CE Marking of Road Traffic Noise Reducing Devices (RTNRDs)

Extendibility criteria for type testing results

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Based on Technical Standard UNI11338

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Summary

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1 Foreword

ENBF is a European association representing the umbrella of traffic noise barriers manufacturers at European level.

The traffic noise barrier is a product to be installed alongside road infrastructure in order to reduce the impact of the excessive noise generated by road traffic.

This product is placed on the market with CE marking based on a set of type testing results.

The present document is the results of crossed experience of both noise barriers manufacturers and notified bodies: ENBF intends to bring attention on the extendibility criteria for type testing results.

The final draft of this document is brought to the attention of ENBF members, Notified Bodies and other stakeholders.

2 Scope

This report concerns the European product standard EN 14388 for the CE marking of Road Traffic Noise Reducing Devices. Therefore, it is of interest for industry providers, installers, designers, buyers and certification laboratories.

Several versions of the above standard have been released by CEN in the recent years. The last version that has been harmonized and published on the OJEU is the EN 14388:2005. This version is then the reference document for CE marking of the product.

Nevertheless, the above mentioned harmonized standard is based on the Construction Product Directive (Council Directive 89/106/EEC) that has been replaced by the Construction Product Regulation (CPR) 305:2011. The CPR clearly identifies the performance that has to be declared for the product placed on the market and set a clear distinction between the performance declared for the product and the "requirement to be met" by the construction where the product is incorporated.

Different roles of manufacturers and notified bodies (or laboratories) are set by the AVPC system (assessment and verification of constancy of performance). Different AVCP system are adopted for different products. For the Road Traffic Noise reducing Devices the AVPC system 3 applies: the manufacturer establishes the DoP on the basis of tests performed by a Notified Laboratory. The manufacturer is also responsible for the Factory Production Control (FPC) necessary to guarantee the constancy of the performances declared.

The Declaration of Performance and the Factory Production Control allow the CE marking of the product to be placed on the market.

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With the CE marking the manufacturer takes the responsibility of the conformity of the product to the declared performance as the major responsible for the CE marking process.

When changes or variations are made on the product (RTNRD) the manufacturer is requested to update the values of performances declared. It may happen that some performances are not affected or augmented by the variations made. In such situations the manufacturer may choose not to repeat the tests in line with the principle of avoiding excessive burden for certification (art.34 of the CPR).

The scope of this document is that of providing criteria for the extension of performances declared to the modified product.

An analysis is provided for different product types (essentially acoustic elements) and a relationship is established between the type of changes or modifications and the performances declared.

The document is based on the experience of manufacturers and notified laboratories having a well-established experience in RTNRDs.

3 Terms and definitions

noise reducing device (NRD)
A noise reducing device is a device that is designed to reduce the propagation of traffic noise away from the road environment. This may be a noise barrier, cladding, a road cover or an added device. These devices may include both acoustic and structural elements.

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

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

noise barrier
Noise reducing device, which obstructs the direct transmission of airborne sound emanating from road traffic.

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

cover
Noise-reducing device, which either spans or overhangs the highway.

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

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combined safety and noise barrier
traffic safe noise reducing device which fulfils all the requirements for safety barriers in a given containment class as defined in EN 1317-2

Characteristic wind load
Actions due to wind forces in accordance to EN 1991-1-4

Non-vertical noise barrier
Noise barrier or a part of it (e.g. cantilever) which has a vertical inclination more than 15°degrees

4 Normative references

The following referenced documents are indispensable for the application 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 1793-1:2020, *Road traffic noise reducing devices - Test method for determining the acoustic performance – Part 1: Intrinsic characteristics of sound absorption under diffuse sound field conditions*

EN 1793-2:2020, *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 1793-4:2020, *Road traffic noise reducing devices - Test method for determining the acoustic performance – Part 4: Intrinsic characteristics - In situ values of sound diffraction*

EN 1793-5:2020, *Road traffic noise reducing devices - Test method for determining the acoustic performance – Part 5: Intrinsic characteristics - In situ values of sound absorption under direct sound field conditions*

EN 1793-6:2020, *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*

EN 1794-1:2020, *Road traffic noise reducing devices - Non-acoustic performance – Part 1: Mechanical performance and stability requirements*

EN 1794-2:2020, *Road traffic noise reducing devices - Non-acoustic performance – Part 2: General safety and environmental requirements*

EN 14389-1:2020, *Road traffic noise reducing devices - Procedures for assessing long term performance – Part 1: Acoustical characteristics*

EN 14389-2:2020, *Road traffic noise reducing devices - Procedures for assessing long term performance – Part 2: Non-acoustical characteristics*

hEN 14388:2005, *Road traffic noise reducing devices - Characteristics*

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EN 14388:2015, *Road traffic noise reducing devices - Characteristics*

EN 1990:2002/A1:2005, Eurocode - Basis of structural design

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

5 Extendibility criteria for type testing results

In present chapter criteria are given for the extension of declared performance values for the following product types:

- metallic kasset panels
- wooden kasset panels
- transparent elements (PMMA, polycarbonate or laminated glass) equipped with a metallic frame
- concrete panels

The above listed products are most used on the European market. The list is to be considered non exhaustive and can be implemented for new products types.

A brief explanation of the criteria used for the extension of declaration is given in the following chapters.

In order to facilitate and standardize the extendibility procedure of the declaration of performance, the annex A presents a list of extendibility criteria per homogenous category of products.

Each table corresponds to a specific type of acoustic element, as listed above.

Each table is arranged in rows and columns where:

- in the rows performances are reported for which the declared value can be extended;
- columns report the technical characteristics that, in case of variation, have a potential impact on the single performances.
- symbols shown at single intersection have the following meaning:

X test repetition is required for any variation of the technical characteristic

- test repetition is not required for any variation of the technical characteristic

↑ the increase of the technical characteristic leads to an improvement of the performance determined.

↓ the increase of the technical characteristic leads to a deterioration of the performance determined.

Grey optional tests

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An explanation is also given for the modifications of the technical characteristics that are often required for the products. (i.e. change of material, change of thickness, modification of density, modification of gasket arrangement..)

This often requires the intervention of the Notified Laboratory to evaluate the need of repeating test already performed.

Extension criteria are based on the principle of the family of products where samples can be identified with a degree of performances lower than the others products of the same family (conservative criteria). In this case the results of the tests and assessments are applied to all the products of the same family.

For each new product, but similar to one already tested via ITT, the manufacturer have to ensure that the test parameters are positively influenced by the production system: in this case the manufacturer is not obliged to submit the product for new ITT and he can use the results of the test already made.

The key criteria to be met in order to avoid undergoing several initial type tests, it is to declare the minimum value of performance reachable for each family product.

The Manufacturer is the only responsible for the extendibility of the declaration of performance for a family product and at this purpose he relies on the opinion of a certified laboratory.

5.1 Sound Insulation

Sound Insulation is directly correlated to the mass per unit area.

The greater the mass is, the better is the expected performance of sound insulation.

For example:

for a concrete anti-noise panel made with a load-bearing layer in reinforced concrete and a layer in light cement based material, the variations in the geometry and composition of the light cement based layer are negligible when sound insulation performance is being evaluated.

The variation of the type of perforation of the sheet of a metallic kasset panel or the variation of the spacing of the strips for a wooden panel are negligible for the purposes of evaluating the performance.

On the other hand, the modification of the gaskets or the variations of the structural component (beam or post) can have effects that cannot be foreseen a priori. In particular, the use of metal profiles of the HEA / HEB type which holds panels that require specific thickness compensation systems, could lead to a decrease in sound insulation at the panel - metal profile junction.

The test must therefore be repeated for at least one type of increased metal profile to verify the effectiveness of the compensation system. The measured value can then be extended to combinations with other metal profiles of the same family (HEA 140, 160, 200, ...).

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The acoustic insulation performance can be assessed in the direct and diffuse fields. Above considerations are valid for both test conditions.

5.2 Sound absorption/reflection

Sound absorption is priorly correlated to the package of porous / fibrous materials used in the panels. Boundary constraints of transparent sheets can affect the sound-absorbing capacity at low frequencies in a way that cannot be foreseen a priori. Taking into account the A-weighted road traffic spectrum, this effect is generally negligible in the calculation of the single index for evaluating the performance to be declared.

The following considerations apply.

The test must be repeated when a change occur for the total thickness of the entire panel.

For wooden barriers, the test must also be repeated in the case of modification of the width and spacing of the strips.

The increase of the thickness of the sound-absorbing material leads to an increase in performance, whilst a change in the volume of the mass has an uncertain outcome.

The increase in the number of joints between the panels (due for example to the choice of panels with reduced length or height) leads to an increase in the portion of the surface without sound-absorbing properties and can lead to a reduction of the performance determined.

Changes in the fiber glass foil covering fibrous materials (e.g. rockwool) can have significant effects, to be evaluated experimentally.

For concrete acoustic elements, the variation in the thickness of the load-bearing layer has no effect on sound absorption. The increase of the thickness of the light cement based layer increase the performance.

Changes in granulometry / volume mass as well as the shape of the slats have an uncertain outcome. The increase in the height of the slats leads to an increase in the overall sound-absorbing surface.

The sound absorption performance can be assessed in the direct field (reflection) and in the diffuse field (absorption). Although with a quantitatively different extent, the above considerations apply to both test conditions.

5.3 Wind Load

The resistance of the panel acoustic component to wind load is determined with a static load test. It is possible to extend the measurement results with a calculation method, for example with an FEM (Finite Element Method) model calibrated on the experimental results.

It is generally observed that for the types of metal panels, the increase in the thickness of the sheets and the decrease in the percentage of perforated surface lead to an improvement in the resistance characteristics.

Structural assessments can be carried out without taking into account the contribution of the internal porous / fibrous panel. However, it should be noted that the increase in the

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volume mass of the sound-absorbing material increases the rigidity of the panel with possible increase of mechanical resistance.

Similarly, the resistance increases with the thickness of the transparent PMMA sheets or with the thickness of the load-bearing layer in the concrete panels.

The change of the constraint system between panel and beam requires careful evaluation with tests and structural calculation models.

5.4 Dead load (self-weight)

Without prejudice to what is indicated in paragraph 5.3, changes in the internal porous / fibrous material may lead to a different degree of impregnation for rainwater and consequently a change in wet weight.

5.5 Snow load

The same applies as indicated in point 5.3 relating to wind load.

5.6 Risk of falling debris

The same applies as indicated in point 5.3 relating to wind load.

For monolithic glass or laminated transparent barriers, the behavior in the event of an impact is difficult to predict and a repeat of the test is usually required as the characteristics change. For glazed sheets according to UNI 7697, the use of products with P3A classification is envisaged for road applications.

For metal and wooden panels, the decrease in the number of joints (small panels) is to be considered as an improvement for the performance evaluation.

For concrete panels, fragmentation in the event of a collision can take place based on the type of lightened layer adopted.

5.7 Shocks caused by stones

The same applies as indicated in point 5.3 relating to wind load.

For the transparent glass barriers, the heat treatment adopted is influential. Based on the UNI technical standard, it is generally requested to repeat the test when caratheristcs changes.

For metal panels, the decrease in the percentage of perforated surface is to be considered as an improvement for the performance evaluation.

For concrete panels, damage to the affected surface can occur based on the type of lightened layer adopted.

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5.8 Resistance to brushwood fire

Except for plastic materials, increases in thickness or volume mass generally lead to an improvement in performance.

For metal panels, the decrease in the percentage of perforated surface is to be considered as an improvement for the performance evaluation.

The type of fiberglass for the protection of fibrous materials (mineral wool) as well as the bonding method influence this performance in an unpredictable way.

The sealing gaskets influence the evaluated performance if they are present horizontally between one panel and another.

For concrete panels, the test result does not depend on the thickness and grain size of the porous layer. The elements that has an influence on the tests are: the type of material used for the lightened layer, the geometry and orientation (horizontal or vertical) of the slats.

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Annex A

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Table A.1 – Extendibility criteria for metallic noise kasset panels

	Thickness of opaque elements	Sound-absorbing typology	Sound-absorbing thickness	Sound-absorbing volume mass	%of perforated surface	Number of horizontal joints	Fiberglass protection	Finishing's colour
Sound Insulation	↑	**-** (if the surface mass does not decrease)	↑	↑	↓	↓	**-**	**-**
Sound absorption	**X**	**X**	↑	**X**	**X**	↓	**X**	**-**
Wind load	↑	**-**	↑	↑	↓	↓	**-**	**-**
Dead load (self-weight)	↑	**-**	↑	↑	↓	↓	**-**	**-**
Snow load	↑	**-**	↑	↑	↓	↓	**-**	**-**
Risk of falling debris	↑	**-**	**-**	**-**	↓	↓	**-**	**-**
Light Reflection	**-**	**X**	**-**	**-**	↑	**-**	**X**	**X**
Shocks caused by stones	↑	**-**	**-**	↑	↓	**-**	**-**	**-**
Resistance to brushwood fire	↑	**X**	**↑(wool) ↓(polyester)**	↑	↓	**-**	**X**	**-**

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Table A.2 - Extendibility criteria for wooden noise kasset panels

	Thickness of opaque elements	Sound-absorbing typology	Sound-absorbing thickness	Sound-absorbing volume mass	Number of horizontal joints	Fiberglass protection	Finishing's colour
Sound Insulation	↑	- (if the surface mass does not decrease)	↑	↑	↓	-	-
Sound absorption	X	X	↑	X	↓	X	-
Wind load	↑	-	-	-	↓	-	-
Dead load (self-weight)	↑	-	-	-	↓	-	-
Snow load	↑	-	-	-	↓	-	-
Risk of falling debris	↑	-	-	-	↓	-	-
Light Reflection	-	X	-	-	-	X	X
Shocks caused by stones	↑	-	↑	↑	-	-	-
Resistance to brushwood fire	X	X	↑(wool) ↓(polyester)	↑	-	X	-
Fire resistance	X	X	X	X	-	x	

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Table A.3 Extendibility criteria for transparent elements of the PMMA, polycarbonate or laminated glass type

	Thickness of panels	Structure of panels	Numbers of horizontal and/or vertical
Sound Insulation	↑	**X**	↓
Wind load	↑	**X**	↓
Dead load (self-weight)	↑	**X**	↓
Snow load	↑	**X**	↓
Risk of falling debris	**X**	**X**	↓
Shocks caused by stones	↑	**-**	**-**
Resistance to brushwood fire	**-**	**-**	**-**
Fire resistance	**X**	**X**	**-**

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Table A.4 – Extendibility criteria for cement based noise panels

	Thickness of the beam layer	Type of grain size for the sound-absorbing layer	Geometry of sound-absorbing layer	Number of horizontal joints	Colour / type of Finishing
Sound Insulation	↑	-	-	↓	-
Sound absorption	-	X	↑	↓	-
Wind load	↑	-	-	↓	-
Dead load (self-weight)	↑	-	-	↓	-
Snow load	↑	-	-	↓	-
Risk of falling debris	X	X	X	↓	-
Light Reflection	-	X	X	-	X
Shocks caused by stones	-	X	X	-	-
Resistance to brushwood fire	-	X	-	-	-

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