
Železniške naprave - Zgornji ustroj proge - Protihrupne ovire in pripadajoče naprave, ki vplivajo na širjenje zvoka po zraku - Neakustične lastnosti - 1. del: Mehansko delovanje pri statičnih obremenitvah - Računske in preskusne metode

Railway applications - Track - Noise barriers and related devices acting on airborne sound propagation - Non-acoustic performance - Part 1: Mechanical performance under static loadings - Calculation and test methods

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Bahnanwendungen - Oberbau - Lärmschutzwände und verwandte Vorrichtungen zur Beeinflussung der Luftschallausbreitung - Nicht akustische Eigenschaften - Teil 1: Mechanische Eigenschaftsanforderungen unter statischen Belastungen - Berechnungs- und Prüfverfahren

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Railway applications - Track - Noise barriers and related devices acting on airborne sound propagation - Non-acoustic performance - Part 1: Mechanical performance under static loadings - Calculation and test method

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This European Standard was approved by CEN on 8 February 2018.

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SIST EN 16727-1:2018

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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 16727-1:2018) has been prepared by Technical Committee CEN/TC 256 "Railway applications", 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of an identical text or by endorsement, at the latest by December 2018, and conflicting national standards shall be withdrawn at the latest by December 2018.

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 is one of the series EN 16727, *Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Non-acoustic performance*, as listed below:

- *Part 1: Mechanical performance under static loadings — Calculation and test method* [this document];
- *Part 2-1: Mechanical performance under dynamic loadings due to passing trains — Resistance to fatigue*;
- *Part 2-2: Mechanical performance under dynamic loadings caused by passing trains — Calculation method*;
- *Part 3: General safety and environmental requirements*.

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EN 16727-1:2018 (E)**Introduction**

Noise barriers and related devices acting on airborne sound propagation are exposed to permanent, variable or accidental actions as set out in EN 1990.

This document permits the evaluation of the effects of forces due to self-weight, air pressure load and impact loads that can act on the noise barrier and/or its components.

Under combinations of permanent, variable, and accidental actions, it is essential that the structural behaviour of the noise barrier are evaluated with the aim of preventing excessive stress of material, separation of elements from structural posts and excessive deflections that may affect their acoustic effectiveness and robustness.

Different materials used in the design of a noise barrier are due to be chemically compatible and not adversely affect each other's characteristics.

With specific reference to accidental actions caused by ballast stones or other debris from passing trains, minor damage may be tolerated but attention will be paid to safety, environmental and functional requirements. Shatter properties are treated in EN 16727-3.

In circumstances where there is a lack of design information, or doubt about the parameters required to undertake tests or calculation for verification of a design, additional surveys and geotechnical investigations are essential so as to obtain the required values in order to ensure the safety and serviceability of the complete noise barrier.

In some countries, the dynamic force of snow ejected by equipment used to clear the rail track in winter will be considered.

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1 Scope

This document applies only to noise barriers composed of posts as structural elements and panels as acoustic elements (fabricated for example from metal, timber, plastic or concrete panels). It also applies for acoustic claddings of existing walls and partial or total acoustic coverings of the rail track.

It is important that acoustic elements are tested together with the structural elements to represent the noise barrier as in the intended use.

This document provides criteria to verify railway noise barriers and related devices according to basic mechanical performance under standard conditions of exposure, irrespective of the materials used. A range of conditions and optional requirements is provided to allow for the wide diversity of practice within Europe. Individual aspects of performance are covered separately in the annexes.

This document provides test methods and criteria for the assessment of railway noise barriers with respect to their mechanical performance and stability under static loading.

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.

EN 1794-1:2011, *Road traffic noise reducing devices — Non-acoustic performance — Part 1: Mechanical performance and stability requirements*

EN 1990:2002¹, *Eurocode — Basis of structural design*

EN 1991 (all parts), *Eurocode 1: Actions on structures*

EN 1991-1-4:2005², *Eurocode 1: Actions on structures — Part 1-4: General actions — Wind actions*

EN 1992 (all parts), *Eurocode 2: Design of concrete structures*

EN 1993 (all parts), *Eurocode 3 — Design of steel structures*

EN 1994 (all parts), *Eurocode 4 — Design of composite steel and concrete structures*

EN 1995 (all parts), *Eurocode 5: Design of timber structures*

EN 1996 (all parts), *Eurocode 6 — Design of masonry structures*

EN 1997 (all parts), *Eurocode 7 — Geotechnical design*

EN 1998 (all parts), *Eurocode 8 — Design of structures for earthquake resistance*

EN 1999 (all parts), *Eurocode 9: Design of aluminium structures*

¹ This document is currently impacted by the amendment EN 1990:2002/A1:2005 and corrigendum EN 1990:2002/A1:2005/AC:2010.

² This document is currently impacted by the amendment EN 1991-1-4:2005/A1:2010 and corrigendum EN 1991-1-4:2005/AC:2010.

EN 16727-1:2018 (E)

EN 16727-2-2, *Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Non-acoustic performance — Part 2-2: Mechanical performance under dynamic loadings caused by passing trains — Calculation method*

EN ISO 291, *Plastics — Standard atmospheres for conditioning and testing (ISO 291)*

ETAG 010:2002³, *Self-supporting translucent roof kits*

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:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 noise barrier
noise reducing device, which obstructs the direct transmission of airborne sound emanating from railways, and which will typically span between posts and also may overhang the railway

Note 1 to entry: Noise barriers are generally made of acoustic and structural elements (3.3 and 3.4).

3.2 cladding
noise reducing device, which is attached to a wall or other structure and reduces the amount of sound reflected

Note 1 to entry: Claddings are generally made of acoustic and structural elements (3.3 and 3.4).

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

3.4 structural element
element whose primary function is to support or hold in place acoustic elements

Note 1 to entry: In some noise barriers the acoustic function and the structural function cannot be clearly separated and attributed to different components.

3.5 added device
added component that influences the acoustic performance of the original noise-reducing device (acting primarily on the diffracted energy)

3.6 segment
length of the noise barrier or cladding, within the total length, where the construction characteristics, the geotechnical conditions and the design loads are constant

³ European Technical Approval Guidelines (ETAG), established by the European Organisation for Technical Assessment (EOTA), under the Construction Products Directive (CPD) 89/106/EEC. Freely available at www.eota.eu.

3.7**load model**

simplified mathematical description of a complicated loading, such as the air pressure wave generated by passing trains

3.8**quasi-static load model**

load model including dynamic effects of loading

4 Symbols and abbreviations

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

Symbol or abbreviation	Designation	Unit
α	Inclination angle of the noise barrier to the vertical axis	degrees
$\gamma_{MR} \gamma_{MC}$	Partial safety factors for the material/structure in accordance with the uncertainty of the model used	-
$C_{p,net}$	Net pressure coefficient (wind)	-
f_{ct}	Horizontal correction factor for noise barriers having a T-top shaped added device	-
f_{ct1}	Vertical correction factor for T-top shaped added devices on the windward side	-
f_{ct2}	Vertical correction factor for T-top shaped added devices on the leeward side	-
H_{zone}	Height difference between two adjacent zones of a noise barrier of variable height	mm
H_{nrd}	Total height of acoustic elements constituting the whole noise barrier	mm
h_{ae}	Height of a single acoustic element	mm
K_{FI}	Factor applicable to actions for reliability differentiation (see EN 1990)	-
L	horizontal distance between the ends of the zones of the noise barrier with different heights	mm
L_a	Greatest free length of an acoustic element (between its supporting structural elements)	mm
L_s	Greatest length of a structural element (e.g. for a cantilever beam, it is calculated from the base)	mm
q_p	Gust wind pressure (from Eurocode)	Pa

5 Structural design**5.1 General**

The determination of mechanical resistance and stability, including the ultimate load carrying capacity and serviceability limits, shall be undertaken on the basis of EN 1990.