

***Practice Note***  
***on***  
***Application of***  
***SOUND INSULATION***  
***in Residential Buildings to Reduce Noise***  
***Transmission Between Units***

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## **Practice Note on Application of Sound Insulation in Residential Buildings to Reduce Noise Transmission Between Units**

### **Preamble**

1. This Practice Note (PN) provides advisory guidelines to relevant stakeholders, including developers, residential owners, property managers, architects, interior designers, construction contractors, renovation contractors, and environmental / acoustic consultants, on the sound insulation performance of building partition elements (i.e. walls and floor slabs) in and between all types of residential units. This PN aims at providing technical information on the design and application of sound insulation on partition walls and floors between residential units for better privacy protection and indoor sound environment in residential buildings in Hong Kong by reducing noise transmission between units and ultimately, enhancing the liveability of the local community.

### **Means of Noise Transmission Between Units**

2. Noise from normal day-to-day activities, such as noise from television, musical instruments, children playing or running, dog barking, furniture moving, hammering, things dropping on the floor, etc., is an inevitable part of everyday life. Such noise, if not properly controlled or contained<sup>1</sup>, may transmit from one unit to another via walls and / or floor slabs, causing nuisance to neighbouring residents. The noise transmission from one unit to another could generally be categorized as airborne sound through walls / floor slabs and impact sound through floor slabs.

### **Recommended Airborne Sound and Impact Sound Insulation Requirements**

3. **Table 1** shows our recommended criterion on the airborne sound insulation performance of partition wall and floor slab between units and the corresponding effect on human perception in neighbouring residents. The recommended criterion is based on field measurement value “ $D_{nT,w} + C$ ” in noise reduction as defined in ISO 717-1 and the measurement should be conducted by an acoustic professional<sup>2</sup>. Definition of the terms “ $D_{nT,w} + C$ ” could be referred to **Annex 3**.

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<sup>1</sup> Proper choosing of floor finishes, installing of false ceiling, laying carpet/rubber mat over areas where kids or pets with long claws resides, adding soft caps/pads to legs of furniture, etc. can in general prevent and minimize most, if not all, noise transmissions due to day-to-day domestic activities between residential units. Similar precautions could be found in EPD’s website [https://www.epd.gov.hk/epd/english/environmentinhk/noise/prob\\_solutions/neighbour.html](https://www.epd.gov.hk/epd/english/environmentinhk/noise/prob_solutions/neighbour.html)

<sup>2</sup> Corporate member of Hong Kong Institute of Acoustics (HKIOA), professional member of Hong Kong Institute of Qualified Environmental Professionals Limited (HKIQEP), or registered professional engineer in the building services, environmental or mechanical disciplines under the Engineers Registration Ordinance (Cap. 409)

**Table 1: Recommended criterion on airborne sound insulation performance of partition wall / floor slab between units at background noise level between 40 and 50 dB<sup>#</sup>**

<b>D<sub>nT,w</sub> + C (dB)</b>	Effect on human perception in neighbouring residents
<b>≥48</b>	<ul style="list-style-type: none"> <li>● Noise from television / musical instruments are <b>barely</b> audible</li> <li>● Loud speech is <b>not</b> audible</li> </ul>

#Refer to standard GB50118-2010 & T/CECS 462-2017

4. **Table 2** shows our recommended criterion on the impact sound insulation performance of floor slab between units and the corresponding effect on human perception in neighbouring residents. The recommended criterion is based on field measurement value “L’<sub>nT,w</sub>” in sound pressure level (in receiving room) as defined in ISO 717-2 and the measurement should be conducted by an acoustic professional. Definition of the term “L’<sub>nT,w</sub>” could be referred to **Annex 3**.

**Table 2: Recommended criterion on Impact sound insulation performance of floor slab/floor system between units at background noise level between 40 and 50 dB<sup>#</sup>**

<b>L’<sub>nT,w</sub> (dB)</b>	Effect on human perception in neighbouring residents
<b>≤55</b>	<ul style="list-style-type: none"> <li>● Only hammering is <b>barely</b> audible</li> <li>● Other activities are <b>not</b> audible</li> </ul>

#Refer to standard GB50118-2010 & T/CECS 462-2017

5. For residential buildings, solely relying on structural floor slabs would unlikely be able to provide the necessary impact sound insulation. Practitioners and professionals are recommended to install resilient flooring system, which is usually a mat made of recycled rubber or equivalent environmentally friendly materials, on the floor slab to minimize impact sound. A typical installation details of the resilient flooring system which could fulfill the above recommended criteria for both airborne sound and impact sound, could be found in **Annex 1**. This would allow normal day-to-day activities, including noise from television, musical instruments, dog barking, children/pets playing or running, furniture moving and things dropping on the floor, without causing significant noise problems to neighbors/downstair neighbors. Practitioners and professionals are highly encouraged to adopt other practical designs to achieve better

sound insulation performance than those recommended in **Table 1** and **Table 2** for enhancement of privacy protection and minimization of noise problem. Sound insulation performance of partition elements with different typical thickness in their existing residential units/buildings is also provided in **Annex 2** for reference and comparison purposes.

### **Other Benefits**

6. Under Building Environmental Assessment Method (BEAM) Plus New Buildings version 2.0/Existing Building 2.0 (Comprehensive Scheme)<sup>3</sup>, 1 normal credit and 1 bonus credit could be granted if the applicant could demonstrate the airborne sound insulation between spaces and impact sound insulation between floors fulfil the prescribed criteria under the credit of “Health and Wellbeing” (HWB 6)<sup>4</sup> and “Indoor Environmental Quality” (IEQ 14)<sup>5</sup>.

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<sup>3</sup> Schemes promulgated by The Hong Kong Green Building Council Limited (HKGBC).

<sup>4</sup> BEAM Plus New Buildings v2.0: [https://www.hkgbc.org.hk/eng/beam-plus/beam-plus-references/manuals-assessment/ManualsFiles/BEAMPlus\\_New\\_Buildings\\_v2\\_0\(2021Edition\).pdf](https://www.hkgbc.org.hk/eng/beam-plus/beam-plus-references/manuals-assessment/ManualsFiles/BEAMPlus_New_Buildings_v2_0(2021Edition).pdf)

<sup>5</sup> BEAM Plus Existing Buildings v2.0 (Comprehensive Scheme): [https://www.beamsociety.org.hk/files/download/BEAM%20Plus%20Existing%20Buildings%20v2\\_0\\_Comprehensive%20Scheme.pdf](https://www.beamsociety.org.hk/files/download/BEAM%20Plus%20Existing%20Buildings%20v2_0_Comprehensive%20Scheme.pdf)

## Points to Note on Installation of Resilient Mat

### Functions of Resilient Mat

1. By installing the resilient mat on the structural floor slab, part of the impact sound energy excited by the impact source from upper unit would be absorbed by the resilient mat and would not fully transmit to the units underneath, therefore achieving impact sound insulation (**Figure 1**). There are varieties on the product of resilient mat available in the market and the exact installation procedures and precautions shall be referred to manufacturer's or acoustic professional's advice as appropriate. A typical installation of impact sound insulation with 10mm thick resilient mat on 150mm thick structural reinforced concrete (r.c.) (the most common current practice) floor slab is illustrated in **Figure 2**.

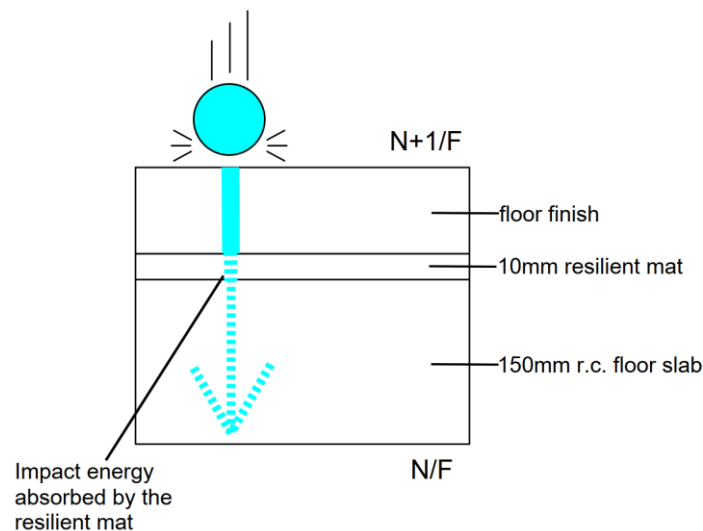


Figure 1 – A Schematic Diagram to Show the Mechanism of Impact Sound Insulation

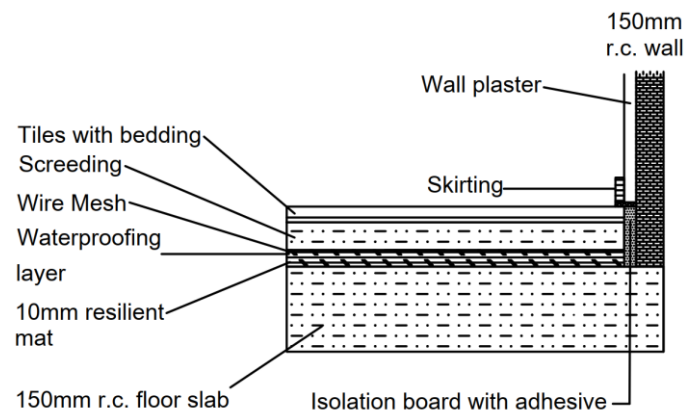


Figure 2 – Typical Installation of Impact Sound Insulation with 10mm thick Resilient Mat on 150mm thick Structural r.c. Floor Slab

### **Installation of Resilient Mat**

2. The following points are generic installation guideline and precautions which shall be considered before and during installation of the proposed typical resilient flooring system, and are applicable to both works in new building and replacement/retrofitting works in existing building. Exact installation requirements or procedures of the resilient mat shall be subject to the advice or information obtained from the acoustic professional or manufacturer as appropriate:

- a) Require structurally sound, clear and level subfloor;
- b) Keep moisture content of the subfloors  $\leq 2.5\%$  by weight;
- c) Install perimeter isolation board by proper adhesive vertically around the entire perimeter of the room with width equal to that of the floor build up to avoid short-circuit point and lateral propagation of impact sound;
- d) Avoid fasten the mat with screws, nails or staples as this may create an acoustical short-circuit point and severely deteriorate the impact sound insulation performance;
- e) Avoid the creation of voids between the resilient mat and the subfloor;
- f) Cover the entire flooring area by the mat without gaps and sealed the joints securely, e.g. by tapes;
- g) Use waterproof layer, e.g. polyethylene sheet or other cementitious waterproofing materials, to cover the mat prior to the application of screed; and
- h) Use wire mesh as a protective layer to prevent accidental damage in future renovation works.

3. In order to achieve our recommended sound insulation performance, developers are suggested to seek proper advice from acoustic professional in early stage to have better advice on the design, workmanship and monitoring to suit their individual project merit as necessary.

### **Maintenance on Resilient Mat**

4. Developers are suggested to include relevant clauses in Owners' Handbook, Deed of Mutual Covenant (DMC), Sales Brochure or other relevant documents to remind/request the future residential owners regarding the provision of resilient mat and also about their responsibility to keep and maintain the mat in appropriate condition so as to avoid any loss in privacy protection and possible nuisance or annoyance to other owners. Residential owners shall remind renovation contractors to avoid, as far as possible, causing any damage to the resilient mat on renovation. In case of any damage to the mat noticed during renovation, renovation contractors could follow the

above generic installation guideline and advice from acoustic professional / manufacturer to re-install the mat partly or entirely.

**Structural and Fire Safety Considerations**

5. The resilient mat is not a structural component of the building and only forms part of the screed and finish floor. The resilient mat is usually made of recycled rubber or other equivalent environmentally friendly material with insignificant mass density, and hence the impact on the design loading of the unit is insignificant.

6. There is no specific fire rating requirements as the resilient mat is installed and sealed underneath the finished floor and generally did not form part of the structural components of the building.

### Sound Insulation Performance of r.c. partition elements with different thickness

**Table 3: Airborne sound insulation performance of r.c. wall / slab with different thickness at background noise level between 40 and 50 dB<sup>#</sup>**

Thickness in mm	$D_{nT,w} + C$ (dB)	Effect on human perception in neighbouring residents
$\geq 100^*$	$\geq 43$	<ul style="list-style-type: none"> <li>● Loud speech is audible and intelligible</li> <li>● Noise from television / musical instruments are audible with clear lyrics</li> <li>● Normal speech heard as murmur</li> </ul>
$\geq 150$	$\geq 48$	<ul style="list-style-type: none"> <li>● Noise from television / musical instruments are <b>barely</b> audible</li> <li>● Loud speech is <b>not</b> audible</li> </ul>
$\geq 175$	$\geq 50$	<ul style="list-style-type: none"> <li>● Loud speech and noise from television / musical instruments are <b>not</b> audible</li> </ul>

\*For units made with r.c wall of thickness <150mm or other materials or designs, residential owners, interior designers and / or renovation contractors may seek professional advice from acoustic professional on applying acoustic surface treatment, e.g. sound insulation board, sound insulation mortar, wall insulation, etc., or purposely designed indoor setting, e.g. furniture, uses, etc., to enhance the airborne sound insulation performance of the wall.

<sup>#</sup>Refer to standard GB50118-2010 & T/CECS 462-2017



**Table 4: Impact sound pressure level of r.c. slab with and without resilient mat at background noise level between 40 and 50 dB<sup>#</sup>**

<b>Different thickness of structural r.c. slab</b>		
<b>Thickness in mm</b>	<b>L' <sub>nT,w</sub> (dB)</b>	<b>Effect on human perception in neighbouring residents</b>
<b>&lt;150</b>	85	<ul style="list-style-type: none"> <li>● Heavy footsteps, furniture movement, kids playing / running, hammering are clearly audible and annoying</li> </ul>
<b>≥150</b>	81-83	<ul style="list-style-type: none"> <li>● Furniture movement, kids playing / running and hammering are clearly audible and annoying</li> <li>● Heavy footsteps are audible but <b>not</b> annoying</li> </ul>
<b>With different thickness of resilient mat on 150mm thick structural r.c. slab</b>		
<b>Thickness in mm</b>	<b>L' <sub>nT,w</sub> (dB)</b>	<b>Effect on human perception in neighbouring residents</b>
<b>5</b>	≤ 65	<ul style="list-style-type: none"> <li>● Hammering is audible</li> <li>● Furniture movement and kids playing / running are <b>barely</b> audible</li> <li>● Heavy footsteps are <b>not</b> audible</li> </ul>
<b>10</b>	≤ 55	<ul style="list-style-type: none"> <li>● Only hammering is <b>barely</b> audible</li> <li>● others activities are <b>not</b> audible</li> </ul>
<b>15</b>	≤ 50	<ul style="list-style-type: none"> <li>● Normal day to day activities are all <b>not</b> audible</li> </ul>

<sup>#</sup>Refer to standard GB50118-2010 & T/CECS 462-2017

### **Terms and Abbreviations**

In this Practice Note (PN), acoustics terms and abbreviations are used to demonstrate the building sound insulation requirements. The definitions of these terms and abbreviations are given below for better understanding of this PN.

#### **Weighted Standardized Level Difference ( $D_{nT,w}$ )**

Single number quantity which characterizes the airborne sound insulation between two rooms in a building as defined in section 4 in ISO 717-1 - *Rating of sound insulation in buildings and of building elements-Airborne sound insulation*. The evaluation is based on field measurements of sound pressure levels in one-third-octave bands between the source and receiving rooms that is standardized to a reference value of the reverberation time in the receiving room using Formula (2) defined in ISO 16283-1 - *Field measurements of sound insulation in buildings and of building elements-Airborne sound insulation*. The requirements on the instrumentation, noise source, procedure and set-up for sound level measurement shall be referred to section 4 to 7 of ISO 16283-1.

#### **Spectrum Adaption Term (C)**

Defined in section 4.5 in ISO 717-1 to characterize the sound insulation with respect to pink noise.

#### **Weighted Standardized Impact Sound Pressure Level ( $L'_{nT,w}$ )**

Single number quantity which characterizes the impact sound insulation of a floor as defined in section 4 in ISO 717-2 - *Rating of sound insulation in buildings and of building elements-Airborne sound insulation-Impact sound insulation*. The evaluation is based on field measurements of impact sound pressure levels in one-third-octave bands in receiving room that is standardized to a reference value of the reverberation time in the receiving room using Formula (1) defined in ISO 16283-2 - *Field measurements of sound insulation in buildings and of building elements-Impact sound insulation*. The requirements on the instrumentation, noise source, procedure and set-up for sound level measurement shall be referred to section 4 to 7 of ISO 16283-2.

**END**