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# EFFECTIVE NOISE REDUCTION BY A NEW-SHAPED NOISE BARRIER

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## ABSTRACT
During modernization of a railway line in Hungary, the claim for noise protection of the dwellings along the railway has arisen. The noise immission, originating from railway transport, was 71 $L_{Aeq}$ dB at night, at the dwellings. The goal was to reduce noise immission by at least 16 dB. In this case the only possible solution for noise abatement was to build a noise barrier. However, based on the experiences of recent years, a noise reduction of only 13-15 dB can be achieved by a noise barrier. To guarantee required noise reduction there has been a new construction planned which contains a noise barrier and an octahedron-shaped structure. In the following, the results of laboratory and field investigation and measurements on this new-shaped noise abatement barrier are given account of.

## 1 - INTRODUCTION
During modernization of the Budapest-Hegyeshalom railway line, the claim for noise protection of the Tata-Tóvároskert residential buildings alongside the railway line has arisen.
To the north of Tata-Tóvároskert railway station, in the distance of 10.5-20 m from the axis of the railway track, there are 1-2-storied family residences. In the environment of these buildings, the competent noise load originating from the railway traffic was 71 dB at night, which meant that the railway-originated noise load would have to be reduced by at least 16 dB.
In this particular case, noise reduction can only be performed by means of noise abatement walls. No other methods can be used. Based on the passed years' experience, it has been proven that only a maximum of 15-16 dB of noise reduction can be achieved by means of noise abatement walls. So we have planned a modern solution to reach the goal.

## 2 - THE EFFECT OF THE SHAPE OF NOISE ABATEMENT WALLS ON THE INSTALLATION LOSS
Recently, mainly in order to improve noise abatement walls' acoustic efficiency, a number of studies have taken place to reveal the connection between the noise abatement wall's shape and the attainable installation loss.
Italian TUBOSIDER have developed a noise absorbing "pipe" installable to the top of the wall. Results of their examinations are summarized below [1].
In studies till now, auxiliary noise abatement had been installed on a given noise abatement wall. However, due to the above-mentioned, a claim for a study to examine the reductor's effects compared with a flat noise abatement wall of the same height has arisen.

## 3 - "LABORATORY" EXPERIMENTS WITH REDUCTOR INSTALLED ON NOISE ABATEMENT WALL
During our laboratory experiments, we performed different examinations on a Schober noise abatement wall with TUBOSIDER reductor pipe installed onto.
Measurement and evaluation of the classifying installation loss ($D_{bM}$) were performed according to the Hungarian standard No. MSS 13-121-1:1992, entitled "Noise abatement establishments. Acoustic classification study" [2].
To demonstrate the reductor-pipe's effects, we performed the study according to the below-mentioned.
We studied the installation loss of walls consisting of

- 8 m long, 3 m high Schober 4. type noise abatement wall with 6 m long, 0.4 m high wall element of the same construction installed onto;
- 2.8 m long, 3 m high Schober 4. type noise abatement wall with 6 m long, in- diameter 0.4 m TUBOSIDER reductor pipe.

The study took place in a concrete-surfaced, open place. The configuration of measurement is demonstrated in Fig. 1.
Section and construction of the TUBOSIDER reductor is demonstrated in Fig. 2.
Classifying installation loss:

- barrier+wall element: $D_{bM}$ = 20,3 dB
- barrier+pipe: $D_{bM}$ = 24,3 dB

Installation loss values ($D_{bM}$>15 dB) prove that both walls are suitable.
Compared the two wall constructions with each other, the following can be stated:

- In the frequency range of 160-800 Hz and 2.5-3.15 Hz, TUBOSIDER reductor pipe gives larger installation loss values than the flat wall of the same height. That is why it is appropriate if the goal is to reduce noise of these frequencies.
- Installation loss difference of the given configuration is 4 dB so, in case of large noise path differences, wall with reductor pipe gives more noise reduction than flat wall of the same height, if installed close to the noise source.

## 4 - NOISE REDUCTION RESULTS BY MEANS OF WALL WITH REDUCTOR ALONG RAILWAY LINES

Along the section studied, there had been a Schober type, absolutely absorbing, 3-4.5 m high noise abatement wall installed. In order to reduce noise abatement wall height and achieve as low noise load as possible, a 207 m long TUBOSIDER noise absorbing reductor was installed onto the noise abatement wall along the critical part, instead of heightening the wall.
After installing the noise abatement wall, on the one hand, we studied the reductor's effects, on the other, we measured noise load in the environment of the buildings to be protected.
We performed long-time measurement in the reference point too, that is to say, we measured SEL value originating from trains passing then determined equivalent noise level relating to measurement time. In the measurement point, we did the same. We formed the difference of the reference point's and the measurement points' equivalent A-levels relating to the same time.
During the evaluation, we determined competent night noise load relating to every single measurement point, and, in addition, we made a spectrum analysis in order to compare them.
Competent noise load in the distance of d=25 m $L_{AM}$ (night) = 65,3 dB.
We performed on-the-spot measurements both after building up the Schober noise abatement wall, before installing reductor, and after reductor had been installed.
In the measurement points mentioned above, we recorded tapes in case of 10 freight and 10 passenger trains passing and evaluated the tapes in laboratory.

| dB | Ground floor | | 1. floor | | Reference point | |
|---|---|---|---|---|---|---|
| | $L_{eq}$ | $L_{AM}$ | | $L_{AM}$ | $L_{eq}$ | $L_{AM}$ |
| Without pipe | 45,0 | 51,6 | 54,1 | 60,7 | 58,7 | 65,3 |
| With pipe | 40,4 | 46,4 | 47,0 | 53,0 | 59,3 | 65,3 |
| Effect of pipe | | 5,2 | | 7,7 | | |

**Table 1:** Results of measurements.

The data above prove that noise load has decreased by 5.2 dB on the ground floor and 7.7 on the first floor due to the pipe.
Examining the frequency spectrum of noise level caused by freight and passenger trains, measured both with and without pipe, it can be stated that the pipe's effect is especially beneficial in case of freight trains.

**REFERENCES**

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2. *MSz 13121-1: 92 Noise abatement establishments*, Acoustical classification study

3. *MSz 13121-2: 92 Noise abatement establishments*, On-the-spot acoustical study

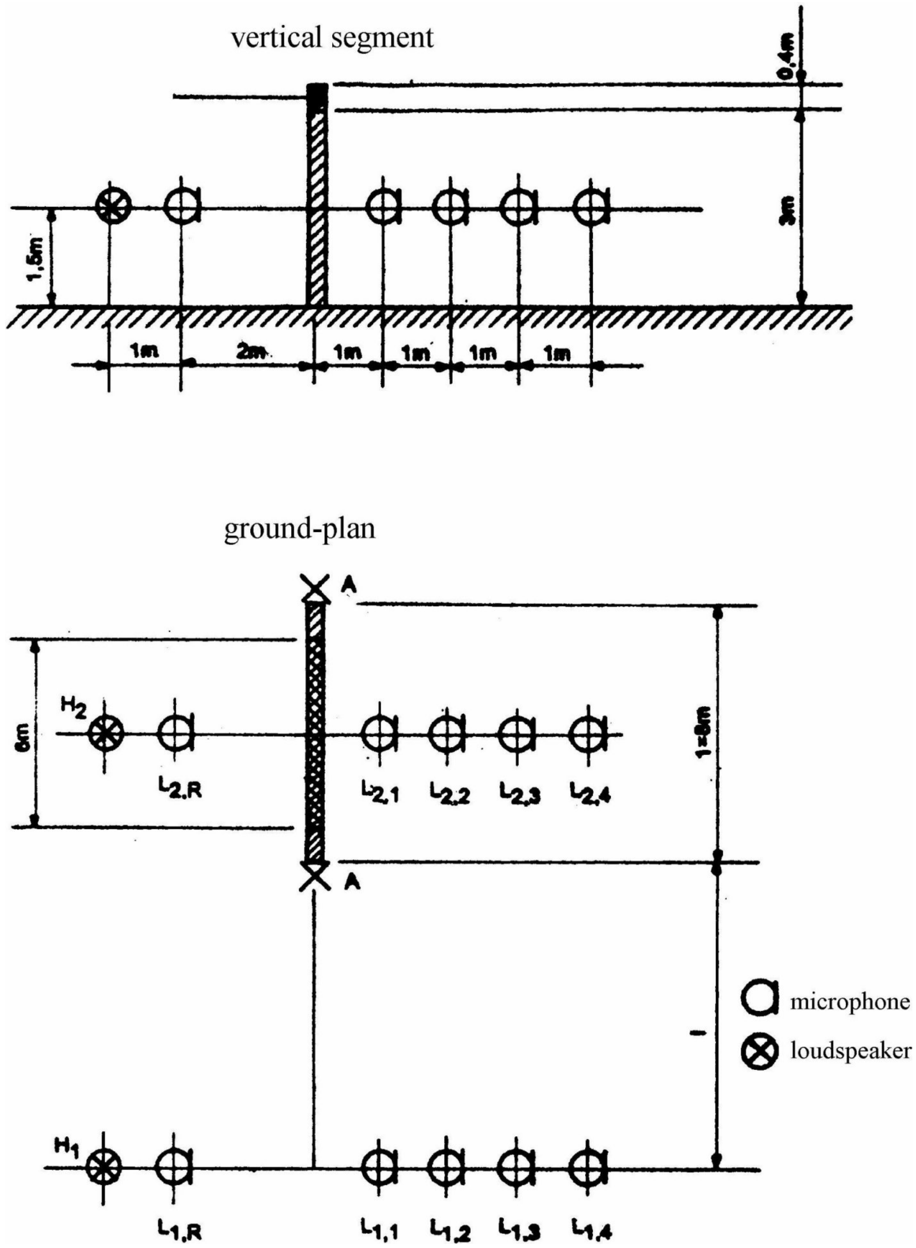


**Figure 1:** Measurement configuration to determine classifying insertion loss.

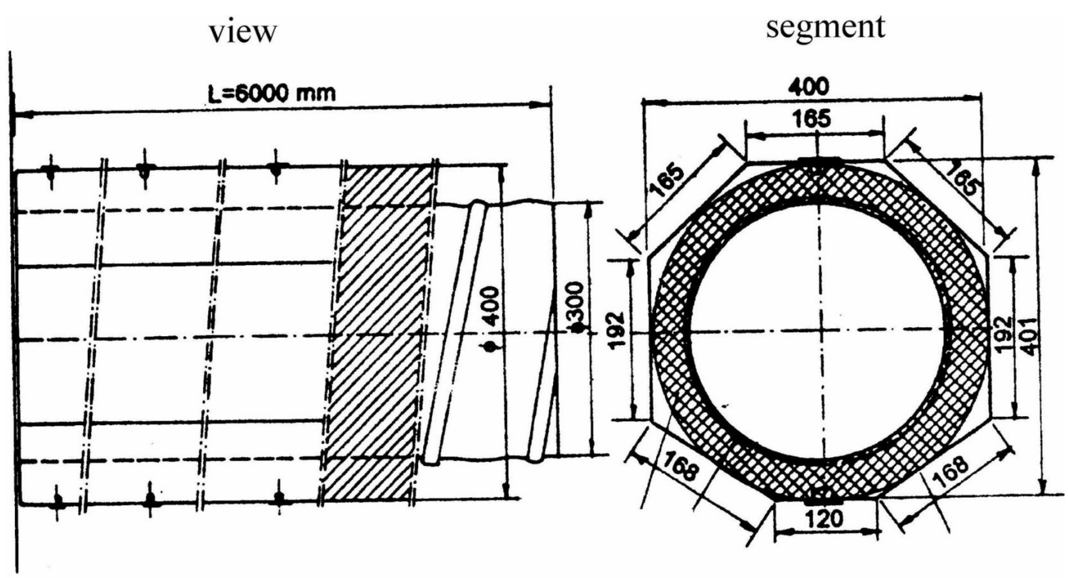


**Figure 2:** TUBOSIDER reductor pipe construction.