



Sustainable Management of Historic Heritage Guidance Series

Repairing Historic Stonework after an Earthquake

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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 and if the earthquake events are strong or long enough, partial or total collapse can occur.

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-

For information about conservation principles that inform works such as repairing historic stonework, see Heritage New Zealand ICOMOS Charter 2010:

www.icomos.org.nz

See also Heritage New Zealand's Sustainable Management of Historic Heritage Guidance Series, Information Sheet No. 1

<http://www.historic.org.nz/Publications/SustainMgtSeries.aspx>

term importance to consider that owners of other buildings may be less concerned 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.

Heritage New Zealand can work through with you any dilemmas of damage versus importance. Heritage New Zealand'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 Heritage New Zealand 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 Heritage New Zealand 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. Heritage professionals experienced in repair of heritage buildings can be found by contacting local heritage New Zealand offices. 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 and formulate a repair and strengthening concept. An engineer will be able to look at the building in terms of the strength of its component parts and 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

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 of any pre-1900 historic building requires an archaeological authority from Heritage New Zealand.

Special emergency procedures exist for the post-earthquake situation in Canterbury in relation to archaeological authorities. See Heritage New Zealand's website: <http://www.heritage.org.nz/protecting-heritage/archaeology/archaeological-authorities>

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 connections.
- Strengthening of wall-to-roof connections.
- Tying floors and masonry walls together.
- Strengthening of the two or more layers of stonework and tying together.
- Methods of strengthening stone walls and their foundations.
- The problems of rubble-filled cavities.

In undertaking repairs to damaged buildings, the local authority will also often require a building consent to meet earthquake strengthening and other NZ Building Code requirements. These requirements ensure that buildings are 'built-back-better' to be more resilient for the future. A resource consent may also be required if the heritage building is listed in a Council plan.

Heritage New Zealand has prepared a draft guide for earthquake strengthening of heritage buildings. The revised guide will be published in 2015. If you would like a copy of the draft guide, please email SnrHerPolAdvisor@heritage.org.nz

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!).
- 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.

Further information about repairing historic stonework is available from the Heritage New Zealand:

Ian Bowman, *Historic Stone Structures*, Conservation Bulletin No.3, NZHPT, 1992

Repairs

Taking advice about repair is well worthwhile as for heritage buildings repair can be technical in nature and appropriate methodologies are required. Inappropriate materials or methods can cause problems later and potentially reduce heritage values. After an earthquake, masonry often has structural failure, related to the strain of the movement that the building has been subjected to. Repairing the mortar may not itself fix the structural fault. There may be wider structural or maintenance issues to address.

A heritage building needs tradespeople skilled in heritage buildings with experience, and advice from a conservation professional is essential. Stonemasonry repairs also require the input and workmanship of an expert stonemason, skilled in the reconstruction of heritage buildings. Careful stone placement and the use of original pointing techniques should match the original wall.

Mortar has a colour and textural appearance both in the mix and the pointing methods used. The choice of mortar and pointing 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 professional or expert stonemason on the mortar 'recipe' and application is recommended. Stonemasons experienced in repair of heritage buildings can be found by contacting local heritage New Zealand offices.

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 in rare circumstances demolished. This is a difficult decision for any building owner and requires guidance to explore all the options at an early stage. 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 Heritage New Zealand. There are usually several options for the future of the building, and there are normally engineering solutions that can assist in the most economical retention and strengthening and repair of heritage buildings without undue loss of heritage value.

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.

Is there funding to support owners of heritage buildings?

Building owners should explore all potential funding options. Access to funding sources, however, is often dependent on the nature of ownership of the building or its heritage status. Further information is available at: <http://www.heritage.org.nz/protecting-heritage/funding-for-heritage-protection>

Further information and advice can be obtained by contacting Heritage New Zealand.

Contact details are available from Heritage New Zealand's website:

<http://www.heritage.org.nz/contact-us>

Heritage New Zealand welcomes any feedback and comments on this information sheet.

Comments can be provided to information@heritage.org.nz.

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