build

BRANZ

BUILDING KNOWLEDGE

ISSUE 202 | JUN/JUL 2024

Circling in on sustainability

The drivers of change

+ Designs on healthy homes

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Repurposing with purpose

Build readers of a certain demographic (to which I undeniably belong) will be familiar with Friday's primetime TV show *The Repair Shop*. It's a ratings winner. Ordinary Brits bring their dilapidated family treasures – furniture, jewellery, artworks, dolls, clocks and so on – to a quaint rural workshop where skilled artisans painstakingly restore the items to their former glory.

The stories behind the items are often very moving, but I believe the show's popularity is partly because the notion of repairing or recycling, rather than discarding and replacing, sits very comfortably with many of us. *The Repair Shop* is a small-scale example of the circular economy at work.

It's heartening to see that, on a much larger scale, the circular economy is gaining strength in the building and construction sector. As David Hindley notes on page 44, recycling or repurposing construction waste are increasingly seen as critical steps to improving sustainability in the sector – meaning less waste in landfills, less pressure on supply, lower emissions and in many cases money saved. Major players like Kāinga Ora and Naylor Love (see *Build* 201) are setting and achieving lofty circular economy goals. There's more to be done, and David explores the drivers of change in his excellent article.

On page 56, BRANZ Environmental Building Scientist Jarred Butler describes how redeploying furniture and other materials during an office refurbishment can help to lower the significant – and surprising – carbon emissions associated with building fit-outs.

Clearly, numerous opportunities now exist for the sector to lift its sustainability game. New businesses are establishing to support the recovery, repurposing and redeployment of construction waste. They are the sector's very own repair shops and I hope they will rate equally well.

Ngā mihi nui

Colin Barkus
***Build* Editor**

BRANZ

BRANZ's vision
Challenging Aotearoa New Zealand to create a building system that delivers better outcomes for all.

1222 Moonshine Road, RD1, Porirua 5381
Private Bag 50 908, Porirua 5240
Telephone +64 4 237 1170
Email build@branz.co.nz
Web buildmagazine.co.nz and branz.co.nz

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Editor Colin Barkus
E build@branz.co.nz
Deputy Editor Dael Climo
Design and layout Jill Ross, Rebecca Holden, Simon Russo
Proofreading and editing Mary Bennett
Advertising sales Jonathan Taggart
T 027 269 8639
E Jonathan.Taggart@branz.co.nz

Subscriptions and rates
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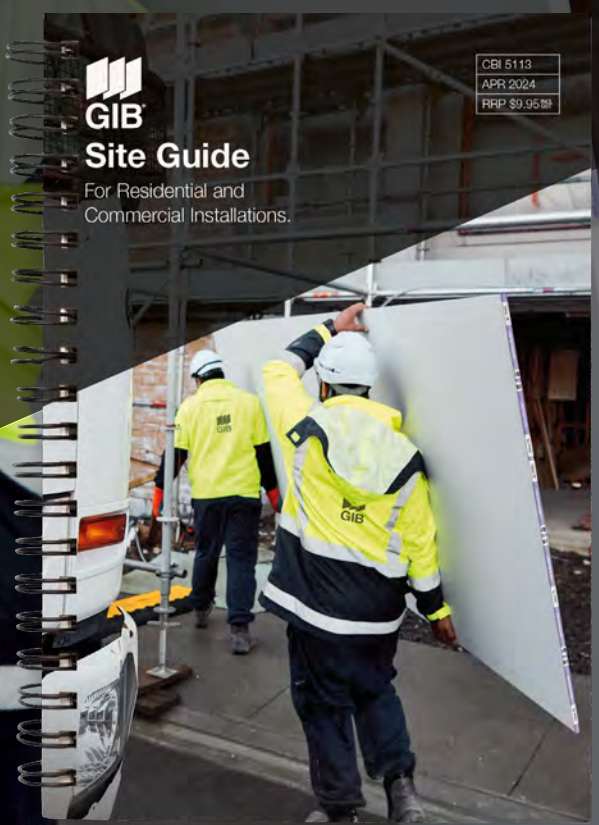

The power of science – a testament to Taiwan

BRANZ CEO *Claire Falck* says Aotearoa New Zealand can learn crucial lessons from life-saving advances in earthquake preparedness made in Taiwan between two significant earthquakes in the last 25 years. Science led the way in Taiwan and it must continue to do so here.

Still haunted by the devastating 1999 Chi-Chi earthquake that killed more than 2,400 people, Taiwan was struck once more on 3 April 2024. Taiwan seismologists described this tremor as having an energy equivalent of 32 of the atomic bombs dropped on Hiroshima.

As the nation mourned the tragic loss of 13 people and the clean-up began, in Taiwan and around the world, three questions were being asked. What had happened in Taiwan in the intervening 25 years to account for a remarkably lower death toll? Why were those tragic deaths largely attributable to rock falls and landslides rather than building collapses? And, importantly, what lessons are there for other earthquake-prone nations to learn?

Learning lessons

In the aftermath of the 1999 tragedy, Taiwan was heavily criticised for being unprepared, inadequately coordinating rescue efforts and the lack of building regulations. Since then, its government has embraced scientific research, collaboration and innovation to significantly improve building resilience and overall disaster preparedness.

The government established the National Center for Research on Earthquake Engineering (NCREE) and invested heavily in earthquake engineering and hazard mitigation research. NCREE's work underpinned major changes to the regulatory environment, including moving from prescriptive building codes to performance-based design.

Collaboration between research organisations – both domestic and international – has also played a crucial role in advancing Taiwan's disaster preparedness, including sophisticated early earthquake warning systems and search and rescue techniques.

A focus on public education, training and drills has ensured citizens have the knowledge and skills necessary to respond effectively to seismic events.

Enhanced building resilience

Researchers have made strides in understanding the complex interactions between soil and building foundations, leading to improved building codes that consider the effects of local soil conditions on building performance.

Geotechnical mapping has been used to identify areas at greater risk of earthquake damage. Building designs in these areas are required to meet even higher seismic safety standards.

Innovation in seismic-resistant technologies has also been actively encouraged. For example, since 2009, tall buildings – including the iconic Taipei 101 – have featured seismic damping elements to limit floor vibrations and swaying during earthquakes.

The concept of building design has changed to ensure buildings are able to:

- remain intact during a small earthquake
- be repairable after a moderate earthquake
- withstand a major earthquake without collapsing.

A 25-year focus on earthquake preparedness by Taiwan coalesced to lower the death toll on 3 April, and the improvements made demonstrate just how essential science is to public safety.

Back at home

Aotearoa New Zealand's own seismic risks and tragic earthquake history make the lessons from Taiwan crucial. While many of the initiatives the Taiwanese Government has undertaken since 1999 are already in place in Aotearoa, there is always more to learn. Science must lead the way.

That's why BRANZ continues to invest in seismic research and facilities that provide the building and construction sector with enhanced testing capabilities.

Our new structural engineering laboratory can now test buildings up to 3 storeys high, simulating the impacts of stronger seismic events. Testing of non-structural building parts like suspended ceilings, partitions and cladding can also be performed.

On the face of it, the lab helps ensure buildings can withstand the big one. But the recent Taiwan earthquake is a timely reminder that seismic testing is ultimately not about buildings and materials – it's about reducing loss of life. That's the true power of science.

No matter how you frame it, good mental health needs solid foundations and sturdy support networks. Don't let your mates bear the load alone.

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Training by the sector for the sector

Upskilling and growing the building workforce is critical at a time when the construction pipeline continues to grow and technology makes new demands. Greg Durkin, BCITO Director, says employers should embrace training opportunities that will develop their workers' skills.

The building and construction sector must continue to train, yet headlines projecting doom and gloom for the sector are putting off both new apprentices and employers.

Record number of apprentices

The figures tell a different story – and show this is still the time to train and be trained. Record numbers of apprentices are being trained, and the existing workforce is upskilling with micro-credentials to become more competitive.

Through BCITO alone, more than 16,000 New Zealanders are doing their apprenticeships right now, and another 4,130 completed training in 2023. This is training by the sector for the sector.

These promising figures have been steadily increasing since the COVID-19 pandemic, demonstrating the enduring value of work-based learning for the economy. We also know the work is there to sustain jobs. Now is not the time to slow down – quite the opposite. We need to keep ramping up the qualified workforce pipeline.

To deliver we need to keep training

According to MBIE's new *National Construction Pipeline Report*, construction activity has returned to 2020 levels. While this represents a slow-down from the post-COVID-19 period, we began from a strong base. The key takeaway is there is still a strong pipeline of work for which we need a skilled workforce.

Non-residential buildings from both the private sector and central and local government are projected to deliver work that exceeds our current skilled labour capacity. If the sector is to deliver, we need to keep training.

The Infrastructure Commission recently reported that the building and construction sector is behind other industries when it comes to qualifications. While half of the construction workforce has a secondary school-level qualification (level 1–4 certificate or overseas secondary school qualification), one in seven workers has no qualification at all.

Only one in three has a level 5–6 diploma or university qualification. For a sector that is increasingly technical, we need to address this to solve our efficiency and productivity challenges.

Upskilling current workforce

It's not just apprentices we need to train. While they are of course essential, we also need to be upskilling and supporting our current workforce.

There's a range of leadership and specialist skills courses available that allow employers to support their current workforce to continue to develop in their careers. This is a vital component of any workplace today – contributing to business growth and productivity, not to mention team retention.

All this is not to underplay that the sector is facing more challenging economic conditions. Inflation, high interest rates and the impacts of severe weather events and other natural disasters are a constant headache. BCITO partners with over 8,000 employers in the building and construction sector, the majority of whom are owners of small to medium-sized businesses who feel the pressures of these conditions sharply.

Our role is to support employers to enable them to train. The announcement by the new government that they will continue the Apprenticeship Boost scheme, a payment made directly to employers to help them keep and take on new apprenticeships, is also welcome news.

Why ITO model works

Despite pressures, the sector gets on with what it knows best – building the people of today to build the houses of tomorrow.

We've weathered ups and downs in the building and construction sector – it's the nature of the boom-and-bust cycle we endure in Aotearoa New Zealand.

The industry training organisation (ITO) model works because it is by the sector for the sector. If employers are well supported to train and qualify apprentices by an ITO, it futureproofs their business, the economy and the job market.

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Photo credit: Jono Parker

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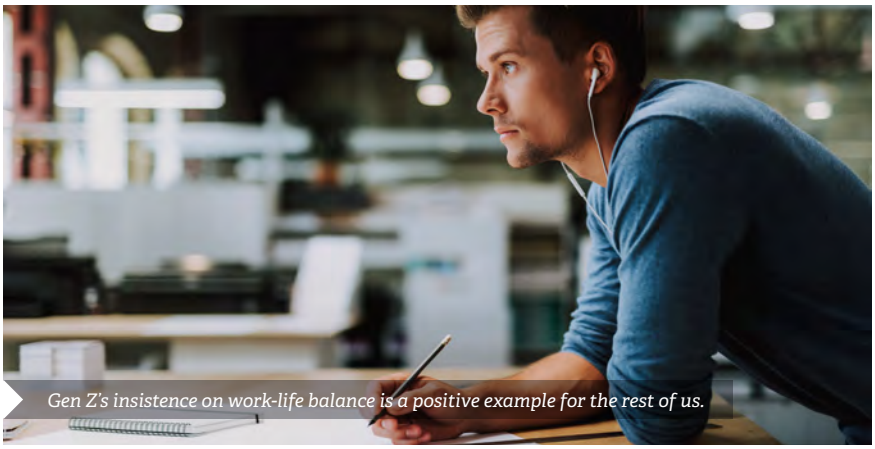
News

With so much going on in the building and construction industry, it's hard to keep up. Here's a few highlights of what you need to know.

Shaping a resilient future

Resilience, better-quality buildings and taking on board Gen Z's fresh thinking were the buzz themes at a recent major industry event, *Build* contributor *Greg Burn* writes.



Gen Z's insistence on work-life balance is a positive example for the rest of us.

The New Zealand Institute of Building (NZIOB) recent annual conference, BuildUP 24, focused on NZIOB's three Ps – people, performance and productivity.

Presentations included improving construction quality, working with artificial intelligence (AI) and other digital technology, meeting the needs of new people in the construction industry, particularly Generation Z (Gen Z or Zoomers) and overcoming adversity through personal resilience.

Advice from over the ditch

Of interest was a presentation by NSW Building Commissioner David Chandler on the role played by a new regulator, the Building Commission NSW, in improving the quality of new builds constructed in Australia and developing capacity for quality construction on an ongoing basis.

The Commissioner explained that significant improvements have been achieved across the industry in Australia by sticking to a mantra of not sacrificing quality for quantity and ensuring collaboration between government agencies and the industry. Australia has taken a hardline approach to ensuring improvements in construction quality.

With our own industry needing to provide significant numbers of new residential buildings, this presentation, emphasising the need for collaboration and a focus on quality, was valuable.

The integration of AI with other digital platforms used in design and construction was shown to deliver significant benefits. This is certainly an area where the industry will see dramatic changes. While this will be challenging to many, the potential for AI to add efficiencies in all areas, particularly the more menial tasks, will free up industry practitioners to focus on delivering more value.

Learning from Gen Z

Insights into the approach taken by Gen Z, not only to work in general but specifically to jobs in design and construction, were enlightening. While Gen Z might approach work differently, giving more consideration to their personal wellbeing and growth, they are generally well educated, keen learners and willing to contribute to all aspects of their own role and the roles of others.

This fresh thinking holds potential for effective change and performance gains as well as much-needed improvements in the work-life balance of those in the industry.

With the catchphrase *Resilience: From surviving to thriving*, a presentation on overcoming significant adversity to become resilient and productive appealed to many.

The construction industry is multi-faceted and a relatively high-pressure environment, making personal health and wellbeing paramount. Resilience is a key to ensuring people thrive within the industry.

FOR MORE For further information on BuildUP24 and to view the keynote presentations, visit www.nziob.org.nz.

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Helping to kick skin cancer out of construction

CARTERS Building Supplies and Melanoma New Zealand have joined forces to promote the prevention and early detection of melanoma among tradies.

Many members of the building and construction industry are at higher risk of melanoma due to prolonged exposure to the harsh Kiwi sun. A new partnership between CARTERS and Melanoma New Zealand will help deliver critical messages about sun protection and early detection to the CARTERS team, its trade customer base and industry associates via in-branch spot checks, promotion at local and national events and other educational content.

'We're excited to be supporting Melanoma New Zealand's mission of championing melanoma prevention, early detection and treatment for all New Zealanders, especially since it's so relevant to both our own team and our customers,' says CARTERS Chief Executive Mike Guy.

Men are more likely than women to die from melanoma. Annually, more than 6,000 people are diagnosed with melanoma in New Zealand and more people die from skin cancer in New Zealand than die on our roads.

The good news is that melanoma can be preventable. If caught and treated early enough, it is almost always curable.

Prevent, check, protect is the key message to tradies. Regular skin checks – either by yourself or a health professional – are key to detecting melanoma early. And if you have concerns, seek advice without delay.

Wellington agrees on densification

Wellington is making way for a denser, more walkable city that will appeal to the next generation as Wellington City Council (WCC) pushes through new plans, while Christchurch has put off a decision until the end of next year.

Wellington City Council has agreed on plans for denser housing in the inner suburbs.

WCC has voted through a new district plan enabling tens of thousands of new homes, including apartments and townhouses in suburbs where they've previously been banned. Heritage listing on 10 properties was also lifted.

Those in favour say the new plan paves the way for a more affordable city, will make building a house easier and will be better for the planet – with fewer people having to commute from outer suburbs, leading to lower emissions.

Wellington Mayor Tory Whanau says the changes were needed to lower emissions and make the city more affordable.

'For me, the choice is simple. I want to lead a Wellington that is a modern, thriving city, where homes are affordable, where people can walk, bike and bus wherever they need to go.'

She wants to make sure Wellington was planning and building for the next generation – 'a generation who will bring their talent and ideas and add to our city's rich history, culture and economy'.

Christchurch votes to delay

In Christchurch, meanwhile, the council has voted to delay major decisions on housing densification in residential areas until the end of 2025, following an extension granted by the government.

'There are many people here that are feeling rushed by this and felt this was imposed on them,' says Councillor Victoria Henstock. 'We have an opportunity here to slow it down a bit and do it properly and a bit more thoughtfully.'

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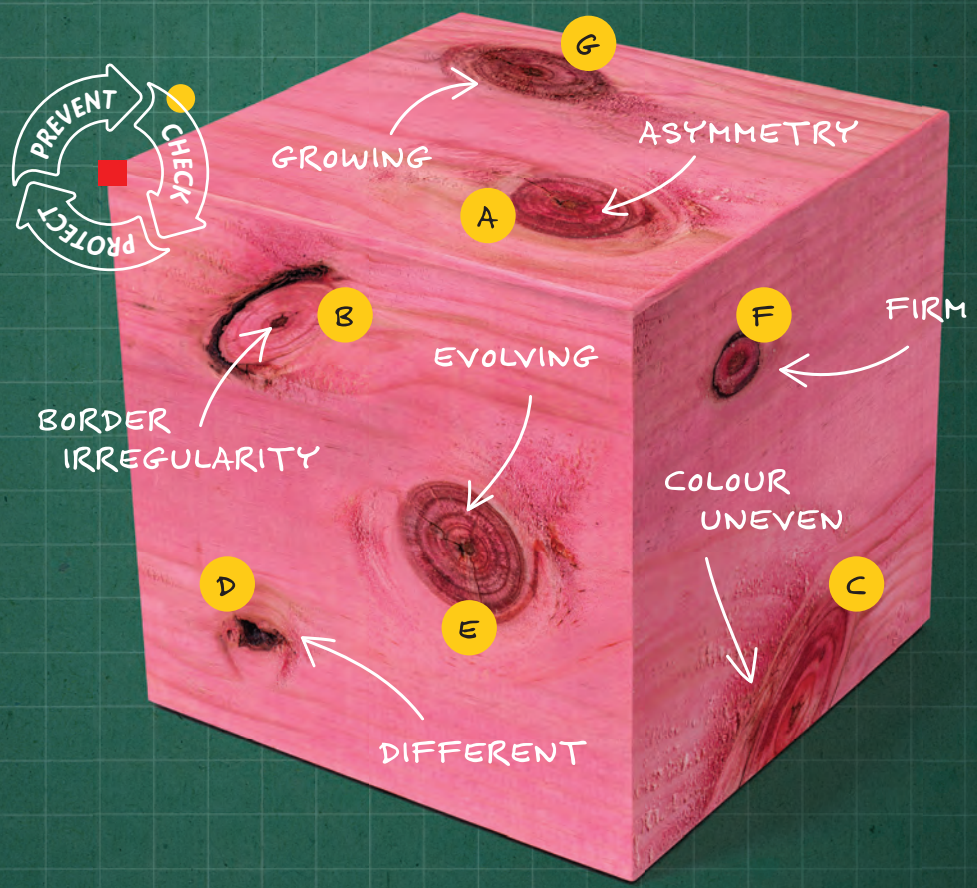

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Milestone for large Auckland development

Parks, new roads and better stormwater systems are among major upgrades improving the lives of residents of a Kāinga Ora housing development.

Bird's eye view of the rejuvenated suburb.

Residents now have access to better roads, new parks and public spaces following completion of extensive civil infrastructure works at the Kāinga Ora development in Northcote, Auckland.

Across the neighbourhood, over 14,700 m² of new and upgraded roads have been delivered, 12 km of underground utility lines installed and around 28,000 new plants and 440 trees planted over the past 5 years.

Significant stormwater infrastructure upgrades have also been completed, including installing over 6.6 km of stormwater piping and daylighting streams, helping to safeguard homes from future severe weather events.

Residents can now enjoy three new parks and two public greenspaces delivered as part of the redevelopment works, including the award-winning Te Ara Awataha Greenway/Ngutu Kōtare and Te Kaitaka/Greenslade Reserve.

The stormwater upgrades performed well during 2023's severe weather events, preventing nearby homes and the town centre from flooding.

Deadline for earthquake remediations extended

Owners of buildings requiring earthquake remediation can breathe a little easier as the deadline for compliance has been extended.

Among a raft of changes introduced by the Coalition Government, the earthquake-prone building review is being brought forward, with work to start immediately, and the deadline for remediations extended by 4 years, Building and Construction Minister Chris Penk says.

'The current earthquake-prone building system was put in place in 2017, requiring buildings considered to be earthquake-prone to be remediated before set dates with nearly 500 deadlines set to expire over the next 4 years.

'Councils and building owners have told me that many buildings will not meet their deadlines due to the high costs involved, further complicated by cumbersome heritage rules and ownership structures,' Minister Penk says.

'While there is already a review scheduled for 2027, the government has decided to bring this forward to provide greater certainty, and this work will begin immediately.

'The review will be extensive and consider the appropriate risk settings to protect safety while ensuring the rules are workable to support businesses, increase economic activity and create jobs. The review will also look at the way overseas jurisdictions manage earthquake risk.

'While this review is under way, all current remediation deadlines will be extended by 4 years.

'However, I encourage building owners to use this time to continue to make improvements to their buildings, particularly due to the positive impacts that remediation has for insurance and their ability to get tenants.'

Climate risk now a top consideration

The percentage of people looking at climate risk when considering a home has risen by 31% in the past two years.

New research from insurers AMI, State and NZI shows 86% of people would now consider climate risk when choosing a home, compared to 55% only two years ago. The research also showed that house hunters rank weather and natural disaster risk as the second most important factor overall when looking to rent or buy, after price.

'Issues like flooding are now impacting people's behaviour around where to buy and rent. People have seen the devastation wrought by storms like Cyclone Gabrielle and are much more aware of the risks,' says Amanda Whiting, CEO of AMI, State and NZI.

The survey also showed that 79% of people wanted councils to provide more information on weather and natural hazard risks for properties, followed by real estate agents (57%), the government (52%) and insurers (41%).

'As a country, we are facing growing risk with unpredictable weather, alongside other natural hazards like earthquakes', says Amanda. 'Claims are becoming more frequent and costly, compounded by inflation, which has led to premium increases.

"This is why it's important we continue to work closely with councils, the government, and other partners to ensure insurance remains accessible for New Zealanders.

What they said...

'The Government is clarifying the definition of a minor variation and introducing minor customisations to the Building Act. This will provide more flexibility, which will help reduce delays and lower the cost of building and renovating. ' – *Chris Penk, Minister for Building and Construction.*

'We'll struggle to see the slashing of emissions necessary for a 1.5 degree future without concerted leadership, regulatory change, and a societal paradigm shift around what we value in a building.' – *Andrew Eagles, CEO, New Zealand Green Building Council.*

Resource for commercial tenants

MBIE has released a seismic risk resource tailored specifically for commercial building tenants.

Commercial buildings in Wellington's CBD.

The new MBIE *Seismic Risk Resource for Commercial Building Tenants*, released in April, is a guide to assist commercial building tenants who are:

- seeking to lease a building
- reviewing new information that impacts the understanding of the seismic risk of the building they occupy – for example, a seismic assessment report
- re-evaluating the suitability of a current lease
- going through the process of renewing a lease.

The guide is easily accessible to commercial tenants with limited experience in considering seismic risk information as it provides practical steps for assessing the seismic resilience of their premises.

It offers a systematic approach to enhancing preparedness and resilience – from understanding building assessments and reports to identifying potential vulnerabilities and implementing risk mitigation strategies.

The resource also outlines the responsibilities of both landlords and tenants concerning seismic risk management. It emphasises the importance of collaboration and communication between parties to ensure that appropriate measures are taken to mitigate risks and maintain a safe working environment.

FOR MORE The guide is available at www.building.govt.nz/getting-started/seismic-work-programme/understanding-seismic-assessments/seismic-risk-series.

BRANZ supports ConCOVE Tūhura

BRANZ is significantly assisting a training organisation to provide education in areas associated with sustainable and zero-carbon building.

ConCOVE Tūhura, which has been appointed lead expert for the UNESCO-UNEVOC Bridging Innovation and Learning in Technical and Vocational Education and Training Expert Group (BILT) in the Asia Pacific region, will be working closely with BRANZ, drawing from its research into building sustainability and zero-carbon construction.

BRANZ Chief Executive Claire Falck says there are many existing research initiatives in construction trades training in Aotearoa New Zealand that will support ConCOVE Tūhura's position as lead expert.

'BRANZ is already well under way with a multi-year project to upskill the building industry for zero-carbon construction, with learning initiatives about to be trialled across Aotearoa,' she says.

'We are so excited to work in partnership with ConCOVE Tūhura to bring these insights to international organisations and to continue to support our local industry to prepare for the future.'

The BILT project is implemented by UNESCO-UNEVOC with support from the German Federal Institute for Vocational Education and Training and the German Federal Ministry of Education and Research.

The three areas of focus for the UNEVOC-BILT Expert Group are greening, digitalisation and migration impact for the construction industry.

Capital's flood-ruined homes policy

The Wellington City Council (WCC) policy for lifting houses flooded during severe weather in 2023 has been adopted.

Called the Elevating Tairāwhiti Policy, it specifies how WCC will appoint service providers to manage the two stages of the work programme, the funding limits for each stage and the works that will be covered.

The policy will give eligible property owners the certainty they have been looking for and enable WCC to move ahead with the planned programme of work.

Property owners can apply for funding if their property has been classified as Category 2P under the Future of Severely Affected Land (FOSAL) framework, along with a recommendation for elevating the dwelling.

Quarterly reporting to speed up consent system

The Coalition Government is taking steps to reduce delays and speed up the building consent system by requiring councils to submit data for building consents and Code Compliance Certificates every quarter, Building and Construction Minister Chris Penk says.

'Applications for building consents and Code Compliance Certificates must be completed within 20 working days. However, feedback from the sector is that they often take a lot longer, causing frustrating and costly delays for builders.

'Delays in the building consent system increase the cost of building and make it harder for the sector to deliver more affordable homes for Kiwi families.'

From April, building consent authorities were required to submit timeframes for building consent and Code Compliance Certificate applications. The data is published on MBIE's website every quarter.

'This added scrutiny will provide greater certainty for the sector, encourage best practice and drive innovation that will help reduce delays and let Kiwi builders get on with the job,' Minister Penk says.

FROM THE BRANZ HELPLINE

In this issue, our question from the helpline looks at installing external wall outlets for domestic extractor fans.

Kitchens and bathrooms must each have an extractor fan – or certain acceptable continuous mechanical ventilation system – vented to the exterior of the building. The BRANZ helpline has recently received requests for clarification about the detailing of extractor fan outlets, specifically in houses with bevel-back weatherboard cladding.

The go-to source for these types of weathertightness queries (penetrations of cladding) is E2/AS1, but the Acceptable Solution, along with the other generally used reference sources, provides little or no help. There's plenty on pipe and meter board penetrations but not extractor fan outlets, and almost all show penetrations of flat sheet wall linings, not weatherboards.

E2/AS1 advises that penetrations should be located where they are sheltered from wind-driven rain, so perhaps an eaves soffit outlet should be considered where possible.

There are, however, many helpful principles and hints that can be gleaned from these other acceptable cladding penetrations. For example, penetrations through a weatherboard lap are not recommended. Timber weatherboards expand and contract, so weathertightness is problematic. Try to position the extractor duct penetration within the face of a single weatherboard.

BRANZ flashing guidelines also recommend that pipe penetrations exit to the exterior of the building with a minimum slope/fall of 1.5° so any moisture will drain outwards. It is hard to plan for this level of accuracy – especially when it might be a subcontractor doing the final outlet work – but at least annotate it on the building consent working drawing documentation.

While the ducting should slope downwards, the outlet grille must be fitted vertically. With bevel-back weatherboards, the grille will usually span multiple boards, and we recommend covering the triangular side gaps with timber scribers to each side of the grille with additional sealant where they meet to maintain weathertightness. We also recommend a small head flashing across the top of the grille especially if the outlet is exposed to the weather.

These measures may seem excessive, but it's much easier to prevent water ingress than deal with deterioration of the structure after it has failed.

For further information, see *Penetrations through existing walls* in *Build* 155.

By Daniel du Plessis and Matt Curtis, BRANZ Economists

Interest and inflation rates easing

Aotearoa New Zealand's annual inflation rate eased to 4% for the 12 months to March 2024 – its lowest level in nearly 3 years. Among the largest contributors were rents (4.7%), the construction of new homes (3.3%) and rates (9.8%). In April, the Reserve Bank of New Zealand's Monetary Policy Committee (MPC) therefore agreed to leave the Official Cash Rate at 5.5%. The MPC signalled that a restrictive monetary policy remains necessary to further reduce inflation in the economy. Financial markets, however, are signalling some easing of rates later this year.

Code Compliance Certificate numbers remain high

The recent release of the experimental building indicators for the December 2023 quarter showed 43,160 new residential Code Compliance Certificates (CCCs) issued in 2023, up 20% from 2022. Over the last couple of years, the median completion time for a stand-alone house has increased from about 300 days (for houses consented in the September 2020 quarter) to over 500 days (for houses consented in the June 2022 quarter). The data does suggest that we have reached a peak of CCCs as the industry works through the backlog of residential work.

Uncertainty ahead but hope for 2025

Consenting activity has fallen in the latest quarter (December 2023), with the number of new dwelling consents down by 27% from December 2022 and the value of non-residential consents down 14%. However, as the effects of high migration flow through the housing system and local councils work through their long-term plans, we may start to see some green shoots for the construction sector in 2025.

FOR MORE Any comments? Contact daniel.duplessis@branz.co.nz or matthew.curtis@branz.co.nz.

Future Thinker of the Year named

A recent award winner is working with at-risk communities on flood resilience.

Widi Auliagisni has been named the New Zealand Green Building Council's latest Future Thinker of the Year award winner. The annual award acknowledges a student or young professional who demonstrates environmental knowledge and leadership and recognises their success and passion for greener, better buildings and communities.

Widi is a Doctoral student in Emergency and Disaster Management at Massey University and an Assistant Project Manager at Beca. She has a Master of Construction from Massey University and a Bachelor of Science in Architecture from Institut Teknologi Bandung, Indonesia.

Her research focuses on community resilience to natural hazards and sustainability, particularly in Northland, where she works closely with at-risk communities to enhance flood resilience.

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Professor Deidre Brown wins top architect honour

Art historian and author Professor Deidre Brown has received the New Zealand Institute of Architects' highest honour – the first academic to do so.

Professor Brown from Te Pare School of Architecture and Planning at Waipapa Taumata Rau | University of Auckland has been awarded the 2023 Te Kāhui Whaihanga | New Zealand Institute of Architects (NZIA) Gold Medal.

Her achievement is historic as she is the first Māori woman and first academic to receive such recognition.

Professor Brown said she thanked the selection committee as her contribution to architecture is 'not through the usual route of professional practice, but by academia to educate the next generation of practitioners and support professional practice through research and service'.

Her appointment in 2019 as Head of the School of Architecture and Planning at University of Auckland was also groundbreaking as she is the first indigenous woman in the world to hold such a position,

When Professor Brown began studying architecture at Auckland University 30 years ago, she was told to 'leave Māori architecture on the marae where it belonged'. Her response was to do the opposite and she now specialises in Māori and Pacific architectural and art history, Māori and Pacific housing and indigenous design. She has written several books.

'The breadth of her work is impressive, encompassing architecture and art, history and housing, culture and craft,' says Judith Taylor, NZIA President.

'Through teaching, research, writing, art curation, leadership and mentoring, Deidre has touched the lives of many. Her sphere of influence is so far-reaching that it's impossible to define.'

Professor Deidre Brown, winner of Te Kāhui Whaihanga | Institute of Architects 2023 Gold Medal. Photographer: Adrian Malloch

OECD notes flooding risks to housing cover

The OECD has weighed in on the insurance risk of housing impacted by severe flooding.

Destroyed by floods and now abandoned – homes in the Esk Valley, Hawkes Bay.

The OECD's recent biennial report into Aotearoa New Zealand's economy found that about 5% of our homes are at such a high risk of flooding, owners should be paying yearly premiums of 1% or more of their homes' value to cover the true risk to homes.

It identified the threat to New Zealand's high level of house insurance cover from insurers moving to greater risk-based pricing for individual homes away from the current model in which homes unthreatened by floods cross-subsidise owners of flood-threatened homes.

This could mean people with homes at higher risk of things like flooding end up being charged premiums they cannot afford to pay.

'Given the high house-price-to-income ratio in New Zealand, this – paying 1% of the value of a home in premiums each year – would pose a serious affordability challenge for many of those households,' the OECD report said.

Today, 96 in every 100 homes are still insured, but the OECD says the Government may need to intervene in the insurance market to keep insurance cover that high.

The OECD also says Aotearoa needs a national strategy to build flood defences –citing the Netherlands as a leading example of taking an evidence-based, co-ordinated approach to reducing flood risk.

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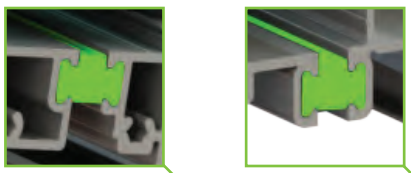
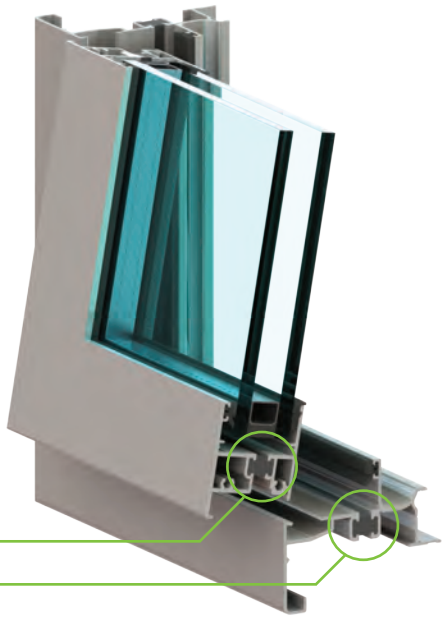


Pour and Debridge Thermal Break



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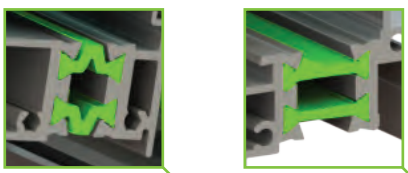
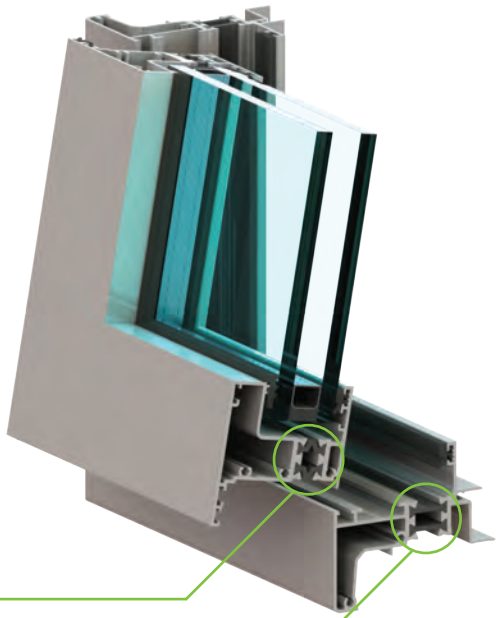


Polyamide Strip Thermal Break



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RLB New Zealand Crane Index

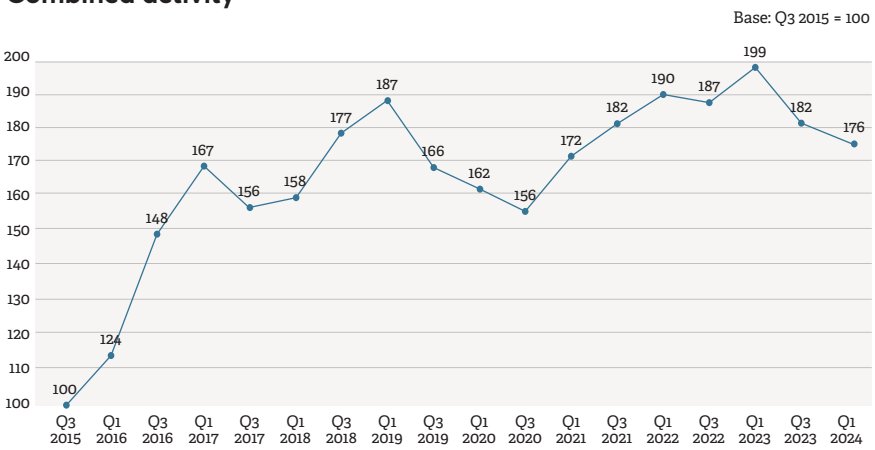
First launched in March 2014, the Rider Levett Bucknall (RLB) Crane Index has become a representative metric of construction activity in Aotearoa New Zealand.

Graphs and highlights reproduced with the permission of RLB Auckland.

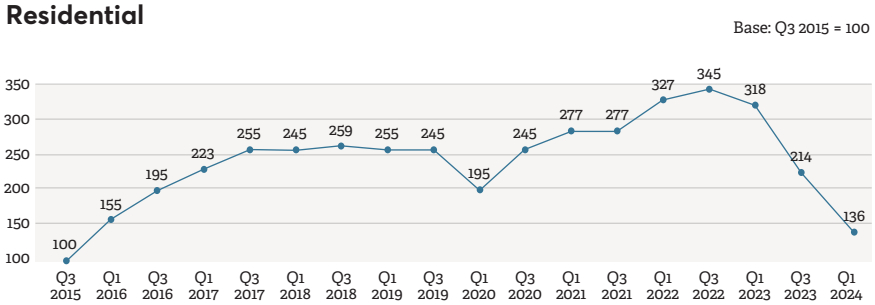
Highlights – Q1 2024

- While the overall value of building activity and consents are at (or near) record highs, New Zealand's RLB Crane Index fell to 176 index points this quarter, representing 139 cranes.
- The fall was largely attributable to the 12.5% decline in crane activity in Auckland where there was a net loss of 11 long-term cranes.
- The residential index fell for the third time since the high of Q3 2022. The drop to 136 index points is 60% lower than 18 months ago.
- The non-residential index continued its upward trajectory, with a record index value of 191 points. The index represents a record 109 non-residential long-term cranes across New Zealand.
- The proportion of residential cranes across New Zealand fell to 21.6%, the lowest since the third edition of the index in Q1 2015.
- Te Kaha Christchurch Stadium is well into the construction phase, with 10 cranes on site—the most cranes on a single project in the country.
- Despite the decrease in net crane numbers, the commercial sector saw strong activity with an additional eight long-term cranes, while the civic and recreation sectors each added four long-term cranes.
- The significant fall of 11.9% in consent value in 2023 points to a significant reduction in the construction pipeline.

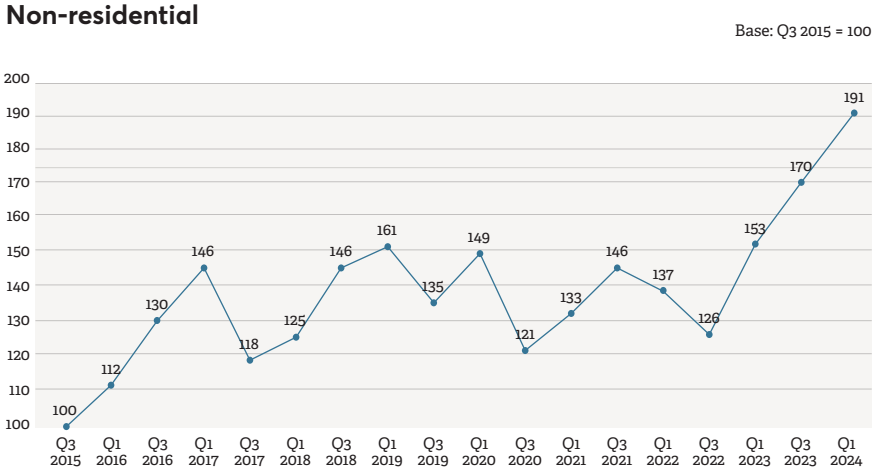
Combined activity



Residential



Non-residential



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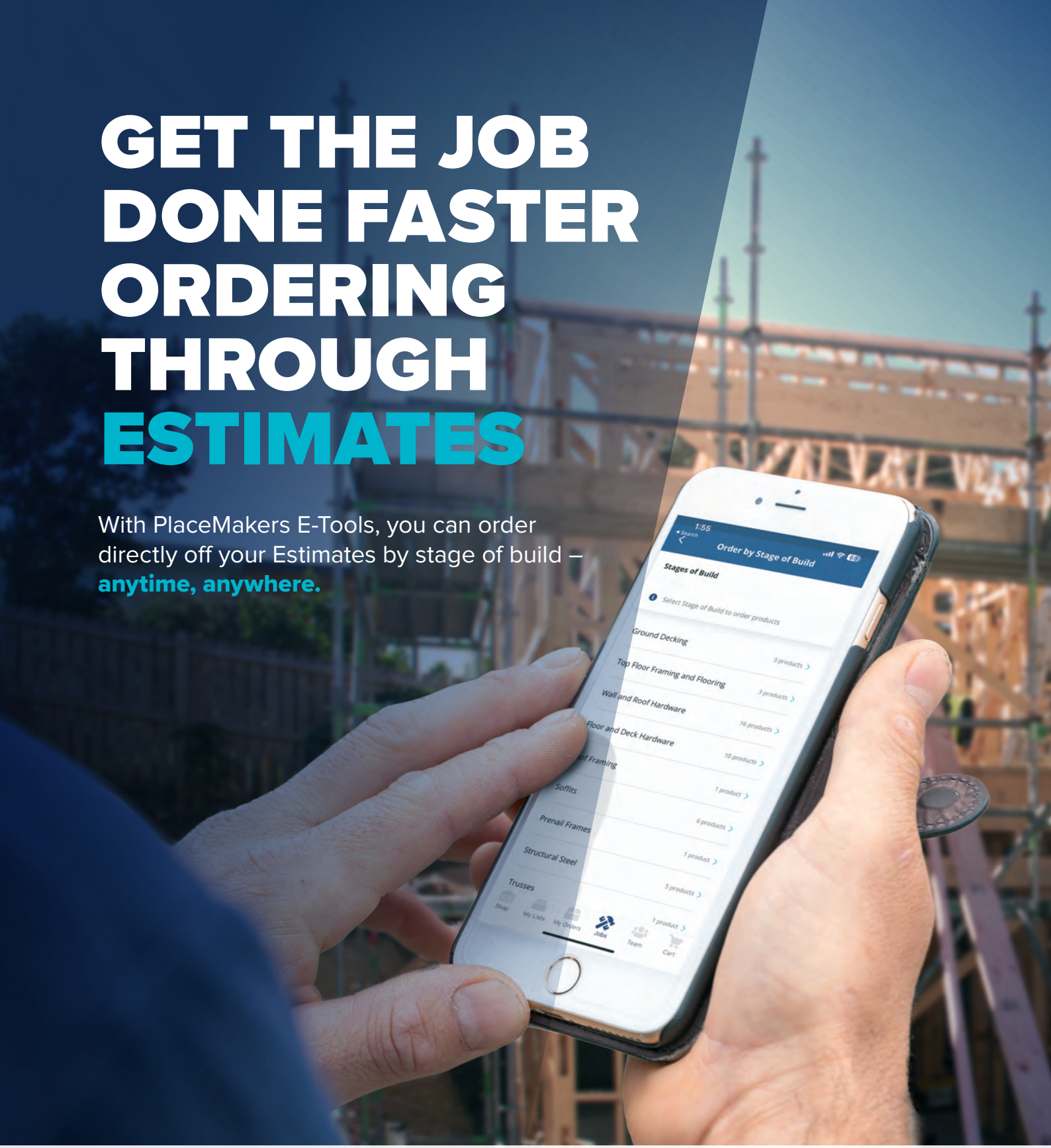

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LowCo pilot house at Waiata Shores, Takanini.

Fletcher develops low carbon housing

Fletcher Building has launched LowCO, a new residential project designed to meet the needs for low carbon housing as housing is one of the largest contributors of carbon emissions.

'On average, the lifespan of a home is 90 years,' says Steve Evans, Chief Executive of Fletcher Building's Residential and Development Division. 'We did some research and found that over that time homes emit 7 times more carbon than acceptable if we are to keep global warming within the 1.5^{0}C limit.

'Fletcher Living wanted to show this doesn't have to be the case. To prove it, we set about designing and building a number of different house typologies that use 7 times less carbon than the average home.'

The recently completed first LowCO build, at Fletcher Living's Waiata Shores development, includes a 3-bedroom detached home plus a 3-unit terrace block. Both builds fit within New Zealand's 1.5^{0}C carbon budget for new built homes.

'We often get asked what it costs to build a high-performance home such as LowCO. While there are slightly higher upfront costs when building, from the point of view of the lifecycle of the home, it will cost less overall due to the reduction in electricity and water consumption, 'says Steve.

A core element is the smart monitoring built in throughout LowCO that will allow Fletcher Living to capture three years of data on energy and water use, advancing the understanding of the homes' thermal performance.

LowCO has recently been awarded the 10 Homestar built rating from the New Zealand Green Building Council, which is the highest independent rating for a residential build.

Leading winners to success

BRANZ Structures Team Leader *Mark Elliott* has spent most of his career immersed in the world of high-performance sport where teamwork is of paramount importance. He has now brought that experience to BRANZ in his role leading a team of engineers enjoying the benefits of a new cutting-edge structures lab.

Q. What is your background – education and recent work history?
I began my career as a sports physiotherapist, high-performance director and elite triathlon coach. This included 20 years working in high-performance sport and leading teams of specialists and technical experts to support the performance goals of athletes and teams on the world stage.

The roles were across multiple sporting codes, including triathlon, winter sports and cycling – leading teams to six Olympic Games, four Commonwealth Games and multiple world championships.

A major project was moving the New Zealand Cycling programme into the new velodrome in Cambridge – a 5-year project from concepts of design with the community and build phase through to moving athletes, staff and their families to a centrally based training environment.

In the last 4 years, I led a team of regional managers working on the 2020 election and then assisted the design and implementation of a national strategic measurement framework for school principals. Latterly, I made a connection with BRANZ through an HR company that recognised my transferable skills into the team environment at BRANZ. I have now completed a year at BRANZ supporting the set-up of the new structures lab.

Q. When you studied, did you have in mind you would work with elite athletes?
My interest in physiotherapy (I have a physiotherapy degree and postgrad in sports medicine) grew when I trained for Ironman and Coast to Coast. I was frequently injured and spent a lot of time at the physio. I was fascinated by how to prevent injury and accelerate return to performance. This is a principle throughout my career – looking at current operating models, how to make improvements and how that can be delivered in actions and execution of performance.

From working as a physio and managing teams on the international stage, it was a natural evolution into coaching. For the last 15 years, I have coached as a volunteer and at an elite level. I have

coached and managed incredibly talented athletes, including 10 years coaching double Olympic medallist Bevan Docherty. It wasn't the plan when I started my degree to attend multiple Olympic Games – that was just the destination of the people I was supporting.

Q. Working with Olympians, what are the most important attributes of a team and how does that correlate to the business environment?
There are multiple attributes of Olympic champions and the team behind them. The most important correlating to both sport and business outcomes is to do with accurate self-correction.

Athletes deliver world-class performances through both failure and success. In the media, we see success or significant failures where expectation and hype create a moment of learning for the athlete. We don't see the assessment, reviews and learning by the best athletes and their coaches to adjust and develop performance to world-leading standards.

The best learn from their wins and mistakes and are constantly assessing their performance gaps. They make direct changes by reflecting, reviewing, modifying and applying these learnings to enhance future performance. They don't do this alone – they build a trusted team around them to challenge direction, consider alternatives or embed the critical factors.

Successful business outcomes are the same – success comes from an aligned team looking to always improve ways of doing things no matter how small. This is what I really enjoy about working within BRANZ. The organisation is always looking at ways to improve what we do, researching better options for housing efficiency and testing new products that will have a positive impact on the building system.

Q. How does your experience working with high-performing sportspeople translate to working with structural engineers at BRANZ?
There are multiple parallels between business and sport. Working with a team of engineers who are specialists in their field and have years of experience, knowledge and industry application is the same as working with a world-class group of biomechanists, physiologists or coaches.

These specialists have the knowledge and experience – the focus is to ensure the team is aligned and is clear on the priorities and outcomes for the client. In sport, the client is the athlete. It is all about creating a supportive framework for the athlete to succeed. New Zealand athletes operate with limited budgets and opportunities to perform so coaches and support staff must be very focused on what will make the best performance difference.

In business, the approach is the same – how can the collective work as a team to get the best outcomes with the limited resources available? We are fortunate at BRANZ to now have a new and larger testing facility. This requires us to work hard on how we can best optimise its capability with the resources we have.

IN BRIEF

Touting a global finance alliance

The Green Building Council of Australia, the US Green Building Council and the UK's Building Research Establishment (BRE) are working together on a new version of a sustainable finance guide to show how rating systems like BREEAM, Green Star and LEED ensure compliance with multiple sustainable classification frameworks used globally.
'This global alliance shows that the world's major sustainability rating systems are aligned not just on climate science but on how we can ensure that all buildings are able to transition to a decarbonised future,' says Davina Rooney, Chief Executive Officer of the Green Building Council of Australia.

No more levy for small building work

In a move it has claimed will cut red tape, from 1 July, the government will exempt building work valued at under $65,000 from the Building Levy.
'Building costs are too high and have risen 41.3% since 2019. It is around 50% more expensive to build a stand-alone house in New Zealand than in Australia – this must change,' says Minister for Building and Construction Chris Penk. 'High construction costs have made it harder for families to get into their first home and exacerbated New Zealand's housing crisis.'

Nelson construction waste available to public

Nelson City Council and Nelson Environment Centre (NEC) have launched a trial project to tackle the high volume of construction and demolition waste that ends up in landfill. From 24 April, builders have been able to bring leftover construction waste to NEC, which is then making it available to the public.

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DESIGN RIGHT

By Greg Burn, Freelance Technical Writer, Structure Limited

H1 requirements and insulating exterior walls

Recent changes to H1/AS1, the guidance document for Building Code clause H1 *Energy efficiency*, call for increased insulation in the exterior envelope of residential buildings.

At a glance

- Required construction R-value for exterior building walls was raised to R2.0 under the revised H1/AS1.
- With exterior walls, we work with component R-value and construction R-value.
- Thermal bridging such as wall framing influences construction R-value.
- BRANZ *House insulation guide* is an online tool for determining construction R-value.
- Accurate installation of insulation is critical.
- Framed voids on the outside face of the wall assembly should be insulated before installation of flexible wall underlay.

H1/AS1 Table 2.1.2.2B *Minimum construction R-values for building elements that do not contain embedded heating systems* establishes a minimum compliance requirement of construction R-value R2.0 for external walls across our six climate zones.

R-value is a measure of thermal resistance, expressed as m^2K/W (square metre kelvins per watt), that defines the ability to resist the transfer of heat. Generally, this relates to the thickness, density and thermal conductivity of the insulation material.

R-values and thermal bridging

With exterior building walls, we work with two R-values. The component R-value is the thermal resistance of a specific component within the wall assembly (for example, the insulation material). The construction R-value is the thermal resistance of the

H1/AS1 now calls for increased insulation in the exterior envelope of residential buildings.

built wall assembly, considering the R-value of each of the components.

Because of factors such as thermal bridging, the construction R-value could be higher or lower than the component R-value of the insulation used in the assembly.

The exterior wall framing bridges the interior to the exterior. This thermal bridge creates a potential heat loss path so minimising the amount of framing in the exterior walls helps to reduce the extent of heat loss.

Thicker insulation might be needed

While the increase in the required construction R-value to R2.0 under the revised H1 is not a big change, it might mean that thicker bulk insulation needs to be installed – depending on the construction of the exterior wall assembly.

The BRANZ *House insulation guide* is an excellent online tool for finding the construction R-value of a building assembly. By entering the components of the assembly into the tool, you can establish the component R-value of the insulation material needed to meet the required construction R-value.

Accurate installation essential

The installation of bulk blanket/segment insulation material such as wool, polyester or glass wool in the exterior wall framing is fundamental to attaining the required outcome. However, the construction R-value of the assembly can be dramatically reduced if installation is inaccurate.

Insulation must be cut to size accurately and installed so that it friction fits firmly in the cavity between timber studs and plates/nogs (with the framing moisture content at the required level) with no gaps at the edges.

Where the cavity is larger than the available size of the insulation and the insulation needs to be joined, it must be cut accurately to achieve a friction fit join with no gaps.

The insulation must not be compressed, folded or tucked. It should also be the same thickness as the framing cavity to ensure it does not sag within the cavity.

Insulate voids before flexible underlay

Some areas of exterior wall framing – particularly at junctions with internal walls and at external corners, will form framed voids on the outside face of the wall assembly. These voids should be insulated prior to the installation of the flexible wall underlay to ensure there are no uninsulated voids in the exterior wall framing.

Insulation must also be installed in a way that avoids forcing the flexible wall underlay across the drained and vented cavity as this may reduce the cavity's drainage and drying capacity.

In extreme situations, it can also force the underlay onto the back of the exterior cladding, restricting ventilation within the cavity and gravity drainage down this secondary drainage plane.

Accurate taut installation of the underlay incorporating plastic tape on the exterior face will ensure that the underlay is held against the exterior face of the timber wall framing and therefore it won't bulge across the drainage cavity.

A rigid air barrier could be installed

A proprietary rigid air barrier (RAB) could also be specified. This forms a solid substrate on the exterior face of the wall framing, ensuring that the integrity of the drainage cavity is maintained once the insulation is installed.

NZS 4246:2016 *Energy efficiency – Installing bulk thermal insulation in residential buildings* provides guidance for the correct installation of insulation.

FOR MORE

Download the *BRANZ House insulation guide*

Go to online version

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By David Hindley, Freelance Technical Writer

Cutting concrete to install a drain

Following 14 steps will ensure a new drain is successfully installed into an existing concrete slab..

At a glance

- Cutting and repairing a concrete slab correctly is crucial.
- Involve an architect, engineer and/or specialist operator before starting work.
- Work must comply with relevant Building Code clauses and standards.
- Find out whether a Building Consent is required before the work is carried out.
- Photograph each stage of the process for evidence of the work that was done.

When a concrete slab on ground for a new house is designed and poured, it should already include all the necessary provisions for drainage and other services. Where an existing slab needs to be cut for a new waste pipe or drain to be installed, repairing the cut in the right way is crucial for the slab's strength and resilience.

This advice may differ from what is required for a main drain or easement drainage beneath a slab. In these cases, the owner should seek specific engineering design advice and check the Building Consent Authority's requirements before commencing work. Main drains may require sleeving and additional foundation work at the slab perimeter.

Relevant Building Code clauses and standards

The work must comply with Building Code clauses and standards, including:

- B1 *Structure*
- B2 *Durability* (a minimum of 50 years)

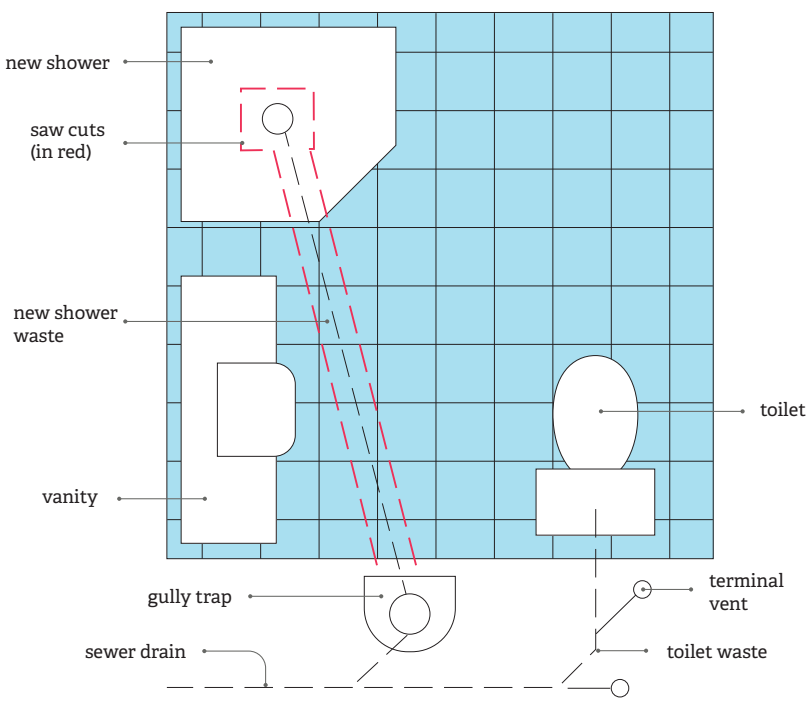


Figure 1: Plan for a new shower waste.

- G13 *Foul water* (for wastewater pipes) – compliance can be demonstrated several ways, including through use of G13/AS2 or G13/AS3, which reference AS/NZS 3500.2:2021 *Plumbing and drainage – Part 2: Sanitary plumbing and drainage*
- NZS 3604:2011 *Timber-framed buildings* section 3 *Site requirements* and section 7.5 *Concrete slab-on-ground floors for timber buildings* as modified by B1/AS1.

Involve an architect or engineer

An architect, LBP designer or or chartered professional engineer will typically be involved in making the decisions over what is required and how compliance with the Building Code and standards will be demonstrated. They will need to confirm which Acceptable Solution or standard they intend to comply with prior to lodging a Building Consent. For example, they will need to choose G13/AS1 and G13/AS2 or G13/AS3 (AS/NZS3500.2) as the pathway as you cannot mix the two solutions. The engineer may be able to advise on the stability of the slab and the design of the new slab and reinforcing prior to consent. However, this may be best done on a site inspection after the slab has been cut.

Consider whether the physical work of repairing the slab can be carried out by the existing building contractor or whether a specialist operator should be brought in – the drainlaying itself will need to be carried out by a registered drainlayer.

In some cases, proposed drainage plans may show a different option to run drainage without having to cut the slab. However, where this is an option the architect or designer will usually be involved in the decision. The property owner should always be informed of proposed work.

The process

In practical terms, the work is a 14-step process (see Figures 1, 2 and 3):

1. Saw cut the slab and remove the concrete, reinforcing, DPM, insulation and so on. Take care not to cut or remove the slab perimeter reinforcing bars. If this is not possible, engage an engineer to oversee and instruct the work.
2. Dig out the ground under the slab to the required depth, ensuring that at least the minimum required falls in the drainage pipe will be achieved. Pipes under a concrete slab complying with G13/AS2 must be laid straight with an even and maximum practicable fall.
3. Prepare bedding for the pipe. The pipe must be on a minimum 150 mm compacted base bedding of sand or other granular material.
4. Lay the drainage pipe to the required falls and backfill over the pipes. The clearance between the top of the pipe and the underside of the slab must be no less than 25 mm under AS/NZS 3500.2:2021 or 50 mm under G13/AS2. Where a drain enters or exits from under a building, G13/AS2 says there must be an access point within 2.0 m outside the building.
5. Lay sand blinding over the backfilled drains and level it out.
6. Lay insulation over the sand blinding if required.
7. Lay DPM such as polythene and tape all the edges. Forming a waterproof junction between new and existing DPM can be difficult but is crucial for a number of reasons, including avoiding the risk of groundwater entering and corroding the reinforcing steel.
8. It can be useful to scabble out a further 250 mm around the existing mesh to support good reinforcing connections. (This is more typically done on commercial projects where engineers may require it. It is often not carried out on smaller residential projects.)
9. Drill into the slab edges around the opening to allow placement of new reinforcing bars approximately 50 mm (confirm all measurements with the engineer) below the slab surface (NZS 3604:2011 requires a minimum 30 mm cover). Cut starter bars of approximately 400 mm long from D12 dowels (or to match existing reinforcing or as an engineer specifies). Place the starters at approximately 150 – 300 mm centres in accordance with the engineer's instructions.
10. Use epoxy resin (as specified by the ▸▸

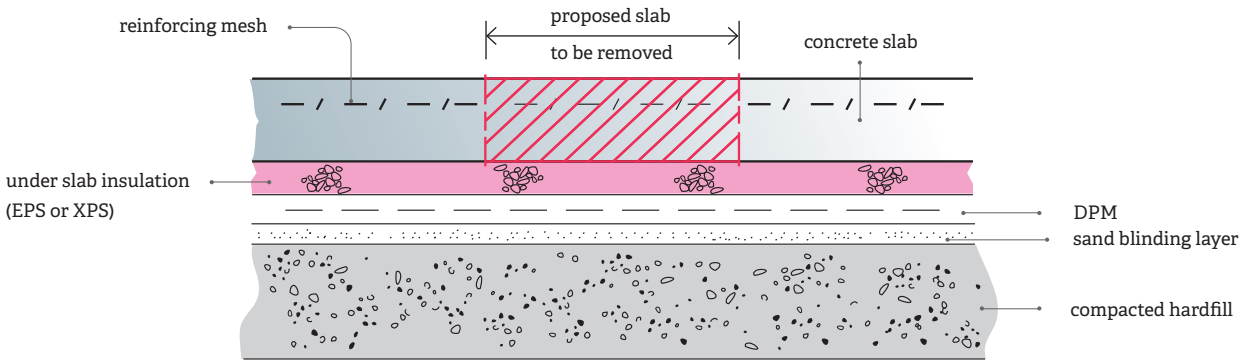


Figure 2: Existing slab detail.

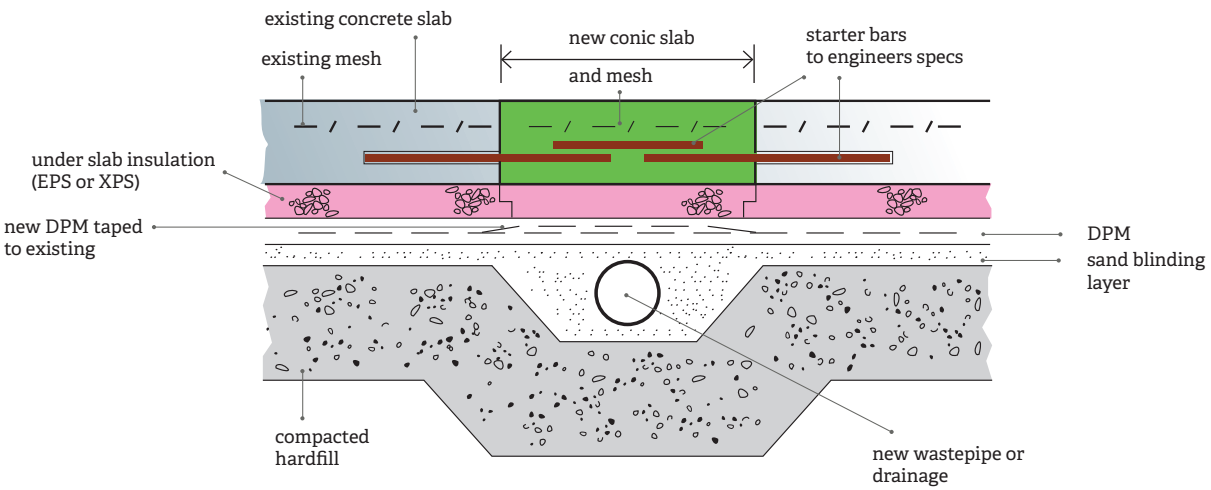


Figure 3: Proposed drainage under slab detail.

engineer) to fix the starters in place usually by injecting it into the holes. Clean the concrete first by waterblasting and using compressed air. Ensure the concrete is dry before installing the epoxy resin, usually a two-part formula, and accurate proportioning and mixing of the constituents is important. Both pot life and curing times are sensitive to temperature. This work should not be carried out below 5˚C or above 30˚C. Consult the manufacturer for use outside this temperature range. Once the starters are in place, insert plastic safety end caps on the exposed cut ends to protect workers from injury while the epoxy resin sets.

11. When the epoxy resin has set, tie the reinforcing bars to the starter bars.
12. Lay new mesh within the opening and tie it to the existing mesh.
13. Prepare to pour the slab to the correct specification, for example, 20 MPa. Concrete strength must meet the requirements of NZS 3604:2011 sections 2.6 and 4.5.
14. After pouring, make sure the slab is cured to reduce the risk of cracking.

Note that prior to covering the draining and again prior to pouring the concrete the BCA may need to carry out inspections before being able to issue a Code Compliance Certificate. It is a good idea to photograph each stage of the works so you have evidence of exactly what was done, the process and the materials used.

By Bruce Sedcole, ANZIA, BRANZ Principal Technical Writer

Slab junctions between conditioned and unconditioned spaces

A question often received by the BRANZ helpline is about thermally separating adjacent reinforced concrete slabs where one is in a conditioned space and the other is not. In short, we're working on it!

Since the introduction of the revised H1 requirements last year, there has been a keen awareness about the different treatments of conditioned and unconditioned spaces in buildings. This comes to a head particularly at the junctions where these spaces meet.

A common scenario

We are commonly asked about the familiar occurrence of a residential reinforced concrete floor slab with an adjacent internal access garage. The habitable dwelling will be a conditioned space – with heating, ventilation and insulation – while the non-habitable garage will typically be unconditioned and uninsulated.

The queries are mostly about the junction of the two adjacent reinforced concrete floor slabs. If one is in a conditioned space while the other is not, how do we thermally separate the two to improve the energy efficiency of the building?

There are several possible variables with this scenario. Are the slabs laid with just one pour or are they constructed with two separate consecutive pours? Is the finished floor level (FFL) the same or is there a step down to a lower garage?

A typical home on a reinforced concrete slab with adjacent garage.

Vertical slab edge insulation not a solution

If the floors are built with one single pour, how can the slabs be thermally separated but still be structurally integral?

In *Build* 201, the article *More on H1* briefly discussed the advantages of vertical slab edge insulation. It noted that R1.0 slab edge insulation was optimal and only minimal improvements in heat loss reduction are achieved with a higher R-value. R1.0 can be achieved with XPS insulation material approximately 20 mm thick.

However, if used between the two slabs, the insulation material on its own will provide no effective structural connection between the slabs. And if we create two structurally separate concrete floor slabs, in an earthquake, the two slabs might move together and apart repeatedly, with destructive effects on the integrity of the building. To counter this, there would normally be heavy deformed steel bars (starter bars) cast into each of the slabs to help them maintain their position.

Problems with starter bars and blocking materials

The R-value of a steel starter bar is far lower than the concrete body of the slab and the steel will act as an extremely efficient thermal bridge – transferring heat from the warmer slab in the conditioned habitable spaces of the dwelling through to the colder garage slab in the unconditioned zone. This is obviously the opposite of what we are trying to achieve.

There have been various attempts to use a third material – such as timber blocking – to physically maintain the space between the slabs without transferring heat. These have been introduced and promoted over the years then later withdrawn as unsatisfactory.

I have seen an extra foundation built to the edge of the garage slab adjacent to the dwelling, with the starter bars cast into each of the two footings well below the plane of the floor slabs and below the bottom edge of the vertical insulation sheet.

However, building a second reinforced concrete foundation (that is otherwise unnecessary) will incur considerable extra labour and material costs and probably additional design costs for the specific engineering required.

The most common slab configuration I notice nowadays uses the same FFL in the dwelling and attached garaging. It probably makes economic sense to keep the configuration simple, but the thermal separation challenges remain.

Experiences in my practice

My practice has been commissioned to design many provincial rural homes over the years, and the brief rarely specifies single-level slabs – instead opting for a definite step down to a lower garage FFL.

Traditional deformed steel starter bars are very efficient thermal conductors.

We have only designed one farmhouse to date with slab edge insulation. The main dwelling had piped hot water heating to the slab as did the zone immediately adjacent in the garage where new lambs were temporarily kept, so it was perhaps more a semi-conditioned space. I confess that I used the starter bars to penetrate the insulation material but my primary concern was that the in-slab hot water pipes didn't fail!

The role of urban garages does seem to be evolving into a storage area, a workshop or hobby room or even a home office or other non-vehicular space. Several of our recent new house projects have specified full perimeter wall insulation to the living areas and the garage – usually also with full wall insulation between those two zones., in anticipation of these changes of use.

It is difficult to meet the full thermal requirements for the garage with garage doors being notoriously non-airtight, but there is a lot of work being undertaken to eliminate this shortcoming. Our most recent new home design was undertaken with the expectation that the garage will eventually be converted to a carer's flat and the garage door replaced with a standard domestic door and window joinery unit.

Potential innovations

There are some interesting new innovations being considered.

BRANZ has been looking at non-metallic mesh and reinforcing bars for use in concrete. These include fibreglass and other synthetic materials with far higher R-values than conventional concrete reinforcing products and I'm excited that the solution to this problem may be imminent.

Fibreglass has been used in the past in concrete with variable results, but we are considering new-generation products for use in concrete in totally new ways.

I can't conclusively answer the question about thermal separation of the slabs, and I would like to hear from any *Build* readers with their ideas and thoughts on this topic. It's a small detail but has the potential to be another step forward in the construction energy efficiency quest.

By Fiona Norten, BRANZ Material Scientist

Building compliance confidence

Buildings stand on the foundations of the New Zealand Building Code. This primer looks at the Building Code and the pyramid that underlies it.

At a glance

- Building Act 2004 – is the high-level regulatory framework.
- Building Code – provides more specific objectives for building performance.
- Acceptable Solutions, Verification Methods and Alternative Solutions – are practical steps to demonstrate Code compliance.
- Proving compliance is critical.

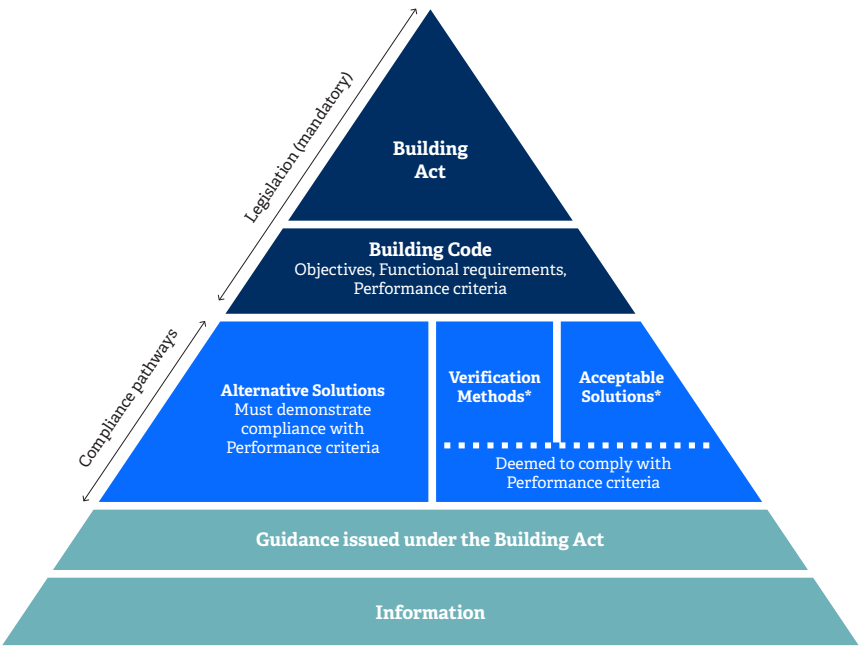
We interact with buildings every single day. We work in them, learn in them, eat and sleep and watch Netflix in them. And while we are working, learning and relaxing, we take it for granted that the building we are in will be up to the task it is designed for.

But how do we know that it is? Who chooses what standard to hold each building to, and what is the process for making sure our buildings are up to scratch?

What are we complying with?

Anyone working in the building industry will be familiar with the concept of the New Zealand Building Code. However, the Building Code is the second level of the building regulatory framework. The top level is the Building Act 2004.

This Act of Parliament sets out the regulations that every building must satisfy. It works alongside other legislation that governs our built environment, like council bylaws. As the primary legislation, the Building Act is very high level, setting out generic rules for all buildings.



* may include cited standards and information

Figure 1: Compliance pyramid developed by MBIE.

The Building Code

Below the Building Act sits the Building Code. The Building Code is more specific, setting out objectives, functional and performance requirements. For example, section B2.1 sets out the objectives for the durability of a building, 'The objective of this provision is to ensure that a building will throughout its specified life continue to satisfy the other objectives of this Code.'

The Building Code can also assign very specific requirements, for example, section B2.3.1 sets out the 5-year, 15-year and 50-year requirements for building elements. The Building Code is split into eight lettered sections, or clauses, ranging from A *General provisions* to H *Energy efficiency* – plus *Specific buildings*, a section with no letter for backcountry huts!

Getting more practical

The Building Act is written in very specific legal and technical language and is time consuming to fully understand – and let's be honest, really dry. Unless you are the Minister of Housing or a compliance lawyer, chances are you have not read this act of parliament. Additionally, the Building Code does not specify how you make a building comply or how to prove it. That said, designers should note the 'limits on application' listed under each clause. These identify specific areas of construction where each clause does not apply - which are sometimes very relevant.

This is where the third layer of the pyramid comes in – Acceptable Solutions, Verification Methods and Alternative Solutions. These documents are compliance pathways that set out the practical steps to demonstrating a building conforms to the Building Code and therefore the Building Act. It is the practicality of these documents that make them the go-to reference guides for people trying to demonstrate compliance.

Why demonstrate compliance?

First, who do you need to demonstrate compliance to? The most common example is a building consent authority (BCA) – usually the local council. BCAs are responsible for signing consent for all new buildings and some renovations carried out on existing buildings. The person submitting the consent is responsible for demonstrating compliance with the Building Code to the relevant BCA.

A builder or designer might also find they need to prove compliance to a customer. That could be another person or company who may for example want proof the concrete slab you just laid is up to scratch before the frame is built on top of it. Alternatively, it could be a clued-up client who wants to know their new dream home isn't going to fall apart around them during the next minor quake.

Proving compliance is also a crucial part of obtaining a BRANZ Appraisal, CodeMark or other verification certificates.

Once you have worked out you need to demonstrate compliance, which compliance pathway is for you?

Acceptable Solutions

In many ways, Acceptable Solutions are the simplest way to demonstrate compliance. These documents set out specific rules so that, if a system follows the letter of the law, it is deemed to comply without needing any more proof.

For example, Table 1A of B2/AS1 states that radiata pine or Douglas fir that is H1.2 treated as per NZS 3640:2003 *Chemical preservation of round and sawn timber* is suitable for use as a subfloor brace, so if a building has subfloor bracing made from H1.2 treated radiata pine, it complies with the Building Code. However, somebody will have to take responsibility for proving the subfloor timbers are H1.2 treated as per NZS 3640:2003 – a task sometimes easier said than done.

Verification Methods

Verification Methods are useful for projects and materials that do not comply with an Acceptable Solution. These are prescribed tests or assessments that can be carried out to demonstrate compliance with the Building Code. These tests or assessments must be carried out exactly as described in the relevant Verification Method.

The steps may be laid out in the Verification Method directly or it might reference a specific standard. For example, E2/VM2 references standard test BRANZ EM7. This is a BRANZ-created evaluation method for testing the weathertightness of cladding systems. If a system passes an EM7 test, it is deemed to comply with E2/VM2 and therefore clause E2 of the Building Code.

Alternative Solutions

The Building Code is performance-based – it prescribes how buildings must perform. This leaves plenty of room for variety – any design that can be proven to perform as the Building Code prescribes is compliant. This is also easier said than done, but Alternative Solutions are here to help.

An Alternative Solution is any system or component of a building that does not comply with an Acceptable Solution or Verification Method. These must demonstrate compliance through a different method. For minor variations, compliance could be demonstrated through comparing your design to the Acceptable Solution or Verification Method, noting and explaining why there are differences.

If your design has been used before in Aotearoa New Zealand or overseas, compliance could be demonstrated through a mechanism known as history of use. Sometimes, compliance can be demonstrated with international standards.

These are just a handful of examples. There is an almost limitless number of ways of demonstrating compliance via an Alternative Solution. The key steps in the process are identifying the relevant clauses of the Building Code, building a body of evidence and presenting your evidence to the relevant authority by proposing an alternative method. A consenting authority will then determine if the proposed alternative method complies with the Building Code.

Compliance matters

While it may often seem like a way to make industry complete more paperwork, the Building Act 2004 and the Building Code exist to ensure we all live, work and play in safe, healthy, functional buildings. There are a myriad of ways to demonstrate compliance with the Building Code, and often it's not as complicated as it first appears.

FOR MORE

See MBIE Building Performance website.

Go to online version

FEATURE SECTION

Sustainability

The circular economy is gaining strength in the building and construction sector but there's much more to do.

IN THIS SECTION

Sustainable practices in construction

Is our present carrot-and-stick approach to improving sustainability in construction the right way to go? There is growing evidence that there may be faster and better ways to bring change.

BY DAVID HINDLEY, FREELANCE TECHNICAL WRITER

Sustainable construction is about building in a way that doesn't deplete natural resources or have harmful impacts. Practical examples are using recyclable and renewable materials, minimising waste and using renewable energy.

The carrots to encourage this take the form of government funding of a wide range of initiatives – from the Warmer Kiwi Homes programme through replacement of fossil fuel boilers right up to $140 million towards an electric arc furnace for New Zealand Steel.

The sticks are increasing fees and charges – in particular, the waste levy being gradually lifted to discourage the amount of waste going straight to disposal. In July this year, the waste levy will be $60 per tonne for municipal landfill (class 1), $30 per tonne for construction and demolition fill (class 2) and $10 per tonne for managed or controlled fill facilities (classes 3 and 4).

The problem with carrots is that you need an awful lot of them to make an impact. The problem with the increased waste levy is that it remains a very small stick. It has only increased from an extremely low base and is low compared to most developed countries. Walk around many building sites today and you see relatively little evidence of careful waste sorting and recycling, with most waste still headed for disposal.

The impact of energy rating schemes

Are there better ways of doing things? Chief Executive of the New Zealand Green Building Council (NZGBC) Andrew Eagles points to the Australian experience, where substantial benefits flowed quickly from the government mandating the NABERS (National Australian Built Environment Rating System) energy rating scheme. A 2010 law required that spaces within office buildings of 2,000 m² or more must get a NABERS energy efficiency rating. The threshold was reduced to 1,000 m² in 2016.

'In Australia, you've seen a massive transformation as building owners invest in energy efficiency improvements,' Andrew Eagles told *Build*. As Table 1 shows, the results are astonishing, with energy savings of close to 40% achieved. Since ratings became a requirement, Australian businesses have saved over AU$1.7 billion in energy bills. 'The thing is that, if you make the performance of buildings transparent, the market drives the changes.'

The benefit of a transparent ratings scheme doesn't just apply to commercial buildings. Andrew Eagles sees a particular importance in performance ratings for homes. 'A home is the biggest thing people will ever buy, yet they have no idea how energy efficient it is. It is very unfair on Kiwis.'

Since 2008, homes that are sold or rented in the UK have been required to have an energy performance certificate (EPC) given a letter from A to G. This helps consumers with information on the health and efficiency of the homes when purchasing. The ratings also provide guidance on how to improve the home. Since April 2020, landlords have not been able to let properties with an EPC rating below E. The UK Government has a target to upgrade all homes to EPC C by 2035.

Energy rating schemes are clearly a powerful way to assess the performance of building stock and an incentive for building owners to upgrade their properties.

Designing and constructing a home to achieve a rating doesn't necessarily mean higher costs – it chiefly means doing things differently. NZGBC engaged Aurecon to review specifications required to achieve a 6 Homestar v5 rating and to compare this with specifications for Building Code clause H1 compliance.

Its 2023 report (with costings by quantity surveyors Kwanto) found that, for different types of home and location, the additional cost for 6 Homestar was

Most people have no idea how energy efficient their home is.

zero in several cases and 0.5% or below in most cases. The report is available on the NZGBC website.

Watching your waste line

A report prepared by Eunomia Research and Consulting for the Ministry for the Environment published last year found that demolition waste is the single-largest category of waste in Aotearoa New Zealand. Just over 4 million tonnes annually are reported – the actual total is likely to be higher. The report says that 223,000 tonnes of aggregate and 249,000 tonnes of mixed construction and demolition (C&D) waste are recovered each year. This indicates that only around 12% of our C&D waste is recovered – the rest goes to cleanfills and landfills.

The waste levy has increased several times in recent years, with one specific aim being to reduce C&D waste. The difficulty is that, even at the new higher levels, the cost is still extremely low by international standards. For example, in some areas of Australia, charges of AU$250–360 per tonne are typical for different types of C&D waste.

How has the Australian market responded? Government figures say that around 81% of all C&D waste is recycled, and C&D recovery rates climbed significantly in the 15 years to 2021 (Table 2). The high disposal costs are not the only reason for this, but they are a significant contributor.

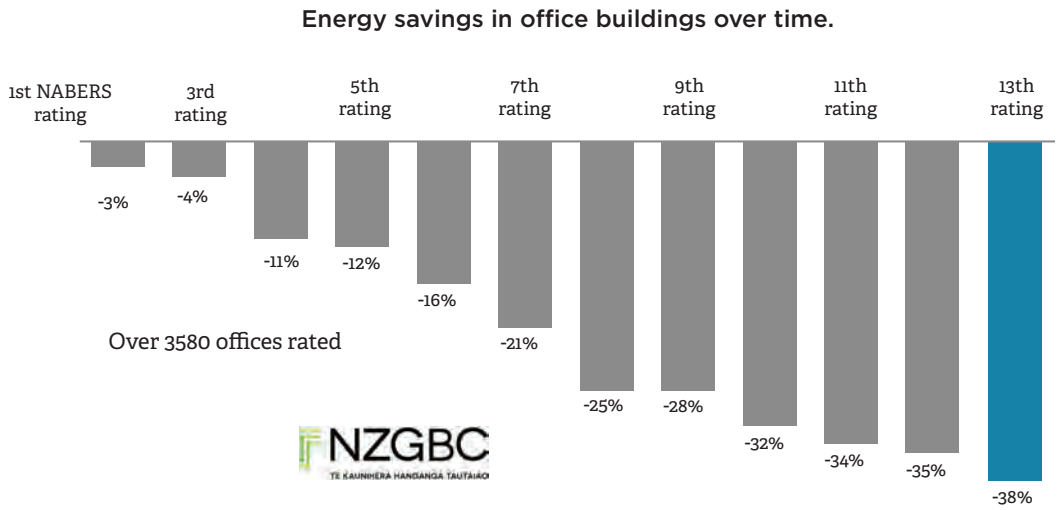


Table 1: Energy savings in Australia following NABERS ratings becoming mandatory. Graph courtesy of NZGBC.

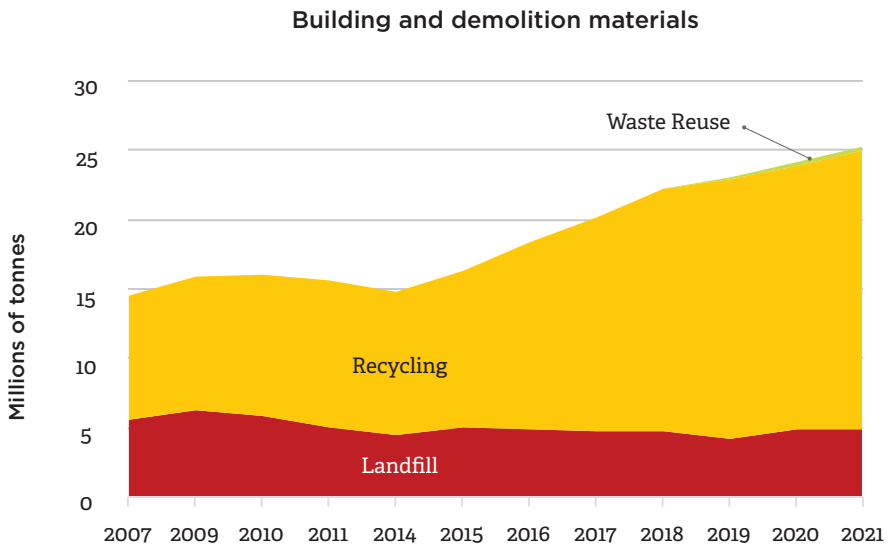


Table 2: C&D recycling rates have increased significantly in Australia.

Source: National Waste Report 2022, The Department of Climate Change, Energy, the Environment and Water (report prepared by Blue Environment Pty Ltd), Australia.

These rates are achievable in New Zealand. Kāinga Ora has a declared aim to reuse or recycle at least 80% of uncontaminated materials from Auckland and Northland development sites and 60% from all other regions. In 2022, it exceeded this, with 87% of uncontaminated materials reused or recycled in Auckland.

Home building projects working to a 6 Homestar requirement or better must have a site-specific waste management plan helping contractors identify waste streams and guiding ways to reduce disposal.

On a project at Auckland University of Technology (AUT) North Campus, Naylor Love undertook a waste management trial and managed to divert over 90% of construction waste from landfill (see *A masterclass in diverting construction waste* in *Build* 201). In a New Zealand first, the company has developed an NZQA micro-credential for resource sorters, and this supports inductions on Naylor Love worksites.

While saving money through waste diversion was a bonus for Naylor Love, the company's Group Environmental Manager Annie Day says she still sees a lot of house construction sites that just have a single large skip with the contents most likely ending up at landfill or cleanfill. 'I don't think the cost of disposal is high enough here for people to review their procedures.'

There is evidence in recent research that supports her view. The 2023 Ministry for the Environment report found that, 'The general feeling of those involved in the construction waste diversion industry is that until disposal costs are higher, the motivation to sort at source or to use a construction waste service that incorporates a sorting stage will remain purely as an environmental choice and the market will be limited.'

Changes on the horizon

With the modest increases in the waste levy just about to be introduced, there is little prospect of the government making substantial increases in the near future. But there has been discussion of other initiatives to reduce waste and introduce energy performance ratings.

MBIE projects held over from 2023 include proposals to make it mandatory for a waste minimisation plan to be prepared for certain building or demolition work and making energy performance ratings mandatory for large new and existing public, industrial and apartment buildings. The power to make these requirements would be put in place in 2024 and the requirements themselves introduced in future years.

BRANZ updating REBRI

BRANZ is currently updating its REBRI resource aimed at reducing the amount of building material waste generated at C&D sites and reducing the proportion sent to landfill and cleanfill. The updated resource is likely to be available later in 2024.

Sustainability certification schemes

One practical approach to achieving greater sustainability is to certify a project using one of the established certification schemes. These are the main schemes available:

- **Homestar** – the country's main certification scheme for new home design and construction, administered by NZGBC.
- **Green Star** – covering all types of commercial buildings, it was launched by Green Building Council Australia in 2003 and has been adapted for Aotearoa. It is administered here by NZGBC. There are over 250 certified Green Star buildings here with a further 200 going through the process.
- **NABERSNZ** – a certification/rating scheme for office buildings based on the Australian NABERS scheme but adapted for Aotearoa. EECA holds the licence and NZGBC administers the scheme in this country. When a government agency wants to lease a building over 2,000 m², the building must have NABERS certification. Around 130 buildings are assessed per year.
- **LEED** (Leadership in Energy and Environmental Design) – a global certification scheme not widely used here.
- **BREEAM** (Building Research Establishment Environmental Assessment Methodology) – a global certification scheme owned by BRE in UK not widely used here.
- **Living Building Challenge** – an international scheme with very strenuous requirements. The Living Pā at Victoria University is following this scheme.

Achieving a path to net-zero carbon concrete

Aotearoa New Zealand's concrete industry has signalled its intention to reduce emissions in its newly released decarbonisation plan – *A Net-Zero Carbon Concrete Industry for Aotearoa New Zealand: Roadmap to 2050*.

BY ROB GAIMSTER, CHIEF EXECUTIVE, CONCRETE NZ

Based on a strong commitment to New Zealand's Climate Change Response (Zero Carbon) Amendment Act 2019 and its intention to help the country reduce its greenhouse gas (GHG) emissions under the Paris Agreement, the concrete industry is determined to reduce its GHG emissions to net-zero by 2050.

Why concrete is vital

Concrete will play an integral role in both mitigating and adapting to the effects of climate change, supporting sustainable and resilient communities around the world, including Aotearoa. Concrete is the essential building material that has shaped modern society, and it is vital for building a more sustainable future.

It will help to create and maintain thriving communities by delivering infrastructure, homes, clean water and clean and renewable energy and by providing a more resilient built environment as our climate changes.

2050 net-zero carbon roadmap

Concrete NZ's members have committed to producing carbon-zero concrete by 2050 in line with global climate targets. The recently released roadmap sets out a plan for how the industry will achieve this goal and play a major role in building the sustainable world of tomorrow.

In short, the roadmap describes an achievable pathway to producing net-zero concrete by 2050 that works for the Aotearoa industry.

Key roadmap stakeholders

Covering both ready-mixed concrete and concrete products, the roadmap builds on past and current initiatives and involves the major parties in the concrete value chain, including:

- cement manufacturers
- concrete producers
- manufacturers of concrete products
- designers of buildings and infrastructure
- construction companies and contractors.

Developed with support from sustainability strategist thinkstep-anz, the roadmap also involved engagement with Concrete NZ's Cement, Masonry, Precast and Readymix sector groups as well as its Learned Society.

Funding was received from BRANZ via the Building Research Levy and from MBIE's Building Innovation Partnership administered through the University of Canterbury.

Targets for 2030 and 2050

The roadmap identifies ways to reduce the direct (Scope 1) and electricity-related (Scope 2) GHG industry emissions by 44% from 2020 levels by 2030 and 100% by 2050.

The 2020 reference year was chosen to align with the Global Cement and Concrete Association (GCCA) *Cement and Concrete Industry Roadmap for Net-Zero Concrete*.

In addition, the focus on Scope 1 and Scope 2 emissions, where the industry has direct influence, aligns with the GCCA's global roadmap and those from other nations.

Figure 1 illustrates Scope 1 and Scope 2 emissions in the cement and concrete manufacturing process. If indirect (Scope 3) emissions are included to align with an environmental product declaration approach,

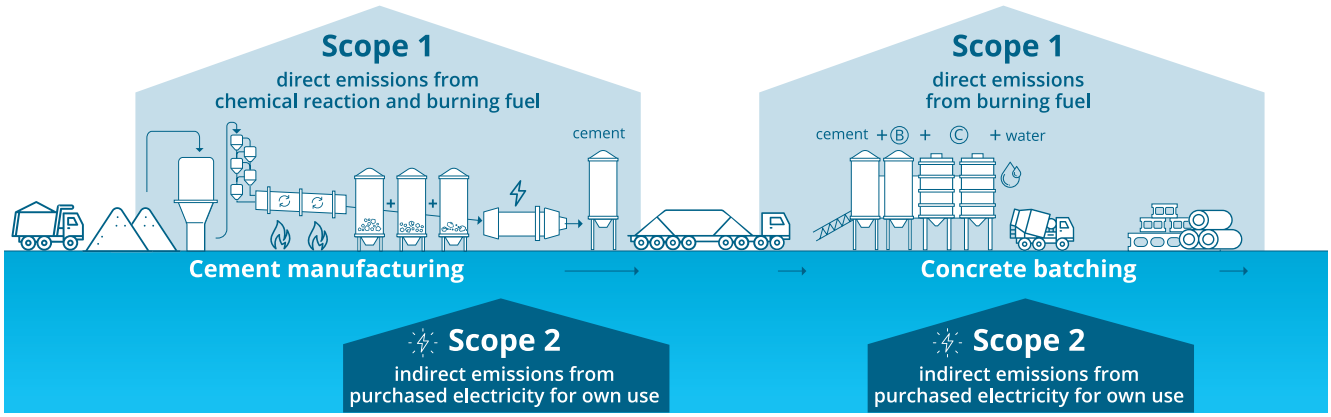


Figure 1: Scope 1 and Scope 2 emissions in the cement and concrete manufacturing process.

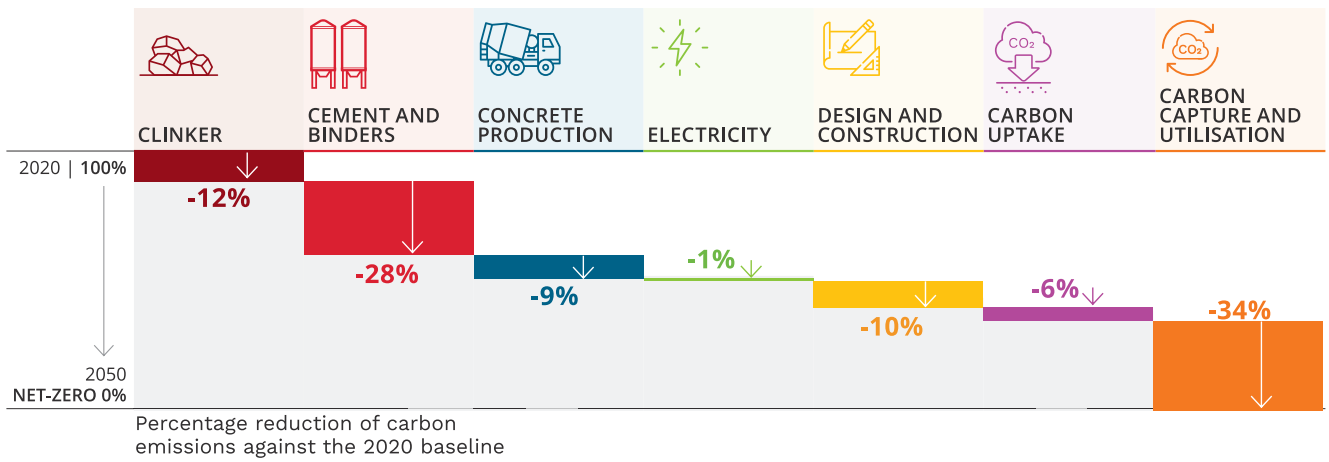


Figure 2: Pathways or levers the industry will take to achieve its emissions-reduction targets.

the 2030 reduction target would drop from 44% to 29%. Figure 2 shows the pathways or levers the industry will take to achieve its emissions-reduction targets.

Manufacturing Portland cement releases CO_2 directly through a chemical reaction, which results in a major share of the industry's total emissions. Burning coal in clinker production is the other main source of emissions.

Until 2030, the industry will reduce emissions by using alternative fuels in clinker production and increasing the use of mineral additions such as ground limestone and supplementary cementitious materials (SCMs), which are mineral byproducts of industrial processes with lower embodied carbon than cement.

Concrete will play an integral role in both mitigating and adapting to the effects of climate change.

The industry in Aotearoa has used SCMs before, but there is scope for growth and greater volumes are now entering the market.

Between 2030 and 2050, the industry will focus on further significant reductions in GHG emissions in cement manufacture and plans to use a technology known as carbon capture, utilisation and storage (CCUS) to capture any remaining emissions.

Further CO_2 will be absorbed naturally by concrete as it ages through a carbon-uptake process called recarbonation.

We also expect that improving efficiency in the design of buildings and infrastructure will make an important difference, while additional small savings will come from decarbonisation of the electricity grid.

Continued successful reduction of the industry's emissions will rely on further research and development, investment and commitment from the government and other stakeholders throughout the value chain.

The industry intends to review the roadmap annually and report on progress across the pathways every 5 years. This will ensure new technologies and innovations as well as regulatory and other changes are reflected in the proposed pathways.

FOR MORE See www.branz.co.nz/about/ourstories/2021-2022/reducing-the-carbon-footprint-of-concrete/ and BRANZ External Research Report ER66 www.branz.co.nz/pubs/research-now/zero-carbon-built-environment/zero-carbon-increasing-scms-in-concrete-production

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Change is here – are companies ready?

How are construction companies dealing with embedding an understanding of climate change into their business? A BRANZ study in association with the University of Otago came up with some answers.

BY DR CASIMIR MACGREGOR, BRANZ PRINCIPAL SOCIAL SCIENTIST, PROFESSOR SARA WALTON, DEPARTMENT OF MANAGEMENT, UNIVERSITY OF OTAGO, AND ANDREA FOLEY, ASSISTANT RESEARCH FELLOW, UNIVERSITY OF OTAGO

The Paris Agreement on climate change established a target of holding the global average temperature increase to no more than 1.5°C above pre-industriaol levels to avoid a climate catastrophe.

In Aotearoa New Zealand, the Climate Change Response (Zero Carbon) Amendment Act 2019 sets out reduction targets and initiatives to help the country reduce net emissions of all greenhouse gases (except biogenic methane) to zero by 2050.

Construction sector crucial to reducing carbon emissions

The construction sector has a critical role to play in addressing climate change and reducing Aotearoa's emissions but we know little about how businesses within the sector are preparing to address climate change challenges.

A study by the University of Otago Business School and BRANZ examined how construction companies understand and prepare for climate change. The research team undertook eight in-depth case studies with companies on the cutting edge of delivering sustainable buildings. A key aspect was to assess how companies embed addressing climate change into their organisational practices and cultures.

Enablers for zero-carbon construction

Case studies highlighted enabling activities carried out by construction companies to support their preparedness for addressing climate change:

- **Accreditations and collaborations:** Participants discoussed their need to have proven low-carbon solutions and technologies and outlined the benefits of working with others to share information.
- **Organisational values:** Some saw developing a climate change culture within their organisation as a key point of difference in the sector. One company executive noted that 'having a sense of who you are as a company' helps drive decision making for sustainability and climate change.
- **Changing attitudes:** All participants were pleased that change is occurring in the construction sector. They noted that some tenders include social and environmental outcomes and a preference to work with clients who value sustainability. They also saw a growing shift towards using quality and sustainability as measures of success ahead of cost or simply meeting consenting requirements.
- **Role models and leaders:** Participants perceived that role models and leaders in the sector help to influence change, and many saw themselves in this role. They spoke about larger companies leading change, which then trickles down, and would welcome case studies of what companies are doing to address climate change.

Addressing barriers to uptake

Despite the many enablers supporting companies to embed climate change into their organisational practices and cultures, key barriers were identified that are stopping the readiness of many to address climate change:

Role models and leaders in the sector will help to influence positive change.

- **Lack of regulation and policy:** Participants identified a need for policy change roadmaps to help them prepare for future changes as well as urgent changes to the New Zealand Building Code to meet international standards. The limited and often poor-quality information shared in the industry also needs to be addressed.
- **Lack of national and local government coordination:** Many participants commented on difficulties working with government departments that might have top-level statements about sustainability and climate change but these are poorly understood at ground level. Interpretations of the Building Code across councils also cause delays, extra work and stress.
- **Costs:** Several participants mentioned that carbon is where the greater costs are in the construction process so reducing carbon can reduce operational costs. The focus also needs to change to both the capital and operating costs of a building as a focus on capital costs alone provides no business incentive to change.
- **Resistance to change:** Most participants mentioned resistance to change in some form – such as the market, the construction sector or people within their own organisation.
- **Risk perception:** The construction sector was described as a high-risk, reactive industry, which doesn't bode well for climate change mitigation and adaptation practices. Participants felt that considerations need to include the risks of not mitigating and adapting.
- **Clients' mindsets:** Clients are a key component driving the construction process. Participants mentioned issues such as shifting clients' mindsets away from large houses. Showing them options that include sustainability and reduced carbon can encourage the adoption of alternative solutions in design and construction.

Embedding climate change practices and cultures

The research identified several key actions that companies in the construction sector could undertake to get ready for climate change and embed its impact into their organisational practices and cultures:

- **Develop understanding:** Learn about the technologies, materials and processes that enable a climate-ready company. Appreciate that this could be an opportunity for a company and does not always have to be a cost.
- **Change practices:** Many construction companies do not have significant fixed assets so they can change their practices relatively easily. Mindsets are changing quickly, and companies need to understand their market and business environment and be prepared for ongoing change in a dynamic environment.
- **Collaborate across the sector:** Identify who has tools to help understand carbon emissions and understand the metrics around low-carbon, high-performance buildings.

Climate change and sustainability were discussed by some participants as the next health and safety issue for business. They saw sustainability and climate change becoming embedded in organisational practices and operations.

The key to addressing organisational change is considering:

- the material culture – the things you have
- the practices – the things you do
- values, norms and meanings – the way you think.

Together, all three aspects can embed a climate culture that proactively creates readiness for both the impacts and risks associated with climate change.

Water in the construction process

With mounting pressure on local authority water supplies and the wider environment, carefully managing water use is of growing importance on all building sites. Here is some practical guidance to help.

BY DAVID HINDLEY, FREELANCE TECHNICAL WRITER

Being an island nation with plenty of rivers and lots of rain – sometimes way, way too much rain – we often take water for granted. That's especially true in construction because it is used at every stage of the process from making the concrete for the floor slab to giving the building a final clean before it is handed over to the new owners.

Water is a legal requirement on all building sites – toilets, hand-washing facilities and drinking water are required under the Health and Safety at Work (General Risk and Workplace Management) Regulations 2016.

But too much water can cause problems – for example, if it leads to sediment run-off polluting waterways or footpaths or neighbouring properties.

Preparation and planning

While some water-wise steps can be taken on the fly such as fixing a split water hose when you notice it, a lot more can be achieved with some forethought.

First up, check what the specific requirements are that you are facing. For example, there may be restrictions around water use in a building consent or resource consent for the project. Keep these documents on site.

Make sure in advance that you have the right equipment on hand or know-how about accessing it to deal with water problems before they arise.

For example, if you need to get rid of rainwater from foundation trenches before concrete is poured or get rid of water ponding to reduce the risk of sediment run-off, perhaps a wet vac can do the job. Bigger jobs such as after extremely heavy rainfall or flooding require calling in a sucker truck.

Auckland Council says, 'The price of a wet vac is very close to a standard RMA infringement fine – and if you get penalised, you still have to pay to clean up the mess, so it makes financial sense to invest in the right equipment.'

Removing rainwater from holes or trenches where concrete will be poured is important because, if it is left in place, the water will spill out when the concrete is pumped in and can potentially cause problems.

Ideally, wait until sediment has settled to the bottom and pump from the surface or the middle of the water rather than the bottom. The water should go to an unsealed part of the site where it can soak into grass or gravel – never to a street kerb or stormwater system.

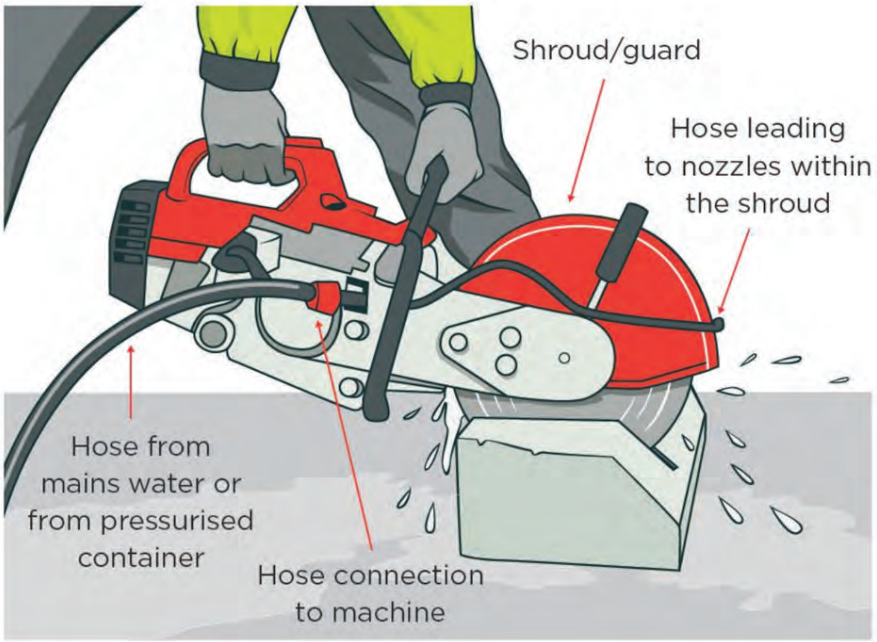
Concrete wastewater

Wastewater that contains concrete or cement is an inevitability on most building sites, especially in the early stages of construction. Concrete has a very high pH that can kill fish and wildlife, so particular care needs to be taken to ensure concrete wastewater does not get into stormwater systems or waterways.

Trying to filter concrete wastewater or thin it down doesn't work. The high pH can't be filtered out, and to neutralise the damaging effects of just 10 L of concrete run-off requires 100,000 L of freshwater.

Water and dust

Water is a crucial component in dust control on construction sites – from spraying a wide arc of water over a bone-dry summer worksite to settle the dust to using water with tools such as saws and grinders. One way of managing hazardous dust production is with devices where nozzles focus a spray of water towards the blade or grinder,



Controlling on-site dust with a water suppression tool. Image: WorkSafe NZ.

preventing dust from becoming airborne.

For more on controlling dust with on-tool water suppression, visit www.worksafe.govt.nz and type 'dust' in the search box.

Water and sediment control

Control of sediment and liquid waste is crucial. For example, cement and other materials can be washed onto neighbouring properties or into waterways with excessive water use when watering down or waterblasting hard surfaces without managing where the water runs to.

This can lead to environmental damage because stormwater systems and street drains typically run straight into waterways or the sea. It can also cause problems with neighbours.

The damage caused can have expensive consequences for contractors. While instant or infringement fines of around $750–1,000 may seem relatively modest, if the damage caused is deliberate and extensive or ongoing and leads to court action, fines of up to $300,000 for an individual and $600,000 for a company are possible.

One approach to reducing the risk of sediment run-off damage is to keep as much grass and weed growth on site as possible, expose ground in stages only as necessary and keep bales of hay or pea straw around to cover stockpiles.

A way to reduce the impact of heavy rainfall on site is to install the drainage system at the earliest opportunity to make the best use of existing infrastructure. As soon as the roof is complete with roof cladding and spouting installed, connect the downpipes to the stormwater system. Make sure that only clear water goes to the stormwater system.

The ultimate water-wise construction

If it has ever struck you as odd that we go to great effort and expense making water clean enough to drink only to use it for washing dirty paintbrushes, you are not alone.

In the UK, the Construction Leadership Council says in its water management guidance that its ultimate aim is to eliminate the demand and use of potable water in construction. 'It is unlikely that water demand can be eliminated, but efforts can be made to reduce and use alternative sources, as well as reuse water for construction activities,' it says.

These are some tips for water-wise construction:

- Plan ahead to connect to the stormwater system as soon as you can after the roof cladding and spoutin is installed.
- Divert clean rainwater away from the exposed worksite to avoid it picking up sediment.
- Talk to your concrete supplier about ways to cure concrete without using continuously-operating hoses or sprinklers. Covering with an impermeable membrane such as polythene will be acceptable in many cases.
- Put paintbrushes in plastic bags for short periods to prevent drying rather than constantly washing them. Consider first rinsing brushes in clean but non-potable water.
- Have a designated area on site for washing down equipment where excess water can run onto grass or gravel and not into drains or off the site.
- Scrape excess clay or soil off tools or boots before washing and then wash using a tub of water rather than under a running hose or tap.
- Where wash down with a spray is required, use a trigger-operated high-pressure but low-volume water spray.
- Fix leaks in hoses and taps as soon as you notice them.
- Have a plan for removing toxic wash water off site rather than letting it soak into the ground. This includes wash water from oil-based paints and any acid or chemical wash wastewater.
- Where fine water droplets are used in the air – for example, for dust suppression on a site in a heavily populated area – use only potable water to avoid the risk of bacterial contamination.

FOR MORE See BRANZ Bulletin BU657 *Designing water-efficient houses* and Study Report SR469 *Residential water use in New Zealand.* Search at www.branz.co.nz.

Carbon-friendly office fit-outs

Office fit-outs, with their use of high-carbon materials and frequent refurbishments, contribute significantly to a building's carbon footprint. How can the carbon intensity of fit-outs be reduced? BRANZ has investigated.

BY JARRED BUTLER, BRANZ BUILDING ENVIRONMENTAL SCIENTIST

For the past 12 years, BRANZ has been developing resources to help industry assess the carbon footprint of office buildings. Until now, these resources have not accounted for the embodied carbon of interior fit-out elements such as partition walls, ceilings and carpet.

However, overseas evidence suggests that office fit-outs can be very carbon intensive. BRANZ has researched the carbon footprint of a fit-out and compared it to the carbon footprint of the office building as a whole.

Office space awaiting a fit-out.

What is a fit-out?

A fit-out refers to the process of installing elements within an office space to make it suitable for the occupant or a particular kind of business.

A fit-out is distinct from the base building, which usually refers to a building's main structure and envelope.

A fit-out might involve installing partition walls to create individual rooms and offices, lining the floor with carpet, installing a ceiling or moving in furniture.

Fit-out projects can range in size from small sections of a single floor to an entire building. A single office space can also be fitted out multiple times throughout its existence as the occupants' needs or the occupants themselves change.

Global research into fit-out and carbon

So how does fitting out an office contribute to carbon emissions? How do those emissions compare to the rest of the building?

Research in the US and Australia suggests that fitting out an office could contribute significantly to a building's carbon emissions. The research identified three contributing factors:

- **High-carbon materials**: The Carbon Leadership Forum in the US found that fit-outs typically use materials with high embodied carbon such as aluminium for partitions, carpet, plasterboard and furniture.
- **Frequent refurbishment**: Research in Australia found that office spaces are refurbished on average every 8.2 years to meet the changing needs of occupants or when tenancies change. This results in a lot of additional material – and thus carbon emissions – given a building is expected to last at least 50 years.
- **Lots of waste:** Research in Australia also found that removing existing fit-out material such as during a refurbish-

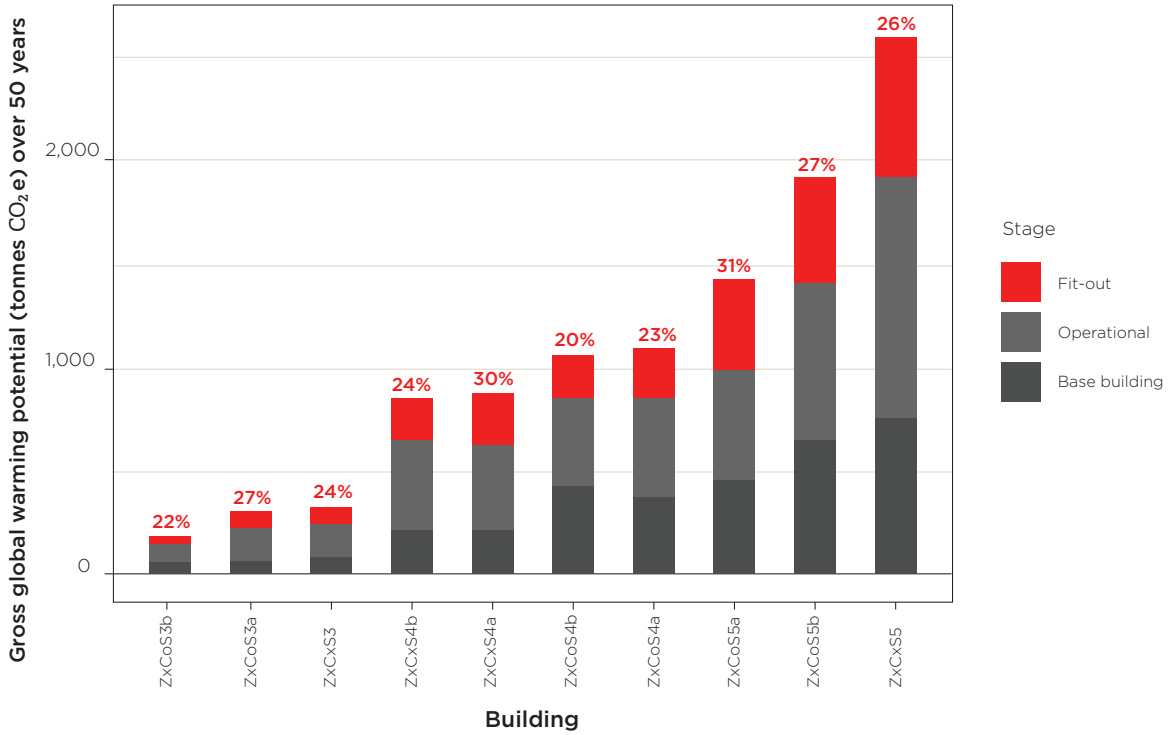


Figure 1: The carbon footprint of 10 BRANZ reference office buildings.

ment generates a large amount of waste that is usually sent to landfill.

These factors create a perfect storm for carbon emissions. High-carbon materials are installed and then removed and replaced frequently, and when they are removed, they are sent to landfill.

Towards Aotearoa data on fit-out

BRANZ sought to integrate this information into a study of carbon emissions that result from fitting out an office in Aotearoa New Zealand and assess how those emissions compare to the total emissions of the base building. Three case studies based on real-world fit-out projects were undertaken.

BRANZ used the case studies to estimate average carbon rates to fit out 1 m^2 of office space, calculating the carbon emissions to fit out reference office buildings that BRANZ has already carbon footprinted.

Results

We calculated that fitting out an office building can release an additional 480 $kgCO_2e$ per m^2 (net lettable area) into the atmosphere over a building's 50-year service life.

Figure 1 shows how this translates to whole buildings in the carbon footprint of 10 of BRANZ's reference office buildings. The red sections illustrate the carbon footprint of the fit-out, and the red figures show the percentage contribution of the fit-out to the whole building's carbon footprint.

When compared to the emissions of the base office buildings, the fit-out contributes approximately 25% of a whole building's gross carbon emissions on average.

For context, this is a similar percentage to the base building's upfront emissions, which are often the main focus of decarbonisation strategies. Only operational energy use contributes more significantly to a building's carbon emissions.

Decarbonisation strategies

Clearly, fit-out needs more consideration when low-carbon design decisions are made for our office buildings.

The research identified several particularly effective strategies for reducing the carbon footprint of a fit-out:

- **Extending service life:** The short service life of fit-outs and therefore frequent refurbishments are a key contributor to high emissions over the lifetime of a building. Extending the service life of fit-outs will lower emissions.
- **Reusing furniture:** Among all materials and products used in a fit-out, furniture contributes most to the carbon footprint. Reusing furniture (reducing the need for the manufacture of new furniture) lowers this impact.
- **Diverting furniture from landfill:** If furniture can't be reused, diverting it from landfill is the next best thing. Options include selling it to employees or donating it to a reuse/recycling organisation such as All Heart NZ.
- **Retaining materials between refurbishments:** Many materials are still fit for purpose when they are removed during a refurbishment. Retaining these materials can help to reduce the carbon footprint of the fit-out.

FOR MORE See the Carbon Leadership Forum's fit-out research at www.carbonleadershipforum.org. Australian research information is available at www.researchgate.net (search 'demolition fitout waste'). All Heart NZ takes unwanted corporate assets for refurbishment and reuse – www.allheartnz.org.nz.


adidas

FEATURE SECTION

Healthy homes

Kiwis don't have to put up with homes that are cold and damp in winter and overheat in summer.

IN THIS SECTION

Designing super-healthy homes

Studies by BRANZ and other researchers have shown that healthy homes provide a range of benefits for their occupants. They're warmer in winter and cooler in summer, drier, better ventilated and often cheaper to run. So why aren't we routinely building them?

BY NICK HELM, FREELANCE TECHNICAL WRITER

Designing and building homes that look after, rather than harm, the wellbeing of their occupants seems like a no brainer.

Yet data from a 2018 Stats NZ survey found that a third of Aotearoa New Zealand homes are too cold in winter, and a third are too hot in summer. It found average temperatures as low as 16˚C. The World Health Organization (WHO) recommends maintaining a minimum indoor temperature of 18–20˚C to maintain comfort, health and wellbeing.

If the occupants of these homes can't afford to heat their home in winter and cool it in summer, they have no choice but to live in an unhealthy environment. It's a serious problem, particularly for the very young and elderly.

Unhealthy homes seen as normal

Some in the building and construction industry think it shouldn't be that way. Architect Bob Burnett is founder of the Superhome Movement, a non-profit industry group aiming to transform Aotearoa's building industry so all new homes are healthier and more energy efficient.

'Most people associate the problem with older homes. But many brand-new builds have these same issues,' he says.

Nor is it a problem with just basic houses. Burnett says he sees large, luxurious, award-winning homes created by respected architects with poor thermal performance and indoor environmental quality, which generate massive power bills for their owners.

'New Zealanders just think it's normal to have a cold, damp home with condensation on the windows in winter. They don't realise you don't have to live like that.'

So, why has this situation arisen?

Good design is fundamental

The trouble begins, according to Burnett, when designers prioritise aesthetics over the performance of the building and the criteria that make it a healthy home.

'Unfortunately, design is often marginalised or, in some cases, completely absent from New Zealand's home-building industry. Homeowners miss out because there's limited understanding of what good design

The Building Code expects that people will open windows to ventilate their homes.

Good design is fundamental to creating homes that look after the wellbeing of occupants.

is and what it can do for them,' he says.

The fact that many homeowners and occupants have little idea how their home works or how to keep its internal environment healthy just adds to the problem.

Take indoor ventilation for example. International guidelines on indoor air quality recommend that ventilation rates should ideally be 0.35–0.5 air changes per hour. This provides sufficient ventilation to effectively remove contaminants but is not so high as to compromise energy efficiency.

However, BRANZ research indicates that building airtightness tends to be based on the age, size and overall complexity of the building. Older homes built prior to 1960 typically had natural ventilation rates of around 0.9 air changes per hour. More modern homes built after 2000, where construction is more airtight, experience only 0.2 air changes per hour on average.

The Building Code expects occupants of more airtight homes to open windows each day to create the necessary ventilation.

'Unfortunately, many people won't open their windows in winter, particularly if they have to pay to heat their home. They don't see the point when all the warmth they've just paid for would escape,' says Burnett.

Building Code is problematic

The Building Code is at the root of the problem, Burnett believes. He says the building industry uses it as the primary performance target despite it falling well below the minimum standards required in other countries with similar climates.

People say you must choose between affordability and a healthy home. With good design, you can have both.

Burnett says the Building Code does a disservice to homeowners, who are led to believe a to-Code build offers them the best possible home when this is simply not the case.

'We have new homes being built today that meet the requirements of our Building Code but fail to meet basic WHO health standards.'

Finding better ways

Efforts like the Superhome Movement, supported by research insights from BRANZ and others (see, for example, the article on warm roofs on page 65), try to set higher performance targets. They're beginning to find traction with designers, builders and other building professionals as well as homeowners and occupants looking for a higher-performing home.

Burnett, a former Homestar assessor, says the primary goal of Superhome is to create awareness for homeowners and occupants about healthy homes and awareness for building professionals to help them find better ways of doing things.

To help achieve its goals, the movement created the Superhome certification, a building credential that assesses a dwelling against 10 key principles that encompass the Superhome ideal: good design, whole-home ventilation, thermal performance, energy efficiency, a very well-insulated envelope, water efficiency, high-performance recessed windows, low-carbon materials, airtightness and good waste management.

Good design solves many problems

'The Superhome certification, and building healthy homes in general, isn't just about sustainability or thermal efficiency –

the industry has other ratings and certifications for those things. It's about how good design can influence the quality of the internal environment and how that environment can improve the physical and mental wellbeing of building occupants,' explains Burnett.

More than just pure building science, he describes good design as the right mix of science, materials, aesthetics and occupant-focused thinking, but when you step into a well-designed healthy home, he says the difference becomes obvious.

Navigating budget concerns

Critics of beyond-Code builds might point to the additional insulation, higher-performing windows and ventilation systems required and say it adds unnecessary costs to an already expensive process.

Superhomes do cost more, on average, although higher-performing materials and energy-efficient systems often pay for themselves in the long term. There are also the long-term health benefits for occupants to consider, with associated healthcare savings for individuals and the country as a whole.

What's more, Burnett says good design can often provide ways around budget concerns.

'Orient the build properly on the site, use the right amount of glazing, place the right rooms in the right locations and prioritise what's important to the homeowner. That's good design. It doesn't cost a cent more,' he says.

'People say you must choose between affordability and performance or between affordability and a healthy home. I say there is no need. With good design, you can have both.'

On Saturday 20 July 2024, the Superhome Movement will hold its annual Superhome Tour, giving designers, builders, prospective homeowners and renovators the opportunity to visit some of the country's highest performing and most energy-efficient homes. See www.superhome.co.nz/tours-superhome-movement for details.

Roofing rethink: warm roofs, healthy Kiwis

Research shows that warm roofs offer homeowners and occupiers a range of benefits over their cold roof counterparts. Warm roofs make it easier to achieve a healthy indoor environment, reduce energy costs and, in some systems, provide a more durable roof structure.

BY NICK HELM, FREELANCE TECHNICAL WRITER

BRANZ, alongside other researchers and industry partners, is exploring how the health and comfort of Kiwis can be improved by addressing the problems of temperature extremes and dampness that plague many of our homes – both new and existing (see story on page 60).

Their research has shown that a construction technique known as a warm roof evens out the large temperature swings characteristic of conventional roof designs, dramatically reducing the risk of moisture problems in the roof structure and offering multiple other benefits for homeowners and occupiers.

What is a warm roof?

The tried-and-true method to put together a profiled metal roof in Aotearoa New Zealand is to mount the cladding, roof underlay and wire mesh on top of the purlins.

If it's a skillion roof, the insulation goes in the gaps between the rafters. If it's a pitched roof with a ceiling void, the insulation typically goes between or, more lately, on top of the ceiling timber.

In both cases, the roof structure (and roof space if there is one) lie outside the insulated envelope of the building. Consequently, they are impacted to a greater extent by the climate – solar radiation during the day and radiative cooling at night. This results in large temperature swings – heating up to well above the outdoor temperature during the day and cooling to below it at night. Where the rafters penetrate the insulation they also present a significant thermal bridge.

Installing the plywood layer in a warm roof structure.

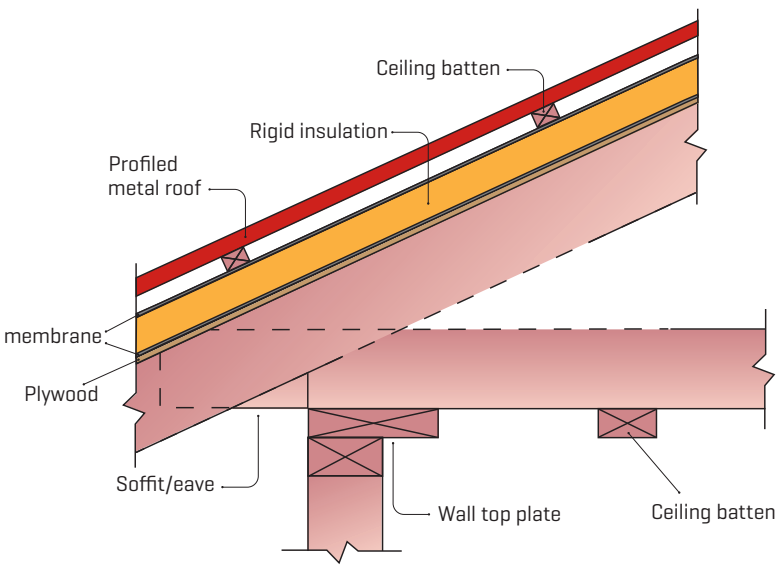


Figure 1: Components of a pitched warm roof.

This kind of construction is known as a cold roof.

A warm roof typically uses a layer of rigid insulation on the exterior surface of the structure, either with an integrated cladding (this could be a membrane or a metal skin bonded to the insulation) or with traditional roof cladding over the top like the BRANZ test building (see *Build* 161).

This brings the roof structure and roof space inside the insulated envelope of the building, protecting them against swings in exterior temperature. They maintain a temperature close to that of the living spaces below.

Significantly reduced condensation risk

Evening out the temperature in this way means that, under normal living habits, condensation is very unlikely to form on the roof structure and in the roof space.

In cold roofs, by contrast, condensation can form on the underside of the roofing underlay and on the structure itself – a problem made much more likely if there is little roof ventilation and moist air is able to move upwards from the living spaces, (for example, through downlight recesses) and into the roof space.

The durability of a cold roof depends on the site receiving enough solar radiation during the day to aid drying, which can't necessarily be relied upon.

Excessive moisture in the roof space can have a number of consequences, including reducing the effectiveness of insulation, damaging building components and promoting the growth of mould. It can be complicated to resolve. Just adding ventilation is no guarantee of a quick fix because the cooling of the roof deck below ambient temperatures can mean that nighttime ventilation actually adds moisture to the space. See, for example, the description in *Build* 178 of a solar extraction fan installed in a Tauranga home to solve a persistent moisture problem.

Wider benefits

Beyond the direct benefits associated with reduced moisture, warm roofs offer multiple advantages to homeowners and occupants:

- Warm roof insulation has significantly less thermal bridging than other methods of construction (there are still screw fixings and suchlike but their impact is less significant).
- The way warm roofs are constructed will typically add rigidity to the roof structure.
- The lifespan of the roof cladding will typically be extended as the condensate load on the cladding will be reduced.
- The insulation tends to make the living spaces quieter.

- Less variability in the roof space temperature enhances the efficiency of air conditioning and other forms of heating and ventilation with ducting that passes through the roof space. This is because the roof space conditions are the same as in the conditioned area of the building.
- In some buildings, a warm roof can eliminate the need for separate climate-controlled plant room.
- Warm roofs help to reduce the risk of overheating risk in the living space.
- The higher R values mean a rework of the structure isn't required.
- Warm roofs potentially reduce the corrosion risk for built assemblies.

An investment in long-term gains

While warm roofs can cost more to install because of the additional insulation and materials, the enhanced thermal efficiency they provide and their reduced maintenance needs can lower running costs in the long term – offsetting the initial expense.

What's more, warm roof technologies continue to evolve. Some new panellised options are quick to install, requiring little more labour time than traditional forms of insulation.

Retrofitted warm roofs offer major advantages to refurbishment projects. Where roofs are at end of life, it is straightforward to add significant thermal resistance with the same level of disruption as a conventional re-roof.

The technique is also an increasingly popular option for new builds, particularly low-pitch and skillion roof projects, and can make a significant contribution to designs aiming to create a healthier, more comfortable living environment.

Roof space moisture – it's complicated

As winter sets in and temperatures drop, there's an increasing risk that moisture will condense in the roof space and cause problems. The source of the moisture – and therefore the solution – isn't always obvious.

BY COLIN BARKUS, BUILD EDITOR, BRANZ

Condensation in the roof space of a house can cause a range of problems including mould, a reduction in the effectiveness of insulation and, in some cases, a reduction in the lifespan of the roof structure.

Look down, not just up

Roof space moisture can come from a number of sources. It's easy to assume that additional ventilation of the roof will solve the problem but this is not always the case. In some situations, ventilation can make the issue worse.

Houses should be thought of as a system and the conditions in the roof space are heavily influenced by the living space below. Activities like cooking, bathing and drying clothes inside introduce moisture to the air inside a house. As a result, the air inside typically carries more moisture than the air outside. This is made worse if the living space is not heated and ventilated effectively and can impact significantly on conditions in the roof space.

Ceiling penetrations like downlights, attic hatches or even poorly installed extractor fans can allow significant quantities of air to pass directly into the roof space. The trend towards more airtight construction means these penetrations are some of the most significant pathways for moisture to enter the roof space in newly constructed homes.

Mechanically ventilating the living area can help reduce the moisture in the air, reducing the risk for the roof space.

Roof moisture problems can be

Drying washing inside can lead to condensation problems in the roof space.

compounded if the house is exposed to little or no direct sunlight as conventional roof constructions rely on solar radiation to help dry them during the day. This means shady sites are more likely to have problems. In extreme cases, shady sites can result in additional moisture collecting in the roof space from the very air supply ventilating them.

Warm roofs make condensation unlikely

Most New Zealand homes are built with a cold roof. The roof structure, cladding and roof space (if there is one) lie outside the insulated envelope of the house, meaning they undergo large swings in temperature – increasing the risk that condensation will form at night. A warm roof (see page 63) incorporates the insulation layer on the outside of the roof structure, bringing the roof structure and roof space inside the insulated envelope of the house and making the temperature similar to that of the living spaces below – day and night.

BRANZ research has shown that installing a warm roof will make condensation problems in the roof space highly unlikely under normal living conditions.

Tackling the problem in cold roofs

In cold roof homes, steps can be taken to reduce the overall risk that moisture will pass upwards from living areas into the roof space.

- Reduce moisture levels inside the house. Install ducted extractor fans in wet areas and ask occupants to avoid drying clothes inside or using portable gas heaters. Encourage occupants to open windows, even if it is for just 10 minutes each day. The goal is to replace the indoor air with fresher (and typically drier) air from outside.
- BRANZ recommends that designers aim for an airtightness of <3ach@50 Pa in new-build construction, along with mechanical ventilation to help reduce the risk and improve indoor air quality.
- Ensure any extractor fans located in the ceiling are ducted so that they vent outside.
- If the ceilings are penetrated by older-style downlights, replace with new, tighter-sealed designs or ceiling-mounted lights.
- Replace air-leaky ceilings (such as older strip timber ceilings and acoustic tiles) with a more impenetrable material such as a stopped plasterboard. BRANZ recommends installing an air barrier behind tongue and groove ceilings.
- If the moisture is coming from a damp subfloor, take steps to make the subfloor space drier. Fix any leaking pipes, ensure there is sufficient subfloor ventilation and lay a polythene vapour barrier on the ground.

Roof ventilation

In some cases, roof space ventilation might still be necessary. Usually, a combination of risk factors are involved:

- The building design or specification means the roof space is likely to be airtight. This is more likely with trough profiles than with conventional corrugated profiles.
- The ceiling cannot be made into an effective air barrier because of the type of material used or the number of ceiling penetrations.
- Occupant behaviour makes indoor moisture levels particularly high.
- The house is located in a low-wind area, meaning less air is naturally exchanged.

Passive and mechanical roof space ventilation options are available. Note that it is very important to avoid depressurising the ceiling diaphragm and thereby pulling more moist air into the roof. So more inlets need to be installed at the eaves than outlets at the ridge.

However, BRANZ recommends that all efforts to address the movement of moist air from the living areas into the roof space are explored first, before considering roof space ventilation options.

FOR MORE See BRANZ Bulletin BU630 *Roof space ventilation* www.branz.co.nz/pubs/bulletins/bu630, *Too much moisture in the roof* in Build 166 www.buildmagazine.org.nz/articles/show/too-much-moisture-in-the-roof and *Passive roof ventilation* in *Build* 152 www.buildmagazine.org.nz/articles/show/passive-roof-ventilation

By Kaveh Andisheh, General Manager Structural Systems, and Amir Shahmohammadi, Senior Structural Sustainability Engineer, HERA

Designing for reduced emissions and waste

BRANZ and HERA are developing a building design framework and guidelines to reduce carbon emissions and construction waste, calculate life cycle embodied carbon and enhance the circular economy. A pilot project will provide the evidence.

The construction sector is a significant emitter of greenhouse gases (GHGs). Globally, buildings are responsible for approximately 40% of carbon dioxide (CO_2) emissions. The construction sector in Aotearoa New Zealand accounts for 20% of the country's total GHG emissions.

Alongside many other countries, the New Zealand Government has committed to cutting CO_2 emissions in half by 2030 and achieving net-zero CO_2 emissions by 2050. To achieve these goals, innovative tools, technologies and frameworks that help the construction and building sector to reduce emissions must urgently be developed.

A HERA-BRANZ co-funded research project will help building designers incorporate steps for reducing CO_2 emissions – as well as construction waste – into their designs.

The project began with a review of existing low-carbon strategies and solutions to identify key strategies. The next step is developing a general design framework that can be used as a template for guidance specific to different materials, building typologies and structural systems and real-world case studies to demonstrate how the framework and guidelines work together (Figure 1).

The project team will pilot the application of the framework as a template for specific design guidance in a low-rise building project using steel and steel-hybrid systems, with learnings from the pilot helping to improve the framework.

The framework

The framework will highlight aspects of low-carbon building design with the greatest potential for reducing CO_2 emissions while promoting circularity in the construction sector.

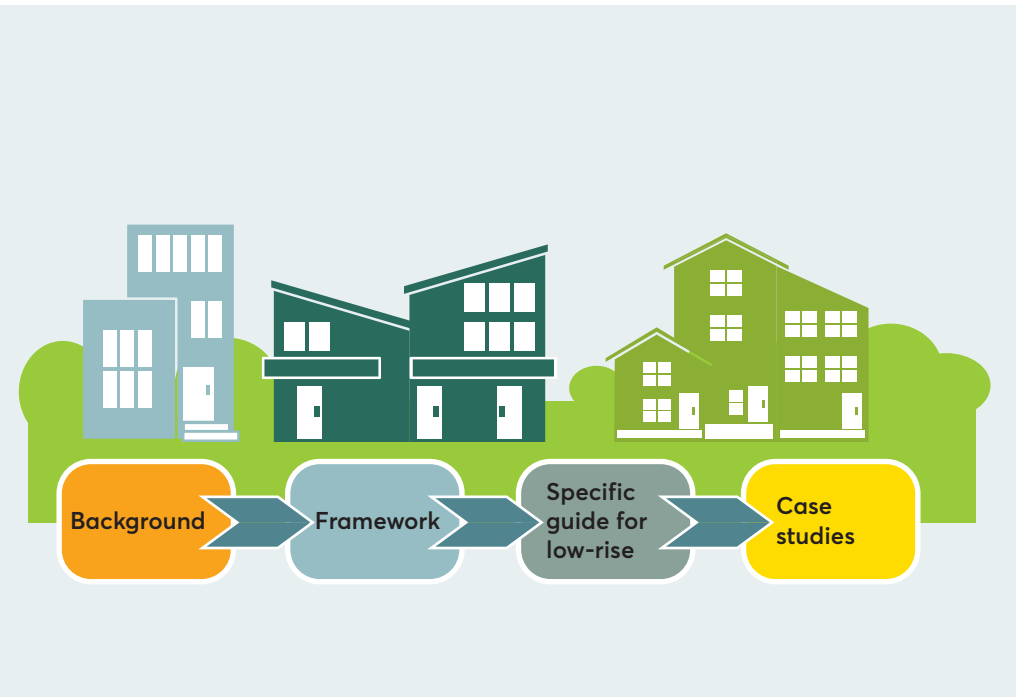


Figure 1: Research methodology.

The framework will be based on a hierarchy of strategies from established international models and identify circular and low-carbon building design approaches with the most impact that should be considered early in the design process. Each strategy will be described using implementation steps to reach actionable solutions.

The framework will also identify the life cycle assessment (LCA) modules of each solution, enhancing understanding of LCA and emissions over time.

Figure 2: Low-rise building case study.

LCA

This research project adheres to ISO 14044 and EN 15978 guidelines for conducting carbon LCAs. ISO 14040 outlines four phases of an LCA study, while EN 15978 specifies the system boundary, functional unit and calculation rules.

The LCA evaluates the environmental impact of the building from cradle to cradle over 50 years, with the gross floor area as the functional unit. The life cycle inventory analysis phase compiles input/output data on the material composition of the building to determine the embodied carbon of each material. Only structural materials used in the superstructure and substructure are considered.

Specific guidance for implementation

The design guidelines, tailored to specific materials, typologies and structural systems and incorporating technical information and design steps, will support the successful implementation of low-carbon design solutions into buildings.

While the framework may be globally applicable, the guidelines must align with local design standards and building codes. The compliance of any design solution developed using the standards, building codes and regulatory framework of another country must be verified in Aotearoa New Zealand.

3-storey case study

To showcase the practical effectiveness of the framework and guidance, a real-world case study is being used (see Figure 2).

The 3-storey Christchurch office building's lateral resistance systems incorporate reinforced concrete shear walls in one direction and moment-resisting steel frames in the perpendicular direction. Steel-concrete composite flooring systems are used throughout. The substructure of the building comprises a raft foundation.

Using the framework and specific design guides, several low-carbon strategies and solutions will be implemented in the building case study.

Preliminary results

Preliminary results indicate that available low-carbon design solutions for low-rise buildings in Aotearoa can help to significantly reduce carbon emissions – contributing to national emissions-reduction targets.

By Associate Professor Olga Filipova, University of Auckland Business School Department of Property, Dr Toni Collins, University of Canterbury Faculty of Law, and Professor Ken Elwood, University of Auckland Faculty of Civil and Environmental Engineering

Christchurch's gappy CBD

More than a decade after the earthquakes, central Christchurch is still peppered with vacant sites and derelict buildings, impacting reinvestment and successful regeneration. So what's the hold-up? Research shows that barrier sites are largely the problem.

In the aftermath of the earthquakes that devastated areas of Christchurch in 2010 and 2011, the city faced the monumental challenge of demolishing and rebuilding approximately 70% of the buildings in the central city.

Christchurch has gone a long way to achieving that mammoth task – evident in the city's numerous modern and resilient buildings.

However, well over a decade on, the CBD is still peppered with vacant sites and derelict buildings that are impacting on private investment and are considered barriers to successful regeneration.

A recent research project reviewed the factors contributing to the slow progress.

Council prioritised barrier sites

In 2016, Christchurch City Council began focusing its attention on sites and buildings where owners had made no effort to remediate damage. The Council initially prioritised 31 properties considered barriers to positive perceptions of the post-quake city, adding a further 15 sites by 2018.

Public awareness and the Council's case management approach of offering willing owners technical support and financial incentives helped achieve action on most of the sites.

While the decision to redevelop privately owned barrier sites rests mostly on individual property owners, the speed of progress on these sites is determined by the specifics of the local environment, including market conditions and the Council's powers to enforce action.

Three factors are contributing to the delays in the regeneration of the central city's barrier sites:

So-called barrier sites are hindering the regeneration of Christchurch's CBD.

- Specific legislation that addresses the issue of barrier sites is absent and therefore the Council must look to a range of legislation for enforcement powers.
- Delays in the delivery of the city's anchor projects – often cited as an impediment to private investment.
- A weak local economy before the earthquakes and strong post-earthquake competition from suburbs offering affordable, modern residential and commercial buildings.

Limited legal power

The Council is limited in its legal powers to deal with barrier sites.

The Building Act does not address the problem adequately. In the Act, only an occupied building can fit the definition of a dangerous building. If a building is unoccupied, which is the case with barrier sites, it must pose a danger to neighbouring properties before the Council can enforce demolition or remedial work.

If there is no immediate danger, the Council is left to work with the owner. In the absence of cooperation, the Council's only means of action is a court order. Furthermore, not all abandoned buildings meet the definition of dangerous, which means the Council cannot act.

Another option is to deem a building insanitary under the Act. If the building is offensive due to disrepair, the Council may be able to act. However, legal testing of this provision for vacant buildings is likely to be expensive. Meanwhile, if the building falls within the definition of an earthquake-prone building, the Council can work with the owner to remediate or demolish the building.

The extensive powers in emergency legislation seem to provide a solution for dealing with Christchurch's barrier sites.

Not all abandoned buildings meet the definition of dangerous, which means the Council cannot act.

However, this opportunity is lost because the emergency period lapsed before the Council initiated the programme. Now the problem does not fit squarely within the parameters of ordinary legislation.

The review also demonstrated that institutional powers alone do not force action on barrier sites. Development projects require the right set of market conditions to test their feasibility.

Construction fled to the periphery

The central city is struggling to compete against the attraction of more affordable suburbs. Moreover, abandoned sites and empty land deter some prospective homebuyers.

Unfortunately, valuable opportunities to rebuild commercial properties in the CBD were also missed early on while the cordon was in place around the city centre. In hindsight, the Crown should have exercised its powers under the Canterbury Earthquake Recovery Act 2011 to limit commercial construction activity outside the CBD.

Unconstrained, developers on the periphery of the CBD and in nearby suburbs quickly met the newly created demand from prime tenants such as financial services and law firms who had been displaced from the central city. This has set back demand for CBD premises by at least 5–10 years – a full lease cycle.

Delay of anchor projects affected investment

The critical stimulus for the recovery was the delivery of 12 anchor projects. Over the years, some projects have been scaled back – for example, the South Frame project – while some have been considerably delayed – for example, the Canterbury multi-use arena.

Lack of planning and ambitious agglomeration of land in the CBD has put brakes on the rebuild, which has limited the city's attractiveness to private investment in residential and commercial construction.

Demand for resilient buildings

Despite delays in recovery, the Christchurch experience is driving demand for resilient buildings. As businesses prioritise continuity, there is strong uptake of low-damage seismic design and structural systems that limit disturbance to operations.

The forced modernisation of most commercial buildings in the Christchurch CBD means it now outperforms Auckland and Wellington in the ratio of high-quality accommodation it boasts. Repairable buildings minimise economic and social disruption, help to retain character and a sense of place and reduce the recovery time and scale of demolition and reconstruction needed, reducing the likelihood of similar battles against barrier sites in the future.

By Colin Barkus, *Build* Editor, BRANZ

ROBUST progress

Just-completed research has proven that friction connections can help protect a building and its occupants and contents from harm during a major earthquake. Now there's more to learn.

In *Build* 201, we reported on collaborative international research (dubbed ROBUST) under way at state-of-the-art facilities in China to test the seismic performance of sliding or friction connections in a building.

Friction connections incorporate scope for movement into the joints between components of the structure that resist lateral load, such as beams and columns, diverting energy away from them during an earthquake. In conventional building designs, some of these components bear the brunt of seismic energy and can yield and deform, placing building occupants at risk and making repairs complex and costly.

The final phases of ROBUST, completed in March, saw a range of friction connection devices put to the test in the last of nine frame configurations. Non-skeletal elements (NSEs) were added to the frame, including external cladding (precast concrete panels and glazed curtain walls), internal partition walls with access panels, ceilings (perimeter-fixed, braced and floating), sprinkler piping and contents such as tables, chairs, shelves and books.

Shaken but barely stirred

The final shake in the testing sequence delivered a peak ground acceleration of a whopping 0.88 g in both directions simultaneously. For comparison, the maximum ground acceleration recorded in central Christchurch in February 2011 was 0.55 g.

The structure performed very well. Initial inspection of the NSEs revealed some minor movement of one precast concrete panel – easily fixed – some separation of a braced ceiling support from the ceiling grid but no ceiling collapse and the opening of some access panels that were not locked and could easily be shut. Unanchored building contents such as books were thrown across the room but easily restored.

Precast concrete panels and glazed curtain walls were added to the structure for the final phases of seismic testing and performed very well.

Checking results.

'Really, apart from the contents, people looking at the tested structure might not realise that the building had been through an earthquake,' says Greg MacRae, a seismic engineer from the University of Canterbury and research lead for the project. 'It's clear that the overall building system performance was excellent.'

Ensuring consistency

MacRae says the priority now is to ensure that performance is equally and consistently high outside of a controlled testing environment.

'We've proven conclusively in the lab that friction connections can deliver the desired performance, but the industry needs certainty before it can confidently adopt these systems,' he says.

'What happens, for example, if there's a difference in the way components are bolted together or they're left exposed to the weather on a building site or there's a fire? We need to ensure there are no surprises in the way they perform.'

Work is well under way on developing proprietary friction joint packages – pretested components and fittings that will ensure systems are installed consistently every time. The University of Auckland is leading this effort.

Deepening understanding

Auckland University of Technology is leading an effort with Auckland and Canterbury Universities to understand and ensure the reliability of non-proprietary connections not only in an earthquake but also when affected by fire or corrosion.

Additional research at the University of Canterbury is investigating how external cladding such as precast concrete panels affect the frequency at which a building vibrates during an earthquake, how this affects the building demands and how these cladding elements can remain undamaged.

'While the large-scale experimental testing has been completed, teams of people in China and New Zealand continue to analyse the data and conduct smaller tests to further understand behaviour,' MacRae says.

Of interest is the uplift of the rocking frames with ratcheting 'grip 'n' grab' dissipation devices that varied by a factor of 10 at opposite sides of the structure – indicating the complex three-dimensional nature of movement.

'Ultimately, this deeper understanding will enable engineers to economically and reliably design buildings that can still be used safely after a number of large shaking events.'

Preparing for the next shake test.

By Clare Botha, Principal Advisor, Building System Delivery, MBIE

Repairing flood-damaged buildings

What you need to know when repairing flood-damaged buildings and carrying out work under the Schedule 1 exemptions of the Building Act.

The severe weather events that hit many regions across Aotearoa New Zealand in 2023 resulted in damage to thousands of buildings. Remediation and recovery work continues.

Before you start

Before you start repair or remediation work on buildings affected by flooding, you should:

- ensure the building is safe to enter
- take photos before and during the work
- take appropriate health and safety precautions, including wearing safety gear, and ensure power and gas are turned off
- ensure that the sewerage system has been checked and presents no risk to health – floodwater may be contaminated by silt and sewage that is deposited as water recedes
- check your local council's website for any current guidance for repair work, if any.

MBIE has produced guidance to assist:

- Removing silt deposited during flooding – www.building.govt.nz/assets/Uploads/managing-buildings/removal-of-silt-deposits-through-flooding-quick-guide.pdf.
- Slope stability – www.building.govt.nz/assets/Uploads/managing-buildings/slope-stability-quick-guide.pdf.

Starting the work

Once you know what work is needed, you should check if it needs a building consent. See CanIBuildIt.govt.nz.

If a building consent is required, your client must obtain this before you start the work. If the work needs to be done urgently to save or protect people's lives or health or to remove the risk of serious damage to property, you should contact your local council. They will be able to advise if you can proceed with the work and apply for a certificate of acceptance after the immediate danger has been removed or reduced.

All work must comply with the Building Code to the extent required by the Building Act, even if a building consent is not required.

Schedule 1 exemptions under the Building Act

The list of building work that does not require a building consent is provided under Schedule 1 of the Building Act and includes specific conditions to manage risk.

When you start repair work, you may find that the extent of the damage is larger than you originally thought. If a building consent may be required, you should contact the property owner and local council to discuss.

Some of the exemptions that may apply to remediating flood-damaged buildings are:

Territorial and regional authority discretionary exemptions

This exemption allows local councils to use their discretion to exempt any proposed building work from the requirement to obtain a building consent if it complies with the Building Code and is unlikely to endanger people or buildings, whether on the same land or another property.

General repair, maintenance and replacement

This exemption allows building owners to maintain their buildings (including carrying out any repairs or replacement) without having to get a building consent.

The following can be repaired, maintained and replaced if a comparable building product or assembly are used and, in the case of a replacement, it is in the same position:

- Building products.
- Assemblies incorporated in or associated with a building.

This clause cannot be used if a complete or substantial replacement of a specified system is required or the product contributes to the building's structural behaviour or fire safety properties.

Internal walls and doorways in an existing building

Building work in connection with an internal wall (including an internal doorway) in any existing building doesn't usually need a building consent unless the wall is:

- loadbearing
- a bracing element
- a fire separation wall – also known as a firewall
- part of a specified system
- made of brick, stone, concrete or similar joined with mortar.

Repair and replacement of plasterboard due to flooding

When a flooding emergency happens and walls have been damaged, it is likely that the plasterboard will need to be partially or completely replaced.

It can be difficult to identify the type or purpose of plasterboard without expert knowledge or information. The building consent plans will usually show where the different types of plasterboard are located, and these plans, if available, can be obtained from your local council.

To help identify the type of plasterboard, you can take photos of the fixings and any information on the back of the plasterboard if you remove it, or you may be able to find out the use and purpose based on its location.

If you're unsure, it's safer to treat all plasterboard as if it is a bracing element and take appropriate measures to repair it.

Before starting repairs, it is important that any cavity spaces such as between cladding and building wrap where silt and other contaminants may have collected have been cleared out and that all timber framing is dry and in good condition.

Consider the safety risks to yourself and others. Make sure you and anyone working on your behalf have the correct equipment and resources.

What information do you need to provide?

You may need to provide a record confirming what work has been completed. The information could consist of a written or drawn record of the repair, a producer statement for construction work (PS3), certificates from any specialist trades such as an electrical certificate of compliance or a record of work for any restricted building work completed.

This information should be provided to the property owner, and if the work is done under a building consent, the record of work must also be provided to the local council.

FOR MORE See the building.govt.nz website and search 'remediation, repair and urgent works', 'building consent exemptions for damaged buildings', 'building work that does not require a building consent' and 'flood damaged buildings'.

Quiz

1. **What must you do before beginning any repairs or remediation to a flood-damaged house?**
   a. Ensure the building is safe to enter.
   b. Take photos before and during the work.
   c. Take appropriate health and safety precautions, including wearing safety gear and ensuring power and gas are turned off.
   d. Check your local council's website for any current guidance for repair work.

2. **If you can't identify which walls require bracing when you're replacing the plasterboard:**
   a. It's safer to treat all plasterboard as if it is a bracing element.
   b. Just brace some of the walls.
   c. Don't worry about bracing, the house is still standing.
   d. Wait for the building inspector to tell you.

3. **How can silt damage buildings?**
   a. Silt can block subfloor vents that help to keep the subfloor dry.
   b. Silt can trap moisture in framing such as piles, bearers or joists. This can lead to rot or damage.
   c. Silt and water loading can dislodge walls and floors.
   d. Silt build-up can prevent water draining away from the building and lead to ponding against building elements, which can cause damage.
   e. All the above.

Answers: 1. e, 2. a, 3. e.

By Small Business Services, MBIE

The business of being a tradie

Starting your own business can be daunting, and we often learn on the job. You're confident on the tools and know you can do a great job on site, but ensuring your business practices are up to scratch is just as important for success.

To help you run the admin side of business as well as you run your tools, the business.govt.nz website features a series of helpful videos and resource templates. Click the 'Tips for tradies' link on the homepage.

Here's a summary of the information you'll find.

How to price a job

Getting your pricing right is key. Too high and you can scare clients away. Too low and you could be losing money on every job.

It's important to quote to potential clients as accurately as you can. There are different ways to set your prices – these three are the most popular:

- Cost-based pricing – where you work out all the costs involved in providing a service and add a bit extra to make a profit. It works best if your costs are low and your clients are focused on keeping the price low.
- Competitor-based pricing – where you look at what other businesses are charging for similar work and set your price around that. You may charge less to beat their price, match them or charge more and use a different benefit like better customer service or getting the work done quickest to win the job.
- Customer-based pricing – where you work within the available budget of your clients. Usually this works best if your clients have bigger budgets and value quality over a lower price.

It's also important you apply a mark-up to help meet your profit goals. Learn how to set your mark-up by watching the 'How to price a job' video in the series. There's also a handy workbook you can use to help calculate your mark-up.

How to prepare a quote

Once you know what you're charging, prepare a quote that gives you the best chance of landing the job, that is realistically priced and that covers your costs. One of the key principles of the Licensed Building Practitioner (LBP) Code of Ethics is to behave professionally – and that means pricing work fairly and reasonably.

Quotes are a great opportunity to build trust, put your best foot forward and show your client you understand their needs and will do the job well.

Business.govt.nz shows you how to create a strong construction proposal for your potential clients in the 'How to prepare a quote' video. There's also a free template to use that covers your legal requirements and contract must-haves.

Remember – it's a legal requirement to have a contract for all building work valued over $30,000 and best practice to have one even when it's less than that, and as an LBP, you're bound by the LBP Code of Ethics.

Variations to contracts

Sometimes when working on a job, the scope can change unexpectedly. You find yourself with more work than you initially planned for. This is where variations to contracts can help.

Variations can be any proposed change to the original job, but common variations include:

- changes to the terms agreed such as timeframes and when payments are due
- changes to the level of quality and finish for the agreed project price
- changes to the size or complexity of the job or the products to be used
- unforeseen circumstances that lead to additional work or delays.

Another key part of the LBP Code of Ethics applies here

– take responsibility for your actions. This means informing and educating your client – advising them of delays as they become apparent and always acting in their best interest.

Variations in contracts must:

- clearly state the specific terms of the contract that are being changed and what the new terms will be
- consider any changes required to other parts of the contract as a result – this may include changing the amount charged if more work is required
- be specific on when the variation will come into effect
- confirm that nothing else in the contract is being amended other than your proposed changes.

Watch a video under the 'Variations to contracts' link on business.govt.nz.

Understand your cash flow

Good cash flow management helps you to stay on top of your business finances and handle unexpected situations like natural disasters or a sudden change in the market.

Managing your cash flow means setting time aside regularly to record all your income and expenses and comparing months, quarters or years to see how much money came in, when it came in and what it was spent on.

You can also create a cash flow forecast – a future view of your business earnings and expenses – to help you budget.

A good cash flow forecast should show:

- your current cash in the bank
- expected cash income from sales or loans and assets
- expected cash flow, which is a fancy way of showing the highs and dips of your cash reserves over time
- your closing balance.

Business.govt.nz has a cash flow forecaster tool that can help visualise all your incomings and outgoings along with a video on understanding your cash flow.

Preparing an invoice and when you don't get paid on time

Invoicing can be a struggle for many small businesses. This can lead to not being paid on time and not having enough cash for really important things like paying yourself and your employees. Be up front from the beginning so there are no surprises when it comes to invoice time. For bigger jobs, you may want a phased approach where invoices are split across the work. Don't be afraid to talk to your customer about a payment plan that works for you both – before the job starts.

Watch the video 'How to prepare an invoice' and use the free business.govt.nz invoice template to make sure all the essential details are given to the client in a way that's easy to follow, understand and, most importantly, action.

If you've done everything right and your customer still hasn't paid, you might need to make a valid payment claim. This must be in writing and include details about the work you've done, how much is owed and a due date.

Quiz

1. **When using competitor-based pricing, what strategies could improve your chances of getting the job?**
   a. Charge less than your competitor.
   b. Charge the same as your competitor.
   c. Charge more but add benefits such as better customer service or an earlier completion date than your competitors.
   d. All the above.

2. **When is the right time to talk to your clients about a payment plan?**
   a. When you give them your first invoice.
   b. After you have made a valid payment claim.
   c. Before the job starts.
   d. After the project is finished.

3. **What would be a reason to make a variation to a contract?**
   a. Changes to the terms agreed such as timeframes and when payments are due.
   b. Changes to the level of quality and finish for the agreed project price.
   c. Changes to the size or complexity of the job or the products to be used.
   d. Unforeseen circumstances that lead to additional work or delays.
   e. All the above.

4. **Can elective skills maintenance points be claimed for watching all five of these 'Tips for tradies' videos?**
   a. Yes, but you need to collect evidence that you have seen them in case you are audited – for instance, 'What's the best thing I learned from each of them?'

Answers: 1. d, 2. c, 3. e, 4. a.

By Brendan Cash, Partner, and Miles Rout, Law Graduate, Dentons New Zealand

Healthy homes standards for rentals

This article summarises the key requirements that rental properties will need to comply with from 1 July 2025 following the introduction of the healthy homes standards in 2019.

On 1 July 2019, the Residential Tenancies (Healthy Homes Standards) Regulations 2019 came into force to improve the quality of rental homes throughout Aotearoa New Zealand. The regulations introduced specific minimum requirements rental homes must comply with.

The standards have been the subject of some publicity. In many cases, compliance is required earlier, but all residential tenancy properties will need to meet the standards by 1 July 2025. This is important for current landlords and for property developers, contractors and other industry players involved in buying or developing properties for rent.

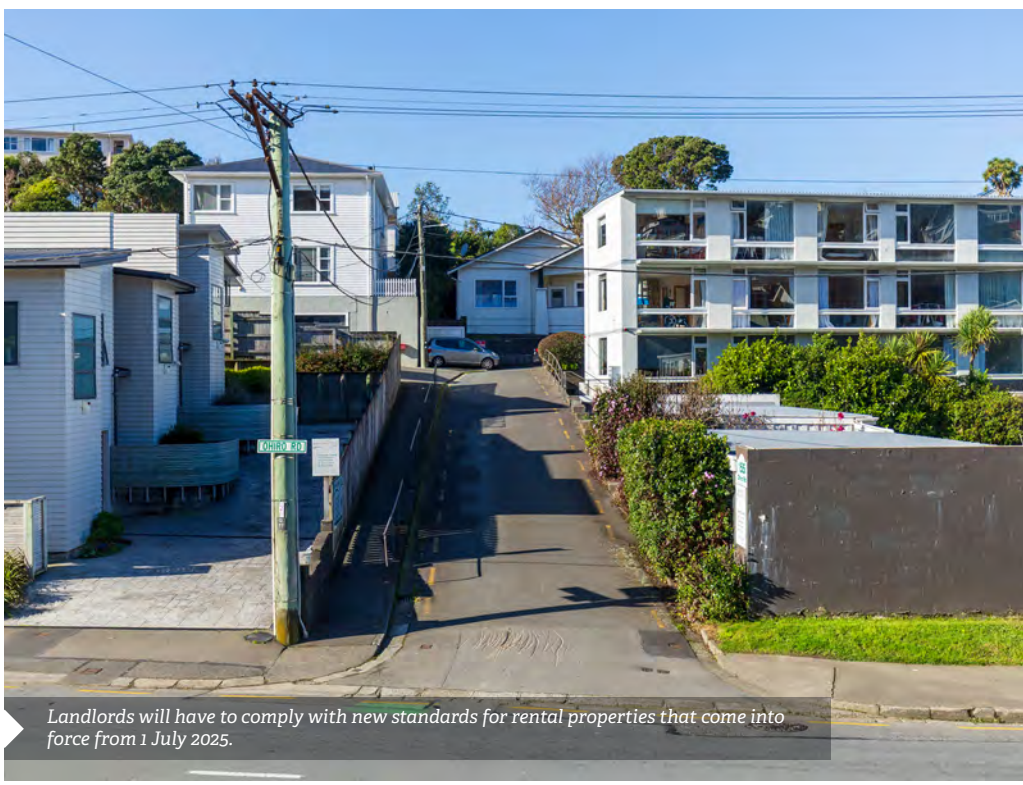
Overview of the standards

The standards require rental homes to have adequate heating, insulation, ventilation, draught stopping, moisture barriers and drainage. The requirements vary slightly between climate zones, which are defined geographically in NZS 4218:2009 *Thermal insulation – Housing and small buildings.*

Landlords also must give tenants information about their compliance with the standards or why they have not. Where exemptions apply, landlords must advise exemptions in place and why.

The standards apply from the start of any new or renewed tenancy. Many existing landlords will have had to ensure compliance when renewing or entering new tenancies since July 2021.

All boarding houses – shared accommodation or rented rooms – must have been compliant since 1 July 2021. Kāinga Ora houses or community housing providers must comply by 1 July 2024.



Landlords will have to comply with new standards for rental properties that come into force from 1 July 2025.

Properties purchased or developed as rentals between now and 3 March 2025 will need to comply within 120 days of the tenancy starting, and all properties must comply by 1 July 2025. A failure to comply may result in exemplary damages through the Tenancy Tribunal.

The standards are organised into five areas – heating, insulation, ventilation, moisture ingress and drainage and draught stopping.

Heating

The main living room of the rental property must be heated. This means that it needs qualifying fixed heating that provides at least a minimum heating capacity calculated using the dimensions of the room and its walls and insulation. Open fires and unflued combustion heaters are unacceptable. If the room requires a calculated heating capacity of over 2.4 kW, fixed heat pumps are the only acceptable form of electrical heating.

Heating must be sufficient to lift the main living room temperature to at least 18˚C within 2 hours and maintain that temperature.

If it is not reasonably practicable to install qualifying heaters, the main living room does not need to comply with the heating standard. In addition, certified passive buildings are exempt.

Another way of complying with the standard is to have the heating assessed by a suitably qualified specialist.

Insulation

Rental properties must have both ceiling and underfloor insulation in a reasonable condition. This has been a requirement since 2019. Ceiling insulation needs to be at least 120 mm thick and must have an R-value of at least R2.9 (for climate zones 1 and 2) or R3.3 (for climate zone 3).

Underfloor insulation needs an R-value of at least R1.3. However, insulation that was sufficient in the past may be partially exempted even if it does not meet the latest standard. An exemption also applies where it is not reasonably practicable to install insulation.

Ventilation

Habitable spaces must each have at least one door or window to the outside. These openings must be able to be fixed open and cover a total area of at least 5% of the floor area of the room. However, this standard does not apply to rooms that were lawfully built without qualifying windows or doors.

Kitchens and bathrooms need to have mechanical ventilation to the outdoors such as extractor fans. Minimum fan and exhaust ducting sizes and capacities apply. Exemptions apply where it is not reasonably practicable to install mechanical ventilation and if the room did not have mechanical ventilation at the start of the tenancy.

Moisture ingress and drainage

Buildings are required to have efficient drainage for the removal of stormwater, surfacewater and groundwater. This must include gutters, downpipes and drains for removing water from the roof. Enclosed subfloors must have ground moisture barriers that comply with NZS 4246:2016 *Energy efficiency – Installing bulk thermal insulation in residential buildings*. Again, there is an exemption where it is not reasonably practicable to install a ground moisture barrier.

Draught stopping

Open fireplaces must be blocked unless the tenant requests that the fireplace be available and the landlord agrees. In addition, premises must be free from unreasonable gaps and holes that allow draughts.

Exemptions from the standards

Landlords must ensure that their rental properties meet these standards unless they qualify for either a general exemption or an exemption from a particular standard. These are the general exemptions:

- If the property is intended to be demolished or substantially rebuilt and the landlord has applied for or received the relevant building/resource consent before the start of the tenancy.
- Where the tenant is the immediate former owner of the property and the tenancy started immediately after the landlord acquired the property from that tenant.
- Partially, where the property is part of a building not owned entirely by the landlord such as an apartment and the landlord is unable to comply because they need to access part of a building or need to install or provide something in that building where they are not the sole owner.

If one of these exemptions no longer applies during the term of the tenancy, the landlord is still obliged to comply with the standards as soon as reasonably practicable.

It is important to be aware of these standards and what needs to be complied with or which exemptions you might qualify for, particularly if you are intending to buy or develop a property to rent.

NOTE This article is not intended as legal advice. For specific advice, contact your legal advisor.

By Steve Alexander, Building Dispute Resolution, ACL Building Science

Builders beware of non-delegable duty

A recent High Court judgment brought a clear and current focus onto non-delegable duties owed by builders. This issue is often misunderstood but is of critical importance as builders need to be aware of their potential liability in the daily conduct of their work.

A judgment by Justice Andrew involved a dispute over an apartment building in central Auckland. The building had 179 balconies cantilevered out from the exterior walls.

Rainwater caught by the balconies was directed by a slope back towards the building to a gutter cast into the concrete adjacent to the exterior wall. As some of the precast concrete balconies were too long to be craned into position in one piece, they included a join. All had a downpipe connection at one end of the gutter. A waterproofing membrane was bonded to the balcony, and acoustic matting and tiles were placed over that.

What went wrong?

The joints in some of the balconies were filled with grout and the downpipes were sealed to the concrete then a liquid membrane applied over the surface before acoustic matting and tiles were added. What could possibly go wrong?

Three things. Some of the joints were not fully filled with grout, leaving holes, some of the downpipes were not completely sealed to the concrete and the waterproofing was poorly applied with inadequate thickness, exposed reinforcing mesh and a few patches missed altogether.

Installing a waterproof membrane.

As the gutter and downpipes were immediately adjacent to the exterior wall, water that was able to get through some of the joints and downpipes could get into the outside wall. The building had a good rainscreen cavity to protect the outside wall, so damage was limited to corrosion of cavity battens and a few isolated areas of damage to the exterior wall.

Claim made against builder

A claim was made in the High Court against the builder, the council and others involving a long list of defects. The claim was for repair costs of $60 million plus damages and consequential costs of about $7 million – significantly more than the original construction cost of the building. While the defects list had been reduced to only two by the time of the trial, the damages claimed remained much the same.

The builder claimed they were not responsible for the defects causing damage or potential future damage because the waterproofing and tiling were carried out by a subcontractor and inspected by the architect.

The builder said they had no duty to inspect the work of the subcontractor because the builder believed them to be competent and a specialist in waterproofing. The builder believed they could not be held responsible for the negligence of an independent subcontractor.

The law on this has been settled for some time. The claim was brought in negligence. The plaintiffs must establish on balance of probabilities that:

- the defendants owe them a duty of care – they must be careful to comply with the Building Code and other standards and regulations
- the duty was breached – they did not comply with the Building Code or other standards and regulations
- the breach of duty caused damage
- damage resulted in a loss to the plaintiffs.

Court established non-delegable duties

In 1996, the Privy Council established that builders and local authorities owe a duty of care to current and future owners of a building. However, the key issue here was whether the builder owed a non-delegable duty – meaning that they could be liable not only for their own work but also for breaches by independent contractors that they hire.

Non-delegable duties were established by the Court of Appeal in 1979. Whether a builder owes a non-delegable duty is specific to the facts of each case. It depends on the builder's role and responsibilities on a particular project and whether the builder is the head contractor and in control of and supervising the work on site.

Builders' duties have been defined in various cases over the last 20 years. Consideration is given to the contract that established the scope of the builder's responsibility on the site, whether subcontractors were hired by and under the direct control of the builder as main contractor and the roles and responsibilities of other parties on the project.

For the establishment of a non-delegable duty, the builder must be in a position of significant control and have the capacity to influence the quality of the construction and compliance with the building consent and Building Code. The terms of the builder's contract with subcontractors will also be important.

Builder had responsibility

Here, the builder was found to have a non-delegable duty and was responsible for the acts and omissions of the subcontracted waterproofer/tiler. The subcontractor was also responsible for their own acts or omissions but was not a party to the litigation, possibly because they were out of business.

Fortunately for the builder, the judge found that the remedial scope of work proposed by the owner's experts was 'a wholly disproportionate and unreasonable response to the defects for which the defendants might properly be held responsible'. Justice Andrew accepted the alternative repair method of the builder's experts, resulting in a judgment of about $5 million – substantially less than the $60 million claimed. Auckland Council was found liable for a 15% contribution to the total judgment.

Waterproofing and tiling are risky

The message is clear for builders. You are responsible for the work of your subcontractors, and you should supervise and inspect their work. One of the highest risk trades in Aotearoa New Zealand is waterproofing. Inadequate waterproofing is a common defect in litigation over the last 25 years.

This builder was unfortunate because concrete balconies outside of the building are low-risk features that should not result in a significant problem. However, design decisions outside of the builder's control contributed to an unusual situation. There are many more common risks with waterproofing that can cause very expensive repair works. The defects on this building were atypical.

By Doran Wyatt, Partner, Russell McVeagh

Heightened risk forces changes to seismic standards

A better understanding of earthquake risk across the country is behind a new technical standard that will enable designers to demonstrate compliance with the Building Code with the use of an Alternative Solution.

A small tremor has been felt across Aotearoa New Zealand with the long-awaited release of a new draft seismic design standard. The draft, TS 1170.5, is a critical piece in the puzzle of how Aotearoa responds to the latest science on earthquake risk and represents a major change in seismic building standards.

It is intended to apply to the design of most buildings, including offices, other commercial buildings, apartments and social infrastructure, and has significant implications for both new builds and investors and occupiers across the existing market.

Why the change?

The update to design standards follows the release of an updated National Seismic Hazard Model (NSHM) in October 2022, which confirmed that the impacts of future earthquakes are potentially greater than previously expected.

Assessed hazard more than doubled in some areas and increased on average by 50% from earlier modelling. The increases were significant in key centres – 1 to 3 times in Auckland, 1 to 2+ times in Wellington and 1 to 2.5+ times in Christchurch.

New modelling shows Wellington is likely to suffer stronger earthquakes than previously thought.

What is the response?

With the updated NSHM confirming a significant increase in understood risk, MBIE convened a specialist technical committee to consider changes to seismic design standards. TS 1170.5 significantly increases seismic design requirements – anecdotally moving standards much closer to those in other areas of high seismicity such as parts of Japan and western United States.

Key changes include increased design seismic loads for many areas, adjustment to the way in which ground conditions are allowed for and specific requirements for considering geotechnical matters in the design of a building.

For now, TS 1170.5 has been a technical specification – a draft standard that closed for consultation on 3 April 2024. From here, it is likely to be published by Standards New Zealand and made available as an Alternative Solution to demonstrate compliance with the Building Code.

After this period of road testing, lasting 3 years, it is likely to become a cited standard in the Building Code with compliance with the new standard or an equivalent level of design essentially becoming mandatory after the existing standard is phased out.

What are the implications?

While TS 1170.5 aims to improve the safety and resilience of Aotearoa's building stock, it comes with trade-offs. Cost implications will vary across different areas, but early estimates are that the new standard could increase building costs by 5–7%, further weighing on development viability.

While the standard will apply only to new building design, of key interest will be the market's response towards existing buildings designed under current or earlier standards. A building's NBS or earthquake rating relative to current design standards is already a key consideration for most occupiers and owners.

Existing buildings will rate lower if benchmarked against a new, higher standard, and it remains to be seen how significant the ratings change will be for existing buildings if measured against TS 1170.5.

TS 1170.5 is unlikely to have an immediate effect on decisions to occupy most buildings or their value, but effects may be initially felt for assets on the cusp of market-accepted occupancy standards.

Health and safety considerations will also come into sharper focus, and when TS 1170.5 becomes a cited standard, commercial leases will be tested where these allow tenants to exit or require strengthening works as NBS or building standards change.

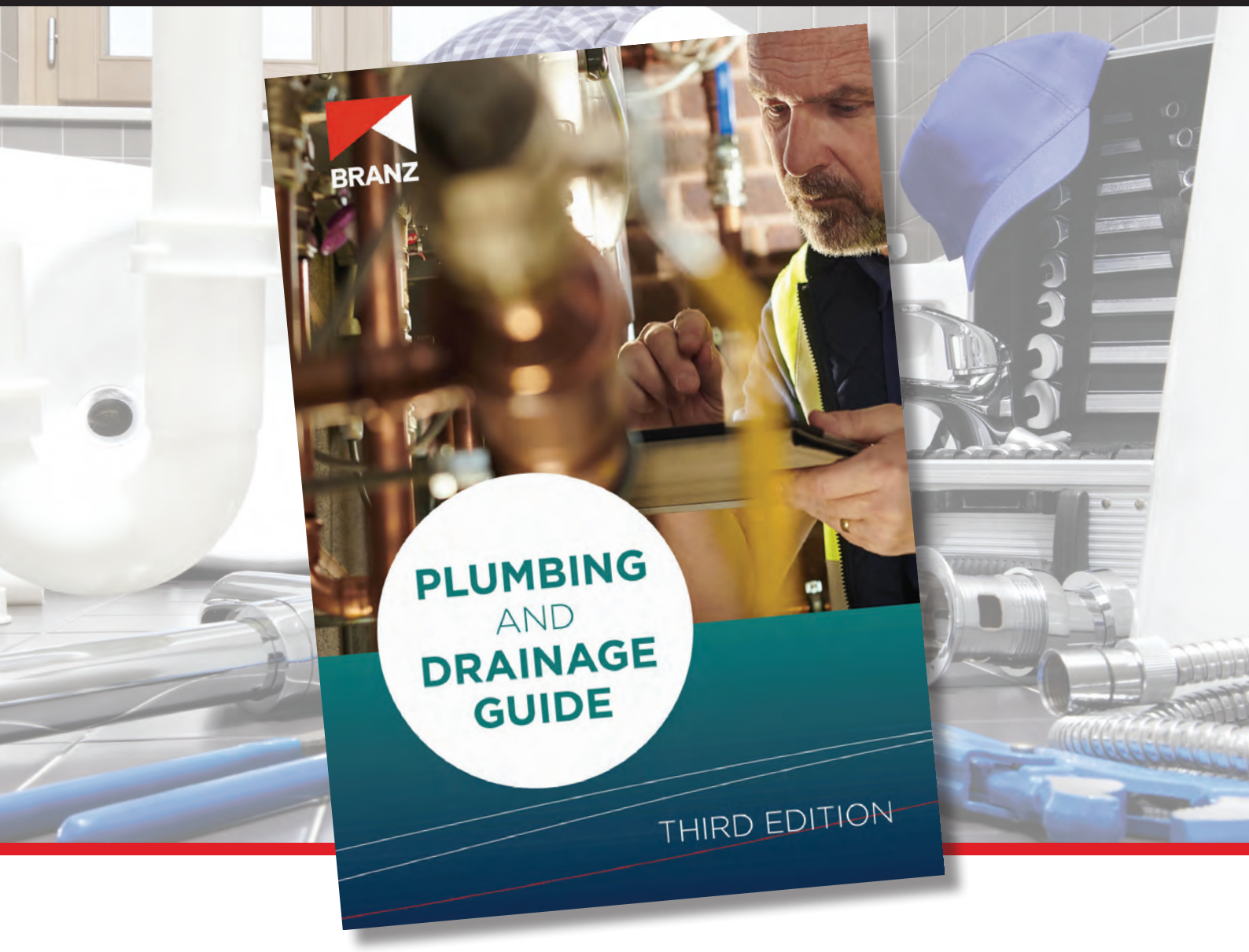
In the short term, compliance with TS 1170.5 is not required. However, given the likelihood that it will essentially become mandatory, it would be sensible to take TS 1170.5 into account now in the design of new buildings. A failure to do so could well mean a new building that underperforms relative to the design standards in force once it is completed.

In the mid to longer term, higher seismic standards will also mean a continuation of occupier flight to quality and will support existing premiums for assets with higher seismic ratings. The same drivers should also see voluntary building strengthening continue where there is capacity in the asset, supported by returns.

What about earthquake-prone buildings?

It is useful that MBIE has confirmed there are no plans to change the basis for the assessment of earthquake-prone buildings requiring remedial work. This will remain fixed at 33% of the current building design standard.

MBIE has also been clear that it would like to see general seismic assessments of existing buildings remain benchmarked against current design standards. However, there is no legal requirement for this, and at least some occupiers will want to know how their buildings rate against design standards that reflect the latest and best science.



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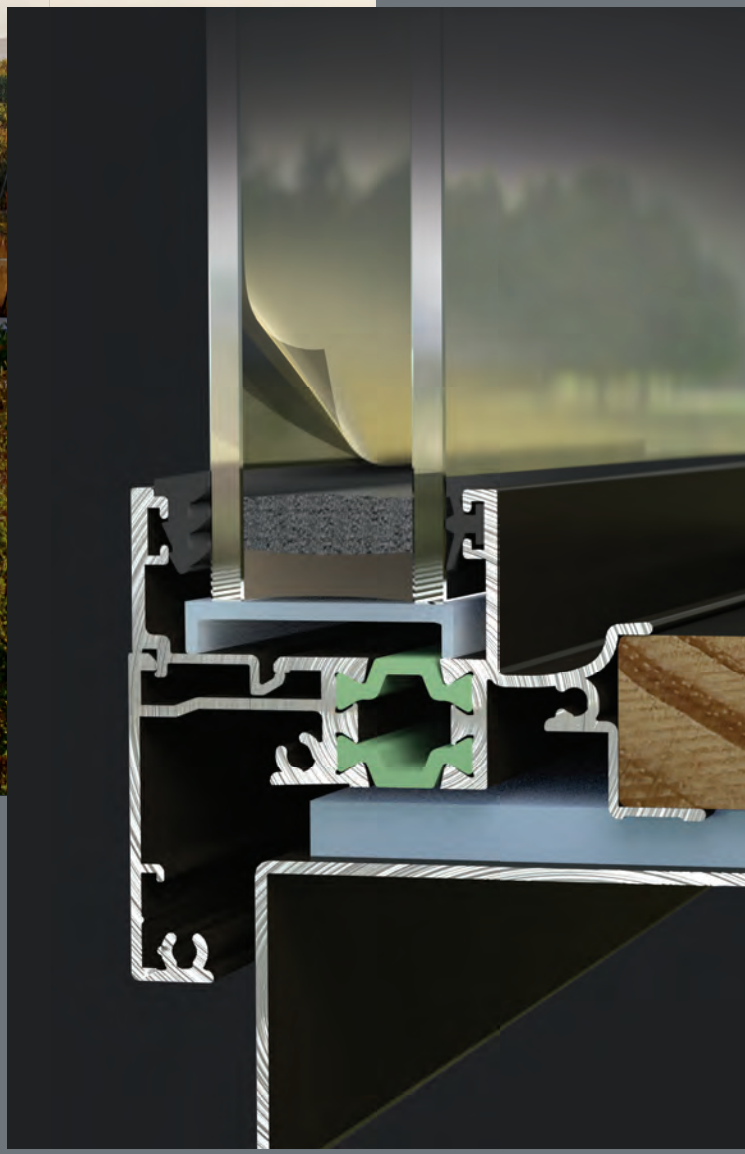

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By Vector Limited

Safe digging

Whether it's for electricity, gas or communications, if you inadvertently dig up a cable, swift action must be taken.

Electricity and fibre cables and gas pipes are usually lying underneath building sites, so it's essential to know what's below before digging or excavating.

Gas pipes

Every year at Vector, we see a significant number of gas leaks caused by builders and construction workers hitting our gas pipes. Not only are gas leaks potentially dangerous, they're also bad for the environment.

If you hit a gas pipe, there is a risk of:

- gas igniting, causing serious harm to life and property
- gas accumulating in adjacent buildings with the potential to explode
- the force of escaping gas causing serious personal injury.

In addition to these dangers, gas leaks are an environmental hazard. For example, third-party damage to gas pipelines is now the largest source of Vector's direct carbon emissions, causing 4,000 tonnes of CO_2 last financial year. That's 20% of the entire Vector group's direct (Scope 1) greenhouse gas emissions.

Electricity and fibre cables

Dangers from striking an electricity cable include electric shock or fire damage, while laser light from a fibre cable can damage your eyesight.

Find out what's below

The most accurate way to tell what's lying below a property is to get the plans. BeforeUDig.co.nz is a centralised service that's essential for builders. This organisation works with multiple infrastructure providers – gas, electricity, fibre and water – to collate all the relevant information for property owners, builders and ▸▸

Find out what lies below a property by consulting the plans before you dig.

developers in one place. Register on the website and request the underground plans for your worksite or call them on 0800 248 344.

You will need to request plans at least 2 business days in advance. However, avoid doing this too far in advance because, generally, reference maps are valid for only 28 days from the date of issue. This will depend on who owns the underground asset.

Once you have the plans

Under the Health and Safety at Work Act 2015, it is your responsibility to establish the location of underground services before starting excavation. If the plans show electricity, gas or communications cables or pipes, you must locate them before you begin work.

Be aware that, although each asset owner provides the most up-to-date map of their underground assets, they cannot always guarantee their accuracy. Road alignment, reconstruction, alterations to ground cover and property boundaries can all affect accuracy.

Consult the maps to work out if you are excavating:

- within 5 m of a power pole or within 12 m of a tower or pylon
- within 2 m of strategic gas mains.

Any work falling into these categories will require a close approach consent. Allow 2 working days to obtain this and up to 20 days for any necessary disconnections.

Additionally, if any strategic cables or pipes are shown on the maps you requested, the BeforeUDig email will notify you to get in contact with the asset owner – for example, Vector – to organise a standover or a close approach consent if required.

If you do not need a standover or a close approach consent, you must still follow the WorkSafe excavation safety guideline and carefully pothole using WorkSafe-approved techniques to expose cables and pipes.

You must hand dig to confirm the location of cables and pipes within your worksite. It is not recommended to rely on finding buried marker tape when you dig as this may not be present if the cable or pipeline was installed by a directional drill or thrusting.

Damage control – electricity

If you hit an underground electric cable:

- Treat the cable as live – jump well clear and get back at least 10 m.
- Evacuate the immediate area.
- If you are in a machine, stay there.
- If you are at serious risk from another hazard such as fire and must leave the machine, jump well clear. Do not touch metal surfaces or the machine and ground at the same time.
- Leave damaged cables exposed for the electricity company to fix.
- Call emergency services on 111.
- In the event of an electric shock, don't touch the victim until you are certain the electricity source has been removed. Call 111.

Damage control – gas

If you hit a gas pipe:

- Switch off all machinery and remove all sources of ignition, including mobile phones and cameras.
- Do not smoke.
- Move at least 20 m away and call the fire service on 111.
- Evacuate the immediate area.
- Leave the damaged pipe to vent, keeping it open and free from any materials or equipment.
- Turn all vehicles off and leave them where they are.
- Leave any ignited gas fires to burn.
- Do not inhale fumes. Move away if you are near them.
- Call the gas company immediately.

Damage control – communications (fibre)

If you hit a communications cable:

- Do not look directly at the cable as laser light may damage eyesight.
- Leave damaged cable exposed for the fibre company to fix.
- Call the fibre company immediately.

See something, say something

Spotted a damaged gas pipe? Help keep pipelines safe by reporting any exposed or damaged pipelines. Some networks have thin plastic coatings over steel pipelines that are easily damaged. It is critical that even minor damage is reported as it can lead to leaks through corrosion over time.

Resources

Download the gas pipeline safety guide – https://blob-static.vector.co.nz/blob/vector/media/documents/vector_gas_safety_guidelines_booklet_a5_rgb.pdf.

NOTE This is general guidance only and is not intended to address specific circumstances. This information is not professional or legal advice. Specific advice should be sought from qualified professionals.

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BUILDING TRUST

By Ruggiero Lovreglio, Daniel Paes, Zhenan Feng and Dorothy Scorgie, Massey University School of Built Environment

Enhancing safety training with VR and AR

Evidence shows that active – not passive – training improves people's ability to learn about safety in construction. New technologies are leading the way.

Training reduces the impact of accidents and disasters on people and reduces or eliminates unsafe behaviour in the workplace and during disasters.

The new world of digital training

New technologies can play a strategic role in enhancing safety training.

Virtual reality (VR) is one such technology. It can be used to immerse users in computer-generated simulations that closely resemble real-life experiences.

VR enables people to experience different training scenarios, showing the realistic consequences of unsafe behaviour while working on a construction site or of a building emergency such as a fire or an earthquake.

In the last decade, as the price of VR equipment has dramatically dropped, many new VR training applications have been developed worldwide for both construction workers and building occupants.

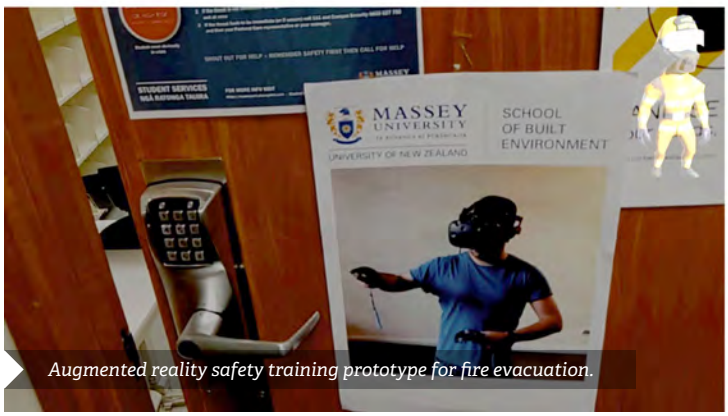
In 2015, VR headsets were confined mainly to university laboratories. From 2016 onwards, the wider public was introduced to the technology although it remained very expensive and required a high-end computer. Nowadays, a standalone VR headset can be purchased for less than NZ$500 and no longer requires an external computer, which makes it affordable to any construction company.

VR training requires doing

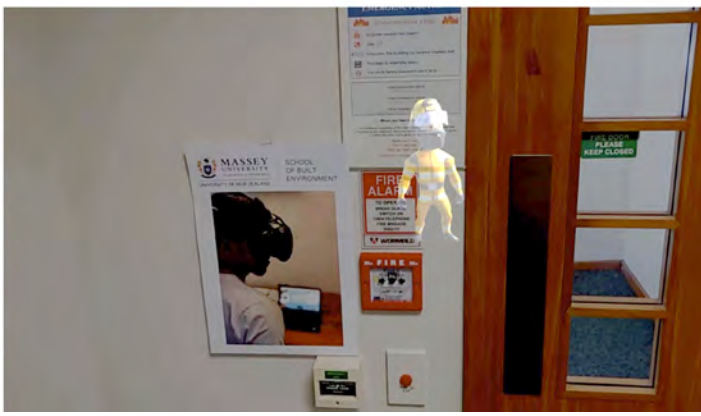
Despite the early promise of VR applications in safety training, two key questions have remained. Is VR training more effective than traditional training methods used so far? Should we invest in this new technology?'

The digitalisation team at Massey University's School of Built Environment (builtenv.ac.nz/digitaltech) has definitive answers to these questions. It analysed over 50 scientific articles published between 2013 and 2021 and found that VR

Virtual reality safety training prototype for construction sites.



Augmented reality safety training prototype for fire evacuation.



outperforms traditional safety training in terms of how much trainees learn and remember – even weeks or months later.

The reason? VR training gives people the opportunity to learn by doing and making mistakes. In contrast, traditional training is passive – trainees are expected only to listen to instructions.

AR takes it up a step

A second emerging technology that can disrupt the safety training field is augmented reality (AR) – an advanced visualisation technology that incorporates digital elements such as 3D models, animated characters, sound and text into views of the real world.

These digital elements are often called holograms. Currently, the technology is used in vehicle reversing cameras and in smartphone games such as Pokémon Go. It is becoming increasingly mature in terms of hardware and software.

The School of Built Environment digitalisation team recently published the results of one of the first AR safety training studies. The research shows how holograms can be used to teach building occupants what to do if they spot a fire in a building.

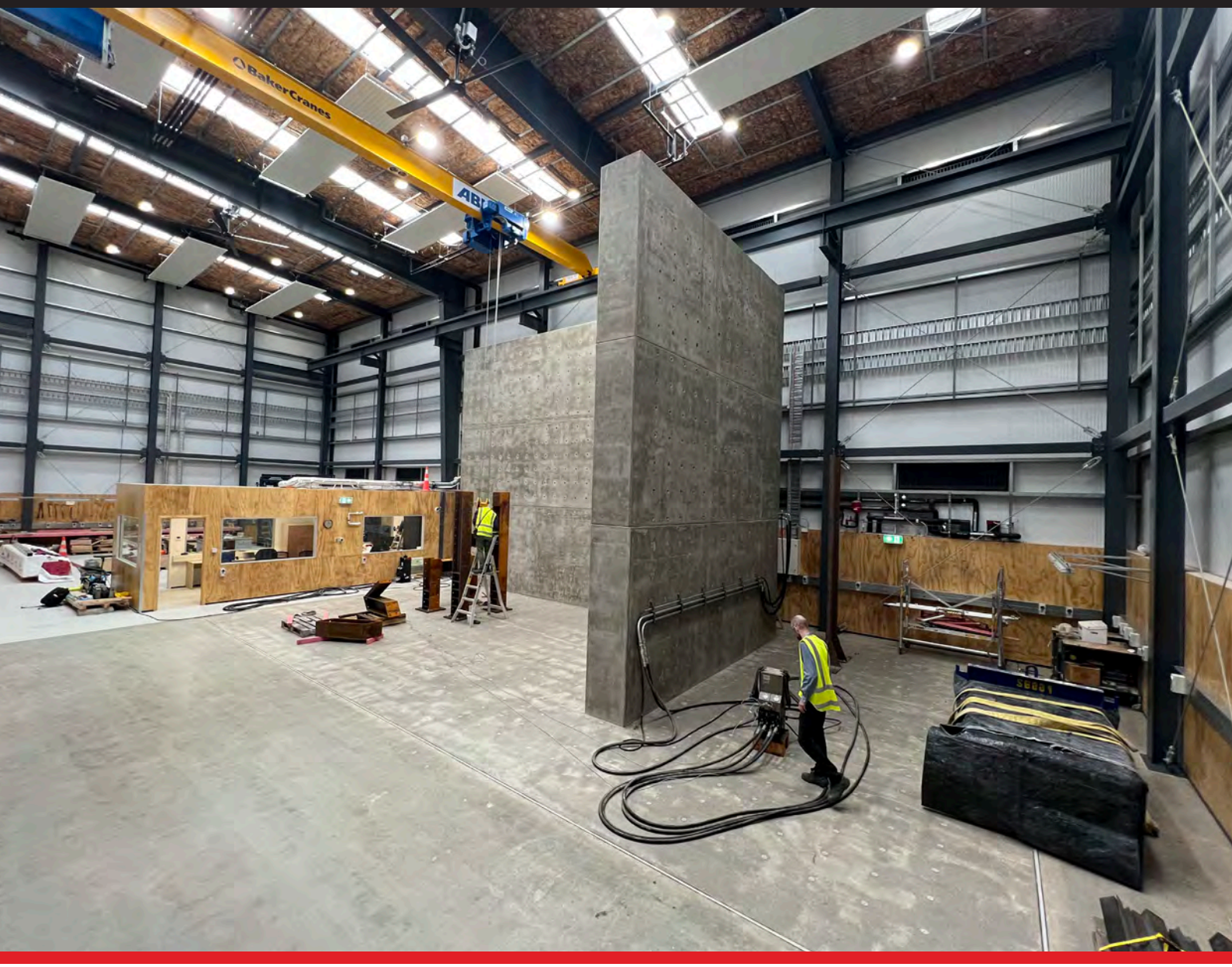
A hologram of a firefighter instructs trainees on the steps necessary to contain and report the fire and finally evacuate the building. By testing this prototype, the research team demonstrated that AR safety training was more effective in increasing motivation and retention than equivalent traditional training.

Testing long-term recall

The Massey University team is currently working on the development and testing of new safety training methods as part of a Marsden project funded by the Royal Society Te Apārangi. Called *How much do they recall? Measuring the effect of safety training on human memory*, the project will assess how much people remember from safety training over a year.

As with previous research, it will compare VR and AR safety training with traditional methods, hoping to identify new solutions and evidence to enhance future safety training programmes and regulations and ultimately save lives.

A participant in training using AR.



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By Matt Washer, Business Advisory Services Associate, Baker Tilly Staples Rodway Tauranga

Operating as a company

Are you a sole trader or a contractor? As your business grows, you may need to employ staff and take on a more sophisticated structure. A company structure can provide many benefits and allow you to scale up your business.

A key advantage of operating as a company is the limited liability protection it offers. Unlike sole traders, whose personal assets are at risk if they can't meet business debts or they face legal issues, a company is a separate legal entity. This may offer some protection, depending on circumstances, as personal assets can be considered separate from business-related liabilities.

Better credibility

Operating as a company often also enhances credibility in the business world. Clients and suppliers may perceive a registered company as more reputable and trustworthy, potentially opening doors to larger contracts and collaborations with big businesses.

A company structure also makes it easier to attract external investment – whether through loans, venture capital or equity financing, companies have more options for raising capital to fuel growth, expand operations or invest in new opportunities.

Along with this, companies are better equipped for long-term sustainability and succession planning. The structure allows for the easy transfer of ownership, making it possible to pass the business on to family members, sell it or bring in new business partners without disrupting day-to-day operations.

Companies often have more opportunities for tax planning and optimisation compared to sole traders. Sole traders are taxed at their personal marginal tax rate – currently 33% for income between $70,000 and $180,000 and

Forecasting is essential for growth and to help better understand financial information.

Operating as a company can enhance the credibility of your business.

39% for income over $180,000. Companies have a flat tax rate of 28% for profits retained in the company.

This can be an advantage when a business is in a growth phase and looking to reinvest profits into new assets or working capital or to pay off debt. The structure provides more flexibility for other growth options or investing in other companies.

Structure is more complex

However, the company structure is more complex, so it is important you understand the specific legal and regulatory compliance required. As your business grows, good financial management is key. You should invest in accounting software that caters to your business needs, allowing you to track cash flow and analyse expenses and revenue.

Budgeting and cash flow forecasting is often essential for sustainable growth and to help with better understanding of financial information. The software you select should also be able to help you manage payroll, GST and other tax compliance requirements.

If growing your business involves hiring new staff, this brings other responsibilities and compliance, which includes payroll, along with employee benefits and entitlements. It is important, therefore, that you understand your responsibilities as an employer.

Get help from the professionals

We recommend seeking guidance from legal and accounting professionals who can help you set things up and make informed decisions that align to your business goals. They can also help you define and regularly monitor key business performance indicators that will help you track progress, identify areas for improvement and make informed strategic decisions.

Transitioning to a company structure could bring a range of benefits from limited liability protection to enhanced credibility and access to capital. However, take care to ensure you take advantage of all the opportunities that a company structure provides and that your growing business is positioned for long-term success.

This article has focused on the advantages of companies. However, in certain situations, other structures or options might be preferable. These include limited partnerships, look-through companies and trusts. Talk through your options with a business advisor.

By Building Performance Team, MBIE

Building a sleepout

MBIE and BRANZ have collaborated on a guide to building a sleepout of up to 30 m² following the addition of building consent exemptions for low-risk building work to Schedule 1 of the Building Act 2004.

The new step-by-step guide – *Constructing a sleepout that does not require building consent* – describes how to select and install appropriate building products for a small sleepout.

Detailed information helps non-professionals decide where to construct a sleepout and where to position doors and windows and describes everything required to construct the complete sleepout – from the foundations to the roof.

Adaptable example

The guide covers building consent exemptions for designing and constructing a single-storey detached sleepout with a 10–30 m² floor area built with lightweight materials (Schedule 1 section 3A of the Building Act).

The sleepout example could be adapted to some other types of small building covered by the exemption in Schedule 1 section 3 of the Building Act.

Requirements outlined

The guide summarises the legal documents such as the Building Code and standards that homeowners should consult before beginning work.

It outlines when a certified builder, electrician or plumber is required to carry out or supervise some of the work and provides examples of how Building Code clauses apply to a small building.

What must be adhered to

The exemptions, which were added to Schedule 1 in August 2020, make lower-risk DIY building projects simpler, faster and less expensive for homeowners. They also allow councils to focus on ensuring larger and more risky building projects will comply with the Building Code.

However, while these exemptions loosen the regulations, the usual requirements about durability of materials, district planning, location of services and boundary restrictions still apply.

A sleepout must be at least its own height away from a boundary, precluding many suburban property owners from building to the maximum 30 m² without consent.

A sleepout is not designed to be lived in exclusively. Facilities from a nearby existing dwelling such as potable water must be available, and as a sleepout is part of a Schedule 1 exemption and is not a tiny house, homeowners wanting to include a toilet or cooking facilities must get a building consent.

Three options

The Building Act amendment in 2020 added three options for sleepouts:

- Single-storey detached sleepouts with 10–30 m² floor area that are built with lightweight wall and roof materials.
- Kitset/prefab sleepouts with 10–30 m² floor area designed or reviewed by a chartered professional engineer.
- Sleepouts with 10–30 m² floor area where LBPs carry out or supervise design or construction.

FOR MORE

Access the step-by-step guide at www.building.govt.nz/sleepouts

Go to online version

BUILDING PERFORMANCE

Can we build it?
Yes we can!

Here's your chance to build a sleepout on your property.

The Ministry of Business, Innovation & Employment (MBIE) and BRANZ have put together a step-by-step guide to help you do this.

Find out more at **www.building.govt.nz/sleepouts**

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New Appraisals

Base-Tect® System

APPRAISAL NO. 1250

The Base-Tect® System is a permeability-reducing system for concrete in basement installations.
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Omega Light Wall Underlay

APPRAISAL NO. 1265

Omega Light Wall Underlay is a vapour permeable synthetic building underlay for use under wall claddings.
For more, contact Siegware Australia Pty Ltd
Ph: 07 849 2113
Web: siegware.com.au

Omega Light Roof Underlay

APPRAISAL NO. 1266

Omega Light Roof Underlay is a vapour permeable synthetic building underlay for use under roof claddings.
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Web: siegware.com.au

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The Building Agency Alucobond® Cladding System

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The Warmup Waterproofed Shower System

Appraisal No. 774

The Warmup Waterproofed Shower System is for internal wet areas of buildings that are to be finished with ceramic or stone tiles.

For more, contact Warmup New Zealand Ltd
Ph: 09 820 4001 Web: warmup.co.nz

SikaProof® A+ 12 Waterproofing Membrane

Appraisal No. 852

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Hitchins Gundec DPM Tanking Waterproofing Membranes

Appraisal No. 966

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Neuchatel Mastic Asphalt Roof Waterproofing System

Appraisal No. 1019

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For more, contact Neuchatel Waterproofing Ltd
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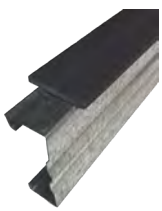

Forman RoofX Thermal Break

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Forman RoofX is a non-structural roof thermal break manufactured from extruded foamed polystyrene.

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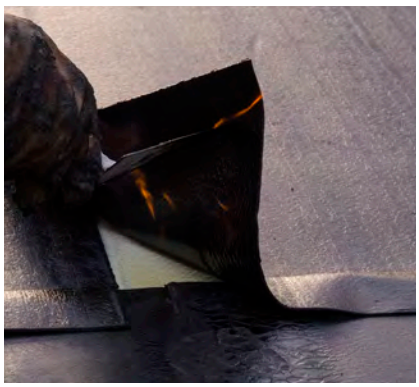
It offers three colour temperature options ranging from a soft yellow glow to a bright white light. With an adjustable height ranging from 1033 mm to 1890 mm and a lightweight design weighing only 4 kg, it is easily transportable and adaptable to various work settings.

Specifications:

- Easy three-buckle set-up with adjustable stand.
- Two brightness levels, maximum 10,000 lm for full site illumination.
- Three colour temperature options.
- Height adjustable from 1033 mm to 1890 mm.
- Two rotatable independent pivoting light heads.
- Ingress protection rating of IP54.

To enter, see the details below.

FIND THE PICS



FIND THE PICS is the challenge. To play, identify the pages the TWO images above appear on inside the magazine.

Then scan the QR code (or type findthepics202.paperform.co into your browser) and complete the form.

You can also post your entry to: Build Editor, Freepost BRANZ, Private Bag 50 908, Porirua 5240 if you prefer.

Entries close on 1 July 2024. The first correct entry drawn wins. The Editor's decision is final. No employees of BRANZ or their relations may enter. Congratulations to the latest winner, Sergio Leal from Wanaka.

Scan to enter

Key industry contacts

StoArmour Facades

Lightweight concrete, StoArmour Facade Panel Systems are tested, specified and installed to surpass New Zealand's harsh environmental conditions that can infiltrate residential or multi-level facades. Tested for moisture ingress, extreme weathering, and fire protection to ensure all the building performance requirements are satisfied.

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Fire Spread: BS 8414-2 & ISO 5660.
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Invested in building, sto.co.nz

Cotfield House, Manawatū
Architect: Gibbons Architects & Ian Poole Architect
Construction: 3D Constructions Services
Sto Contractor: Paterson Exterior Plastering

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