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# IMPROVEMENT OF IMPACT NOISE ISOLATION OF FLOOR STRUCTURE BY RESILIENT MATERIAL IN APARTMENT BUILDINGS

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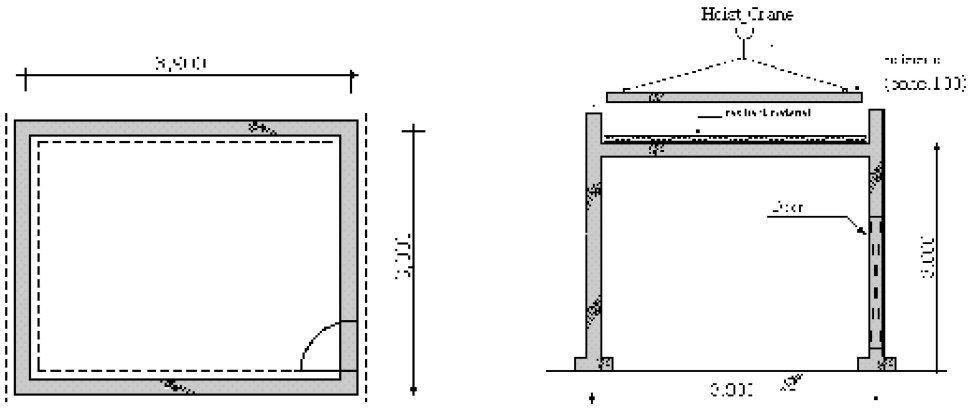
**ABSTRACT**
The floor impact noise transmission has been a problem in the radiant heating floor system (so called "On-dol") of the apartment housing buildings since housing developers have allowed the minimum floor thickness as well as floor height to make more floors to sell. Therefore in the text, the purpose of the study is to find the optimum resilient material that can reduce the floor impact noise transmission. To find an optimum material, 13 resilient materials were selected and adopted to the radiant heating floor system. Each material was tested in the Mockup test room to measure the sound isolation level.

## 1 - INTRODUCTION

It is necessary that floor structure basically become to floating floor for floor impact noise isolation. That material is inserted into the floor structure on the concrete slab. In this study, it is estimated and to make comparison between thirteen kinds of resilient materials for impact noise isolation.

## 2 - RESILIENT MATERIAL AND TEST PROCEDURE

After the resilient material is sited on floor slab (thickness; 150 mm) and covered the rectangular concrete mass (reference, thickness; 100 mm), the impact noise level is measured. And, under the condition without resilient material, it is measured. This is called as Ref. to classify value of that. Noise reduction of floor impact for resilient material is estimated by difference of noise level between the values. Fig. 1 presents the plan and section of Mockup.
Shown as Table 1, the resilient materials are divided into the four groups such as inorganic fiber (W), poly-stylene (S), poly-ethylene (E), composite material (C).




**(a):** Plan. **(b):** Section.

**Figure 1:** Plan and section of Mockup test room.

| Division | Symbol of material | Material | Thickness (mm) | Density (kg/m$^3$) |
|---|---|---|---|---|
| Inorganic fiber (W) | W1 | Board type of Rock Wool | 15 | 350 |
| | W2 | Glass Wool | 25 | 100 |
| poly-stylene (S) | S1 | Poly-stylene | 20 | 30 |
| | S2 | | 20 | 25 |
| | S3 | | 20 | 20 |
| | S4 | | 20 | 15 |
| poly-ethylene (E) | E1 | Poly-ethylene | 10 | 33 |
| | E2 | | 20 | 33 |
| | E3 | | 30 | 33 |
| Composite material (C) | C1 | Damping mat | 10 | |
| | C2 | S3 + E1 | 30 | - |
| | C3 | Rubber_chip and cork | 10 | - |

**Table 1:** Outlines of resilient material.

## 3 - RESULTS AND DISCUSSION

### 3.1 - Characteristics of radiating noise for floor impact

Light-weight impact noise

Fig. 2 is show the effect of noise reduction for light-weight impact, it is generally high upward 500 Hz. In the case of Glass Wool (W2), noise reduction is peak at 2000 Hz as 27.6 dB. Otherwise, no material is higher reduction about Poly-stylenes on the basis of density, and poly-ethylene on the basis of thickness is too.

Heavy-impact noise

Fig. 3 is showing the effect of noise reduction for heavyweight impact, it is generally satisfied at 250 Hz and 500 Hz. But, upward 2000 Hz it is estimated that the other except inorganic fiber (W) is higher on the contrary. Also, noise reduction by thickness is much little.

### 3.2 - Estimation of noise reduction for floor impact by dB(A)

Fig. 4 is show that noise reduction for floor impact is estimated by dB(A). Noise reduction is estimated by difference of impact noise level in the receiving room which resilient material is inserted or not between floor slab and rectangular concrete mass (reference). Noise reduction of heavy-weight impact is estimated as 0.9 $\sim$ 10.0 dB(A), especially, effect of noise reduction is about over 10.0 dB(A) such as Glass Wool (W2), Damping mat (C1), Vibration Isolator (D1). In the case of lightweight impact, noise reduction is generally higher than compared with heavyweight impact noise. Especially, it can be verified that reduction of Glass Wool (W2) is almost higher. Also, it is estimated as 12$\sim$14 dB(A) at 20mm thickness

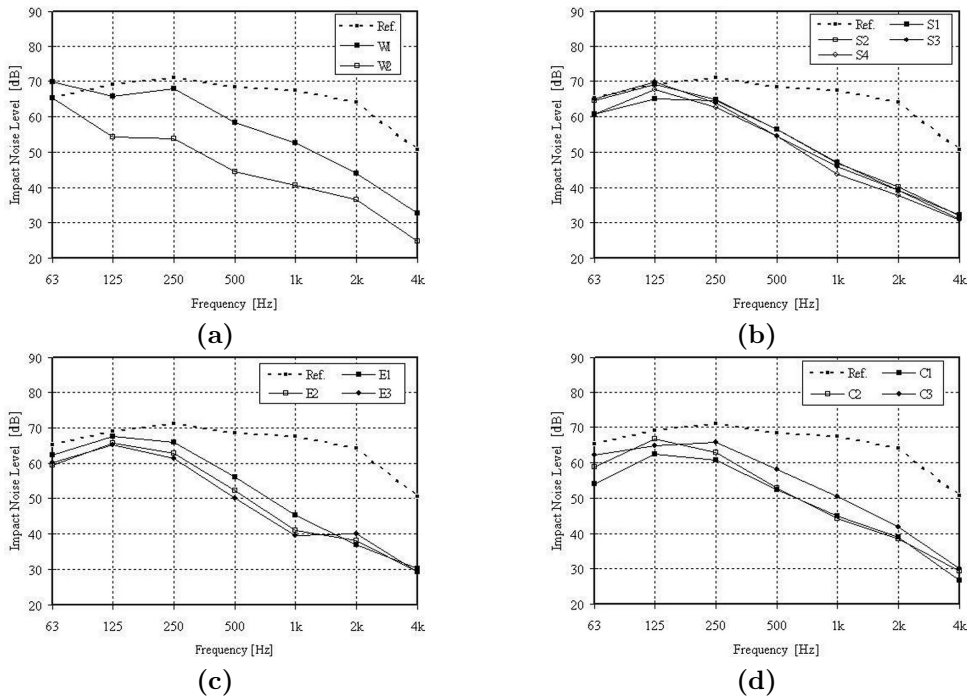



**Figure 2:** Effect of noise reduction for lightweight impact.

of poly-stylene (S1, S2, S3, S4) and 10mm thickness of poly-ethylene(E1), as 15∼16 dB(A) at over 20mm thickness of poly-ethylene (E2, E3). It is almost higher among the resilient material that reduction of Damping mat is 16.4 dB(A).
Therefore, reduction of noise level for floor impact by resilient material is estimated that it of lightweight impact noise is higher than heavyweight impact noise

## 4 - CONCLUSION

- The aspects of noise reduction for floor impact, the Glass Wool and Damping mat is excellent than others, but above material have a weak point as work condition for Glass Wool due to stuff and material cost for Damping mat
- Because anti-moisture layer (P.E Film) is not constructed above resilient material, although Noise reduction for floor impact is less than Glass Wool and Damping mat; the poly- ethylene has merit that the working condition of poly-stylene is reasonable for a little permeability against moisture.
- Therefore, reduction of noise level for floor impact by resilient material is estimated that it of lightweight impact noise is higher than it of heavyweight impact noise is

## REFERENCES

1. **Cyril M. Harris**, *Handbook of Noise Control*, McGraw-Hill Book Company, pp. 23.17-23.18, 1979
2. **DIN 18164**, *Rigid cellular plastic insulating building material*
3. **Din 18164**, *Fiber insulating building material*

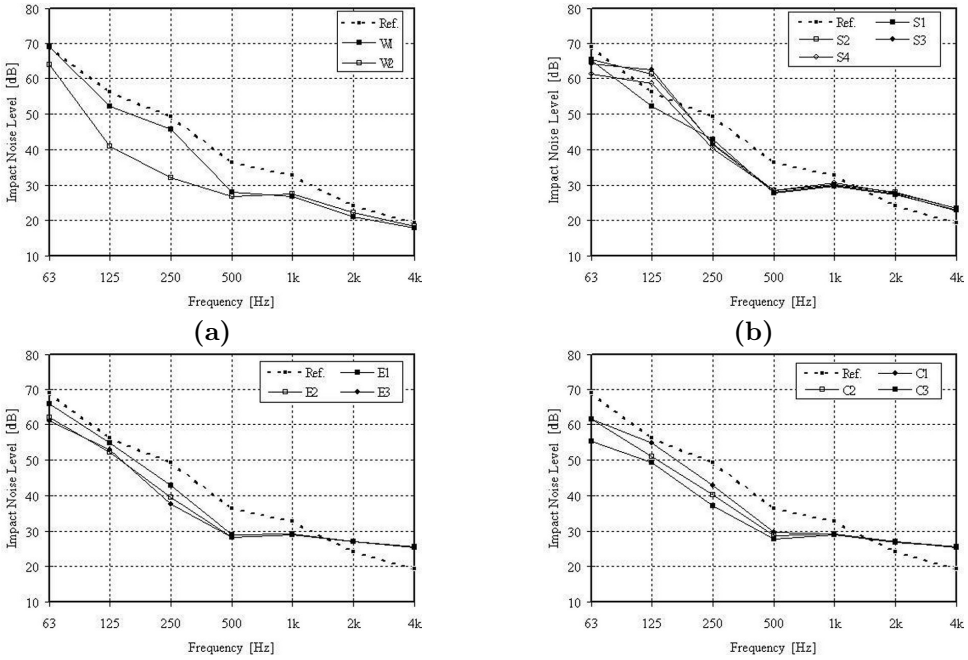
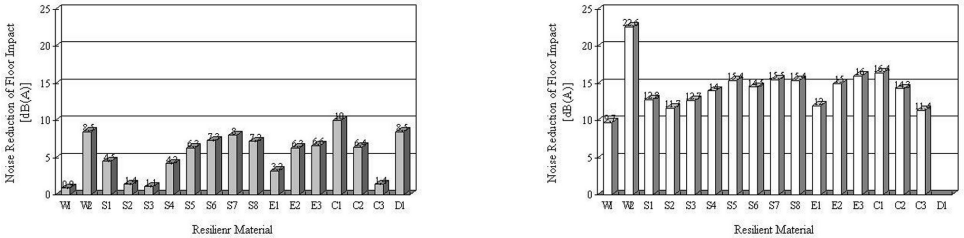



**Figure 3:** Effect of noise reduction for heavyweight impact.




**(a):** Heavy-weight impact. **(b):** Light-weight impact.

**Figure 4:** Comparison of noise reduction for resilient material.