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ISO 13473-2

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Characterization of pavement texture by use of surface profiles —

Part 2: Terminology and basic requirements related to pavement texture profile analysis

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

Partie 2: Terminologie et exigences de base relatives à l'analyse de profils de texture d'une surface de chaussée

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Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this part of ISO 13473 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 13473-2 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 and basic requirements related to pavement texture profile analysis*

— *Part 3: Specification and classification of profilometers*

Introduction

The terminology related to surface texture analysis by profiling techniques used in International Standards for applications other than pavements is often not appropriate for pavement analysis. Although many basic measurement and analysis procedures in these other applications are similar to those used in pavement analysis, the terminology has by tradition developed very differently. It is therefore necessary to issue this terminology standard for **pavement** applications, although attempts have been made to be consistent with the other terminology standards where suitable.

Characterization of pavement texture by use of surface profiles —

Part 2: Terminology and basic requirements related to pavement texture profile analysis

1 Scope

This part of ISO 13473 defines terms, expressions and parameters that are related to the analysis of pavement texture, on roads as well as on airport runways and taxiways. In particular, it defines terms and expressions related to profile representations of texture, which are anticipated to be useful in the modelling of pavement characteristics such as tyre/road noise emission, tyre/road friction, tyre rolling resistance and tyre wear. In addition, some brief general information on pavement surface characteristics and their effects is presented.

This part of ISO 13473 also contains some basic requirements in connection with the use of the terms, expressions and parameters.

Profile analysis of machined surfaces is not included, since this subject is dealt with in other International Standards, for example ISO 3274, ISO 4287, ISO 4288, ISO 5436-1 and ISO 12085. Profile analysis of road unevenness, which is dealt with in ISO 8608, is also excluded.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this part of ISO 13473. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 13473 are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

IEC 61260, *Electroacoustics — Octave-band and fractional-octave-band filters*

3 Terms and definitions

For the purposes of ISO 13473 (all parts), the following terms and definitions apply.

3.1 General terms

3.1.1
pavement texture
texture
deviation of a pavement surface from a true planar surface, with a texture wavelength less than 0,5 m

NOTE It is divided into micro-, macro- and megatexture according to 3.2.

3.1.2
surface profile
texture profile
two-dimensional sample of the pavement texture generated if a sensor, such as the tip of a needle or a laser spot, continuously touches or shines on the pavement surface while it is moved along a line on the surface

NOTE The profile of the surface is described by two coordinates: one along the surface plane, called “distance” (the abscissa), and the other in a direction normal to the surface plane, called “amplitude” (the ordinate); refer to the example illustrated in Figure 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.

3.1.3
texture wavelength
quantity describing the horizontal dimension of the irregularities of a texture profile

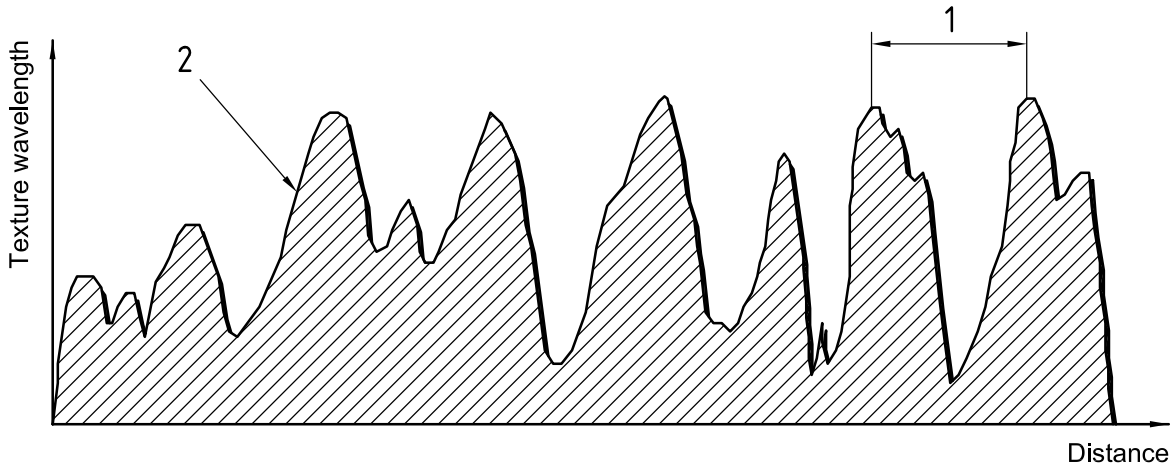
NOTE 1 Texture wavelength is normally expressed in metres (m) or millimetres (mm).

NOTE 2 Wavelength is a concept commonly used and accepted in electrotechnical and signal-processing vocabularies. The profile may be considered as a stationary, random function of the distance along the surface. By means of a Fourier analysis, such a function can be mathematically represented as an infinite series of sinusoidal components of various frequencies (and wavelengths), each having a given amplitude and initial phase. For typical and continuous surface profiles, a profile analysed by its Fourier components contains a continuous distribution of wavelengths. The texture wavelength in ISO 13473 is the inverse of the spatial frequency, the unit of which is m^{-1} [equivalent to cycles per metre (cycles/m)]. Refer also to 3.8.2.

NOTE 3 The wavelengths can be represented physically as the various lengths of periodically repeated parts of the profile, see Figure 1.

3.1.4
profilometer
device used for measuring the profile of pavement texture

NOTE Current designs of profilometers used in pavement engineering include, but are not limited to, sensors based on laser, light sectioning, needle tracer and ultrasonics technologies.



Key

1 Amplitude
2 Profile

NOTE “Texture wavelength” is an illustration of a component of the profile related to the wavelength concept but is not correct from a strictly mathematical point of view. Also note that amplitude (height) has an arbitrary reference.

Figure 1 — Illustration of some basic terms describing pavement surface texture

3.2 Ranges of texture

3.2.1
microtexture
pavement microtexture
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 up to 0,5 mm expressed as one-third-octave centre wavelengths

NOTE 1 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 produced by the surface properties (sharpness and harshness) of the individual chippings or other particles of the surface which come in direct contact with the tyres.

NOTE 2 Figure 2 illustrates the different texture ranges, with approximate limits regarding their effects on vehicle-pavement interactions.

3.2.2
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 with one-third-octave bands including the range 0,63 mm to 50 mm of centre wavelengths

NOTE 1 Peak-to-peak amplitudes 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.

NOTE 2 Based on physical relationships between texture and friction/noise, etc., the World Road Association (PIARC) originally defined the ranges of micro-, macro- and megatexture (see reference [14]). Figure 2 illustrates how these definitions cover certain ranges of surface texture wavelength and spatial frequeny.

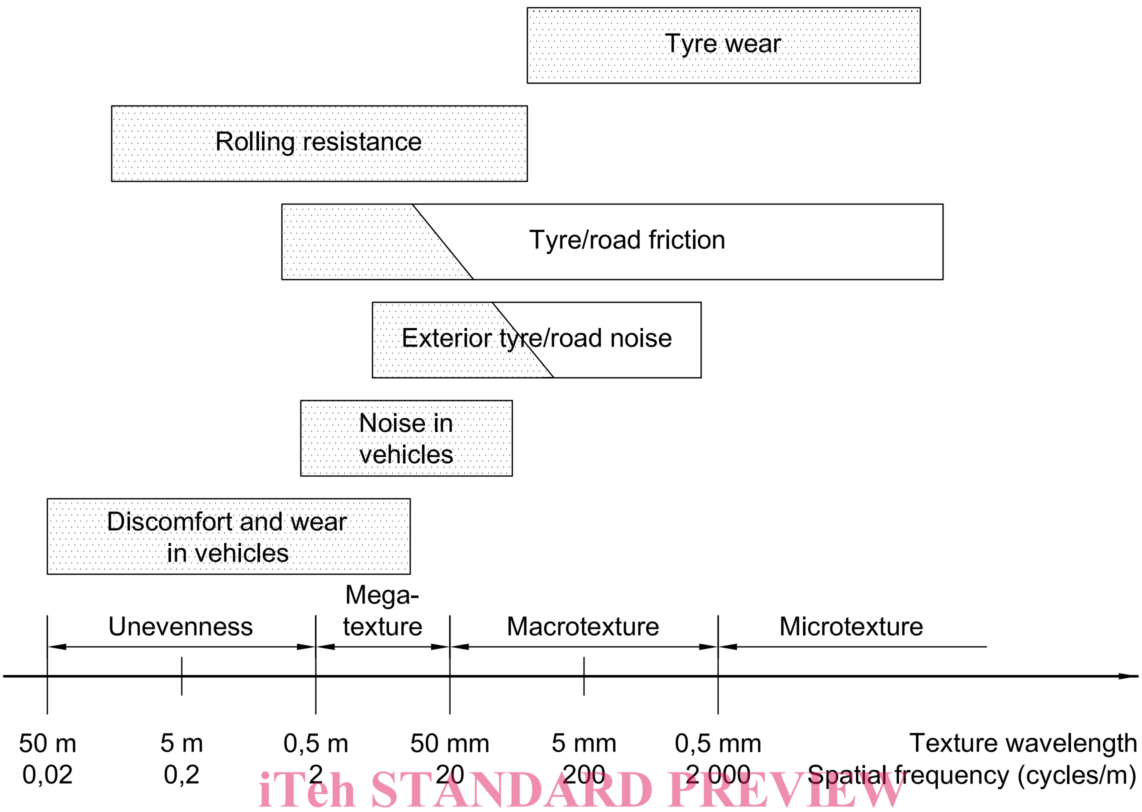
3.2.3
megatexture
pavement megatexture
deviation of a pavement surface from a true planar surface with the characteristic dimensions along the surface of 50 mm to 500 mm, corresponding to texture wavelengths with one-third-octave bands including the range 63 mm to 500 mm of centre wavelengths

NOTE 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. Surface roughness with longer wavelengths than megatexture is referred to as “unevenness”.

3.2.4
unevenness
pavement unevenness
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 1 Pavement characteristics at wavelengths longer than 0,5 m are considered to be above that of texture and are referred to here as “unevenness”. For airfield applications, even wavelengths longer than 50 m would be considered.

NOTE 2 Longitudinal unevenness is a type of surface roughness which, through vibrations, affects ride comfort in and road holding of vehicles. Transverse unevenness due to, for example, rutting, affects safety through lateral instability and water accumulation. It is not the intention of this part of ISO 13473 to include terms which are specifically related to unevenness. Such terms are defined in ISO 8608, prEN 13036-5 and prEN 13036-8.



NOTE A lighter shade means a favourable effect of texture over this range, while a darker shade means an unfavourable effect.

Figure 2 — Ranges in terms of texture wavelength and spatial frequency of texture and unevenness and their most significant, anticipated effects

3.3 Macrotexture depth measures

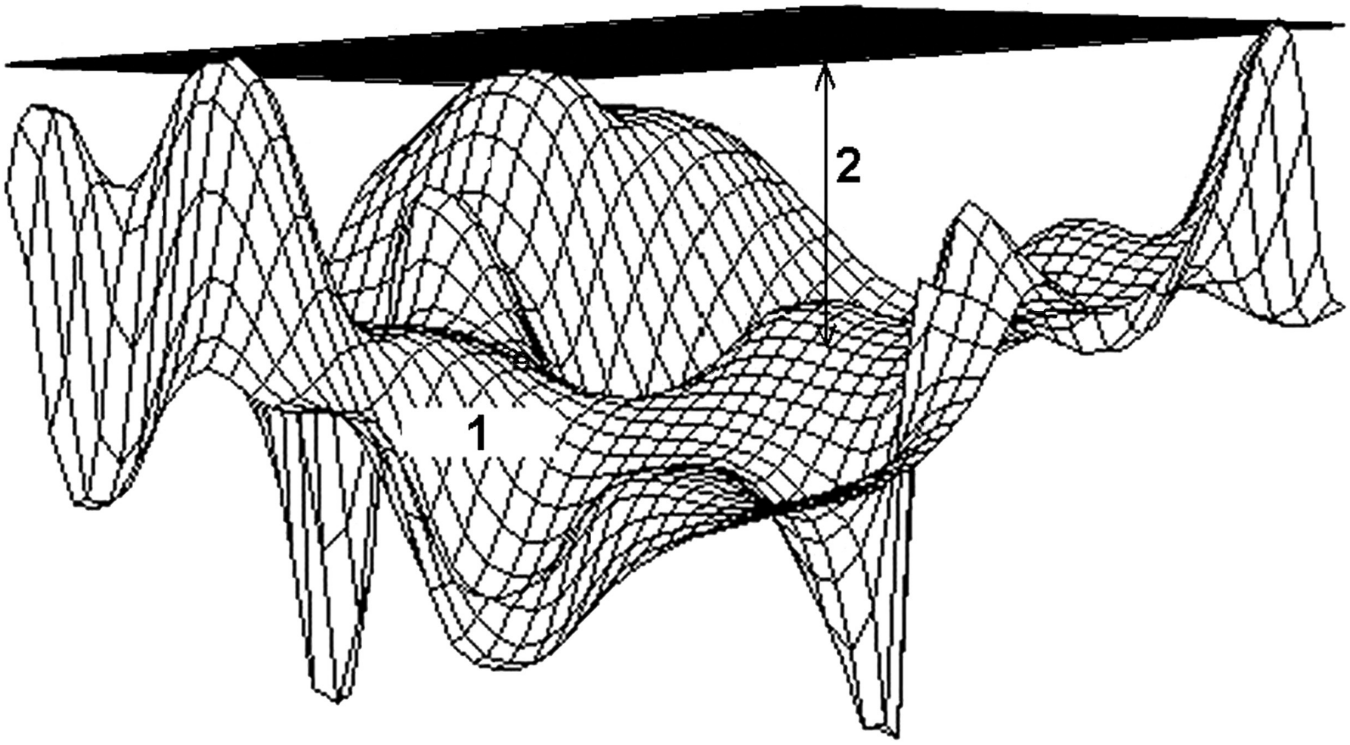
3.3.1
texture depth
distance between the textured surface and a plane through the peaks of the three highest particles within a surface area in the same order of a size as that of a tyre/pavement interface

See Figure 3.

NOTE 1 Texture depth is normally expressed in millimetres (mm).

NOTE 2 Texture depth refers to a three-dimensional case.

NOTE 3 Figure 3 illustrates the texture of a pavement in the three-dimensional case and the term “texture depth”, which is the distance between an arbitrary point of the plane down to the surface perpendicular to the plane. The plane is defined by the three highest peaks of the surface. The texture depth according to this definition depends on the size and position of the reference plane.



Key

1 Surface
2 Texture depth

Figure 3 — Illustration of the terms surface and texture depth

3.3.2
Mean Texture Depth
MTD
quotient of a given volume of standardized material and the area of that material spread in a circular patch on the surface being tested

NOTE 1 Mean Texture Depth is normally expressed in millimetres (mm).

NOTE 2 A method based on measurement and calculation of MTD is standardized as the “volumetric patch method”, see ISO 10844:1994, annex A, and EN 13036-1. The reference “plane” described in 3.3.1 is then in practice determined by the contact between a rubber pad and the surface, when this pad is rubbed over the area in order to spread out the material in a circular patch. Therefore, the texture depth obtained in this case is not based on a “plane”, but on a somewhat curved surface that attempts to simulate the tyre/road contact.

3.3.3
profile depth
height difference between the profile and a horizontal line through the highest peak (the peak level) within a distance along the surface of the same order of length as a tyre pavement interface,

See Figure 4.

NOTE 1 Profile depth is normally expressed in millimetres (mm).

NOTE 2 Whereas texture depth and mean texture depth both refer to a three-dimensional case, the term “profile depth” refers to a two-dimensional case, i.e. when studying a profile.