



New Zealand Historic Places Trust Pouhere Taonga

## Sustainable Management of Historic Heritage Guidance Series

# Repairing Historic Stonework after an Earthquake

---

### Repairing Historic Stonework after an Earthquake

Stonework damage can occur during earthquake events and may continue during aftershocks. Stone block walls may have little inherent strength unless well mortared or tied to other wall structure.

In countries with minor seismic activity, masonry can be constructed, stone upon stone, and remain stable for centuries. In New Zealand, however, the sideways thrusts of earthquakes strain the stonework. If strong enough, the earthquake forces eventually cause damage.

Unsupported stonework is particularly prone to failure or collapse. Cracks might appear, individual stones or whole walls of stone fall away, walls might lean or move out of alignment, or mortar between the stones might be lost. If stonework was compromised before the earthquake, the cracking or loss of stones may be exacerbated.

#### First, Make Your Place Safe

In the first days after an earthquake you will hopefully have had initial assistance in deciding what degree of damage has been caused. For severe damage, you may have been advised to evacuate and tape off or barricade the building or undertake urgent work to hold the stonework together. It may have been necessary to contain or remove loose stones to prevent them falling on people, or waterproof your building where stone loss makes it open to weather.

#### How to Repair

All building owners will be keen to resolve their damaged building as soon as possible and there are a range of matters to consider. Many of the decisions to be made are complex. For heritage building owners, there are further issues of long-term importance to consider that owners of other buildings are unconcerned with.

#### Heritage Buildings

Heritage buildings have historical, architectural, cultural or other values that make them important. The loss of stone material may have been devastating and subsequent restoration may be necessary for the understanding of the building. For instance, a house that is important for its architectural values should have aspects of architectural design repaired. Otherwise the sense of the building is changed – even diminished. Most importantly, apparent damage is not a reason to unnecessarily alter or demolish the heritage building until all avenues and options are considered.

#### Every part of a Heritage Building is Important...

But some parts may be more important than others. As a heritage owner you may be well aware of the significance of your building and its material fabric, or you may be contemplating removing stonework because it looks too hard to repair.

For information about conservation principles that inform works such as repairing historic stonework, see the NZHPT ICOMOS Charter 2010: [www.icomos.org.nz](http://www.icomos.org.nz)

See also the NZHPT's Sustainable Management of Historic Heritage Guidance Series, Information Sheet No. 1 <http://www.historic.org.nz/Publications/SustainableMgtSeries.aspx>

The New Zealand Historic Places Trust (NZHPT) can work through with you any dilemmas of damage versus importance. The NZHPT's experience in many issues of heritage repair nationwide means it is well placed to offer advice for seemingly unsolvable problems. You can be sure that when the NZHPT works with you to confirm your direction it will be based on sound best practice heritage principles.

### **You Are Not Alone**

As a heritage building owner confronted by extraordinary circumstances you have the goodwill of New Zealand's heritage community. Please contact the NZHPT anytime during working hours to discuss options about repairing your heritage building.

It may be the first time you need to engage a structural earthquake engineer or architect with conservation knowledge. They will have had experience with other stone buildings around the country. A list of heritage professionals experienced in repair of heritage buildings is available on the NZHPT's website:

<http://www.historic.org.nz/en/ProtectingOurHeritage/FAQs-Earthquake.aspx>

You will need to check with your insurer and EQC before proceeding with the employment of consultants or the carrying out of work.

### **Determine the structural cause of the failure**

A structural engineer is needed to determine the cause of the material failure. An engineer will be able to look at the building in terms of the strength of its component parts and see which gave way and how. The engineer will observe the building – perhaps over a period of time – looking at the types of failure and where they occurred.

### **Designing Repairs**

The design repair of damaged buildings will involve a comprehensive look at the strength of the building. Repairing to be able to withstand another earthquake is the aim. An engineer will not only look at the areas that were damaged this time, but will look to ensure it will survive as a whole in the future. There is no point in repairing one corner after this quake only to have the opposite corner damaged if it happens again from a different direction. A conservation architect can help design the repairs so that they don't impact adversely on the special features that your place has.

Some of the repairs that will be considered are:

- Reinstating individual stones.
- Repairing mortar.
- Re-built walls.
- Re-seating stone lintels.
- Structural tying of gable ends, towers.
- Strengthening of wall-to-wall joints.
- Strengthening of wall-to-roof joints.
- Strengthening of the two or more layers of stonework and tying together.

Resource consent is required under the RMA from your local authority to demolish or alter any listed heritage building.

Always check with your local authority before carrying out any repair work to heritage buildings.

- Methods of strengthening stonework for the entire height into the ground.
- The problems of rubble-filled cavities.

In undertaking repairs to damaged buildings, the local authority will also often require earthquake strengthening and other NZ Building Code requirements. These requirements ensure that buildings are 'built-back-better' to be more resilient for the future. The NZHPT has prepared a draft guide for earthquake strengthening of heritage buildings:

<http://www.historic.org.nz/en/ProtectingOurHeritage/ConsultingOn.aspx>

### **Pre-existing Conditions**

Repair work can be complicated by pre-existing conditions. These may have been part of an ongoing maintenance programme for your building or they may have been there undetected for some time. These matters may include:

- Crumbling or decayed mortar.
- Crumbling or fractured stones.
- Incorrect stone combinations or orientations.
- Rising damp, soiling.
- Water penetration from above.
- Settling of the stonework or movement.
- Efflorescence (that white stuff!) or subflorescence.
- Damaged or inadequate lintels or other structural members.
- Existing but inadequate structural strengthening.

Now is the time to also look at these issues as well. Your engineer and conservation architect can advise you on how to proceed.

### **Repairs**

Taking advice about repair is well worthwhile as for heritage buildings repair is not as simple as it might seem. Inappropriate materials or methods can cause problems later. After an earthquake, masonry often has structural failure, related to the strain of the movement that the building has been subjected to as its root cause. Repairing the mortar may not itself fix the structural fault. The presence of water or damp which may have brought soluble salts into mortar and porous stone may have spalled away the wall material.

A heritage building needs skilled tradespeople with experience, and advice from a conservation architect is essential. The rebuilding may be a matter of relaying intact stones but also may involve cutting stones out of and into sound stonework. The selection of stones and the way in which they are reattached and mortared in place is a skilled piece of work. Careful stone placement and the use of original pointing techniques should match the original wall.

The demolition of any pre-1900 historic building requires an archaeological authority from the NZHPT.

Special emergency procedures exist for the post-earthquake situation in Canterbury in relation to archaeological authorities. See the NZHPT's website: <http://www.historic.org.nz/en/ProtectingOurHeritage/FAQs-Earthquake.aspx>

Mortar has a colour and textural appearance both in the mix and the pointing methods used. The choice of mortar composition is vital. It should not be stronger than the stone itself. Ideally, the original mix should be tested and re-used.

Advice from a conservation architect/heritage expert on the mortar 'recipe' and application is recommended. See the list of heritage professionals on the NZHPT's website:

<http://www.historic.org.nz/en/ProtectingOurHeritage/FAQs-Earthquake.aspx>

### **Is the damage too serious?**

By their nature heritage buildings are worth keeping because of their heritage values. If an entire building is seriously compromised, it may need to be partially rebuilt or demolished in only rare circumstances. This is a difficult decision for any building owner and requires guidance. A heritage building, or part of it, may hopefully be restored and may be deemed inappropriate for demolition.

This is not a decision to be taken quickly but after discussion and advice from engineering consultants, insurers, the Earthquake Commission, the local Council, and the NZHPT. There are usually several options for the future of the building, and there are normally engineering solutions that can assist in the economical retention and strengthening and repair of heritage buildings.

### **Consultation**

A building and/or resource consent may be required for any repair and strengthening work and this needs to be clarified with your local authority. The Christchurch City Council has its own dedicated heritage team that will need to be consulted in conjunction with NZHPT about significant stonework repairs.

### **Is there funding to support owners of heritage buildings?**

The government, NZHPT and local authorities have established the Canterbury Earthquake Heritage Building Fund as a source of assistance for owners to repair damaged heritage buildings. Information about this funding campaign is available from the NZHPT's website: <http://www.historicplaces.org.nz/donationForm.aspx>

Further information about repairing historic stonework is available from the NZHPT:  
Ian Bowman, *Historic Stone Structures*,  
Conservation Bulletin  
No.3, NZHPT, 1992

Further information and advice can be obtained by contacting the NZHPT.

Contact details are available from the NZHPT's website:

<http://www.historic.org.nz/ContactUs.aspx>

© Copyright, NZHPT,  
December 2010