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Building for our changing climate

Seminar handbook

Building for our changing climate

Acknowledgements

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Skills Maintenance for LBPs

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1 hour of learning = 1 point

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Building for our changing climate

Presentation

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Meet the team

Phil McNamara – BRANZ

Steve McNeil – BRANZ

Jonquil Brooks – BRANZ

Greg Burn – Structure Limited

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Comfort and safety

Emergency procedure

Bathrooms

Devices silent please

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Programme

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9:00am – 1:00pm

- Climate change
- Rainfall
- Wind
- Temperature
- Other considerations

Morning tea break

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Breakout sessions

Group discussions, feedback and questions/answers

Two sessions during the seminar

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New residential buildings

Focus on residential new builds – applicable to detached/attached medium density

Relevant to renovation of existing homes

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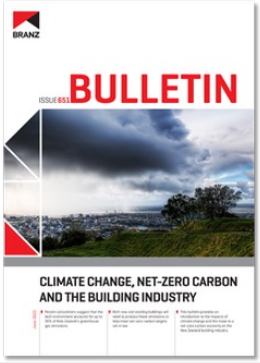
The built environment and climate change

Huge topic with increasing amount of information becoming available

More detail on specific topics to come from BRANZ

Extra resource in back of seminar books



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It's time for action

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Greenhouse gas accumulation – carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) – has increased the atmosphere's ability to hold heat (greenhouse effect)

Atmospheric levels of CO_2 are high and continue to rise

CO_2 is primarily a result of emissions from the consumption of fossil fuels

Climate change is the result – yes, it's real folks!!

We have left it really late – we need to act now!!

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Carbon emissions

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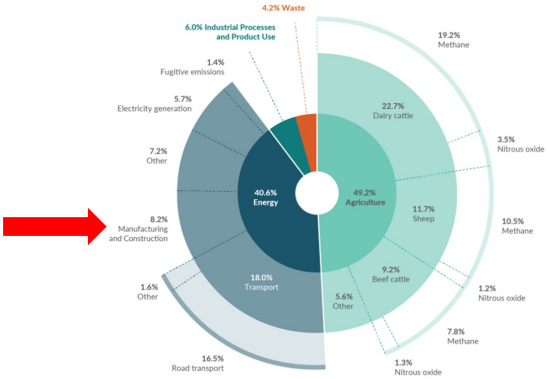
Construction industry a major contributor

Figure 2: Gross greenhouse gas emissions in 2021 by sector, sub-category and gas type



Published: 13 April 2023

Ministry for the Environment

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Carbon emissions

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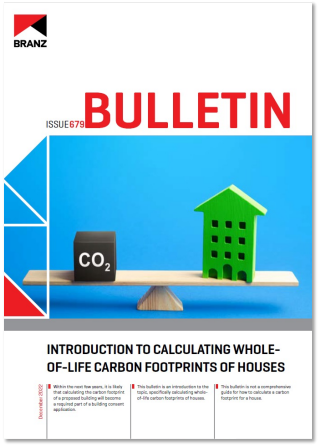
Embodied carbon emissions – building components (source to site)

Operational carbon emissions – heating and cooling demands (non-renewable energy)

Important to focus on both embodied and operational at the design stage

"Run the numbers!!!!"



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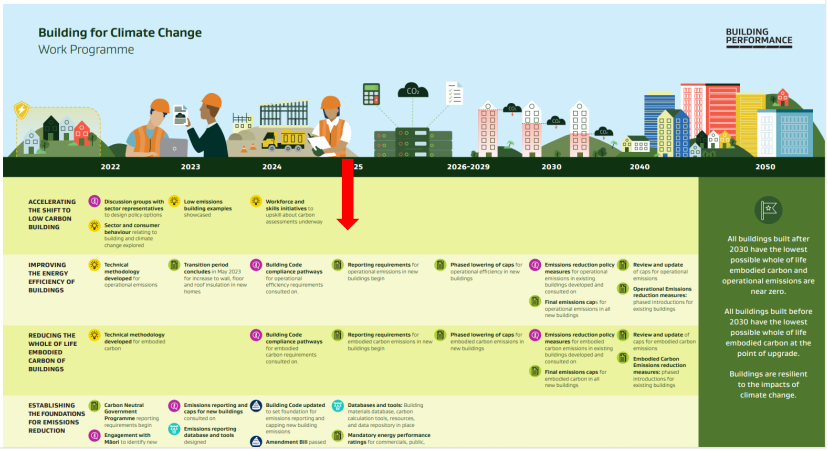
MBIE – Building for Climate Change Work Programme

Compliance thresholds for embodied/operational carbon emissions of buildings due in 2025



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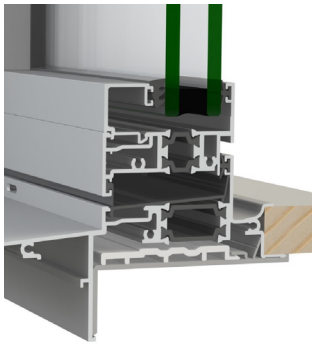
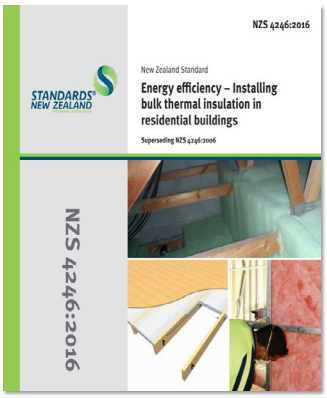
Increase in embodied and operational carbon emissions

Embodied – H1 – more insulation and higher-performance exterior joinery

Operational – climate change – increased need for cooling buildings – will often require mechanical ventilation





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Climate change

Global temperature increase – land and oceans

Sea-level rise

Extreme weather events:

- More regular
- Greater intensity
- Longer duration

Outlook not good!!!

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Climate change

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- Flooding
- Landslides
- Coastal erosion/increased wave action/storm surge
- Changing rivers/streams
- Wind damage
- Wildfire

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Climate change

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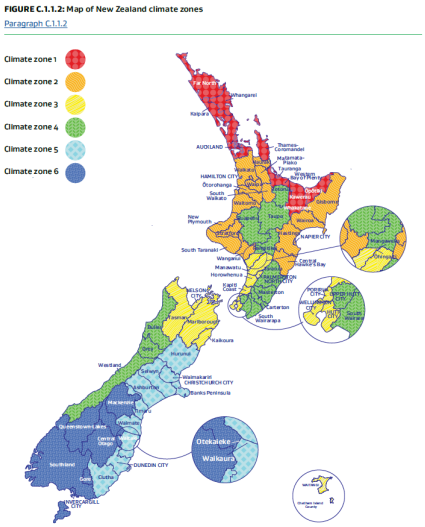
Huge impact on:
- Buildings
- Infrastructure
- Economy

People!!!



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Cost of climate change

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- Unrepairable buildings
- Unbuildable sites
- Potential for loss of life
- Demolition/replacement/relocation
- Financial cost
- Insurance
- Interior environment
- Managed retreat?

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Action required by us!!!

Mitigation – to reduce greenhouse gas emissions

Adaptation – to reduce the negative effects of climate change

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Adaptation – 'building' climate resilience

Buildings
Infrastructure

Knowledge required within industry

Analysis
Advice
Design

Code + design and construction

Affordability a key challenge

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Climate-resilient design

Be proactive – not compliance driven

Opportunity to improve overall building performance – robust, resilient buildings that are comfortable to live in

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Plenty of tools

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Council maps

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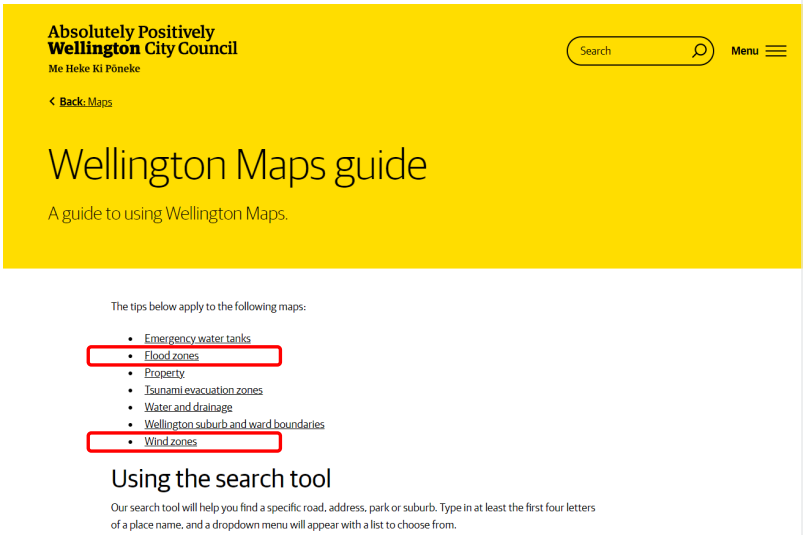
History



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Compliance

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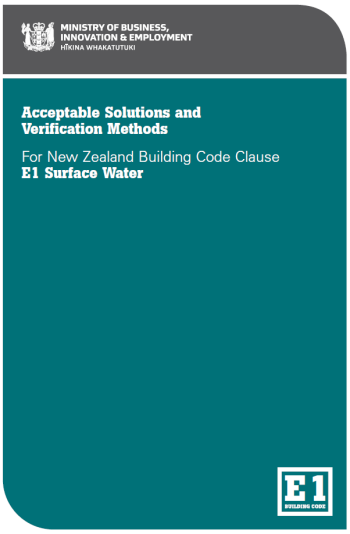
E1 *Surface water*
E1/VM1
E1/AS1
E1/AS2

Drainage, gutters, downpipes and overflows
Rainfall intensities

E2 *External moisture*
E2/AS1
E2/AS2
E2/AS3
E2/VM1



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Rainfall

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High volume, intense rainfall more common

Both short and long duration, intense events – often associated with wind

Increased regularity

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Compliance

E1/AS1 rainfall intensities

2019 NIWA data

AEP = annual exceedance probability

230 mm/hr recorded

Table A: Rainfall Intensities continued
10 minute duration rainfall intensities for various locations in New Zealand

Location	Latitude degrees	Longitude degrees	10% AEP intensity mm/hr	2% AEP intensity mm/hr
Upper Hutt	-41.12	175.07	72	99
Featherston	-41.12	175.32	63	88
Porirua	-41.13	174.83	76	105
Mākara-Ohariu	-41.2	174.75	74	102
Lower Hutt	-41.21	174.91	72	100
Martinborough	-41.22	175.44	54	77
Wellington	-41.28	174.77	70	97
WEST COAST				
Hector-Ngakawau	-41.63	171.87	84	122
Westport	-41.75	171.58	101	145
Reefton	-42.11	171.87	71	103
Blackball	-42.3	171.49	92	132
Dobson	-42.39	171.44	93	133
Greymouth	-42.45	171.21	95	133
Hokitika	-42.72	170.97	104	144
Ross	-42.9	170.82	110	149

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Residential building design

Increased volume, high-intensity rainfall significantly increases 'load' on the external envelope

Wind-driven rain increases risk further

Requires weathertightness design for extreme conditions

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Rainwater management – roofs

Impacts the choice/design of:

- Roof style and pitch
- Roofing material
- Gutters/overflows
- Downpipes
- Flashings
- Details

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Roof style

Style:
- Gable – generally simple
- Hip – incorporate more junctions, flashings and valley gutters – higher risk
- Monopitch – effective but can overload gutters
- Low slope – heavy dependence on drainage/overflows – higher risk

Consider:
- Complexity/buildability
- Penetrations
- Maintenance

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Roof pitch

Pitch:
- Steep (25° and above) – enables good run-off but can overload gutters
- Moderate (10–25°) – generally effective
- Low (below 10°) – drainage/detail dependent

Consider:
- Complexity
- Penetrations
- Maintenance
- Wind load

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Roofing material

Consider:
- Suitability for style and pitch
- Installed complexity (vulnerable junctions)
- Dissimilar material junctions
- Intense rainfall capacity
- Performance under wind-driven rain
- Durability
- Maintenance

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Roof gutters E1/AS1

Gutter size – 5.1.2 and 5.1.3

Consider rainfall intensity in storm events

Be conservative

5.0 Roof Gutters

5.1 Size of roof gutters

5.1.1 Roof gutters shall discharge to downpipes that are sized as given in Paragraph 4.2.

5.1.2 Any gutter under consideration shall be divided into sections and each section shall be sized. A section shall comprise the length of gutter between a downpipe and the adjacent high point on one side only of that downpipe. Each section of gutter shall have a cross-sectional area of no less than that determined from Figure 15 or Figure 16 (depending on whether the gutter is external or internal), and increased where required in accordance with Paragraph 5.1.3.

5.1.3 Figures 15 and 16 are based on a rainfall intensity "I" of 100 mm/hr. Where "I" exceeds 100 mm/hr the required gutter size shall be increased by taking the value read from the figures and multiplying it by the ratio of "I"/100. Paragraph 3.2.2 describes how to determine the value of "I".

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External gutters

Consider:

- Capacity
- Fall
- Overflow
- Complexity
- Downpipes:
  - Number/capacity
  - Location

Maintenance

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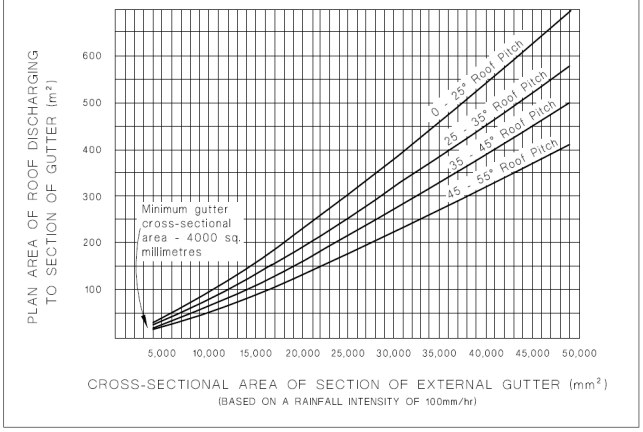
External gutters E1/AS1

Figure 15 – external gutter size

Figure 15: Cross-sectional Area of External Gutter
Paragraphs 5.1.2 and 5.1.3



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External gutter capacity

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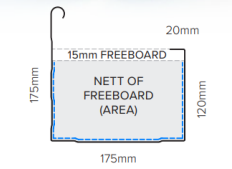

TOTAL CROSS SECTIONAL AREA	21000mm²
NETT OF FREEBOARD	18375mm²
WETTED PERIMETER	385mm

NOTES:
Total cross sectional area of gutter only to be used when installed with an overflow.

OVERFLOW WITH SOFFIT
Back of external gutter needs to be positioned 10mm belown top of fascia height and have a gap of at least 3mm.

OVERFLOW WITH NO SOFFIT OVERHANG
Back of external gutter needs to be positioned 10mm below top of fascia height and have a gap of at least 10mm.

When no overflow Nett of Freeboard (Area) must be used.

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Metalcraft Roofing

External gutter capacity

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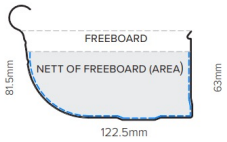

TOTAL CROSS SECTIONAL AREA	6967mm²
NETT OF FREEBOARD	5186mm²
WETTED PERIMETER	191mm

NOTES:
Total cross sectional area of gutter only to be used when installed with an overflow.

OVERFLOW WITH SOFFIT
Back of external gutter needs to be positioned 10mm belown top of fascia height and have a gap of at least 3mm.

OVERFLOW WITH NO SOFFIT OVERHANG
Back of external gutter needs to be positioned 10mm below top of fascia height and have a gap of at least 10mm.

When no overflow Nett of Freeboard (Area) must be used.

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Metalcraft Roofing

Internal gutters

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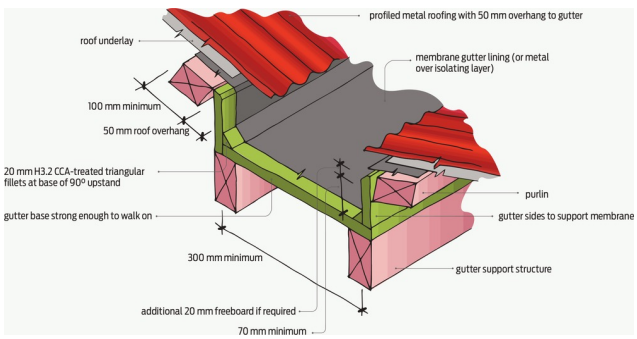
Consider:
- Risk – avoid where possible
- Capacity/thresholds/freeboard
- Fall
- Complexity
- Material/installation
- Drainage:
  - Outlet size/capacity
  - Rainwater heads/downpipes
  - Overflows

Maintenance



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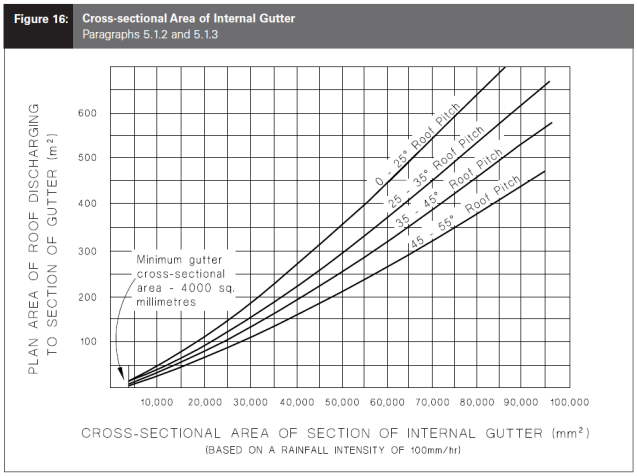
Internal gutters E1/AS1

Figure 16 – internal gutter size

21000 mm² nett of freeboard



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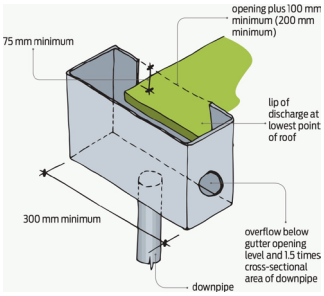
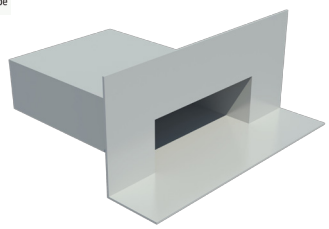
Gutter overflows E1/AS1





5.5 Overflow outlets

5.5.1 All internal gutters shall be fitted with overflow outlets which drain to the exterior of the *building*. The top of the outlet shall be set at least 50 mm below the top of the gutter. The cross-sectional area of the outlet shall be no less than the cross-sectional area of the downpipes (determined by Paragraph 4.2.1) serving the gutter.

COMMENT:
An internal gutter overflow outlet should be located to give an early, conspicuous warning to the *building* occupier that maintenance is required.

5.5.2 External gutters do not require overflow outlets but shall be installed to ensure any overflow from the gutter spills to the outside of the *building*.

COMMENT:
Although specific overflow provision is not necessary it is nevertheless important to ensure any overflowing water cannot track back inside the *building* where it could cause problems.

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Downpipes

Consider:
- Size
- Number
- Location
- Complexity
- Blockage protection

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Downpipes E1/AS1

Downpipe sizes

Table 5: Downpipe Sizes for Given Roof Pitch and Area
Paragraph 4.2.1

Downpipe size (mm) (minimum internal sizes)	Roof pitch			
	0-25°	25-35°	35-45°	45-55°
	Plan area of roof served by the downpipe (m²)			
63 mm diameter	60	50	40	35
74 mm diameter	85	70	60	50
100 mm diameter	155	130	110	90
150 mm diameter	350	290	250	200
65 x 50 rectangular	60	50	40	35
100 x 50 rectangular	100	80	70	60
75 x 75 rectangular	110	90	80	65
100 x 75 rectangular	150	120	105	90

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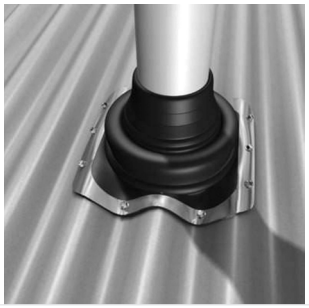
Roof flashings/penetrations

Increase vulnerability

Consider:
- Laps and upstands
- Fixings
- Performance under wind-driven rain
- Penetration locations

E2/AS1 +



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Rainwater management – exterior walls

Intense rainfall dramatically increases wall cladding load

Wind-driven rain further increases the load – particularly at junctions

Roof overhangs provide significant protection

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Wall cladding selection

Cladding is the primary line of defence/drainage plane

Gravity drainage flow paths

Consider:
- Profile
- Laps/junctions/overhangs
- Penetrations
- Finish/durability
- Ground clearance

Resilience

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Wall cladding selection

Cladding profile – so which will work best under heavy rain load??

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Drained/vented cavity cladding installation

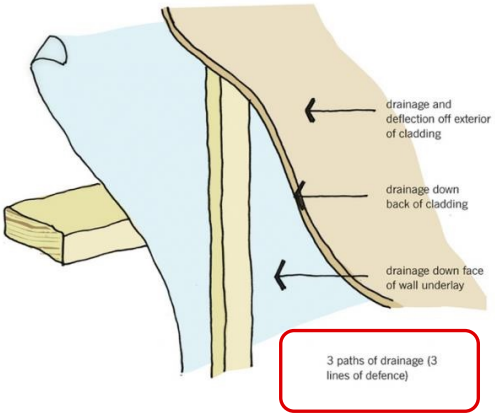
'Engineered' drainage and ventilation paths

Drainage paths:
- Primary – face of cladding
- Secondary – back of cladding
- Tertiary – face of wall underlay/RAB

Nominal 18–20mm more than enough capacity

Cavity is not a primary drain

Resilience



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Rigid air barrier

Weathertight tertiary drainage plane

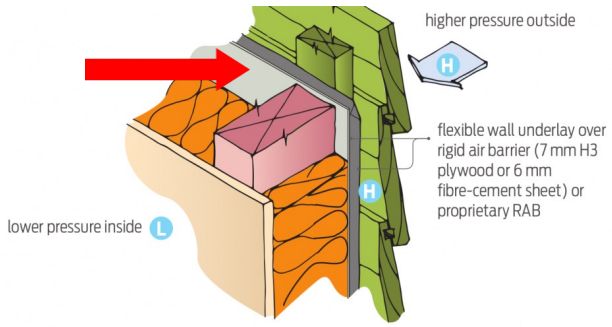
Gravity drainage path

Rigidity

Aids taping of penetrations

Restrains wall insulation – cavity integrity

Resilience



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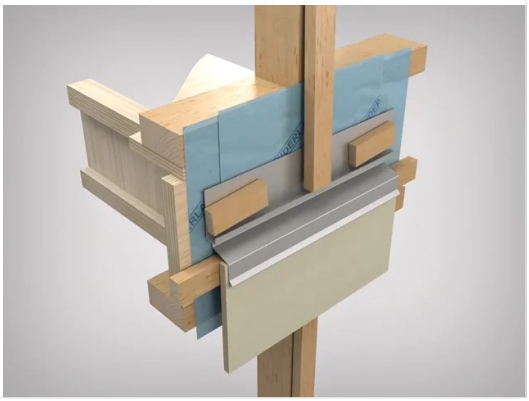
Cladding junctions

Gravity drainage and wind-driven rain – flow paths

Consider:
- Flashing cover/upstand
- Location
- End treatment
- Upstand protection

E2/AS1 +



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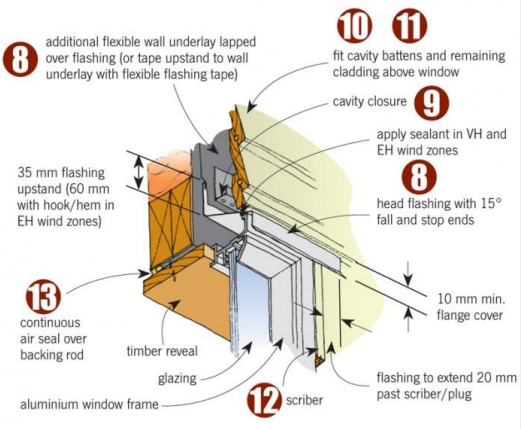
Exterior wall penetrations – exterior joinery

Head flashing:
- Joinery cover
- Upstand
- Sealant
- End overhang
- Stop-ends

Jamb closure

Wind-driven rain

E2/AS1 +



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Other exterior wall penetrations

Consider:

- Minimise
- Ensure all penetrations pre-installed
- Protection at face of underlay (drainage paths)
- Fall to exterior
- Cladding flange/seal

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Cladding finish

Water management – gravity drainage

Absorption – primary line of defence

Stability

Durability

Maintenance

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Breakout session 1

1. What issues can you see with the design and construction of roofs to manage wind-driven, high-intensity rainfall?

2. Which exterior cladding systems are more weathertight in high-rainfall events?

3. What issues can you see with the design and construction of drained and vented cavities to provide extra lines of defence on a building exterior?

4. Where would you find information on overland flow paths, surface drainage and flooding vulnerability when deciding on a finished floor level?

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Rainwater management – reticulation

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On-site drainage:
- Capacity
- Pipe runs/falls
- Blockage
- Complexity

Public drainage:
- Capacity – may require on-site retention

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Rainwater management – below-ground storage

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Primarily retention

Reuse stored water

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Rainwater management – above-ground storage

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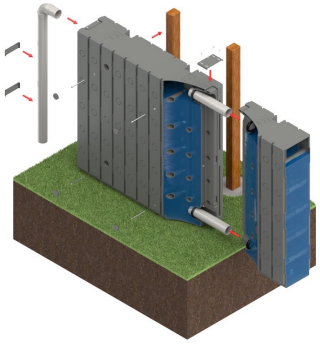
Capacity

Overflow



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Rainwater management – permeable/impermeable surfaces

Design to minimise impermeable

Fall away from building

Impermeable drainage

Provide drainage to permeable areas

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Rainwater management – ground saturation

Continuous intense rainfall reduces soil ability to absorb/drain

Raised water table

Contour to avoid ponding/flooding

Provide drainage

Manage ground run-off towards overland flow path

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Rainwater management – overland flow paths

Keep buildings clear

Contour to ensure flow through site

Drainage to building perimeter

Consider:
- Surrounding terrain and structures
- 'Upstream' and 'downstream' influences

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Rainwater management – floor levels

Contour finished ground away from slab floors

Building perimeter water catchment/drainage

'Factor of safety' with slab floors

Consider timber floor construction to raise floor level

Available information/restrictions

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Rainwater management – E1/AS1 floor levels

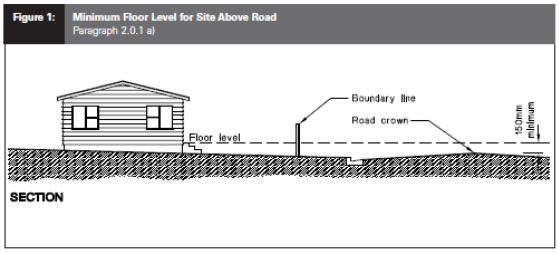
Be conservative

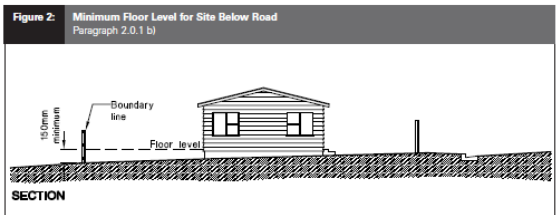
2.0 Minimum Acceptable Floor Level

2.0.1 Suspended floors and slabs on ground shall be at least 150 mm above the finished level of the surrounding ground immediately adjacent to the *building*, and:

a) For sites level with or above the road, no less than 150 mm above the road crown on at least one cross-section through the *building* and roadway (see Figure 1).

b) For sites below the road, no less than 150 mm above the lowest point on the site boundary (see Figure 2).





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Rainwater management – general

Long-term soil strength for foundations

Retaining/tanking and associated drainage – manage intense events

Site suitability:
- Proximity to rivers/streams
- Adjacent terrain
- Run-off from adjacent properties

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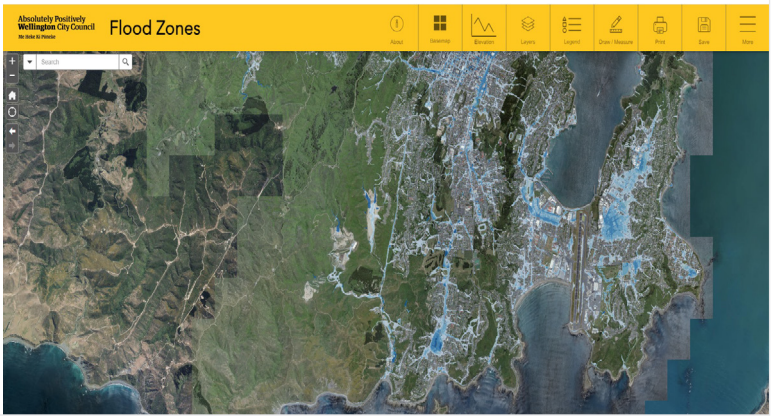
Rainwater management – flooding

Council information/maps

Be conservative



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Wind

Increased average velocity

Both short and long duration intense events, often associated with rain

Increased regularity of events

Peak windspeeds occurring more often

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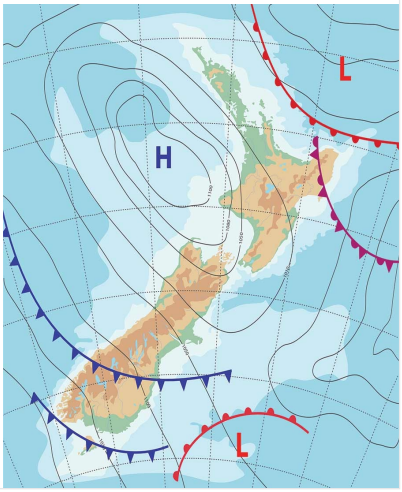
Higher wind speed

Impacts the choice/design of:

- Building type/orientation
- Roof and pitch
- Exterior wall cladding
- Exterior joinery
- Bracing – foundation/structure
- Details



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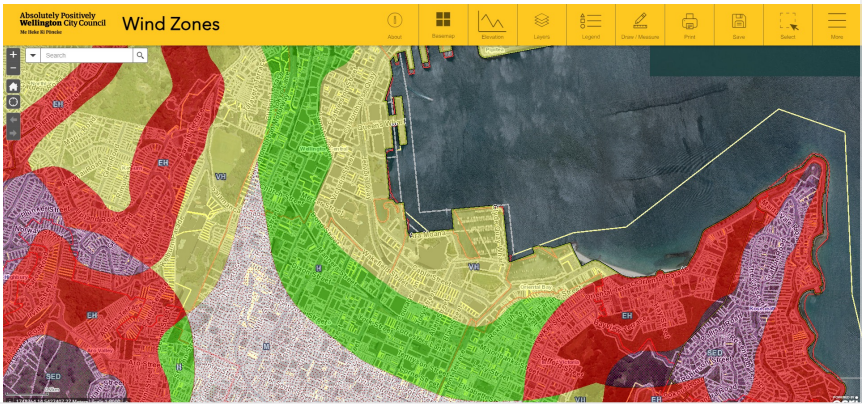
Wind loads

Information available – site-specific requirements may vary

Be conservative with all aspects of design – don't 'cheat' bracing demand



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Wind-driven rain

Impacts the choice/design of all aspects of the exterior envelope

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Building typology

Height/style

Exterior wall area

Glazing size, percentage and orientation

Appendages

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Building orientation

Prevailing wind

Site contour

Adjacent shelter

Influence of the surroundings

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Roofs

Height/pitch/style/orientation

Gust impact

Uplift/fixings

Flashing cover/fixings

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Exterior walls

Exterior wall construction – options available
Stud sizes/connections for framed walls
Wall height/bracing/openings
Orientation

Cladding type – consider:
- Horizontal/vertical
- Laps
- Surface water run-off
- 'Layering'

Drained and vented cavity
RAB
E2/AS1 +

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Exterior joinery

70

Size – glazing and frame loads

Glazing percentage/orientation – strongest wind

Details – wind-driven rain

E2/AS1 +

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Wind bracing

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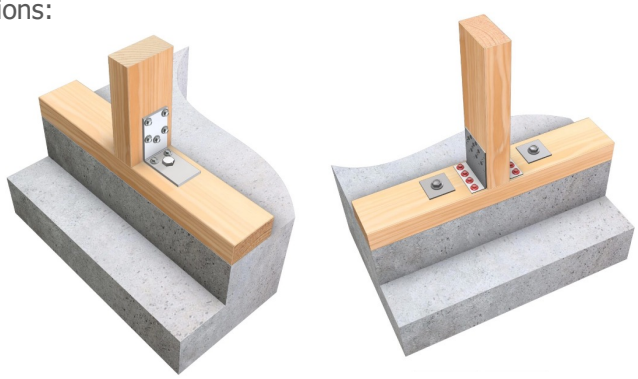
Be conservative

Balanced layout

Brace fixings specification/connections:

- Steel brace frames
- Wall braces
- Bottom plate slab connections



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Exterior cladding details

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Be conservative with cladding selection

Relevance to design

Increase laps/upstands/overhangs

Sealant

'Layering' of cladding at critical locations

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Site suitability

Wind shear re slope

Adjacent influences

Mitigation

Avoidance

Compatible design

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Breakout session 2

1. What are the issues when calculating the wind bracing demand for a building?

2. Do you have issues installing compliant exterior wall bracing bottom plate connections in concrete slabs – particularly when vertical slab edge insulation is incorporated?

3. Have you encountered issues when using dark-coloured exterior wall and roof claddings?

4. What concerns you about the need to install efficient mechanical cooling systems in residential buildings?

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Temperature

Higher peak/average temperatures increase the potential for:
- Overheating building interiors
- High external cladding temperatures

Cooling interiors more of a requirement

Humidity also an issue – moisture

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Typical moisture flows

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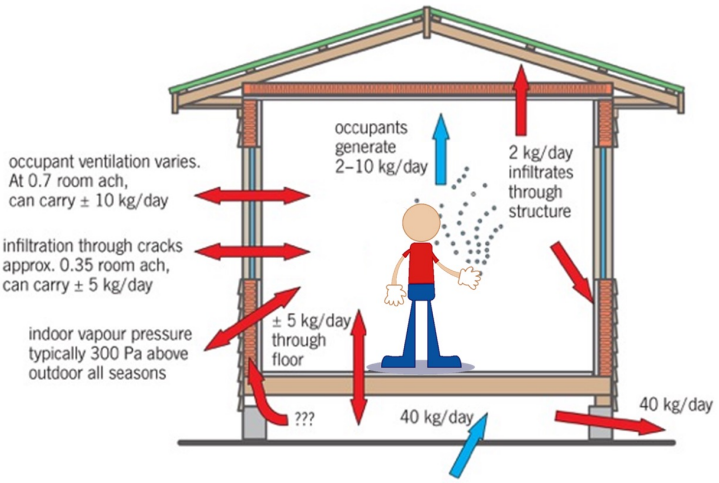

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What determines how much moisture can be removed?

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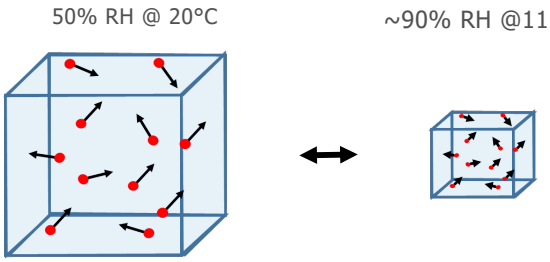
It's a dilution problem – as long as there is some heating

In general, the outdoor air is drier than indoors (especially in winter)



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Psychrometric chart

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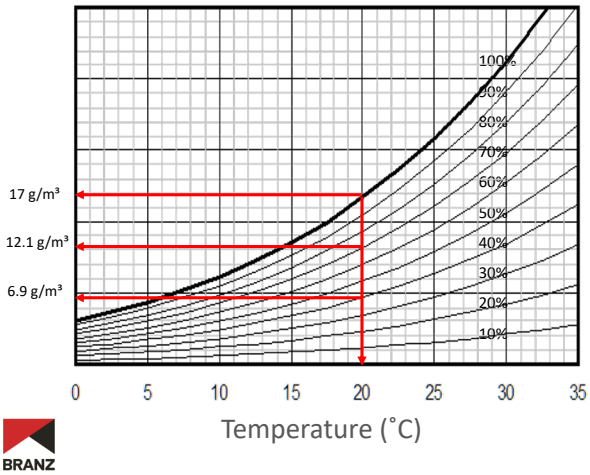

Presents the governing relationship in a visual form

From the point of view of ventilation, RH is not as useful as absolute moisture content

- Saturated air at 20°C: 17 g/m³
- @40% RH – this is ~7 g/m³
- @70% RH – this is ~12 g/m³

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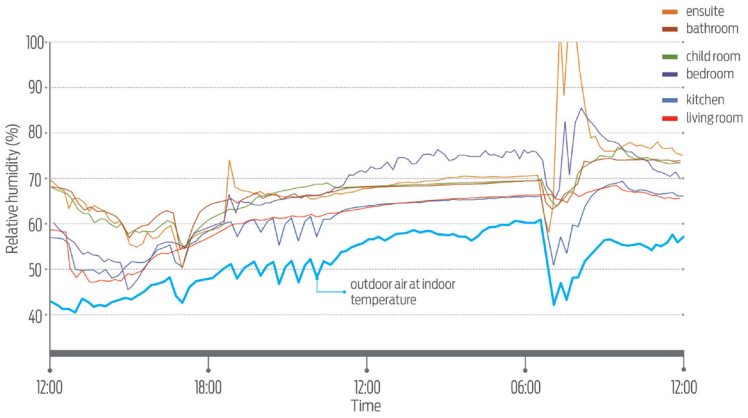
Case study – helping to fix an internal moisture problem



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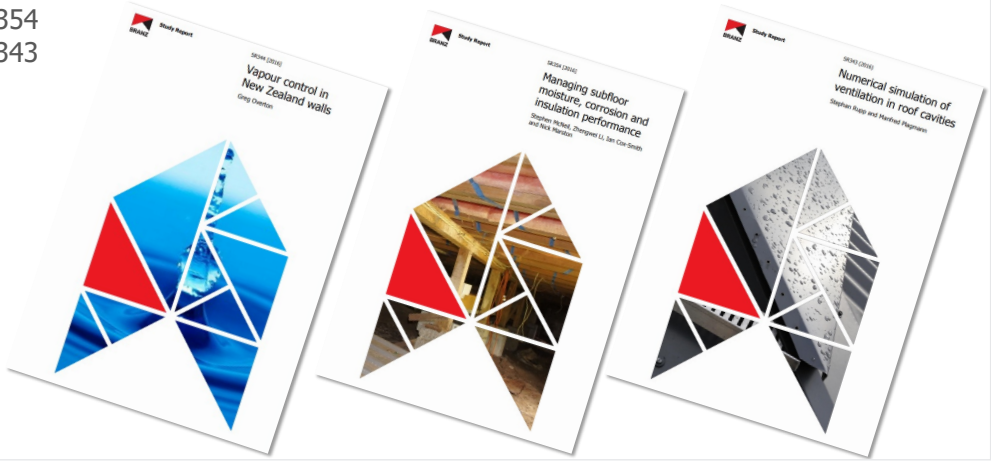
Previous research

Internal conditions a large contributor

- SR344
- SR354
- SR343



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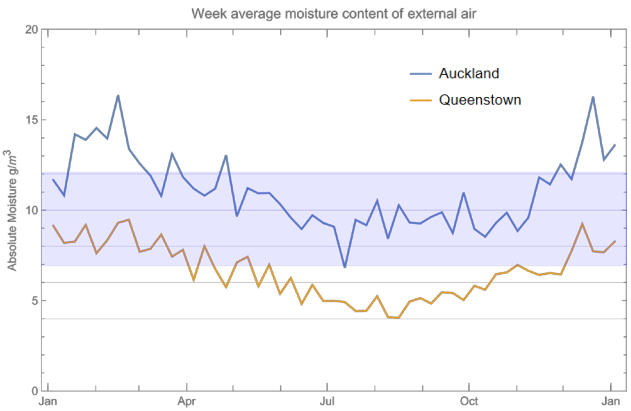
The external environment matters



Shaded area, where external conditions allow – 40–70% RH indoors @20°C

The higher the curve, the harder it is to achieve a good indoor environment by ventilation alone

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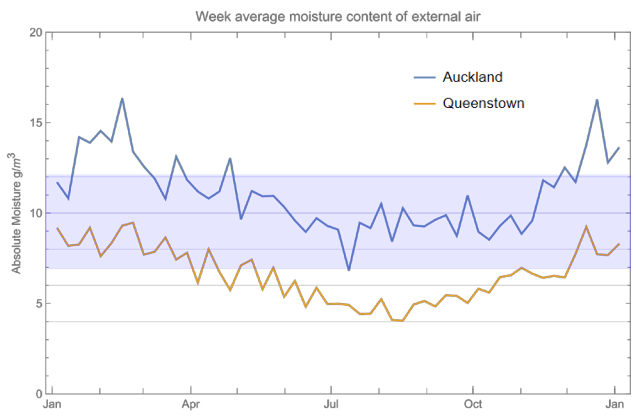
The external environment matters



For ~31% of year, Auckland is already above the band

For Queenstown, this is 0.7%

What can be done?

Consistent ventilation

Mechanical ventilation a good option as it removes the comfort disincentive of opening windows in winter

Increase internal temperature

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The ventilation we provide has to work

Build tight – getting there

Ventilate right – hmmm …

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Impact of climate change

Climate files for energy/moisture simulation are being updated

Indication from NIWA is that absolute humidity is increasing

Longer term, this could lead to considering dehumidification in some climate zones

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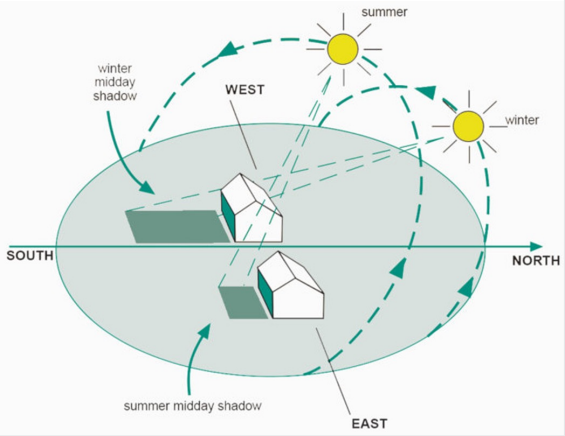
Building orientation

'Manage' the sun

Consider:
- North/west glazing
- Cooling wind direction



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Glazing

Glazing percentage (window/wall ratio)

Openings

Orientation

Protection (shading)

Overheating must be a major design consideration – particularly with medium density

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Shade devices

Roof overhangs/verandas

Plenty of options for flexible shade devices – block solar in hot months, allow during cool months

Planting

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Passive ventilation

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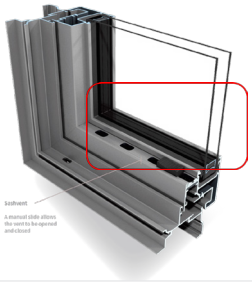
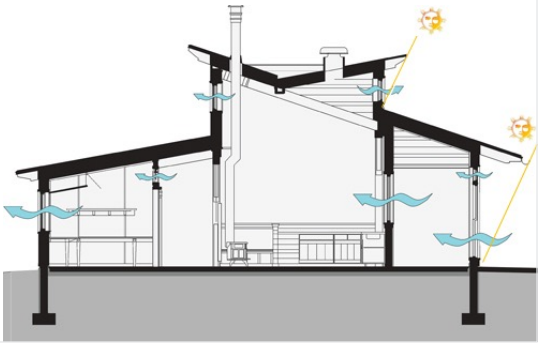
Design to use the prevailing wind

Cross-ventilation

Exterior joinery – sash vents

Options for leaving windows open





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Mechanical ventilation

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May be a necessity as climate warms

Indoor air quality also important – ensure systems expel internal air to the exterior and bring in and modify (cool/heat, dehumidify and filter) fresh air

Cooling and humidity management important


BRANZ Research Now: Indoor air quality #3

The impact of ventilation in New Zealand houses

Ventilation plays a major role in indoor air quality and moisture management in houses, lowering humidity levels and diluting and removing contaminants that impact on health and productivity. Research suggests, however, that houses are not being effectively ventilated. There are steps that both designers and home occupiers need to take to ensure healthier air in our homes.

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Exterior envelope

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Cladding colour

Roofing colour

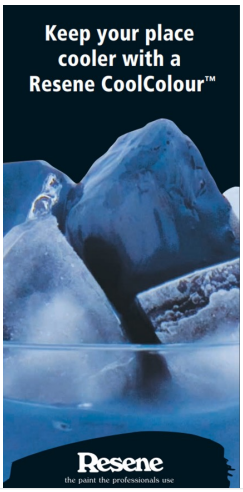
Cladding/roofing type

Cladding finish

Surface temperature

Expansion/contraction

Durability/maintenance



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Exterior envelope

Lighter colours will reduce overheating but will also make house cooler in winter

Important to model!!!

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Fire risk

Rural areas are high risk with increasing temperatures

Site suitability

Proximity to flammable vegetation

Fire breaks

On-site water supply/firefighting equipment

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Other considerations

Sea-level rise

Erosion

Landslides

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Sea-level rise

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Associated with vertical land movement

Storm surge increases impact

Available information

Site suitability/risk

Insurance

NZ SEA RISE
TE TAI PARI O AOTEAROA

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Erosion

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Coastal

Rivers/streams

Available information

Site suitability/risk

Insurance

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Landslides

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Available information

Site suitability/risk

Adjoining land/buildings

Insurance

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Managed retreat

Feasibility/practicality

Cost

Where do you move to?

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Not all bad news

Renewable energy – hopefully more to come

Primarily build with timber

Plenty of nice lakes/rivers/beaches to cool off at!!!

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the paint the professionals use

FORMANCE

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Thanks

We really appreciate the effort you have made to attend – travel safely

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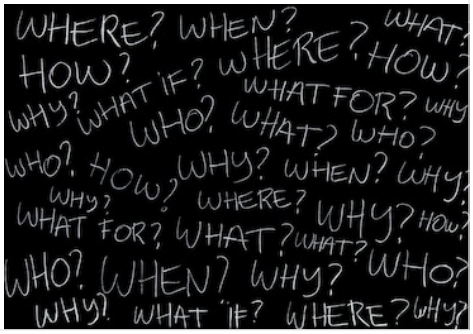
Questions

We are happy to take any further questions



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Notes

Notes

DESIGN RIGHT

By David Hindley, Freelance Technical Writer

Designing gutters to cope with high rainfall

With storms bringing massive rainfalls this year and a forecast of more in future, BRANZ recommends a conservative approach in designing gutters.

Rainfall records around the country were smashed this year. Auckland received more than five times its normal summer rainfall, Napier had more than six times its February average and 13 February proved unlucky for Tūtira in Hawke's Bay, with 316 mm of rain falling in a single day.

The Ministry for the Environment says there is evidence that climate change is increasing the frequency and severity of events such as heavy rainfall. Given that homes designed today will have to cope with extreme weather events for many decades, it is important to make sure that gutters are designed to cope.

Designers must determine:

- rainfall intensity for the location
- catchment area of the gutter
- cross-section
- fall
- outlet and downpipe type and size
- overflows.

Rainfall intensity

For sizing gutters, rainfall intensity must be determined for the location. For external gutters this is a measurement in mm/hour of the rainfall for a storm with a 10% probability of occurring annually and with a 10-minute duration. Rainfall intensity in different areas can be found in E1/AS1 Appendix A or in E1/AS2 (which cites AS/NZS 3500.3 *Plumbing and drainage Part 3: Stormwater drainage.)*

E1/AS1 allows for a minimum rainfall intensity of 100 mm/hour when sizing an external gutter, but always check the data for a specific location – a higher figure needs to be used for quite a few locations.

You can also use NIWA's High Intensity Rainfall Design System (HIRDS) available at niwa.co.nz/information-services/hirds.

By Professor Tim Naish, Dr Richard Levy, Dr Rob Bell FEngNZ and Ceridwyn Roberts, NZ SeaRise

Local sea-level rise data

Sea-level rise is affecting our coastlines and will have an increasing impact on where and how we build. The recent release of national sea-level rise maps will play an important role in decisions that will have to be made.

Insurance industry data shows that damaging flood events in Aotearoa New Zealand have increased since the late 20th century. Many of us living near the coast are fully aware of this shift having experienced waves crashing high over seawalls, seawater flooding houses and rocks flung across key access roads.

Sea levels are clearly rising

Climate change and sea-level rise will only increase the frequency of these coastal flooding events. For many parts of our coast, only small amounts of sea-level rise will turn today's rare events into common ones. For example, a 42 cm increase in sea level around Auckland's coastline means that an extreme flood from past decades that might occur once every century will happen yearly.

Knowing when these thresholds will be reached and crossed is key as we work hard to adapt to unavoidable change.

New science from the NZ SeaRise programme has shown that, for many regions of Aotearoa New Zealand, sea level is rising faster than we thought due to the influence of land subsidence. We are all aware that our land can rapidly rise or drop in large jumps during earthquakes, but less obvious is that smaller shifts occur continuously in between large seismic events.

Tectonic forces are slowly pulling down the southern and eastern margins of the North Island and northern regions of the South Island, and land subsidence rates are high.

Some land sinking, some rising

As builders and designers understand, it is vital to know how the land we are building on is affected by subsidence. Groundwater extraction can also cause land to sink, and soil compaction can lower the height of the ground.

Add in the small inter-seismic land movements, and these small but continuous changes add up, meaning that, in areas that are going down, the annual rate of sea-level rise can double in coming decades.

In regions that are sinking, important thresholds will be reached within the next several decades. A total rise of 30 cm above 2005 levels may occur in parts of Wellington within the next 20–30 years. In regions along our coast that are rising, sea-level rise will occur more slowly.

If a rough sea surges against a coastal road or bridge, the decision whether to

Aftermath of storm on the south coast of Wellington.

By Kate Lees, Advisor, Information and Education, Building Systems and Performance, MBIE

Rebuilding in the aftermath of severe summer weather

MBIE has developed and updated several resources to provide information and guidance to help LBPs navigate the remediation and recovery of buildings that have been damaged by flooding.

The summer of 2023 has proven to be one of Aotearoa New Zealand's most challenging, with severe weather hitting most of Te Ika-a-Māui North Island and affecting the lives and livelihoods of thousands of New Zealanders .

In January, Tāmaki Makaurau Auckland received 45% of its annual rainfall according to the National Institute of Water and Atmospheric Research (NIWA) with many areas of Te Ika-a-Māui receiving over 400% of normal January rainfall. In February came ex-tropical Cyclone Gabrielle, bringing widespread flooding and damage to land and buildings across Te Ika-a-Māui, cutting off several communities from the rest of the country.

We know the road to recovery will be long and will bring many challenges. MBIE is here to support home and building owners, and those in the building sector, as our communities look to start their journey.

MBIE has developed and updated several resources to provide information and guidance to help LBPs navigate the remediation and recovery of buildings that have been damaged by flooding.

Placard information

If the building you are working on has a rapid building assessment placard (sticker), you need to know what this means. MBIE has produced information on what rapid building assessment placards are and what they mean. You must not start repair work on a building with a red or yellow placard without first contacting your local council to discuss this.

The council will, if appropriate, issue authorisation to access the building. In some cases, access may be refused – for instance, due to a high risk to life safety. In the case of a red placard, it is likely that a detailed damage evaluation will need to be undertaken. This may also be recommended for a yellow or white placard.

Read about placards at www.building.govt.nz/assets/Uploads/managing-buildings/building-management-information-homeowners-placard-removal-change-fact-sheet.pdf

Flood-damaged buildings

This guidance provides advice on what to consider before undertaking repairs and how to minimise future damage.

MBIE has resources to help LBPs with remediating flood-damaged buildings.

Taking action for more resilient homes and buildings

Toka Tū Ake EQC is working towards improving the resilience of Aotearoa New Zealand's homes and buildings. They have released two plans about how to achieve this and are putting out a call for others to get involved.

BY CALEB DUNNE, SENIOR ADVISOR RISK REDUCTION AND RESILIENCE, TOKA TŪ AKE EQC

Toka Tū Ake is responsible for providing natural hazard insurance to residential property owners in Aotearoa New Zealand. Contributing to risk reduction and building resilience is a big part of how it does this, especially in the built environment.

Strong building regulation and governance is one of the most effective ways to manage natural hazard risk. Along with land-use planning, insurance and resilient infrastructure, it determines how communities and the built environment come through natural hazard events.

A plan for more resilient homes and buildings

The work of Toka Tū Ake towards a more resilient built environment in Aotearoa is laid out in its Resilient Homes and Buildings Action Plan. The plan is complemented by its Smarter Land Use Action Plan, which lays out its commitment to proactively reduce current and future risks through smarter, risk-informed land-use planning. Together, they set out where Toka Tū Ake views the biggest opportunities to improve the built environment and how it can be most effective in working towards those goals with key partners.

The Resilient Homes and Buildings Action Plan has three overarching objectives of:

- raising the bar for our new builds
- managing the worst risks in our existing buildings
- making sure the built environment system enables more natural hazard resilience.

The work Toka Tū Ake does around new homes and buildings focuses on making sure future buildings are designed to meet the expectations and needs of owners and occupiers, including for natural hazard events.

Raising the bar for new builds

Recent memory demonstrates that our buildings have not been serving our communities well enough. From homes situated in known floodplains to excessive levels of damage in earthquakes, natural hazards must become a driving factor in decision-making for the built environment. We need to work towards a more sustainable, more resilient building stock that remains fit for purpose in an uncertain future.

Contributing actions under this objective include supporting MBIE in promoting low-damage seismic design, considering the intersection of climate change adaptation and natural hazard resilience and driving best practice for design practitioners.

Managing the worst risks in existing buildings

Our existing building stock is a diverse mosaic comprised of pieces from different times built to different standards and with different materials. We still use many of these older buildings despite understanding that they were not built to the same standards we expect today.

It would not be economical, practical or environmentally responsible to demolish all these buildings and rebuild to new higher standards to reduce the risk.

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ISSUE 666 BULLETIN

RESTORING A HOME AFTER FLOOD DAMAGE

December 2021

- Once building access is safe and services such as electricity are turned off or made safe, flood debris should be cleared away quickly so drying can start as soon as possible.
- Finishing work must not begin until the building is fully dry. Beginning work too soon may result in longer-term damage such as mould growth and timber decay.
- This bulletin updates and replaces Bulletin 455 *Restoring a house after flood damage*. It does not cover making residential properties resilient to flooding.

1 INTRODUCTION

1.0.1 After a home is flooded, the building may need remedial work to help it dry out and to repair any damage.

1.0.2 The building owner should contact their insurance company as early as possible and follow the insurer's instructions. Work on the building should not begin until the owner has confirmed that the insurance assessor has visited and/or the insurance company has authorised the work to go ahead.

1.0.3 Presented with an expensive repair plan, the owner may choose not to proceed, particularly if they have no insurance or are underinsured and cannot afford the repairs. The risks of doing nothing include:

- the building may be damp and unhealthy to live in
- the building condition may deteriorate and become unsafe or uneconomical to repair
- the building may eventually be declared dangerous or unsanitary by the local territorial authority, which can then require work or demolition at the owner's cost
- the condition of the home may affect its future saleability.

1.0.4 An owner may decide to demolish or to sell the building 'as is'.

1.0.5 Whether they own or rent their home, people often have a large emotional investment in it, and being flooded is a traumatic experience. Bear this in mind during work on the building.

1.0.6 This bulletin updates and replaces Bulletin 455 *Restoring a house after flood damage*. It does not cover making residential properties resilient to flooding.

2 REQUIREMENTS

2.0.1 Remediation work sometimes involves reconstruction. This is considered building work under the Building Act and must comply with the Building Code (section 17 of the Act).

2.0.2 The requirements of the Building Code and the need for building consent must be considered for each particular type of repair.

2.0.3 Where work involves general repairs and replacing existing materials with comparable materials, it may not need building consent. For example, replacement of damaged wall linings with comparable materials may be exempt from needing building consent unless the lining being replaced contributes to the building's structural behaviour or fire-safety properties or is being substantially or completely replaced (see Building Act Schedule 1 *Building work for which building consent not required*). Check with the local authority to find out if building consent is needed.

2.0.4 Building consent is generally needed if:

- structural elements are being replaced
- repairs are being made to fire separations in non-detached dwellings.

2.0.5 Other parts of the building that are not remediated must continue to comply with the Building Code to at least the same extent as before the flooding. Apart from considerations for escape from fire in multi-unit residential buildings, there is no requirement to upgrade parts of a building not being repaired.

2.0.6 If the work involves an upgrade or alteration, check whether it needs building consent. Extensions or additions will require consent and will need to comply with the current Building Code, including thermal performance requirements.

2.0.7 If the house structure is substantially damaged, a structural engineer must be consulted to decide whether it can be repaired. If not, salvageable items should be removed and arrangements made for demolition.

2.0.8 Demolition may or may not require building consent. Schedule 1 of the Building Act allows exemptions for the full demolition of detached buildings not more than 3 storeys high. Partial demolition will generally require building consent but may be exempt if the removal does not affect the primary structure of the building, any specified system or any fire separation. If in doubt, check with the local authority.

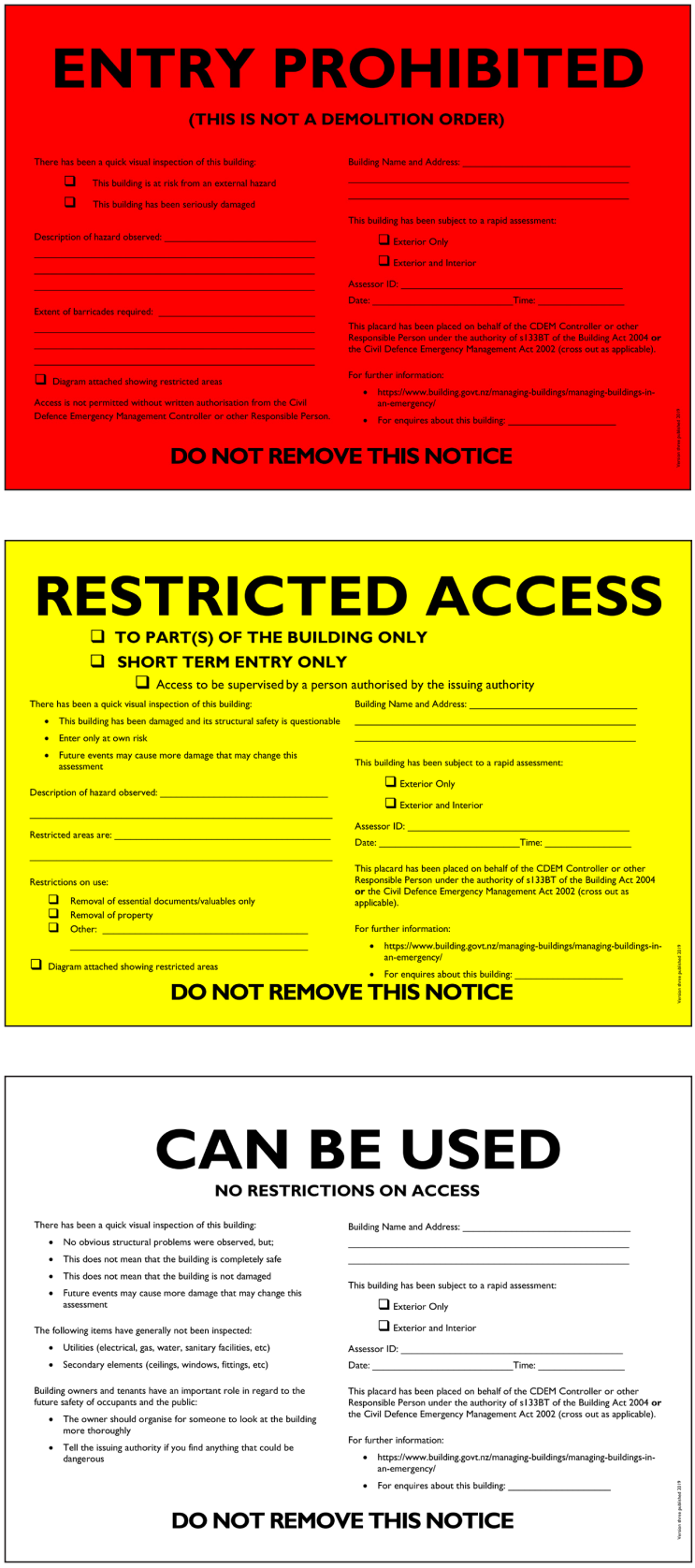
3 IMMEDIATELY AFTER A FLOOD

3.0.1 Civil defence emergency management personnel will advise householders when they can return home. This procedure gives a chance to recover important items, but it does not necessarily mean that the dwelling is safe or can be occupied.

3.0.2 If a building is not safe to enter for structural and/or health reasons, emergency authorities will usually place a red 'Entry prohibited' placard near the entrance (Figure 1). The building must not be entered until this is removed or changed. A yellow 'Restricted access' placard allows access to some parts of the building or short-term entry only. A white 'Can be used' placard allows access but does not mean the building is safe to work or live in. Further safety checks may be required. Before beginning work, check with the local authority or civil defence emergency management that return to the property is allowed.

3.0.3 Before starting the clean-up, check that the property presents no immediate danger:

- Floodwaters have receded enough to make the building safe to enter and no further flooding is expected.
- Land damage such as undermining and subsidence will not pose a risk for people on site.
- The building is structurally safe – a structural engineer, suitably qualified building consultant or experienced builder who is also a licensed building practitioner (LBP) should confirm this.
- A registered electrician has either checked and confirmed that the power supply and installation is safe or has cut off the power supply (appliances must be checked individually). They may hook up temporary electrical services if it is safe.
- The gas supply has been checked by a registered gasfitter and either tagged as safe or disconnected.



ENTRY PROHIBITED

(THIS IS NOT A DEMOLITION ORDER)

There has been a quick visual inspection of this building:

- ❑ This building is at risk from an external hazard
- ❑ This building has been seriously damaged

Description of hazard observed: _____

Extent of barricades required: _____

❑ Diagram attached showing restricted areas

Access is not permitted without written authorisation from the Civil Defence Emergency Management Controller or other Responsible Person.

Building Name and Address: _____

This building has been subject to a rapid assessment:

- ❑ Exterior Only
- ❑ Exterior and Interior

Assessor ID: _____

Date: _____ Time: _____

This placard has been placed on behalf of the CDEM Controller or other Responsible Person under the authority of s133BT of the Building Act 2004 **or** the Civil Defence Emergency Management Act 2002 (cross out as applicable).

For further information:

- https://www.building.govt.nz/managing-buildings/managing-buildings-in-an-emergency/
- For enquires about this building: _____

DO NOT REMOVE THIS NOTICE

Version three published 2019

RESTRICTED ACCESS

- ❑ **TO PART(S) OF THE BUILDING ONLY**
- ❑ **SHORT TERM ENTRY ONLY**
- ❑ Access to be supervised by a person authorised by the issuing authority

There has been a quick visual inspection of this building:

- This building has been damaged and its structural safety is questionable
- Enter only at own risk
- Future events may cause more damage that may change this assessment

Description of hazard observed: _____

Restricted areas are: _____

Restrictions on use:

- ❑ Removal of essential documents/valuables only
- ❑ Removal of property
- ❑ Other: _____

❑ Diagram attached showing restricted areas

Building Name and Address: _____

This building has been subject to a rapid assessment:

- ❑ Exterior Only
- ❑ Exterior and Interior

Assessor ID: _____

Date: _____ Time: _____

This placard has been placed on behalf of the CDEM Controller or other Responsible Person under the authority of s133BT of the Building Act 2004 **or** the Civil Defence Emergency Management Act 2002 (cross out as applicable).

For further information:

- https://www.building.govt.nz/managing-buildings/managing-buildings-in-an-emergency/
- For enquires about this building: _____

DO NOT REMOVE THIS NOTICE

Version three published 2019

CAN BE USED

NO RESTRICTIONS ON ACCESS

There has been a quick visual inspection of this building:

- No obvious structural problems were observed, but;
- This does not mean that the building is completely safe
- This does not mean that the building is not damaged
- Future events may cause more damage that may change this assessment

The following items have generally not been inspected:

- Utilities (electrical, gas, water, sanitary facilities, etc)
- Secondary elements (ceilings, windows, fittings, etc)

Building owners and tenants have an important role in regard to the future safety of occupants and the public:

- The owner should organise for someone to look at the building more thoroughly
- Tell the issuing authority if you find anything that could be dangerous

Building Name and Address: _____

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- For enquires about this building: _____

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Figure 1. Placards that may be placed on dwellings following severe flooding. © The Crown.

- The sewerage system is safe and presents no health danger to workers cleaning. Flooded septic tanks should be checked by a certifying plumber and/or registered drainlayer and pumped out as soon as possible if necessary and the disposal field cleared of any silt.

3.0.4 When entry to the dwelling is permitted, maintaining security may be difficult. The occupants should remove any remaining valuables.

3.0.5 Before any clean-up or repair work begins, take photographs and/or videos of all the damage and store them safely. Where you can see the maximum height that floodwaters came up to, mark that point in each room with a permanent marker.

3.0.6 With buildings on suspended timber floors, try to determine whether the house has moved on its foundations. If this seems likely, consult a registered engineer. Door frames out of shape and new cracks in walls may be evidence of this.

4 HEALTH AND SAFETY

4.0.1 Floodwater is often contaminated. Do these things to keep safe during clean-up:

- Wear long trousers, a top with long sleeves, gloves and sturdy shoes and have a mask handy.
- Prioritise safe disposal of accumulations of sewage and dead animals in the vicinity of the building and manage any other health hazards.
- Only drink purified water until the regular supply is confirmed as safe to drink and you have run taps until the water is clear.
- Discard all food exposed to the flood unless stored in sealed airtight containers. Wash all food containers carefully before opening. Do not eat vegetables from the garden if the garden was under floodwater. Disinfect and wash crockery, glassware and cutlery thoroughly before use. Dispose of thawed food in freezers where the power has been off for 2 days or more.
- If the water in a water storage tank was affected by floodwater, dispose of the water, clean out and disinfect the tank.
- Keep small children, pets and anyone with asthma or allergies away during clean-up.
- Use liberal amounts of disinfectant when cleaning, and wash hands thoroughly before eating and drinking.
- Disinfect cuts and skin injuries immediately and cover with a waterproof dressing.
- If you need light, use a battery-powered torch or lamp and not a light with a naked flame.

5 CLEANING UP INSIDE

5.0.1 Remove wet belongings, furniture, bedding, wet curtains and floor coverings. Once items are thoroughly cleaned and dried, arrange to store these elsewhere. Some items that cannot be satisfactorily cleaned and dried (such as innersprung mattresses) will need to be disposed of.

5.0.2 Appliances and systems that have been covered by floodwater should be checked and may need to be removed. These include space heating and water heating systems and so on. Some may be cleaned, dried and checked/tested before being reinstalled/used while others must be disposed of.

5.0.3 Leave nothing inside the house that can trap moisture and slow the drying process.

5.0.4 Locate and clear pockets of trapped water and debris:

- Remove skirtings, cupboard kick panels and front panels to showers and baths.
- Remove wall linings sufficiently to allow cleaning of the wall cavity and the removal of wet insulation materials.
- Drill holes in or remove ceiling linings when water is trapped above.
- Ensure the power supply is disconnected and then remove electrical switch plates and fittings.

5.0.5 Remove any water, mud and silt that may be trapped:

- underneath the bath and shower tray
- in and beneath cupboards
- under stairs
- in wall cavities and between internal linings and claddings
- in a fireplace, chimney or woodburner
- above the ceiling
- in electrical switchboards and wall sockets (ensure power is disconnected)
- in sanitary fittings such as toilets, bidets, cisterns and pipes.

5.0.6 Remove all visible mud and debris. If sufficient clean water is available, use a hose with a reasonable nozzle pressure, starting from the top or upper limit of the flooding and working down. Insert the hose into concealed spaces to flush out dirt as work proceeds.

5.0.7 After hosing down, wipe or wash surfaces with disinfectant to reduce the risk of flood-carried infections and contaminants.

5.0.8 It is usually easier to clean wall framing cavities from the inside due to the presence of wall underlay on the outer face of the framing and the need to remove wet insulating materials. However, if the floodwater carried silt, this may be trapped between the wall cladding and the underlay. If this is the case, remove the outside cladding sufficiently to allow the silt to be removed. Silt left behind will affect wall underlay performance.

5.0.9 Hard linings such as wood panelling or wallboard can be scrubbed with a stiff bristle brush, water and detergent to remove dirt from cracks, corners and crevices. The surfaces should be well rinsed with clean cold water.

5.0.10 Gypsum plasterboard has a low tolerance to water and will almost always have to be replaced if it has been immersed.

5.0.11 Where plasterboard is used as bracing, it must be removed and complete sheets replaced, following specified fastening schedules to ensure the bracing

capacity is restored to the original. Removing these bracing elements means temporary bracing is required, particularly when the building requires an extended period for drying. Always consult a registered engineer, building consultant or experienced licensed builder. Building consent will be required.

5.0.12 If the plasterboard is not a bracing element and depending on the wall finishes being reinstated, it may be possible to remove a strip to 300 mm higher than the flood damaged zone. Where plasterboard sheets are cut, include nogging or flat-wise timber to provide some support at the edges for stopping. However, a better result will be achieved if full sheets are removed and then replaced after the framing has dried.

5.0.13 If it is not clear whether the plasterboard is used for bracing, replace with a braced lining with appropriate fixings and brackets.

5.0.14 Items made from composite wood materials such as medium-density fibreboard (MDF) or non-flooring grade particleboard have low tolerances to water immersion and may need to be replaced if fibres have swollen. This may affect skirtings, architraves, scotias, window jamb linings and joinery units.

5.0.15 Flooring board made from composite wood materials may also need to be replaced, as flooding damage could cause structural weakness. If checking the floor strength, it must first be completely dry. If in doubt, consult an appropriate expert.

5.0.16 Timber framing, whether treated or not, should be checked by a registered building surveyor before it is re-enclosed. It should be cleaned where required, treatment applied as advised and then be allowed to dry (see 9.0.3).

5.0.17 If there is significant mould growth, affected linings should be removed and disposed of in sealed bags. Any affected timber framing should be washed thoroughly, rinsed, treated and dried. If mould has been removed from the sides of a stud, it is likely to also be present on the back face of the stud, and this should be managed accordingly.

6 CLEANING UP SUBFLOOR SPACES AND BASEMENTS

6.0.1 For homes with subfloor spaces under suspended ground floors, clean out the space to prevent excess moisture remaining, to speed up the drying out of the structural timber above and to reduce the risk of future rot.

6.0.2 Options to remove water under the floor are:
- pumping out
- digging drainage channels to the outside
- digging a pit to drain the water into, then pumping or bailing the water out.

6.0.3 The water removed from under the building should be disposed of as far away as is practicable without impacting other properties. Where the subfloor is lower than the surrounding ground, it may take some time for water to stop accumulating.

6.0.4 Once the subfloor water has been drained, remove any dirt and debris left behind by floodwater. Leaving the silt slows the drying process, but solid debris including silt could be left if it is inaccessible and:
- there are no foul odours present
- the foundation vents are not blocked and there is at least 400 mm between the lowest timber and the ground
- the debris contains no organic matter.

6.0.5 Remove wet insulation. Underfloor insulation should be reinstated or replaced after the subfloor is dry to the level required by the current Building Code or the material manufacturer. If metallic foil subfloor insulation is present, disconnect the electricity supply, remove the foil and replace with a Code-compliant product (foil cannot legally be installed or repaired).

6.0.6 Hose down the underside of the suspended floor to remove dirt from nooks and crannies, particularly around the perimeter. Dirt left behind can hold moisture, slow the drying and may cause rotting.

6.0.7 Check services such as drains, pipes, wiring and conduits for damage and repair if necessary. Silt can be deposited into drains through gully traps. Flush these with clean water.

6.0.8 The best way to dry the subfloor space is to maximise airflow:
- Clear any debris blocking ventilation openings.
- Knock out the grilles to underfloor vents.
- Cut back plants that are obstructing vents.
- Remove items stored under the dwelling.
- Leave subfloor access doors open.
- Remove part of the foundation enclosure such as base boards or sheet linings. If these materials are part of the subfloor bracing system, install temporary diagonal bracing and ensure the bracing is restored to the equivalent of the original. If in doubt, consult a registered engineer or experienced licensed builder.
- Form new ventilation openings in concrete foundations, ensuring there is no structural compromise.
- Set up fans to circulate air if space allows and they can be set up safely. Hire centres often have larger industrial fans.

6.0.9 Concrete foundations can hold water and will need time to dry.

6.0.10 If a basement is flooded, pump the water out over several days. Emergency management authorities advise that, if water is removed from a basement too quickly, water-saturated soil outside the basement could put strong pressure on basement walls, with the risk of collapse.

7 CLEANING UP OUTSIDE

7.0.1 Remove and dispose of driftwood, rubbish and decaying vegetation.

7.0.2 Protect the outside of the building to prevent further rainwater entering while the interior is drying.

7.0.3 Clean external walls with water and detergent as soon as possible, as dirt on the surface will keep it damp.

Use a stiff nylon or bristle brush for brick or blockwork and a soft brush or cloth for timber. Do not waterblast, as this is too aggressive and can do damage.

7.0.4 Wedging out or removing the bottom two or three weatherboards will allow draining and flushing out of the bottom of the wall cavity where it continues past the inside floor level. This will also give much better ventilation to the wall and assist in drying. Sheet claddings that span from top to bottom may have to be removed completely.

7.0.5 With masonry veneer cladding, silt may be cleaned out by inserting a hose through the perpend drain points. Where there is more significant silting, remove bricks or blocks in the bottom course to make access ports to flush out the silt.

7.0.6 All monolithic claddings (stucco, exterior insulation and finish systems (EIFS), flush-stopped fibre-cement sheet) should be inspected by a registered architect, registered building surveyor or building surveyor experienced with this type of building. Some of these materials are quite absorbent. Fibre-cement sheet, for example, must be allowed to dry thoroughly.

8 DRYING OUT THE HOME

8.0.1 Once wet materials have been removed and the dwelling is thoroughly cleaned, drying out can begin. Drying out, particularly in winter, can take several months.

8.0.2 Ideally, a building should dry as quickly as possible to reduce risks such as mould growth. Removing linings will speed the drying of concealed places, and linings can be replaced when the building is dry. Relining should not be carried out until the moisture content in the timber wall framing has dropped to acceptable levels (see 9.0.3), and the framing must show no signs of rot. Where time is critical, it may be more practical to replace timber that is wet than wait for it to dry.

8.0.3 On dry days, keep all windows and doors open to maximise ventilation. On wet days, leave windows ajar so there is still some ventilation. Leaving cupboard doors and drawers open will speed the drying of storage areas.

8.0.4 Heaters (and fans and dehumidifiers) can be used, but too much heat may cause wood to warp and split. An inside air temperature of approximately 20°C (or at least 8°C above the outside air temperature) will increase the drying rate without creating additional problems. Ventilation as well as heating allows warm moist air to escape (although doors and windows should be closed if using dehumidifiers). Do not light a fire in a brick fireplace unless it has dried fully – steam created from the moisture can cause damage as it expands, and wet bricks and mortar can explode.

8.0.5 To speed drying of floors:
- remove polyurethane coating or sealer
- lift water-resistant floor coverings such as vinyl sheet, vinyl tiles and ceramic tiles
- ensure good ventilation inside the home and under suspended floors.

8.0.6 Hardwood floorboards need to be dried slowly to prevent cracking and buckling. Do not attempt to straighten warped or buckled timber floors until the whole building has dried completely and the timber moisture content is 20% or less.

9 REPAIRS

9.0.1 The building must be sufficiently dry before repair work is carried out.

9.0.2 Undertaking repairs to the structure and finishes before the building is dry enough can result in:
- mould developing
- future degradation of structural materials if they are enclosed before drying
- poor adhesion (blistering) of finishes
- materials continuing to move as they finish drying, resulting in cosmetic cracking to plaster and paintwork
- lifting and bubbling of vinyl floor coverings
- health problems for occupants.

9.0.3 Timber in homes normally has an in-service moisture content of 12–20%. Timber standing in water will absorb it, and it may take months for the moisture content to return to what it was. The moisture content in timber framing must drop to below 20% before the wall linings are replaced (plasterboard manufacturers may require 18% or less). Before any wall linings are replaced, there should be a prelining inspection by the territorial authority. The timber must also be dry before timber weatherboards or exterior joinery are painted. Use a moisture meter to check. These can be hired.

9.0.4 For concrete floors, a flooring hygrometer is the most reliable for testing dryness. The concrete must be sufficiently dry to give a relative humidity reading of 75% or less before installing fixed floor coverings.

9.0.5 Damaged wall underlay in external walls may need replacing. Removing the outside cladding to replace underlay is best practice.

9.0.6 Replace insulation under the floor and in the walls. When reinstating insulation, take the opportunity to upgrade to current Code requirements or, ideally, better than Code.

9.0.7 BRANZ recommends upgrading to current bracing requirements wherever possible (see NZS 3604:2011 *Timber-framed buildings* for timber-framed buildings less than 3 storeys or consult an engineer). If there is doubt over what bracing was used at the time of construction, refer to the consent plans held by the local authority. If the construction dates from before 1978, a bracing schedule should be recalculated by an architect or engineer using NZS 3604:2011 and bracing installed.

9.0.8 Where appropriate, take the opportunity to add tie-down straps between the studs and bottom plates and check the number of foundation holding-down plates, straps and bolts and add to them if necessary.

9.0.9 Ventilation holes in foundation walls should be made vermin proof if they have been damaged or

removed to assist drying. Any base boards removed for drying should be replaced when drying is complete.

9.0.10 Replace doors and frames (including cupboard doors) that are damaged by swelling, warping and/or blistering or peeling surfaces.

9.0.11 Check particleboard floors for swelling at the joints by using a long straight edge. If swelling is more than 4 mm, the floor should be sanded flat. If it exceeds 6–8 mm, replace the floor.

9.0.12 Once the dwelling is cleaned and the building fabric dried, items that can be reinstalled after cleaning, repair or replacement include:

- appliances
- hot water cylinders and gas water heaters
- heaters
- central vacuum and heating systems
- electrical fittings
- carpet that does not have rubber backing or rubber underlay (rubber underlay will restrict the final drying).

9.0.13 No decorating should be carried out until moisture levels have dropped to the acceptable levels for relining.

9.0.14 Occasionally, a dwelling can be lived in while repair work is carried out, when:

- there is not a health risk
- the initial clean-up of water, mud and debris is completed
- the power supply is safely restored and electrical appliances have been checked
- potable water supplies and sewerage systems have been checked, repaired if necessary, tested and declared safe for use
- the local authority has lifted any notices on the dwelling.

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New BRANZ research: Climate Resilience – Building Back Better

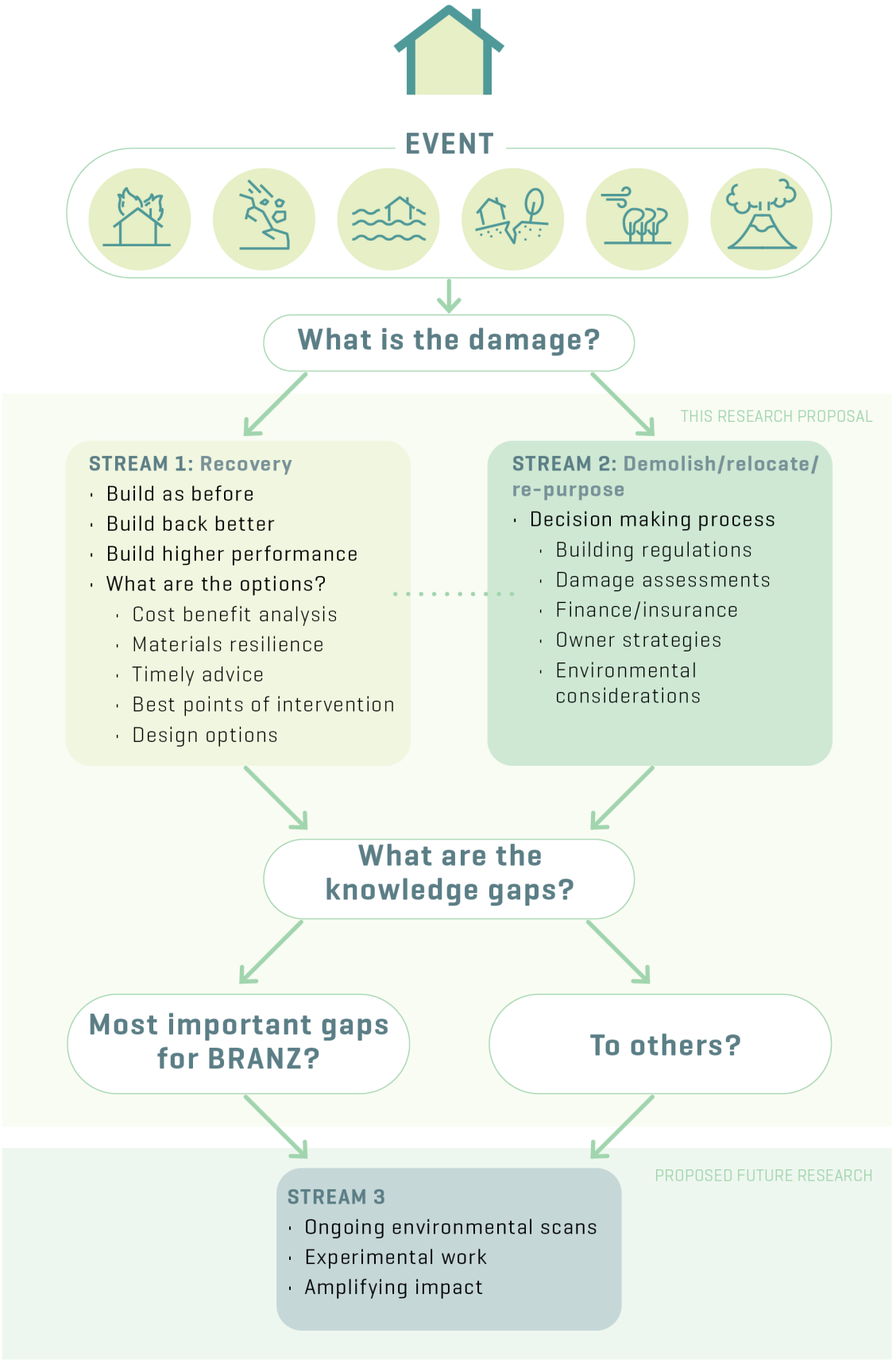
A new BRANZ research project on building resilience and building back better starts in April 2024. The project aims to provide practical guidance on effective action to minimise the risks associated with future natural disasters and climate change.

The work will focus on three areas: (see figure below):

- options for recovery after an event, including a comprehensive review of guidance that already exists in both Aotearoa New Zealand and internationally, with a view to updating or adapting the guidance for multiple audiences as appropriate
- addressing the question of how a building is classified for rebuild or demolition after a severe event, or to limit damage before an event, through relocation or preventative measures
- identifying knowledge gaps where we need more research to be able to provide evidence-based guidance.

We are keen to hear from anyone who would like to share any experience they have had relating to this new project, and/or if you would like to be kept informed of progress.

For more information, please contact the project leaders: Catherine Nicholson (catherine.nicholson@branz.co.nz) or Katy Stokes (kathryn.stokes@branz.co.nz)


EVENT
What is the damage?
THIS RESEARCH PROPOSAL
STREAM 1: Recovery
Build as before
Build back better
Build higher performance
What are the options?
Cost benefit analysis
Materials resilience
Timely advice
Best points of intervention
Design options
STREAM 2: Demolish/relocate/ re-purpose
Decision making process
Building regulations
Damage assessments
Finance/insurance
Owner strategies
Environmental considerations
What are the knowledge gaps?
Most important gaps for BRANZ?
To others?
PROPOSED FUTURE RESEARCH
STREAM 3
Ongoing environmental scans
Experimental work
Amplifying impact

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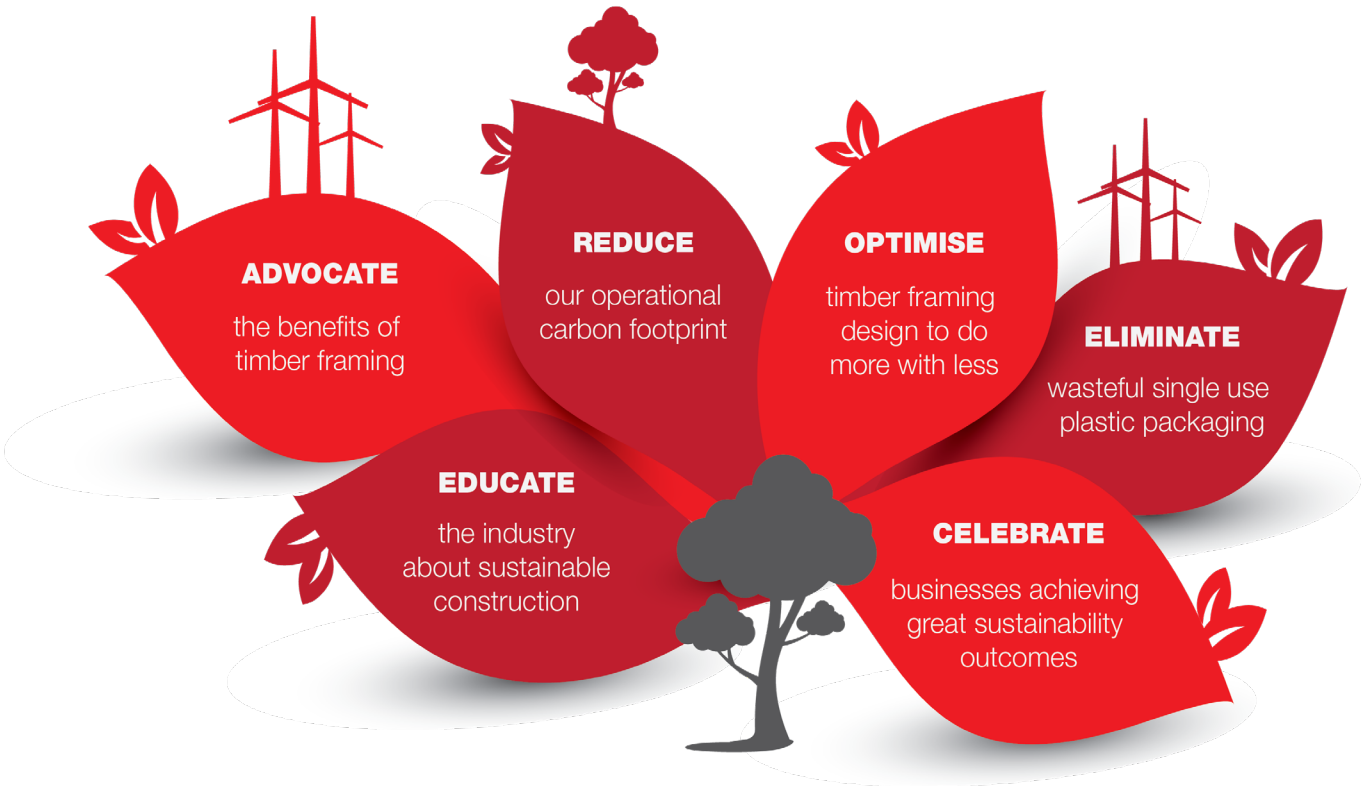

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