



HERITAGE NEW ZEALAND  
POUHERE TAONGA

## Sustainable Management of Historic Heritage Guidance Series

# Repairing and Rebuilding Historic Chimneys after an Earthquake

### Background

Chimneys were a ubiquitous feature of pre-1960 buildings in New Zealand. The majority of chimneys were built using unreinforced brick masonry. The Canterbury earthquake (4 September 2010), and its subsequent aftershocks, caused significant damage to a high proportion of unreinforced masonry chimneys in the region.

Chimneys are often vital components of a building's composition and it would be regrettable to lose these architectural elements from the skyline. Not only are chimneys aesthetically pleasing, they serve as tangible reminders of a previous way of life.

Heritage New Zealand strongly recommends that, where possible, chimneys damaged or destroyed as a result of an earthquake, should be repaired, restored or reconstructed in the most authentic manner feasible. However, safety must be the priority and seismic strengthening may require significant intervention.

No two chimneys, or the damage they have sustained, are identical. Repairing or rebuilding a chimney to its original form, using original materials is the most heritage-sensitive solution. However, in some instances replacement using engineered lightweight construction may be an option. Each chimney needs to be dealt with on a case by case basis.

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

See also Heritage New Zealand's Sustainable Management of Historic Heritage Guidance Series 'Heritage Provisions for earthquake-prone buildings policies under the Building Act 2004' <http://www.heritage.org.nz/resources/sustainable-management-guides>

# Following an earthquake the Heritage New Zealand suggests you:

## 1. Ensure your building is safe:

### Chimney appears (visually) undamaged

- Record (photograph, draw and measure as appropriate) damage even if chimney appears undamaged to the naked eye. Aftershocks may have an unknown effect on the structure.
- Check the structural integrity of the chimney both above and below roof level.
- Consider seismically strengthening the chimney to ensure the structure will withstand any future seismic activity. Heritage New Zealand strongly recommends strengthening all chimneys.

### Chimney partially destroyed – bricks missing, displaced or destabilised

- Record remaining structure (photograph, draw and measure as appropriate). Photographing where the bricks fell can provide useful information also.
- Remove bricks which have become detached from the structure (check ceiling cavity).
- Stabilise the chimney shaft by deconstructing to roof or ceiling level, tying, propping or cladding.
- Ensure building is temporarily weatherproof.
- Check structural integrity of the chimney below roof level.
- Ensure all intact bricks (and/or other important building materials) removed from the chimney are stored on site.
- In some instances the damage may be so extensive and pose such a risk to personal safety that the building is deemed uninhabitable until remedied.

## 2. Repair, /rebuild or replace a damaged chimney:

- All work must comply with the Building Act 2004.
- Given the risk inadequately repaired chimneys can pose, skilled and professional building practitioners should be used.
- Do not rush building work. All options should be carefully considered before building begins. Generally it takes a considerable amount of time for EQC and insurance companies to assess the property and to pay out claims.
- A structural engineer will be required in most instances to: (a) assess the full extent of chimney damage and (b) to provide a design to strengthen the chimney against future earthquake damage.

Resource consent is required under the Resource Management Act 1991 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.

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

- Heritage New Zealand recommends strengthening all chimneys. Heritage New Zealand has prepared a draft guide for earthquake strengthening of heritage buildings: The revised guide will be published in 2016. If you would like a copy of the draft guide, please email [SnrHerPolAdvisor@heritage.org.nz](mailto:SnrHerPolAdvisor@heritage.org.nz)
- More information regarding basic strengthening solutions for post-earthquake reconstruction can be found in a document prepared by Salmond Reed Architects Ltd. titled: *Preliminary advice note on repair of earthquake damaged chimney.*
- All work should be done in accordance with the ICOMOS New Zealand Charter <http://www.icomos.org.nz/nzcharters.htm> (Guidance can be provided by Her Council staff).

### Repairing (using original or like materials)

Repair will be appropriate when the chimney has sustained minimal damage and the structure is relatively intact as assessed by an engineer. When repairing a chimney it is important to preserve the original appearance as much as possible.

- Where feasible, original material should be used or if this is not achievable identical or closely similar material should be utilised.
- The repair of mortar joints should be carefully considered.
- The type of mortar used will depend on the age of the chimney and when/if any repair work has been undertaken. Each mortar type has inherent strengths and weaknesses. Lime mortars behave very differently to cement mortars and it is vital that the mortar used is consistent throughout the structure.
- Lime-based mortars (crumbly in consistency and paler in colour) were most often used on buildings pre 1900. Cement-based mortars (harder and more impervious in consistency and darker in colour) have typically been used in buildings post 1900.
- Professional advice from a heritage specialist is recommended when repairing mortar joints.

### Rebuilding

Rebuilding is appropriate where the chimney has sustained serious damage. For example, when a number of bricks have fallen or the structural integrity has been compromised to such an extent that the chimney needs to be carefully taken down to a level where it is structural stable and reassembled back to the original form with engineering advice. When restoring a chimney it is important to preserve the original appearance so much as possible.

- Where feasible original masonry should be used or if this is not achievable identical or closely similar material should be used.
- In order that the chimney is able to withstand future seismic events a new internal structure may be required. Various options are available. The appropriate solution will depend on a number of variables, e.g. height of chimney, degree of damage and whether the chimney will be functional or not.



**Rob Roy Hotel, Auckland.**

Reinforcing of chimneys with carbon fibre strips. This is an option when a chimney has a covering plaster/paint finish. Photo, Heritage New Zealand



Timber frame fabricated to original form with brick slips providing the skin.

Photo: Heritage Replica Chimneys

- If the chimney is to be functional a triple skinned flue may be inserted. A new cast iron tube is a simple way to add strength.
- Threaded tension rods or wires may be anchored at the base of the fireplace to run the entire height of the chimney in the mortared cavity between flue and brick.
- A plywood diaphragm surrounding the chimney shaft in the roof space may be necessary to provide lateral strength.
- A lightweight steel frame may be utilised. Affixed to the frame is a suitable substrate to which the original bricks can be affixed. Cement based boards,, fibreglass or marine plywood are some of the substrates available. Note that the longevity of these systems is unlikely to match a full brick solution.

### Replacing (Using lightweight materials)

Replacement is considered the least desirable option from a heritage conversation perspective. However, there will be occasions when it may be necessary to reproduce discrete elements within a building which have been lost or destroyed due to a destructive event (i.e. earthquake). Using lightweight replacement materials would be unlikely to be an acceptable option for buildings with the highest heritage value. Solutions for each building/chimney **must** be carefully considered on a case by case basis.

- Any reconstruction should be accurately replicate the visual appearance of the original chimney.
- In order to ascertain the form of the original structure architectural plans (if available) should be studied. Photographs taken pre-damage will also provide valuable information.
- If sufficient information is not available to accurately replicate the original form rebuilding should not proceed. In such cases it may be deemed most appropriate to remove the chimney altogether. Use of conjecture is not considered acceptable on a heritage building.
- Further information is available on a separate information sheet on the use of lightweight materials.

### Using original materials which have been modified.

Instead of replacing chimneys with bricks laid two or three deep, cut down bricks (brick slips) can be affixed to a suitable substrate to create a lightweight brick 'skin'. The substrate must be formed in such a way that when clad with bricks, as the visual result will replicate the original structure of the chimney. The original bricks or matching bricks, carefully cleaned and prepared, should be used for the slips if strong enough. Note – it is important to consider that this technique is new and issues such as longevity are yet to be proven.

### Lightweight composite materials.

Several companies are now manufacturing fibreglass replica chimneys. Fibreglass can potentially reduce the weight of a chimney from more than 1300kg down to approximately 60kg. This approach should be treated with caution. It is essential the colour matches the existing bricks, the form is



Section of fibreglass replica chimney

Photo: Reflex

accurate and the detailing is authentic as possible, and long term weathering taken into account.

## Consultation

If your building is listed as a Heritage or Character building on the City or District Plan or it is also entered on the New Zealand Heritage List/Rārangī Kōrero under the Heritage New Zealand Pouhere Taonga Act 2014, you must consult with Council Planners and/or the Heritage Advisor of Heritage New Zealand to comply with the requirements of the Resource Management Act 1991.

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

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

## 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 in a separate Information Sheet or our website: <http://www.heritage.org.nz/protecting-heritage/funding-for-heritage-protection>

## Heritage Specialists

Heritage specialists experienced in the repair and reconstruction of heritage buildings (including chimneys) can be sourced by contacting your regional office of Heritage New Zealand's.

Contact details are also available from the Christchurch City Council. Note - You will need to check with your insurer and EQC before proceeding with the employment of consultants or the carrying out of work.

## Additional Sources of Information:

Heritage New Zealand – Sustainable Management Series – Information Sheets: <http://www.heritage.org.nz/resources/sustainable-management-guides>

Salmond Reed Architects Ltd. *Preliminary Advice Note on Repair of Earthquake Damaged Chimneys*

Christchurch City Council Earthquake Damaged Buildings Guidelines for Building Owners:

- *Guideline 3 – Reconstruction of Elements*
- *Guideline 4 – Strengthening of Buildings*

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

Comments can be provided to [information@heritage.org.nz](mailto:information@heritage.org.nz).

Copyright © Heritage New Zealand Pouhere Taonga

November 2016