

Resilient Homes

Storms, Floods and Heavy Weather

Many New Zealanders look to build or buy their dream home as part of a long and happy retirement. For many it's an opportunity to buy a place with views, be near the beach, or be close to rivers.

Large windows, decks and glass doors to give indoor/outdoor flow are often favoured. However, these features can be more vulnerable to natural events which can damage our biggest investment in our futures – our homes.

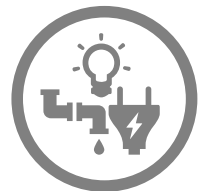
We are all aware of earthquakes in New Zealand. These are difficult to avoid in many parts of the country, which is why our building regulations attempt to ensure our homes are built to keep us safe during earthquakes.

But we face other natural events that can have huge impacts. Storms, high winds, floods and slips are common adverse natural events in New Zealand.

We can make our homes more resilient and we can choose to buy or build new homes that are more resilient. Spending time now to assess your home will always be a good investment into choosing your biggest asset.

This guide provides you with a quick way to identify risk to house resilience that might be present in your home.

Professional help: Always get professional help if you are concerned about the vulnerabilities of your home. This is just a quick guide to highlight some issues that you might want to explore. It cannot replace a professional assessment.



RESILIENT
COMMUNITIES
DOING BETTER IN BAD TIMES

Acknowledgement

This tool was produced as part of the research programme *Resilient Communities: Doing Better in Bad Times*. The research was funded primarily by the Public Good Science Fund with assistance from the BRANZ Levy.

BRANZ and CRESA would like to thank the individuals including the many older people and organisations who piloted the tool in its early forms.

We must acknowledge too the contributions of those who served on the programme's national reference group and our overseas Advisory Group: Catherine Bridge, Associate Professor, Faculty of Built Environment, University of New South Wales, Sue Roaf, Professor of Architectural Engineering, Heriot Watt University, Edinburgh, and Rob Wiener, Executive Director, California Coalition of Rural Housing.

In addition we would like to thank the research team who have contributed to our understanding of older people's resilience needs: Kay Saville-Smith and Ruth Fraser (CRESA), Bev James (Public Policy & Research), Roman Jaques (BRANZ), Rob Bell (NIWA), Ryan Paulik (NIWA), Mark Jones (BRANZ), Nick Marston (BRANZ), Sally Priest (Flood Hazard Research Centre), Middlesex University, London.

For more information about the project as well as previous publications please see the research website www.goodhomes.co.nz and go to the resilience page.

© This publication is copyright. Details may only be stored or copied for personal or corporate use for its stated purposes. Copying for the inclusion in other publications for sale is strictly forbidden.

CRESA, BRANZ, or any of the Good Homes projects members including the *Resilient Communities Doing Better In Bad Times* programme, or its advisers do not accept any responsibility or liability for any damage or injury arising from use of this publication, or reliance on information contained in this publication.

Resilient Homes: What's It About?

A home is resilient to storms, floods and heavy weather when it:

- Helps to protect you during an event.
- Minimises damage.
- Minimises the costs and time involved in recovering and repairing damage.

A resilient house features simple design, materials and systems. This guide looks at those. But the site of a house also matters.

A site that allows a house to be oriented for solar gain can make a big difference if you lose electricity and have no heating or alternative lighting. You could be reliant on the sun when it returns to dry you out, keep you warm and light you in the afternoon and early mornings. A site that gets no sun will make a house less resilient than exactly the same house with a better orientation. A Site Selection Tool will be available on www.goodhomes.co.nz to assess house sites for resilience.

Your home can cost big money – think about the implications for your future if:

- It is destroyed and you cannot rebuild it.
- It needs a lot of remedial work to repair or remodel.

We all make trade-offs when selecting a home – thinking about the building and its vulnerabilities is just one part of that.

You can also use the *Good Homes Repair and Maintenance Tool* especially designed to help older people assess and plan for home maintenance at www.goodhomes.co.nz.





1. A resilient roof

Some roofs work better than others in extreme conditions. Some roofs are also easier to maintain and less costly to repair if something goes wrong and as a roof ages. Some roofs are able to cope better when other systems – like gutters – are not working well.

So if you are looking to buy or build bear in mind:

- Flat roofs and complex roofs with lots of different planes, junctions, pitches or levels are particularly at risk during storms and high winds.
- Flat roofs and roofs with internal gutters or gutters concealed in the soffit can be more vulnerable to significant and damaging leaks unless well maintained and repaired.
- Roofs with unrepaired damage or deterioration may cope in ordinary weather for a period of time but adverse weather will be too much for them.
- A complex roof has more junctions that need to be maintained and these junctions may also be more complicated and costly to repair.



Looking to buy an existing home? Checking out your existing home?

Because roofs are difficult to get at, it is worthwhile getting a tradesperson or property inspector to inspect the roof of any house you want to buy and ask them to report on its condition.


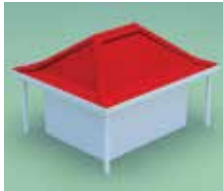


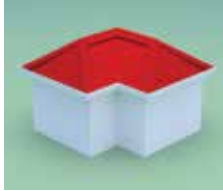







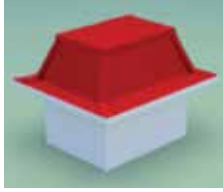
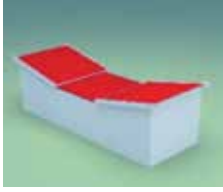

Ask them to look particularly at:

- The roof structure and whether it is sound.
- The roof cladding and whether it is:
 - Properly attached.
 - Adequately flashed around junctures.
 - Free of holes, missing tiles, gaps.
 - Free of lichens, moss.
 - Free of surface deterioration.
 - An adequate number of downpipes.

1.1 Roof design and resilience

If you are buying a new home or are talking with a builder, architect or designer about a new home use these diagrams to help you decide the most resilient roof structure.

Circle the types that fits the house best. Put a cross if it's in the two higher risk categories.

Lower Risk	→	Higher Risk
<p>Hip</p> 	<p>Bonnet</p> 	<p>Flat</p> 
<p>Gable</p> 	<p>Cross Hip</p> 	<p>Flat with parapet</p> 
<p>Simple Monopitch</p> 	<p>Cross Gable</p> 	<p>Flat Topped Mansard</p> 
<p>Salt Box</p> 	<p>A Frame</p> 	<p>Multilevel</p> 
	<p>Mansard</p> 	<p>Complex</p> 
		<p>Complex</p> 

1.2 Guttering and downpipes

Circle the features that fit the house best. Put a cross if it's in the two higher risk categories

Lower Risk	→		Higher Risk
<p>Guttering is in good condition</p> <p>No internal or concealed guttering without an overflow fitting</p> <p>Plenty of downpipes – well attached</p>	<p>Guttering well attached with adequate downpipes</p> <p>Requires cleaning and minor deterioration</p>	<p>Internal and concealed gutters</p> <p>Few downpipes</p> <p>No overflows on guttering and downpipes poorly attached</p>	

1.3 Roof condition and resilience

Lower Risk	→		Higher Risk
<p>Properly attached, well flashed</p> <p>No holes, missing tiles or gaps with no surface deterioration or lichen/moss</p>	<p>Minor surface deterioration and lichen/moss on otherwise properly attached and flashed roof</p>	<p>Poorly attached or holes or missing tiles</p> <p>Poorly flashed and major surface deterioration</p>	



2. Skylights

Skylights are a weak link during storms and other high wind events. They can be:

- Broken by windblown debris.
- Vulnerable to water forced in by very heavy and wind driven rain.
- Difficult and costly to maintain and repair.

Because they are difficult to repair and maintain, older skylights are more likely to be a risk in storms and heavy weather than newer skylights. Newer skylights are also likely to be more resilient because of technical advances over the years.

So if you really want that house with skylights or your house has skylights make sure they are as low risk as possible.



Circle the types that fits the house best. Put a cross if it's in the two higher risk categories.

2.1 Skylight placement

Lower Risk		Higher Risk		
No skylights	One skylight on a protected side of the roof	More than one skylight on protected side of the roof	One skylight on an exposed part of the roof	More than one skylight on exposed parts of the roof

2.2 Skylight age and condition

Lower Risk		Higher Risk	
New skylight with manufacturer and installer guarantee	Older skylight regularly checked to ensure flashings, gaskets and installation are effective and well maintained	Older skylight not checked or maintained	Older skylight or any skylight with evidence of damage, poor fitting or signs of leaks, corrosion or warping of the frame

Because skylights are on the roof and can be difficult to check, it is worthwhile getting a tradesperson or property inspector to inspect them.



3. Canopies, Verandas, Decks, Lean-to and Additions

Canopies, verandas, decks, porches, lean-tos and additions like conservatories or even new rooms can be:

- Weakly connected to the original dwelling
- Poorly maintained if they are not a routinely inhabited space
- Poorly detailed if not professionally designed
- Built without a building consent if below a certain floor area
- Damaged because they create different air pressures around the house in high winds.

Of course, these structures are also useful. They can provide shade or warmth. They can also allow people to be sheltered as they enter the house.



You are least likely to have problems with these structures if they:

- Have been built into the house as part of its original design rather than added on later.
- Have been added recently AND with a building consent.
- Have been well-maintained.

You will be able to check with the council whether lean-to structures, decks, canopies or conservatories have:

- Been built as part of the original structure or added on or
- Had a building consent and code compliance.

Remember some work doesn't require a building consent, so it is important to check that work for any sign of damage, weak connections, poor repair and maintenance, or signs that the structure is unsteady or wobbly. Check who did the work and whether they had the right skills and whether there are guarantees for the job.

3.1 Canopy, veranda, deck, lean-to, conservatory and additions resilience risks

Circle the types that fits the house best. Put a cross if it's in the two higher risk categories

Lower Risk		Higher Risk		
No canopies, verandas, decks, or lean-tos	Built as part of dwelling with building consent and code compliance in last 10 years	Added to dwelling in last ten years, in good condition with building consent and code compliance	Built as part of dwelling with building consent more than 10 years old and in good condition	Added more than ten years ago or any structure with evidence of poor connection to the dwelling or in poor condition



4. Windows

Windows can be broken by windblown debris and they can also be broken because of wind pressure. Shutters or screens can add extra protection to exposed windows and doors. But they won't necessarily reduce the risk of window breakage from extreme wind pressures. You can also make your windows more resilient by:

- Having toughened safety glass, bearing the "S Mark", in some windows. You may also already have this in some glass doors.
- Double glazing.
- Ensuring that windows with chips or cracks are repaired and/or replaced.
- Making sure window frames and gaskets around windows are in good repair and are not warped.



There are also implications for damage and the cost of repair when windows fail. Window and door failure can result in the roof failing. Similarly, the consequences of failure of larger window panes can be greater. Broken small windows will allow in less rain and will be simpler to protect and temporarily cover if they break and are easier to repair.

Glass doors are unlikely to break from the pressure of water against them in a flood unless the glass is damaged or the water contains large debris. If you see water rising against the glass of a door – DO NOT OPEN IT **UNLESS** YOU NEED TO USE THE DOOR TO EVACUATE.

The amount of glass in a wall can also reduce resilience. Here are some resilience indicators around glass doors and windows.

Circle the types that fits the house best. Put a cross if it's in the two higher risk categories

4.1 Window and glass door age, condition and materials

Lower Risk		Higher Risk	
Windows, doors can be screened to reduce wind-blown debris damage, glass is toughened, or double glazed with smaller panes	Smaller window panes with glass in good condition and well maintained frames	Large window panes on exposed walls or windows that protrude from the walls of the house with minimal or poor frames	Old or poorly maintained windows with frames that are warped or with chipped / cracked glass.

4.2 Window and glass doors in walls

Lower Risk		Higher Risk
Less than 25% of walls occupied by glass doors and windows	Between 25% and 50% of walls occupied by glass doors and windows	> 50% of walls occupied by glass doors and windows



5. Walls and wall cladding

Simple is best.

A house that has multiple junctions (corners) and lots of different claddings requires more maintenance. Joining one cladding, such as weatherboard, to another sort of cladding, such as brick or cement board, requires good installation. Remember too that different materials react differently to temperature changes and move differently due to temperature and moisture. So junctions between different materials may be complicated and may also be more difficult to maintain and repair if they are damaged in an adverse event.


Wide eaves can protect the cladding but concealed gutters in the soffit may pose a risk of leaks in the roof space. They can be difficult to maintain too.

The age and condition of a dwelling makes it more or less resilient. This is partly because older dwellings were built under less stringent building regulations. But a well maintained old home may be very resilient. So age isn't everything.

Looking to buy an existing home? Checking out your existing home? You can use the Good Homes Repair and Maintenance Tool especially designed to help older people assess and plan for home maintenance at www.goodhomes.co.nz. This will help you assess the condition of a dwelling.

5.1 House cladding and form resilience

Circle the types that fits the house best. Put a cross if it's in the highest risk category.

Lower Risk		Higher Risk
Single cladding and simple square or rectangle forms. Building consent and code compliance available.	Mixed claddings in good condition, newer dwelling with building consent and code compliance. Simple forms.	Many different claddings, with different colours (especially if a mix of light and dark colours) complex forms, particularly where evidence of poor repair or condition.



6. Exterior door types

Doors, like windows, tend to be weaker than walls so they can be vulnerable to windblown debris and they can fail at much lower wind pressures than walls.

Doors which are more resilient tend to be:

- Metal or solid wood, not MDF.
- Sheltered, including those within a porch.
- If doors are glazed, double glazing and safety glass are important.




Hollow core doors:

- Are not very resilient
- Sound drummy (hollow!) when tapped.
- Will be painted.
- Have very limited detail or are flat-surfaced.
- Sometimes have a 'tell-tale' edge which makes the door look like a sandwich.

6.1 Exterior doors

Circle the types that fits the house best. Put a cross if it's in the highest risk category.

Lower Risk			Higher Risk
Solid wood exterior doors Aluminium / metal exterior doors	Solid wood exterior doors with some glazing PVC exterior doors with some glazing Double glazed exterior doors with safety glass	Glass exterior doors without safety glass Hardboard faced hollow core exterior doors A door that is sticking due to swelling is likely to be routinely wet with rain	

6.1 Number of crosses



7. Wiring and electrical systems

Some systems can be very vulnerable to water. Resilient houses:

- Have plugs and switches set a metre above the floor. These are less likely to be affected by flood damage. Switches and plugs at that height are also easier to use for older people and people with disabilities. Wiring a new house to meet LifeMark standards can also be less costly in a new build because cabling does not come so far down the wall.
- Don't have underfloor wiring as it is less resilient in flood situations.

Remember it is best NOT to use any electrical systems or appliances during high winds or electrical storms, or during or subsequent to your house being flooded. Unplug electrical appliances.

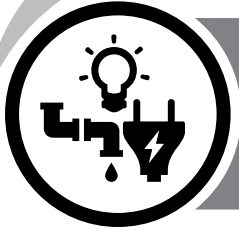
See www.getthru.govt.nz for information about protecting yourself, your house and appliances in an emergency. Also see your local council for advice on electrical appliances and your lines company if your house is damaged or flooded.

7.1 Wiring and electrical

Put a cross if the house has:

- Underfloor wiring.
- Plugs and switches below 500mm from the floor.

7.1 Number of crosses



8. Resilient Heating, Cooking, Lighting and Water

A house that keeps you comfortable in ordinary weather across all the seasons and gives you good natural light during the day is most likely to be resilient. A resilient house will also let you:

- Keep warm or cool.
- Cook and heat without electricity.
- Have access to water.

A house that can easily maintain comfortable indoor temperatures and daylight will typically be:

- Oriented to the sun.
- Well insulated in ceilings, walls, and floors.
- Double-glazed.
- Well-ventilated with the ability to shade.

A house that is not always dependent on reticulated water and electricity will be more resilient.

Here are some indicators of the risk to a house's resilience and people's ability to look after themselves during an adverse natural event.

8.1 Risks to adequate thermal comfort

Circle the types that fits the house best. Put a cross if it's in the highest risk category.

Lower Risk	→	Higher Risk
A home which is naturally warm in winter and cool in summer without the need for heaters, dehumidifiers, heat pumps or air conditioners	Dual fuel burner Solid fuel (not pellet) burner Bottled gas AND/OR Movable window shades A good amount of opening windows for cross ventilation	Poorly insulated exterior Lots of glazing (especially in the western aspect) which cannot be shaded externally Low availability of direct sunlight in winter Few or small opening windows for good summer ventilation

8.2 Risks to adequate cooking and adequate water heating

Circle the types that fits the house best. Put a cross if it's in the highest risk category.

Lower Risk	→	Higher Risk
Wood-burner with wetback and cooktop Bottle gas cooking and water heating Alternative electricity generation (eg., diesel or gas generator or photo-voltaic panels with batteries)	Wood burner with cooktop OR Bottled gas cooking AND Standalone water heating systems using renewables (e.g. photo-voltaic, wind turbine etc.) OR Solar hot water system	All heating, cooking and water systems reliant on reticulated electricity

8.3 Risks to adequate water supply

Circle the types that fits the house best. Put a cross if it's in the highest risk category.

Lower Risk	→	Higher Risk
Water supplies can be easily obtained from nearby, uncontaminated well, river or stream OR A potable water storage device of at least 200 litres	An easily accessible header tank or water storage	Standard reticulated water supply

Using the results

Count up the number of circles **WITHOUT** crosses:

This is the number of features that will help the house and you to be resilient.

Count up the number of **CROSSES** the house has:

1.1 Roof design and resilience

1.2 Guttering and downpipes

1.3 Roof condition and resilience

2.1 Skylight placement

2.2 Skylight age and condition

3.1 Canopy, veranda, deck, lean-to, conservatory and additions resilience risks

4.1 Window and glass door age, condition and materials

4.2 Window and glass doors in walls

5.1 House cladding and form resilience

6.1 Exterior doors

7.1 Wiring and electrical

8.1 Risks to adequate thermal comfort

TOTAL

These make you house more vulnerable.

Look at the risk factors, if you have lots of crosses in section 8 your dwelling will be difficult for you if you lose electricity

Some Information Sources

Information about maintaining your home:

www.goodhomes.co.nz.

www.maintainingmyhome.org.nz.

Information about more systematic renovations:

www.renovate.org.nz

Information on designing for thermal comfort:

www.level.org.nz under the 'Passive Design' section

www.smarterhomes.org.nz

Information about designing accessible houses:

Some options and approaches are detailed at www.homemods.info/publications-by-hminfo/occasional/landscape-modification-an-alternative-to-residential-access-ramps-and-lifts

www.lifemark.co.nz

Information about building consents and compliance on existing dwellings:

Your local council

Information on building materials and systems:

www.branz.co.nz

