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Determination of Insertion Loss of Acoustic Barriers under Specific Conditions

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Abstract

The World Health Organization the noise from road traffic composes as a main contribution in the total environment noise. In suburbia areas near the highways road traffic produce especial high noise levels. The acoustic barriers along the roads are designed to reduce this noise impact in protected against noise areas. The effectiveness of such barriers is expressed by "insertion loss" descriptor and determined from an in-situ measurement according to ISO 10847 standard that cover only typical in-situ situations. But there are some cases when the additional efforts are needed for adequate/realistic insertion loss determination. When, local connection road is constructed inside the barrier protected area and noise from this road mask the sound penetrating through the barrier from the highway. In such case insertion loss cannot be measured directly by standard procedure. In such specific conditions the application of provisions of the ISO 1996 series standards can be adopted to highway's noise extraction from total environmental noise measured inside protected area. The appropriate methodological solutions of discussed problems with the practical results of in-situ experimental measurements are presented.

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Keywords: road traffic noise, specific noise, acoustic measurements, sound exposure

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1. Introduction

Road traffic noise by the World Health Organization (WHO) [1] contributes mainly to the environmental noise pollution. One of the noise abatement measures is to build across the roads (highways) noise barriers that separate roads from protected areas of environment. Such barriers design for various environmental conditions is a complicated task [2, 3] especially when acoustic effectiveness together with construction cost are considered [4]. The problems concerned to the determination of effectiveness of various form of noise barriers are studied also in [5–7] applying in situ measurements [5] as well as the modeling technique [6, 7]. The acoustic effectiveness of noise barriers is described using "insertion loss" descriptor D_{IL} and determined from an in-situ measurement according to the ISO 10847 standard [8]. By standardized method barrier insertion loss is calculated as a difference between simultaneously measured noise levels on reference microphone position and interested environmental site point with following subtraction of so-called environmental correction. The last one is analogously determined as a difference or just for this site before the barrier is erected or in the similar environmental site without barrier.

The usage provisions of ISO 10847 sometimes are complicated when in the interested site point exist a relatively high background (or extraneous) noise level. Such level may be caused by common noise situation in the protected area (especially when the distance to the noise barrier is relatively large) or when the local connection road is constructed inside the barrier protected area. In last situation the noise penetrating through the barrier is an object for measurements. But, it is evident that noise from this road masks in some time intervals sound penetrating through the barrier and insertion loss cannot be determined directly by standard procedure.

In such specific conditions the application of provisions of the ISO 1996 series standards [9, 10] can be adopted to the highway's noise extraction from total environmental noise measured inside protected area. In presented paper the case study of connection road constructed inside the barrier protected area is studied. Correspondingly the disturbing noise generated by traffic from local road, what make problems for barrier insertion loss determination, is focused in this paper only.

2. Environmental situation description

View of the case study site is presented in Fig. 1.

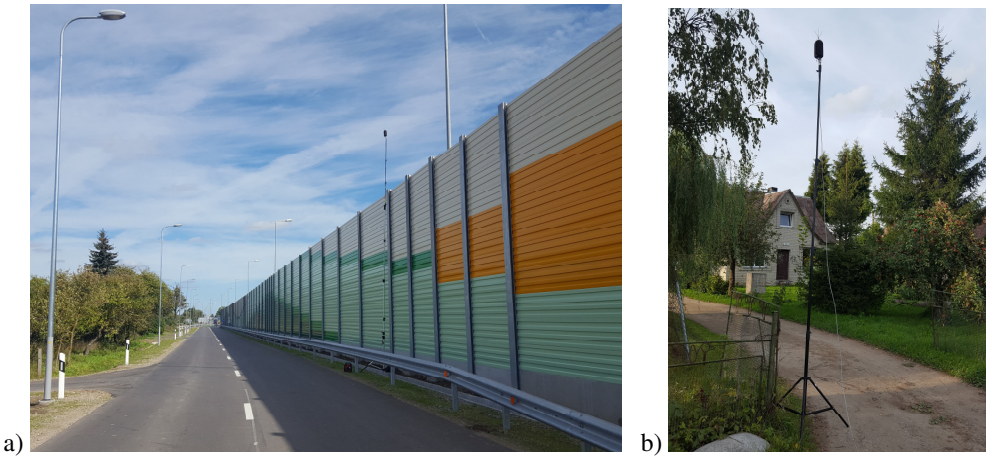

Fig. 1. Local connection road in the noise protected area and reference microphone point above the barrier (a); interested site point with 4 m height microphone (b).

In presented experimental site the height of the barrier is 5 m and the investigated point in protected area is placed 30 m from the barrier. For comparison in second investigated analogous site the height of the barrier was 6 m and the investigated point in protected area is placed at the 20 m distance from the barrier.