



New Zealand Historic Places Trust Pouhere Taonga

## **Sustainable Management of Historic Heritage Guidance Series**

# **Repairing Historic Brickwork after an Earthquake**

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### **Repairing Historic Brickwork after an Earthquake**

Brickwork damage can occur during earthquake events and may continue during aftershocks. Bricks have little inherent strength on their own but require a system of mortar, reinforcing and ties to hold them together.

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

Unreinforced brickwork is particularly prone to collapse but partly reinforced or partly strengthened brickwork can also suffer failure. Cracks might appear, bricks or whole walls of bricks fall away, brick walls might lean or move out of alignment, or mortar between the bricks might be lost. If brickwork was compromised before the earthquake, the cracking or loss of bricks 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 bricks together. It may have been necessary to contain or remove loose bricks to prevent them falling on people, or waterproof your building where brick 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 may be unconcerned with.

#### **Heritage Buildings**

Heritage buildings have historical, architectural, cultural or other values that make them important. The loss of brick 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.

For information about conservation principles that inform works such as repairing historic brickwork, see the NZ 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>

### **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 fabric, or you may be contemplating removing brickwork because it looks too hard to repair.

The New Zealand Historic Places Trust (NZHPT) can work through with you any dilemmas of damage and options for appropriate repair. 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 confirms 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 brick 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 and repair of damaged buildings will involve a comprehensive look at the strength of the building. There is no point in putting back a brick walls and chimneys if they are not adequately strengthened. 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. A conservation architect, heritage consultant or contractor skilled in heritage work 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:

- New mortar & reinstating individual bricks.

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.

The demolition or partial 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>

- Re-building walls.
- Re-seating 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 brickwork and tying together.
- Methods of strengthening brickwork for the entire height into the ground.
- Tying floors and ceilings into walls.
- Reinstating chimneys with increased strength.

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 and earthquake damage may have been exacerbated by these 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 decayed bricks.
- Rising damp.
- Water penetration from above.
- Settling of the brickwork or movement.
- Efflorescence (that white stuff!).
- 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/expert can advise you on how to proceed.

#### **Repairing Mortar**

Taking professional heritage advice about repair of mortar joints is recommended. Inappropriate materials or methods can cause problems very quickly.

Further information about repairing historic brickwork is available from the NZHPT:  
Ian Bowman, *Historic Brick Structures*, Conservation Bulletin No.2, NZHPT, 1992

The presence of water or damp can move soluble salts through the bricks and mortar, which over time can be left on the surface as the moisture evaporates. The salts can expand and spall away the wall material.

The choice of mortar composition is vital. The commonly-used high-cement mortar is harder, more impervious and allows little movement. It is also likely to crack, allowing in moisture which then becomes trapped because the mortar will not allow evaporation. As a general rule the mortar mix should be weaker than the bricks themselves to prevent the bricks breaking in any future event.

Mortar has a colour, composition and textural appearance both in the mix and the pointing methods used. For a heritage building, the match is important and skilled tradespeople with experience on heritage buildings need to be 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 brickwork 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 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>

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