpendicular to the pavement.

NOTE Three different slip ratios are retained in order to use the same slip speed for the three different nominal testing speeds of 40 km/h, 60 km/h and 80 km/h for comparison measurements. The common slip speed is chosen equal to 30 km/h:

- for a testing speed of 40 km/h a slip ratio of 75 % should be applied;
- for a testing speed of 60 km/h a slip ratio of 50 % should be applied;
- for a testing speed of 80 km/h a slip ratio of 37,5 % should be applied.

A machine conforming to the general characteristics of the RoadSTAR and the specific provisions of this Technical Specification should be used for the tests.

In addition to friction measurements, to estimate the macro texture of the pavement surface, a laser system is used. This system is placed in front of the test wheel in order to be able to measure macrotexture (mean profile depth – MDP) on the dry surface and on the same path as the skid resistance measurements. The standard for this measurement and the device is described in EN ISO 13473-1 and ISO 13473-2.

2 Recommended uses

RoadSTAR may be used in the following fields of application:

- determining the skid resistance of surfaces in service;
- approval of new surfacing;
- type approval purposes;
- investigation of surface skid resistance;
- measurements on project-level compliance;
- comparative measurements among different devices;
- research measurements.

3 Terms and definitions

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

3.1
skid resistance
characterisation of the friction of a road surface when measured in accordance with a standardised method

3.2
friction
resistance to relative motion between two bodies in contact, the frictional force being the force which acts tangentially in the contact area

3.3
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.

3.4
bound surface
top layer or surface course of a road with the aggregates secured permanently in place

NOTE Aggregates are commonly secured in place by bitumen or Portland cement.

3.5
vertical force
load
force applied by the wheel assembly (the static and dynamic force on the test tyre, the test tyre weight and the rim weight) on the contact area

NOTE Some devices (not RoadSTAR) use an assumed load based on the static load.

3.6
horizontal force
drag
horizontal force acting tangentially on the test wheel in line with the direction of travel

3.7
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

3.8
fixed slip
condition in which a braking system forces the test wheel to roll at a fixed reduction of its operating speed

3.9
operating speed
speed at which the device traverses the test surface

3.10
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.

3.11
slip speed
relative speed between the test tyre and the travelled surface in the contact area

3.12
slip ratio
slip speed divided by the operating speed

NOTE For devices meeting the requirements of this Technical Specification the slip ratio is fixed by the geared braking system of the test wheel. The gear box is connected with the rear axle of the vehicle. If the test vehicle is in motion, the test wheel slides or slips in the forward direction.

3.13
longitudinal friction coefficient
LFC
ratio between horizontal force (drag) and vertical force (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.

3.14
longitudinal friction coefficient RoadSTAR
LFCS
LFC measured by a device meeting the requirements of this Technical Specification and which is the mean of a number of instantaneous friction readings over a defined length

3.15
RoadSTAR
device developed by “Forschungsinstitut für Kraftfahrwesen und Fahrzeugmotoren Stuttgart (FKFS)” in cooperation with “Österreichischen Forschungs- und Prüfzentrum Arsenal GmbH (arsenal research)” to arrange routine measurements of skid resistance continuously on long sections and which is not manufactured under license

3.16
sampling length or 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.

3.17
subsection
defined length of surface for which one set of the measured variables is reported by the device

NOTE Different devices may use different subsections depending on the context of the measurements, such as 5 m, 10 m or 20 m.

3.18
test section
length of road between defined points (e.g. location references, specific features, or measured distances) comprising a number of subsections over which a continuous sequence of measurements is made

3.19
water delivery system
system for depositing a given amount of water in front of the test tyre so that it then passes between the tyre and the surface being measured

3.20
water flow rate
rate at which water is deposited on the surface to be measured in front of the test tyre

NOTE Water flow rate is expressed in litres per second (l/s).

3.21
theoretical water film thickness
theoretical thickness of a water film deposited on the surface in front of the measuring tyre, assuming the surface has zero texture depth

3.22
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.

3.23
nearside wheelpath
wheelpath that is closest to the edge of the road in the normal direction of travel, which is, for countries that normally drive on the right, the right-hand side, and for countries that normally drive on the left, the left-hand side

3.24
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 machines meeting this Technical Specification is given in Clause 10.

3.25
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 %

3.26
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 %