

Road traffic noise reducing devices - Test method for determining the acoustic performance - Part 1: Intrinsic characteristics of sound absorption under diffuse sound field conditions

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

|   |  |
|---|--|
| See Eesti standard EVS-EN 1793-1:2017 sisaldab Euroopa standardi EN 1793-1:2017 ingliskeelset teksti.               | This Estonian standard EVS-EN 1793-1:2017 consists of the English text of the European standard EN 1793-1:2017.                    |
| Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas   | This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation. |
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English Version

Road traffic noise reducing devices - Test method for  
determining the acoustic performance - Part 1: Intrinsic  
characteristics of sound absorption under diffuse sound  
field conditions

Dispositifs de réduction du bruit du trafic routier -  
Méthode d'essai pour la détermination de la  
performance acoustique - Partie 1 : Caractéristique  
intrinsèques de l'absorption acoustique dans des  
conditions de champ acoustique diffus

Lärmschutzvorrichtungen an Straßen - Prüfverfahren  
zur Bestimmung der akustischen Eigenschaften - Teil  
1: Produktspezifische Merkmale der Schallabsorption  
in diffusen Schallfeldern

This European Standard was approved by CEN on 6 February 2017.

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This European Standard exists 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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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## European foreword

This document (EN 1793-1:2017) has been prepared by Technical Committee CEN/TC 226 "Road equipment", the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by September 2017, and conflicting national standards shall be withdrawn at the latest by September 2017.

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

This document supersedes EN 1793-1:2012.

With respect to the superseded document, the following changes have been made:

- the description of the test arrangement has been improved;
- the method for determining sound absorption coefficients in each one-third octave band, as described in EN ISO 354, has been modified: the Sabine absorption coefficient  $\alpha_{Si}$  has been replaced by a new absorption coefficient  $\alpha_{NRD,i}$  that is specific to noise reducing devices and which takes account of the volume of the test sample (the new coefficient  $\alpha_{NRD,i}$  might be derived from  $\alpha_{Si}$ );
- the contents of the test report have been better defined;
- the declaration of the measurement uncertainty and the related confidence level is now mandatory. The reported uncertainties have an impact on the determination of informative categories of single number rating performance; depending on the performance of the product this could potentially result in products being 'downgraded' to a lower category. As a result, the informative annex addressing categories of single number rating has been removed. The performance of the noise reducing device is, from now on, only to be reported in terms of the numeric values of the single number rating;
- a detailed example is presented (Annex C).

EN 1793-1 is part of a series and should be read in conjunction with the following:

- EN 1793-2, *Road traffic noise reducing devices — Test method for determining the acoustic performance — Part 2: Intrinsic characteristics of airborne sound insulation under diffuse sound field conditions*;
- EN 1793-3, *Road traffic noise reducing devices — Test method for determining the acoustic performance — Part 3: Normalized traffic noise spectrum*;
- EN 1793-4, *Road traffic noise reducing devices — Test method for determining the acoustic performance — Part 4: Intrinsic characteristics — In situ values of sound diffraction*;
- EN 1793-5, *Road traffic noise reducing devices — Test method for determining the acoustic performance — Part 5: Intrinsic characteristics — In situ values of sound reflection under direct sound field conditions*;

- EN 1793-6, *Road traffic noise reducing devices — Test method for determining the acoustic performance — Part 6: Intrinsic characteristics — In situ values of airborne sound insulation under direct sound field conditions.*

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: 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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Introduction

Where a sound reflecting surface is installed along a road, it may be effective to use sound absorbing devices on its traffic side to reduce additional noise nuisance caused by reflected sound. This treatment may be needed in the presence of the following:

- noise barriers, rocks or retaining walls that can reflect sound waves toward unprotected areas;
- vertical cuttings or reflective surfaces that face each other;
- tunnels and their approaches;
- traffic passing close to a barrier where reflections between the vehicles and the barrier may reduce effectiveness.

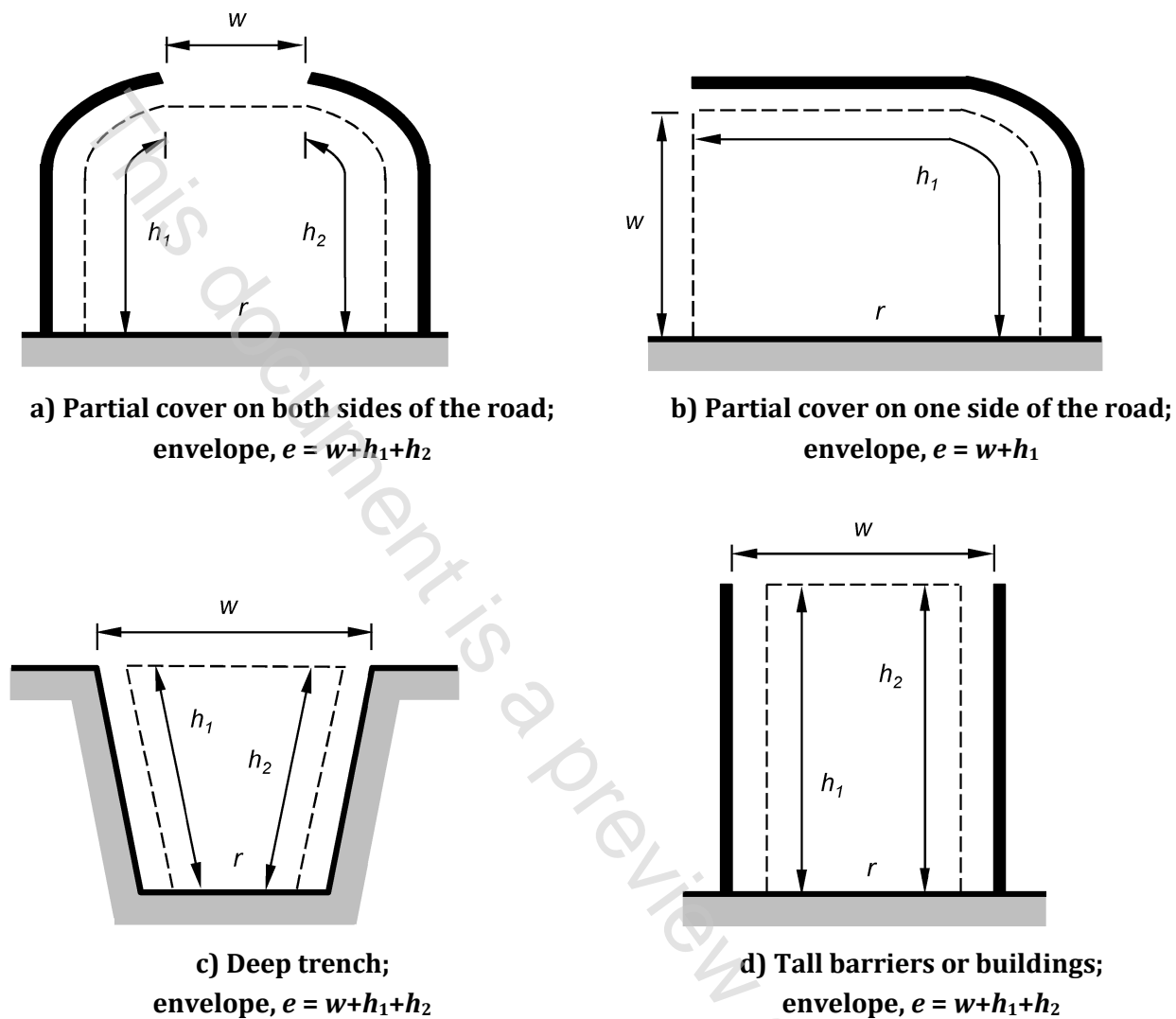
This European Standard specifies a test method for qualifying the sound absorption performance of noise reducing devices designed for roads (a measure of intrinsic performance). It is not concerned with determining insertion loss (extrinsic performance) which depends on additional factors which are not related to the product itself, e.g. the dimensions of the barrier and quality of installation work and site factors such as ground impedance, site geometry etc. The test is designed to allow the intrinsic sound absorption performance of the device to be measured under diffuse sound field conditions; the resulting rating should aid the selection of devices for particular roadside applications.

The measurement results of this method for sound absorption are not directly comparable with the results of the in situ method (EN 1793-5), mainly because the present method uses a diffuse sound field, while the in situ method assumes a directional sound field. The test method described in the present document should not be used to determine the intrinsic characteristics of sound absorption for noise reducing devices to be installed on roads under non-reverberant conditions.

Research studies suggest that some correlation exists between laboratory data, measured according to EN 1793-5 and laboratory data, measured according to the method described in this European Standard [1], [2], [3], [4].

For the purpose of this European Standard, reverberant conditions are defined based on the envelope,  $e$ , across the road formed by the device under test, trench sides or buildings (the envelope does not include the road 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,  $w$ , is less than or equal to 25 %, i.e. reverberant conditions occur when  $w/e \leq 0,25$ , where  $e = (w + h_1 + h_2)$  or  $e = (w + h_1)$  as per Figure 1.

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



# Key

$r$  road surface

$w$  width of open space

NOTE Figure 1 is not to scale.

**Figure 1 — Sketch of the reverberant condition check in four cases**



## 1 Scope

This European Standard specifies the laboratory method for measuring the sound absorption performance of road traffic noise reducing devices in reverberant conditions. It covers the assessment of the intrinsic sound absorption performance of devices that can reasonably be assembled inside the testing facility described in EN ISO 354.

This method is not intended for the determination of the intrinsic characteristics of sound absorption of noise reducing devices to be installed on roads in non-reverberant conditions.

The test method in EN ISO 354 referred to in this European Standard excludes devices that act as weakly damped resonators. Some devices will depart significantly from these requirements and in these cases, care is needed in interpreting the results.

## 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.

EN 1793-3, *Road traffic noise reducing devices - Test method for determining the acoustic performance - Part 3: Normalized traffic noise spectrum*

EN ISO 354:2003, *Acoustics - Measurement of sound absorption in a reverberation room (ISO 354:2003)*

ISO 9613-1, *Acoustics — Attenuation of sound during propagation outdoors — Part 1: Calculation of the absorption of sound by the atmosphere*

## 3 Symbols and abbreviations

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

| Symbol or abbreviation    | Designation   | Unit             |
|---------------------------|---|------------------|
| $\alpha_{NRDi}$           | Sound absorption coefficient in the $i^{\text{th}}$ one-third octave band   | -                |
| $A_1$                     | Equivalent sound absorption area of the empty reverberation room  | $\text{m}^2$     |
| $A_2$                     | Equivalent sound absorption area of the reverberation room containing a test specimen   | $\text{m}^2$     |
| $A_T$                     | Equivalent sound absorption area of the test specimen   | $\text{m}^2$     |
| $c_1$                     | Propagation speed of sound in air in the empty reverberation room   | $\text{ms}^{-1}$ |
| $c_2$                     | Propagation speed of sound in air in the reverberation room with the test specimen during the measurement                     | $\text{ms}^{-1}$ |
| $DL_{\alpha, \text{NRD}}$ | Single-number rating of sound absorption performance expressed as a difference of A weighted sound pressure levels            | dB               |
| $L$                       | Length of the test panels on one side of the post   | m                |
| $L_i$                     | Normalized A weighted sound pressure level of traffic noise in the $i^{\text{th}}$ one-third octave band defined in EN 1793-3 | dB               |