SLOVENSKI STANDARD
SIST EN ISO 13473-1:2004

01-september-2004

Karakterizacija teksture vozišča z uporabo profilov površine - 1. del: Ugotavljanje povprečne globine profila (ISO 13473-1:1997)

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

Charakterisierung der Textur von Fahrbahnbelägen unter Verwendung von Oberflächenprofilen - Teil 1: Bestimmung der mittleren Profiltiefe (ISO 13473-1:1997)

Caractérisation de la texture d'un revetement de chaussée a partir de relevés de profil - Partie 1: Détermination de la profondeur moyenne de la texture (ISO 13473-1:1997)

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ICS:

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93.080.20	Materiali za gradnjo cest	Road construction materials

SIST EN ISO 13473-1:2004 **en**

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This European Standard was approved by CEN on 16 January 2004.

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

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

Foreword

The text of ISO 13473-1:1997 has been prepared by Technical Committee ISO/TC 43 "Acoustics" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 13473-1:2004 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of an identical text or by endorsement, at the latest by October 2004, and conflicting national standards shall be withdrawn at the latest by October 2004.

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.

Endorsement notice

The text of ISO 13473-1:1997 has been approved by CEN as EN ISO 13473-1:2004 without any modifications.

INTERNATIONAL STANDARD

ISO 13473-1

First edition
1997-09-01

Characterization of pavement texture by use of surface profiles —

Part 1:
Determination of Mean Profile Depth

Caractérisation de la texture d'un revêtement de chaussée à partir de relevés de profil —

Partie 1: Détermination de la profondeur moyenne de la texture

Reference number
ISO 13473-1:1997(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 13473-1 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

ISO 13473 consists of the following parts, under the general title *Characterization of pavement texture by use of surface profiles*:

— *Part 1: Determination of Mean Profile Depth*

— *Part 2: Terminology related to pavement texture profile analysis*

— *Part 3: Specifications and classification of profilometers*

Annexes A to F of this part of ISO 13473 are for information only.

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Introduction

Road surface texture determines factors such as noise emission from the tyre/pavement interface, friction between the tyre and road, rolling resistance and tyre wear. Valid methods for measuring surface texture are therefore highly desirable.

The so-called 'sand patch' method, or the more general 'volumetric patch' method (see clause 3, Definitions) has been used worldwide for many years to give a single and very simple measurement describing surface texture. It relies on a given volume of sand or glass spheres which is spread out on a surface. The material is distributed to form a circular patch, the diameter of which is measured. By dividing the volume of material spread out by the area covered, a value is obtained which represents the average depth of the sand or glass sphere layer, i.e. a 'mean texture depth'. The method has been standardized in ISO 10844 in order to put limits as to surface texture for a reference surface used for vehicle noise testing.

The volumetric patch method is very crude; it is operator-dependent and can be used only on surfaces which are partly or fully closed to traffic. Therefore, it is not practical for use in network surveys of roads, for example. Along with developments in contactless surface profiling techniques, it has become possible to replace the volumetric patch measurements with those derived from profile recordings. However, several very different techniques have been used to calculate 'predicted mean texture depths', many of them quite successfully. The values they give are not always comparable, although individually they generally offer good correlation coefficients with texture depth measured with the volumetric patch method.

It is therefore important to have a standardized method for measuring the texture depth by a more modern, safe and economical technique than the traditional volumetric patch method, resulting in values which are directly compatible both with the patch-measured values and between different equipment.

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Characterization of pavement texture by use of surface profiles —

Part 1:
Determination of Mean Profile Depth

1 Scope

This part of ISO 13473 describes a test method to determine the average depth of pavement surface macrotexture (see clause 3, Definitions) by measuring the profile curve of a surface and calculating the texture depth from this profile. The technique is designed to provide an average depth value of only the pavement macrotexture and is considered insensitive to pavement microtexture and unevenness characteristics.

The objective of this part of ISO 13473 is to make available an internationally accepted procedure for determination of pavement surface texture depth which is an alternative to the traditionally used volumetric patch technique (generally using sand or glass spheres), giving comparable texture values.

This ISO 13473 series has been prepared as a result of a need identified when specifying a test surface for vehicle noise measurement (ISO 10844). Macrotexture depth measurements according to this International Standard are not generally adequate for specifying test conditions of vehicle or traffic noise measurements, but have limited applications as a *supplement* in conjunction with other ways of specifying a surfacing.

This test method is suitable for determining the Mean Profile Depth of a pavement surface. This Mean Profile Depth can be transformed to a quantity which estimates the macrotexture depth according to the volumetric patch method. It is applicable to field tests as well as laboratory tests on pavement samples. When used in conjunction with other physical tests, the macrotexture depth values derived from this test method are applicable to estimation of pavement skid resistance characteristics (see e.g. reference [1]), estimation of noise chacteristics (see e.g. ISO 10844), and assessment of the suitability of paving materials or pavement finishing techniques.

The method, together with other measurements (where applicable) such as porosity or microtexture can be used to assess the quality of pavements.

Pavement aggregate particle shape, size, and distribution are surface texture features not addressed in this procedure. The method is not meant to provide a complete assessment of pavement surface texture characteristics. In particular, care should be exercised in interpreting the result if the method is applied to porous surfaces or to grooved surfaces (see annex B).

NOTE 1 - Other International Standards dealing with surface profiling methods include for example ISO 468, ISO 1878, ISO 1879, ISO 1880, ISO 3274, ISO 4287 and ISO 4288 (see annex F). Although it is not clearly stated in these, they are mainly used for measuring surface finish (microtexture) of metal surfaces and do not apply to pavements. This part of ISO 13473 is adapted for pavement texture measurement and is not intended for other applications.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 13473. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 13473 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 10844:1994, *Acoustics — Specification of test tracks for the purpose of measuring noise emitted by road vehicles*

3 Definitions

For the purposes of this part of ISO 13473, the following definitions apply.

3.1 pavement texture: The deviation of a pavement surface from a true planar surface, within the wavelength ranges defined in 3.4.

3.2 profile: A two-dimensional representation of a surface. The profile of a surface is generated if a sensor, like a tip of a needle or a laser spot, continuously touches or shines on the pavement surface while it is moved along the surface. See figure A.1 in annex A.

The profile of a surface is described by two coordinates: one along the surface plane, called *distance*, and the other in a direction normal to the surface plane, called *amplitude*. See figure A.1. The distance may be in a longitudinal or lateral (transverse) direction in relation to the travel direction on a pavement, or any direction between these. In a Fourier analysis, the profile curve can be mathematically described by a series of Fourier coefficients combined with sinusoidal curves with certain frequencies and wavelengths.

3.3 texture wavelength: The (minimum) distance between periodically repeated parts of the curve. For normal surface profiles, a profile analysed by its Fourier components contains a continuous distribution of wavelengths.

In this part of ISO 13473, the term *texture wavelength* (unit: m or mm) is used to describe the wavelengths of a profile taken from a pavement (see figure A.1 in annex A).

NOTE 2 - The term wavelength has historically been used mostly in acoustics (with regard to sound waves) or in electrotechnics (with regard to electrical signals or electro-magnetic waves). Since people may not be accustomed to using the term wavelength in pavement applications, and also since electrical signals often are used in the analyses of road surface profiles, the term 'texture wavelength' is introduced here. The inverse of texture wavelength is called 'spatial frequency' (unit: m^{-1} or cycles/m), which is when multiplied by the factor 2π, called 'texture angular wavenumber' (unit: rad/m).

3.4 Ranges of texture

3.4.1 macrotexture: The deviation of a pavement surface from a true planar surface with the characteristic dimensions along the surface of 0,5 mm to 50 mm (corresponding to texture wavelengths with third-octave bands including the range 0,5 mm to 50 mm of centre wavelengths).

See figure A.2 in annex A for an illustration of the different texture ranges.

NOTE 3 - Peak-to-peak amplitudes may normally vary in the range 0,1 mm to 20 mm. This type of texture is the texture which has wavelengths in the same order of size as tyre tread elements in the tyre/road interface. Surfaces are normally designed with a certain macrotexture in order to obtain a suitable water drainage in the tyre/road interface. The macrotexture is obtained by suitable proportioning of the aggregate and mortar of the surface or by certain surface finishing techniques.

3.4.2 microtexture: The deviation of a pavement surface from a true planar surface with the characteristic dimensions along the surface of less than 0,5 mm (corresponding to texture wavelengths with third-octave bands with up to 0,4 mm of centre wavelengths).

NOTE 4 - Peak-to-peak amplitudes normally vary in the range 0,001 mm to 0,5 mm. This type of texture is the texture which makes the surface feel more or less harsh but which is usually too small to be observed by the eye. It is obtained by the surface properties (sharpness and harshness) of the individual chippings or other particles of the surfacing which come in direct contact with the tyres.

3.4.3 megatexture: The deviation of a pavement surface from a true planar surface with the characteristic dimensions along the surface of 50 mm to 500 mm (corresponding to texture wavelengths with third-octave bands including the range 63 mm to 500 mm of centre wavelengths).

NOTE 5 - Peak-to-peak amplitudes normally vary in the range 0,1 mm to 50 mm. This type of texture is the texture which has wavelengths in the same order of size as a tyre/road interface and is often created by potholes or 'waviness'. It is usually an unwanted characteristic resulting from defects in the surface. Pavement characteristics at longer wavelengths than 0,5 m are considered to be above that of texture and are referred to as unevenness.

3.4.4 unevenness: The deviation of a pavement surface from a true planar surface with the characteristic dimensions along the surface of 0,5 m to 50 m (corresponding to wavelengths with one-third-octave bands including the range 0,63 m to 50 m of centre wavelengths).

NOTE 6 - Unevenness is a type of surface roughness which, through vibrations, affects ride comfort in and road holding of vehicles.

3.5 Texture depth measurements

3.5.1 Texture Depth, TD: In the three-dimensional case, the distance between the surface and a plane through the top of the three highest particles within a surface area in the same order of a size as that of a tyre/pavement interface. See figure A.3 in annex A.

3.5.2 Mean Texture Depth, MTD: The texture depth obtained in the case of the volumetric patch method.

NOTE 7 - In the application of the 'volumetric patch method' (see below) the 'plane' is in practice determined by the contact between a rubber pad and the surface when the pad is rubbed over the area. Therefore, the texture depth obtained in this case is not based on exactly a 'plane', but rather an approximation which is a somewhat curved and hard-to-define surface.

3.5.3 Profile Depth, PD: In the two-dimensional case, i.e. when studying a profile, the difference, within a certain longitudinal/lateral distance in the same order of length as that of a tyre/pavement interface, between the profile and a horizontal line through the top of the highest particle within this profile. See figure A.4 in annex A.

3.5.4 Mean Profile Depth, MPD: The average value of the profile depth over a certain distance (baseline). See figure A.4 in annex A.

3.5.5 Estimated Texture Depth, ETD: Term used when the Mean Profile Depth (MPD) is used to estimate the Mean Texture Depth (MTD) by means of a transformation equation.

3.6 texture spectrum: Spectrum obtained when a profile curve has been analysed by either mathematical Fourier techniques or corresponding filtering processes in order to determine the amplitude of its spectral components (wavelengths or spatial frequencies).

3.7 volumetric patch method: Method relying on the spreading of a material, usually sand or glass spheres, in a patch. The material is distributed with a rubber pad to form an approximately circular patch, the average diameter of which is measured. By dividing the volume of material by the area covered, a value is obtained which represents the average depth of the layer, i.e. a 'mean texture depth'.

The volumetric patch method is described in annex A of ISO 10844:1994. This method is based on the use of glass spheres.

NOTE 8 - The volumetric patch method is used not only with sand or glass spheres as the patch material, but in some cases with putty or grease. However, such materials have certain disadvantages, and for international standardization only glass spheres have been recommended. The ETD measure is based on glass spheres as the patch material.

3.8 profilometer method: Method in which the profile of a pavement surface is obtained for subsequent analysis. The data are used for calculation of certain mathematically defined measures. In some cases, the profile is recorded for subsequent analysis, in other cases it may be used only in real-time calculations.

4 Test surfaces

4.1 Condition of the surface

Measurements shall not be made during rain or snow fall. Unless it has been proven that the equipment works properly also on wet or damp surfaces, the surface shall be dry during the measurements. It shall also be clean and free of any foreign objects.