

COMPARISON BETWEEN STANDARD RECOMMENDATIONS, SOUND MEASUREMENTS AND USER OPINIONS IN TEACHING PREMISES

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ABSTRACT

The project involves comparison between user's opinions of teaching premises to standard recommendations used in Iceland. This will be done with sound measurements, comparison of measurement results to standards and outcome of a poll sent to teachers. What is to be examined is reverberation time of variable room types (gymnasium, canteen, classrooms and open-landscape classrooms), sound insulation and sound pressure level from technical equipment. The purpose of the project is to declare whether the Icelandic building code [1] assures pleasant working environment for teachers or if it is desirable to use other guidelines.

1. INTRODUCTION

The purpose of this project is to compare the opinion of the users of school facilities to acoustic design standards and actual acoustic environment of school facilities. For comparison, previous measurements conducted by Línuhönnun were used for some of the facilities among with new measurements. Emphasis is put on reverberation time, sound insulation and noise from technical equipment.

1.1. Standards regarding acoustical environment

The Icelandic Building Code nr. 441/1998, addresses the reverberation time of few types of spaces in school facilities. The standard deals with average reverberation time in the frequency range 250 – 4.000 Hz [1]. As can be seen in the building code, reverberation time requirements are somewhat more lenient than in other Nordic countries. Therefore, a Swedish code (SS 02 52 68) [2] is often referred to when looking for suitable reverberation times for various spaces. The Swedish standard implements different requirements for reverberation time depending on the type of the building and desired acoustic quality of the building. It should be noted that this code is based on the maximum value at the frequency bands from 125 – 4.000 Hz but not the average in the range of 250 – 4.000 Hz like the Icelandic Building Code. The requirements to sound insulation in the Icelandic building code is quite more ambitious than reverberation time requirements, but still are much more detailed in the Swedish standard. The same is valid for noise from technical equipment.

1.2. Question poll to teachers

Question poll was sent out to 317 teachers in 9 schools in Reykjavik city. In the poll the teachers were asked to describe their form of teaching, the teaching premises, sense of reverberation time, sense of noise and sound insulation.

The questions were divided into four groups; Form of teaching, Form of teaching premises, Reverberation time, Annoyance due to noise sources and noise direction. In addition the teachers could give subjective comments, if desired.

1.3. Measurements results – one example

Here below, is an example and analysis of preliminary results of measurements and users opinion for one of the schools investigated in the project. In total, 9 schools will be examined in the ongoing project.

The example is the school Breiðholtsskóli which was built in 1969. Participants from this school were 17 teachers.

Here below two reverberation times are shown. The users rating of each room can also be seen in the graphs among with pictures taken inside the rooms.

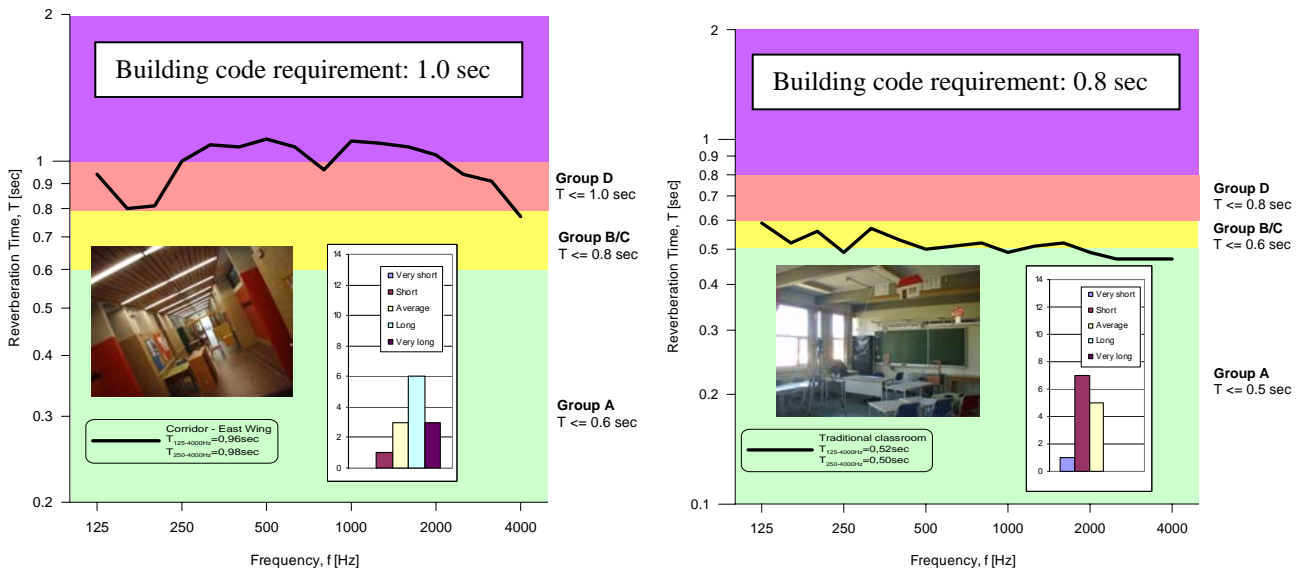


Figure 1. Reverberation time in two rooms in Breiðholtsskóli.

As can be seen in figure 1, a good coherence is between the Swedish requirements and users opinions. However, the building code requirement seems to be outdated, for this type of premises.

Here below are two graphs showing annoyance factors according to the poll results in Breiðholtsskóli.

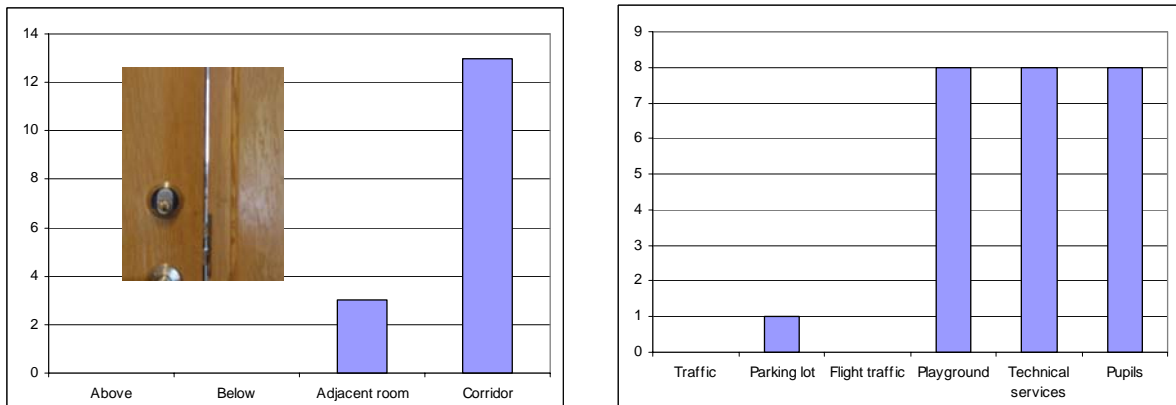


Figure 2. Annoyance factors in Breiðholtsskóli.

As can be seen, annoyance is mostly caused by pupils walking in corridors outside the classrooms. The little picture inside the graph on the left shows a gap besides the door. Measured airborne sound insulation of doors between corridor and classroom explains the number of teachers annoyed by noise from corridor, since R_w measures 6 dB and 9 dB respectively for the two doors measured. According to the Icelandic building code, doors from classroom to corridor shall have sound insulation class 30 dB or better.

Noise from technical services was also measured for three rooms; the canteen, library and the corridor. In the question poll, 8 out of 17 teachers claimed to be annoyed by noise from building services. Measurement results can be seen in the table here below.

Location	Subject	Measured values [dB(A)]	Building Code Requirement [dB(A)]	Deviation from Building Code requirement [dB(A)]	Requirements	Requirements	Requirements
					according to Swedish Code SS 02 52 68 for quality group A	according to Swedish Code SS 02 52 68 for quality group B/C	according to Swedish Code SS 02 52 68 for quality group D
Breiðholtsskóli		L _{Aeq}	L _{Aeq}	L _{Aeq}	L _{pA}	L _{pA}	L _{pA}
Canteen	Air conditioning and refridgerators	49,7	-	-	40	40	45
Library	Air conditioning by computers	43,7	35	8,7	35	35	35
Hallway / corridor	Air conditioning unit in hallway	55,1	-	-	45	45	45

Table 1. *Measured sound level from technical services*

Measured values are between 43,7 dB(A) and 55,1 dB(A), and is 8,7 dB(A) – 10,1 dB(A) above required sound level according to the Swedish standard.

2. CONCLUSIONS

The conclusion of this preliminary comparison of one example shows that good coherence is between the Swedish standard and the users (teachers) opinions of their work environment and teaching premise. Icelandic building code seems to be somewhat outdated and therefore other guidelines found important when designing new school buildings.

3. REFERENCES

- [1] Dómsmálaráðuneytið, *Byggingarreglugerð 441/1998*, Dómsmálaráðuneytið, Reykjavík, 1998.
- [2] Swedish Standards Institution. *Swedish standard SS 02 52 68 – Acoustics – Sound classification of spaces in buildings – Institutional (healthcare) premises, rooms for education, day centres and after school centres, rooms for office work and hotels*. Ecophon, Astorp, Sweden.