THE ICELANDIC SOUND CLASSIFICATION STANDARD FOR DWELLINGS – EXPERIENCE AND DEVELOPMENT

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1. INTRODUCTION

In July 2003 the Icelandic standard IST 45:2003 "Sound classification of dwellings" was approved. The standard is identical to the Nordic standard proposal INSTA 122:1998, which was prepared by a Nordic working group in 1998. The acoustical demands in the Icelandic building code have not changed since 1979, but in 1998 the so called. "recommended values" were introduced. These values are identical to the C - class demands in the classification standard.

2. USING THE STANDARD

Already before 2003 the Nordic standard proposal INSTA 122:1998 was introduced to the Icelandic building industry. Many building firms started to design their houses according to class C and the recommended values in the building code. Others continued as before - just to meet the minimum demands in the building code. A few made attempts to reach class B.

Traditional Icelandic building methods for dwellings were for many years concrete walls and slabs - cast at the building site – both façade walls and also walls between dwellings and walls between a dwelling and a common corridor. The thickness of the walls and slabs were kept at minimum, the thickness was decided partly by structural demands, and partly acoustical demands. The slabs were often as thin as 180 mm, the walls between dwellings as thin as 150 – 160 mm, but façade walls were usually minimum 180 mm.

If no other factors influenced the sound insulation these concrete walls and slabs should be able to fulfill the minimum demands in the building code $R'_{w,8dB}$ = 52 dB. Also the minimum demands on impact sound insulation should be fulfilled with sufficiently soft floor materials.

This was shown to be the case before the houses were thermal insulated, but after that the houses often did not fulfill these minimum demands for airborne sound insulation. The traditional way to thermal insulate the dwellings was to use plaster to glue 100 mm of polystyrene expanded plastic on the inside of the façade walls and this was then plastered with sand-cement plaster. This resulted in flanking transmission, with a peak at about 250 -300 Hz which was the resonance frequency of the plaster on the cellular plastic.

This flanking transmission was often so effective that the resulting insulation did not fulfill the minimum demands

2.1. Building for Class C

In order to fulfill the demands for class C it was even more important to stop this flanking transmission, and a research project at the Icelandic Building Research Institute [3] developed several different ways to do this, for those who wanted to continue to use this traditional method of insulating the concrete walls on the inside. Also it has become more and more common in the last 5- 10 years to insulate the concrete walls on the outside, and thus eliminating this type of flanking transmission.

Besides improving the method for thermal insulation the concrete structures are made heavier, the slabs typically 220-240 mm and the walls between dwellings typically 180 – 210 mm.

This has been shown to fulfill the demands for class C, with the exception that floating parquet floors on thin "traditional" elastic underlayers were not sufficient for class C.

Heavy floating floors on a thin elastic underlayer have been tried in several building projects. An example is a 40 - 50 mm floating slab of anhydrite on top of a 10 mm elastic layer. This has however been shown to be very sensitive to even small contacts between the floating floor and the surrounding walls. When these contacts are eliminated the results show that the demands for impact sound insulation can be fulfilled: $L'_{n,w}$ = 53 dB, and even the recommended demands can just about be fulfilled: $L'_{n,w} + C_{I50,\,2500}$ = 53 dB.

This solution of floating floors is chosen in order to allow the people living in the dwellings to choose the floor material freely. It is very popular now to have wooden floors glued directly to the concrete floor, and also popular are different types of tiles glued directly to the concrete floor. Without the floating floor, different types of elastic underlayers must be used under the tiles or the wooden floors, and these are often too stiff for the acoustic demands.

However, when even small contacts exist between the floating floor and the surrounding walls the demands are not fulfilled.

The results in houses with this type of floating floors show that in almost all cases the airborne sound insulation demands are fulfilled, and where the contact between the floating floor and the rest of the building structure is small the demands for the impact sound level are also fulfilled.

An example is shown in Figure 1 below, where it was carefully made sure that there are no accidental extra contacts to the rest of the building structure. Here the elastic material is 10 mm thick and the floating floor is 60 mm anhydrite without a floor covering. The result is $L'_{n,w}$ = 48 dB, but $L'_{n,w} + C_{I50,\,2500}$ = 54 dB.

More practical results often show $L'_{n,w}$ = 53-54 dB, because it is very difficult to ensuer that the contact is minimal.

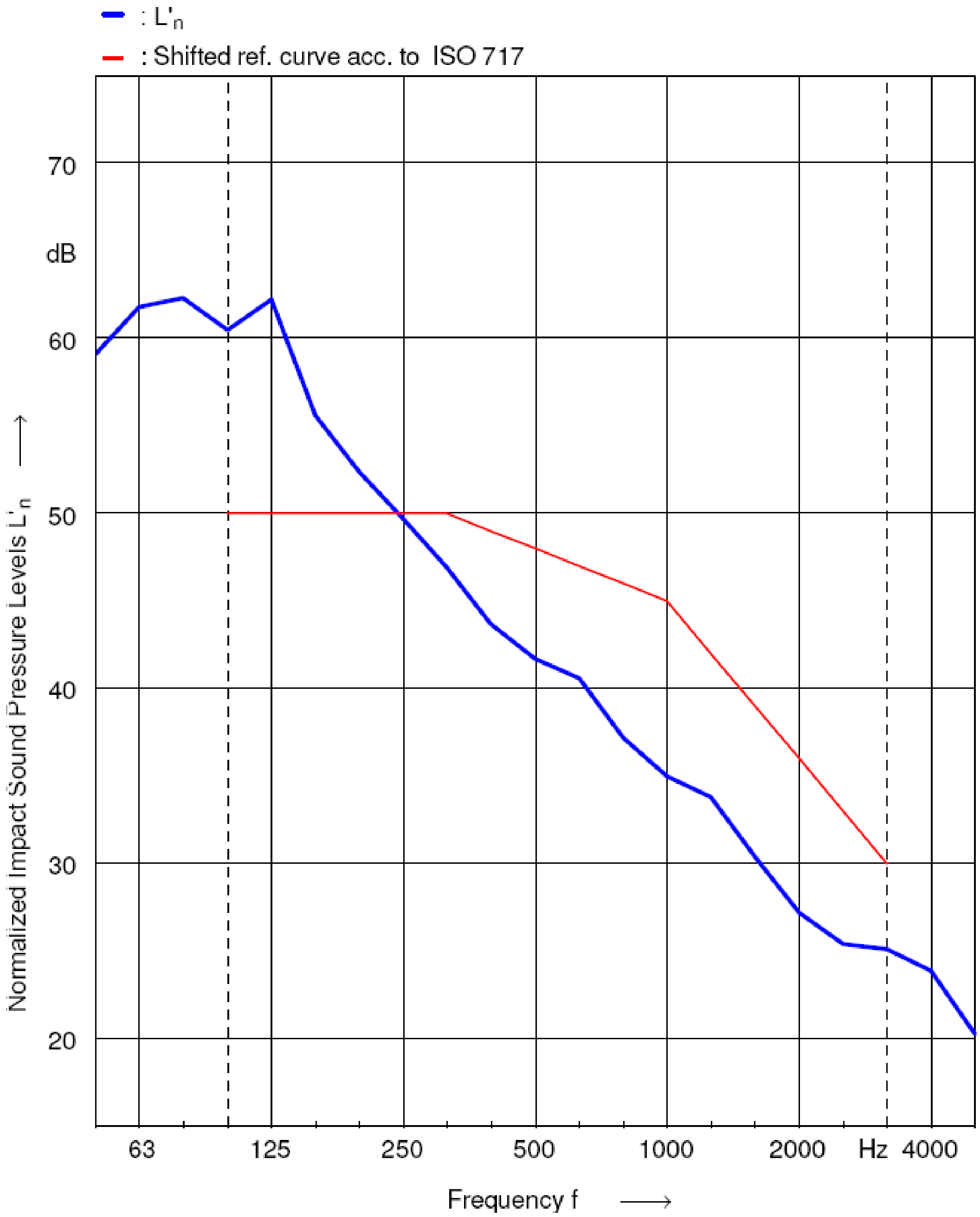

Figure 1 *A measurement of the impact sound level of a heavy floating floor on a thin elastic underlayer. The result is* $L'_{n,w}$ *= 48 dB, but* $L'_{n,w} + C_{I50,\,2500}$ *= 54 dB.*

2.2. Building for Class B

The attempts to reach class B have in all cases be done by introducing heavy floating floors and also somewhat thicker concrete walls between apartments than usual.

As this was a new building technique in Iceland there were some initial problems, but now the method has been established as more or less a standard method in buildings with a “higher standard”.

Several different types of floating floors have been used, and many measurements of the sound insulation in these houses have been made.

The most common method is to use about 30 mm soft cellular plastic and about 50 mm anhydrite floating floor. In some cases mineral wool has been used (30-40 mm), and in some cases a concrete floating floor has been used.

The results show that in almost all cases the airborne sound insulation demands are fulfilled, but only in some cases are the demands for the impact sound level fulfilled. A very common result is a very low (good) value for $L'_{n,w}$ but when $L'_{n,w} + C_{i,50-2500}$ is introduced the results are 1-3 dB too high.

An example is shown in Figure 2 below, where the elastic material is 40 mm rockwool and the floating floor is 40 mm anhydtrite with a wooden parquet floor. The result is $L'_{n,w} = 43$ dB, but $L'_{n,w} + C_{I50,\,2500} = 51$ dB.

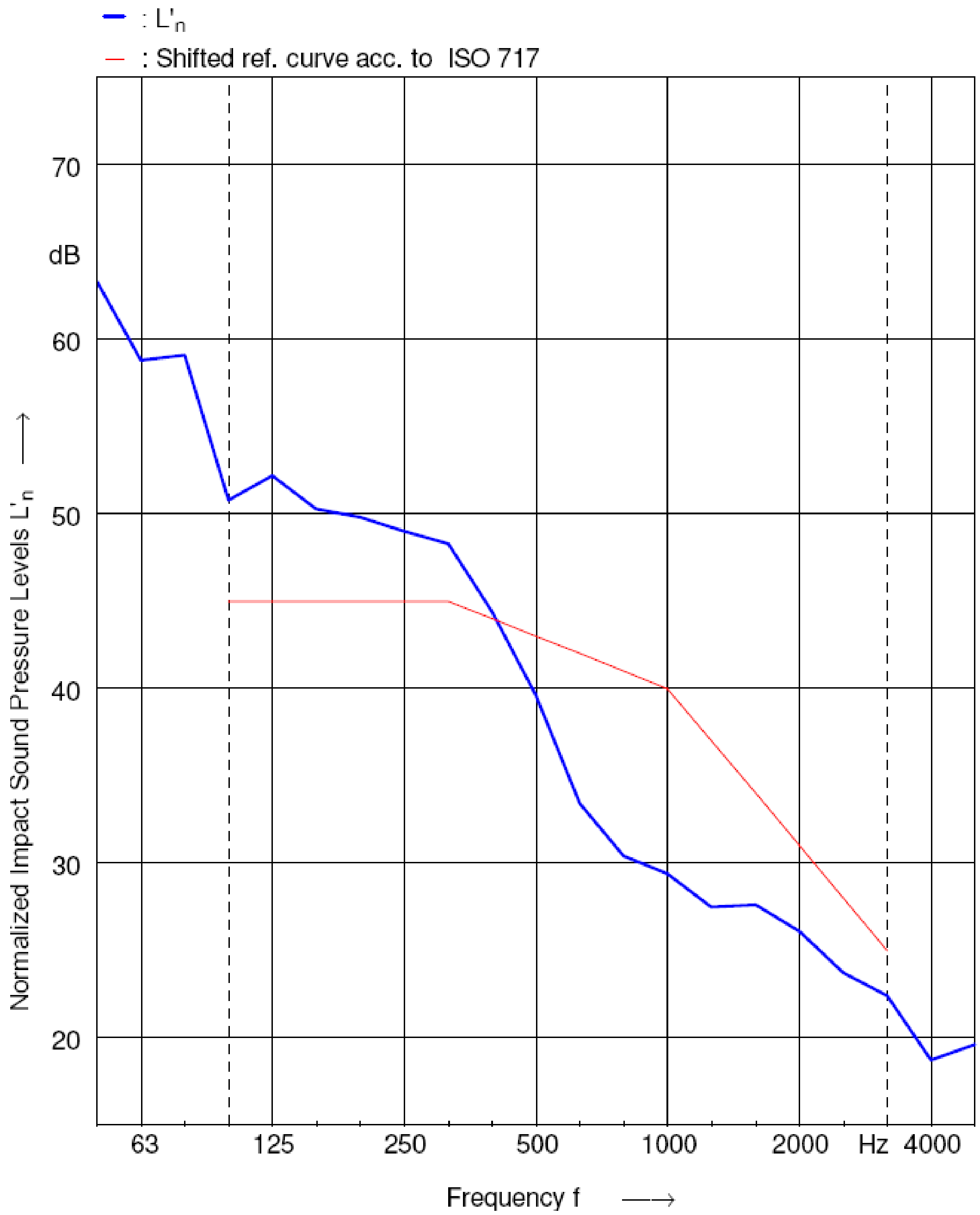

Figure 2 *A measurement of the impact sound level of a heavy floating floor on mineral wool. The result is* $L'_{n,w}$ *= 43 dB, but* $L'_{n,w} + C_{I50,\,2500}$ *= 51 dB.*

The building method to use light floating floors, which is common in Sweden, Norway and Denmark has not been much used in Iceland. The introduction of heavy floating floors has also encouraged the use of floor heating systems with hot water in plastic pipes in the floating floors. This is very common now in new houses.

3. SOUND INSULATION FROM A COMMON CORRIDOR

The demand on airborne sound insulation from a common corridor into the apartments has been very much debated by architects in Iceland.

This demand is both in the building code and also in the classification standard. In both cases the demand is the same as between apartments, and this calls for a closed entrance space in each apartment.

This demand is not identical in all the Nordic countries and the building practice in these countries is also different. In Iceland the practice is different between different communities, as the building authorities interpret the demands in a different way.

Is it too strict to have the same demand as between two apartments ?
Is it maybe enough for most residents just to have the demand R'_w = 40 dB between a common corridor and an open space consisting of a living room / kitchen / TV-room just behind the door to the common corridor ? This would in most cases be fulfilled by using a single 35 dB door.

4. CONCLUSIONS

The introduction of the Icelandic sound classification standard has resulted in a change in building methods for dwellings. This in turn has led to better sound insulation between dwellings than before, and many new houses now are designed to fulfill sound insulation class C. This does not always successful, mainly regarding impact noise, but the dwellings in general have better sound insulation than a few years ago.

Regarding “luxury” dwellings, where the goal has been class B, the results are sometimes not quite good enough to reach the intended sound class. The explanation is probably a little bit too thin floating floors, and underlayers that are not soft enough (not thick enough).

5. REFERENCES

[1] IST 45:2003 “Sound classification of dwellings”
[2] The Nordic standard proposal INSTA 122:1998. “Sound classification of dwellings”
[3] Gudmundsson, S. “Better Acoustic Climate with Improved Building Methods” (in Icelandic) Report 03-10, The Icelandic Building Research Institute, Reykjavik, June 2003.