



**Levy in
Action**
2019





Inspiring the industry to
provide better buildings
for New Zealanders





4

Foreword

6

Investing the Building Research Levy

7

Building Research Levy stewardship

8

Collaborating to tackle key priorities

10

Investing to deliver value to New Zealand

12

New Zealand's issues, research and our contribution

14

Investment overview for 2019/20

16

Research programmes



17

Transition to zero carbon



20

Building fire-safe higher-density housing for New Zealand



23

Towards warmer, drier and healthier buildings

38

Other research investments

39

Stand-alone research

48

Scholarships

50

Strategic initiatives

52

Investment details

53

Stand-alone projects under way in 2019/20



27

Exceeding the minimum



31

Building better medium-density housing



35

Eliminating quality issues



Foreword

Great research leads to meaningful change that has a significant impact on society.

BRANZ aims to help create a better building system for the benefit of all New Zealanders by investing the Building Research Levy in valuable and evidence-based research.



Over the last 12 months, we've seen the difference our research can have on the lives of New Zealanders.

We've seen changes that increase the protection and opportunities given to people who live in rental homes. We've seen the quality of homes improve and better living conditions for our children. And we've seen positive steps taken, informed by BRANZ research, that help ensure a healthier indoor environment for all our whānau.

Our research is breaking new ground in many diverse aspects of the built environment, and I'm proud of the contribution BRANZ makes. But our challenge both to ourselves and to the building sector is to ask: what else can we do to improve? What does better look like? I believe we all need to work together to transform our building industry, so it's agile, resilient, and fit for the 21st century.

The research set out in this issue of *Levy in Action* illustrates how we are pursuing practical solutions across a wide range of areas in order to make a difference.

A particular highlight this year is the work we have taken forward around two new programmes of work critical to New Zealanders' wellbeing.

The first supports New Zealand's journey to a zero-carbon economy. The Prime Minister has described this as the nuclear-free issue of our day. This programme, *Transition to Zero Carbon*, will support the building sector to make real inroads in reducing its carbon footprint. With an estimated 20% of New Zealand's carbon emissions coming from the built environment, it's clear that action is required. Building on BRANZ's legacy of climate change research, this new programme will support the industry to make the changes required to build more sustainably.

Our second new programme looks at how higher-density housing can become safer from fire. Fire can be a serious hazard in built-up urban environments as recent horrific events in other countries have shown. While most New Zealanders live in stand-alone housing, this is changing. New Zealand is becoming increasingly urbanised and this means more families are living in high-rises. I'm pleased with the role that BRANZ has played in working with the fire engineering profession to focus effort on this emerging risk.

A core characteristic of BRANZ research is that we can draw on expertise from right across New Zealand and internationally. Our work pulls together the right teams needed to address issues and identify practical solutions that the industry can apply. Reflecting on the diverse challenges facing New Zealand's built environment, I'm clear that this collaboration is key to unlocking a safer and sustainable future for all New Zealanders.

Chelydra Percy
Chief Executive Officer



Sheng-Huei Huang, Senior Technician
Materials at BRANZ measuring the
dimensions of an insulation sample.

Investing the Building Research Levy

BRANZ invests the Building Research Levy to deliver
the best outcomes for New Zealanders.



Building Research Levy stewardship

BRANZ is committed to ensuring New Zealanders receive the greatest possible benefits from Building Research Levy investment.

Using the Levy wisely

A core responsibility of BRANZ is effective stewardship of the Levy. This demands robust decision-making processes, a commitment to transparency and disciplined management of Levy investments.

BRANZ receives research income from Levy receipts, which are directly linked to the levels and values of building consents.

This means Levy income is subject to the same boom-bust cycles as the building industry. This requires careful and considered management.

BRANZ has a long-term Levy utilisation policy in place that helps manage these ups and downs in Levy income. A 10-year rolling forecast model has been developed to create a stable, sustainable platform for this income. This enables BRANZ to plan its investments of the Levy effectively.

In practice, this means that BRANZ can be a confident and considered steward of the Levy. When Levy income increases, BRANZ is prudent on expanding its investment. When Levy income decreases, BRANZ doesn't have to make unnecessary or drastic cuts.

Levy utilisation policy

The long-term Levy utilisation policy sets out how BRANZ will effectively manage the Levy by:

- › determining a baseline Levy investment sum using the 10-year model – this is incorporated into the annual BRANZ Group budget for investment in Levy-funded activities
- › investing the baseline Levy investment sum in internal and external research and knowledge dissemination
- › investing the Levy in an open, transparent and contestable way
- › ensuring that any investment in core internal capability is linked to BRANZ's long-term strategic priorities
- › investing to avoid unnecessary duplication of capability and facilities across New Zealand
- › ensuring availability of funding for maintenance and investment in property, plant and equipment
- › maintaining appropriate cash reserves.



Collaborating to tackle key priorities

To help BRANZ take a system-wide view of the building industry, we work collaboratively with key groups in the sector.

Facilitating conversations between these groups helps inform our investment priorities across a range of industry needs and keeps the focus on what's important.

The introduction of the Construction Sector Accord in 2019 is an important milestone, marking a shared commitment between government and industry to transform the sector. BRANZ is working closely with the Accord team and is committed to playing its part.

Working with industry

BRANZ has deep connections throughout the construction industry which are fundamental to the way we work.

Building professionals help inform our research priorities and are actively involved in our research. This helps us keep our work grounded in the real world, and we can test whether our solutions are going to be practical to use. Our findings are then shared with the industry as accessibly as possible as part of our commitment to knowledge transfer.

BRANZ also collaborates with a wide range of industry organisations and industry experts across a range of specialist areas. We use surveys to consult the wider building industry and gain insight into research and information needs. This keeps us informed about emerging issues, and allows us to gauge how well we are sharing our knowledge.

Engaging with government

BRANZ works closely with government on building and housing issues. We have a strong relationship with the Ministry of Business, Innovation and Employment (MBIE). This provides important insights into policy priorities and enables us to share information on industry concerns. We play a key role in providing impartial evidence to support New Zealand Building Code and standards development.

BRANZ also has relationships with many other government organisations, including the Ministry of Housing and Urban Development, Kainga Ora, the Energy Efficiency and Conservation Authority, the Ministry for the Environment, and the Ministry of Education.



Researchers

Our relationships with universities, Crown Research Institutes (CRIs) and other research providers are also critical to us. We are currently working with more than 30 research organisations from across New Zealand. Shared information helps us monitor priorities for funding, ensuring we aren't duplicating effort and are playing to our respective strengths. When we can get the right team together to address particular issues, we can achieve so much more.

International community

BRANZ maintains a watching brief on key international trends and developments facing the building and construction industry.

Some offshore developments can have direct implications for New Zealand, such as changes to shared international standards. Information from our international scanning can also highlight information about opportunities or issues we may face in the future.

Many BRANZ researchers and scientists are members of international collaborative groups. This enables us to participate in the international science community and share that expertise within New Zealand. For example, BRANZ is a member of CIB, the International Council for Research and Innovation in Building and Construction. We also work with our Australian colleagues through the Australian Building Codes Board.



Investing to deliver value to New Zealand

The BRANZ Inc. Board determines how much of the Levy is spent on research and knowledge transfer activity.

BRANZ Ltd

BRANZ Ltd is New Zealand's primary building research provider and is nationally and internationally recognised as a centre of building science expertise.

A wholly owned subsidiary of BRANZ Inc., BRANZ Ltd operates predominantly out of the Judgeford campus near Wellington. Over 100 staff work here, of whom most are scientists and researchers or experts in knowledge transfer.

Levy investment is allocated to work undertaken by both BRANZ Ltd and external providers. A significant proportion is invested with BRANZ Ltd. To ensure the work is of a high quality, this is subject to robust scrutiny. All proposals undergo a vigorous assessment process.

This process includes the use of independent assessors appointed by the BRANZ Inc. Board. The Levy Allocation Advisory Group (LAAG) is made up of leaders and experts drawn from the Building Research Advisory Council and the wider industry. MBIE also participates on this advisory group in recognition of the strong connections between Levy-funded research and government regulatory and policy direction. The aim of this group is to provide independent, expert advice that can give confidence to the BRANZ Inc. Board on the focus and quality of BRANZ Ltd research.

External providers

There is significant expertise within universities, Crown Research Institutes and independent research providers to complement BRANZ-based specialist teams. Working in partnership and collaborating with other providers is an important part of how BRANZ strives to deliver best value from the Levy.

Sometimes, this can involve external providers directly accessing investment and being contracted by BRANZ Inc. to carry out projects. Other times, external providers act as subcontractors to BRANZ Ltd as part of a team to deliver Levy-funded work.

BRANZ works hard to be open and transparent about how external providers can access Levy funding. External proposals are sought through an open call for ideas – the publication of a Research Prospectus. This is sent out annually to the industry and research community, seeking proposals to help deliver on research priorities.

Next generation of researchers

Part of the Levy funding is reserved every year for outstanding postgraduate scholars and researchers to work on industry issues. This supports the next generation of scientists and researchers. It also builds on our ties to tertiary education providers, helping support their capability.

BRANZ's scholarship programme is an important investment in the future of building research. Every year Masters and PHD students finish studies supported by BRANZ and take their ideas and expertise back out into the sector.

Emerging issues

Most of BRANZ's research investments are delivered through the annual funding rounds described above. But as part of its portfolio approach, BRANZ also recognises the importance of being an agile investor. We want to be able to respond to opportunities and issues outside the usual investment cycles.

BRANZ is able to respond quickly to emerging industry issues and invest in discrete pieces of timely work such as a publication or guidance on a pressing issue. These out-of-cycle investments can come from ideas identified and developed within BRANZ or from external organisations.

Infrastructure

BRANZ also invests Levy funding in developing and maintaining building research capability at its campus.

This research infrastructure is a key national asset. Capital investment in property, plant and equipment is undertaken at BRANZ through a cyclical process targeting progressive improvement. By understanding the value and quality of existing assets and identifying future needs, BRANZ can develop a programme of capital requirements and understand investment priorities.



A Campus and Asset Management Plan shapes these investments. The plan creates visibility of the potential size and scale of investment in property, plant and equipment at BRANZ over the next 10 years. This supports the Board in making individual project investment decisions relative to the size and scale of other likely investments. Recent investments have seen improvements to the fire research facilities, and further major investments are planned for re-developing ageing infrastructure at Judgeford.

Strategic initiatives

From time to time, BRANZ also invests the Levy in strategic initiatives beyond the core baseline investment in research. These are typically focused on national strategic opportunities and are approved by the BRANZ Inc. Board.

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New Zealand's issues, research and our contribution

Building and construction impacts on New Zealand's economy, environment and people's wellbeing.











BRANZ, along with other research organisations, carries out research to better understand the nature of particular issues and how they interact in order to inspire the industry to provide better buildings for New Zealanders.

The graphic below sets out key areas in which BRANZ undertakes research and its relative strengths (red shading), the depth of research effort across New Zealand (grey shading) and areas where research has opportunity for increased effort.



Existing portfolio overview

[Indicative examples]

	2019/20	2020/21	2021/22	2022+	
COMPONENTS SHAPED BY LEVY INVESTMENT PORTFOLIO STATEMENT (LIPS)	MEDIUM-DENSITY HOUSING 	Technical gaps around MDH confirmed	Programme winds down with focus on knowledge transfer	Technical solutions continue to be developed as required outside a programme	New Zealand is benefiting from high quality, affordable, medium density housing as part of our market
	EXCEEDING THE MINIMUM 	Tools to lift minimum developed	Programme winds down with focus on knowledge transfer	Work on issues around minimum performance integrated into other programmes	New Zealand is benefiting from a lift in the performance of our building stock from pre-programme levels
	ELIMINATING QUALITY ISSUES 	Priority problems tackled through new focus and tools	New types of knowledge transfer focus on behaviour change	Research provides evidence that quality problems are being addressed	Quality issues are being addressed as solutions take hold
	WARMER, DRIER, HEALTHIER BUILDINGS 	Key insights support shift in quality of existing rental housing stock	Solutions to lift the quality of indoor environments in high density living are being developed	Solutions around improved indoor living conditions are rolled out	Evidence from this programme has led to policy changes lifting the quality of both new and existing housing stock
	LOW-CARBON TRANSITION 	Programme of action launched	Existing solutions being shared and new solutions being fast-tracked	Tools to support low carbon building are becoming mainstreamed	Low carbon construction has become mainstreamed as a core element of New Zealand's building system
	KEEPING SAFE FROM FIRES 	Key partners brought together to identify action around high density living	First projects from new programme begin	New solutions developed	Shift in construction practices around fire safety begins on back of new insights driven by the programme
	INVESTMENT ON EMERGING ISSUES 	Urgent work to address retrofit gap around pre-cast concrete flooring systems	BRANZ is able to act quickly and decisively on urgent issues as they emerge		
DISTINCT, STANDALONE PROJECTS 	eg: Over framing of timber buildings	Projects initiated by both researchers and end users			
SCHOLARSHIPS 	Helping ensure that New Zealand has strong research capability in core STEM and building science areas				
INDUSTRY TRANSFORMATION 	Industry Transformation Agenda development and evolution in alignment with Construction Sector Accord	Projects developed that tackle root cause challenges faced by building systems	Project solutions trialled, refined and rolled out	Shift in industry performance can be measured against baseline	

Core activities that make our research and knowledge accessible and actionable

Publications	Services	Long term studies	Tools
<ul style="list-style-type: none"> Build Guideline Bulletins 	<ul style="list-style-type: none"> Seminars Live webinars E-Learning modules Building controls Information management Advisory services 	<ul style="list-style-type: none"> Durability verification database Weathering site Levy forecast House condition survey 	<ul style="list-style-type: none"> MyBRANZ knowledge B-RISK User Support



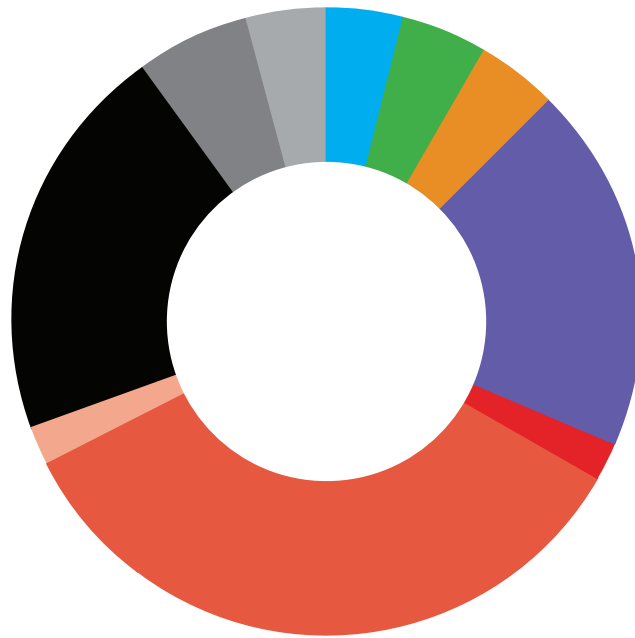
Research investment overview 2019/20

The BRANZ Inc. Board is investing \$15,857,672 of the Building Research Levy in 2019/20.

This includes new research investments as well as budgeted expenditure for existing research committed for the year 1 April 2019 to 31 March 2020.

	New projects (\$)	Current projects (\$)	Ongoing (\$)	Total (\$)	%
Programmes					
› Transition to zero carbon	430,000	71,500	-	501,500	3.2%
› Building fire-safe, higher-density housing for New Zealand	-	54,867	-	54,867	0.3%
› Towards warmer, drier and healthier buildings	120,000	2,169,450	180,000	2,469,450	15.6%
› Eliminating quality issues	-	488,870	160,000	648,870	4.1%
› Building better medium-density housing	235,000	196,000	155,000	586,000	3.7%
› Exceeding the minimum	150,450	560,695	205,000	916,145	5.8%
Stand-alone projects	433,000	3,565,767	180,000	4,178,767	26.4%
Scholarships	45,990	264,187	-	310,177	2.0%
Knowledge transfer and associated activity	127,000	50,000	3,195,400	3,372,400	21.3%
Strategic initiatives	-	-	1,899,000	1,899,000	12.0%
Funding to be allocated through 2019/20 Prospectus round and towards emerging issues	920,496	-	-	920,496	5.8%
TOTAL	2,461,936	7,421,336	5,974,400	15,857,672	100.0%

These figures are correct in representing the total Levy investment for the year at the time of publication. This is subject to change due to project variations and new investments made in response to emerging issues.



- Medium-density housing programme **4%**

- Exceeding the minimum programme **4.5%**

- Eliminating quality issues programme **4%**

- Warmer, drier and healthier buildings programme **19%**

- New programme development **2%**

- Standalone projects **34%**

- Scholarships **2%**

- Knowledge transfer and associated activity **20.5%**

- Strategic initiatives **6%**

- Funding to be allocated through 2018/19 Prospectus round **4%**

The total figure excludes capital expenses or investments in the campus and other infrastructure assets.



Research programmes

Developing end-to-end solutions for some of New Zealand's most pressing issues

BRANZ's programme approach brings together experts with a range of skills to find practical solutions to complex, high-priority issues.



Transition to zero carbon

We know the built environment potentially contributes up to 20% of New Zealand's carbon footprint and possibly even more. That means our industry needs to be at the forefront of innovation to combat climate change.

To support the transition to a net zero carbon economy, this programme examines how buildings impact climate change through production of materials and energy efficiency performance, and what can be done to mitigate this.

What we're doing

Buildings that go up today will still be standing in 50 years' time. We need to examine their impact, to support New Zealand's transition to a net zero carbon economy.

Buildings use a lot of energy, and producing construction materials, actual construction and getting rid of associated wastes all contribute to our greenhouse gas emissions.

Under the Paris Agreement signed in 2016, New Zealand is committed to achieving a 30% reduction in our 2005 greenhouse gas emissions by 2030 and achieving net zero carbon emissions between 2050 and 2100.

The Climate Change Response (Zero Carbon) Amendment Bill was introduced into Parliament in May 2019 as part of the government's effort to reduce our carbon footprint.

The *Transition to zero carbon* programme is focusing effort on climate change and the built environment. It aims to encourage leadership, strategic direction and action in this space and develop tools to help the industry prepare for a zero carbon future.

This work is guided by a working group comprised of experts from BRANZ, central and local government, industry leaders and other research organisations.

The programme has been scoped, and we are now defining outcomes and investment requirements and seeing which other avenues of research could be explored.

Already, we can see clear alignment to government policies and initiatives. Our work was highlighted in the 2018 Productivity Commission report into transitioning to a low-emissions economy. Work with the Ministry for the Environment's Transition Hub and MBIE's Just Transitions Unit has also confirmed the direction of the programme.

The full programme will launch in 2020. Recognising the urgency of the issue, some initial projects have been fast-tracked in parallel. These are detailed on page 19.

PROGRAMME LEADER

Casimir MacGregor
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BEES 2.0: Addressing energy demand and flexibility to reduce carbon emissions in non-residential buildings – pilot study

The Building Energy End-use Study (BEES) 2.0 is a pilot study which will examine energy end use in hospital buildings. The amount of energy hospitals use is growing. Carbon-reduction plans from these buildings can help provide insights with wider application.

An earlier study which ran from 2007 to 2013 monitored and examined energy and water consumption of commercial buildings around New Zealand. Last year, BRANZ collaborated with key stakeholders on a scoping project to create a collective vision and plan (BEES2(A)), which built on the earlier work.

Looking at how energy is used in the context of a hospital building – the technologies, systems and human behaviour – will help us recommend ways to become more energy efficient. This will contribute to New Zealand’s transition to a net zero carbon built environment and help the construction industry address its climate action requirements under the Paris Agreement.

Levy investment

\$500,000

Timeframe

April 2019 – March 2021

Contact

Casimir MacGregor,
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Lead organisation

BRANZ Ltd.

Home heating left cold

In the mid-2000s, there were heat pumps in around 4% of New Zealand homes. By 2015, they were in 40% of homes.

While they’re popular, we don’t know much about how much electricity heat pumps need to make a home warm. Research shows that many households had higher energy bills after installing heat pumps. We need to know more about how energy efficient heat pumps are and how best to operate them.

The Healthy Homes Guarantee Act requires rental homes to meet the healthy homes standard for heating. Living rooms must have a fixed source of heating that can warm the room to 18°C. Heat pumps are one of the options allowed under the new law.

This project will examine how effective heat pumps are in various climates and operating conditions. It will highlight the factors involved in choosing, designing and operating heat pump systems to achieve the necessary temperatures at an acceptable level of energy use.

Levy investment

\$180,000

Timeframe

April 2019 – March 2020

Contact

Andrew Pollard,
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Lead organisation

BRANZ Ltd.

Progress in the Transition to zero carbon programme

This timeline shows all the projects that are either part of this programme or contributing to it. It shows the timing of each project and how much we're investing. If you would like to know more about this programme, please contact the programme leader directly.

Low carbon transition	2016	2017	2018	2019	2020	2021	\$	
Climate change in building industry		■					94,800	
Low impact buildings			■				Mar 2022 →	1,575,000
Low carbon economy programme			■				150,000	
Carbon budget			■				185,000	
SCHOLARSHIP: Sandi Sirikhanchai: Balancing building energy			■				20,000	
Home heating left cold				■			180,000	
BEES 2.0: Addressing energy demand				■			500,000	
SCHOLARSHIP: Louise Bullen: Environmental impacts of grid				■			20,000	
Total:							2,724,800	

Key: ■ Completed ■ Under way



Building fire-safe higher-density housing for New Zealand

Fire is a serious hazard in built-up urban environments.

This programme looks at fire safety in higher-density housing. It looks at ways of optimising the fire safety provisions in the New Zealand Building Code to make it safer for people to live in apartments.

What we're doing

The government has identified fire safety as a top priority for improvement in the building system, particularly as demand for higher-density housing increases.

To ensure the building industry is delivering fire-safe housing, work on this programme began with an aim of understanding the gaps in our knowledge about high-density housing fire safety and performance.

A national approach has been taken, with a focus from the outset on bringing together key fire professionals from around the country.

A Fire Research Stakeholder Group was established in 2018. This group brings together key government, industry and fire researchers from across New Zealand to co-ordinate activities. Government representatives include MBIE, Auckland Council and Fire and Emergency New Zealand. Key fire industry representatives also bring

their expertise to the Group. Representatives include the Fire Protection Association of New Zealand, the Society of Fire Protection Engineers and the institution of Fire Engineers New Zealand.

The group also has a "whole of New Zealand" research focus. This sees BRANZ researchers joined by colleagues from the University of Auckland, Victoria University of Wellington, Heavy Engineering Research Association, University of Canterbury and Scion. Independent international experts from the United States and the United Kingdom are also included.

With stakeholders and researchers working hand in hand, the scoping work for the programme has been progressing well. The full programme will launch in 2020. Some work on early projects has begun and information about these follows.

Fire-safe use of timber construction II

Timber is currently considered high risk for use in buildings because it is a combustible material. We're investigating whether that risk can be managed by how we use timber in construction.

BRANZ is developing new modelling to understand what the real fire hazard is for both exposed and protected timber in buildings. This will test a wide range of room sizes and lining configurations. This modelling will help inform improved design and analysis methodologies. It will also support future changes to building regulations.

The research aims to increase confidence in timber as a fire-safe option for construction. It could open up the range of construction materials used for mid-rise and tall buildings, which are rapidly developing as housing options for New Zealand. Timber is also increasingly attractive to use because as it is a sustainable building material.

Levy investment

\$1,120,000

Timeframe

July 2017 – September 2021

Contact

Kevin Frank,
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Lead organisation

BRANZ Ltd.



Fire safety of combustible facades in New Zealand

Disastrous urban fires overseas have raised concerns about fire risks associated with combustible facades.

This project investigates how the fire risk of combustible facade materials is managed in New Zealand's building regulations. It will also undertake large-scale tests to determine an appropriate method to evaluate the fire risks of different types of facade.

The aim of the research is to provide confidence in the use of facade systems in New Zealand.

Levy investment

\$1,030,000

Timeframe

August 2017 – September 2021

Contact

Kevin Frank,
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Lead organisation

BRANZ Ltd.

Progress in the *Building fire-safe higher-density housing for New Zealand* programme

This timeline shows all the projects that are either part of this programme or contributing to it. It shows the timing of each project and how much we're investing. If you would like to know more about this programme, please contact the programme leader directly.

Keeping people and buildings fire safe	2016	2017	2018	2019	2020	2021	\$
SCHOLARSHIP: Peter Marriott: Fire safety design		← Aug 2016					20,000
Development of a fire research programme							185,300
Fire-safe use of timber construction II							1,120,000
Fire safety of combustible facades in NZ							1,030,000
Total:							2,355,300
Key: ■ Completed ■ Under way							



Towards warmer, drier and healthier buildings

BRANZ has made important contributions to improve the quality of housing and buildings in New Zealand.

This programme was established to understand and solve issues that prevent buildings from being warm, dry and healthy.

What we're doing

The programme was established in 2016 to address building issues that affect people's health, such as weathertightness, roof moisture issues and indoor air quality (including insulation and ventilation). It's genesis was an understanding that unhealthy buildings have a significant impact on the people who live and work in them.

The findings from the programme are helping improve New Zealanders lives. They have played a significant role in shaping new tenancy law, providing impartial evidence to help MBIE and the Ministry of Housing and Urban Development understand and set new standards for rental homes.

Changes to the Residential Tenancies Act required all rental homes to be insulated to minimum standards by 1 July 2019. The Healthy Homes Standard sets minimum standards for heating, insulation, ventilation, drainage and moisture ingress.

This programme is also improving our overall understanding of housing in New Zealand. Work with Statistics New Zealand has led to new insights around housing from the New Zealand General Social Survey, which measures New Zealanders'

wellbeing. This information complements other surveys on housing quality, including the BRANZ House Condition Survey and new 2018 Census questions.

Issues prioritised in the programme this year include developing tests for weathertight cladding for medium-density buildings, ventilation in roofs, airtightness, indoor air quality and energy efficiency. With an increasingly strong evidence base to draw on, the programme is now looking closely at new ways to communicate key insights and solutions.

A programme review has been undertaken in 2019. This has identified that there is an ongoing need for this programme given continued concerns over the condition of NZ's housing stock and increasing evidence globally on the effects of indoor air quality (IAQ) on occupant health. The next phase of the programme will aim to meet the increasing demand for more answers on a broader range of factors affecting IAQ, evidence of its effects and the need for further solutions leading to healthy homes. The programme will be re-scoped and refreshed in 2020. →

Programme objectives

- › There is a strong understanding of the issues that prevent our current homes and buildings from being warm, dry and healthy.
- › Solutions to developing warmer, drier and healthier homes and buildings in New Zealand have been successfully identified.
- › The industry understands the knowledge, ways of implementing the solutions and benefits provided.
- › Owners, suppliers and users of New Zealand buildings have the knowledge and understanding to make effective decisions for producing and maintaining warm, dry, healthy environments.

PROGRAMME LEADER:

Mark Jones
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Experimental buildings

BRANZ has several test buildings that have underpinned valuable research on weathertightness, ventilation and interstitial moisture. These have informed changes to the New Zealand Building Code over the last 20 years.

With the BRANZ campus being developed and new buildings going in, the test buildings will need to be moved or demolished.

We've looked at how we've been using the buildings and what New Zealand will need in future. An opportunity has been identified to redevelop or replace them with new flexible facilities to support future research needs. This project will develop design concepts for new and redeveloped buildings to inform BRANZ on investing in the facility.

A key part of this project will include looking at research facilities around the world and elsewhere in New Zealand to ensure our design thinking keeps pace and aligns with our peers.

Levy investment

\$35,000

Timeframe

August 2019 – October 2019

Contact

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Lead organisation

BRANZ Ltd.



Regional healthy housing stocktake

Wellington’s housing stock is generally in poor condition with low levels of insulation, heating, and ventilation in many homes, affecting people’s physical and mental health.

The Regional Healthy Housing Response Group (RHHRG) was established in 2017 and includes diverse agencies from across the Wellington region. The shared goal is: “Everyone in the Wellington region lives in warm, dry, and safe housing by 2025.”

Regional Public Health on behalf of the RHHRG is leading a housing data stocktake to identify available research and data that is specific to Wellington’s experience. This information will be used to address questions around housing quantity and quality and shape the group’s future priorities.

Their methodology will be published, to provide insight for other New Zealand regions working to tackle housing-related health issues.

Levy investment

\$30,000

Timeframe

May 2019 – September 2019

Contact

Tara D’Sousa,
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Lead organisation

Regional Public Health.

Heat recovery ventilation performance measurements

Heat recovery ventilation (HRV) systems may be better for New Zealand homes than other systems as they don’t tend to pressurise the building envelope and there is less energy loss.

However, HRV systems don’t always perform as expected. This could be because some influencing factors haven’t been properly examined. For example, performance could be affected by particular building characteristics or the difference in air temperature between indoors and outdoors.

Recent findings around energy-efficient ventilation need to be retested to ensure the building industry has the best possible evidence about HRV systems. With this information, building design can be adapted to allow for effective HRV installation.

Levy investment

\$60,000

Timeframe

July 2019 – August 2019

Contact

Aidan Bennett-Reilly,
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Lead organisation

BRANZ Ltd.

Progress in the Towards warmer, drier and healthier buildings programme

This timeline shows all the projects that are either part of this programme or contributing to it. It shows the timing of each project and how much we're investing. If you would like to know more about this programme, please contact the programme leader directly.

Towards warmer, drier and healthier buildings	2016	2017	2018	2019	2020	2021	\$
Façade testing	← Jan 2014						410,000
Occupant behaviour	← Oct 2014						430,000
SCHOLARSHIP: Phoebe Taptiklis: Maintenance and dampness	← Mar 2015						75,000
Energy efficiency ventilation	← Apr 2015						400,000
SCHOLARSHIP: Mike Bedford: Daycare environmental conditions							75,000
Ridge and fascia vent design and performance							175,000
Roof design							165,000
Ventilation performance in large span roofs							320,000
Airtightness trends							400,000
NZ's experimental buildings							345,000
School monitobox							100,000
Indoor environment and fungal exposure							183,000
Internal moisture VM							90,000
Risk assessment: Retrofitting wall insulation							310,000
Airtightness of apartments							650,000
Air quality in high performance houses							148,000
Roof design pathway							210,000
Growing up in New Zealand							720,840
Model buildings for the next generation of the New Zealand Building Code							Mar 2023→ 1,600,000
Pollutant levels in modern homes							390,000
Risk assessment tool for roof ventilation							470,000
Feasibility of an updated residential energy-use study							280,000
Corrosion rates in vented roof cavities							187,000
Chemical contamination of building materials							800,000
Smart ventilation and indoor environmental quality							Mar 2023→ 1,250,000
Roof ventilation calculator							150,000
Fungal exposure in New Zealand homes							325,000
SCHOLARSHIP: Jarred Butler: Mould in New Zealand bathrooms							20,000
SCHOLARSHIP: Karin Henshaw: Public housing transitions							20,000
Regional healthy housing stocktake							30,000
Experimental buildings							35,000
HRV performance measurements							60,000
Total:							10,476,840

Key: ■ Completed ■ Under way



Exceeding the minimum

While New Zealand buildings must meet the minimum requirements of the New Zealand Building Code, there are many benefits in building to a higher standard.

This programme promotes these benefits to consumers and industry. It helps identify opportunities to improve building performance.



What we're doing

If consumers are better informed about their options for building and the outcomes of a higher standard of design, they may choose not to settle for a minimum standard for their building.

If industry faces higher expectations, it's likely they will respond by delivering higher-performing buildings.

One way that buildings can perform better is through improving thermal performance and energy efficiency. Research carried out in this programme is helping guide the specifications to build beyond the requirements of the New Zealand Building Code.

Work under the programme so far has looked at why people choose to exceed minimum building standards set by the New Zealand Building Code. We looked at how consumers

interact with the industry and whether they're able to make an informed decision about the building performance they want.

We found that it's challenging for consumers to build beyond Code, partly due to inadequate information and a lack of confidence and trust in building professionals.

A programme review has been undertaken in 2019. Through the review process, it has become clear the issues being tackled in this programme sit with the larger overall goal of improving the performance of our building stock in general, e.g. by building better or setting higher standards.

Given the work to date, and work on related issues being undertaken in other programmes, this programme will begin to be wound down in 2020. →

Programme objectives

- › Consumers and industry understand that the New Zealand Building Code and standards are a minimum that must be met but can and should be exceeded (“where we are now and where we want to get to”).
- › The benefits of exceeding the minimum can be clearly articulated based on meaningful terms (“the limitations of what we have now and the benefits of exceeding the minimum are understood”).
- › The barriers to exceeding the minimum have been addressed (“we understand the barriers to exceeding the minimum and the enablers for change”).
- › Consumers expect and demand buildings and communities that perform to a higher standard (“we focus on breaking down barriers to exceeding the minimum and changing consumer expectations”).
- › The industry delivers buildings and communities that perform to a higher requirement in a cost-effective way (“the industry is equipped to meet consumer expectations of higher performance”).

PROGRAMME LEADER:

David Dowdell
david.dowdell@branz.co.nz

Building beyond minimum requirements: a literature review

This research will help us understand the costs and benefits of exceeding the minimum by reviewing existing studies in New Zealand and overseas.

It will look at the broad benefits and costs and how these were quantified, possible barriers to implementing or understanding beyond minimum, any assumptions and the relevance to New Zealand.

The scope for benefits and costs of exceeding the minimum include direct economic benefits such as electricity cost savings and wider social benefits such as health or environmental improvements.

Levy investment

\$30,450

Timeframe

June 2019 – September 2019

Contact

Michael Bealing,
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Lead organisation

New Zealand Institute of
Economic Research (NZIER)

Financial incentives to exceed the minimum

Internationally, there is growing interest in using financial incentives to improve housing stock. For example, the World Green Building Council’s Europe network and their partners are creating mortgages to incentivise borrowers.

These incentives include increased loan amounts and reduced interest rates for homeowners who build or buy energy-efficient houses.

This study focuses on the role the banking sector currently plays in the residential housing market. It aims to understand whether there are opportunities available to this sector to lift the standard of residential buildings in New Zealand.

Levy investment

\$64,925

Timeframe

November 2018 – September 2019

Contact

Amanda Reid,
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Lead organisation

Business and Economic
Research Ltd. (BERL)



Home performance – scope

Presenting useful data about how our houses perform can help inform choices about how we build and which homes we buy.

We know that keeping homes warm enough is important to consumers and the building industry, but it's difficult to measure performance with only fragmented information available.

This project will test the market around visible performance information and develop and assess a base set of metrics for performance. Further work will explore the practical aspects of a wider metrics set for various consumer and industry-related groups.

The long-term aim is to provide a robust way for building industry organisations, consumers and

regulatory bodies to understand the performance of new and existing New Zealand homes. This will inform consumers before they buy or build homes and provide evidence around real-world housing performance. Accessibility and understanding of home performance information could help accelerate improvement in New Zealand's housing stock.

Levy investment

\$120,000

Timeframe

April 2019 – March 2020

Contact

Roman Jaques,
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Lead organisation

BRANZ Ltd.

Measuring the extent of thermal bridging in timber-framed walls

Over-framing in exterior walls is becoming a new industry norm, with more framing being added over what was specified. Victoria University of Wellington research showed a substantial difference between wall framing ratios as specified by designers/architects and as built. Wall framing ratios were much higher than specified.

Additional wall framing reduces the space available for wall insulation. This means it's harder to keep homes warm, and they may not comply with the New Zealand Building Code.

This project aims to determine the scale of over-framing in residential buildings, the main causes for increased framing and the impact of this on thermal performance. It will undertake a case study sample of up to 40 new builds in Auckland and Christchurch. The results will inform the construction industry, building consent authorities and the building regulator about the size of the issue and associated risks.

Levy investment

\$149,350

Timeframe

March 2019 – March 2020

Contact














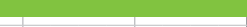
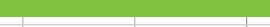










Verney Ryan,
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Lead organisation

Beacon Pathway

Progress in the *Exceeding the minimum* programme

This timeline shows all the projects that are either part of this programme or contributing to it. It shows the timing of each project and how much we're investing. If you would like to know more about this programme, please contact the programme leader directly.

Helping consumers understand and exceed the minimum	2016	2017	2018	2019	2020	2021	\$
Valuing sustainability in housing stage one	← Aug 2014 						469,000
Energy modelling methodologies	← Aug 2015 						140,000
Life-cycle analysis framework dissemination	← Sep 2015 						256,000
The choice to exceed	← Nov 2015 						145,000
When is good enough not good enough	← Nov 2015 						90,000
Which standards can be exceeded to provide benefits	← Nov 2015 						150,000
Quantifiable evidence of going beyond code	← Nov 2015 						205,000
Building to rent							180,000
Who benefits from exceeding standard							92,800
LCAQuick residential							213,000
Informed decision making on retrofitting insulation							98,500
Exceeding the minimum for volume home builders and their clients							78,540
Accurately calculating thermal performance							98,265
Tools for young people							99,880
Performance of higher-specified windows							312,000
SCHOLARSHIP: Sanjeev Ganda: LCA of thermal envelopes							20,000
Encouraging better building							120,000
Cost benefit analysis methodologies							150,000
Home performance – scope							120,000
Financial incentives							64,925
Scoping workshop – framing and thermal bridging							7,850
Measuring thermal bridging							149,350
Building beyond minimum requirements lit review							30,450
Total:							2,821,560
Key:  Completed  Under way							



Building better medium-density housing

In the currently tight housing market, medium-density housing (MDH) has emerged as a viable alternative to traditional stand-alone housing in New Zealand.

This programme aims to help the industry build high-quality and liveable medium density homes.

What we're doing

MDH can be part of the solution to New Zealand's housing crisis if it is fit for purpose and attractive to live in.

BRANZ is providing industry with the knowledge to produce high-performing MDH and encourage communities to live in it.

Over the past two years, the MDH programme has carried out research examining the technical and the social aspects of building new MDH.

Technical research included cladding performance, fire spread, airtightness and construction quality. The social component of the work has looked at liveability. This has included the development of an MDH assessment tool to guide choices made in the planning and design stages of new builds.

The consenting process was also identified as a barrier to delivering MDH, and BRANZ has shared Insights with local and central government based on research in this area. Other research in the programme has shown that industry must upskill the existing workforce if it is to deliver the MDH New Zealand needs. It has also highlighted the opportunity to leverage off

knowledge gained by those who have successfully built good-quality MDH so others can improve what they do.

The programme is also working to better understand how residents and communities interact with MDH. This includes looking at the performance of MDH new builds from the consumer perspective through post-occupancy evaluations.

BRANZ's research and findings are available on the MDH online hub www.mdh.org.nz.

A programme review has been undertaken in 2019. This has identified that there is an ongoing need for technical information related to new building typologies like MDH. The review also confirmed that solutions for these can be addressed through specific projects rather than maintaining a programme of work in this area. This programme will begin to be wound down in 2020. →

Programme objectives

- › The building industry has the technical information it needs to design and build quality, affordable and desirable medium-density housing.
- › The building industry has the skills needed to design and build quality, affordable and desirable medium-density housing.
- › Medium-density residential buildings are maintained to sustain long-term performance.
- › Everyone has a shared understanding of how to ease medium-density housing through the building and consents process.
- › Communities increasingly accept the reality and appreciate the benefits of medium-density housing.

PROGRAMME LEADER:

Anne Duncan
anne.duncan@branz.co.nz



MDH for people and communities

As more MDH is built, it's increasingly important that thought and planning goes into the social and community aspects of new homes. This is important both for the people who live in them and the local communities that will be affected by an influx of new neighbours.

Poorly planned MDH development can deter people from choosing this housing option to buy or rent. This is shown in the New Zealand Housing Preferences Survey, which looks at attitudes towards MDH. This project will produce technical evidence and guidance about how MDH can be better planned and

delivered so it strengthens communities. The research will help ensure that MDH remains a viable housing choice for the New Zealand market.

Levy investment
\$200,000

Timeframe
November 2018 – April 2020

Contact
Anne Duncan,
anne.duncan@branz.co.nz

Lead organisation
BRANZ Ltd.

Building and maintaining MDH for long-term performance

Research into maintenance and common repair issues shows MDH is not being as well maintained as it needs to be. Some maintenance is not happening or seen as important to the buildings' whole-of-life value.

This project investigates the advantages of a whole-of-life approach to MDH maintenance. It will consider what maintenance needs to look like when considering the life of a building, not just over the short term. It will also look at how we can build MDH so it's easier to maintain throughout the building's life.

The evidence-based advice produced will support the construction industry to design and build MDH to allow more effective long-term maintenance. This will support better long-term performance of MDH homes in New Zealand.

Levy investment

\$225,000

Timeframe

November 2018 – April 2021

Contact

Anne Duncan,
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Lead organisation

BRANZ Ltd.



MDH post-occupancy evaluations

A post-occupancy evaluation (POE) engages with occupiers about their experience of living or working in a building and then helps address any issues that are identified.

This project will undertake POEs of a sample of new MDH buildings around New Zealand to see if they are performing as designed. The work will also identify what remediation can be undertaken to address any issues. This evidence will provide guidance to the industry and help improve the quality of MDH construction in New Zealand.

Levy investment

\$200,000

Timeframe

December 2018 – April 2021

Contact

Anne Duncan,
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Lead organisation

BRANZ Ltd.

Progress in the *Building better medium-density housing* programme

This timeline shows all the projects that are either part of this programme or contributing to it. It shows the timing of each project and how much we're investing. If you would like to know more about this programme, please contact the programme leader directly.

Embracing medium density housing (MDH)	2016	2017	2018	2019	2020	2021	\$
MDH demand side market analysis	← Oct 2015						140,000
MDH supply side market analysis	← Nov 2015						150,000
MDH information resource							110,000
Defining medium-density housing							180,000
MDH construction quality survey							200,000
MDH liveability							250,000
Fire and MDH							409,000
MDH skills							250,000
Leveraging MDH experts' knowledge							150,000
MDH: Who has the ability to deliver							190,000
MDH flooring: scoping							50,000
Industry perspectives on MDH consenting issues							86,990
Understanding resource consents in NZ							92,190
Industry-identified technical issues facing MDH							162,000
MDH community acceptance							320,000
MDH for people and communities							200,000
MDH post-occupancy evaluations							200,000
Building and maintaining MDH for long term performance							225,000
MDH future buyers and renters							65,000
Residents' perspectives on maintaining MDH							120,000
Community acceptance of MDH							320,000
Total:							3,870,180

Key: ■ Completed ■ Under way



Eliminating quality issues

It's critical to eliminate poor-quality practices and materials in construction as part of creating a better building system.

This programme aims to help industry understand how to change its practices to eliminate common quality issues in building.

What we're doing

BRANZ has been working with industry to address poor construction quality and support changes in building practice.

However, the issue is complex with many causes. We found there are four main barriers to industry changing the way it does things:

1. Cost – investing time and money can be a deterrent to undertaking change.
2. Education and skill levels – workers in the industry need to understand the changes and have the skills to implement them.
3. Regulation – the current regulatory environment has played a role in a risk-averse industry, which typically will not use or adopt unfamiliar ways of doing things.
4. Social inertia – it is in our nature as people and societies to resist change, even when there is a clear benefit.

This year, the programme is investigating the cost of rework and defects on the new-build housing sector and the economy as a whole. This will show the size of the issue and help us develop solutions.

We are also currently investigating why weathertightness issues persist in the industry to help us solve quality issues in the future.

A programme review has been undertaken in 2019. This has identified that there is an ongoing need for this programme with a shift in emphasis towards helping solve quality issues. Work in 2020 will re-scope the programme with a focus on helping the industry with the means to prevent quality issues e.g. through training and adoption of appropriate tools and new technology.

Programme objectives

The building industry:

- › has identified common quality issues that occur in construction
- › understands why some previous work to solve common quality issues has not been successful
- › understands the need to change its practices
- › has determined the best way to reduce the incidence of common quality issues
- › has eliminated common quality issues by using existing knowledge
- › has eliminated quality issues by designing new solutions.

PROGRAMME LEADER:

Matthew Curtis
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The economic cost of quality defects

If there were no quality issues in building New Zealand homes, how much money would we save? We know that defects cost us as a country, but the economic costs and benefits have never been formally calculated.

This project aims to fill that information gap. This is needed to underpin policies, approaches and investments seeking to address the issue.

This project will estimate what issues related to poor quality in New Zealand homes actually cost and the benefits of eliminating them. This includes direct costs to the construction industry, indirect effects on productivity and the housing supply and the estimated opportunity cost of rework. It will show the potential for improvements in construction productivity. It could have significant value for industry business cases or regulatory interventions.

Levy investment
\$96,370

Timeframe
November 2018 – November 2019

Contact
Michael Bealing,
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Lead organisation
New Zealand Institute of Economic Research (NZIER).

Progress in the *Eliminating quality issues* programme

This timeline shows all the projects that are either part of this programme or contributing to it. It shows the timing of each project and how much we're investing. If you would like to know more about this programme, please contact the programme leader directly.

Eliminating quality issues	2016	2017	2018	2019	2020	2021	\$
What is quality in buildings							140,000
Evidencing quality issues – what can industry data tell us							54,150
Prioritising quality							150,000
Adopting new ways							130,000
Clerk of Works costs and benefits							55,000
Measuring sustainability							155,500
Knowing enough to ask							200,000
Measuring new-build quality							170,000
Persistence of weathertight issues							150,000
Procurement							230,000
SCHOLARSHIP: Kimberley Russell: Identifying BIM procurement							20,000
FM industry census							-
Economic cost of quality defects							96,370
Total:							2,020,020
Key: Completed Under way							



Nigel Kell, Senior Technician Materials at BRANZ looks for damage on the surface of a sample after testing.

Other research **investments**

BRANZ invests in diverse range of research outside of the research programmes.

These can be stand-alone research projects, scholarships or strategic initiatives.



Stand-alone research

BRANZ invests more than \$4 million of the Building Research Levy in stand-alone research projects.

These are targeted at priorities from the Levy Investment Portfolio Statement.

A full list of all stand-alone projects under way in 2019/20, including those continuing from previous years, is shown on page 54.



ArchEngBuild 2019

Each year, ArchEngBuild brings together 30 of the country's best architecture, engineering and construction management students to work together on a design challenge.

Each team has a student from each discipline working together, and teams compete to deliver a real-life client brief for the host city. Students are encouraged to use the latest building materials, innovations and technology in their designs. Often the ideas that are explored provide inspiration for industry professionals.

In 2019, the brief was to facilitate a zero-carbon city through buildings with a low environmental impact and promote zero-carbon building, design and use.

This is a unique investment in the talent of New Zealand's future industry leaders and in fostering collaboration between different sectors of the building industry.

Levy investment

\$98,000

Timeframe

January 2019 – July 2019

Contact

archengbuild@branz.org.nz

Lead organisation

Concrete NZ

B-RISK continuous integration

B-RISK is a software application developed at BRANZ for analysing fire safety and smoke spread in buildings.

B-RISK provides practising engineers with the tools to support innovative fire design of buildings. It's commonly used to show building compliance with New Zealand Building Code Verification Method C/VM2 *Framework for fire safety design*.

This project allows a process of continuous software integration. This will keep the application up to date and accurate so it can continue to support the construction of more cost-effective, sustainable and safer buildings in New Zealand.

Levy investment

\$77,000

Timeframe

May 2019 – March 2020

Contact

Kaiyuan Li,
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Lead organisation

BRANZ Ltd.



Compliance and assurance prototypes for manufactured buildings

Using prefabricated products may be a way to meet New Zealand's demand for more homes. However, buildings manufactured this way must also meet quality and affordability requirements.

New Zealand is increasingly exploring greater use of manufacturing in construction. The sector needs a robust and supportive regulatory environment for alternative building solutions to ensure manufactured buildings are fit for purpose.

This project looks at how successful compliance and assurance practice from other countries can be

transferred to New Zealand and used for manufactured buildings. It also looks at best practice from the manufacturing industry to examine the compliance and assurance approaches used.

Levy investment

\$50,000

Timeframe

September 2018 – August 2019

Contact

Alice Chang-Richards,
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Lead organisation

University of Auckland



Chip off the NEW block: How to use blockchain in the construction sector

There is a lot of hype around blockchain, a technology that uses a decentralised database shared across a network of computers to record transactions.

In many sectors including shipping, law, the arts and finance, entrepreneurs, scholars and researchers are looking at blockchain's implications and exploring where and how it might be applied. Early adopters like shipping company Maersk are demonstrating how it can streamline complex business processes.

How can blockchain help construction? An industry must first understand a new technology before it can make informed decisions about where it can add value. This is the first challenge of blockchain – understanding what it is and what it can do for the industry.

In this project, researchers will work with construction industry stakeholders to understand blockchain and its potential, identifying if and where it can be applied to the industry.

Levy investment

\$181,490

Timeframe

September 2018 – October 2020

Contact

Dermott McMeel,
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Lead organisation

University of Auckland

Fire performance of precast floors

Many seismic improvement measures have been introduced to hollowcore floor designs since 2006 because of serious concerns about their performance in earthquakes. However, there has been little consideration of the impact of these changes on fire performance.

This project will scope the studies and investigations needed to address concerns raised about the fire performance of precast hollowcore floors in new builds. It will also ensure that the future seismic retrofit solutions of hollowcore floors in existing buildings won't compromise fire performance of the buildings.

This research provides a framework to address the fire performance of hollowcore floors. It complements the national seismic research programme ReCast: Seismic assessment and improvement of existing precast concrete floors (see page 45).

The research projects likely to arise from this scoping project will provide fire rating information of current precast floors to be used in fire engineering designs. Verification methods for the effect of the proposed seismic retrofit solutions on fire performance of precast concrete floors can be made available for fire engineers to use. Ultimately, the project will help prevent fire performance being compromised by the seismic improvement and help save lives and fire compliance costs in future.

Levy investment

\$37,000

Timeframe

May 2019 – December 2019

Contact

Angela Liu,
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Lead organisation

BRANZ Ltd.



Identifying the trends: working towards suicide prevention for the construction industry workforce

The New Zealand construction industry has the highest numbers of suicides of any industry in the country.

The recent BRANZ Study Report SR411 *Mental health in the construction industry* highlighted that better understanding of the high number of suicides is both urgent and important. The high rate of suicide in the Australian construction industry has been well recognised for over a decade, and research has helped to inform prevention programmes.

To help the industry begin to understand suicide in the context of New Zealand’s construction workforce, this research undertook a systematic content analysis of coroners’ closed case files to establish demographic and social trends.

The results support the view that there are many factors that contribute to suicide risk for construction industry workers. It provides some new details about these factors, especially work-related ones.

The technical research report ER40 *Suicide in New Zealand’s construction industry workforce: Factors identified in coronial reports* provides evidence-based details that can be used to inform suicide prevention and mental health education initiatives. It also offers baseline information to support future efforts to measure progress.

Levy investment
\$100,000

Timeframe
September 2018 – May 2019

Contact
Christopher Stachowski,
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Lead organisation
Site Safe NZ



Industry knowledge of building assembly fire performance evaluation

Seeing and understanding how fire behaves in building spaces is essential for both fire and building industry professionals, but many have never seen a fire test.

Implementing passive fire protection in New Zealand buildings – whether through compartmentalising buildings or preventing surface fire spread – has become a major issue recently. There is often no link from as-built construction back to a tested solution, and the effects on fire risk are unknown.

This project will develop and deliver a multi-stream course for fire engineers, fire engineering technicians, and building industry participants. It will bring them to BRANZ to observe real fire tests in a controlled environment. It will equip them with knowledge about what fire tests can show us and how to apply the results properly in the real world.

By improving building industry knowledge of fire testing and assessment, we can encourage a shift to building construction that has been properly tested or assessed instead of having questionable fire performance. The shared learnings will improve confidence around how buildings will perform in a fire and ultimately result in better passive fire protection outcomes for New Zealand buildings.

Levy investment

\$150,000

Timeframe

May 2019 – March 2021

Contact

Kevin Frank,
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Lead organisation

BRANZ Ltd.

Multi-storey light timber-framed buildings: architectural design

There is currently a lack of published information in New Zealand on the design of light timber-framed construction that goes beyond 2.5 storeys and is outside the scope of NZS 3604:2011 *Timber-framed buildings*.

This New Zealand-specific resource provides guidance to architects and designers on how to develop resilient Building Code-compliant designs for light timber-framed structures up to six storeys. It will be a companion publication to the engineering guide *Multi-storey light timber-framed buildings in New Zealand – engineering design*, due to be released in 2019.

The guide for architects and designers will focus on the challenges of designing and detailing this particular building typology and will support the appropriate and increased use of multi-storey light timber-framed buildings in New Zealand construction.

Levy investment

\$40,000

Timeframe

April 2019 – March 2020

Contact

Jonquil Brooks,
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Lead organisation

BRANZ Ltd.

ReCast: Seismic assessment and improvement of existing precast concrete floors

Buildings with precast floors comprise a large percentage of the commercial building stock in all New Zealand cities, with a significant proportion of commercial floor area in major centres being in this category.

New Zealand's use of precast floors in regions of high seismicity is unusual worldwide, so there's little international research about how these floors would perform in an earthquake. This is "New Zealand's problem", highlighted by failures seen in Statistics House after the Kaikōura earthquake in 2016. If measures are not taken to address known performance deficiencies, we could face the issue of multiple floor collapses during any earthquakes generated by the Wellington fault or Hikurangi subduction zone.

This research will develop a New Zealand Inc. approach to the problem, form a coalition of researchers and engineering practitioners to develop solutions and provide clear and frequent communication to the building industry. It builds on previous work

led by MBIE and a working group that drafted guidance for engineers to use in the short term: *The seismic assessment of existing buildings – technical guidelines for engineering assessments* (July 2017).

Engineers now need direction on retrofit approaches to address vulnerable buildings. There are also unanswered questions about assessing precast floors, and further research will help implement the guidelines. The working group has developed a list of research issues that need to be addressed to more fully inform the guidance and provide retrofit solutions in the medium term.

Levy investment

\$1,053,161

Timeframe

September 2018 – October 2021

Contact

Ken Elwood,
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Lead organisation

University of Auckland

Scoping research requirements for engineered wood products

The past two decades have seen a significant global increase in the use of timber products within the built environment.

Most of this increase is attributable to engineered wood products (EWPs), from large-scale structural elements through to non-structural and decorative components used on the interior and exterior of buildings. New Zealand has an urgent need to supply new housing stock, with clear signals for significantly increased use of EWPs.

This scoping project gathers information about EWP use across the building landscape, from acceptance and design through to delivery. It is assessing both the current and future growth of EWP use in New Zealand housing and identifies where research is needed to support this increased use.

Levy investment

\$120,000

Timeframe

August 2018 – October 2019

Contact

David Carradine,
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Lead organisation

BRANZ Ltd.



Timber design guides

Timber is a go-to product for many environmentally conscious developers of mid-rise buildings in North America and Europe.

New engineered wood products and systems are being developed and are on a rapid growth path. In New Zealand, the recent trend towards multi-residential units and opportunities to build faster with timber are encouraging the use of New Zealand-grown and made timber products. Without supporting information, buildings are likely to be built in the same way with the same results, missing opportunities to make the most of the new technology. Design guides help share consistent information, providing solutions and advice for the industry to adopt and build on.

This project is a cross-industry collaboration to provide a suite of new and updated design guides for developers, engineers, architects, quantity surveyors, building consent officials and other professionals to enable engineered wood products to be used effectively.

The guides will meet New Zealand Building Code requirements and industry-approved practices.

These NZ Wood design guides will facilitate the specification and construction of wooden buildings that lie outside the scope of NZS 3604:2011 *Timber-framed buildings* and improve the speed and efficiency of building multi-residential apartments.

Levy investment

\$100,000

Timeframe

December 2018 – December 2019

Contact

Jeff Parker,
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Lead organisation

Wood Processors and
Manufacturers Association
(WPMA)



Toxicity of combustible building materials in fires – scope

Inhalation of toxic smoke is a primary cause of death and injury in building fires, yet it is not well understood how building materials contribute to fire toxicity in New Zealand.

The New Zealand Building Code stipulates a maximum carbon monoxide level that building occupants can be exposed to during fire evacuation. This is intended as a practical simplification of the risk of toxic injury and does not include many other toxic products resulting from burning contents and building materials that present a risk to occupants and emergency services. As a result, the risk posed by combustion products may not be completely described or adequately controlled.

This scoping study will review international data and research on

the toxicity of common building materials to understand how they contribute to the toxicity risk in building fires. The research aims to establish to what extent this is an issue in New Zealand and to identify areas where further work may be needed to reflect New Zealand’s built environment. This research will support a greater understanding of how different materials contribute to overall toxicity during building fires.

Levy investment
\$101,000

Timeframe
April 2019 – November 2019

Contact
Anna Walsh,
anna.walsh@branz.co.nz

Lead organisation
BRANZ Ltd.

Upgrading durability verification database – scope

BRANZ maintains a limited database of durability testing methodologies and commonly used materials performance data from commercial tests.

The database does not currently capture BRANZ’s wider pool of durability data and knowledge, and there is a need to develop a more inclusive, readily accessible BRANZ-wide materials database.

This scoping project aims to identify the resources and solutions needed to expand the capacity and optimise the utility of the current database. This could significantly enhance our capability to capture, integrate and process BRANZ-wide materials and related data for use in research, testing and other applications.

With the upgraded database, we will be able to identify and package complementary materials data to provide external stakeholders with more comprehensive information about materials performance. One example of the potential impact is robust durability assessment data on new or innovative materials that can inform the New Zealand Building Code and Standards.

Levy investment
\$50,000

Timeframe
April 2019 – March 2020

Contact
Zhengwei Li,
zhengwei.li@branz.co.nz

Lead organisation
BRANZ Ltd.



Scholarships



Beth Noble



Jack Steele



Louise Bullen

Each year, funding is made available for outstanding postgraduate scholars in New Zealand tertiary institutions.

The scholarship programme brings diversity to BRANZ's portfolio of investments, supports future research and strengthens our relationships with tertiary education providers. The scholars undertake research which brings new findings and perspectives to the building and construction industry.

Scholars with excellent academic credentials and early-stage researchers pursuing innovative projects can apply for scholarships of up to \$25,000 a year. Master's scholarships are usually for one year projects, and PhD scholarships are for three years.

Beth Noble: Artificial lighting systems that meet the needs of autism spectrum

Beth's research builds on her master's thesis, which showed **artificial lighting was a significant cause of discomfort, distress and avoidance in people on the autism spectrum.**

She is now looking at why this has a greater effect on people on the autism spectrum. What is it about artificial light that causes the negative effects – colour spectrum, brightness, directionality?

She aims to understand the implications of how lighting is designed in the built environment, particularly the shift towards LED lighting, which has a different set of parameters to fluorescent. She will also look at how lighting systems can be designed to be more accessible to people on the autism spectrum.

Timeframe

To be completed by October 2021

Contact

research@branz.org.nz

Tertiary institute

Victoria University of Wellington

Jack Steele: Reliable early-stage simulation of computer-aided design (CAD) models

Jack has set his sights on producing a user-friendly tool that makes it easy for industry professionals to do environmental assessments of their designs.

Jack's project will create an advanced simulation programme that will link computer-aided design (CAD) models with building energy models so that users don't have to learn or make individual models for every new design.

The result will be a tool that designers and the industry can use to look at environmental factors such as energy consumption, lighting levels, temperature and air quality in medium-density housing (MDH) design and construction. By showing the designer the benefits that small alterations can contribute to energy consumption and building running costs, these alterations are more likely to be made throughout the development process.

This will help industry professionals have a conversation with clients about the benefit of exceeding minimum New Zealand Building Code requirements and ultimately improve MDH performance in New Zealand.

Timeframe

To be completed by February 2020

Contact

research@branz.org.nz

Tertiary institute

Victoria University of Wellington

Karin Henshaw: Relationship between public housing transitions and long-term outcomes for public housing tenants

Karin's research looks at what happens to tenants who repeatedly move in and out of Housing New Zealand tenancies.

She aims to understand the drivers, associated outcomes and longer-term health, employment and social functioning effects of repeated transitions within public housing.

Karin will examine how New Zealand's public housing system can affect long-term adult tenant health and employment and long-term child tenant social functioning. Her research is connected to other He Kainga Oranga work on the impact of buildings on society. In this work, public housing is part of a wider focus covering housing provision, security of tenure and mixed-tenure communities.

Timeframe

To be completed by October 2020

Contact

research@branz.org.nz

Tertiary institute

University of Otago

Louise Bullen: Future life cycle-based environmental impacts of New Zealand's grid electricity

Buildings use a significant amount of energy during their lifetimes, mostly from grid-supplied electricity.

Establishing the environmental impacts of this electricity use as accurately as possible into the future will support more accurate evaluation of the whole life cycle impacts of buildings.

Louise is researching grid electricity models used to calculate future greenhouse gas emissions and other environmental impacts. As New Zealand moves towards a net zero carbon economy, understanding how consumption affects carbon intensity will support improved energy efficiency and low-carbon construction of buildings.

Her research has particular significance given potential greenhouse gas trade-offs between energy efficiency improvements for buildings and changed future electricity mixes. It can support modelling of future electricity demand and related environmental impacts and provide insights into the environmental footprint of New Zealand's electricity grid infrastructure.

Timeframe

To be completed by May 2020

Contact

research@branz.org.nz

Tertiary institute

Massey University



Strategic initiatives

Strategic initiatives supported by the Building Research Levy this year include industry transformation and further development of Artisan, a digital solution that helps Councils and build teams work together more effectively.

BRANZ's strategic investments have ambitious goals and aim to have long-term, positive and far-reaching outcomes.

Industry transformation

BRANZ has championed the need for industry transformation through a suite of activities launched in August 2017.

This work has included introducing the industry to the system change work of the World Economic Forum and adapting the international Industry Transformation Agenda for the New Zealand context.

Supporting this campaign, BRANZ has hosted and sponsored a series of Leadership conversations and discussions for industry players wanting to support and drive transformative change. The programme has also undertaken workshops analysing root causes of pain that bedevil the building and construction industry sector, such as behaviours around managing risk.

A long-term ambition of the BRANZ transformation work is to build a system-wide understanding of industry performance, and the levers for transformation change that can be driven by industry players.

The introduction of the **Construction Sector Accord** in 2019 has been a critical milestone in the goal to foster a climate that supports transformative change across the industry. The Accord marks an overt and visible shared commitment between government and industry to transform the sector in New Zealand. BRANZ's work will continue to support and strengthen the Accord's purpose and goals.

Artisan

Artisan is a quality assurance tool BRANZ has developed as an industry transformation initiative to support Councils and build teams to deliver better residential build outcomes.

The state-of-the-art app tools up builders to photograph and record the build process each step of the way. The app captures the workflow format that matches the process used by building consent authorities (BCAs). The resulting record provides the evidence required for many elements of the consent process which builders can inspect, capture and submit online.



Prime Minister Jacinda Ardern and Ministers Jenny Salea and Phil Twyford with construction industry representatives at the launch of the Construction Sector Accord.

The BCAs can then either approve the work or send back advice on how to reach the required standard and reduce the number of on-site inspections required.

Site testing of the app, partnership with the Auckland Council this year, is demonstrating that builders are growing their own knowledge of **New Zealand Building Code** compliance, inspecting their work more closely and engaging more collaboratively in the consent process. This is delivering better quality outcomes on residential build sites.

Councils now using the app have found that they can approve building consents more efficiently as fewer onsite inspections are required. This reduces health and safety risks, travel costs and travel time.

Artisan ensures there are quality permanent records for each building. Over time, these will provide a source of valuable data that can be used to study long-term building performance in New Zealand.



Investment details

This section details all the stand-alone projects under way in 2019/20, including those that are ending and those just getting started.



Stand-alone projects under way in 2019/20

The timeline overleaf presents the individual research projects in progress in the 2019/20 year.

It shows the timing of each project and how much we're investing across a diverse range of areas.

Details for projects described in this document are correct at time of publication, but may be subject to change.

Work completed in previous years can be found in previous issues of Levy in Action. If you would like to know more about any project listed here, we welcome your interest and invite you to email: research@branz.org.nz or speak to our programme leaders directly.

Stand-alone projects under way in 2019/20	2016	2017	2018	2019	2020	2021	\$
Specific design of light timber framed housing	←Dec 2008						620,000
SCHOLARSHIP: Audsley Jones: Design and behaviour of buckling restraining braces	←Feb 2013						75,000
Materials testing methodologies	←Apr 2013						1,478,000
SCHOLARSHIP: Julia Thompson: Natural ventilation for large audience spaces	←Jan 2015						75,000
Positional material deterioration over building envelope	←Apr 2015						540,000
Structural adhesives	←Apr 2015						1,005,000
Durability evaluation framework for innovative materials							570,000
Residential water use							656,468
Monitoring industry performance							180,000
New house owners satisfaction survey							250,000
Corrosion in the Bay of Plenty environment						Sep 2024→	665,000
Preparing the foundation for risk-informed fire safety design							270,000
Towards durable timber structures							400,000
SCHOLARSHIP: Dan Court-Patience: Connections in buckling restraining braces							70,000
SCHOLARSHIP: Vicky Southworth: Stormwater management and water-sensitive urban design							20,000
SCHOLARSHIP: Rochelle Ade: Performance of homestar-rated homes							75,000
BIM initiative 2019/20							600,000
Performance and effectiveness of smoke management							125,560
Building a team with He Kainga Oranga							580,000
SCHOLARSHIP: Mikayla Heesterman: Robotic connections							20,000
SCHOLARSHIP: Emily Newmarch: Performance of thermal envelopes							20,000
Precast floors							635,000
House conditions survey							1,302,500
ROBUST building system testing							50,000
SCHOLARSHIP: Jono MacIntyre: Predicting structural fire security – an update							75,000
SCHOLARSHIP: Andrew Walmsley: Men's health and suicide prevention							75,000
Building basics – Weathertightness second edition							25,000

Stand-alone projects under way in 2019/20	2016	2017	2018	2019	2020	2021	\$
Regional waste minimisation							175,000
SCHOLARSHIP: Nicole Allen: Multi-volcanic hazard impact assessment for residential buildings in Auckland							75,000
SCHOLARSHIP: Armano Papageorge: Semi-autonomous off-site construction							75,000
SCHOLARSHIP: Gerard Finch: Defab – prefabricated architecture for a circular materials economy							82,000
Identifying the trends – working towards suicide prevention for the construction industry							100,000
Compliance and assurance prototypes for manufactured buildings							50,000
Applying blockchain to product compliance and assurance							178,875
Scoping research requirements for engineered wood products							120,000
Foundations on sloping sites							60,000
Risk management strategies							191,000
ReCast floors						Oct 2021+	1,053,161
Timber design guides							100,000
Building industry insights from 2018 Census							100,000
SCHOLARSHIP: Beth Noble: Artificial lighting systems that meet the needs of autism spectrum						Oct 2021+	75,000
ArchEngBuild 2019							98,000
Toxicity of combustible building materials in fires – scoping study							101,000
Upgrading durability verification database – scoping							50,000
SCHOLARSHIP: Jack Steele: Reliable early stage simulation of CAD models							20,000
Fire performance of pre-cast floors							37,000
B-RISK continuous integration							75,000
Multi-storey light timber-framed buildings: Architectural design							40,000
Industry knowledge of building assembly fire performance evaluation							150,000
Plumbing and drainage guide							50,000
Chip off the NEW block: Blockchain in the construction sector							181,490

Total: 13,695,054

Key: Completed Under way







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