Noisy or Quiet Apartments: A Bit of Forethought Required?

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Introduction

The recent proliferation of inner city apartments has resulted in several instances where noise has been a serious issue. Purchases are becoming more aware these issues and in some cases having refund clauses in the sale agreement relating to noise.

- Noise affecting apartments can be classified into;
- Noise from adjacent tenants - TVs, stereos
- Noise from adjacent buildings - Pubs, clubs, cooling towers
- Transportation noise – cars, trains, planes
- Services noise – fans, plumbing, lifts, fan coil units

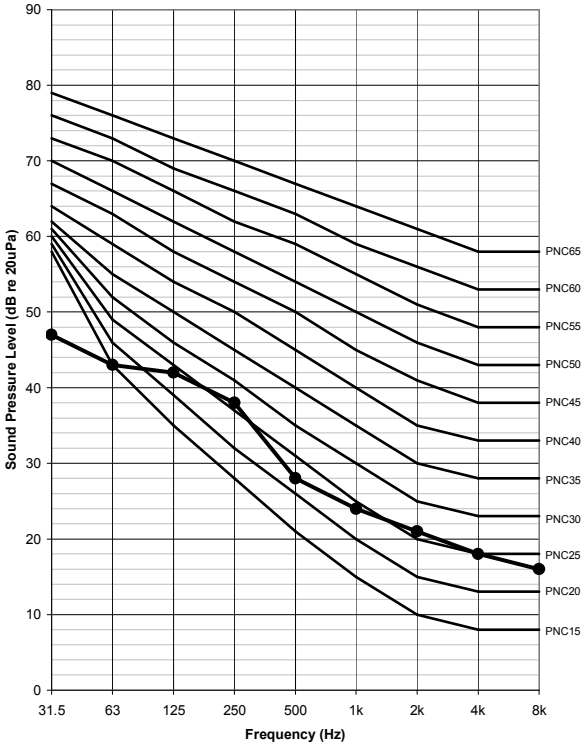
The Building Act clearly defines the minimum acoustic separation requirements between apartments that must be met. These are a minimum sound insulation of STC55 and a minimum impact isolation of IIC55 (eg. footfall noise). These requirements are reasonably well understood by architects and engineers. There are some pitfalls when services are common to apartments or run through apartments.

Noise from adjacent buildings is controlled by the Resource Management Act. This gives local councils the power to set and enforce noise limits between adjacent properties. There has been recognition that the ambient noise levels in areas such as the inner Auckand region are higher than urban areas. This is reflected in less stringent noise limits in the inner Auckland City. Large items of plant such as cooling towers or standby generators can require significant and expensive acoustic treatment when located close to apartments.

Aircraft noise controls have recently been introduced with the inclusion of noise zones around airports and building standards within district plans. However there are no controls on buildings relating to road or rail noise. Dealing with this noise is up to the developer and architect. Wall, roof and window constructions need attention. Air intakes and outlets also should be considered.

The main topic I want to discuss is noise from services. This falls in a void between the various pieces of legislation. These are no legal requirements limiting noise from services within apartments and common to apartments. Consequently there are large variations in internal noise levels within apartments depending on the forethought given by the developer, designers and the contractors.

Figure 1: Bedroom Noise Level



Appropriate Criteria

The noise level specified for apartments needs to be very carefully considered. People's expectation of noise can be very different. Occupants moving from a typical New Zealand home will not be expecting to hear noise from fans, lifts, plumbing, risers etc. Those people moving from overseas apartment living may not be so sensitive to noise. Treating services noise in apartments like hotels is not acceptable. Hotels have short-term occupants who will tolerate a higher level of noise up to PNC30. Noise within permanently occupied apartments has to be much lower. PNC35 is not appropriate for bedrooms. The

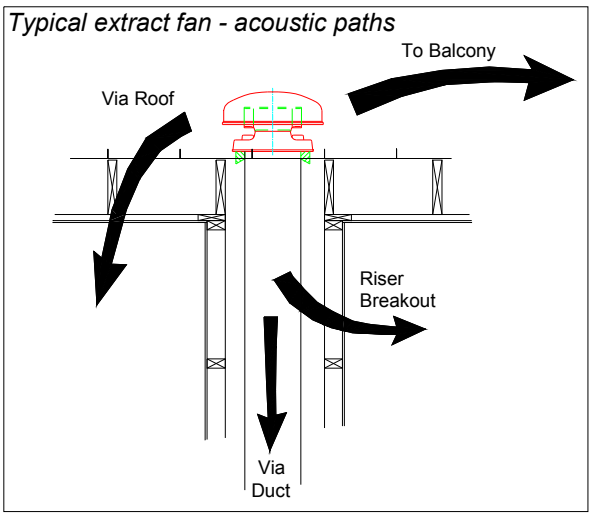
design noise level in a bedroom should be PNC20-25. Lounges and living areas could be designed to PNC 30-35.

However, there may even be some instances where even low noise levels are not low enough. Consider the case were a high quality apartment selling for in excess of $1M, a purchaser may not want to hear any mechanical plant. Figure 1 shows the bedroom noise level that was unacceptable to the new occupants of a $1M apartment. The level measured was PNC26. This is an example where the noise level in the apartment, while low, was not low enough. It did not match the expectations of the owner. The point I make is, think carefully about design criteria and what is appropriate for the intended quality of the building.

Fans

Roof top extract fans are a typical source of noise. The usual transmission paths down the duct and radiating from risers are present along with external noise to balconies and down through longrun type roofs. Acoustic treatment can be reduced by sensible placement of the fans away from areas such as bedrooms and balconies, proper construction of the risers and treatment to the roof areas around the fan. The radiated noise from integrated roof extract fans is difficult to treat and in some cases precludes the use of this type of fan.

Typical extract fan - acoustic paths



It is essential that the acoustic assessment is done as part of the design process as remedial treatment to walls and roofs will be difficult and costly.

Be careful using fan data. Some small tube type fans quote a noise level in dBA at 3m. This will not be the noise level in an enclosed environment of a room. For example of a fan is quoted as 35dBA at 3m this will be around PNC45 when placed in a room.

Proper vibration mounts are essential and neoprene mounts generally won't do the trick. Springs are the best bet with static deflections in excess of 25mm depending on fan size.

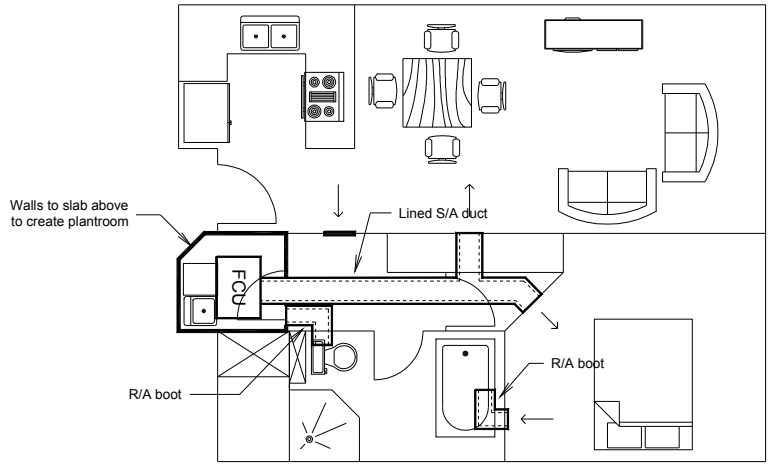
Fan Coil Units

Fan coil units can be a huge

acoustic problem. At the risk of stating the obvious, don't position a fan coil unit above the master bedroom and expect it to be quiet unless you want to spend a fortune on acoustic treatment. Position the fan coil unit over the laundry

deflections greater that 25mm. Neoprene mounts are generally not enough. Take care when setting up the mounts. I have seen many instances where spring hanger systems have been useless through poor installation.

Layout of apartment FCU equipment



or other less noise sensitive spaces. Construct a mini plantroom around the FCU by extending the walls of say the laundry up to the underside of the roof. These suggestions are even more important for hydronic type units that have a compressor cutting in and out. The supply and return air ducts will need to be lined with return air boots as shown. For larger units specially adapted splitter type silencer arrangements will be required.

As a general rule the FCU should be over-sized to avoid running the fan at high speeds.

The velocities in the ducting and grilles need to be lower than normally used for office type systems. Typically run-out ducts should be limited to 2-3m/s and flexibles to 1.5-2m/s. Grilles are to be selected carefully. Sizing the duct with low velocities has the added benefit of reducing the pressure losses and thus reducing the noise from the fan.

The FCU is to be mounted using proper spring hangers with static

Plumbing

Sometimes the sounds of running water are not that soothing especially when it conveys your neighbour's toilet habits. Storm water, waste water and mains water all typically run through neighboring apartments, especially waste water from showers where piping runs through the ceiling space of the apartment below. Treatment typically involves pipe lagging with foam and barium loaded vinyl type products.

To delve into the acoustics of water pipe noise is an article on its own and separate from the focus of this article. Perhaps a good topic for a sequel.

Crosstalk

Where ventilation systems are common to several apartments (eg. kitchen and toilet extracts) there is the potential for crosstalk between apartments. Careless installation will weaken the sound insulation of the adjoining partition such that the requirements of the Building Act are not met. Small in-line silencers can be used to good effect not only reducing the crosstalk problem but also reducing the level of fan noise. Careful duct layouts and the use of lined duct and flexible ducting can be used to reduce the extent of acoustic treatment required.

Cooling Towers, Lifts

These substantial items of plant require just as much attention. As in office towers, it is the high priced apartments which are right beside plantrooms. The close proximity of bedrooms to the plantrooms, places special demands on the vibration isolation of plant and piping and on the sound insulation of walls and risers. When there are nearby apartment balconies the acoustic demands are even greater. Even in the inner city where there is a higher ambient noise, large cooling towers will require intake, discharge attenuation and perhaps speed control at night. Typically concrete walls or separate framed walls will be required around plantrooms and additional layers of Gib will be required to risers.

Lift noise can be tricky. It is generally a structure borne noise problem from the lift machinery and as the lift passes each floor. Easiest solution, keep sensitive areas such as bedrooms well away from the lift and lift shafts.

Final Plea

All these problems and remedies are so much simpler and cheaper to deal with at the design stage. Remedial treatment may not be that expensive on a one-off case, but if you get it wrong and there are one hundred or so apartments then even a cheep remedial solution is going to be very expensive. As the saying goes - "A *stitch in time.....*" ❑