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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 profils de la surface —

Partie 1: Détermination de la profondeur moyenne du profil

Reference number
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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This second edition cancels and replaces the first edition (ISO 13473-1:1997), which has been technically revised. The main changes compared to the previous edition are as follows:

— Some alternative calculation options such as the slope suppression for continuous data have been removed.

— A more precise definition of high-pass and low-pass filtering has been provided.

— Removal of spikes has been introduced in the profile.

— The MPD now refers only to the overall value obtained after averaging all *MSD*s where *MSD* means Mean Segment Depth (earlier, MPD was used as the term both for the mean segment depth and for mean profile depth, which might have been confusing).

A list of all parts in the ISO 13473 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This corrected version of ISO 13473-1:2019 incorporates the following corrections:

— The segment length was corrected to 100 mm throughout the document;

— in 7.3, at the end of the fourth paragraph, the following sentence was added: "If there are more invalid samples than 5 mm in the beginning or the end of a sampled profile the effected MSD value(s) should be discarded." and in the last paragraph, "Profiles" was replaced by "Segments" and "readings" replaced by "samples";

— in 7.6, the third paragraph was replaced by the following one: "If there are no data available before and after the section to be computed, one should extend the signal by mirroring the first and the last segments before filtering.";

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— in 7.10, the first list element was rephrased;

— in Clause 10, the following text was deleted: "whether or not spike removal procedure was applied;", "type and order of filters used;" and "and type of interpolation used";

— in D.3.7, replace "7.10" by "7.9";

— in E.1, fifth paragraph, a third sentence was added as follows: "The spikes are first identified in forward and reverse direction before replacing them with the interpolated value.".

— Figure E.3 was corrected.

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Introduction

Road surface texture determines factors such as noise emission from the tyre/pavement interface, acoustic comfort inside vehicles, friction between the tyre and road, rolling resistance and tyre wear. The main concept and the basic terms are illustrated for information in Annex A. 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), 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 beads 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 bead layer, known as "mean texture depth" (MTD). The method was originally standardized in ISO 10844:1994[1)], Annex A[5] in order to put limits concerning surface texture for a reference surface used for vehicle noise testing but was later adopted by CEN as EN 13036-1[13].

The volumetric patch method 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, which are possible to make by mobile equipment in flowing traffic. However, several very different techniques have been used to calculate a "predicted mean texture depth", 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 and evaluating 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.

1) Withdrawn and replaced by ISO 10844:2014.

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Characterization of pavement texture by use of surface profiles —

Part 1: Determination of mean profile depth

1 Scope

This document describes a test method to determine the average depth of pavement surface macrotexture (see Clause 3) by measuring the profile 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 document 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 beads), giving comparable texture depth values. To this end, this document describes filtering procedures that are designed to give the best possible representation of texture depths determined with the volumetric patch method[13].

Modern profilometers in use are almost entirely of the contactless type (e.g. laser, light slit or light sheet, to mention a few) and this document is primarily intended for this type. However, this does not exclude application of parts of it for other types of profilometers.

This ISO 13473 series has been prepared as a result of a need identified when specifying a test surface for vehicle noise measurement (see ISO 10844:2014[6]). Macrotexture depth measurements according to this document 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 (MPD) of a pavement surface. This MPD 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 [15]), estimation of noise characteristics 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.

This document is adapted for pavement texture measurement and is not intended for other applications. 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, it is known that there are problems in interpreting the result if the method is applied to porous surfaces or to grooved surfaces (see Annex B).

NOTE Other International Standards dealing with surface profiling methods include, for example, References [1], [2] and [3]. Although it is not clearly stated in these, they are mainly used for measuring surface finish (microtexture) of metal surfaces and are not intended to be applied to pavements.

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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.

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

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:

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

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

3.1
texture wavelength
λ
quantity describing the horizontal dimension of the irregularities of a *texture profile* (3.3)

Note 1 to entry: Texture wavelength is normally expressed in metres (m) or millimetres (mm).

Note 2 to entry: Texture wavelength is a descriptor of the wavelength components of the profile and is related to the concept of the Fourier Transform of a series regularly sampled measurement points along a spatial axis. Vertical displacement (height) has an arbitrary reference.

3.2
texture
pavement texture
deviation of a pavement surface from a true planar surface, with a *texture wavelength* (3.1) less than 0,5 m

3.3
surface profile
texture profile
upper contour of a vertical cross-section through a pavement

Note 1 to entry: Texture profile is similar to surface profile but limited to the texture range.

Note 2 to entry: The profile of the surface is described by two coordinates: one in the surface plane, called **distance** (the abscissa), and the other in a direction normal to the surface plane, called **vertical displacement** (the ordinate). An example is given in Figure A.1. The distance may be in the longitudinal or lateral (transverse) directions in relation to the travel direction on a pavement, or in a circle or any other direction between these extremes.

3.4
macrotexture
pavement macrotexture
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* (3.1) with one-third-octave bands including the range 0,63 mm to 50 mm of centre wavelengths

Note 1 to entry: 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 of the same order of size as tyre tread elements in the tyre/road interface. Surfaces are normally designed with a sufficient macrotexture to obtain suitable water drainage in the tyre/road interface. The macrotexture is obtained by suitable proportioning of the aggregate and mortar of the mix or by surface finishing techniques.

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