SLOVENSKI STANDARD
oSIST prEN 13036-8:2024

01-julij-2024

Značilnosti cestnih in letaliških površin - Preskusne metode - 8. del: Določanje indeksov prečne neravnosti in prečnega nagiba

Road and airfield surface characteristics - Test methods - Part 8: Determination of transverse unevenness and crossfall indices

Oberflächeneigenschaften von Straßen und Flugplätzen - Prüfverfahren - Teil 8: Bestimmung von Querunebenheit und Querneigung

Caractéristiques de surface des routes et aérodromes - Méthodes d'essais - Partie 8 : Détermination des indices d'uni transversal et de dévers

Ta slovenski standard je istoveten z: **prEN 13036-8**

ICS:

17.040.20	Lastnosti površin	Properties of surfaces
93.080.10	Gradnja cest	Road construction
93.120	Gradnja letališč	Construction of airports

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT prEN 13036-8

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ICS 93.080.10; 93.120

Will supersede EN 13036-8:2008

English Version

Road and airfield surface characteristics - Test methods - Part 8: Determination of transverse unevenness and crossfall indices

Oberflächeneigenschaften von Straßen und Flugplätzen - Prüfverfahren - Teil 8: Bestimmung der Breitenunebenheit und der Querneigung

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

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European foreword

This document (prEN 13036-8:2024) has been prepared by Technical Committee CEN/TC 227 “Road materials”, the secretariat of which is held by BSI- British Standards Institution.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13036-8:2008.

prEN 13036-8:2024 includes the following significant technical changes with respect to EN 13036-8:2008:

— routines for pre-processing the transverse profile before calculating the indices;

— the standard includes procedures to calculate transversal unevenness for profilometers with a densely collected transverse profile;

— the standard contains more possibilities to characterize the transversal unevenness and crossfall. The calculation routines for all indices have been updated and better described:

  — two additional principles to describe the rut depth are added, sliding wire rut depth and total transverse unevenness;

  — one additional principle to describe crossfall is added, crossfall line;

  — the definition of Edge slump is updated;

  — distance between rut buttons is added;

  — rut width is added;

  — rut area is added;

  — water area is added;

— step height has been removed;

— a link to an implementation guide to calculate the indices has been added.

EN 13036 consists of the following parts, under the general title Road and airfield surface characteristics — Test methods:

— Part 1: Road and airfield surface characteristics — Test methods — Part 1: Measurement of pavement surface macrotexture depth using a volumetric patch technique

— Part 2: Road and airfield surface characteristics — Test methods — Part 2: Assessment of the skid resistance of a road pavement surface by the use of dynamic measuring systems

— Part 3: Road and airfield surface characteristics — Test methods — Part 3: Measurement of pavement surface horizontal drainability

— Part 4: Road and airfield surface characteristics — Test methods — Part 4: Method for measurement of slip/skid resistance of a surface: the pendulum test

— Part 5: Road and airfield surface characteristics — Test methods — Part 5: Determination of longitudinal unevenness indices

— Part 6: Road and airfield surface characteristics — Test methods — Part 6: Measurement of transverse and longitudinal profiles in the evenness and megatexture wavelength ranges

— Part 7: Road and airfield surface characteristics — Test methods — Part 7: Irregularity measurement of pavement courses: the straightedge test

— Part 8: Road and airfield surface characteristics — Test methods — Part 8: Determination of transverse unevenness and crossfall indices

Introduction

Road surface unevenness and crossfall affects safety, ride comfort, environmental impact, and the technical performance of roads. When a road is in use the surface will be deformed and worn due to the traffic load. Contributing causes of surface degradation are the time in use, the traffic load, weather/climate conditions, geological conditions, used materials as well as the strength of the road construction. To simplify quantifying the degree of deformation and wear, indicators have been developed that are based on the transverse (perpendicular to the direction of traffic flow) and longitudinal (parallel to the direction of traffic flow) profiles. Rut depth is such an indicator of the technical performance of the surface that arises from permanent deformation from traffic loads and wear from the tyre and pavement interaction. A road with a moderate level of rut depth in combination with a sufficient crossfall will lower or even eliminate the risk of aquaplaning in wet conditions and as far as rut depth is concerned, a low or moderate level will ensure sufficient lateral stability of vehicles with trailers (especially by a lane change). More than two wheel paths can occur due to wear from heavy traffic and cars since the transverse location of the wheels differs. This is most prominent in countries where studded tyres are used. Transverse road profile evenness is consequently a key information for acceptance of newly laid pavements and for road maintenance management and planning systems. The transverse unevenness encompasses aspects, such as: irregularities in the transverse profile including the longitudinal ruts and deformations in the wheel paths caused by the traffic. Measurement devices measuring the transverse profiles can be divided into two groups:

— slow or stationary equipment, such as the straightedge for irregularities and longitudinal ruts;

— equipment used at traffic speed, such as profilometers, which depending on the characteristics of the device, are suitable for measuring single sections as well as longer road sections and networks.

1 Scope

This document specifies the mathematical processing of digitized transverse profile measurements to produce indices in the transverse direction for unevenness, other defects and crossfall. The document describes the calculation methods of the indices such as irregularities (1) rut depth, (2) ridge height, (3) water depth and area, crossfall and how to evaluate and report the indices. It also describes possibilities to do further analysis to examine defects and problems on the road that can be seen in the transverse profile. The latter is described in Annex E, Other transverse indices (edge deformation/edge slump, crossfall line, rut area and width and the distance between the rut bottoms).

The quantified evenness indices derived from this document are useful support for quality control of newly laid pavement surfaces, especially with respect to the evidence of irregularities due to improper laying and/or compacting actions. It is also useful for evaluating the condition of pavements in service as part of routine condition monitoring programs, and finally as indices to be used for maintenance planning of resurfacing activities on pavements in use. The derived indices are portable in the sense that they can be obtained from transverse profiles measured with any suitable instrument.

All indices described in this document are related to the actual lane and direction of the road at which the measurement is done.

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 13036-6, *Road and airfield surface characteristics — Test methods — Part 6: Measurement of transverse and longitudinal profiles in the evenness and megatexture wavelength ranges*

EN 13036-7, *Road and airfield surface characteristics — Test methods — Part 7: Irregularity measurement of pavement courses: the straightedge test*

ISO 3534-1, *Statistics — Vocabulary and symbols — Part 1: General statistical terms and terms used in probability*

3 Terms and definitions

The described indices in this document are in some cases calculated for the left and right side of the measured lane. This implies for left-hand traffic that the left side of the profile is close to the road shoulder and the right side is close to the centre of the road. For right-hand traffic it is the opposite. The transverse profile describes the shape of the measured lane from left to right transversally in the driving direction.

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp/

— IEC Electropedia: available at https://www.electropedia.org/

3.1
acquisition repetition interval
distance corresponding to the longitudinal interval between two consecutive reported measured results

Note 1 to entry: Low level, typical 0,1 m to 1 m, see Figure 1 for further information.

3.2
bias
differences between the expectation of the test results and an accepted reference value admitted term

Note 1 to entry: Bias is the total systematic error as contrasted to random error. There can be one or more systematic error components to the bias. A large systematic difference from the accepted reference value is reflected by a large bias value (see ISO 3534-1).

3.3
crossfall
transverse slope across a lane, measured perpendicular to the centre line and expressed as a percentage (the ratio of the height difference of the transverse profile and the profile length) with a positive value when the right end of the transverse profile is lower than its left end (for right-hand traffic and the opposite for left-hand traffic)

Note 1 to entry: An alternative procedure to calculate crossfall is described in the informative Annex E.

3.4
distance between rut bottoms
distance between the rut bottom in the right and left side of the lane, expressed in mm

3.5
edge slump
degree of deformation of the part of the measured lane closest to the road shoulder, expressed in mm

3.6
inner part of the transverse profile
inner part of the transverse profile, closest to the road centre (the right side of the transverse profile for left-hand traffic and the opposite for right-hand traffic)

3.7
outer part of the transverse profile
outer part of the transverse profile closest to the road shoulder (the left side of the transverse profile for left-hand traffic and the opposite for right-hand traffic)

3.8
pavement
structure, composed of one or more courses, to assist the passage of traffic over terrain

3.9
surface course or wearing course
upper course of the pavement, which is in contact with the traffic

3.10
precision
closeness of agreement between independent test results obtained under stipulated conditions

Note 1 to entry: Precision depends only on the distribution of random errors. The measure of precision is usually computed as a standard deviation of the test results. Less precision is reflected by a larger standard deviation (see ISO 3534-1).

3.11
profilometer
measurement device that operates at normal traffic speed, used to measure different properties of the road surface, e.g., longitudinal and transverse profiles, texture and road geometry

3.12
repeatability
variation in measurements made by the same machine, under the same condition, operated by the same crew on the same section of road in a short period of time

3.13
reporting repetition interval
distance between two consecutive reported measurement results of transverse profiles (higher level, typical 10 to 100 meter, see Figure 1 for further information)

3.14
ridge height
transversal evenness index, especially designed for minor roads where ruts more seldomly appear, expressed in mm

3.15
rut area
rut area for left and right part of the transverse profile, calculated as the sum of areas for the left and right side of the profile, expressed in mm^2

3.16
rut depth
transverse evenness calculated as the maximum deviation between the transverse profile of a pavement surface and a virtual straight reference line, expressed in mm

3.17
rut width
width of the left and right rut, calculated from the left and right side of the transverse profile, expressed in mm

3.18
sampling interval
travelled distance between two consecutive measured transverse profiles (raw data for calculating acquisition repetition interval, see Figure 1 for further information)

3.19
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

3.20
straightedge
mechanical device used to measure individual irregularities of the road surface statically

3.21
surface wire method
method to calculate rut depth where a wire is stretched between two endpoints and rests on any high points in between used to define rut depth as the maximum perpendicular distance between the wire and the transverse profile

3.22
theoretical sum of water area
indicator of the sum of area(s) created between a horizontal reference line and the measured profile, calculated separately for the left and right part of the transverse profile, expressed in mm^2

Note 1 to entry: Typical water area level is between 0 and 10 000 mm^2, corresponding to 0 to 1 dm^2.

3.23
theoretical water depth
indicator of the maximum distance between a horizontal reference line and the measured profile, calculated separately for the left and right part of the transverse profile, expressed in mm

Note 1 to entry: Theoretical water depth and area are indicators of the risk for aquaplaning. The theoretical water depth in a depression or dip is also called “ponding depth”.

3.24
transverse acquisition sampling interval
transversal distance between two consecutive measured data points, at the surface, in a discrete transverse profile

Note 1 to entry: If the transverse acquisition sampling interval is not equal along the profile, the mean value is calculated.

3.25
transverse profile
geometrical shape of the road surface in the transverse direction, described by the height of the measurement points, expressed in mm

3.26
trueness
closeness of agreement between the average value obtained from large series of test results and an accepted reference value

Note 1 to entry: The measure of trueness is usually expressed in terms of bias and reflects the total systematic error as contrasted to random error. There may be one or more systematic error components to the trueness. A large systematic difference from the accepted reference value is reflected by a large value (see ISO 3534-1).

3.27
wheel paths
contact area of the pavement surface and wheels, corresponding to where most vehicle wheel passages are concentrated

4 Symbols and abbreviated terms

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

CF_L is the crossfall line