

Multi-storey LTF guidance

Higher-density housing is becoming more common and necessary as our population grows. BRANZ is helping designers with guidance on the specific engineering design methods and requirements for multi-storey light timber-framed buildings.

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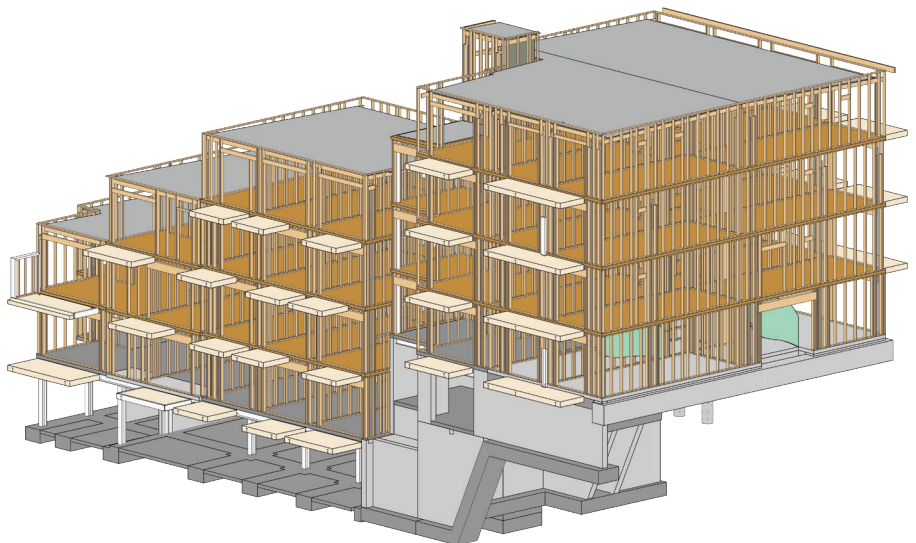
AS THE New Zealand population continues to increase and the need for housing becomes more critical, options for developing residential and commercial buildings aligning with the realities of denser urban centres and the need for multi-storey residential structures are being considered.

LTF provides resilient buildings

Throughout the world, the challenges of mid-rise construction are being met by using timber options and, in particular, light timber framing (LTF). This is seen as an effective method for providing resilient buildings.

Typically, these buildings do not include expansive floor spans and large open spaces, but have many walls and rooms, making them well suited as accommodation and residential structures.

Because of its light weight in comparison to other building materials, LTF can deliver



Mary Potter Apartments. Image courtesy of PTL Structural Consultants.

buildings of lower mass that have smaller foundations and reduced seismic mass, resulting in lower earthquake forces.

Some challenges to think about

However, multi-storey LTF buildings also have issues that need to be addressed to satisfy Building Code requirements and provide robust designs that people enjoy occupying.

The lightweight nature of timber buildings, including LTF, means there are serviceability aspects like sound transmission and floor vibrations that require some thought. Ideally, these should be considered as an integral part of the building design rather than an afterthought.

Fire resistance is always a critical consideration due to the combustible nature of timber. However, because LTF buildings have interior and exterior linings that cover the wooden structure, fire resistance ratings can usually be achieved using conventional construction methods detailed in the technical literature of plasterboard suppliers.

Require specific detailing

The flexible nature of LTF buildings - often utilising plywood nailed to the timber framing as the primary lateral load-resisting system - must be taken into account for larger buildings.

Buildings that can deform without collapsing can have greater ductility and thereby lower seismic demand inputs. This can result, though, in unacceptable movement and excessive deformation leading to significant damage following an earthquake or potentially unacceptable movement during low-level earthquake events or even high winds.

Consequently, designers must understand how to properly detail multi-storey LTF buildings. Adequate performance requires balancing the strength and stiffness of the structural system while also providing occupants with safe and satisfying living and working environments.

Free guidance for buildings up to 6 storeys

To answer these challenges, BRANZ recently published design guidance aimed at helping building designers and consenting officials better understand the requirements for LTF buildings up to 6 storeys. This will help pave the way for the increased use of timber in larger buildings and provide design options for multi-storey residential buildings that could help satisfy housing needs throughout the country.

Using more timber to satisfy a growing market of multi-storey buildings is seen as a great way to utilise and add value to a New Zealand-grown resource. It also provides a significant source of carbon sequestration.

The guidance, *Multi-storey Light Timber-framed Buildings in New Zealand: Engineering Design*, is available as a free download.

The guidance document was the topic of a four-part webinar series by BRANZ during January and February 2019 and part of the Timber Design Society Timber MDH and Mid-Rise Roadshow in August 2019.

The Roadshow also included a case-study design of a complex 5-storey LTF building designed for Wellington using the methods in the guide. This provided an example of how the guidance can be applied and the resulting structural solutions.

Provides methods but not prescriptive

The guidance includes complete structural analysis methods for calculated loads and load paths for larger LTF buildings. It has explanations of how these buildings respond differently to earthquakes compared to traditional reinforced concrete and structural steel buildings and how to account for those differences. The various building components and the loads on them are described along with methods for designing them.

The guidance is not intended to be a prescriptive solution but instead provides specific engineering design methods that

will be unique for the building and loadings under consideration. It includes acknowledgement of the methods included in the new timber standard that is poised to replace NZS 3603:1993 as a Verification Method for specific engineer designed timber buildings in New Zealand.

Methods from NZS 3604:2011 *Timber-framed buildings* can be used to design some of the parts of larger LTF structures, but there are many instances where more complex engineering solutions must be considered. These include structural diaphragms, connections and lateral load-resisting shear walls.

Calculation procedures using existing building standards are provided. Suggestions for how these buildings can be modelled using computer-based structural analysis tools are also discussed to allow designers to incorporate LTF models within more complex building options and potentially BIM applications.

Included is an example design of a 4-storey block of flats having realistic complexity and architecture.

LTF will continue to dominate housing

LTF has always had a place in the New Zealand building landscape and will continue to dominate the residential building scene due to its simplicity, constructability and efficiency.

As our growing population drives demand for increased-density housing, LTF can provide high-performance building solutions for multi-storey timber buildings with lower environmental impact and no compromise on safety or amenity.

The BRANZ guidance on multi-storey LTF buildings aims to help designers create robust and resilient buildings using well-understood and simple methods and a locally available New Zealand resource. ◀

Note The guidance, *Multi-storey Light Timber-framed Buildings in New Zealand: Engineering Design*, is available as a free download at www.branz.co.nz/LTFBuildings.