



# REPAIRING EARTHQUAKE DAMAGED WALL LININGS

**Many Canterbury houses have lost stiffness and strength following the earthquakes. Repairs to gypsum plasterboard linings need to restore this to prevent future small events repeating the cracking and damage.**

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**T**he Canterbury earthquakes subjected many structures to forces far greater than what they were designed for. Gypsum plasterboard wall bracing performed well, protecting people and their homes, but inevitably, these walls were damaged due to the severity of the event and the movement from the earth shaking, liquefaction and lateral spreading of soil.

## Loss of stiffness and strength

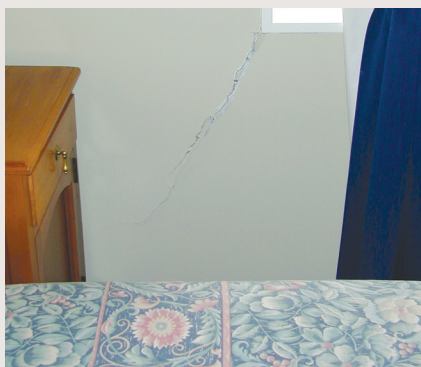
Anecdotal evidence suggests that many Christchurch homes are now 'noisier' during low-level aftershocks and moderate winds, indicating a loss of stiffness.

Laboratory testing confirms that, once bracing sheet panels such as plasterboard or plywood have been loaded to capacity, they lose the ability to accept even moderate loads before significant displacement takes place. Like a rubber band that has lost its 'stretch', the building will not be able to accept load until almost fully extended or displaced. For example, a test panel originally resisted a 2 kN serviceability load at about 3 mm displacement, but after it had been subjected to a major event, it required a displacement of about 15 mm to resist the same force.

This is important when determining suitable repair methods – simply raking out and plastering over cracks will probably result in cracks reappearing.

## Design changes

An assessment of each home is needed before deciding on the appropriate repair methods, as these vary depending on age and type of construction, design features, budget constraints and owner expectations.



Diagonal crack in lining, which appeared at the corner of the window after the earthquakes.

Ensure the building has returned to square. If not, this needs to be addressed before repairing wall linings.

Also consider the increase in the seismic zoning for the Canterbury earthquake region – earthquake design requirements are approximately 25% higher than what buildings were previously designed for.

Check existing bracing plans to see if sufficient resistance has been provided and to identify the type and location of designated bracing elements. If a bracing plan is inadequate or not available, a new assessment should be undertaken.

Where possible, consider design options that reduce earthquake forces. Significant damage has been observed to buildings with heavy claddings, and changing from a heavy to a lightweight roof can reduce earthquake forces by up to 40% for a common 1-storey house.

## Start by assessing damage to linings...

The extent of damage to gypsum plasterboard linings needs to be assessed before selecting an appropriate repair technique.

Damage around fasteners can be clearly visible or hardly detectable, but signs of fastener

stress or sheet 'slotting' around fasteners indicate degradation of the stiffness of a bracing element that must be repaired.

Cracking of joints can occur within or at the sides of bracing elements. Consider negative details or cover trims, particularly when cracks have occurred in joints aligning with opening jambs.

Cracks within the field of the lining usually extend diagonally from the corners of openings such as doors and windows. Cracked sheets must be replaced or overlaid with a new lining.

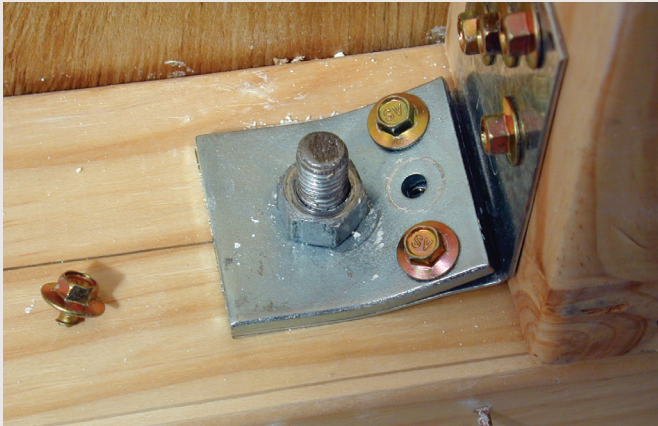
## ...and damage to connections

Movement may have lifted bottom plates and compromised connections. Sometimes, walls have returned to their original position, but stiffness will have been lost.

Floor coverings should be pulled back to allow inspection. A steel ruler or similar can be pushed under the bottom plate to determine the extent of separation. Replacing bottom plate fixings will inevitably mean that linings require replacement.

Damage to framing and panel hold-down connections is often not apparent, although damage to other elements, such as doors or windows, can indicate wider damage. Skirting boards will need to be removed to inspect damage around fasteners attaching linings to the bottom plate. Further investigation is necessary if signs of significant movement are detected. Damaged framing and panel hold-down connections must be repaired.

Note that partial lining replacement can result in unsightly sheet butt joints. Replace entire sheets or use best practice back-blocking techniques to reinstate the linings in the case of local repairs. →



Damage to panel hold-down during laboratory testing.



Damage to stud lift during laboratory testing.

### **Refasten if little damage to framing connections**

Existing linings can be refastened where no or only insignificant damage to framing connections has been found. Refastening along studs alone is not effective. Trims need to be removed to fix around the entire bracing element perimeter by inserting fasteners in-between existing ones.

This method is expected to reinstate the performance of bracing elements to about 80% of original stiffness and strength.

### **Replace linings when extensive damage**

Linings need to be replaced where there has been extensive damage to sheets or fasteners. Framing repairs must be carried out prior to installing new linings. Offset new lining fasteners from existing fastener holes. This repair method

will re-establish the original stiffness and strength of the bracing element.

Overlining is often carried out in preference because it is a cleaner process and eliminates the need to remove and dispose of the damaged linings.

### **Overlaying of existing linings**

Overlaying will restore stiffness and enhance the strength of bracing elements. Repair framing connections prior to installing the overlay by removing sections of the existing lining to gain access. These sections are patched before a new lining is overlaid.

Increase the length of the new lining fasteners by the thickness of the original lining and install in a bracing pattern offset from the existing fasteners.

This repair technique is attractive in buildings with rebated jambs when the new lining is placed up against existing window and door

reveals and new architraves are fitted. For buildings with existing architraves, these can be removed, the opening frames packed and the new linings installed before architraves are re-positioned or replaced.

### **Hidden bracing elements may be damaged**

Sometimes, bracing elements behind claddings have sustained damage and can not be readily accessed, repaired or replaced. Alternative bracing elements or new high-performance linings need to be provided to restore the structure's stiffness and strength. This again requires careful assessment of the building's bracing plan.

*For further information, call the GIB® Technical Helpline on 0800 100 442, or for a full copy of the research report visit [www.gib.co.nz/canterburyearthquake](http://www.gib.co.nz/canterburyearthquake). ◀*