SLOVENSKI STANDARD
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Akustika v stavbah - Ocenjevanje akustičnih lastnosti stavb iz lastnosti sestavnih delov - 3. del: Izolirnost pred zvokom v zraku iz zunanjosti (ISO/DIS 12354-3:2016)

Building acoustics - Estimation of acoustic performance of buildings from the performance of elements - Part 3: Airborne sound insulation against outdoor sound (ISO/DIS 12354-3:2016)

Bauakustik - Berechnung der akustischen Eigenschaften von Gebäuden aus den Bauteileigenschaften - Teil 3: Luftschalldämmung von Außenbauteilen gegen Außenlärm (ISO/DIS 12354-3:2016)

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 (ISO/DIS 12354-3:2016)

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91.120.20	Akustika v stavbah. Zvočna izolacija	Acoustics in building. Sound insulation

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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

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

ICS: 91.120.20

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the European Committee for Standardization (CEN), and processed under the **CEN lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

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European foreword

This document (prEN 12354-3:2016) has been prepared by Technical Committee CEN/TC 126 “Acoustic properties of building elements and of buildings”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12354-3:2000.

This document is the second edition of a standard, which forms a part of a series of standards specifying calculation models in building acoustics:

— EN 12354-1, *Building Acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 1: Airborne sound insulation between rooms*;

— EN 12354-2, *Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 2: Impact sound insulation between rooms*;

— EN 12354-3, *Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 3: Airborne sound insulation against outdoor sound*;

— EN 12354-4, *Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 4: Transmission of indoor sound to the outside*;

— EN 12354-5, *Building acoustics — Estimation of acoustic performance of building from the performance of elements — Part 5: Sounds levels due to the service equipment*;

— EN 12354-6, *Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 6: Sound absorption in enclosed spaces*.

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.

Annex A (normative) forms an integral part of this part of EN 12354; Annexes B, C, D, E, F and G are informative.

1 Scope

This draft European Standard 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 according to EN ISO 140-5. Calculations can be carried out for frequency bands or for single number ratings.

The calculation results can be used also for calculating the indoor sound pressure level due to for instance road traffic; this use is treated in the informative Annex E.

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

This revised edition has been updated mainly for normative references (including the sound reduction of joints and slits).

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 12354-1:2016, *Building Acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 1: Airborne sound insulation between rooms*

EN ISO 140-3, *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 3: Laboratory measurements of airborne sound insulation of building elements (ISO 140-3)*

EN ISO 140-5, *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 5: Field measurements of airborne sound insulation of façade elements and façades (ISO 140-5)*

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

EN ISO 10140-1:2010, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 1: Application rules for specific products (ISO 10140-1)*

prEN ISO 16283-3, *Acoustics — Field measurement of sound insulation in buildings and of building elements — Part 3: Façade sound insulation (ISO/DIS 16283-3)*

3 Relevant quantities

3.1 Quantities to express building performance

3.1.1 General

The sound insulation of façades in accordance with EN ISO 140-5 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 EN ISO 717-1, for instance R'_{w}, $D_{\mathrm{ls,2m,nT,w}}$ or $(R'_{\mathrm{w}} + C_{\mathrm{tr}})$.

3.1.2 Apparent sound reduction index $R'_{45°}$

Airborne sound insulation of a building element when the sound source is a loudspeaker and the angle of incidence is 45°. This apparent sound reduction index is evaluated from:

$$R'_{45°} = L_{1,\mathrm{s}} - L_2 + 10\lg\frac{S}{A} - 1{,}5 \text{ dB} \quad (1)$$

where

$L_{1,\mathrm{s}}$ 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.

3.1.3 Apparent sound reduction index $R'_{\mathrm{tr,s}}$

Airborne sound insulation of a building element when the sound source is traffic noise. This apparent sound reduction index is evaluated from:

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

where

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

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

3.1.4 Standardized level difference $D_{\mathrm{2m,nT}}$

The 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. The standardized level difference is evaluated from:

$$D_{\mathrm{2\,m,nT}} = L_{\mathrm{1,2\,m}} - L_2 + 10\lg\frac{T}{T_0}\mathrm{dB} \quad (3)$$

where

$L_{\mathrm{1,2m}}$ is the average sound pressure level at 2 m in front of 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.

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. $D_{\mathrm{tr,2m,nT}}$ or $D_{\mathrm{ls,2m,nT}}$.

3.1.5 Normalized level difference $D_{\mathrm{2m,n}}$

The 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. The normalized level difference is evaluated from:

$$D_{2\,\mathrm{m,n}} = L_{1,2\,\mathrm{m}} - L_2 - 10\lg\frac{A}{A_0}\,\mathrm{dB} \tag{4}$$

where

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

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 $D_{\mathrm{tr,2m,n}}$ or $D_{\mathrm{ls,2m,n}}$.

3.1.6 Relations between quantities

The two **sound reduction indices**, $R'_{45°}$ and $R'_{\mathrm{tr,s}}$, tend to give results with a systematic difference over a large frequency range. The apparent sound reduction index $R'_{45°}$, both for the single number rating and for the lower frequencies, gives results which are 0 dB to 2 dB higher than the results for $R'_{\mathrm{tr,s}}$. $R'_{\mathrm{tr,s}}$ gives values which are comparable to those measured under laboratory conditions. These differences will be taken into account in the calculation model.

The two **sound level differences**, $D_{\mathrm{2m,nT}}$ and $D_{\mathrm{2m,n}}$, are directly related to each other:

$$D_{\mathrm{2m,n}} = D_{\mathrm{2m,nT}} - 10\lg\ 0{,}16\frac{V}{T_0 A_0} = D_{\mathrm{2m,nT}} - 10\lg 0{,}032\,\mathrm{V}\ \mathrm{dB} \tag{5}$$

where

V is the volume of the receiving room, in cubic metres.

It is therefore sufficient to estimate one of these quantities in order to deduce the other. As far as the level differences are concerned the standardized level difference $D_{\mathrm{2m,nT}}$ is chosen in this document as the prime quantity to be estimated.

The measurements with traffic noise or a loudspeaker as noise source tend to give results which are equal without a systematic difference. So:

$$\mathrm{D}_{\mathrm{tr,2m,nT}} \approx \mathrm{D}_{\mathrm{ls,2m,nT}}\ \mathrm{dB} \tag{6}$$

The sound level difference of a façade is related to the sound reduction index. The model for the sound level difference therefore is linked to the model for the sound reduction index.

3.2 Quantities to express element performance

3.2.1 General

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 EN ISO 717-1, for instance $R_{\mathrm{w}}(C;C_{\mathrm{tr}})$ and $D_{\mathrm{n,e,w}}(C;C_{\mathrm{tr}})$.

3.2.2 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:

$$R = 10 \lg \frac{W_1}{W_2} \ \mathrm{dB} \tag{7}$$

This quantity shall be determined in accordance with EN ISO 10140-1:2010, Annexes A, B, C and D.

3.2.3 Element normalized level difference $D_{\mathrm{n,e}}$

The 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). $D_{\mathrm{n,e}}$ is normalized to an equivalent sound absorption area (A_{o}) in the receiving room; A_{o} = 10 m².

$$D_{\mathrm{n,e}} = L_1 - L_2 - 10 \lg \frac{A}{A_0} \ \mathrm{dB} \tag{8}$$

This quantity shall be determined in accordance with EN ISO 10140-1:2010, Annex E.

3.2.4 Sound reduction improvement index *ΔR*

The difference between the sound reduction indices of the basic element with and without the lining.

$$\Delta R = R_{\mathrm{with}} - R_{\mathrm{without}} \ \mathrm{dB} \tag{9}$$

This quantity shall be determined in accordance with EN ISO 10140-1:2010, Annex G.

3.2.5 Sound reduction index of joints or slits R_{s}

The 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 through the joint or the slit. R_{S} is normalized to the length l of the joint or slit and the equivalent sound absorption area A in the receiving room, with S_{o} = 1 m² and l_{o} = 1 m.

$$R_{\mathrm{s}} = L_1 - L_2 + 10 \lg \frac{S_o \cdot l}{A \cdot l_{\mathrm{o}}} \tag{10}$$

This quantity shall be determined in accordance with EN ISO 10140-1:2010, Annex J.

3.2.6 Other relevant data

For the calculations additional information on constructions could be necessary, e.g.:

— the shape of the façade;