BRANZ is the New Zealand building industry’s centre of science and innovation.

Our research helps to make buildings healthier, safer, more durable, and more sustainable, and contributes to the success of the building and construction industry.
BRANZ has always had a pivotal role to play in ensuring that the codes and standards that our industry operates within will deliver the built environment that they set out to achieve. In research terms, this means understanding the technical basis for the required performance levels (regulations), and ensuring that the industry has the tools to deliver buildings which meet them (standards, technical advice, reference material).

As a research organisation, BRANZ has a responsibility to support the future development of the industry by ensuring that the (necessary) long-term research view distils into work that assists the industry to cope with “what comes next”, such as sustainability and materials durability (now linked via life-cycle analysis) and, more recently, indoor environmental quality and moisture. Ultimately much of the work done with this future focus in mind supports new industry practices and may eventually be picked up in codes, standards or industry practices. BRANZ’s primary role is to gather the facts that the industry needs to take those next steps.

The research presented in this summary document has been grouped according to the two themes described above, to give the appropriate context and intent. The work presented here is being undertaken by BRANZ itself, with both Building Research Levy and other funding sources, notably the Foundation for Research Science and Technology and the Department of Building and Housing. In other words, work funded by the Building Research Levy in other institutions is not presented here (please refer to BRANZ GROUP Annual Review 2008).

The Building Research Advisory Council is pleased to support this research programme, and will be taking an active role in coming years to ensure that it remains relevant and delivers to meet industry needs, both in content and timeliness.

Greg Boyden
Chairman

BRANZ is the New Zealand Building and Construction Industry’s primary funder and supplier of research and information. The results delivered by BRANZ for the last 40 years have been aimed at moving the industry and its customers forward. This year’s Research Programme summary shows that the strong industry focus remains.
SUPPORTING INDUSTRY EFFICIENCY VIA CODES AND STANDARDS

BRANZ staff currently sit on 25 standards committees, industry advisory groups, or NZ Building Code review subcommittees. The direct investment from the Building Research Levy in supporting this level of attendance by BRANZ staff is around of $300,000 for the 2008-09 year1.

The research activities below which provide the new knowledge that feeds into the codes and standards process is supported by another $2.5 million of investment predominantly from the Building Research Levy and the Foundation for Research Science and Technology.

Software tool for risk informed fire design

BRANZ and the University of Canterbury are working together to develop a software tool which will allow designers and fire engineers to simulate fire outcomes such as spread of fire and smoke, and analyse the probability of each outcome. Designers and building officials will be able to use the tool to ensure that buildings meet Building Code fire performance criteria.

Funders:
Foundation for Research Science and Technology; Building Research Levy; Department of Building and Housing.

Completion date:
June 2012.

Guidance on the use of fire zone models

BRANZ is developing guidelines on use of the BRANZFIRE fire zone model for predicting spread of smoke. The model is based on experimental results and physics-based equations, and its scope and limitations are not always well understood. The guidelines will help fire engineers to ensure they are using the model appropriately.

Funder:
Building Research Levy.

Completion date:
September 2008.

Roof venting effectiveness under fire conditions

BRANZ is researching the use of roof venting to remove smoke and heat from a building during fire. In particular, we are developing methods to test the effectiveness of plastic roof venting materials, and using computer models to assess the effectiveness of roof venting on fires.

Funder:
Building Research Levy.

Completion date:
November 2008.

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1 BRANZ also funds experts from outside of BRANZ to provide support to codes and standards committees – the figure given does not include these costs.
This research is working towards an outcome of “New Zealand buildings adopting water managed envelope designs to mitigate leaking buildings problems”. It is developing the science necessary to support the development of innovative and cost effective wall designs for New Zealand. The experimental part of the programme has measured moisture recovery rates in 24 walls and compared the effectiveness of several water management tactics. This has provided a much better understanding of the physics of the moisture removal and the role played by cavity design and material selections. The programme is now in a position to generalise these experimental results to other centres in New Zealand using a computer based model of moisture movement in buildings. This makes a significant contribution to the net review of the Building Code and Standards relating to weathertight buildings.

Ventilation is known to move air and moisture around in walls and this programme has made major advances in its understanding. The tracer gas method developed early in the programme has been used to measure ventilation in a wide range of construction cavities that include the trim cavities around windows and all of the main types of water managed cavities behind wall claddings. The weathertightness project can now progress to the modelling phase with confidence that air carried moisture effects are modelled along with liquid and vapour transport in materials.

The experimental part of the programme has changed some views on how cavities work. In particular, the importance of a non-absorbent drainage path on the back of the cladding has been strengthened by results that show free draining walls recovering much quicker from a water leak than those with absorbent claddings. Another important result emphasises the role of cavities in preventing water bridging across to the framing and insulation. Water trapped in these areas has been found to dry slowly at rates that depend more on the properties of timber than the design of the wall. This result shifts the focus of water managed cavities back to coping with water on the back of the cladding and preventing water from bridging across into the insulated areas.

Decay rates caused by brown rot in 5 timber species (heart and sap) and with three treatment options (untreated, LOSP and boron) have been measured by researchers at SCION. After two years there was severe decay in the untreated radiata pine and in the untreated sapwood of the other species. Decay was established in the untreated heartwood of Douglas fir and larch but only isolated minor spots were present on the macrocarpa and Lawson cypress. Boron treated samples were free from decay. There were isolated decay pockets at the joints in LOSP treated Lawson cypress and macrocarpa sapwood. This comprehensive decay rate comparison is helping the industry to understand the effectiveness of different treatment options for framing.

Flashing tapes and wall wraps play an important part in water management in walls and must be durable and free from any incompatibility problems with other materials. Research results are showing that there should be no concern about incompatibility with timber treatment chemicals and that the products available resist UV radiation during the construction phase of building. The final phases of this work will investigate the role that wall wraps play in preventing corrosion of fasteners and other metal components by helping to manage condensation in cool areas in walls.
Pre-committee review of NZS 3604 – SR0929

BRANZ is kick-starting the process of updating NZS3604 for the first time since 1999. We are assessing the Standard, incorporating technical and regulatory changes since 1999, and developing suggestions and recommendations for a Standards New Zealand review committee to consider.

Funder: Building Research Levy.
Completion date: December 2008.

Performance-based earthquake engineering – SR0911

BRANZ is contributing to a GNS Science project aimed at improving seismic performance of non-structural components in buildings. One of the benefits of this work is that it will help businesses resume operations more quickly after earthquakes, reducing economic losses.

Funder: Foundation for Research, Science and Technology.
Completion date: June 2009.

Indoor environments – BRANZIAQ

BRANZ is researching the behaviour of indoor air pollutants (such as formaldehyde, combustion products, dust mite allergens and mould spores) and developing a tool (called BRANZIAQ) to model the impact of dehumidifiers and ventilation systems on these pollutants. This work will contribute to healthier indoor environments.

This project is being carried out in collaboration with AgResearch and the University of Otago.

Funder: Foundation for Research, Science and Technology; Building Research Levy.
Completion date: October 2009.

Multi-function timber joints

BRANZ is working on development of wall-to-floor joint systems for use in timber-framed multi-storey buildings. This work, which includes acoustic, fire and structural testing and economic analysis of various options, will be published in a BRANZ design guide.

Funder: Building Research Levy.
Completion date: September 2009.

Ferritic stainless steel fasteners

BRANZ is also investigating the corrosion performance of ‘ferritic’ stainless steels (i.e. steels that don’t contain nickel or molybdenum, alloying elements which are falling out of favour because of rising prices). Though these steels are being sold in New Zealand, there is little research available on their corrosion resistance. This project will help to determine how durable they will be in New Zealand atmospheric conditions.

Funder: Building Research Levy.
Completion date: Early 2009 (preliminary results).

Moisture management in parapet walls

The purpose of this research is to gain confidence in the weathertight performance of open rainscreen wall designs used in barrier clad parapet walls.

Rotting in parapet walls is thought to be caused by the fact that the parapet is at a cooler temperature than the main body of the wall. A 6.5 m x 3.4 m parapet wall has been built, incorporating three different water management strategies. Each area is dosed with 35 ml of water each day and the condition of each wall is monitored.

The results of the study should allow further detail to be included into E2/AS1, giving confidence in selecting the water management strategy required to ensure a weathertight parapet. Completion is expected in July 2009.

Funder: Building Research Levy.
Completion date: July 2009.

Drainage plane systems

This research is investigating the use of drainage plane systems as alternatives to conventional direct-fixed and rainscreen wall systems. Before any of these products can be incorporated into the Building Code there are a number of questions that need to be answered.

A series of walls has been placed in the experimental building at BRANZ. The key things being investigated are the drying rates and ventilation characteristics that the different products offer.

The results should eventually be integrated into E2/AS1, and it is also planned that training courses will be available to designers to inform them about these possible new options for water-managed wall systems.

Funder: Building Research Levy.
Completion date: March 2012.
Materials and construction methods continue to evolve. The empirical knowledge derived from traditional building practice is often insufficient for predicting durability problems with emerging materials and construction techniques. Consequently, the capability for robust durability assessment of new products and techniques is an essential platform for supporting an innovative, dynamic building industry.

The Building Code is primarily performance-based: only for a few classes of materials, such as timber and concrete, do prescriptive ‘deemed-to-satisfy’ solutions exist. For other situations, the Verification Method for the B2 Durability Clause offers only the advice that suitable durability performance may be demonstrated through laboratory testing, a documented history of use, or by analogy with the behaviour of similar building components. Little further guidance is provided concerning how these criteria might be satisfied in practice.

In response, the BRANZ ‘Taxonomy’ project aims to develop an overarching durability verification framework for assessing building materials, components and systems under the Building Code. The aims of the project include systematising existing durability knowledge and verification methods, identifying critical knowledge gaps to guide future research, and making this information available in a convenient manner to a wide range of potential users. The latter goal is achieved through the development of an interactive web-based interface to the underlying information. The project is scheduled for completion in mid-2009.
Supporting the future development of the industry

As a research organisation, much of the work BRANZ undertakes has a planning horizon of ten years or more – often because the work needed to deliver a timely solution may take that long to accomplish. A great example of this is the HEEP project, begun in 1995 and completed in 2007 and now delivering value to the industry and public in general by providing the information needed to save energy in homes.

Similarly, issues such as sustainability and materials durability (now linked via life-cycle analysis) have been in the work programme for more than ten years. Ultimately much of the work done with this future focus in mind supports new industry practices and may eventually be picked up in codes, standards or industry practices. Its primary role is to gather the facts that the industry needs to take those next steps.

This work programme has a value of approximately $2.2 million, sourced primarily from the Building Research Levy, Foundation for Research Science and Technology and Department of Building and Housing.

Virtual research communities

BRANZ is exploring the potential for ‘virtual research communities’, where groups of researchers (not necessarily in the same organizations) share their investigations in real time – rather than waiting for scientific papers to be published.

This approach will speed up progress, reduce duplication, and encourage more efficient use of research funding.

Funder: Building Research Levy.
Completion date: November 2008 (stage 1).

The seismic performance of brick veneer construction

BRANZ is investigating the seismic performance of brick veneer houses to determine how it will stand up in earthquakes and under what circumstances it can be used for seismic bracing.

Brick veneer is currently being used in 44% of New Zealand’s new houses. Using veneer to contribute to bracing performance could reduce building costs while maintaining performance.

Funder: Building Research Levy.
Completion date: March 2009.

New applications of seismic isolation

BRANZ has been working as a sub-contractor to GNS Science on a six-year project examining new uses for base isolators. The first phase of the project, which has been completed, examined the feasibility of using base isolation systems in lightweight and medium-weight buildings. The second phase is examining
The commercial buildings sector spends over $900 million/year on energy, accounting for 9% of New Zealand's energy and 20% of electricity use. It is responsible directly for 4% of Greenhouse Gas (GHG) emissions and these have grown in absolute terms by 26% since 1990 – 60% faster per year than the agriculture sector. More than half of commercial sector fuel is electricity, making it vulnerable to supply and transmission problems, as well as future carbon costs.

Understanding how energy and water resources are used in today’s commercial buildings will make it possible to use those resources more efficiently and so enhance New Zealand's sustainability. An efficiency improvement of 10% would give $90 million fuel and at least $2 million direct GHG savings per year, plus benefits from reduced electricity demand.

Over the next six years Building Energy End-use Study (BEES) will make the first step toward these efficiency improvements by establishing (a) where and how resources are used, and (b) the determinants of resource use. The overall results of this project will be:
- quality data on the uses of energy and water in New Zealand commercial buildings
- an improved basis for policy development and implementation, including any future New Zealand Energy Strategy (NZES) and the National Energy Efficiency and Conservation Strategy (NZEECS)
- guidance to create more productive work environments
- support for reduction of greenhouse gas (Kyoto) emissions and adaptation to climate change
- design and operation guidance to reduce greenhouse gas emissions
- improved basis for development of the Building Code, Standards, Green Star and design guidance
- improved models of commercial sector energy (including electricity) use.

The research will develop a holistic understanding of the relationships between energy and resource use, building type and use as well as the opportunities to improve energy and resource efficiency of commercial buildings. This will be achieved through scientific design and support for the detailed measurements in a range of building types, the development of an integrated database and analysis system for the resulting data, coordination with international energy efficiency tools and instruments, and the development and testing of planning, policy, design and operating such tools in the New Zealand context.
the possible use of base isolation systems to protect plant and equipment (for example, heavy machinery) in buildings.

**Funder:** Foundation for Research, Science and Technology.

**Completion date:** October 2009.

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**Healthy House Index**

BRANZ is working with other research organisations to develop a Healthy House Index – i.e. a single number representing how healthy and safe a house is.

Once the index is completed, local authorities, major landlords, health authorities and other officials will be able to use the index to assess housing conditions and make decisions about improvements.

**Funders and stakeholders:** Building Research Levy; Ministry of Health; ACC; the Department of Building and Housing; the Ministry of Social Development; Te Puni Kokiri; Statistics New Zealand; the Energy Efficiency and Conservation Authority; Housing New Zealand.

**Completion date:** March 2010.

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**Dust-mite cross-infection**

BRANZ is developing a heated carpet system to kill dust mites and reduce incidence of asthma. So far, the system has proved 100% effective in the laboratory. The next step is to test it in homes to find out how effective it is when dust mites can get into the carpet from bedding and furniture.

This research is using genetic techniques to ‘label’ dust mites so we know where they come from (the carpet or other sources) and hence can calculate rates of cross infection.

**Funder:** Building Research Levy.

**Completion date:** August 2008.

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**Sensors and indicators**

Previous BRANZ research has successfully used simple sensors to detect moisture movement in the weathertightness test house and in parapet walls. In the current project, materials science expertise will be applied to deliver new sensor technologies. Moisture sensors will be capable of detecting unwanted moisture in very specific areas of the building structure. Corrosion sensors will indicate the onset of corrosion. In parallel, the project will explore the potential of using real-time sensor outputs for web-based building monitoring. It is anticipated the project will prove that simple sensor data could facilitate the remote identification of problems with the building in a timely fashion.

**Funder:** Building Research Levy.

**Completion date:** June 2009.

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**Housing stock life cycle and sustainability**

BRANZ is carrying out research on maintenance and renovation of New Zealand’s existing housing stock.

The research will identify typical renovation and maintenance patterns (for example, how often windows and wall claddings are replaced) to identify opportunities for retrofitting sustainability features such as insulation and double glazing.

It will also look at the life-cycle costs of various sustainability options, and compare the costs and benefits of demolition versus major refurbishment.

**Funder:** Building Research Levy.

**Completion date:** June 2009.
BRANZ concrete creep machine