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THE SOUND CLASSIFICATION SCHEME OF BUILDINGS AS A LITHUANIAN REGULATION FOR PROTECTION AGAINST NOISE: 10 YEARS USAGE EXPERIENCE

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Abstract. Different needs for quietness in working and living environment can be expressed by introducing classification scheme defined as a set of minimum two classes with different limit values for acoustical performance. One of the first approach to develop classification schemes to describe acoustic comfort in buildings have been presented in Germany as a VDI 4100 standard. Some years later Nordic countries initialized project looking to developed and standardized acoustic classification scheme for dwellings. Results obtained during this project were implemented on a national level in Sweden, Norway, Denmark, Iceland and Finland as standards for sound classification schemes of appropriate acoustic comfort in different purpose buildings. Looking for the best approach in Lithuania how to implement essential requirement "protection against noise" at construction works [1], sound classification scheme was too developed in 2003. It was put in a force as a technical regulation STR 2.01.07:2003 [2] and linked to a building code. Conception of this document take into account the main idea related to provisions of the Nordic country INSTA project and, additionally, results of local investigations [3]. It is applicable to different kinds of buildings and in general describes sound insulation requirements between noise sensitive areas, for example between flats in multi-storey or row housing. Additional advantage of the classification scheme is a possibility to take into account different needs in acoustic comfort level and to design buildings with optimal sound insulation quality. For real estate developers it opens possibility to switch to better acoustical comfort conditions just by voluntary application as requirement limit values are presented in the higher sound class.

Developing the first sound classification scheme for buildings in Lithuanian comparative studies of sound insulation performance with link to sociological research results were used to justify the number of sound classes and level step between the classes. Lithuanian classification scheme comprises five acoustic comfort classes – A, B, C, D and E. The highest (best) sound class is A and it comprises limit values to ensure lowest possible noise levels in protected premises. Fulfilment of requirements comprised in this class ensures full acoustical comfort in the case of loud neighbours as well for sensitive persons.

Acoustical requirements expressed by the C sound class limit values correspond to the least acceptable acoustic comfort level. The lowest (worst) sound class is E and it comprises limit values corresponding to the acoustical comfort level in buildings erected when sound insulation requirements were different. It is applicable only to renovated buildings when improvement of protection against noise quality is economically falsified. Availability of two different sound classes intended to use for new and existing buildings show necessity to have at least two enhanced acoustic performance classes – B and D. New possibilities to influence acoustic quality of buildings gives the E sound class requirements, which are applied when it is unreasonable and uneconomic to pursue modern requirements. During design renovated buildings it is recommended to evaluate the possibility of ensuring better quality by D sound class. Because of this reason the step in limit values between different classes is not constant and depends from changes in acoustical demands during the time. Class D sound insulation demands corresponds to limit values introduced since 1977, while class E represent an average performance estimated from testing in old buildings.

For each sound class are defined airborne and impact sound insulation, reverberation time and environmental noise limit values. Sound classes are applicable for newly designed multi-storey dwellings, double-apartments, blocks of multifamily housing, and some non-residential buildings with noise-sensitive indoor environment [4, 5].

Classification schemes have two applications – in order to describe legal requirements for protection against noise in buildings and also as a tool to select in practice suitable acoustic comfort. A significant amount of differences is observed when comparing up to date applied classification schemes in ten European countries [6]. There are differences of the class number and the intervals between classes. In some countries the classification schemes are for voluntary application and exist as technical backup for testing particulary on approved construction.

Concerning the descriptors used in sound classification schemes - differences also exist, both for airborne (R'_w, $D_{nT,w}$ or $D_{n,w}$) and impact ($L_{nT,w}$ or $L_{n,w}$) sound insulation [7]. It is found that for in-situ measurement situations the most appropriate way is to apply both descriptors R'_w and $D_{nT,w}$ for airborne sound insulation evaluation for partitions between dwellings [8] as far the

$L_{nT,w}$ and $L_{n,w}$ – for impact sound. It also concerns the application of adaptation terms C, C_{tr} accounting the insulation performance in low frequency range. Most complicated situation represents the sound classification of building façade, because it based on relation with the environmental noise metric. So the façade classification depends on the appropriate descriptor [L_{den} (L_{dn}), L_{max}, etc.] for environmental noise assessment used.

For enforcement legal requirements expressed through mandatory sound class C for new dwellings and E for renovated buildings from 2007 pre-completing testing becomes mandatory. Regulations require carrying out pre-completing test to demonstrate conformance with all requirements presented in particular sound class. Due to development of Lithuanian sound classification scheme, more strict requirements could be voluntary applied to low-rise dwellings by application of acoustic classes designed for the high-rise apartment buildings. Investigations of results collected during the pre-completing acoustic testing of new erected or renovated buildings in Lithuanian allowed to enhance the real insulation between dwellings from 50–52 dB to 55–56 dB for airborne sound and from 60 dB to 53 dB for impact sound. Pre-completing testing gives additional values by dissemination useful information for designers about constructions and materials used to provide the required acoustic comfort.

Keywords: classification scheme, acoustic comfort, sound class, sound insulation.

References

[1] Regulation (EU) No 305/2011 of the European parliament and of the council of 9 March 2011 laying down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC, *Official Journal of the European Union* 4.4.2011.

[2] STR 2.01.07:2003 *Pastatų vidaus ir išorės aplinkos apsauga nuo triukšmo*. (Lithuanian building regulations. Protection against noise in buildings). Lithuania: Lietuvos Respublikos Seimas, 2003.

[3] Jagniatinskis, A. 2003. Relationship between draft Lithuanian regulation "Protection against noise" and Nordic standards, *Ultragarsas* 2 (47): 106-108.

[4] Jagniatinskis, A.; Mickaitis, M.; Fiks, B. Development classification scheme for evaluation dwellings sound insulation performance in Lithuania // Procedia Engineering. *11th international conference on modern building materials, structures and techniques (MBMST), May 16-17, 2013, Vilnius, Lithuania*. Amsterdam: Elsevier Science Ltd, 2013. ISSN 1877-7058. 2013, Vol. 57, p. 443–449.

[5] Jagniatinskis, A.; Fiks, B.; Girnius, V. 2007. Airborne sound insulation performance of lightweight partitions for dwellings // *The 9th international conference "Modern building materials, structures and techniques": selected papers, May 16-18, 2007 Vilnius, Lithuania. Vol. 3*. Vilnius: Technika. ISBN 9789955282006. p. 1186-1190.

[6] Rasmussen, B. Sound insulation between dwellings – Requirements in building regulations in Europe, 2010. *Applied Acoustics* 71(4), 373–385. http://dx.doi.org. /10.1016/j.apacoust.2009.08.011.

[7] Jagniatinskis A., Fiks B. Application of different descriptors for in situ sound insulation. *InterNoise2004*. Praha. PaperID 609.

[8] Jagniatinskis, A.; Fiks, B. Misunderstandings about airborne sound insulation quality estimated in-situ with different descriptors // *Acta acustica united with acustica*. EURONOISE 2009 : 8th European conference on noise control, Edinburgh, Scotland, 26-28 October 2009 / The European Acoustics Association (EAA) Stuttgart : S. Hirzel Verlag. ISSN 1610-1928. Vol. 95, suppl. 1 (2009), p. 104.