



Inter-tenancy floors in MDH

Part 2 of this *Build* series on designing and building medium-density housing covers inter-tenancy floors. The most important consideration here is to eliminate penetrations into the inter-tenancy floor zone.

Just as the inter-tenancy wall (ITW) has special status in a medium-density housing (MDH) development, so too does the floor separating vertically adjoining units such as apartments. Due to the onerous fire and acoustic considerations between units, we chose in our book *Medium* to call this the inter-tenancy floor (ITF). Let's explore the issues.

Firstly, the floor that separates two adjoining households is a legal boundary. This means that the ownership will move from fee simple – owning all the space above and below your piece of land – to unit title where ownership is defined by boundaries running both vertically and horizontally.

Clearly one of the key aspects of a unit titled apartment is the need to provide support for other structures and units above and on either side. It must also cause no damage and no nuisance to the neighbours, which limits how to plan the services.

New Zealand Building Code clause B1 *Structure* and clause B2 *Durability* are the most important, followed closely by clause C *Protection from fire*. Less prominent but no less important is the need for acoustic separation (clause G6 *Airborne and impact sound*).

Combat acoustic transmission with solid heavy mass, physical separation of surfaces and soft fluffy absorbency.

Above-Code apartments can eliminate noise

Residents of existing apartment buildings that meet the Building Code will be able to confirm what BRANZ research has shown – hearing noises from people in other apartments proves to be the most annoying.

On the other hand, if you live in a well-built apartment that exceeds the Building Code, you may pass years without hearing a single sound from an adjoining residence either above, below or to either side. What makes this possible?

While ITW must be designed to a certain standard of STC (airborne sound transmission class), ITF must meet the

more difficult impact insulation class (IIC) standard. This addresses noise transmission from something physically hitting the floor, like footsteps. If not treated properly, that noise transfers straight through.

Footsteps on a well-carpeted floor will be largely inaudible to people below, but if you trade slippers for stilettos and carpet for trendy polished concrete, you have a nightmare on your hands.

A small metal object dropped on a tiled surface over a concrete floor can transmit the sound straight through to the floor below, so avoid situating bathrooms above living areas or bedrooms.

Noise transmission through a floor matters less if upstairs and downstairs are within the same household – parents can always call out, in time-honoured fashion, to keep the noise down! This is a lot harder in a multi-unit residential dwelling where you may not know the residents upstairs.

Reducing sound with good design

The best approach is to remove the problem from the outset using good design.

To combat acoustic transmission, three aspects are needed – solid heavy mass, physical separation between surfaces and soft fluffy absorbency to combat different frequency sounds.

Selecting materials to use

Some materials work better than others. Concrete floors work well for everyone, due to their heavy mass, if they are carpeted with a nice Aotearoa New Zealand wool looped pile and a thick rubber underlay.

Solid timber solutions such as cross-laminated timber (CLT) can also be good, but the natural resonance of springy timber needs tamping down with a layer of cement screed to deaden any sound transmission.

Standard particleboard and timber joists in the style of NZS 3604:2011 *Timber-framed buildings* are a firm no without significant adaptations and additional layers.

Tiled surfaces or timber/plastic floor overlays can be a nightmare for people in the floors below. Remember, the easiest way to stop noise transferring through the floor is to stop it getting into the floor in the first place.

Adding suspended ceilings

Having reduced the amount of noise entering the flooring system, it is important to stop any further residual noise breaking out.

For this reason, suspended plasterboard ceilings on flexible resilient metal rails are good, supporting one or two layers of plasterboard below and a thick layer of acoustic absorbent insulation above that.

Remember that sound waves can reproduce that noise not just directly below but can travel quite some distance sideways as well.

Don't puncture the ITF with services

There is another route for sound to travel through and this is the worst of all – services, especially piped services. The ITF is not a place to be punctured with services – every time a tradie puts a hole in the ceiling for a light fitting or a ventilation duct, it creates an acoustic problem as well as a potential fire risk.

Avoid penetrating the ceiling with recessed downlight fittings – in fact, avoid them completely because they are an awful light to read by. Plan instead for wall-mounted uplighters or free-standing table lamps that can bounce light upwards to wash the ceiling with a gentle subtle glow.

Even worse, if a plumber plans to punch through the ITF and run plumbing services

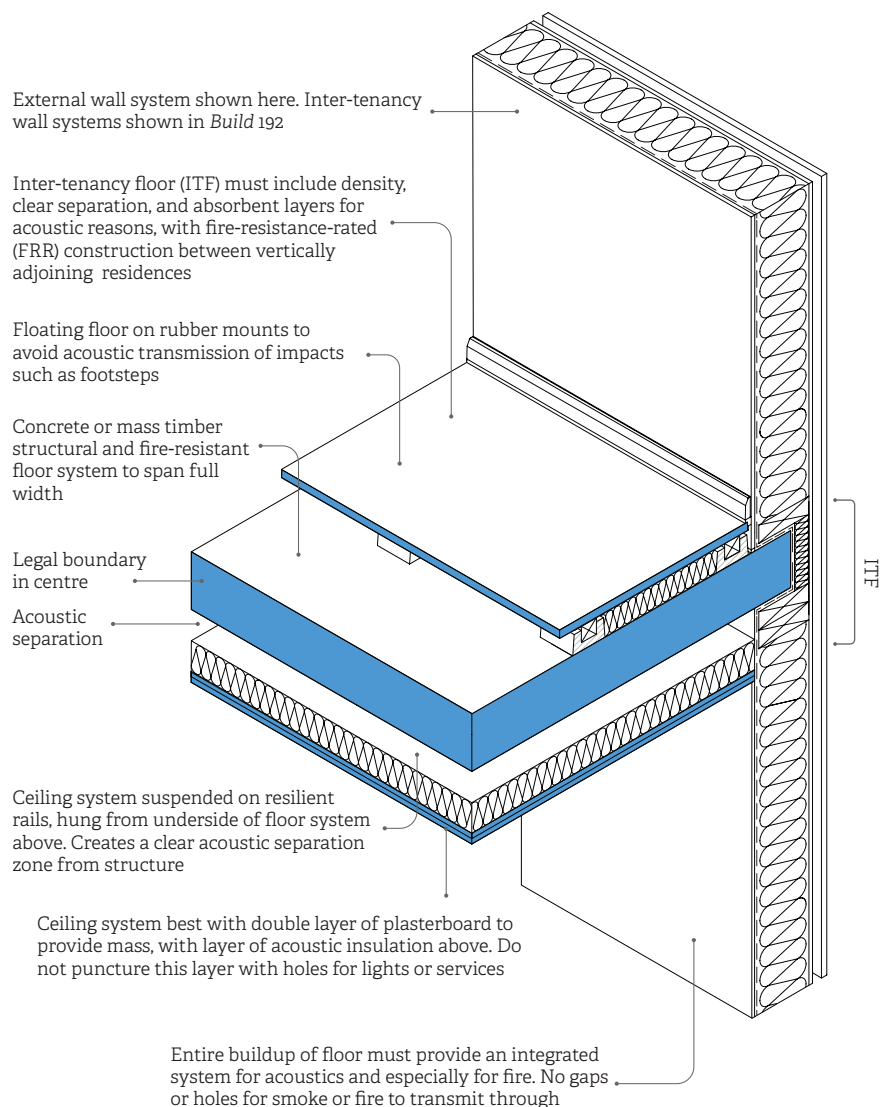


Figure 1: Components of a typical inter-tenancy floor (ITF) system.

in the unit below, that will create acoustic, fire control and legal problems as well.

Services through into a neighbouring apartment should be strictly forbidden. That's where it is up to the skill of the architect or the design professional to design out this sort of problem right from the beginning.

Any penetrations of services from one fire compartment to another – such as into the ceiling of the common area – should have a compliant fire-stopping solution such as fire dampers to a duct or fire collars fitted to wiring and pipework. Somewhere in the middle of that whole sandwich of layers lies the theoretical

legal boundary, which will be noted on the unit title plan.

Options with concrete floor

If you are laying a concrete floor, install the drainage so that it is encapsulated fully within the concrete floor before you pour the slab – liaise with the structural engineer. Better yet, drop the slab down locally, allowing freedom to replan bathroom fixtures later, and complete the rest of the area as a raised floor to bring the finished floor back to flush with finished floor level (FFL). Alternatively, particularly in retrofits, design in a raised floor just a step or two higher. ◀