Residential Sound Control Options

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Non-refereed

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A challenge for dwellings is to cater for potentially conflicting acoustic environments for all phases of life – whether within the home or between tenancies. Developers are increasingly seeing the value of quiet, while owners see noise control as a "want to have". This article examines acoustic comfort, building systems and success factors.

Introduction

It is pointless installing a sound-control system unless you know it will keep out enough noise and you are attacking all problem sound paths. So it is necessary to know what to design for (acoustic comfort) and how to achieve it (appropriate building system selection and connection).

Acoustic comfort

Acoustic comfort is the design goal around which you select a system. There is no 'one size fits all' level of acoustic comfort. Plus there are cost implications. As a rule, high-performing systems require more expensive materials, more specialist help and are more sensitive to build quality.

Occupants generally are not interested in technical noise control ratings, just the level of acoustic comfort needed in their daily lives. For instance, some may not mind hearing an occasional muffled shout, but would be disturbed by clear speech. It's not an exact science because people's impressions of acoustic comfort vary.

A developer may use group consensus to apply a likely standard of comfort to a building, for example, '80% of occupants will be satisfied with this construction'. This would be questionable for a deluxe apartment. Another approach is to compare buildings of known comfort, for example, 'I want noise in this building to be half as loud as that one'. When designing for specific occupants, care is needed to determine their expectations and sensitivity to noise.

Noise control

Once the acoustic comfort is decided, the next step is to select building systems that can deliver it. Building systems can be measured and rated for sound control. The common ratings in New Zealand are:

- **STC** (sound transmission class) for airborne sound (stereos, voices) – a higher value suggests more sound is kept out
- **IIC** (impact insulation class) for impact sound (footsteps, dropped objects) – a higher value suggests more sound is kept out
- **dB(A)** (A-weighted sound pressure level) for the sound level received (traffic, air conditioning) – a lower value suggests a sound is quieter.

Although the tables given here relate acoustic comfort to sound ratings and examples of wall systems, specifying appropriately rated building systems does not in itself guarantee a certain comfort level (especially for inter-tenancy or specialist within-residence systems).

Success factors

The following factors affect success.

Consider the building systems

A sound may enter a room by more paths than expected. Figure 1 shows that if you just upgrade a wall to reduce noise it may not suffice – sound can travel through the floor too. Consider a quiet room as a zone where sound can get in from every direction, e.g. walls, floors, ceilings, windows, doors, and building services. Know likely weak links.

Consider junction details

Connections between systems affect how much sound passes between rooms. A high-comfort STC 65 wall on a floor that is continuous beneath a wall may struggle to meet code compliance. Thicker supports, floor overlays, or a discontinuous floor are the sorts of details that can help remedy this. Knowing which parts of a building are likely to affect sound control creates an awareness of when specialist help is needed.

Consider sound sources

Typical types of noise that need to be considered are external noise (e.g. traffic noise through the façade), airborne and impact noise (through walls, ceilings and floors), and service noise (from HVAC, plant rooms, lifts, and pipes). Non-typical residential sounds may require special design, e.g. plant rooms, entertainment centres or a very busy road.

Reducing low-frequency sounds, such as from a home theatre, increases comfort levels, but again requires special design. Balance the design – it may be pointless reducing traffic noise if the air-conditioner is louder.

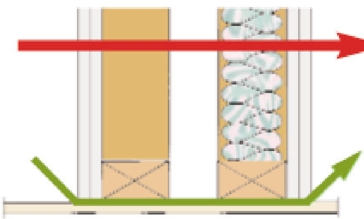

Figure 1: Consider all sound paths.

Sound control between household units

Table 1 gives typical levels of acoustic comfort, sound control ratings and examples of sound control building systems for inter-tenancy situations. The New Zealand Building Code sets the legal minimum sound control permitted between adjoining habitable spaces.

As a general rule, sound performance moves up a comfort category each time 5 dB is added to the STC value.

Sound control within the home

The trend in New Zealand is for more homeowners to specify sound control within their homes, especially around master/guest bedrooms and between upstairs and downstairs.

In the UK it is accepted good practice that a wall laboratory-tested to STC 40 is built between bedrooms, living areas and bathrooms. But New Zealand does not have a code minimum for sound control within a residence.

The acoustic comfort level of homes depends on the needs and sensitivity of the occupants and the likely noise sources.

As a rule of thumb, STC 45 provides a general sound control upgrade within a home. Special rooms (for the budding drummer) will require specific design. Junctions in houses are usually not designed for noise control so obtaining very high levels of sound control can be difficult and specialist help is usually required. To control external sounds, all external walls, windows, doors and vents need to be considered.

People are generally more tolerant of sounds emanating from their

Table 1: Sound control options for adjoining household units.

	Code minimum	Good	Better	Best
Acoustic comfort*	50% occupants satisfied	80% occupants satisfied	sometimes disturbed by noise	seldom disturbed by noise
Sound control rating	Field STC 50 Field IIC 50	Field STC 55 Field IIC 55 + dB(A) 30 in living areas	Field STC 60 Field IIC 60 + dB(A) 25 in living areas + low-frequency design	Field STC 65+ Field IIC 65+ + dB(A) 20 in living areas + low-frequency design
Construction** (all have R1.8 insulation in cavity; sound sealant around perimeter)	2 × 10 mm noise-control plaster-board each side of single-frame wall with resilient rail; 70 mm cavity	2 × 13 mm noise-control plaster-board each side of staggered steel-stud wall; 90 mm cavity	2 × 13 mm fire-rated plasterboard each side of double-frame wall; 150 mm cavity	2 × 13mm noise control plaster-board each side of double-frame wall; 205 mm cavity

* Based on off-shore building classification systems and research (e.g. INSTA 122).

** Generic construction descriptions are given to indicate typical building work. It is critical that system performance is verified by a manufacturer or acoustic specialist, even small variations can undermine performance.

Table 2: Sound control options for individual homes.

	Code minimum	Good	Better	Best
Acoustic comfort	standard construction	slight upgrade	about half as loud as standard construction	excellent
Sound control rating	STC 35 IIC 30 (for hard floor covering)	STC 40 IIC 40 (for hard floor covering)	STC 45 IIC45 (for hard floor covering) + external noise db(A)	STC 50+ IIC 55+ (for hard floor covering) + external noise db(A) + low-frequency design
Construction (see note ** above) (all have 20 mm particle-board floor; 200 × 50 mm joists, except 'Best')	100 mm timber studs; 10–13 mm plasterboard each side; 13 mm plasterboard to steel or timber ceiling battens at 600 mm centres	2 × 10 mm noise-control plaster-board one side and one layer other side 100 mm timber frame	2 × 10 mm noise-control plaster-board each side 100 mm timber frame; acoustic overlay for timber floors	by special design
		noise control batts in cavity; sound sealant around perimeter; 13 mm noise-control plasterboard to steel ceiling battens on clips at 600 mm centres		

own home than from their neighbours. So what works well in a home may not be the case between apartments. Table 2 gives typical levels of acoustic comfort, sound control ratings and examples of sound control systems within homes.

Retrofitting sound control

Upgrading existing buildings for sound control can be very successful and it can also be problematic.

As already noted, junctions and services affect sound control, and it may not be possible to view these details, or the junctions and services may not be designed for sound control.

In some cases, a belt and braces approach may be required, with the risk that a retrofit may not significantly enhance performance. Specialist or manufacturer help is recommended.

Sound control for all buildings

Determining the appropriate sound control option is important for all buildings. Think of the value of designing the right amount of 'quiet' into a hotel.

If patrons suffer sleep disturbance they are less likely to return and will tell others about it, potentially affecting the profitability of the business. Well-designed noise control systems can affect productivity in offices, well-being in rest homes and health-care facilities, and learning ability in educational facilities.

People value quiet. It is a matter of being aware of the acoustic comfort level desired, translating this to building systems, understanding the success factors and knowing whether to engage specialist help or turn to an off-the-shelf solution. ❑