THE QUEST FOR THE MISSING SEVEN DECIBELS

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1. INTRODUCTION

Ligthweight porous concrete is a very sensitive structural material in terms of sound and vibration. This is due to a high noise radiation coefficient. The material is anyway highly used in constructing of partitioning walls built as double walls. The wall usually consists of two 100 millimetre thick concrete bricks (approx. 600 kg/m³) with a cavity between. The thickness of the cavity usually varies between 75 – 125 millimetres. In the perfect situation there is no mechanical connection between the two wall parts. During the building process some connection will occur, but well designed and erected with care on a split foundation a sound insulation of $R'_w \geq 60$ dB can often be achieved. Small imperfections or design errors can though bring the R'_w below 50 dB. The errors can then be hard to find.

2. CHECKING SOUND INSULATION

In Denmark the building regulations set requirements for the sound insulation and the impact noise level. These requirements are $R'_w \geq 55$ dB and $L'_{n,w} \leq 53$ dB, which on demand from the building authorities may be tested before the building is taken into use. Most often only a small sample is tested – i.e. 2 partitioning walls randomly chosen from perhaps 25 equal walls.

The sound insulation tests are usually performed by independent private laboratories like Acoustica. Acoustica made in 2003 such a test on a newly build estate consisting of 5 buildings forming 25 dwellings in all. For one party wall the results were $R'_w = 55$ dB and $L'_{n,w} = 44$ dB. For another one the results were $R'_w = 48$ dB and $L'_{n,w} = 38$ dB. The first one OK – the other not! In the good wall there was a 30 centimetres vertical displacement between the dwellings.

3. FINDING THE ERROR

The results for the pour wall showed a typical loss of sound insulation in the mid frequencies (around 500 Hz – see figure 1). This is due to some kind of mechanical interaction between the two wall parts.

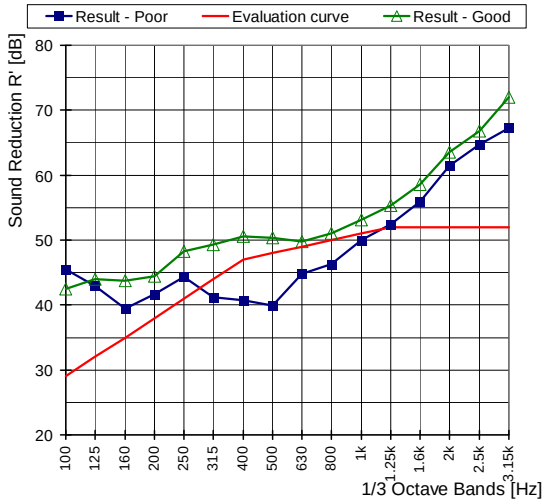

Figure 1. *Initial sound insulation of walls*

The search for stiff connections started at the top of the building and got us through the entire wall before the error(s) was located in the foundations, where some unusual construction details were found. Unfortunately it was almost impossible to correct. In stead a rather simple solution with gypsum boards added directly to the existing wall surfaces succeeded in achieving $R'_w \geq 55$ dB.

4. CONCLUSIONS

Lightweight porous concrete is often used in double walls. Minor design or construction errors can lead to major lack of sound insulation. This can be mended through adding gypsum boards directly to the existing wall surfaces. A relatively cheap solution that only takes up a little space.