
**Building acoustics — Estimation of
acoustic performance of buildings
from the performance of elements —**

**Part 3:
Airborne sound insulation against
outdoor sound**

*Acoustique du bâtiment — Calcul de la performance acoustique des
bâtiments à partir de la performance des éléments —*

Partie 3: Isolement aux bruits aériens venus de l'extérieur

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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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 126, *Acoustic properties of building elements and of buildings*, in collaboration with ISO Technical Committee TC 43, *Acoustics*, SC 2, *Building acoustics*, in accordance with the agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition cancels and replaces ISO 15712-3:2005, which has been technically revised.

A list of all the parts in the ISO 12354 series can be found on the ISO website.

Introduction

This document is part of a series specifying calculation models in building acoustics.

Although this document covers the main types of building construction it cannot as yet cover all variations in the construction of buildings. It sets out an approach for gaining experience for future improvements and developments.

The accuracy of this standard can only be specified in detail after widespread comparisons with field data, which can only be gathered over a period of time after establishing the prediction model. To help the user in the meantime, indications of the accuracy have been given, based on earlier comparisons with comparable prediction models. It is the responsibility of the user (i.e. a person, an organization, the authorities) to address the consequences of the accuracy, inherent for all measurement and prediction methods, by specifying requirements for the input data and/or applying a safety margin to the results or applying some other correction.

It is intended for acoustical experts and provides the framework for the development of application documents and tools for other users in the field of building construction, taking into account local circumstances.

The model is based on experience with predictions for dwelling; it can also be used for other types of buildings provided the dimensions of constructions are not too different from those in dwellings.

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Building acoustics — Estimation of acoustic performance of buildings from the performance of elements —

Part 3: Airborne sound insulation against outdoor sound

1 Scope

This document specifies a calculation model to estimate the sound insulation or the sound pressure level difference of a façade or other external surface of a building. The calculation is based on the sound reduction index of the different elements from which the façade is constructed and it includes direct and flanking transmission. The calculation gives results which correspond approximately to the results from field measurements in accordance with ISO 16283-3. Calculations can be carried out for frequency bands or for single number ratings.

The calculation results can also be used for calculating the indoor sound pressure level due to for instance road traffic (see [Annex E](#)).

This document describes the principles of the calculation model, lists the relevant quantities and defines its applications and restrictions.

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 717-1, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation*

ISO 10140-1:2016, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 1: Application rules for specific products*

ISO 12354-1:2017, *Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part: Airborne sound insulation between rooms (in revision)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions, and the symbols and units listed in [Annex A](#), 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 Quantities to express building performance

NOTE The sound insulation of façades in accordance with ISO 16283-3 can be expressed in several quantities. These quantities are determined in frequency bands (one-third-octave bands or octave bands) from which the single number rating for the building performance can be obtained in accordance with ISO 717-1, for instance R'_{w} , $D_{ls,2m,nT,w}$ or $(R'_{w} + C_{tr})$.

3.1.1

apparent sound reduction index

R'_{45°

<loudspeaker> airborne sound insulation of a building element when the sound source is a loudspeaker and the angle of incidence is 45° , which is evaluated from

$$R'_{45^\circ} = L_{1,s} - L_2 + \left(10 \lg \left(\frac{S}{A} \right) \right) - 1,5 \text{ dB}$$

where

$L_{1,s}$ is the average sound pressure level on the outside surface of the building element including the reflecting effects from the façade, in decibels;

L_2 is the average sound pressure level in the receiving room, in decibels;

S is the area of the building element, in square metres;

A is the equivalent sound absorption area in the receiving room, in square metres.

3.1.2

apparent sound reduction index

$R'_{tr,s}$

<traffic noise> airborne sound insulation of a building element when the sound source is traffic noise, which is evaluated from

$$R'_{tr,s} = L_{eq,1,s} - L_{eq,2} + \left(10 \lg \left(\frac{S}{A} \right) \right) - 3 \text{ dB}$$

where

$L_{eq,1,s}$ is the average equivalent sound pressure level on the outside surface of the building element including the reflecting effects from the façade, in decibels;

$L_{eq,2}$ is the average equivalent sound pressure level in the receiving room, in decibels.

3.1.3

standardized level difference

$D_{2m,nT}$

difference between the outdoor sound pressure level at 2 m in front of the façade and the sound pressure level in the receiving room, corresponding to a reference value of the reverberation time, which is evaluated from

$$D_{2m,nT} = L_{1,2m} - L_2 + \left(10 \lg \left(\frac{T}{T_0} \right) \right) \text{ dB}$$

where

$L_{1,2m}$ is the average sound pressure level at 2 m in front of the façade including the reflecting effects from the façade, in decibels;

T is the reverberation time in the receiving room, in seconds;

L_2 is the average sound pressure level in the receiving room, in decibels;

T_0 is the reference reverberation time, in seconds; for dwellings given as 0,5 s.

Note 1 to entry: The standardized level difference can be determined either with the prevailing traffic noise or with noise from a loudspeaker. This is indicated by adding the subscript “tr” and “ls” respectively, i.e. $D_{tr,2m,nT}$ or $D_{ls,2m,nT}$.

3.1.4

normalized level difference

$D_{2m,n}$

difference between the outdoor sound pressure level at 2 m in front of the façade and the sound pressure level in the receiving room, corresponding to a reference value of absorption area, which is evaluated from

$$D_{2m,n} = L_{1,2m} - L_2 - \left(10 \lg \left(\frac{A}{A_0} \right) \right) \text{dB}$$

where A_0 is the reference equivalent sound absorption area, in square metres for dwellings given as 10 m².

Note 1 to entry: The normalized level difference can be determined either with the prevailing traffic noise or with noise from a loudspeaker. This is indicated by adding the subscript “tr” and “ls” respectively, i.e. $D_{tr,2m,n}$ or $D_{ls,2m,n}$.

3.2 Quantities to express element performance

NOTE 1 The quantities expressing the performance of elements are used as part of the input data to estimate building performance. These quantities are determined in one-third-octave bands and can be expressed in octave bands as well. In relevant cases a single number rating for the element performance can be obtained from this, in accordance with ISO 717-1, for instance $R_w(C;C_{tr})$ and $D_{n,e,w}(C;C_{tr})$.

NOTE 2 For the calculations, additional information on constructions could be necessary; for example, the shape of the façade (see [Annex C](#)), the total façade area (see 4.3.1), etc.

3.2.1

sound reduction index

R

ten times the common logarithm of the ratio of the sound power W_1 incident on a test specimen to the sound power W_2 transmitted through the specimen, which is evaluated from

$$R = \left(10 \lg \frac{W_1}{W_2} \right) \text{dB}$$

Note 1 to entry: This quantity shall be determined in accordance with ISO 10140-1:2016, Annexes A, B, C and D.

3.2.2

element normalized level difference

$D_{n,e}$

difference in the space and time average sound pressure level produced in two rooms by a source in one room, where sound transmission is only due to a small technical element (e.g. transfer air devices, electrical cable ducts, transit sealing systems), which is evaluated from

$$D_{n,e} = L_1 - L_2 - \left(10 \lg \left(\frac{A}{A_0} \right) \right) \text{dB}$$

where A is the equivalent sound absorption area in the receiving room, in square metres.

Note 1 to entry: $D_{n,e}$ is normalized to the reference equivalent sound absorption area (A_0) in the receiving room; $A_0 = 10 \text{ m}^2$.

Note 2 to entry: This quantity shall be determined in accordance with ISO 10140-1:2016, Annex E.