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A BETTER SOUND INSULATION BETWEEN HOUSES BY USING A FLEXIBLE MOUNTED FLOOR

W.F. Landheer

Rijksdienst voor de IJsselmeerpolders
(IJsselmeer Development Authority)

INTRODUCTION

A heavy dividing wall will not guarantee good sound insulation. Light weight prefabricated floors may have an important influence on flanking transmission. In addition to this they often cause a poor impact-noise insulation.
These problems can be solved by a flexible mounting of the floor.
In a project of 348 houses in Lelystad, the floor at ground level was laid on a flexible layer. Four different types were tested in 30 houses.
At first the sound insulation in total was calculated and the amount of the transmission via the rigid connection of the floor.
Afterwords the airborne and impact sound insulation was measured on the ground and the first floor. The transmission losses through the connection were measured by vibration measurements.
At last the results were compared.

THE PROJECT

The project included 348 houses in Lelystad, built in 1976 - 1977.
The construction consist of reinforced concrete, cast in situ.
At ground level, prefabricated floors of reinforced concrete were used, mass 250 kg/m^2. The dividing wall had a mass of 550 kg/m^2, the other floor and the roof had a mass of 430 kg/m^2. Light weight inner-walls were kept separated.
Figure 1 shows the plan of the ground and the first floor and a through-section.
The following types of layers were tested:

- a rigid connection
- felt (Nevima 633) unburdened 5 mm burdened 3 mm
- the same felt in a plastic surround
- impregnated felt (Nevima 296) unburdened 5 mm burdened 4 mm
- rubber neopreen (CR) unburdened 5 mm burdened 4,5 mm

MEASUREMENTS

Measurements were carried out in accordance with I.S.O. recommandation R 140 and the Dutch standard NEN 1070.

$$Dnt = L_1 - L_2 + 10 \log T/T_0$$

where Dnt = normalized sound insulation
L_1 = average sound pressure in the source room
L_2 = average sound pressure in the receiving room
T = reverberation time (s)
T_0 = normalized reverberation time (0.5 s)

Airborne and impact sound insulation are shown in figure 2.
In addition to this the transmission loss (D) between the floor and the wall, and between floors of adjacent houses was measured.
A tapping machine was used as a source

$$D = L_1 - L_2$$

where L_1 = the acceleration level on the source floor
L_2 = the acceleration level on the receiving floor (wall)

RESULTS

To compare the results, the sound insulation is expressed in one number, the mean of the insulation in the frequencies of 250, 500 and 1.000 Hz.
The insulation of airborne noise rose about 1.5 dB, according the calculated value.
For impact noise the results were better, about 2 to 6 dB depending of the layer used. Rubber and impregnated felt were the better.
Unsurrounded felt showed great differences between the insulation in several dwellings, probably caused by penetrating of cement water during the finishing of the floor. The transmission loss shows the same characteristic as the impact noise insulation.

CONCLUSIONS

By using flexible moutings, flanking transmission through light weight floors can be reduced to the same proportions of that through heavy floor.
The flexibly connected floor can have a better impact sound insulation then the same floor with a rigid connection of about 6 dB and reaches about the same insulation as a floated cement floor (measured in other projects), but it is cheaper and less critical by construction in situ.
Good materials for the flexible layer are rubber and impregnated felt.

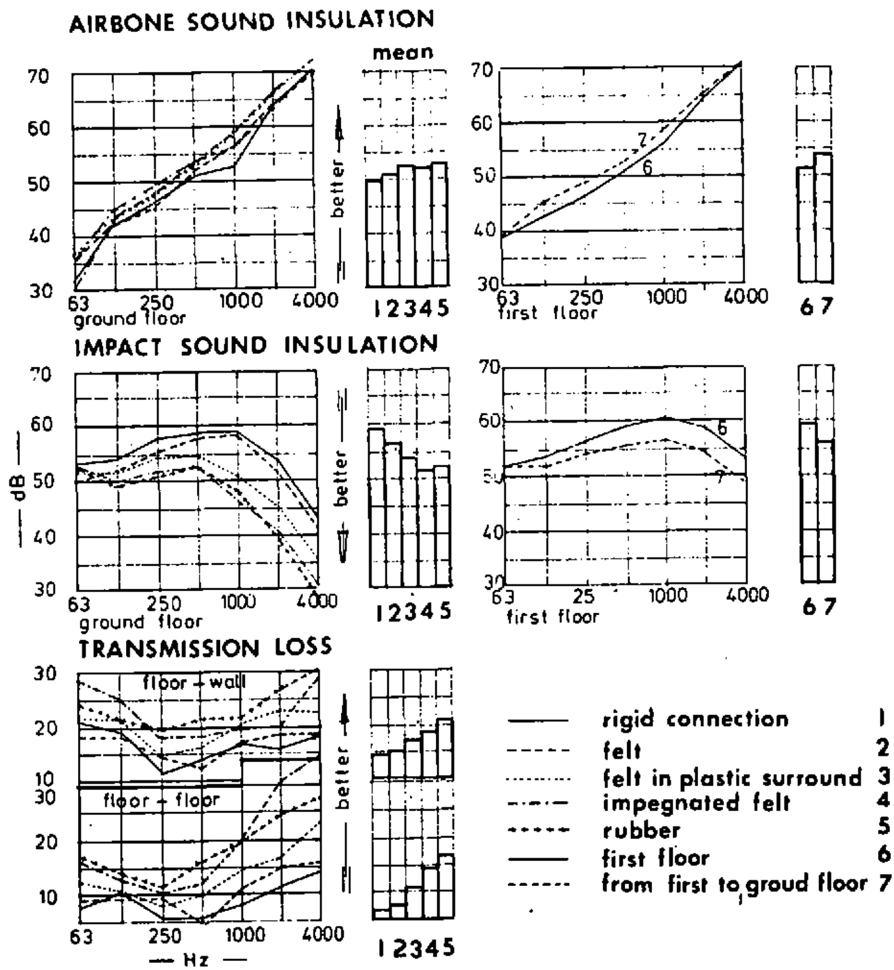
AIRBONE SOUND INSULATION
mean
70
60
50
40
30
63
250
1000
4000
ground floor
better
12345
first floor
7
6
67
IMPACT SOUND INSULATION
— dB —
first floor
TRANSMISSION LOSS
floor + wall
floor + floor
— Hz —
rigid connection 1
felt 2
felt in plastic surround 3
impegnated felt 4
rubber 5
first floor 6
from first to groud floor 7

figure 2

The floor and the wall were seperated by polystyreen foam.

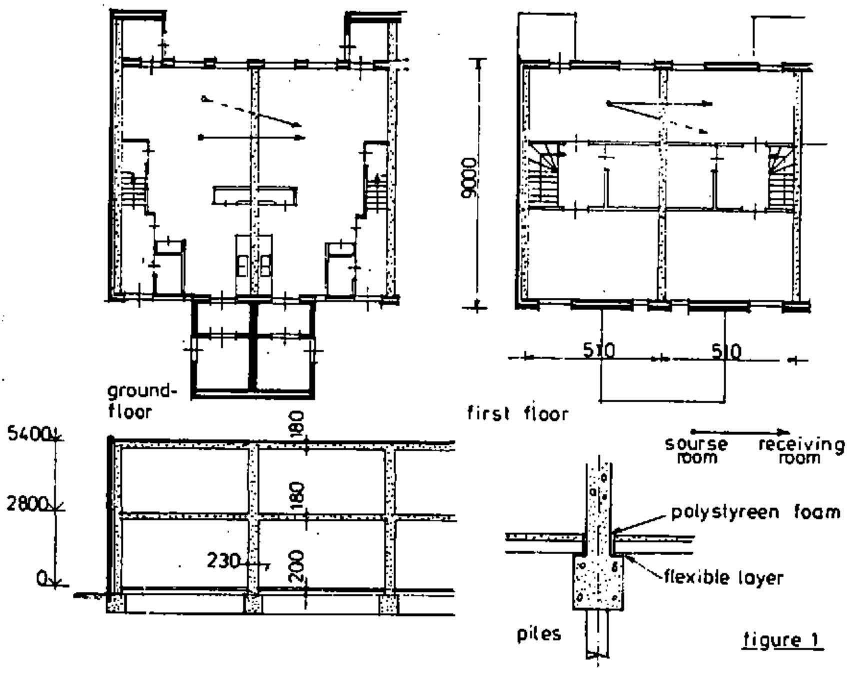

figure 1

CALCULATION OF THE SOUND TRANSMISSION

For the computation of the sound insulation a method developed by T.P.D., Institute of Applied Physics, Delft, was used.
In this method the sound insulation is determined by the mean of the sound insulation in the octaves of 250, 500 and 1.000 Hz.
The sound insulation calculated for the ground floor, using a rigid connection was 50.8 dB. The same case with a disconnected floor gave a sound insulation of 52.3 dB, 1.5 dB better.
The sound insulation calculated for the first floor was 51.7 dB.