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Will our buildings stand climate change?

A research project is examining whether light-timber framed buildings built to Building Code requirements, particularly for wind, will be fit for purpose in the face of changing weather events.

NEW ZEALAND IS accelerating its efforts to catch up with the actions required to address climate change.

The Climate Change Response (Zero Carbon) Amendment Act 2019 provides the overarching framework for New Zealand to deliver on its commitments under the Paris Agreement. A wide range of work is now under way across many parts of the economy, with the Climate Change Commission playing a key role in shaping New Zealand's response and coordinating government and industry responses.

Damage to a house after a tornado swept across Mt Maunganui, Tauranga.

PHOTO – SNPA/CAMERON AVERY

Shift to low carbon-buildings

Throughout the building industry, significant efforts in recent years have focused on preparing for the shift to low-carbon buildings. BRANZ is playing a key role in this, leading the *Transition to a zero-carbon built environment* programme of work.

More recently, MBIE Building System Performance initiated the *Building for climate change* programme, which has two key elements reflecting the two strands of New Zealand's response under the Zero Carbon Act - mitigation and adaptation.

Mitigation has a strong focus on transitioning to low-carbon buildings and building use. Adaptation looks at what needs to change with building performance considering our changing climate and extreme weather events. As an area of

focus, adaptation is less mature because efforts have been predominantly directed at reducing carbon emissions.

BRANZ has signalled the importance of both strands through its Levy Investment Portfolio Statement. It has also been providing leadership on the transition to a low-carbon built environment at the system level through the Construction Sector Accord process.

Does the Building Code need to change?

Since June, BRANZ and WSP have been working together on a Building Research Levy-funded project to explore what potential changes to the Building Code might be required given our changing climate.

With our complementary expertise around these key climate issues, we aim to gauge the ability of present building design and construction practices to deal with climate change effects.

Starting with LTF buildings

As a first step, the team is investigating whether current Building Code design and construction practices for light timber-framed (LTF) buildings result in buildings with sufficient redundancy to accommodate the effects of climate change. Will these buildings maintain their current performance levels when climate events get worse?

The focus on buildings designed and built in accordance with NZS 3604:2011 *Timber-framed buildings* has been chosen as this is the dominant form of residential construction in New Zealand.

In the future, construction practices are likely to extend the boundaries of LTF construction as a mechanism to address carbon in building materials. If this research proves successful, it is anticipated that the approach could be applied more broadly - for example, to non-residential buildings.

The issue of adapting buildings to climate change is potentially broad, and many facets of construction and buildings will need to be considered. Rather than try and map the full range of issues that could be considered, the approach is very much prototyping - work will focus on a key area that we can learn and build from.

Wind events can provide insights

There is a particular focus on wind effects in the project. This has been identified as a key area of future climate effects that needs to be better understood if buildings are to remain fit for purpose over their intended life.

Wind is one of the main considerations in the structural design of buildings in New Zealand and is the dominant lateral loading for many structures. Unlike earthquakes, which may or may not occur over a given period, damaging wind events are more frequent. Ongoing trends in weather can be addressed in a probabilistic manner to assist in predicting potential future scenarios.

Wind is an important input into weathertightness (with rainfall), natural ventilation and acoustic performance of buildings. It also plays a role in the amenity and safety of areas around buildings where people live and work.

Wind effects are more likely to relate to serviceability effects, such as deflection, rather than structural failure or a building collapse.

Approaching the challenge

The project is mapping out the changes in the design of new buildings that would correspond to changes in the climate parameter of wind speed. This will allow us to establish the extent to which building design in New Zealand may or may not need to adapt for climate change and the associated high-level economic impacts, such as implications for insurance.

The design standards widely used for LTF buildings are being analysed to establish how changes in climate parameters - specifically wind - affect the design solutions for LTF buildings and the products and components they use. The sensitivity of LTF building designs to climate change can be estimated by determining design solutions for a range of wind speeds, allowing the relative effects of different climate change scenarios on building design to be seen.

A benefit of this approach - using sensitivity rather than absolutes - is that, as climate data is updated or amended, the approach remains valid. It is not wedded to a particular moment in time or set of assumptions. The team is also looking to apply latest climate change data to provide current estimates of the impact.

Such an approach will also allow any redundancy in the current design standards to be identified and reveal which parts of a building's design will not need to change. A sensitivity analysis of the climate change effects would allow a risk-based approach to climate adaptation to be assessed.

Current design methods may require further investigation to assess the true impacts of changes in climate where factors other than wind speed come into play. For example, the effects of changes in wind speed on the weathertightness of buildings will also need to incorporate changes that are expected in rainfall and temperatures.

Key building controls

Four key standards have been identified for consideration in this research due to their significance and cornerstone roles in the industry:

- NZS 3604:2011 *Timber-framed buildings*
- E2/AS1 *External moisture*
- NZS 4211:2008 *Specification for performance of windows*
- NZS 4223.4:2008 *Glazing in buildings - Part 4: Wind, dead, snow and live actions*.

In tandem with climate adaptation, the team has also identified that the project may have wider benefits for the industry - it could help identify where better deterministic methods are needed for designing buildings.

For more To find out more about the project, get in touch with the WSP and BRANZ team at research@branz.co.nz.