Experimental research of acoustic louver sound insulation

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Introduction

Acoustic louver is a structural element that controls noise and at the same time enabling air ventilation of engineering equipment. Acoustic louvers used in facades of buildings, as sound-attenuating jackets for engineering equipment that needs ventilation, e.g. air conditioners.

Sound attenuation mechanisms in louver simply described as:

- The acoustical energy is reflected to the sound source. This phenomenon mainly effected by the mass of the blades. [1]
- Interference generated inside the louver (blades and openings), can be interpreted as secondary sound sources. [2;3]
- Losses that occur when the sound waves travel through the sound absorptive material.[4,5]

The designed acoustic louver in this research has larger spaces between blades to provide the higher air movement for the engineering equipment where acoustic louver could be used.

Method

Experimental research of acoustic louver is done in semi – anechoic chamber. This chamber used for testing sound insulation of various building constructions or passive sound reduction elements.

The designed acoustic louver dimensions 1 m x 0,2 m x 1 m. Louver consists of seven, 3 mm-thick equally spaced at 120 mm, steel blades.

In this research it is analysed three possible compositions of acoustic louver using sound absorbing material:

- covered with foil-faced rockwool on both sides: density 35 kg/m³, thickness 30 mm
- covered with pressed rockwool on both sides, density 40 kg/m³, thickness 20 mm
- covered with pressed rockwool on both sides, density 40 kg/m³, thickness 30 mm

When measuring angle of blades changed in 15 degree steps. From 0 to 45 degree. All louver blades are tilted in parallel.

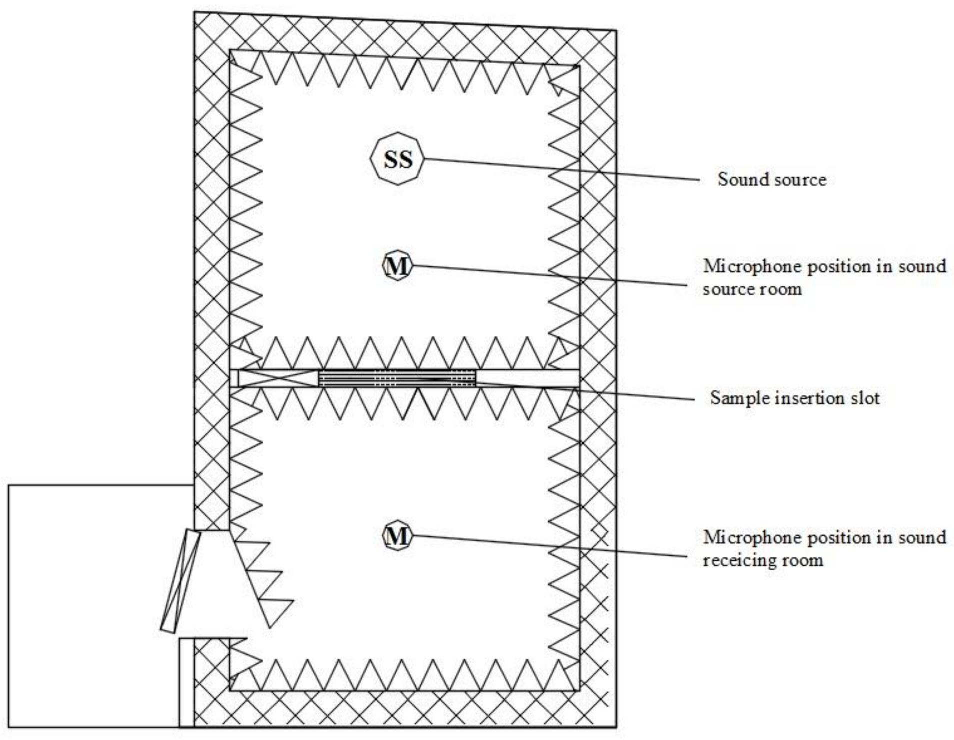

Fig. 1. The design of semi anechoic chamber

The tests were done following the methodology described in ISO 10140-1:2016. One microphone was placed in the sound source room and the second one was placed in the sound receiving room. The acoustic louver was built-in in the special window of separating wall between rooms.

The data post processing was done with Bruel kjaer building acoustics software Type 7830.

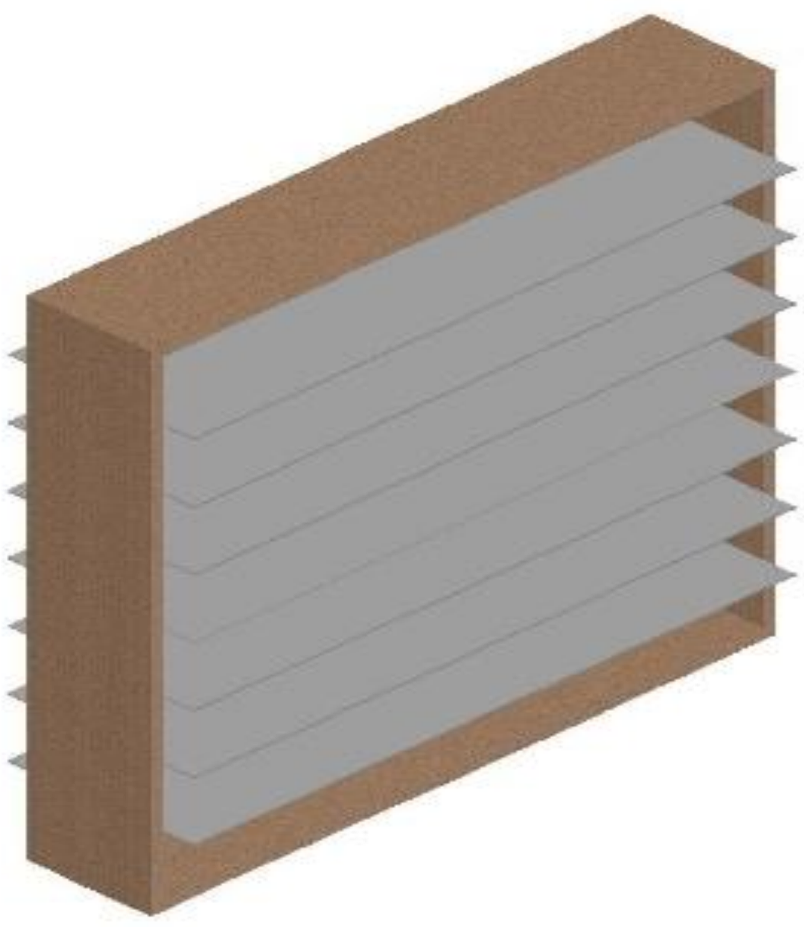

Fig. 2. The design of acoustic louver frame

Results

When louver blade was covered with 20 mm pressed rockwool *Rw* values differ from 3,9 dB to 4,4 dB depending on the louver blade tilting angle. The least sound insulation was gained when louvre blades were horizontal position and highest insulation was gained when blades were tilted 45 degrees.

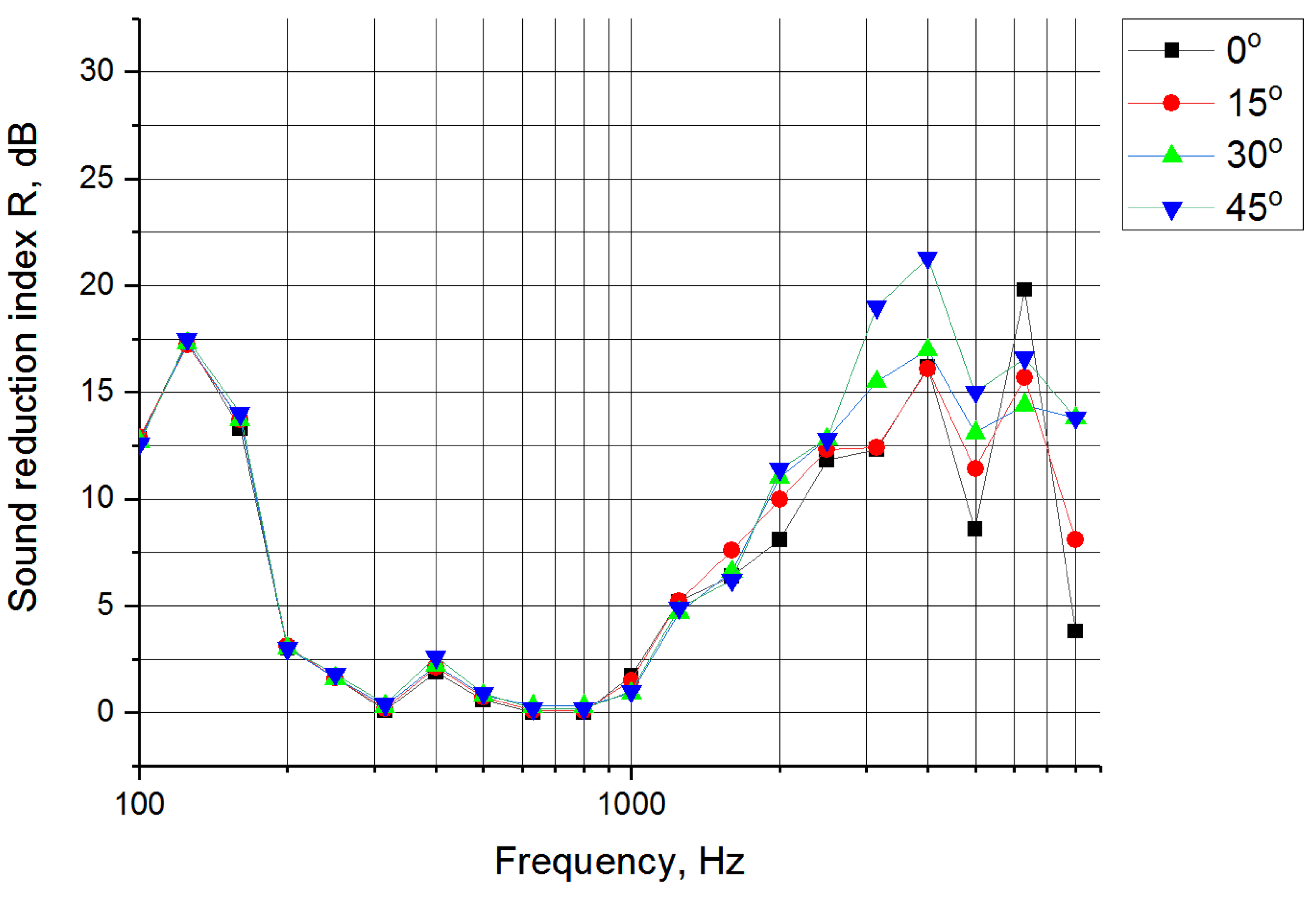

Fig. 3. Sound reduction index using 1/3 octave band filter of acoustic louver covered with 20 mm pressed rockwool

When louver blade was covered with 30 mm pressed rockwool *Rw* values differ from 7,8 dB to 9,8 dB depending on the louver blade tilting angle. The least sound insulation was gained when louvre blades were horizontal position and highest insulation was gained when blades were tilted 45 degrees.

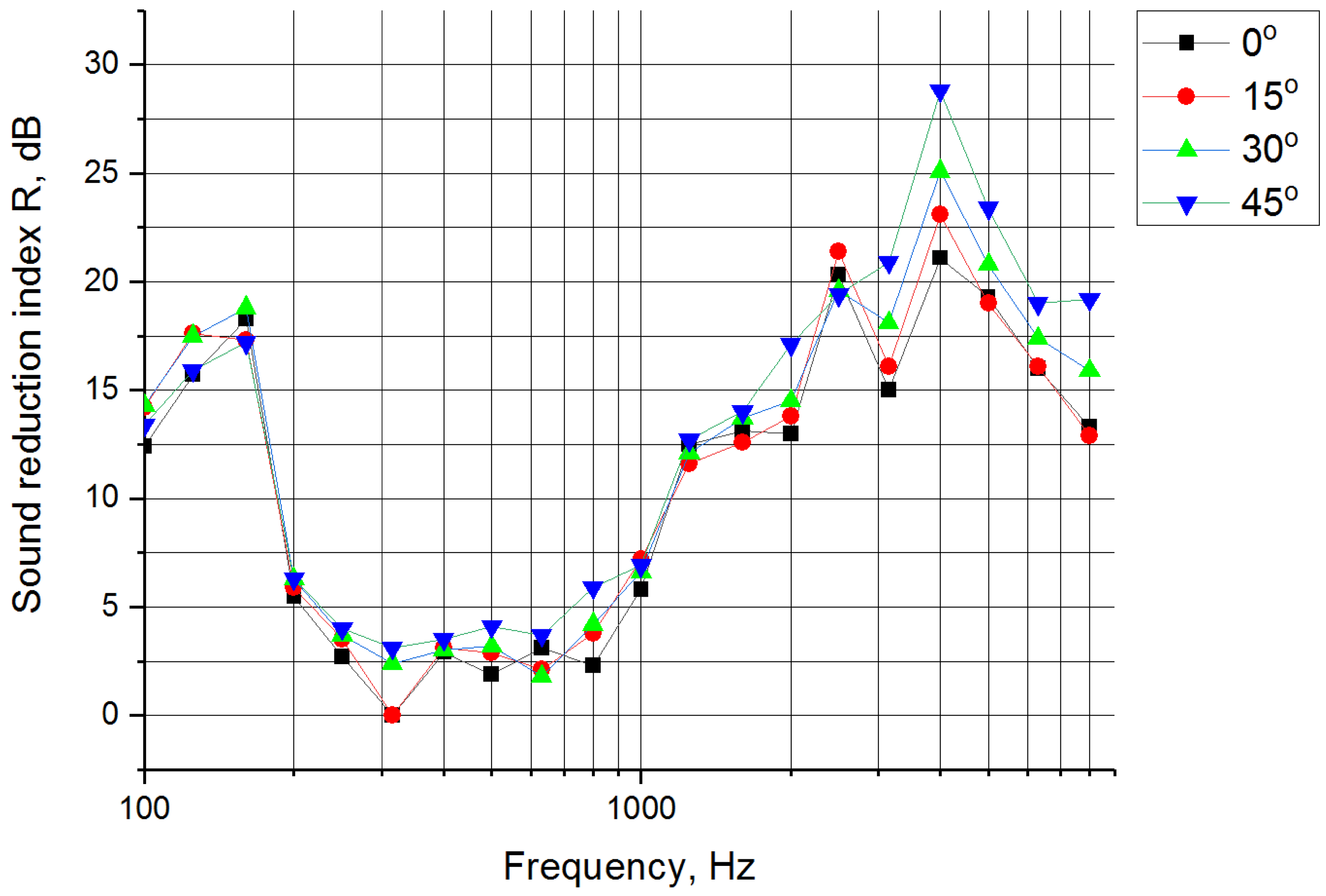

Fig. 4. Sound reduction index using 1/3 octave band filter of acoustic louver covered with 30 mm pressed rockwool

When louver blades covered with foil-faced rockwool *Rw* values differ from 7,3 dB to 13,2 dB depending on the louver blade tilting angle. The best result gained when louver blades were tilted maximum angle 45°. The least sound insulation was gained when louvre blades were horizontal position. Highest insulation was gained when blades were tilted 45 degrees.

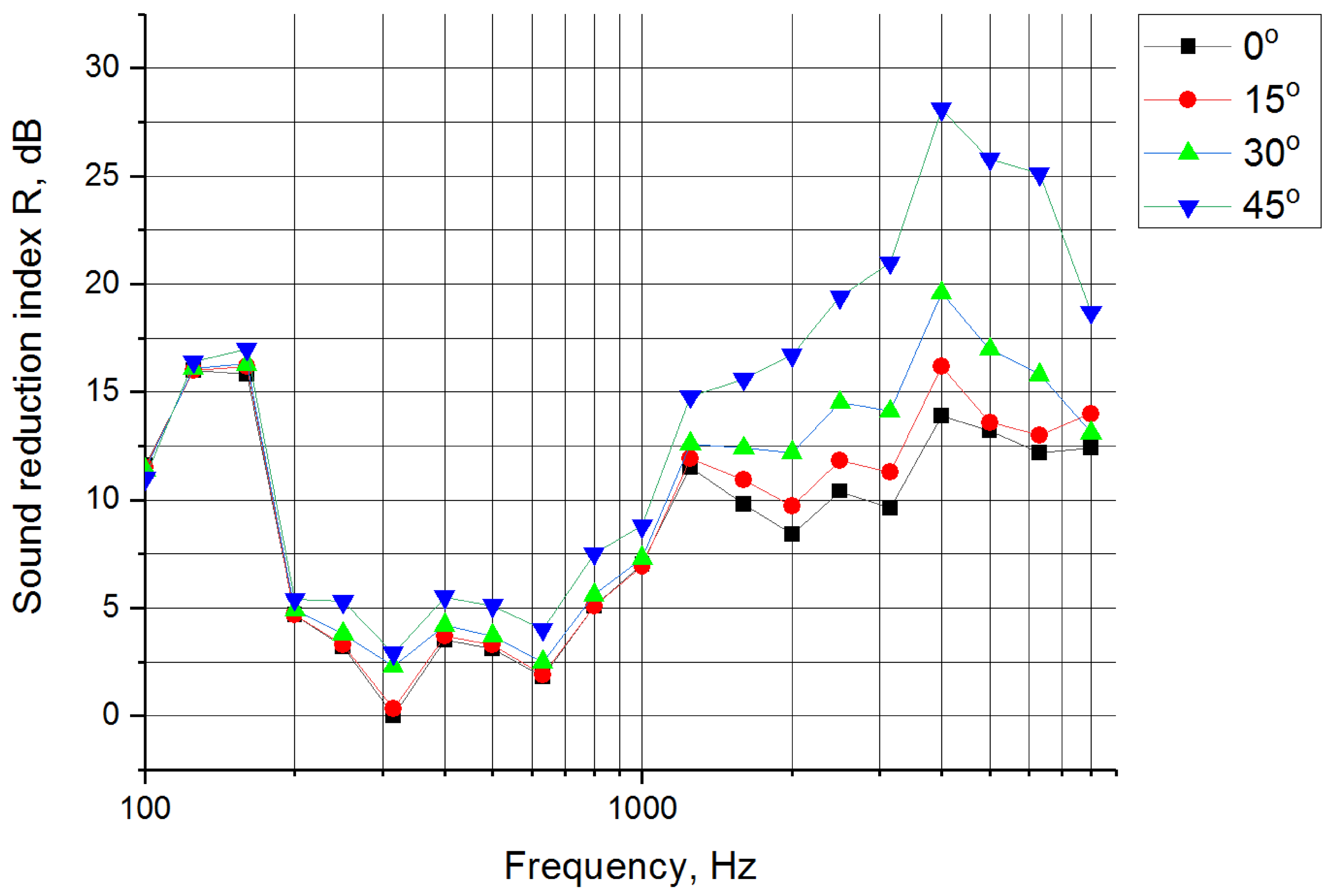

Fig. 5. Sound reduction index using 1/3 octave band filter of acoustic louver covered with 20 mm foil-faced pressed rockwool

The results of *Rw* values of acoustic louver covered with different rockwool at different tilting angles is shown in table 1. Results show that highest sound insulation is gained when acoustic louver tilted to 45 degree. The best sound insulation was gained with louver covered with foil-faced rockwool.

Table. 1. Rw values of different acoustic louver designs

Tilting angle	Pressed rockwool, 20 mm	Pressed rockwool, 30 mm	Foil-faced rockwool, 20 mm
0°	4,2 dB	7,8 dB	7,3 dB
15°	4,2 dB	8,2 dB	7,9 dB
30°	4,4 dB	8,6 dB	9,0 dB
45°	4,4 dB	9,8 dB	13,2 dB

Conclusions

The best sound insulation was achieved, using louver blades tilted by 45 degrees and covered with foil faced rockwool. Maximum weighted sound reduction index (*Rw*) was 13.2 dB.

Significantly better sound insulation is when covering rockwool thickness is 30 mm in comparison to 20 mm layer. However, in this case the gap between two separate blades is much narrower, therefore air movement is slightly restricted and requires further investigation.

References

1. E. B. Viveiros. Evaluation of the Acoustical performance of louvre by impulse response analysis, *Ph. D. Thesis*. 1998
2. R. Lyons, B.M. Gibbs, Investigation of an open screen acoustic performance, *Applied acoustics*, 1996.
3. C. Wassilieff Improving the noise reduction of picket barriers. *J Acoust Soc Am*, 1988
4. G.R. Watts, D.C. Hothersall, K.V. Horoshenkov, Measured and predicted acoustic performance of vertically louvred noise barriers, *Applied acoustics*, 2001.
5. E. B. Viveiros, B. M. Gibbs, S. N. Y Gerges. Measurement of sound insulation of acoustic louvres by an impulse method. *Applied acoustics*, 2002.