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METHOD FOR ASSESSING THE IMPACT OF AGING OF SELECTED BUILDING MATERIALS ON THEIR ACOUSTIC PROPERTIES

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ABSTRACT

The aim of the work is to assess the impact of aging on selected different building materials. Natural climatic exposures of building materials result in the deterioration of their acoustic properties. Laboratory tests performed on small samples, including acoustic tests correlated with climatic exposures in laboratory conditions, will allow for the assessment of the durability of the functional properties of building materials at the stage of introducing the product to the market. Assessment of the durability of acoustic properties of building materials is to consist in changes in acoustic parameters as a result of exposing samples to various weather conditions. This paper presents the results of preliminary tests carried out on small samples in an impedance tube. Based on the tests performed, an analysis of the results will be carried out in terms of the impact of exposure on the acoustic properties of the elements, mainly in terms of parameters specific to road screens..

Keywords: *aging, building materials, sound properties)*

1. INTRODUCTION

The assessment of the durability of the acoustic properties of road noise barriers is one of the elements in evaluating the functional performance of these structures. Currently, there are standards related to such assessment; however, they remain very general and describe the evaluation procedure in an ambiguous manner

Various approaches have been proposed in the existing literature, yet a clearly defined and standardized methodology is still lacking. Each of the considered proposals exhibits both advantages and shortcomings. To date, methods have primarily focused on testing elements already installed and exposed to natural environmental factors [1]. However, such methods are not suitable for application at the stage of product introduction to the market.

Large-scale sample testing has been undertaken, for instance, at the Silesian University of Technology, where the first assessments of the durability of road noise barriers were performed on samples with a surface area of approximately 5 m². This is the only study of this kind currently referenced in the literature [2].

Numerous publications address the ageing of construction materials and their impact on the acoustic properties of building components. Nonetheless, these studies do not concern road noise barriers and do not account for parameters directly related to this product – namely, the DL_R and DL_α indices [3,4].

The innovation of the proposed methodology lies in the use of small samples, approximately 15 cm² in size. This approach enables broader application, particularly under various environmental exposure conditions. Although previous literature indicates certain correlations between the absorption properties of large and small samples, the studies do not specifically address parameters associated with the evaluation of road noise barriers. [5,6]

2. EXPERIMENTAL WORK

The assessment of the durability of the acoustic properties of the barrier is to be based on the change in acoustic parameters resulting from exposing the samples to various atmospheric conditions: alternating UV radiation and rain, UV and condensation-based humidification, elevated temperature, heating–raining cycles and humid atmosphere.

The preliminary research were conducted on the simple samples: mineral wool with cover made of textile.

Based on the conducted tests, the results will be analyzed in terms of the impact of environmental exposure on the

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acoustic performance of the elements – see the test cycle on the fig. 1.

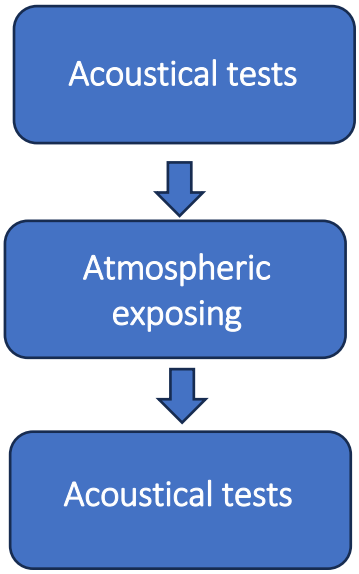


Figure 1. The cycle of test.

Sound absorption tests were carried out in accordance with PN-EN ISO 10534-2 [7], and airborne sound insulation was assessed based on ASTM E1050 [8] and ASTM E2611 [9] standards. Both tests were performed in the impedance tube (see Fig.2).

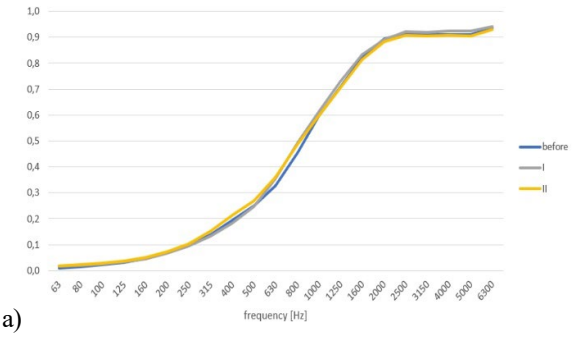
Figure 2. Impedance tube used for measurement of the acoustical parameters

Figure 3. Atmospheric exposing

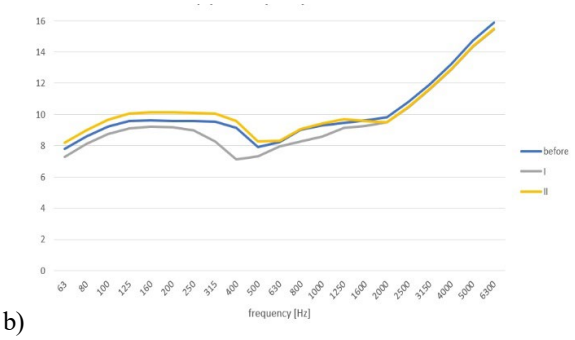
Atmospheric exposing was performed in the following setups:
Setup I – UV + rain: 336 cycles according to EN ISO 4892-3 [10],
Setup II – Temperature and humidity: 1008 hours according to TR024 [11].
Figure 3 presents the samples during atmospheric exposure.

3. RESULTS AND DISCUSSION

Figure 4 presents sound absorption and sound insulation of the samples before and after atmospheric exposing. It is seen, that applied exposing to the mineral wool doesn't change it's acoustical properties.



a)



b)

Figure 4. Sound absorption (a) and sound insulation (b) of samples before and after atmospheric expositions I and II

The results presented above are consistent with the findings reported by Nowoświat et al. [2]. They conducted similar tests on large samples with a surface area of 5 m², which were exposed to heat, cold, and rain. A total of 1000 exposure cycles were performed. Comparable changes in the parameters characterizing road noise barriers were observed — either no change or a decrease of 1 dB. These parameters are presented in Table 1. It means, that the sample size has no influence on this type of researches.

Table 1. Table captions should be placed above the table.

Acoustical parameter	ΔDL_R	ΔDL_α
Setup I	0 dB	0 dB
Setup II	0 dB	0 dB

4. SUMMARY

The method of assessing the impact of aging on selected different building materials and it's acoustical parameters. The preliminary research were conducted on the simple samples: mineral wool with cover made of textile. The applied cycle test included acoustical test of sound absorption and sound insulation with atmospheric exposing. Results confirm previous findings, that there is no influence despite of the sample size.

Future studies will involve samples made from different materials. It is also worth noting the duration of the exposure tests conducted so far, which correspond to approximately five years of natural environmental ageing. The standard requires data after 5, 10, 15, and 20 years of exposure. In the coming years, further research will be undertaken to address these timeframes.

5. REFERENCES

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