PD CEN/TS 16272-5:2014

BSI Standards Publication

Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance

Part 5: Intrinsic characteristics — In situ values of sound reflection under direct sound field conditions

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee RAE/2, Railway Applications - Track.

A list of organizations represented on this committee can be obtained on request to its secretary.

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ISBN 978 0 580 76214 7

ICS 93.100

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This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 May 2014.

Amendments issued since publication

Date	Text affected

TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

TECHNISCHE SPEZIFIKATION

CEN/TS 16272-5

April 2014

ICS 93.100

English Version

Railway applications - Track - Noise barriers and related devices acting on airborne sound propagation - Test method for determining the acoustic performance - Part 5: Intrinsic characteristics - In situ values of sound reflection under direct sound field conditions

Applications ferroviaires - Voie - Dispositifs de réduction du bruit - Méthode d'essai pour la détermination des performances acoustiques - Partie 5: Valeurs in situ de la réflexion acoustique dans des conditions de champ acoustique direct

Bahnanwendungen - Oberbau - Lärmschutzwände und verwandte Vorrichtungen zur Beeinflussung der Luftschallausbreitung - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 5: Produktspezifische Merkmale - In-situ-Werte zur Schallreflexion in gerichteten Schallfeldern

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Foreword

This document (CEN/TS 16272-5:2014) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This Technical Specification is one of the series EN 16272 “*Railway applications – Track – Noise barriers and related devices acting on airborne sound propagation – Test method for determining the acoustic performance*” as listed below:

— *Part 1: Intrinsic characteristics – Sound absorption in the laboratory under diffuse sound field conditions*

— *Part 2: Intrinsic characteristics – Airborne sound insulation in the laboratory under diffuse sound field conditions*

— *Part 3-1: Normalized railway noise spectrum and single number ratings for diffuse field applications*

— *Part 3-2: Normalized railway noise spectrum and single number ratings for direct field applications*

— *Part 4: Intrinsic characteristics – In situ values of sound diffraction under direct sound field conditions*

— *Part 5: Intrinsic characteristics – In situ values of sound reflection under direct sound field conditions*

— *Part 6: Intrinsic characteristics – In situ values of airborne sound insulation under direct sound field conditions*

— *Part 7: Extrinsic characteristics – In situ values of insertion loss*

It should be read in conjunction with:

EN 16272-1, *Railway applications – Track – Noise barriers and related devices acting on airborne sound propagation – Test method for determining the acoustic performance – Part 1: Intrinsic characteristics – Sound absorption in the laboratory under diffuse sound* field conditions

EN 16272-3-1, *Railway applications – Track – Noise barriers and related devices acting on airborne sound propagation – Test method for determining the acoustic performance – Part 3-1: Normalized railway noise spectrum and single number ratings for diffuse field* applications

EN 16272-3-2, *Railway applications – Track – Noise barriers and related devices acting on airborne sound propagation – Test method for determining the acoustic performance – Part 3-2: Normalized railway noise spectrum and single number ratings for direct field applications*

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This Technical Specification describes a test method for determining the intrinsic characteristics of sound reflection of noise barriers and claddings designed for railways in non-reverberant conditions (a measure of intrinsic performance). It can be applied *in situ*, i.e. where the noise barriers are installed. The method can be applied without damaging the surface.

The method can be used to qualify products to be installed along railways as well as to verify the compliance of installed noise barriers to design specifications. Regular application of the method can be used to verify the long term performance of noise barriers.

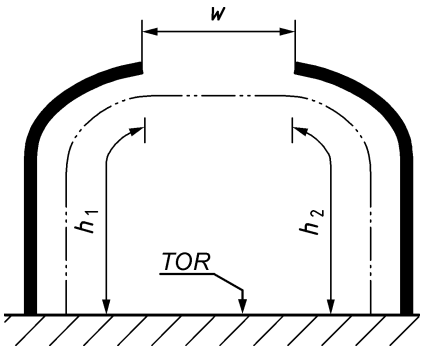
The method requires the average of results of measurements taken in different points in front of the device under test and/or for specific angles of incidences. The method is able to investigate flat and non-flat products.

The measurements results of this method for sound reflection are not directly comparable with the results of the laboratory method (EN 16272-1), mainly because the present method uses a directional sound field, while the laboratory method assumes a diffuse sound field. The test method described in the present document should not be used to determine the intrinsic characteristics of sound reflection of noise reducing devices to be installed in reverberant conditions, e.g. claddings inside tunnels or deep trenches.

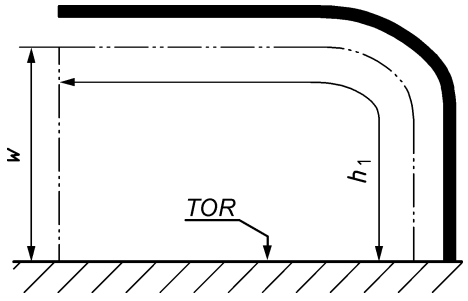
For the purpose of this Technical Specification reverberant conditions are defined based on the envelope, *e*, across the rail formed by the barriers, trench sides or buildings (the envelope does not include the railway surface) as shown by the dashed lines in Figure 1. Conditions are defined as being reverberant when the percentage of open space in the envelope is less than or equal to 25 %, i.e.:

Reverberant conditions occur when $w/e \leq 0{,}25$, where $e = (w + h_1 + h_2)$

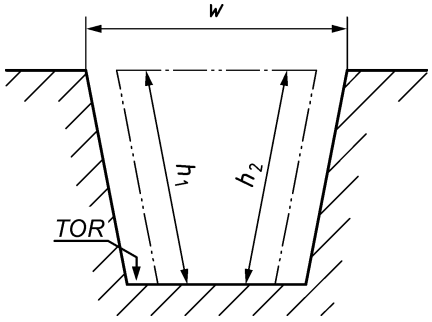
This criterion is applied also to the open space between the train body and the barrier surface.



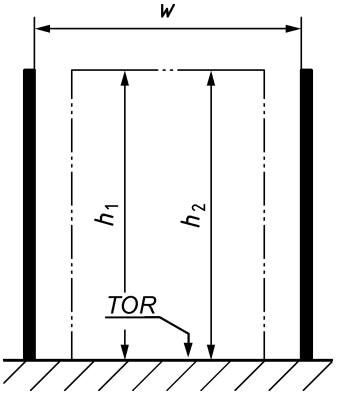
(a) Partial cover on both sides of the railway; envelope, $e = w + h_1 + h_2$



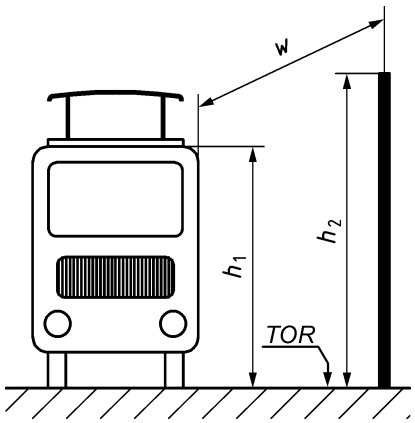
(b) Partial cover on one side of the railway; $e = w + h_1$



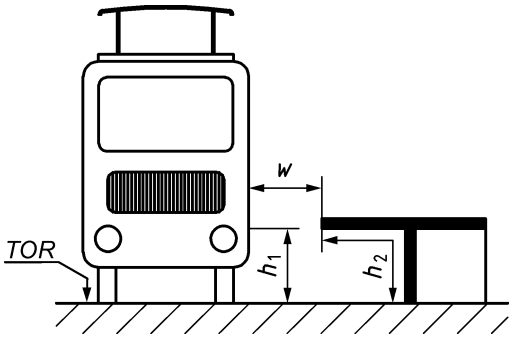
(c) Deep trench envelope, $e = w + h_1 + h_2$



(d) Tall barriers or buildings; envelope, $e = w + h_1 + h_2$



(e) Train passing close to a noise barrier envelope, $e = w + h_1 + h_2$



(f) Train passing close to a platform at the station, $e = w + h_1 + h_2$

Key

TOR top of rail

w width of open space

Figure 1 — (not to scale) Sketch of the reverberant condition check in six cases.

This method introduces a specific quantity, called reflection index, to define the sound reflection in front of a noise barrier or cladding, while the laboratory method gives a sound absorption coefficient. Laboratory values of the sound absorption coefficient can be converted to conventional values of a reflection coefficient taking the complement to one. In this case, research studies suggest that a quite good correlation exists between laboratory data, measured according to EN 16272-1 and field data, measured according to the method described in the present document.

This method may be used to qualify noise reducing devices for other applications, e.g. to be installed along roads or nearby industrial sites. In this case the single-number ratings should be calculated using an appropriate spectrum.

1 Scope

This Technical Specification describes a test method for measuring a quantity representative of the intrinsic characteristics of sound reflection from railway noise barriers: the reflection index.

The test method is intended for the following applications:

— determination of the intrinsic characteristics of sound reflection of noise barriers to be installed along railways, to be measured either on typical installations alongside railways or on a relevant sample section;

— determination of the *in situ* intrinsic characteristics of sound reflection of noise barriers and claddings in actual use;

— comparison of design specifications with actual performance data after the completion of the construction work;

— verification of the long term performance of noise barriers and claddings (with a repeated application of the method).

The test method is not intended for the following applications:

— determination of the intrinsic characteristics of sound reflection of noise reducing devices to be installed in reverberant conditions, e.g. inside tunnels or deep trenches.

Results are expressed as a function of frequency, in one-third octave bands between 100 Hz and 5 kHz. If it is not possible to get valid measurements results over the whole frequency range indicated, the results should be given in a restricted frequency range and the reasons of the restriction(s) should be clearly reported.

All noise reducing devices different from noise barriers and related devices acting on airborne sound propagation, e.g. devices for attenuation of ground borne vibration and on board devices are out of the scope of this Technical Specification.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

prEN 16272-3-2:2012, *Railway applications – Track – Noise barriers and related devices acting on airborne sound propagation – Test method for determining the acoustic performance – Part 3-2: Normalized railway noise spectrum and single number ratings for direct field applications*

EN 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications (IEC 61672-1)*

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 purpose of this document the following definitions apply.

3.1
acoustic element
element whose primary function is to provide the acoustic performance of the device