New Zealand Historic Places Trust Pouhere Taonga

HISTORIC HERITAGE RESEARCH PAPER No.1

Toward improved national and local action on earthquake-prone heritage buildings

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Cover photo: Cobbler Building, Marton, September 2005. Photo, R McClean, NZHPT

1 Introduction

New Zealand is an 'earthquake country'. The land mass was raised from the sea as a result of the collision of two tectonic plates. This geological reality continues to shape the land and influence human settlement.

Since the early days of New Zealand settlement, buildings have been designed to withstand earthquakes. Timber was favoured over brick and timber framing remains the dominant building method for residential buildings. The current building code promotes high engineering standards across the nation to ensure new buildings withstand ground shaking so to preserve human life.

Despite successive improvements in building technology and building code standards, many existing buildings are at risk from earthquakes. In these buildings, people may be harmed or even killed in the event of a substantial earthquake.

The Building Act 2004 provides for the management of buildings that pose a serious risk to people in the event of even a moderate earthquake. These buildings, known as earthquake-prone buildings or EPBs, are subject to special procedures in the Building Act 2004. The management of EPBs has been delegated to territorial authorities. Each territorial authority is required to develop a policy to provide a strategic district approach. This approach must also provide for heritage buildings. While the Building Act 2004 requires action to be taken on mitigating the risks associated with EPBs, it is the territorial authorities who decide the approach and the timetable.

This report does not explain how to strengthen a heritage building or provide statistical information on the risks of heritage buildings in New Zealand from earthquake. Instead, this report examines the policy context of managing heritage buildings that are earthquake-prone.

The report firstly reviews the international agreements, context and guidance available from agencies such as the International Centre for the Study of the Preservation and the Restoration of Cultural Property (ICCROM), the US Federal Emergency Management Agency (FEMA) and the Italian Ministry for Cultural Heritage and Activities (*Ministero per i Beni e le Attivita Culturali*). This international review indicates that there is an emerging consensus that heritage buildings should be safe and governments should act to assist in the protection of both people and heritage properties. This will require providing information on risks confronting heritage at a regional and national level, facilitating continued maintenance of structures, taking a planned approach by examining all the options on a case-by-case basis and ensuring all earthquake strengthening work is compatible with the heritage values involved.

Following the international review, the development of building code provisions for earthquake safety in New Zealand is examined and the policy requirements of the Building Act 2004 are explained in detail. In addition, the existing national policy context is explored with regard to non-statutory guidance provided by agencies such as the Department of Building and Housing, New Zealand National Society for Earthquake Engineering (NZSEE), and the NZHPT.

The report goes on to provide an overview of the EPBs policies prepared by territorial authorities since 2004, and in particular, the aspects of the policies that have implications for heritage buildings. This review takes a close examination of EPBs policy priorities and specific policies for heritage buildings. It also examines the current range of incentives provided by central and local government that could be accessed by owners of heritage buildings to undertake strengthening works.

The report also examines current civil defence planning under the Civil Defence Emergency Management Act (the CDEM Act) and the need for improved coordination of emergency responses following an earthquake with regards to historic heritage. The Gisborne Earthquake of 20 December 2007 provides some valuable lessons and highlighted the need to develop response systems and relationships to connect civil defence with historic heritage (see appendix 2 for a summary of the Gisborne Earthquake).

The final section of this report contains a number of recommendations for further research and policy development. The recommendations are as follows:

Civil Defence

1. *Central and local government (including the NZHPT) should ensure that earthquake-risk interventions are integrated with Civil Defence planning following the recommendations outlined in appendix 1 of this report.*

Knowing the risks

2. *The NZHPT should facilitate the development of a National Risk Map of New Zealand's Historic Heritage.*

National guidance

3. *The NZHPT's existing national guidance for earthquake-risk heritage buildings should be updated and expanded.*

Local government planning

4. *Local government policies should be informed by sufficient information and detailed cost/benefit analysis for earthquake-prone heritage buildings.*

Local government policy provisions

5. *Local government Building Act policies must contain adequate provisions for historic heritage.*

Incentives for heritage buildings

6. *Central and local government must provide sufficient incentives to owners to facilitate appropriate strengthening of heritage buildings.*

As indicated, these recommendations are not limited to local authorities but are also directed towards central government and the NZHPT. At the heart of the recommendations is an alignment with the emerging pre-emptive strategy of the NZHPT. In other words, more effort must be dedicated to proactive strategies in managing risk to historic heritage in New Zealand. There is a growing public expectation that organisations such as the NZHPT will take measures to provide protection of historic heritage from risk – structural decay, demolition, fire, earthquakes, flooding, etc, and that these matters are not left to owners or tenants to deal with alone. Hence, the traditional reliance on identification, registration and listing is not adequate. Further, many owners of heritage buildings are seeking understanding and assistance from the NZHPT and local authorities to address the realities of stewardship in difficult economic, environmental and social environments.

For these reasons, the recommendations of this report highlight the importance of building a risk map for historic heritage in New Zealand, following the Italian example, and developing improved national guidance. This guidance will better inform the progress of the next generation of local authority policies prepared under the Building Act 2004 and the development of appropriate incentives. It is critical that central and local government (including the NZHPT) work together as 'joined-up' agencies on this issue. This work will make an important contribution to New Zealand as a world leader in sustainability.

2 Research Overview: Historic heritage and earthquake disaster management

2.1 International Conventions and Organisations

The UNESCO *Convention concerning the Protection of the World Cultural and Natural Heritage* (the World Heritage Convention) 1972, aims to recognise and safeguard cultural and natural heritage of outstanding universal value. In addition to the recognition and safeguarding of heritage of outstanding universal value and the World Heritage List, the Convention requires each State Party to 'ensure that effective and active measures are taken for the protection, conservation and presentation of the cultural and natural heritage situated on its territory.'[1] These measures include the adoption of a general policy which 'aims to give the cultural and natural heritage a function in the life of the community and to integrate the protection of that heritage into comprehensive planning programmes.'[2] New Zealand ratified the World Heritage Convention in 1984.

In addition to the World Heritage Convention, the *Convention for the Protection of Cultural Property in the Event of Armed Conflict*, 1954 (the Hague Convention) has parallels to the management of earthquake risk and historic heritage. The original 1954 Hague Convention provided for the protection of historic heritage during situations of war and conflict.[3] This provision has been supplemented by the first and second protocols of the Hague Convention which introduce requirements for peacetime preparations. Article 5 of the Second Protocol of the Hague Convention states:

> Preparatory measures taken in time of peace for the safeguarding of cultural property against the foreseeable effects of an armed conflict pursuant to Article 3 of the Convention shall include, as appropriate, the preparation of inventories, the planning of emergency measures for protection against fire or structural collapse, the preparation for the removal of movable cultural property or the provision for adequate *in situ* protection of such property, and the designation of competent authorities responsible for the safeguarding of cultural property.

New Zealand is currently in the process of accession to the Hague Convention by the introduction of the Cultural Property (Protection in Armed Conflict) Bill.

In relation to the Hague Convention, UNESCO facilitated the establishment of an international committee for the protection of cultural heritage threatened by wars and

[1] Article 5, Convention concerning the Protection of the World Cultural and Natural Heritage (the World Heritage Convention), 1972
[2] ibid
[3] UNESCO, *Convention for the Protection of Cultural Property in the Event of Armed Conflict*, 1954

natural disasters in 1996. This committee is now known as the International Committee of the Blue Shield (ICBS or the 'Blue Shield'). The Blue Shield is effectively the cultural equivalent of the International Committee of the Red Cross (ICRC). The objectives of the Blue Shield include the facilitation of international responses to threats or emergencies threatening cultural property, promoting risk preparedness for cultural property, training of experts to prevent, control and recover from disasters, providing professional expertise to help meet emergencies and identifying resources for disaster prevention and for rapid intervention in emergencies.[4] The Blue Shield has also established the Association of National Committees of the Blue Shield which facilitates the establishment of national committees within nations. In July 2004, the Blue Shield adopted the Torino Declaration which includes recommendations that:

> Encourages national governments to include the protection of the movable and immovable cultural heritage from destruction and displacement in the mandate of their humanitarian operations.
>
> Recommend that governments and relevant organisations of the United Nations act to prevent looting and destruction of cultural heritage sites and buildings and illicit trade in cultural property.
>
> Considering the importance of risk preparedness, response and recovery, recommend that cultural heritage professionals and others integrate these stages into their programmes.[5]

Further, the Torino Declaration recommends the establishment of National Committees of the Blue Shield to protect movable and immovable cultural heritage in the event of natural or man-made disasters and urge governments to support these committees. New Zealand has not, as yet, formed a Blue Shield National Committee.

In addition to the Blue Shield, the International Council on Monuments and Sites (ICOMOS) and International Centre for the Study of the Preservation and the Restoration of Cultural Property (ICCROM) are active in the provision of guidance and information for disaster management and historic heritage as will be referred to in this research paper.

There has been little research in New Zealand relating to issues concerning historic heritage and post-disaster or civil defence management. Further, as part of the wider field of civil defence management, few studies have examined issues relating to historic heritage and earthquake disaster management with the exception of issues relating earthquake strengthening of historic buildings.[6]

Internationally, there is a growing recognition for greater communication and dialogue between disaster managers and historic heritage specialists and agencies. As noted by Kristy Graham and Dirk Spennemann, 'while the preservation of life and property will

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[4] See ICBS website, http://www.ifla.org/blueshield.htm

[5] ICBS, Torino Declaration, 24 July 2004

[6] Lou Robinson and Ian Bowman, *Guidelines for Earthquake Strengthening,* NZHPT, 2000; Tom Lancaster, *The ICOMOS Charter and Earthquake Strengthening of Historic Buildings,* unpublished architectural research paper, Victoria University, 1999; Tonks, G, Russell, A, Ingham, J, 'Heritage Unreinforced Brick Masonry Buildings in New Zealand – The Retention of Architectural Qualities in a Seismic Environment', unpublished conference paper, ECCOMAS, Greece, June 2007; Cattanach, A.G., Alley, G.W., Thornton, A.W., 'Appropriateness of Seismic Strengthening Interventions in Heritage Buildings: A Framework for Appraisal', unpublished conference paper, NZSEE 2008

always be a priority in any disaster situation, other 'assets', such as the preservation of cultural heritage places has also become significant elements in disaster management.'[7]

In terms of earthquakes, a review of issues relating to earthquakes and heritage buildings was carried out in 1987 by Sir Bernard Feilden for ICCROM and the Getty Conservation Institute.[8] This review covered issues relating to cultural heritage and earthquakes, pre-disaster policy, emergency action, and post-disaster measures. In terms of pre-disaster policy, Feilden emphasised the need for all countries to undertake a range of pre-disaster planning measures for cultural property co-ordinated by a disaster relief agency responsible for all cultural property. The recommended pre-disaster actions for cultural properties are outlined in the table below:

Recommended pre-earthquake disaster administrative and technical actions for cultural properties[9]	
Coordination	Establish a national or regional emergency group for the protection of cultural property
Documentation	Make full inventories of all cultural resources supported by photographs and photogrammetric records
	Prepare seismic survey forms and outline drawings of all important buildings
	Keep duplicate records preferably in a non-seismic zone or in an earthquake and fire resistant building
Education and information	Educate public on importance of historic buildings, maintenance and seismic upgrading of vernacular buildings
	Publish guidelines for local builders on the correct techniques for maintaining and upgrading buildings, and preserve skills and materials needed for maintenance and repair of historic buildings
	Train architects and engineers in seismic resistant design and inspection for historic buildings
Insurance	Insure buildings and movable objects when feasible
Research	Commission geological studies indicating underlying site properties and geologic studies
	Initiate seismic studies, including historic records, to evaluate return periods of earthquakes with various intensities
	Develop vulnerability studies for earthquakes of different intensities. Such studies should relate to the artistic and historical value of the buildings, their furnishings, and their contents
	Compile town and country plans relating developments to various grades of seismic damage
Planning	Assess risk to infrastructure (lifelines)
	Prepare seismic safety plans for historic buildings
Seismic strengthening	Strengthen buildings by stages when this becomes economical

As indicated in the table above, undertaking seismic strengthening is only one action of a range of other recommended pre-disaster planning actions, and it is recommended that seismic strengthening is only to be undertaken if it is economically viable to do so. In contrast to seismic strengthening, Feilden places greater emphasis on promoting maintenance of historic buildings. He states that 'observation shows that well-maintained buildings survive much better than those that are poorly maintained. Indeed it has been estimated that some 50 percent of the damage that occurs in an earthquake may be

[7] Kristy Graham and Dirk Spennemann, 'Disaster management and cultural heritage: An investigation of knowledge and perceptions of New South Wales Rural Fire Service Brigade Captains' *The Australian Journal of Disaster and Trauma Studies*, Vol 2006-1

[8] Sir Bernard M.Feilden, *Between Two Earthquakes, Cultural Property in Seismic Zones*, ICCROM and the Getty Conservation Institute, 1987

[9] Adapted from Sir Bernard M.Feilden, *Between Two Earthquakes, Cultural Property in Seismic Zones*, ICCROM and the Getty Conservation Institute, 1987, pp 15-16

attributed to lack of proper maintenance'.[10] In this context, 'maintenance' means taking action on structural decay and weaknesses (for example repairs to foundations) rather than simply painting a building.

Feilden is particularly critical of building codes that do not provide for the specific characteristics of heritage buildings:

> Since the art of designing earthquake-resistant structures is still in its infancy, most codes are still based on gross simplications, using sub nominal horizontal loading or base shears as the design criteria for new buildings. It is the considered opinion of experts that such codes should not be applied to historic buildings of different structural types, and it must be stressed that no historic building should be condemned to destruction or taken out of beneficial use because it does not or cannot comply with the current official code; with expert design and special techniques it can be strengthened...Each historic building requires individual and meticulous inspection of the fabric.[11]

To provide some policy direction, Feilden noted the recommendations of the ICCROM International Course of Preventive Measures for the Protection of Cultural Property in Earthquake Prone Regions. These recommendations (outlined below) were adopted at Skopje, former Yugoslavia in July 1985

Final Recommendations of the ICCROM International Course of Preventive Measures for the Protection of Cultural Property in Earthquake Prone Regions, July 1985

Expecting that progress in such studies will continue and that more special interdisciplinary studies on historic buildings be undertaken so that the 'state of art' will improve;

Appreciating that every historic building is unique and deserves special studies, it is recommended that:

The structural system of such historic buildings should be respected because it may have already resisted a number of earthquakes.

Any new materials and structures used for repair and strengthening should be compatible and durable and the use of reinforced concrete should be restricted.

The degree of protection required should be assessed individually based on the various possibilities of seismic events and the possibility of further strengthening at a future date when better techniques will have been developed.

The loss of cultural values should be assessed for different seismic effects involving the formal consideration of alternative projects by engineers, historical architects, archaeologists and art historians.

Building owners or occupiers should be encouraged and instructed to better maintain the existing structural system and fabric.

A thorough documentation and survey of historic buildings in seismic areas should be undertaken and a schedule of regular inspections and maintenance be organised.

[10] ibid, p 32
[11] ibid, pp 50-51

Local area studies of seismic risk should be undertaken starting with the most vulnerable historic building sites.

In addition to these recommendations, an international workshop on structural and functional rehabilitation of housing in historic buildings in seismic regions in 1986, included further recommendations on earthquake-prone historic buildings policies. These recommendations included:

- Establishment of a permanent conservation programme (maintenance and rehabilitation) for historic areas.
- Ensuring building codes include adequate criteria for historic buildings and areas, not only for new construction.
- Establishment of a permanent national fund for the study, conservation and revitalisation of historic and traditional areas.
- Financial support for projects for the conservation and revitalisation of built heritage.[12]

This work was followed by the development of a risk management manual for World Cultural Heritage in 1998 by ICCROM in conjunction with UNESCO, ICOMOS and the World Heritage Centre.[13] This manual provides a number of key principles for risk management of heritage places.

Principles for Risk Management of Heritage Places[14]

The key to effective protection of cultural heritage at risk is advance planning and preparation.

Advance planning for cultural heritage should be conceived in terms of the whole property, and provide integrated concern for its buildings, structures, and their associated contents and landscapes.

Advance planning for the protection of cultural heritage against disasters should integrate relevant heritage considerations within a property's overall heritage prevention strategy.

Preparedness requirements should be met in heritage buildings by means which will have least impact on heritage values.

Heritage properties, their significant attributes and the disaster-response history of the property, should be clearly documented as a basis for appropriate disaster planning, response and recovery.

Maintenance programmes for historic properties should integrate a cultural heritage-at-risk perspective.

[12] ibid, pp 95-97
[13] Herb Stovel, *Risk Preparedness: A Management Manual for World Cultural Heritage*, ICCROM, Rome, 1998
[14] ibid, p 20

Property occupants and users should be directly involved in development of emergency-response plans.

Securing heritage features should be a high priority during emergencies.

Following a disaster, every effort should be made to ensure the retention and repair of structures or features that have suffered damage or loss.

Conservation principles should be integrated where appropriate in all phases of disaster planning, response and recovery.

In an explanation of these principles, ICCROM emphasise that 'requirements to contain risks and hazards should not be reduced in order to maintain heritage character', but that the key concern is the 'design and installation of disaster-protection systems or mechanisms in ways which will minimise impact on heritage values.'[15] This will require the review of a large variety of alternative options to ensure the 'least-impact option has been identified.'[16]

Since the 1990s, ICCROM has continued to facilitate research and policy regarding heritage buildings and earthquake risk. A large number of conferences on the subject have taken place and there is a growing body of literature in journals such as *Journal of Earthquake Engineering* and the *International Journal of Architectural Heritage.* A major recent research topic has been traditional buildings and reinforced concrete buildings. These research streams have focused on how many types of traditional construction methods have earthquake resistant properties and the risk posed by more recent reinforced concrete buildings.[17] It is now accepted in the USA that older concrete buildings constitute the greatest risk of failure and collapse during an earthquake.[18]

Randolph Langenbach, a noted authority in this research area from the USA, is particularly critical of the use of reinforced concrete buildings. Langenbach noted that at the 13th World Conference on Earthquake Engineering, Fouad Bendimerad, Director of the Earthquakes and Megacities Initiative, reported that:

> Approximately 80% of the people at risk of death or injury in earthquakes in the world today are the occupants of reinforced concrete frame infill-masonry buildings. Concrete frame buildings with masonry infill-walls (RC infill) are commonly constructed with brick or hollow block masonry partitions and exterior walls. Thousands have died in this type of building in earthquakes in different countries around the world, including recently in Turkey and Taiwan in 1999, India in 2001...and Morocco in 2003. In Iran, where light steel frames are used instead of concrete, these infill wall buildings also fell down in the Bam earthquake of 2004.[19]

[15] ibid, p 21
[16] ibid
[17] International Disaster Reduction Conference (IDRC), Davos, Switzerland 2006 ICCROM: Integrating traditional knowledge systems and cultural heritage into risk management. Also, for example, Randolph Langenbach, 'From Opus Craticium to the Chicago Frame, Earthquake resistant traditional construction, *International Journal of Architectural Heritage,* 1, 2007, pp 29-59
[18] Pacific Earthquake Engineering Research (PEER) website: http://peer.berkeley.edu/
[19] Randolph Langenbach, 'Preventing Pancake Collapses: Lessons from Earthquake-Resistant Traditional Construction for Modern Buildings of Reinforced Concrete', Paper for International Disaster Reduction Conference (IDRC), Davos, Switzerland 2006 ICCROM: Integrating traditional knowledge systems and cultural heritage into risk management.

This research highlights the need to limit the reliance on reinforced concrete buildings and promotes learning from traditional historic buildings to inform new construction techniques.

Additional research in the USA has reconsidered the characteristics of unreinforced masonry buildings (or URM buildings) in historical earthquakes. For example, Stephen Tobriner has studied damage to URM buildings in the 1906 San Francisco earthquake.[20] Tobriner comments that 'it is challenging to confront the surprisingly good performance of many brick buildings in San Francisco in 1906 considering the prevailing belief in the engineering profession today that such buildings are almost dangerous.'[21] Tobriner considers that the effect of partitions was a likely influence on building survival:

> The pictorial evidence suggests that a majority of brick buildings in the city did not lose cornices and firewalls, and did not collapse. In fact complete collapse of multi-storied brick buildings or offices in earthquakes in the United States is a rarity because internal wooden partitions often keep the roof up when the exterior brick walls fail. These partitions take the load off the roof or upper floors when they are not designed to. The more like a rabbit warren the interior is, the more walls, the more capacity.[22]

2.2 USA Standards in Seismic Rehabilitation of Existing Buildings

The earliest approaches to developing seismic code provisions for existing buildings occurred in the State of California following events such as the 1906 San Francisco quake. In California, the State recognised the inherent tension between historic preservation and building code requirements, especially in relation to earthquake safety. The State developed a building code to provide flexibility in relation to historic buildings and earthquake engineering standards. As summarised in the *APT Bulletin*:

> The 2001 *California State Historical Building Code* (SHBC) has been described as a pioneering effort in the development of a code that promotes both public safety and historic conservation objectives.[23] It first became effective in 1976 and became mandatory regulation in 1985. The code applies to all qualified historic buildings being listed on the National Register, the California Register or local government registers. The code covers the full range of issues relating to existing buildings including use and occupancy, fire protection, egress, accessibility, structural work, materials, mechanical, electrical, and plumbing. Importantly, the code does not contain a 'change of use' requirement trigger. For example, Section 8-302 2.2 states that 'change in occupancy shall not mandate conformance with new construction requirements as set forth in prevailing regular code, provided the new use or occupancy does not create a fire hazard or other condition detrimental to the safety or occupants or of fire fighting personal.'[24] Thomas Winter comments that the achievements of the *California State Historical Building Code* have not been limited to historic conservation, but also to sustainability in general:

[20] Stephen Tobriner, 'An EERI Reconnaissance Report: Damage to San Francisco in the 1906 Earthquake – A Centennial Perspective', *Earthquake Spectra,* Vol 22, No.S2, ppS11-S41
[21] ibid, p S22
[22] ibid, p S22
[23] Thomas A. Winter, 'A Pioneering Effort: The California State Historical Building Code', *APT Bulletin,* Vol 34(2-3), 2003, pp 17-22
[24] California Building Standards Commission, *2001 California Historical Building Code* (Part 8, Title 24, C.C.R.)

> The purpose of the SHBC [California State Historical Building Code] is to preserve historic fabric. When compared to more recent goals of sustainability, there is a symbiosis between the SHBC and rehabilitation with the goal of keeping materials in situ and in use. A good example is the Jean Vollum Natural Capital Centre in Portland, Oregon. Using the Green Building Council's Leadership in Energy and Environmental Design (LEED) 2.0 standard, this project has been awarded gold-level certification because of materials reuse, water efficiency, sitting, and indoor air quality.[25]

As a measure of the success of the *California State Historical Building Code*, the California Preservation Foundation and the State Historical Buildings Safety Board have published selected case studies relating to the rulings and actions of the State Historical Buildings Safety Board between 1985-1995.[26]

In addition to the *California State Historical Building Code*, a large number of local authorities in California State have incentive schemes for owners to promote the strengthening of un-reinforced masonry buildings. A review carried out by the Federal Emergency Management Agency (FEMA) in 1994 considered these incentive schemes were critical in facilitating strengthening of earthquake-risk heritage buildings at the local level.[27] The review found that rather than grants, the most common form of incentive in California are low-interest loans or rates subsidies, zoning, fee waivers or other subsidies. FEMA recommended that local governments work closely with communities, including owners and heritage agencies, to ensure incentives are fair and reasonable and facilitate effective and appropriate safety interventions.[28]

Other US States have also developed code provisions for historic buildings. Massachusetts was the first US state to incorporate a full set of special provisions for existing structures, including historic buildings in 1979. Chapter 34 (780CMR Sixth Edition) of the *Massachusetts State Building Code* contains an approach that divides historic buildings into two categories: those to be totally restored and those to be totally preserved.[29] The latter category 'explicitly permits broad exemptions when historic fabric will be adversely affected.'[30] The originality of *Massachusetts State Building Code* was to introduce a hazard index ranking system relating to requirements for continuation of the same use group or change to a new use group.[31] Depending on the extent of hazard change (easily determined by consulting code tables that specify a hazard index ranking for each occupancy type), requirements range from minimal work to compliance with new construction standards. For example, a change in occupancy that resulted in no increase in hazard index ranking may have required only that egress and floor loading be evaluated, while hazard index rankings that increased by more than two could require new construction standards to be met.[32]

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[25] Thomas A. Winter, 'A Pioneering Effort: The California State Historical Building Code', *APT Bulletin*, Vol 34(2-3), 2003, p 22

[26] California Preservation Foundation, *Building code issues in historic preservation, selected case studies*, http://www.californiapreservation.org/cs/

[27] FEMA, Seismic Retrofit Incentive Programs, A Handbook for Local Governments, 2004, FEMA 254

[28] ibid, p 6

[29] William F. Galvin, *Massachusetts State Building Code*, User Guide, Sec of Commonwealth, State of Massachusetts.

[30] Marilyn E. Kaplan, 'Rehabilitation Codes Come of Age: A Search for Alternate Approaches' *APT Bulletin*, Vol 34(4) 2004, p 7

[31] John M Watts Jr, 'Fire-Risk Indexing: A Systematic Approach to Building Code 'Equivalency' for Historic Buildings', *APT Bulletin*, Vol34(4), 2004, pp 23-28

[32] Marilyn E. Kaplan, 'Rehabilitation Codes Come of Age: A Search for Alternate Approaches' *APT Bulletin*, Vol 34(4) 2004, p 7

The first comprehensive rehabilitation 'sub-code' was introduced in New Jersey in 1998. This code has enabled special provision to be provided for existing buildings without compromising basic safety considerations. The New Jersey *Rehabilitation Sub-code* contains performance requirements relating to repairs, renovation, alteration, reconstruction, change of use and additions with the use of a hazard index system.[33] The New Jersey's Rehabilitation Sub-code managed to reduce instances of inconsistent local decision making and has avoided reliance on a system of waivers, determinations or appeal procedures.[34] The sub-code has been described as a major success story for both historic and existing buildings. In 1998, the New Jersey Rehabilitation Sub-code received a Historic Preservation Award.[35]

Following the US state codes, national code guidance has now been developed by the US Department of Housing and Urban Development. The Department published the *Nationally Applicable Recommended Rehabilitation Provisions* (NARRP) distributed by the US Department of Housing and Urban Development in 1997.[36] This document provides a framework for addressing all types of work in every type of existing building and is intended to be suitable for use by State and local jurisdictions or model code organisations with a minimum of adaptation. The provisions state that they 'incorporate a philosophy that improvements required when work is being done in existing buildings should be proportional to the nature and extent of the underlying work.'[37] Chapter 9 of the provisions deals with historic buildings and includes standards relating to repairs, relocated buildings, renovation, alteration or reconstruction and change of occupancy.

In the United States at the federal level, FEMA is the leading agency for the development of standard guidelines for the seismic rehabilitation of buildings. In 1997, the first generation of guidelines were published (the *NEHRP Guidelines 273 & 274*).[38] These guidelines adopted a performance-based engineering design approach for a number of different objectives. As commented by Daniel Shapiro (et al):

> Existing buildings present an especially challenging variety of issues that must be faced when seismic rehabilitation is considered. It is obvious that the needs and desires of building owners can vary widely from both economic and safety standpoints. While for some owners it may be sufficient (or only affordable) to prevent building collapse from earthquake shaking, for others, it may be essential to protect building contents and continued operation without interruption after an earthquake; for still others, there may be other gradations of desired performance and degrees of affordability.[39]

For this reason, the *NEHRP Guidelines 272 & 274* established three main performance objectives: Limited Rehabilitation (collapse prevention), Basic Life Safety, and Enhanced (enhanced life safety, damage control and operational). These objectives were explained as follows with varying levels of expected damage resulting from a seismic event:

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[33] NJAC 5:23-6, *Rehabilitation Subcode*, http://www.state.nj.us/dca/codes/rehab/pdf/rehab_7_17_2006.pdf
[34] Marilyn E. Kaplan, 'Rehabilitation Codes Come of Age: A Search for Alternate Approaches' *APT Bulletin*, Vol 34(4) 2004, p 7
[35] William M. Connolly, *Rules That Make Sense, New Jersey's Rehabilitation Subcode,* http://www.state.nj.us/dca/codes/rehab/pioneerart.shtml
[36] US Department of Housing and Urban Development, *Nationally Applicable Recommended Rehabilitation Provisions* (NARRP): http://www.huduser.org/publications/destech/narrp/toc_narrp.html
[37] ibid (foreword)
[38], *Guidelines and Commentary for the Seismic Rehabilitation of Buildings* (FEMA 273 and 274)
[39] Daniel Shapiro, Christopher Rojahn, Lawrence D. Reaveley, James R. Smith, 'NEHRP Guidelines and Commentary for the Seismic Rehabilitation of Buildings' *Earthquake Spectra*, Vol 16,1, February 2000, p 232

Limited Rehabilitation (collapse prevention)

Objective: To make the building better than it was before rehabilitation.

Overall damage: Severe. Little residual stiffness and strength, but load-bearing columns and walls function. Large permanent drifts. Some exits blocked. Infills and unbraced parapets failed or at incipient failure. Building is near collapse.

Comment: Limited rehabilitation provides for seismic rehabilitation to reliability levels that are lower than the BSO (see below). It is included in the *Guidelines* to provide a method for owners and agencies with limited economic resources to obtain a reduction in their existing seismic risk, rather than doing nothing. Limited rehabilitation may involve two types: partial rehabilitation which addresses only a portion of the building and reduced rehabilitation which addresses the entire structure; however, they permit greater levels of damage, at more probable levels of ground motion, than is permitted under the BSO.

Basic Life Safety (BSO):

Objective: To provide a low risk of endangerment of life safety for any event likely to affect the building.

Overall damage: Moderate. Some residual strength and stiffness left in all stories. Gravity-load-bearing elements function. No out-of plane failure of walls or tipping of parapets. Some permanent drift and damage to partitions. Building may be beyond economical repair.

Comment: Buildings meeting the BSO are expected to experience little damage from relatively frequent, moderate earthquakes, but significantly more damage and potential economic loss from the most severe and infrequent earthquakes that could affect them. The level of damage and potential economic loss experienced by buildings rehabilitated to the BSO may be greater than that expected in properly designed and constructed new buildings.

Enhanced (enhanced life safety, damage control and operational):

Objective: To provide a low risk of endangerment of life safety for any event likely to affect the building and to further protect building features and/or contents against damage.

Overall damage: Light-Very Light. Structure substantially retains original strength and stiffness. Minor cracking of facades, partitions, and ceilings as well as structural elements. Elevators can be restarted. Fire protection operable [in relation to operational buildings, it would be expected that all systems important to normal operation are functional].

Comment: Enhanced interventions would involve buildings critical for immediate occupancy following an earthquake such as hospitals, fire stations and other buildings critical for post-earthquake response and recovery.[40]

[40] NEHRP, *Guidelines and Commentary for the Seismic Rehabilitation of Buildings* (FEMA 274 and 356), p 2-2, 2-4

Of the three main objectives, FEMA recommended that basic life safety 'should be the primary goal of rehabilitation, but that a variety of choices should be available depending on the individual circumstances of the building, its purpose, its use and its context'[41]

In addition to the performance objectives, FEMA published guidance on dealing with the social issues associated with planning for seismic rehabilitation.[42] This publication highlighted the importance of seismic rehabilitation in relation to many health and safety and social issues:

> The goals of seismic rehabilitation are important. They include, above all, protecting life and property in future earthquakes as well as protecting investments, lengthening a building's usable life, reducing demands on post-earthquake search and rescue resources, protecting historic structures, shortening business interruption time, maintaining inventories and customers, and reducing relocation needs/demands. Other worthy goals include limiting the need for post-earthquake emergency shelter and temporary housing, minimizing the release of hazardous sub-stances, conserving natural resources, avoiding the costly processes of settling insurance claims and applying for post-disaster aid, protecting savings and contingency funds, reducing the amount of debris to be removed, and facilitating an earthquake-stricken community's return to normal patterns of activity.[43]

The guidance promoted a four-step decision making process involving:

1. Defining the problem by conducting preliminary and, if needed, detailed analyses of the risk.

2. Developing and refining the alternatives for addressing seismic rehabilitation.

3. Adopting an approach and an implementation strategy.

4. Securing the needed resources and implementing the seismic rehabilitation measures.

Intervention strategies in each particular state or district will reflect the specific mixture of private efforts and governmental policies which will generate different levels of conflict:

> Attrition is one choice and has the least conflict. A second choice is purely voluntary rehabilitation, but even this approach may engender some conflict as government becomes involved in the permitting process. The third choice involves a more proactive role of government and, therefore, a potentially higher level of conflict; it entails informally encouraging owners to rehabilitate their buildings by establishing some standards and triggers and then negotiating the scope of work on a case-by-case basis as a condition of being granted the necessary permits. The fourth and final strategic choice and the one with the highest degree of conflict centers on government mandating of seismic rehabilitation-i.e., the establishment of seismic rehabilitation ordinances defining which types or uses – of buildings require rehabilitation,

[41] , Daniel Shapiro, Christopher Rojahn, Lawrence D. Reaveley, James R. Smith, 'NEHRP Guidelines and Commentary for the Seismic Rehabilitation of Buildings' *Earthquake Spectra*, Vol 16,1, February 2000, p 233 (and FEMA 356)

[42] FEMA, *Planning for Seismic Rehabilitation: Societal Issues*, FEMA 275 (FEMA, 1997c)

[43] ibid, p vii

the applicable standards, reporting and inspection requirements, time frames for compliance, and penalties for not doing so.[44]

FEMA acknowledged the complex issues associated with historic buildings and seismic rehabilitation and suggest a number of steps to take for the engineering assessment of historic buildings (see text box below).

Strategies for Managing Earthquake-Prone Historic Buildings, FEMA, 275[45]

Determine if the particular building has indeed been designated historic and by whom. This information will determine whose design and construction regulations and enforcement processes will govern the project.

Review the regulations and processes, paying particular attention to any special standards or exemptions, design review requirements, appeals or approval processes, flexibility in time for compliance, alternative approaches, and similar factors. Like other buildings, determine the current use of the historic structure and what the dislocation and other extra needs might be to accommodate the occupants and functions. This will require some effort if these problems can be handled imaginatively, easily, in a timely fashion, and affordably.

Analyze the exposure of the building to the expected earthquake risk in the region and balance this with the building's value to the community. There is the need to judge the building's long-term significance, its occupancy and function, the cost to replace it versus the cost to repair it occasionally, and other factors. The answer will almost never be clear. Given the desired permanence of historic buildings, it may mean that the rehabilitation decision will have to consider lower probability but more severe ground motions and more earthquake occurrences during its estimated post-rehabilitated lifetime.

Select the desired seismic rehabilitation performance level from the Guidelines. As with other buildings, this is critical because the selection will drive the design alternatives, costs, and scheduling. FEMA 273(p. 80) notes that such an '...approach will help preserve historic buildings from earthquakes, even if they are strengthened only up to a minimum life-safety level, and prevent the situation from developing where the historic buildings will be the most hazardous in a community.'

Determine what efforts are needed to accommodate the relocation of the occupants, time needed for rehabilitation, and how and if the most important functions performed in the building can be or need to be maintained. Solutions to these issues will vary with each project.

Involve and, to the extent possible, obtain consensus among the controlling stakeholders that the preferred seismic rehabilitation technique will be effective and workable. Historic buildings are highly visible and the foci of often influential advocacy groups. Therefore, it is important that advocates be informed of the potential project and be brought into the process 'early; it is worth the upfront investment of time and energy.

Obtain the advice of state historic preservation officers and other specialists in the preservation of historic finishes and involve them from the very beginning of the rehabilitation process. Finding ways to address the unique problems associated with the

[44] ibid

[45] FEMA, *Planning for Seismic Rehabilitation: Societal Issues*, FEMA 275 (FEMA, 1997c), p 34-35

seismic rehabilitation of historic buildings will help ensure that the threat of earthquake damage to these structures will be reduced and that they will continue to be important reminders of earlier times and events.

In November 2000, the American Society for Civil Engineers developed, for FEMA, a detailed commentary for the seismic rehabilitation of buildings.[46] This commentary included guidance on seismic rehabilitation of historic buildings. It was noted that while seismic rehabilitation 'can serve to better protect a historic building from un-repairable damage', seismic intervention work may also impact on the historic fabric of the building.[47] For this reason, the guidance highlighted that many building codes provide flexibility for historic buildings. In selecting performance targets, it is stated that it may be 'desirable' to achieve a level exceeding Basic Life Safety to ensure architectural fabric survives certain earthquakes if a building contains items of unusual architectural interest.[48] A range of strategies recommended by the American Society of Civil Engineers and FEMA included:

- Initial risk mitigation strategies should consider the historic value of the building and its fabric.
- Development of a Historic Structure Report (Conservation Plan) may be essential.
- Consider structurally adequate solutions that may be unacceptable because they may involve the destruction of historic fabric or character.
- Consider alternative rehabilitation methods that lessen the impact on historic fabric.
- Partial demolition may be inappropriate.
- Elements that create irregularities may be essential to the historic character of the structure.
- Seek the advice of a historic preservation expert early in the rehabilitation process.
- Structural rehabilitation of historic buildings may be accomplished by hiding the new structural members or by exposing them as admittedly new elements in the building's history. Often, the exposure of new structural members is preferred because alterations of this kind are "reversible"; that is, they could conceivably be undone at a future time with no loss of historic fabric to the building. The decision to hide or expose structural members is a complex one and is best made by preservation professional.[49]

As a result of the implementation of the new performance-based objectives promoted by FEMA, the US National Park Service published guidance for the seismic retrofit of

[46] American Society of Civil Engineers, *Pre-standard and commentary for the seismic rehabilitation of buildings*, FEMA, November 2000, 356
[47] ibid, p A.2
[48] ibid, p A.5
[49] ibid, p A.5-A.6

historic buildings.[50] Adopting the FEMA typology, the US National Parks Service suggested three basic options for seismic retrofit of historic buildings depending on the expected seismic activity and the desired level of performance.

Options for Levels of Seismic Retrofit[51]				
Category	**Objective**	**Explanation**	**Scope of upgrade work**	**Performance expectations during an earthquake**
1	Basic life safety	Addresses most serious life-safety concerns by correcting those deficiencies that could lead to serious human injury or total building collapse	Bracing and tying most vulnerable elements of the building (i.e. parapets, chimneys, routes of exit)	Serious damage (but not collapse) Building will require major repairs, post-quake
2	Enhanced life safety	Building is upgraded using a flexible approach to the building code for moderate earthquake	Inherent deficiencies, such as poor floor to wall framing connections and un-braced masonry walls would be corrected	Some structural damage (i.e. masonry cracking). Building will require repairs, post-quake
3	Enhanced damage control	Building is substantially upgraded to meet prescribed building code provisions to the extent possible	Major new structural framing	Minor repairable damage
4	Immediate occupancy	Total upgrade to meet highest building code performance specifications for buildings intended to be designated to remain open and operational during a major earthquake (i.e. hospitals and emergency shelters)	Total reconstruction	No damage

The US National Parks Service considered that only the first three categories will realistically apply to historic buildings since to upgrade to category 4 would result in massive intervention and damage to fabric of heritage value. In terms of categories 1-3, the National Parks Service comment:

> Devising the most appropriate approach for a particular historic building will depend on a variety of factors, including the building's use, whether it remains occupied during construction, applicable codes, budgetary constraints and the projected risk of damage.[52]

[50] David. W. Look, AIA, Terry Wong, PE, and Sylvia Rose Augustus, 'The Seismic Retrofit of Historic Buildings', *Preservation Briefs*, No.41, National Park Service, US Dept' of the Interior, October 1997
[51] Adapted from David. W. Look, AIA, Terry Wong, PE, and Sylvia Rose Augustus, 'The Seismic Retrofit of Historic Buildings', *Preservation Briefs*, No.41, National Park Service, US Dept' of the Interior, October 1997, pp 10-11
[52] ibid, p 11

In particular, the US National Parks Service highlights the importance of carrying out a thorough cost-benefit analysis and the need for financial support to owners of heritage buildings at risk:

> Each property owner has to weigh the costs and benefits of undertaking seismic retrofit in a timely manner. Owners may find that an extended engineering study evaluating a wide range of options is worthwhile. Not only can such a study consider the most sensitive historic preservation solution, but the most cost-effective one as well. In many cases, actual retrofit expenses have been lower than anticipated because careful analysis of the existing building was made that took the durability and performance of existing historic materials into consideration. Most seismic retrofit is done incrementally or incorporated into other rehabilitation work. In large public buildings, a seemingly expensive 'high-tech' solution such as installing foundation base isolators can turn out to be justified because significant historic materials do not have to be removed, replaced or replicated. The cost for a fully retrofitted building can offset the potential loss of income, relocation, and rebuilding after an earthquake. Without careful study, these solutions are often not evaluated.[53]

The emergence of the FEMA set of seismic guidance in the USA has been followed by the development of the International Existing Building Code (IEBC) by the International Code Council (ICC) in 2003. This code has now been updated and published as the *2006 International Existing Building Code*. The code is designed to encourage the use and reuse of existing buildings. The scope of the code covers repair, alteration, addition and change of occupancy for existing buildings and historic buildings, while achieving appropriate levels of safety without requiring full compliance with the new construction requirements in the building code.[54] As at January 2006, some 14 US states have adopted the IEBC standards. In addition, the International Conference of Building Officials (ICBO) published *Guidelines for Seismic Retrofit of Existing Buildings* in 2001.[55] These guidelines were originally published as the *Uniform Code for Building Conservation* in 1984. The 2001 guidelines contain technical guidance for strengthening unreinforced masonry bearing wall buildings, existing reinforced concrete and masonry wall buildings, wood-frame residential buildings and masonry infill buildings. The standards contained in the guidelines are generally designed to promote public safety and welfare by reducing the risk of death or inquiry. While they are intended to reduce the risk of life loss or injury, they will not necessarily prevent loss of life or injury, or prevent earthquake damage to rehabilitated buildings.[56]

FEMA is now in the process of revising the existing performance-based set of seismic rehabilitation guidelines and are planning for a new generation of standards.[57] This revision will re-examine the appropriateness of the first generation performance standards of collapse prevention, life safety, immediate occupancy and operation performance.[58] This revision is particularly informed by the 1994 Northridge and 1995 Kobe earthquakes which highlighted that damage, sometimes severe, can occur in

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[53] ibid, p 12
[54] International Code Council, *2006 International Existing Building Code*, www.iccsafe.org
[55] International Conference of Building Officials, *Guidelines for Seismic Retrofit of Existing Buildings*, July 2001
[56] ibid, p 1
[57] FEMA, *Next-Generation Performance-Based Seismic Design Guidelines, Program Plan for New and Existing Buildings*, FEMA=445, 2006
[58] ibid, p. x

buildings designed in accordance with building codes.[59] In addition, the revision will attempt to resolve a number of outstanding issues including the accuracy of the analytical procedures in predicting actual building response, the level of conservatism present in the acceptance criteria, and the need for alternative ways of communicating performance to stakeholders that is more meaningful and useful for decision-making purposes.[60] It is unknown if the current FEMA revision will consider the effect of the seismic rehabilitation guidelines on historic buildings.

2.3 Guidelines for Managing Seismic Risk to Cultural Heritage in Italy

While the USA has the most advanced guidance standards relating to general seismic rehabilitation, countries such as Italy have developed procedures for management of seismic risk to cultural heritage. Italy is a country of seismic risk in the Mediterranean basin and has a high density of listed historic monuments and buildings. In Italian law the 'State, regions and other territorial public entities as well as every public institution has the obligation of guaranteeing the safety and preservation of the cultural heritage which belongs to it.'[61]

Italian cultural heritage is an intensely public issue and is viewed constantly by thousands of tourists daily. This situation means that any interventions involving historic fabric are critically assessed and the Italian authorities have sustained a heavy degree of public criticism for allowing the strengthening of historic monuments in an inappropriate manner, including the Temple of Athena, Ancient Pompeii, and plans for strengthening of the Coliseum.[62] As commented by the Italian Ministry for Cultural Heritage and Activities (*Ministero per i Beni e le Attivita Culturali*):

> A strengthening intervention of poor quality is worse than not intervening at all. On the whole, up to now, work towards anti-seismic safety has not been of sufficient quality. Usually projects have been carried out without even examining the building materials, thus ignoring them on purpose in the short-sighted conviction that they were inadequate; this led to the idea that the only possible solution was to literally work on top of the existing fabric, utilising new construction criteria and adopting equally inappropriate strengthening intervention methods. The result was disastrous; considerable parts of our cultural heritage have been lost and can no longer be recuperated.[63]

During the 1990s, the Italian Ministry of Cultural Heritage and Activities, or more specifically the *Insituto Centrale per il Restauro* (ICR) developed a risk-based approach for the identification and management of cultural heritage using a GIS-based tool. This approach, called the Risk Map of Italian Cultural Heritage (the risk map), is one of the 'most advanced on-going projects to plan conservation of cultural heritage through enhanced traditional planning of treatment and preventive action.'[64] The risk map was not solely generated to manage natural risks such as earthquakes but also on the basis of a recognition that damage can be caused by human development and actions such as

[59] ibid, p 2
[60] ibid, p x
[61] Art 30, *Legislative Decree, No.42/2004, Code for Cultural Heritage and Landscape*, Italian Government
[62] S.D'Agostino, M. Bellomo, 'Seismic risk and conservation of architectural heritage in the Mediterranean basin', *The Built Environment*, Vol 95, 2007, p 616-617
[63] Italian Ministry for Cultural Heritage and Activities, *Guidelines for Evaluation and Mitigation of Seismic Risk to Cultural Heritage*, June 2007, p 1
[64] G. Accardo, E. Giani and A. Giovagnoli, 'The Risk Map of Italian Cultural Heritage', *Journal of Architectural Conservation*, No.2, July 2003, p 42. See also: http://www.uni.net/aec/riskmap/english.htm

thefts. The process of building the risk map requires a survey of each Italian territory. Each territory is assigned a danger index considering:

- Seismic activity
- Landslides
- Flooding
- Coastal dynamics
- Avalanches
- Volcanic activity
- Human impact danger (population density, tourist flows, number of thefts)
- Environmental danger (erosion, blackening, physical stress)

This data is overlaid with a corresponding survey of cultural heritage places using a 'specific data sheet' (DS) to synthetically describe the state of conservation of the monument and thus its vulnerability (vulnerability index)'.[65] This system ensures that the state/condition of the monument is recorded in relation to its type of damage including:

- Generic damage
- Material decay
- Moisture
- Biological deterioration
- Surface deterioration
- *Lacunae*, missing fragments/pieces.

This system of condition recording recognises that damage from natural events is often in proportion to the lack of maintenance characterising the historic monument or artefact.[66]

By combing the vulnerability index and the territorial danger index, a tool is provided at the national level that provides a generalised picture of risk for 62,526 monuments within 8,100 Italian municipal districts.[67]

In addition to the risk map, the Italian Ministry for Cultural Heritage and Activities (*Ministero per i Beni e le Attivita Culturali*) has recently prepared guidelines for the evaluation and mitigation of seismic risk to cultural heritage.[68] Italian law requires that for historic buildings (listed monuments, landmarks and buildings) situated in areas of seismic risk, restoration must also include structural strengthening interventions.[69] Most of Italy has now been classified as being high seismic risk, so henceforth the requirement for structural strengthening is triggered when restoration work is being carried out on historic buildings.

The national Italian guidelines are designed for masonry buildings and provide standard procedures for identifying and recording structures, standard procedures for evaluation of seismic safety relating to different types of buildings (e.g. villas, religious buildings, towers, masonry bridges, triumphal arches) and a detailed monitoring program for the state of preservation of architectural heritage.

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[65] ibid, p 52

[66] S.D'Agostino, M. Bellomo, 'Seismic risk and conservation of architectural heritage in the Mediterranean basin', *The Built Environment*, Vol 95, 2007, p 612.

[67] Accardo, E. Giani and A. Giovagnoli, 'The Risk Map of Italian Cultural Heritage', *Journal of Architectural Conservation*, No.2, July 2003, p 54

[68] Italian Ministry for Cultural Heritage and Activities, *Guidelines for Evaluation and Mitigation of Seismic Risk to Cultural Heritage*, June 2007

[69] Art 29, para 4, *Legisative Decree, No.42/2004, Code for Cultural Heritage and Landscape*, Italian Government

The guidelines emphasise the goal of avoiding unneeded interventions, or minimal intervention, but also highlights the need to intervene in a decisive manner in certain cases.[70] The guidance starts with stressing the importance of monitoring the state of conservation of cultural heritage in the first instance and promoting the monitoring techniques developed by the risk map project by the Ministry for Cultural Heritage and Activities.

For listed buildings, 'it is compulsory to adopt, when necessary, seismic improvement interventions instead of seismic upgrade.'[71] The term 'seismic improvement' is 'intended to mean the execution of work able to give a building greater safety with respect to earthquakes although the level of seismic protection may not necessarily be equal to that required for new constructions.'[72]

Two performance objectives are outlined in the Italian guidance: SLU (last limit state) and SLD (limit state of damage). There is an additional SLA (limit state of damage for works of art).

SLU relates to the performance of a building in reference to a seismic event of exceeding 10% in 50 years. It expected that the structure, even when submitted to grave damage, maintains a residual resistance and stiffness when confronted with lateral shifting and the entire load capacity when under vertical stress.[73] As explained, SLU attempts to achieve a performance standard that achieves basic life safety and a degree of fabric preservation:

> With the SLU verification not only is the safety of the occupants guaranteed, but the preservation of the building which can be restored following an earthquake. The limit state of damage is considered only in relation to functional loss (declared habitable) of a building as far as damage to a historic masonry building is concerned especially with respect to frequent earthquakes, both of the intrinsic character of the building as the consequence of its acceptability as a whole.[74]

SLU evaluation is required for all listed buildings, 'even when not in use, because it aims to guarantee the safety of the occupants and the preservation of the building.'[75]

SLD relates to the performance of a building in referenced to a seismic event of exceeding limits by 50% in 50 years. It is expected that the building as a whole is not greatly damaged in a way that justifies the interruption of use following an earthquake that has a major probability of occurring with respect to reference values for the last limit state. SLD is required for a listed building as a whole when there 'is a desire to guarantee the functionality of a building in use following an earthquake.'[76]

Essentially, the Italian guidance means that the large majority of listed buildings are required to be strengthened roughly equivalent to US FEMA basic life safety or enhanced life safety performance standards when restoration work is being carried out. In some circumstances, listed buildings should be strengthened roughly equivalent to US FEMA

[70] Italian Ministry for Cultural Heritage and Activities, *Guidelines for Evaluation and Mitigation of Seismic Risk to Cultural Heritage*, June 2007, p 22
[71] ibid, p 21
[72] ibid
[73] ibid, p 23
[74] ibid
[75] ibid
[76] ibid

enhanced damage control or continued occupancy standards when the building is required for post-disaster response functions. Italian law also requires all public agencies to take a proactive stance to guaranteeing the safety and preservation of cultural heritage which has spurred the development of the cultural risk map project.

2.4 Post-disaster response strategies and planning for historic heritage

Following the Montenegro earthquake in 1979, a new system for rapid building identification and evaluation was developed for international usage.[77] The system adopted three colour codes to indicate categories of damage:

1. Green (usable, light structural damage)

2. Yellow (temporarily unusable, structural damage)

3. Red (unusable, severe structural damage, partial and total collapse)

This system has now been adopted in the US, Australia and New Zealand by guidance such as the US Applied Technology Council (ATC) *Procedures for Post earthquake Safety Evaluation of Buildings* (ATC-20) and the NZ Society for Earthquake Engineering (NZSEE) *Building Safety Evaluation during a Declared State of Emergency* (draft, December 2008).

Since the development of international systems for rapid building identification and evaluation, there have been instances of historic heritage loss as a result of poor management decisions. Spennemann and Look cite two examples:

- The demolition of the Oddfellows Fraternal Hall, Watsonville, California, after the 1989 Loma Prieta earthquake. Falling parapet masonry killed a pedestrian and the building was demolished despite being repairable.[78]

- The demolition of the Century Theatre following the Newcastle Earthquake, Australia, of 1989. Despite damage being restricted to a collapsed awning, the entire building was demolished.[79]

Following these instances, Spennemann and Look provide a concise summary of major issues confronting disaster management and historic heritage.[80] These issues include:

- Need for communication between disaster management and historic heritage agencies at all levels (federal, state and local).

- General public misconceptions about building safety evaluation during a declared state of emergency: it can be assumed that all 'red-tagged' buildings must be demolished.

[77] The Montenegro earthquake destroyed most of Budva Old Town, a World Heritage Site.
[78] Dirk H.R. Spennemann and David W. Look (eds), 'From conflict to dialogue, from dialogue to cooperation, from cooperation to preservation', in Dirk H.R. Spennemann and David W. Look (eds), *Disaster Management Programs for Historic Sites*, digital edition, 2004, p 178
[79] ibid, p 179
[80] Dirk H.R. Spennemann and David W. Look (eds), 'From conflict to dialogue, from dialogue to cooperation, from cooperation to preservation', in Dirk H.R. Spennemann and David W. Look (eds), *Disaster Management Programs for Historic Sites*, digital edition, 2004

- Unnecessary demolition of historic heritage during the post-disaster phase as a result of poor advice, retribution or perceived opportunities to advance urban development.

- Need for nation-wide standardisation in the application of rapid post disaster response relating to historic places.

- Need for more public and professional education.

- Establishment of mobile heritage damage assessment task forces.

- Need to consider cultural groups and protection of sacred sites.

- Need for financial incentives to promote appropriate earthquake strengthening of historic buildings.

As a consequence of these and other instances, disaster management and historic heritage guidance and programes have expanded, particularly in the United States. In May 2005, the US Federal Emergency Management Agency (FEMA) issued comprehensive guidance for integrating historic property and cultural resource into hazard mitigation planning.[81] This guidance provides a range of information relating to the organisation of resources, risk assessment, developing a mitigation plan and implementing the plan and monitoring of progress. Other sources of guidance include:

- Dirk H.R. Spennemann and David W. Look (eds), *Disaster Management Programs for Historic Sites*, digital edition, 2004

- Herb Stovel, *Risk Preparedness: A Management Manual for World Cultural Heritage*, ICCROM, Rome 1998.

- Paige Swartley, *Model Ordinance: Post-Disaster Alteration, Repair, Restoration, Reconstruction and Demolition of Historic and Cultural Resources*, California Preservation Foundation.

- Jeff Eichenfield, *20 Tools that protect historic resources after an earthquake: Lessons Learned from the Northridge Earthquake,* California Preservation Foundation.

- Roy W. Harthorn, *Temporary Shoring and Stabilisation of Earthquake Damaged Historic Buildings,* California Preservation Foundation.

- US National Parks Service, *Emergency Preparedness for Historic Sites*, bibliography, 2002.

This guidance has informed the development of recommendations for earthquake disaster management responses for historic heritage in New Zealand discussed below and as outlined in appendix 1 of this paper.

[81] FEMA 386-6, *Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning,* May 2005

3 Managing earthquake risks to heritage buildings in New Zealand

New Zealand has substantial experience in the management of earthquake risk relating to the built environment. The country is located astride active tectonic plates, in particular, the Pacific and Australian plates. A large area of central New Zealand is subject to constant earthquake activity.[82] Maori society had experience of earthquakes over a long period of time and particularly large earthquakes were remembered in oral and tribal histories.[83] Early European settlement in New Zealand also experienced earthquake activity on a regular basis. In 1855, Wellington was hit by a magnitude 8.1 earthquake which destroyed a large number of brick buildings. Consequently, the growth of Wellington after 1855 until the 1880s was characterised by the dominance of timber-framed buildings.

After 1880, the threat of fires especially in commercial town areas generated a range of fire-related codes introduced by municipal authorities and the increased use of masonry construction in the towns during the period 1880-1930. It is from this period, that the large stock of existing unreinforced masonry (URM buildings) in New Zealand date.[84]

During the 1931 Hawke's Bay earthquake, the majority of large commercial unreinforced masonry buildings in Napier, Hastings and Central Hawke's Bay were largely destroyed resulting in extensive loss of life. Consequently, the government was moved to take action to develop a national building code. This was achieved by the establishment of the New Zealand Standards Institution in 1932 and the Building Code Committee in May 1934. The Building Code Committee developed the first standard model building bylaw for New Zealand in December 1935. The model building bylaw recommended standards of design and construction to ensure buildings could resist horizontal movement caused by earthquakes and that masonry buildings had to be firmly bonded and tied together. The model building bylaw was not mandatory unless adopted by the responsible municipal authority.

It was not until 1965 that the first national mandatory building code was introduced in New Zealand. Part of this code, known as NZS 1900, Chapter 8: 1965, required all new buildings to adopt reinforced methods of masonry construction.[85] In addition to the new code, the New Zealand Society for Earthquake Engineering Inc was established in 1968 with a particular role to promote the strengthening of URM buildings.[86]

Legislation, starting with the Local Municipal Corporations Act 1968 and followed by the Local Government Act 1974, introduced the first strengthening powers and requirements with regard to existing URM buildings. The legislation gave territorial authorities the

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[82] G. Tonks, A. Russell, J. Ingham, 'Heritage unreinforced brick masonry buildings in New Zealand - The retention of architectural qualities in a seismic environment', unpublished paper for ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering, Crete, Greece, June 2007

[83] R, McClean, *Te Whanganui a Tara, Wellington Harbour*, unpublished report for the Waitangi Tribunal, 1997

[84] G. Tonks, A. Russell, J. Ingham, 'Heritage unreinforced brick masonry buildings in New Zealand - The retention of architectural qualities in a seismic environment', unpublished paper for ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering, Crete, Greece, June 2007, p 2

[85] Barry Potter, 'Shake, Rattle and Roll Earthquakes and Heritage Structures', unpublished paper, 1990, NZHPT vertical file, Antrim House, Wellington

[86] "Earthquake-Prone Buildings", *Department of Building and Housing Te Tari Kaupapa Whare* http://www.dbh.govt.nz/bomd-earthquake-prone-buildings (24 October 2006)

right to apply to the Minister to take up powers to require the strengthening of buildings that were deemed likely to constitute an earthquake risk. This was those buildings (or parts of buildings) that were assessed to be of a strength less than half the earthquake loading of the standard required for new buildings in NZS 1900, 1965.

The legislative powers were adopted by some, but not all, territorial authorities at varying times. Wellington City, in particular, took a proactive stance to identifying and removing perceived earthquake risk buildings from the mid-1970s to the late 1980s. While the action by Council to remove (by demolition) earthquake risk buildings in Wellington was driven by a desire to safeguard people, the Council was also criticised by the heritage community for failing to prevent the demolition of important heritage buildings.[87] This resulted in a number of high profile preservation campaigns such as the Public Trust Building, Wellington Town Hall and St James Theatre during the late 1970s and early 1980s.

In the early 1990s, the Building Industry Commission (later the Building Industry Authority or BIA) proposed new strengthening requirements for new and existing buildings. In the draft Building Bill of 1990, it recommended that a building 'should be considered unsafe in an earthquake if the structural condition of the building would likely to give rise to loss of life in an earthquake having a return period of 150 years.' The term 'return period' is the average interval between earthquake shakings of a specified intensity.[88] The BIA promoted the development of a new standard to determine earthquake-risk buildings being those URM buildings which were assessed to have less than half the strength of the current loadings provisions.

After substantial public and Parliamentary debate and revision, the Building Act 1991 did not introduce the new standard proposed by the BIA and the basic 1968 standard remained in place. The Building Act 1991 did, however, introduce methods for the identification of 'earthquake-prone' buildings. Earthquake-prone buildings were those buildings where the 'minimum level of earthquake resistance for buildings constructed wholly or substantially of unreinforced masonry or unreinforced concrete was not achieved.' The minimum level of earthquake resistance was established at a level that would ensure avoidance of catastrophic collapse in a moderate earthquake. A moderate earthquake was defined as 'one that produces effects on the building one-half as great as the effect created by the application of loads specified in NZS 1900: 1965.' Consequently, territorial authorities could take action (by issuing a notice to fix or demolish) in relation to any URM building that had insufficient strength to resist 50% of the load established by the 1965 standard. [89] In practice, the New Zealand Society for Earthquake Engineering recommended that 67% of the current code should be applied as the minimum target strengthening level.[90]

The Gisborne earthquake of 20 December 2007 has stimulated a further round of policy reconsiderations. The earthquake resulted in substantial damage to historic heritage in the Gisborne CBD as summarised in appendix 2 of this research paper. The earthquake highlighted the absence of any formal systems of historic heritage response or coordination with emergency services. In particular, formalised communication channels and relationship agreements were missing between the NZHPT, civil defence, Gisborne

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[87] |Victoria University School of Architecture and NZHPT, 'New Lives for Old Buildings' Conference, April 1980

[88] Lou Robinson and Ian Bowman, *Guidelines for Earthquake Strengthening,* NZHPT, 2000, p 4

[89] R.D. Jury, "Issues Associated with Making Existing Buildings Safe", pp 157-163, *The 1855 Wairarapa Earthquake Symposium* http://www.gw.govt.nz/council-publications/pdfs/The_1855_Wairarapa_Earthquake_Symposium_Proceedings_Volume_Web_Version.pdf (24 October 2006).

[90] Lou Robinson and Ian Bowman, *Guidelines for Earthquake Strengthening,* NZHPT, 2000, p 4

District Council and the Earthquake Commission. Basically, some historic heritage was 'saved' as a result of the presence of a conservation architect (on holiday in Gisborne at the time of the earthquake) and the local chairperson of the NZHPT Branch Committee who is also a heritage architect. The presence of these skilled professionals may not be the case when another earthquake hits in another region or place.

The recommendations for improved responses to earthquake situations, outlined in appendix 1, have been developed in the context of the Gisborne earthquake and the available international guidance. A summary of events associated with the Gisborne earthquake are outlined in appendix 2.

3.1 Building Act 2004

The Building Act 2004 provides special management provisions for certain categories of buildings which are considered to be dangerous, earthquake-prone or insanitary.[91] With regard to earthquake-prone buildings, these buildings are those which will have their 'ultimate capacity exceeded in a moderate earthquake.'[92] A moderate earthquake means, in relation to a building:

> an earthquake that would generate shaking at the site of the building that is of the same duration as, but that is one-third as strong as, the earthquake shaking (determined by normal measures of acceleration, velocity, and displacement) that would be used to design a new building at that site.[93]

In simple terms, a building may be considered earthquake-prone if it is assessed to be less than one-third of the current standard for new buildings.[94]

This provision means that the reliance on the old and revoked 1965 standard has been removed and the minimum target promoted by the New Zealand Society for Earthquake Engineering has been adopted for all, but small scale, residential buildings.

Under the Building Act 2004, the emphasis on URM buildings has been removed in relation to earthquake prone buildings (EPBs). Instead, section 122 states that EPBs can include any buildings with the exception of buildings that are wholly or mainly for residential purposes unless the building comprises 2 or more storeys and contains 3 or more household units.[95]

If a territorial authority considers that a building is dangerous, earthquake-prone or insanitary, the territorial authority can take action to safeguard both life and property. These actions include putting up a hoarding or fence to prevent people approaching the building, attaching a public warning notice, or issuing a written notice to the owners requiring them to reduce or remove the danger or prevent the building from remaining insanitary.[96] A copy of any such notice must be provided to the NZHPT if the building is a heritage building.[97]

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[91] See definitions of dangerous, earthquake-prone, and insanitary buildings: sections 121-123 Building Act 2004

[92] Section 122(1)(a) Building Act 2004

[93] Building (Specified Systems, Change the Use, and Earthquake-Prone Buildings) Regulations 2005

[94] It is noted that the standard for new buildings includes for ductility which reduces the required design forces. Older buildings do not have much ductility so the forces required to meet current standards are much more than for a new building. This is why the definition refers to the ground shaking, not the response of the building. *Pers Comm* David Hopkins, Department of Building and Housing, Wellington

[95] Section 122, Building Act 2004

[96] Section 124 Building Act 2004

[97] Section 125(2)(f) Building Act 2004

As with past legislation, discretion on taking action on EPBs has been retained by territorial authorities under the Building Act 2004. However, in order to promote a strategic response to managing earthquake-prone, dangerous, and insanitary buildings, section 131 of the Building Act 2004, contains requirements for local authorities to adopt policies on such buildings. The policies must state:

(a) the approach that the territorial authority will take in performing its functions under this Part; and

(b) the territorial authority's priorities in performing those functions; and

(c) how the policy will apply to heritage buildings.

Policies for dangerous, earthquake-prone, and insanitary buildings must be subject to public consultation processes with the opportunity for submissions and a public hearing.[98]

Section 131 policies are prepared in the context of the purpose of the Building Act 2004. This purpose includes the need to ensure that buildings are safe, promote physical independence and wellbeing, have adequate fire escape provisions and are designed, constructed, and able to be used in ways that promote sustainable development. Further in preparing the section 131 policies, territorial authorities are required to take into account a number of principles outlined in section 4 of the Act. In terms of historic heritage, relevant principles include:

> The importance of recognising any special traditional and cultural aspects of the intended use of a building:
>
> The need to facilitate the preservation of buildings of significant cultural, historical, or heritage value.

In contrast to earthquake-prone buildings, dangerous and insanitary building policies under section 131 apply to all types of buildings as there is no exclusion for residential buildings within the meaning of dangerous and insanitary buildings. Consequently, all types of buildings are covered by dangerous and insanitary buildings policies.

The Building Act 2004 does not suggest a 'one size fits all' EPBs policy. Instead the legislation leaves it up to territorial authorities and their communities to develop an EPBs policy approach which best suits their area's particular seismic, economic and social conditions.

3.2 Civil Defence Emergency Management Act 2002

The Civil Defence and Emergency Management Act 2002 (the CDEM Act) is the primary legislation for the management of emergencies in New Zealand. Section 3 of the CDEM Act promotes the sustainable management of hazards; encouraging and enabling risk acceptance by communities; planning and preparation for emergencies, including response and recovery; local authority coordination; integrated national and local civil defence emergency management planning; and coordination across the wide range of agencies and organsiations.[99] In relation to sustainable management, the CDEM Act states 'to improve and promote the sustainable management of hazards...in a way that

[98] Section 83, Local Government Act 2002.
[99] Section 3, CDEM Act 2002

contributes to the social, economic, cultural and environmental well-being and safety of the public and also the protection of property.'[100]

Historic heritage is relevant to the range of matters outlined in section 3 of the CDEM Act including social, economic, cultural and environmental wellbeing and as part of integrated and inter-agency planning and coordination.

The CDEM Act establishes a strategic and policy framework involving the Civil Defence Emergency Management Regulations 2003 and three key plans:

1. The National CDEM Strategy.
2. The National CDEM Plan (and associated guidelines).
3. CDEM Group Plans.

The National CDEM Strategy 2008 promotes an integrated approach to CDEM based on the four R's: reduction, readiness, response and recovery. In this context, the CDEM Strategy sets out five principles, being:

1. Individual and community responsibility and self-reliance.
2. A transparent and systematic approach to managing the risks from hazards.
3. Comprehensive and integrated hazard risk management.
4. Addressing the consequences of hazards.
5. Making best use of information, expertise and structures.

As part of principle one, the importance of Maori cultural heritage is highlighted:

> In the New Zealand context, it is particularly important to note the role of Maori as an important community stakeholder. The Maori worldview incorporates a special relationship with the environment, expressed inter-generationally through kaitiakitanga. The environment forms the base from which cultural, spiritual, emotional, and physical sustenance flows. Because of this perspective, Maori have a particular interest in the management of hazards and associated risks, including risks that may be posed to wahi tapu sites and other sites of significance. It is important that whanau, hapu, iwi and the wider Maori community are involved in CDEM planning. In addition Maori communities often have important resources for response and recovery, such as marae for use as emergency shelters and Maori welfare and support services.[101]

Principle four also notes the cultural implications of hazards by stating that the 'consequences of hazards can be physical, social, technical, environmental, cultural, or economic, and may affected one or more communities.'[102]

While there are no other explicit references to the historic or cultural environment in the strategy, historic heritage issues would be relevant to a range of goals and objectives such as the implementation of effective recovery planning, enhancement of the recovery

[100] Section 3(a), CDEM Act 2002
[101] MCDEM, *National CDEM Strategy*, 2008, p 7
[102] ibid

process, improving community participation, improving CDEM research, and the coordination of government policy.

The National CDEM Plan is a regulation (dated November 2005) that provides detailed information on the main responsibilities, roles and organisation involved in emergency events. Further information is provided in the guidelines to the National CDEM Plan. The guidelines include a section outlining the voluntary commitments of a number of organisations including the NZHPT. This section states that the NZHPT 'can deploy multi-disciplinary teams as appropriate to affected areas to offer advice and assistance. This can include such measures as conservation workshops to assist the community in any clean up.'[103]

The CDEM Act provides a range of powers to civil defence directors during an emergency. These powers include the 'removal or disposing of, or securing or otherwise making safe, dangerous structures and materials wherever they may be.'[104] These powers are supported by section 330 of the RMA which basically mean that in the event of a civil emergency, persons exercising emergency powers under the CDEM Act could demolish or remove severely damaged listed heritage buildings without a resource consent in the interests of public safety.

Section 59 of the CDEM Act is a general obligation for all government departments and others to undertake civil defence emergency management functions and responsibilities.

3.3 New Zealand's Earthquake-Prone Buildings Policy Framework

The Building Act 2004 operates in context of international practice and policy, and also within a national policy context. Although New Zealand has developed substantial experience in earthquake engineering, there has been a policy vacuum relating to the topic of earthquake engineering and heritage buildings at both the national and local level. This vacuum has resulted from lack of research into the seismic retrofit of heritage buildings and lack of policy relating to heritage disaster planning and risk management.[105]

In terms of general earthquake-risk responses, the national policy context has been informed by the work of the Structural Engineering Society of New Zealand and the New Zealand National Society for Earthquake Engineering (NZSEE). In 1984, W.D. Smith and K.R. Berryman published 'Revised Estimates of Earthquake Hazard in New Zealand' in the *Bulletin of the NZSEE*.[106] This work has been developed into national Australian and New Zealand standards for earthquake assessment and engineering. The current standard, AS/NZS 1170, sets seismic hazard factors in different parts of the country.

This standard is based on the shaking intensity level that has a given intensity and so avoiding a reliance on calculating individual earthquake events of a given return period in any particular place. For example, the current standard has a coefficient for Dunedin of 0.13 compared with 0.45 for Wellington. An EPB in Dunedin has to be lower than 0.13/3 = .043, against a similar figure of 0.15 for Wellington.[107] AS/NZS 1170 is based on a 450-

[103] MCDEM, *Guidelines to the National CDEM Plan*, November 2007
[104] Section 85, CDEM Act 2002
[105] G. Tonks, A. Russell, J. Ingham, 'Heritage unreinforced brick masonry buildings in New Zealand - The retention of architectural qualities in a seismic environment', unpublished paper for ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering, Crete, Greece, June 2007, p 2
[106] W.D. Smith and K.R. Berryman, 'Revised Estimates of Earthquake Hazard in New Zealand', *Bulletin of the NZSEE*, vol 16, No.4, December 1983
[107] *Pers Comm*, David Hopkins, Department of Building and Housing, Wellington

year return period, taking account of all known sources of earthquake events and their probabilities. In addition, this standard allows for higher loads for important buildings.[108]

The NZHPT supported the recommendations of the NZSEE in 2000 in its *Guidelines for Earthquake Strengthening,* authored by Lou Robinson and Ian Bowman.[109] The NZHPT promoted the approach recommended by ICCROM and the US National Parks Service (as outlined above) and established a primary strengthening objective to 'minimise the risk to people in and around' the building.[110] For any required strengthening or stabilisation, the objective should be 'to minimise the adverse effects on the building fabric and spaces within the building'.[111]

The NZHPT promoted the adoption of threshold levels to determine whether or not strengthening is necessary. The NZHPT stated that 'preference is for a level based on return period rather than on a fraction of what is required for new buildings. It is suggested that the target strengthening level should be 'based on earthquakes with a return period of 150 years'. However, the NZHPT stated that 'if this target is not reasonably practicable, as agreed with the territorial authority, less resistance might be acceptable. However, nothing should need to be done unless the resistance is less than the threshold level'.[112]

Using the fraction method, as a minimum, the NZHPT supported the NZSEE in its view that the level of earthquake strengthening works relating to heritage buildings should be at least 33% of current Design Standards to comply with the Building Act 2004. However, each building must be assessed on an individual and 'case by case' basis. As indicated by NZHPT, 'consideration should be given to higher threshold and strengthening levels for buildings containing people in crowds, or of prime importance to the community in terms of heritage value of the building or contents.'[113]

Since 2000 and the arrival of the Building Act 2004, the NZSEE has carried out substantial work to update earthquake risk building guidance. In June 2006, the recommendations of the NZSEE Study Group on Earthquake Risk Buildings were published. These recommendations, entitled *Assessment and Improvement of the Structural Performance of Buildings in Earthquakes,* provide major policy guidance in relation to strategies of prioritisation, initial evaluation, detailed assessment and improvement measures.[114] The guidance aims to provide a means of assessing the earthquake structural performance of an existing building and in particular its capability to reach a minimum required level of performance, and provides approaches to and guidance on techniques for improving seismic performance.[115]

The NZSEE notes that the Building Act 2004 targets only the worst buildings (earthquake-prone buildings) - the type of buildings that will collapse in a moderate earthquake. However, the NZSEE consider that many other buildings that are below 67% NBS (new building standard) should be regarded as earthquake-risk buildings. The structural performance of earthquake-risk buildings should also be improved 'to protect the interest of both the owner and the community generally.'[116] For this reason, the

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[108] ibid
[109] Lou Robinson and Ian Bowman, *Guidelines for Earthquake Strengthening,* NZHPT, 2000
[110] ibid, p 4
[111] ibid
[112] ibid, p 5
[113] ibid, p 5
[114] NZSEE Study Group on Earthquake Risk Buildings, *Assessment and Improvement of the Structural Performance of Buildings in Earthquakes,* June 2006
[115] ibid, p 1-13
[116] ibid, p 2-3

NZSEE strongly recommends that 'every effort be made to achieve improvement to at least 67%NBS.'[117]

As part of the guidance, the NZSEE have established a grading system to assess risk relating to the percentage a building has been strengthened to a particular building code standard.[118] The highest risk buildings are those which fall below the 33% of current standard or those buildings with critical structural weaknesses.

The basic implication of the NZSEE grading system is that a large number of pre-1976 buildings would be considered a high earthquake risk. In Wellington, for example, it is estimated that about 10% of the building stock would be considered EPB.[119] Many of these buildings would be currently listed or registered heritage buildings. The NZSEE comment:

> There are many buildings in New Zealand constructed prior to 1976. The cost to the community of requiring full compliance with current standards would be considerable, and arguably disproportionate to the risk reduction achieved.
>
> The NZSEE considers that the community would accept a higher level of risk in an existing building than for a new building, if only for the reason that it will, in general, be economically more feasible to provide higher levels of dependable strength and reliable ductility in a new building than in an existing one. As a result, existing buildings which can be shown to be able to resist demand corresponding to two-thirds of the design event may be categorised as Low Risk.
>
> The acceptance of a factor of 67% as a minimum for existing buildings to be considered as Low Risk is based on this corresponding to an increase in risk for an existing building of approximately two times that of an equivalent new building. This is judged reasonable and compares well to equivalent levels set for the evaluation of existing buildings in the United States. For example, the approach taken in ASCE 31 leads to approximately 75% of the new building standard.
>
> Whilst this increase in risk could appear high on a building-by-building basis, it appears a reasonable minimum target overall. The NZSEE recommends upgrading to as nearly as is reasonably practicable to that of a new building. However NZSEE considers it is more important and realistic to identify the high risk buildings, and reduce the risk they pose to a more acceptable level, than to attempt to ensure that all existing buildings comply with the latest standards. The elimination of non-ductile failure mechanisms and critical structural weaknesses is in itself of greater importance than the actual assessment and strengthening level. Building failures during earthquakes rarely occur solely because the design forces have been underestimated. More often than not, poor performance results from some obvious configurational or detailing deficiency.[120]

In relation to setting priorities in EPBs policies, the NZSEE recommends that territorial authorities should focus on those buildings with critical structural weaknesses. However, factors such as quantitative recognition of building importance, building occupancy

[117] ibid
[118] ibid, p 2-13
[119] *Pers comm.*, David Hopkins, Department of Building and Housing, Wellington
[120] ibid, p 2-14

(number and intensity), and building location as well as the building under-capacity may be factors in determining priorities. The NZSEE provide a list of priority factors to assist for establishing relative priorities for action. These factors are:

> a) The size of the building;
>
> b) The complexity of the building;
>
> c) The location of the building in relation to other building, public spaces, and natural hazards;
>
> d) The intended life of the building;
>
> e) How often people visit the building;
>
> f) How many people spend time in or in the vicinity of the building;
>
> g) The intended use of the building, including any special traditional and cultural aspects of the intended use;
>
> h) The expected useful life of the building and any prolongation of that life;
>
> i) The reasonable practicality of any work concerned;
>
> j) In the case of an existing building, any special historical or cultural value of that building;
>
> k) Any other matter that the territorial authority considers to be relevant."[121]

In relation to section 131 EPBs policies required by the Building Act 2004, the NZSEE briefly note the requirement to provide for heritage buildings:

> A TA is required to make particular provision for heritage buildings in its risk reduction policy.
>
> Due to their age, layout, construction type and aesthetic sensitivity, improvement of the structural performance of heritage buildings may be unusually expensive. However in deciding on a suitable standard of performance improvement, the TA will need to consider that, in addition to life safety, protection of the building fabric will be more important than would otherwise be the case.
>
> The TA could consider offering incentives for building owners to achieve an appropriate result.[122]

With the adoption of the Building Act 2004, the Department of Building and Housing prepared guidance material to help TAs prepare their policies for earthquake-prone buildings.[123] The document aligns closely with the NZSEE recommendations.[124] The

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[121] ibid, appendix 2B
[122] ibid, p 2-11
[123] Department of Building and Housing, *Earthquake-Prone Building Provisions of the Building Act 2004 Policy Guidance for Territorial Authorities*, June 2005.
http://www.building.govt.nz/publish/publications.php

guide contained model provisions for territorial policies to be prepared under section 131 of the Building Act 2004. The guidance established a key aim to reduce the level of earthquake risk to the public over time and that 'measures in the legislation also recognise the need for consistent, transparent and accountable approaches to the implementation.' In the guidance, the Department encouraged territorial authorities to adopt clear priorities in relation to which potential earthquake-prone buildings will be identified. For example, the Department suggested these priorities should include factors such as:

- Community importance, such as hospitals and schools.
- Level of use, such as how often the buildings are occupied and by how many people.
- Location, such as high-density inner city environment.
- On a major highway.
- Size of building.
- Age of building.[125]

Further, in the process of identifying earthquake-prone buildings, the Department considered territorial authorities should explicitly recognise buildings with varying importance levels, including buildings of heritage value. In the model 'Quaketown' policy it was stated that:

> [Council will] categorise the earthquake-prone buildings according to the following:
>
> 1. Buildings with special post-disaster functions as defined in AS/NZS 1170.0: 2002, Importance Level 4.
> 2. Buildings that contain people in crowds or contents of high value to the community as defined in AS/NZS 1170.0: 2002, Importance Level 3.
> 3. Buildings with a Heritage Classification of A or B under the Council's register.
> 4. Buildings with an Importance Level less than 3 as defined in AS/NZS 1170.0:2002.[126]

It was suggested in the Quaketown model policy, that these categories provide priorities for identification and requirements to strengthen or demolish. For example, buildings with a heritage classification of A or B under the Council's register were listed as priority 3 with a 25 year period established for strengthening or demolition.

In terms of general policy guidance for heritage buildings, the Department stated:

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[124] David Hopkins was the principal editor of the early versions of the NZSEE Recommendations and the main author of the DBH guidelines
[125] ibid, p 9
[126] ibid, p 27

> The Building Act requires TAs to state in their EPBs policies how they intend to manage heritage buildings that are earthquake-prone. The age, layout, structure, type of construction and the cultural and aesthetic sensitivity of heritage buildings are such that the cost of their structural improvement is likely to be very high. These special considerations and constraints mean that TAs will need to engage fully with the owners of heritage buildings and the Historic Places Trust. TA policies should also indicate how the TA would manage the different needs of private and public owners of heritage buildings.
>
> In determining a suitable standard of performance improvement, TAs will need to take into account the high priority that owners and the Historic Places Trust will place on the protection of a building's fabric, in addition to meeting its EPBs policy requirements concerning the life safety of occupants.
>
> Given the importance of heritage buildings to the historical and cultural life of the nation and the local community, TAs may wish to consider special implementation measures in relation to these buildings. These could include setting an extended period in which structural improvements are to be completed or providing incentives to owners to upgrade buildings. Incentives could include, for example, cash assistance or rebates on rates.[127]

Following the Department's guide, the NZHPT prepared its own guidance on EPBs policies. [128] This guidance now forms part of the Sustainable Management of Historic Heritage Guidance Series and can be accessed from the NZHPT's website.[129] Within its guidance, the NZHPT cautioned against 'targeting' heritage buildings with ambitious strengthening programmes, and promoted a passive approach backed up by substantial support for owners of heritage buildings.

Following the Gisborne earthquake of 20 December 2007, the NZSEE have prepared revised guidance for building safety evaluation during a declared state of emergency.[130] The draft guidance highlights the application of EPBs policies in an emergency post-disaster situation. For example, the Gisborne earthquake situation raised issues such as:

- The need for a proactive approach to the securing of parapets.
- The relationship between building safety evaluation and the issuing of section 124 Building Act notices.
- The status of section 124 Building Act for buildings on the basis of a rapid building safety evaluation assessment.
- Should buildings (or parts of the building) that have survived a severe earthquake be considered a non-earthquake-prone building?
- Should damaged buildings be strengthened beyond 34% NBS?

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[127] ibid, p 19

[128] New Zealand Historic Places Trust, *Guide to Heritage Provisions Dangerous. Earthquake Prone, Insanitary Buildings and Dangerous Dams Policies: Building Act 2004*, 10 April 2006.

[129] www.historic.org.nz

[130] NZSEE, *Draft Building Safety Evaluation During a Declared State of Emergency – Guidelines for Territorial Authorities*, December 2008

- The need for rapid issuing of section 124 Building Act notices in tight timeframes.[131]

The draft guidance recommends that territorial authorities need to ensure EPBs policies 'address the issue of post disaster recovery by allowing Council officers to issue notices with appropriately short timeframes in these circumstances.'[132] In September 2008, Gisborne District Council proposed changes to its EPBs policy to provide for post-disaster emergency situations, parapets and buildings that are damaged in a seismic event.

4 Territorial Authority Earthquake-Prone Buildings Policy Approaches

Section 131 of the Building Act 2004 requires territorial authorities to adopt a policy on EPBs. This was a new requirement of the Building Act 2004. Few territorial authorities had developed and adopted policies relating to earthquake-prone buildings before the Building Act 2004. In fact of all the territorial authorities in New Zealand, only Wellington City Council and a few smaller local authorities (such as Manawatu District Council) had developed a policy approach to managing earthquake-prone heritage buildings.[133]

Research for the NZHPT carried out in 2006 examined some 65 EPBs policies prepared by territorial authorities. Of these 65 policies, 40 were in finalised form. Most of the EPBs policies followed a standard format with the introducing covering:

- Seismic area information.
- The shape of the community's building stock
- Strengthening efforts that have been conducted in the past
- The overall approach that the territorial authority will apply to its policy

This introduction section is generally followed by methods of EPBs identification, with such tools as an initial desktop review of council files and a more detailed Initial Evaluation Process (IEP) as guided by the New Zealand Society for Earthquake Engineering.

Under section 131, an EPBs policy must state the approach that Council will take in performing its functions under the Building Act 2004. The overall approach is significant in that it suggests the action that the territorial authority could take in regards to EPBs. Territorial authorities have the option of taking an active or a passive approach. Under an active approach, a territorial authority would carry out an initial evaluation of buildings in its district to identify those likely to be at high risk. In light of this, the territorial authority would establish priorities for further more detailed evaluations, set timetables for action, and set guidelines of required performance levels for upgrading.[134]

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[131] David Hopkins, 'Gisborne Earthquake Key Issues' Paper to the NZSEE Conference, April 2008; Dave Brunsdon, 'Rapid Evaluation of Building Safety: Learnings from the December 2007 Gisborne Earthquake' *Paper to the 2008 Australian Earthquake Engineering Society Conference*, Ballarat, Victoria

[132] NZSEE, *Draft Building Safety Evaluation During a Declared State of Emergency – Guidelines for Territorial Authorities*, December 2008, p 17

[133] Wellington City Council, *Building Safety Policy for Earthquake Prone Buildings in Wellington*, 1998

[134] Department of Building and Housing, Appendix 1, p 20.

At the other end of the scale, under a passive or reactive approach, any necessary improvements in structural performance would be triggered by an application under the Building Act 2004 for building alteration, change of use, extension of life or subdivision.[135]

Alternatively, there is the approach which embodies both active and passive policy implementation. In this case the active component of the policy is the prioritising of 'significant' buildings for assessment and strengthening; for example, those which have heritage value, or act as places of assembly. All other buildings have the assessment processes triggered by change of use or consent applications made under the Building Act 2004.

Only a limited number of territorial authorities have chosen to adopt largely active policies:[136]

- North Shore City Council
- New Plymouth District Council
- Gisborne District Council
- Wanganui District Council (claims to be active/passive 'with a bias towards active')
- Dunedin City Council

North Shore City Council's policy on EPBs is notable in regard to its active stance and relatively tight deadlines. North Shore City Council will carry out an initial evaluation of its whole building stock to identify those which fall within the scope of EPBs. The owners of these buildings will be asked to further investigate the buildings' safety and to propose remedial work if assessment shows that the buildings are at risk.

- For buildings in Category 1 and 2 (post disaster functions and contains crowds or contents of high value), the level of protection required will be assessed at two-thirds of the current buildings regulations.
- For buildings in Categories 3 and 4 (Heritage Classifications of A or B and Importance Level of less than 3), the level of protection will be set at one-third of the current building regulations.

The Council stated that building owners have between 5 and 15 years to strengthen or demolish:

> 'We could have taken a passive approach with this policy where existing buildings would only have been assessed for their earthquake risk if an application is received to alter, change the use, extend the life of or subdivide a building,' says North Shore City's group manager building, Kelvin Goode. The active approach provides the community with the best possible risk reduction while a passive approach could leave some significant high risk buildings untouched for a long period of time.[137]

[135] ibid.
[136] Note, many of the active policies also contain passive approaches. For example, Wellington City Council's policy adopts a passive approach for Importance Level 1 buildings
[137] 'Earthquake-prone buildings under discussion', Press Release, North Shore City, June 21 2006

Gisborne District Council provides another example of a territorial authority undertaking an active policy, while its neighbouring territorial authorities take active/passive approaches.

New Plymouth is located in a zone of low seismic activity, yet it has also determined that its policy on EPBs will take an active approach. Nevertheless, New Plymouth District Council does allow longer timeframes than other active territorial authorities for earthquake strengthening.

Wellington City Council's EPBs policy is an example of an active/passive approach. After an initial desktop review to assess buildings that could be potentially earthquake-prone, WCC states that the Council will use the Initial Evaluation Process set out by the New Zealand Society for Earthquake Engineering to determine the structural performance of these buildings. WCC will employ, at its own cost, qualified engineers to undertake the evaluations proposed. From here the Council has identified a priority scheme for buildings to be assessed and if necessary strengthened. The priority scheme is determined by building type and use; whether a building has a post-disaster function, serves a specific community purpose or is likely to cause injury or damage to other property in an earthquake; and also building age and condition.

Wellington City Council will advise building owners of the need to strengthen the building and issue a notice under the Building Act to begin the work within two years. The maximum timeframes for undertaking strengthening work for earthquake-prone buildings are 5 to 15 years.

Marlborough District Council proposes a combination of an active and passive approach which targets buildings that are either multi-storeyed or have high density occupations (for example theatres, churches and halls). The Council will address higher risk buildings through an 'active' programme, with the assessment of other 'at risk' buildings to be reactionary and arising from building consent application processes. Marlborough District Council also categorises its building stock into two classes:

- Class 2 structures have higher occupancy loadings and consequently they will attract the minimum period for strengthening, with strengthening or demolition to occur within 5 years.

- Class 1 structures are allowed a longer period to reflect the lower risk occupancy. Strengthening or demolition should occur within 10 years.

The Council states that a combination of both an active and passive approach may still take some time to have buildings up to the standards set in the Building Act, yet at the same time it balances need with cost, recognising the economic implications of requiring significant remedial building work. This balanced approach to EPBs is the most common among New Zealand's territorial authorities.

Waitaki District Council is an example of a number of territorial authorities opting for a passive approach to policy on EPBs. Upon receipt of a building consent application, the Council will require the owner to have an appropriately qualified structural engineer undertake an initial evaluation or an assessment of the building's performance as part of the application process. This will be carried out at the owner's expense, and the owner shall provide a copy of the report to the Council. An assessment would be required when an initial evaluation indicates the building is likely to be earthquake-prone.

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http://www.scoop.co.nz/stories/AK0606/S00229.htm 19 June 2006.

Following an earthquake-prone assessment, the Council states that improvements will not be required if buildings comply with 34 percent or greater of the design code. Those failing to meet that threshold will have between 15 and 25 years to prove compliance.

Design code status	**Upgrade time**
34% + of current design code	No action required
25-32% of current design code	25 years
20-24% of current design code	20 years
<20% of current design code	15 years

4.1 Earthquake-Prone Buildings Priorities and Heritage Buildings

Section 131 of the Building Act 2004 requires the territorial authority to establish priorities in performing its functions with regard to EPBs. As indicated in the model Quaketown policy guidance published by the Department of Building and Housing, heritage buildings could form part of a list of priority actions if desired by Council.

A large number of Councils followed the Quaketown policy model and included heritage buildings in a list of priority actions. For example, many priorities were similar to Nelson City Council's EPBs which states:

> Nelson City Council will categorise the earthquake-prone buildings according to the following:
>
> 1. Buildings with special post-disaster functions, Importance Level 4
>
> 2. Buildings that contain people in crowds or contents of high value to the community, Importance Level 3
>
> 3. Buildings with a Heritage Classification of A or B under the Nelson's Resource Management Plan or registered under the New Zealand Historic Places Act
>
> 4. Buildings with an Importance Level less than 3
>
> Nelson City Council will advise and liaise with owners of earthquake-prone buildings. Owners will be required to carry out an independent assessment of the structural performance of those buildings identified as earthquake-prone. Council will serve formal notices to all owners of earthquake-prone buildings once the deadline for meeting Council has passed and, subject to the results of discussions, will require them to carry out work to reduce or remove the danger within a specified time-frame.

Tasman District Council adopted a similar approach with specific strengthening timeframes:

> Tasman District Council will categorise earthquake-prone buildings according to the following, with a date given by which notices are to be issued, and a timeframe given for the completion of work required by a notice:
>
> A. Buildings with special post-disaster functions, Importance Level 4 (December 2008, 15 years)

B. Buildings that contain people in crowds or contents of high value to the community, Importance Level 3 (December 2009, 20 years)

C. Heritage Buildings (December 2010, 25 years)

D. Buildings with an Importance Level less than 3 (December 2011, 30 years)

New Plymouth followed a similar priority approach:

- Buildings in Category 1 which have special functions or whose failure poses catastrophic risk to a large area or a large number of people, and buildings with special post-disaster functions have a maximum of 15 years for strengthening or demolition.

- Buildings that as a whole may contain people in crowds or contents of high value to the community or pose risks to people in crowds have a maximum of 20 years for strengthening or demolition.

- Buildings with a heritage classification of Category A under the New Plymouth District Plan that have not already been earthquake strengthened to withstand a moderate earthquake have a maximum of 30 years for strengthening or demolition.

Ruapehu District Council placed heritage buildings at the top of the priority list with a target of 5 years for identification processes to be completed:

Category A: Buildings of high value to the community, including Heritage Buildings (within 5 years)

Category B: All other buildings (within 10 years) except private dwellings

Category C: Private dwellings (within 15 years)

Not all territorial authorities, however, included heritage buildings in the priority actions. Wellington, in particular, categorises its building stock as follows:

- Importance Level 1. Low degree of hazard (e.g. farm buildings, isolated structures).

- Importance Level 2. 'Normal' structures and not in other levels (e.g. single family dwellings).

- Importance Level 3. Contains crowds or high value to the community (e.g. some schools, medical centres).

- Importance Level 4. Highest priority with post-disaster functions (e.g. medical facilities).

Other Councils such as Napier City Council established priorities based on assessed performance assessments:

Intensity of shaking at the site that the building is capable of sustaining, as a percentage of the intensity of shaking assumed for the design of a new building	Time to be specified in the notice within which the work require by the notice is to be carried out
33%	50 years (No work is required; use for interpolation)
30%	40 years
25%	30 years
20%	20 years
15% or less	10 years

Some Councils established simple priorities using type of buildings or age. For example, Wairoa District Council established the priority buildings as being those constructed prior to 1935.

The inclusion of heritage buildings in priorities for actions within some EPBs policies resulted in some anxiety and public concern in some districts. In these districts, it was felt that heritage buildings were being unnecessary 'targeted' by the Council. This issue was keenly experienced in Dunedin. The draft Dunedin EPBs policy included a priority action that required owners of registered Category I Historic Places to carry out an engineering assessment within two years. In addition, the Council also required owners of buildings 4 or more stories high and those that had an occupancy density greater than 500 people to have an appropriately qualified structural engineer to assess the building within two years. Building owners were required to either strengthen the building, or, if it is not viable to carry out the work, demolish. However, the Council draft policy made demolition only an option if the building was not listed as being a heritage or historic building, with buildings having between 15 and 25 years to upgrade.

Many public submissions were critical of the priority system, especially that Category I historic places should be included in the priority actions. For example the owners of Dunedin's iconic Larnach Castle made a high profile submission which alleged the policy would cost millions of dollars to implement.

As a result of the submissions and the public hearing, the Council made a number of changes to its EPBs policy which included removing heritage buildings from the list of priority actions. Council was also influenced by advice from a structural engineer with expertise in the structural performance of buildings. This advice considered that the majority of Dunedin's heritage buildings would probably survive an earthquake because of their construction style. The Council's adviser further explained that the Building Act 2004 exists to ensure the preservation of life, not structures per se, and if the majority of Dunedin's heritage buildings would not be considered earthquake-prone because of the style of construction, then the buildings, in general, would be a low risk if there is a seismic event.

Not unlike the situation in Dunedin, Wanganui District Council also faced intense criticism from its community over its EPBs policy priorities in relation to heritage buildings. Wanganui District Council's draft EPBs policy stated relatively short time-frames for identification and strengthening of EPBs:

A Buildings with special post-disaster functions, importance level 4 (December 2007, 2 years)

B Buildings that contain people in crowds or contents of high value to the community, Importance Level 3 including all Council owned buildings (December 2008, 3 years)

C Buildings with a Heritage Classification of A or B under the Council's register, Historic Places Trust (Register of buildings, and building in the Central Business District, and buildings in the Old Town Conservation Overlay Zone, December 2011, 5 years)

D Buildings with an Importance Level of less than 3 (December 2011, 15 years)

This strict timetable for compliance generated public opposition which resulted in revisions following submissions and public hearing. Wanganui's finalised policy gives owners of heritage buildings until 2040 to ensure their buildings are up to the Building Code, with a key feature of the new EPBs policy being confirmation of strengthening timeframes following review which begins in December 2007.

4.2 Earthquake-Prone Buildings policies for heritage buildings

All EPBs policies must state how the policy will apply to heritage buildings. With regard to this requirement, the large majority (estimated approx' 80% +) of EPBs policies contain special provisions for heritage buildings.

The EPBs policies with special provisions recognise that heritage buildings should be treated differently from other general buildings on the basis that preservation of heritage buildings is in the public interest and that heritage buildings raise special management issues. At a general level, the special provisions promote flexibility when dealing with heritage buildings and promote methods such as management plans, dialogue and other special requirements. Examples of common methods in EPBs policies include:

- Initiation of discussions with the NZHPT.
- Seeking advice from NZHPT and/or heritage professionals.
- Consultation processes with all stakeholders.
- Extended timeframes for engineering assessments and structural upgrade works.
- Public consultation.
- Upgrading work to comply with ICOMOS NZ Charter or other standards.
- Use of waivers and modifications to the building code.
- Financial assistance.
- Risk and recovery management and pre-disaster planning assistance.
- Demolition as the last option (or avoiding demolition).

Some Councils have included a range of special provisions. For example, Palmerston North City Council state:

> While heritage buildings will be assessed in a manner consistent with assessments for other potentially earthquake-prone buildings, special efforts will be made to meet heritage objectives. Discussions will be held with owners and the New Zealand Historic Places Trust to identify a mutually acceptable way forward. When dealing with earthquake-prone heritage buildings, PNCC will ensure the development of special and appropriate recovery management and planning for heritage buildings to ensure, where possible, risk mitigation

> for the protection of heritage fabric and values. The skills of suitably qualified professionals with heritage expertise will be engaged to advise and recommend actions.

Palmerston North also noted that the Council's Natural and Cultural Heritage Incentive Fund is available with a total annual budget of $35,000.

Invercargill City Council follows a similar approach:

> Where a building is identified as potentially earthquake prone from Council records and where that building is also classified as Category I or Category II by the Historic Places Trust, the Council will notify the building owner and the Historic Places Trust of its initial assessment and take into account any submissions from the Trust and the building owner before making a decision on the earthquake prone classification.
>
> Council will take into account the heritage value of the building, any particular structural characteristics of the building and characteristics of its use with respect to risk to people and property from earthquakes.
>
> Council may then decide, or may decide not, to classify the building as earthquake-prone.
>
> The Council shall also apply this process to building consent applications involving sections 112, 114 and 115 [of the Building Act 2004].

In Wellington City, the Council introduced a management plan approach with substantial financial assistance provisions:

> Earthquake-prone buildings (buildings listed in the Wellington City District Plan, and/or NZHPT Register) must follow the requirements as described above for earthquake-prone buildings, with maximum timeframes for undertaking strengthening work still being applicable. Owners of earthquake-prone heritage buildings must provide as part of the consent application a management plan outlining how strengthening will preserve the heritage fabric of the building. WCC does not encourage demolition.
>
> A new heritage incentive fund of $250,000 in year one and $350,000 a year thereafter is proposed as part of the Council's 2006/2007 Long Term Council Community Plan 'for a range of heritage-related projects, including those that are required as a result of the adoption of WCCs Earthquake-Prone Policy.

Some rural local authorities have substantial special provisions for heritage buildings. Manawatu District Council state:

> Heritage Buildings will be screened through a similar process to other potentially earthquake-prone buildings, with initial evaluation followed by detailed assessment. Following the initial evaluation, discussions will be held with owners and the New Zealand Historic Places Trust to identify a mutually acceptable way forward. Special efforts will be made to meet heritage objectives. In particularly important cases, public consultation will be included in the process. 33 of Feilding's 42 heritage buildings were identified in an engineer's survey in 1995, with 15 'high-risk' buildings in Feilding already heritage listed.

Manawatu District Council's policy also contains information about incentives available to owners of heritage buildings:

> Council adopted a package of incentives for earthquake-strengthening in 1998. The Heritage Incentive Strategy was based on the concept that if District Plan controls were placed over historic buildings because it was in the public interest for these buildings to be retained and looked after, it was only fair for the public (via the Council) to assist building owners to meet some of the added costs that arise from owning such a building. One of these potential costs was identified as earthquake strengthening. In 2001 Council added a policy of making low-interest loans available to strengthen the facades of heritage buildings:
>
> - $23 000 per annum grants
> - $50 000 per annum loans.
> - Loans interest free first year then less than market rate subsequently.
> - Public can apply for rates remissions
> - Grants to owners of listed buildings to help pay for strengthening advice – engineer reports
> - Reimbursement of any building consent fees incurred to the maximum percentage depending on category of listing

A small number of local authorities decided to adopt no special provisions for heritage buildings. These policies generally contain a simple statement that heritage buildings will be treated the same as other types of buildings. Marlborough District Council's approach is typical of Councils who have adopted no special provisions for heritage buildings:

> A heritage building includes all buildings listed as a heritage resource in either of the Council's resource management plans: the Marlborough Sounds Plan and the Wairau/Awatere Plan; as well as those registered by the New Zealand Historic Places Trust. MDC sets no different requirement for strengthening works than for other potentially earthquake-prone buildings. Accordingly, the building owner can elect to strengthen to any level (above the threshold) that suits.

However, this policy also states that an owner may make an application for funding assistance under the Council's heritage strategy.

Stratford District Council takes a similar approach. The Council states that 'heritage buildings will be assessed in the same way as other potentially earthquake-prone buildings'. However, the Council also states that 'rates remission for the protection of heritage resources' is available. The Council provides 'rates remission of up to 100% of the rates on land with a heritage structure on it to all ratepayers who meet the objectives, conditions and criteria of this policy.'

Auckland City Council's EPBs policy is unusual as it appears to contain additional requirements for heritage buildings. The policy states that 'Council believes that heritage buildings need to have a good chance of surviving a major earthquake. To achieve this, these buildings will require strengthening to levels that exceed those imposed by section 131 Building Act 2004'. The Council, however, follows this statement with a range of

special provisions such as adoption of a passive approach (reliance on Building Act application triggers for alteration or change of use), working with owners on a mutually acceptable way forward, and making special effort in meeting heritage objectives, including the use of dispensations and waivers.

Marae

Marae are special buildings of cultural heritage value and are unique to New Zealand/Aotearoa. Marae may be both historic and contemporary. They can include a number of buildings, including the whare nui, whare kai, and associated facilities. Often marae are associated with a whare karakia, urupa and papa kainga.[138]

As noted in this research paper, marae have been identified in the National CDEM Strategy 2008 as potential emergency shelters. This function was particularly highlighted during the Manawatu-Wanganui floods of February 2004. Research has suggested that the role of marae should be acknowledged and 'incorporated meaningfully into regional and local civil defence policy and plans.'[139]

Currently, few EPBs policies prepared by local authorities explicitly mention marae or other types of traditional Maori buildings. Marae, however, could be included within priorities relating to 'buildings of high value to the community' and heritage buildings. It is unknown how many marae in the country would be considered to be dangerous or earthquake-prone.

The formal incorporation of marae into EPBs policies and civil defence plans may, however, have a number of implications for Maori communities and historic heritage since the traditional structure of marae may present many Building Act-related challenges. For example, fire is a particular hazard for many marae and protecting marae from fire is an issue that requires ongoing education and fire safety measures.[140] Further, funding and support will be required for marae that have been identified as having special post-disaster functions and require earthquake strengthening.

5 Benefits/Costs and existing incentives for earthquake-prone heritage buildings

Generally, earthquake risk-related literature and research has been limited, both in New Zealand and overseas, to technical matters over building safety design without recognising the complex social aspects of earthquake risk policy and its implementation. This research gap is being addressed overseas by FEMA and agencies such as the Pacific Earthquake Engineering Research Centre which has facilitated the commissioning of

[138] Whare nui: meeting house; whare kai: dinning hall; whare karakia: church; urupa: burial ground; Papa kainga: residential village

[139] J Hudson and E Hughes, 'The role of marae and Maori communities in post-disaster recovery: a case study', GNS Science Report 2007/15, April 2007

[140] NZ Fire Service, NZHPT, Ministry of Consumer Affairs, *Protecting Marae from Fire Nga whakatupato ahi mo te marae,* 2005

research on the social aspects of earthquake risk policies.[141] This research has highlighted the need for earthquake-risk policies to be informed by detailed cost/benefit analysis. Such analysis has traditionally focused on the immediate costs of the strengthening work, disruption to existing uses, and continued use as summarised by Peter J. May below:

Claims about Benefits and Costs of Earthquake-Risk Performance-Based Approaches (adapted from Peter J. May, 2006)[142]	
Consideration	**Expectation**
Prospective benefits	
Construction costs	*Lowered* due to greater ability to innovate in design and to optimize design choices
Innovation potential	*Increased* incentives for innovation in building approaches and materials
Enhancement of seismic safety	*Increased* due to better ability to predict performance and make better choices about risk management; assuming the choices are indeed made
Losses from seismic events	*Reduced* due to "better" choices about risk management; assuming the choices are made
Prospective costs (Costs to):	
Building and facility owners	*Uncertain*—Greater potential costs of performance assessments and designs weighted against potential long run savings in losses
Design community	*Increased short run* given educational needs for understanding methods of performance-based design and potential increased liability costs
Occupants (tenants, renters)	*Uncertain*— may increase due to increased design costs and market value of safer buildings, but could be reduced due to lowered costs of construction and reduced insurance premiums
Governments (regulatory authorities)	*Uncertain*— Increased costs of educating building regulators but potential for streamlined review processes for complex structures; potential increased costs of developing alternative code provisions and standards
Regulatory uncertainty	*Increased* - Potential for inconsistencies in interpretation of acceptable non-prescriptive designs and performance predictions; depends on processes for review of alternative designs

This analysis, however, does fully capture the complex and dynamic costs and benefits associated with earthquake-risk performance policies as commented by May:

> There is a difference between safety at any cost and safety gains that can be achieved for tolerable costs. Performance-based seismic assessment is appealing because it helps to expose the safety gains and associated costs. Decision makers can in principle decide what costs they are willing to pay—in terms of functional design choices and dollar outlays—to achieve different levels of seismic safety when measured in terms of potential dollar value of damages, downtime to facilities, or loss of life. Evaluating these tradeoffs takes on added complications when thinking about seismic codes and minimum performance-based seismic-safety standards.

[141] Peter J. May, *Societal Implications of Performance-Based Earthquake Engineering*, Pacific Earthquake Engineering Research Centre, PEER 2006/12
[142] ibid, p 9

> Societal expectations seem to be shifting about minimum performance goals from preventing loss of life—life safety—to increased emphasis on property protection. But, establishment of new regulatory objectives entails value judgments about acceptable risks that public officials are reluctant to make.[143]

This means that consideration of benefits and costs often depends on the 'perspective that is adopted: Whether one considers costs to building and facility owners, the design community, occupants of performance-based facilities, or governmental entities.'[144] Further May comments that other unknown factors complicate the cost/benefit exercise such as the 'implications of changes in potential liability for design community and contractors if the expected performance of structures does not materialize in an earthquake event.'[145]

In New Zealand, earthquake risk cost-benefit analysis has been carried out by the BIA, NZSEE, the Department of Internal Affairs and some local authorities.[146] For example, David Hopkins and George Stuart carried out comprehensive cost-benefit research involving a wide range of commercial and residential buildings in 32 cities and towns in New Zealand.[147] This research considered factors such as seismic values, building floor area, damage, fatalities, business and social disruption. The research highlighted the value of cost-benefit analysis in informing central and local government policy and underlined the 'need to deal with existing buildings, and particularly high risk buildings at least in those towns and cities in New Zealand that are subject to moderate to high seismicity.'[148]

Strengthening of buildings provides both public and private benefits in terms of safety to the public and preservation of buildings in the event of earthquakes. The benefits, however, will often apply to both present and future generations of both private owners and the public in general. In terms of direct and immediate costs, seismic upgrades for heritage buildings under the Building Act 2004 raises two main issues:

- The cost of an engineering report which may range from$1,000 for an initial evaluation and $10,000 for a full assessment of a sizeable building.
- The cost of the actual engineering work.[149]

At both a national and local level there is a need for a more detailed assessment of the benefits and costs of strengthening work involving heritage buildings. This benefit/cost analysis should inform the need for public incentives and financial support for private/public buildings.

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[143] ibid, p 2
[144] ibid, p 11
[145] ibid
[146] NZSEE, *Consolidated Report on Parametric Study*, Project for the Building Industry Authority, September, 1997; WRC (Wellington Regional Council) *Earthquake Risk Assessment Study*, Works Consultancy Services Ltd, Wellington, 199; DIA (NZ Dept of Internal Affairs) *Report on Cost Benefit of Improving the Performance of Buildings in Earthquake*. David Hopkins Consulting, March, 2002
[147] David C Hopkins and George Stuart, 'Strengthening Existing New Zealand Buildings for Earthquake An Analysis of Cost Benefit using Annual Probabilities' unpublished paper for the 2003 Pacific Conference on Earthquake Engineering (available at http://db.nzsee.org.nz/PCEE)
[148] ibid, p 6
[149] In 2003, the cost of building retrofit was estimated at varying from $120 per square metre to over $500 per square metre. David C Hopkins and George Stuart, 'Strengthening Existing New Zealand Buildings for Earthquake An Analysis of Cost Benefit using Annual Probabilities' unpublished paper for the 2003 Pacific Conference on Earthquake Engineering (available at http://db.nzsee.org.nz/PCEE)

In terms of existing incentives, the current source of funding assistance for owners of heritage buildings is the NZHPT National Heritage Preservation Incentive Fund. In 2003 the Government established the incentive fund to provide support for privately owned heritage places for which financial assistance cannot be obtained from many of the usual public funding sources. The value of the fund is $500,000 annually. The fund is administered and allocated by the NZHPT. Priority is given to heritage places of national significance which need conservation work, and heritage places of national significance where conservation work is planned and could be improved through extra funding.[150] The fund will normally pay no more than 50 percent of the cost of conservation work in any particular case, and individual grants will not normally be greater than $100,000. Any property in private ownership that is either registered as a Category I historic place under the Historic Places Act, or in exceptional circumstances which could satisfy the requirements for Category I registration, is eligible to apply to the fund with earthquake strengthening applications being eligible.[151]

Despite the perceived need for financial assistance, the NZHPT has not experienced any increase in demand for applications to the National Heritage Preservation Incentive Fund from owners of Category I historic places to support earthquake-strengthening work. It is likely, however, that there may be an increase in demand for funding resulting from the implementation of the local authority policies.

Another national fund that may be a source of support for owners of heritage buildings involved in the tourism industry to undertake earthquake strengthening is the Tourism Facilities Development Grant Programme. The principal objective of this grant is to 'enhance the understanding and enjoyment of New Zealand by overseas visitors, through increasing the quality and number of nationally significant tourism facilities.'[152] Currently, the NZHPT is not aware of any applications to this funding source involving earthquake-prone heritage buildings.

Some territorial authorities offer some financial support through heritage fund schemes. In most instances these heritage funds were put in place before the new Building Act 2004 and consequently without regard for the costs associated with earthquake strengthening. Thus while many territorial authorities have incentive fund schemes, many these schemes outside the main urban centres provide only minor sums of money and would be of little consequence in the face of the substantial costs required for earthquake strengthening. Incentives made available by territorial authorities include rates relief, waiving of building consent fees or small one off payments which were designed more for tasks like roof painting or façade enhancement than for seismic retrofit. As an example, Dunedin City Council's incentives involve:

- A Heritage Fund of $40,000 per annum.
- Rates relief for projects over a certain value.
- A waiver of 30 percent of its portion of building consent fees, excluding any levies, for any application to strengthen a building to the minimum design standard required by the Act.

[150] New Zealand Historic Places Trust Pouhere Taonga, *National Heritage Preservation Incentive Fund* pamphlet.
[151] ibid.
[152] The Ministry of Tourism Te Manatü Täpoi, 'Tourism Facilities Development Grant Programme', http://www.tourism.govt.nz/funding/fndtfgp.html (14 August 2006)

- When a building owner takes the initiative to strengthen before the process is initiated by another method, DCC will waive 100 percent of the fees, excluding any levies, if the work is carried out within ten years of the introduction of the policy.

The North Shore Heritage Trust provides one off grants of up to $5,000 to help stabilise, repair or restore heritage homes, or prepare conservation plans and protect sites. North Shore City Council contributes $50,000 to the fund annually, while Telecom New Zealand provides $15,000 annually in support of the Trust's work.

New Plymouth District Council provides:

- $20,000 annually for surveys by a certified structural engineer
- Heritage Protection Fund $50,000 per annum which rolls over if not all used
- Resource consent fees waived
- Free technical advice
- Free first consultation architect up to two hours

Wellington City Council has an incentive fund of $250,000 in year one, with $350,000 a year thereafter being proposed as part of the Council's 2006/2007 Long Term Community Plan for a range of heritage-related projects, including those that are required as a result of the adoption of the Council's EPBs policy.

Gisborne District Council does not appear to make any financial incentives available to private owners of earthquake-prone heritage buildings to upgrade.

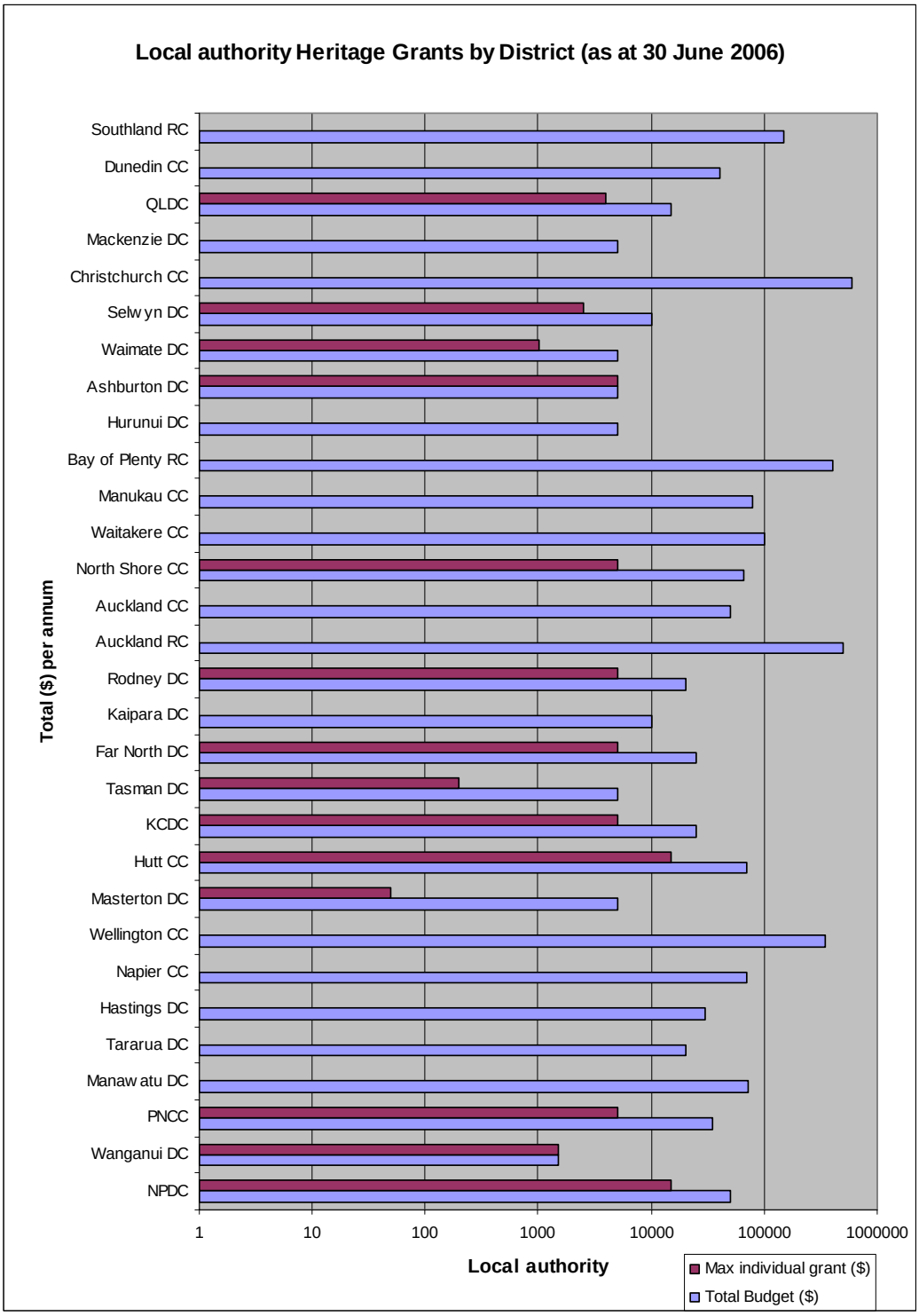
Wanganui District Council's policy notes:

> Council believes funding adequate to strengthen many of Wanganui's heritage buildings is unlikely to be found within the local community alone. Therefore, Council will work closely with the Historic Places Trust and central government agencies and other funding agencies to secure funding for the retention and strengthening of Wanganui's heritage buildings.

While territorial authorities currently have a crucial role to play in offering incentives to help protect and conserve New Zealand's important heritage places, many of them do not have the necessary funds or resources to provide incentives for private building owners to earthquake-strengthen their buildings. This point is confirmed particularly well by comments made by the Manager of Regulatory Services for Buller District Council:

> Council has not currently considered providing any incentives to owners of the heritage buildings. It should however be noted that this district having a population of approximately 10,000 and only being able to rate approximately 10 percent of the land area, it is unlikely that the Council will be in a financial position to provide this type of incentive in the short to medium term.[153]

[153] Correspondence with TN Archer, Manager Regulatory services, 15 June 2006.



Local authority heritage grants by district (as June 2006). Local authorities with no grant schemes are not shown (see appendix 4 for summary table).[154]

As indicated in the above graph, geographic distribution of available territorial authority funding assistance is uneven – being largely concentrated in Northland, Auckland Region, Wellington City, Christchurch City and the Bay of Plenty. For most other areas of

[154] The 'max individual grant' indicates the highest amount or limit that can be granted by the local authority

the country, the available funding assistance for owners of heritage places from territorial authorities is, at best, extremely limited or non-existent.[155]

5.1 Issues and Options for Improved Assistance

It is considered that in the first instance detailed cost/benefit analysis is required at a national and local level in relation to policy options on strengthening earthquake-prone heritage buildings. Following the detailed cost/benefit analysis, initiatives for providing assistance to private owners should be explored. One option could be the expansion of the NZHPT National Heritage Preservation Incentive Fund so that more owners of heritage buildings facing earthquake strengthening costs are more fully supported.

It has also been suggested that owners of heritage buildings are unwilling to apply for funding assistance due to the fact that grants commonly fall short of expectations, and because of additional requirements that need to be complied with. A reason for low demand for funding assistance from private owners may be that many owners see incentive schemes as unwanted interference into their property rights and wish basically to be 'left alone'.[156]

As indicated in this report in relation to the California experience, low-interest loans may be more desirable than one-off grants. A national low-interest loan scheme could be one option for investigation and available for the strengthening of registered Category I and Category II historic buildings. Such a scheme would have the advantage that it could be self sustaining, unlike heritage funds which require frequent injections of fresh capital.

Low-interest loans could be provided by New Zealand's Earthquake Commission (EQC). For 60 years EQC has been collecting premiums from insured people and during that time a substantial fund against damage has built up. There is currently around $4.73 billion in the Natural Disaster Fund which is backed up by reinsurance from overseas groups and a Government Guarantee. The Government Guarantee ensures that EQC will always be able to meet its obligations, regardless of the circumstances.[157]

Section 5(e) of the Earthquake Commission Act states the Function of the Commission is to 'facilitate research and education about matters relevant to natural disaster damage, methods of reducing or preventing natural disaster damage, and the insurance provided under this Act.'[158] Section 15 provides for payment of money from the Natural Disaster Fund for research, information and education.[159]

The National Disaster Fund as a source of low-interest loans would require a change to the purpose of the Earthquake Commission Act. The likelihood of success in achieving an amendment to the Act is unknown as there could be issues about the use of the Fund for non-post disaster funding purposes.

Housing New Zealand also offers a Housing Innovation Fund and Local Government Fund to encourage community groups and local government to increase their involvement in providing social housing initiatives.[160] This fund operates from

[155] New Zealand Historic Places Trust 'National Heritage Preservation Incentive Fund Policy: Incentive Fund Review: Issues and Options Report', 30 June 2006, sec 6.5-6.7, p 21.
[156] New Zealand Historic Places Trust 'National Heritage Preservation Incentive Fund Policy: Incentive Fund Review, sec 6.9-6.10, p 23.
[157] Earthquake Commission, 'What We Do', http://www.eqc.govt.nz/abouteqc.aspx (25 July 2006)
[158] Statutes of New Zealand, 'Earthquake Commission Act 1993', http://www.eqc.govt.nz/abouteqc/eqcact.aspx (3 August 2006)
[159] ibid.
[160] Housing New Zealand, 'Housing Innovation Online', http://www.hnzc.co.nz/HIO/index.html

$63,000,000 over four years. Perhaps this initiative could also be altered to offer a loan scheme that would assist owners of heritage building to earthquake strengthen their properties.

5.2 Tax incentives

In relation to incentives, tax reforms in the United States have revolutionised the way that developers and private investors think about heritage places. The US Tax Reform Act 1976 provided, for the first time, provision that owners of historic buildings were allowed to claim accelerated depreciation for expenses incurred in rehabilitating their historic buildings. The incentive was removed under the US Economic Recovery Tax Act 1981. Instead, the new incentive provides a tax credit that directly reduces taxes for restoration work involving commercial historic properties. To prevent owners from receiving a double tax benefit, the depreciable base of the building must be reduced by the amount of the credit generated, effectively reducing the overall amount of depreciation that would otherwise be deducted on the tax return.

The US tax credit applies to costs incurred for rehabilitation, renovation, restoration, and reconstruction of historic buildings. The percentage of costs taken as a credit is 10% for buildings placed in service before 1936, and 20% for certified historic structures. The credit is available to any person or entity that holds the title for an income producing property. Expenses that qualify for the credit include expenditures for structural components of a building such as: walls, partitions, floors, ceilings, tiling, windows and doors, air conditioning and heating systems, plumbing, electrical wiring, chimneys, stairs, and other components related to the operation or maintenance of the building. Additionally, soft costs such as architect or engineering fees qualify for the credit.[161]

The United States Secretary of the Interior established 10 Standards for Rehabilitation which projects must meet to be eligible for the 20% rehabilitation tax credit. They are:

> 1. A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.
>
> 2. The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.
>
> 3. Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.
>
> 4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.
>
> 5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a historic property shall be preserved.
>
> 6. Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, colour, texture, and other visual qualities

(14August 2006)

[161] Heritage Canada Foundation "Canada's Endangered Places Report Card" February 19, 2007

and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.

7. Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.

8. Significant archaeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

9. New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.

10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.[162]

In New Zealand there are no heritage incentives tied to the tax system. There is, however, some limited environmental restoration provision. The amended Income Tax Act provides a system of environmental restoration accounts that relate to expenditure by business to avoid, remedy or mitigate the detrimental effects of contaminant discharge.[163] This system could be applied by Government to provide for restoration of heritage buildings and properties; for example to provide an incentive for strengthening in response to the requirement of the Building Act 2004 for EPBs.

In relation to depreciation, the Government initiated a review of tax depreciation in July 2004. It was considered that the depreciation rate for buildings was too high since generally buildings appreciated in value (according to data from Valuation New Zealand and quotable Value). The review led to changes in the tax legislation under the Taxation (Depreciation, Payment Dates Alignment, FBT and Miscellaneous Provisions) Act 2006. This Act made amendments to tax law and introduced new depreciation provisions.

The new provisions mean a new economic depreciation rate is established for buildings using a straight-line depreciation formula.[164] The straight-line formula will generally mean lower depreciation rates for buildings. So in general the changes mean that owners of commercial buildings will be subject to lower depreciation rates, and thus result in higher taxable income.

The 2004 review of depreciation rates did not explicitly consider issues relating to historic buildings. However, it would be possible for any owner of a heritage building to make an application for a special determination rate under 91 AAG of the Tax Administration Act 1994.

The US system of tax credits to assist owners repair and maintain heritage buildings could be investigated for New Zealand. This system could apply nationally and promote a consistent and transparent incentive programme.

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[162] United States National Park Service "A Guide to the Federal Historic Preservation Tax Incentives Program for Income-Producing Properties" http://www.nps.gov/history/hps/tps/tax/incentives/index.htm
[163] Sections CB24B, EK 1-23, Schedule 6B Income Tax Act 2004.
[164] Section EE 25C Income Tax Act 2005.

6 Conclusions and Recommendations: Toward improved national and local action on earthquake-prone heritage buildings

Improving national and local action on earthquake-prone heritage buildings will require a range of policies and actions. The issue is complex and there are no 'quick fixes'. The following recommendations provides a number of ideas to make progress on this issue in relation to civil defence planning, national-level information, guidance, local government policies and provisions, and incentives.

***Civil Defence*: Central and local government (including the NZHPT) need to ensure that earthquake-risk interventions are integrated with Civil Defence planning following the recommendations outlined in appendix 1 of this report.**

International guidance reviewed in this report encourages states which are subject to earthquake risk to take action for pre-disaster planning for historic heritage. This international guidance indicates that a range of pre-disaster actions are required at both a national and local level in order to take a pro-active stance to managing heritage buildings in seismic zones. Carrying out strengthening works on individual heritage buildings is only one action. Other necessary actions include pre-disaster planning for historic heritage at a national level, ensuring full recording and documentation, promoting regular structural maintenance and repair and preparing seismic safety plans for heritage buildings.

The table below provides a summary of New Zealand's actions in comparison with the recommended pre-earthquake disaster administrative and technical actions for cultural properties as recommended by ICCROM.

New Zealand has a substantial civil defence network and the NZHPT is part of this network as outlined in the guidelines of the National Civil Defence Management Plan. However this aspect of New Zealand's policy framework requires further work, especially outlining in detail the actions that would be required in the event of widespread damage to heritage buildings after an earthquake and the role (and resources) the NZHPT would play in an emergency.

Appendix 1 contains a number of recommendations to improve coordination between the NZHPT, civil defence, local authorities and the EQC on improving post-disaster responses and planning for historic heritage.

ICCROM Recommended pre-earthquake disaster administrative and technical actions for cultural properties and New Zealand's response[165]		
	ICCROM Recommendations	**New Zealand response**
Coordination	Establish a national or regional emergency group for the protection of cultural property	National Civil Defence Network established NZHPT can provide limited assistance in national emergencies, but formal systems and coordination is absent. Requires further planning and resources
Documentation	Make full inventories of all cultural resources supported by photographs	Local inventories developed in some districts.

[165] Adapted from Sir Bernard M.Feilden, *Between Two Earthquakes, Cultural Property in Seismic Zones*, ICCROM and the Getty Conservation Institute, 1987, pp 15-16

	and photogrammetric records	
	Prepare seismic survey forms and outline drawings of all important buildings	Some important buildings have comprehensive documentation
	Keep duplicate records preferably in a non-seismic zone or in an earthquake and fire resistant building	Some important records are retained in earthquake and fire resistant buildings (i.e. National Archives)
Education and information	Educate public on importance of historic buildings, maintenance and seismic upgrading of vernacular buildings	Some educational information provided by NZHPT. Requires further development and resources
	Publish guidelines for local builders on the correct techniques for maintaining and upgrading buildings, and preserve skills and materials needed for maintenance and repair of historic buildings	NZHPT guidance published in 2000 Requires further development and resources
	Train architects and engineers in seismic resistant design and inspection for historic buildings	Limited training opportunities
Insurance	Insure buildings and movable objects when feasible	All buildings in NZ are insured against earthquake by the EQC. NZHPT insurance and heritage properties guidance published, 2007
Research	Commission geological studies indicating underlying site properties and geologic studies	Substantial research available (i.e. GNS)
	Initiate seismic studies, including historic records, to evaluate return periods of earthquakes with various intensities	Substantial research available (i.e. GNS)
	Develop vulnerability studies for earthquakes of different intensities. Such studies should relate to the artistic and historical value of the buildings, their furnishings, and their contents	Requires further research (potentially unclear in terms of application to NZ)
	Compile town and country plans relating developments to various grades of seismic damage	Unclear in terms of application to NZ
Planning	Assess risk to infrastructure (lifelines)	Under action by local and central government
	Prepare seismic safety plans for historic buildings	Some individual buildings have conservation plans, which incorporate aspects of seismic safety plans
Seismic strengthening	Strengthen buildings by stages when this becomes economical	A large number of heritage buildings have been strengthened over the past 20 years, particularly in the main urban centres. NZHPT experience suggests that large numbers of unreinforced masonary buildings and earthquake-prone buildings are located in commercial areas in smaller urban centres

<u>Knowing the risks</u>: The NZHPT should facilitate the development of a National Risk Map of New Zealand's Historic Heritage

New Zealand, as a nation, should have a clear picture of its historic heritage, the state of this heritage and the environmental risks and threats. Currently there is no systematic monitoring system for historic heritage and State of the Environment frameworks are lacking for heritage.

Traditionally, the heritage community in New Zealand has relied upon the identification of significant values associated with places to provide a basis for protection and conservation, including registration and listing. This approach does address risks associated with issues such as alterations and additions, relocation and demolition of individual heritage buildings. However, as discussed in this report, perceptions of risk in society are changing and there is a greater awareness of the range of risks that may harm or damage values, such as decay, urbanisation, fire, earthquakes, flooding and events associated with global climate change (i.e. frequent storms and drought).

In addition, different sectors and groups in the community hold various degrees of risk-related information. For example, the owners of a commercial heritage building in Marton may be sensitive to the economic viability of the premises while the local authority will hold information about possible flood or earthquake risk, and the NZHPT may hold information about the historic significance of the property. Since the NZHPT holds incomplete information about the risks, pre-emptive responses can be inadequate to resolve complex issues of continual use and survival of the building. It may be suggested that the NZHPT failed to resolve conservation issues confronting the Sidnam Building in Feilding because the organisation did not fully grasp the range of environmental and commercial risks confronting both the owners and the building.

The Italian risk map of cultural heritage is an approach that could be adopted in New Zealand. This system has the advantage of a GIS-based framework to provide information on threats to historic heritage, both structural and contextual. This tool would assist Central Government, NZHPT and local authorities adopt pre-emptive and proactive strategies to manage the high priority risk to historic heritage. For example, in many areas, structural decay of buildings from lack of maintenance may present the highest risk to historic heritage. Other risks such as erosion, ground subsidence, and coastal erosion may constitute threats to historic heritage. These issues may take priority over earthquake risk-related interventions.

Ideally, the risk map should be developed and managed at a national level by the NZHPT. The NZHPT, however, currently lacks the financial ability and capacity to undertake such a project and even the national Register lacks GIS-base information. In addition, environmental risk-related information is generally held at a local level in New Zealand by regional and territorial authorities. For this reason, it may be a possibility to develop a risk map at a territorial or regional level as a pilot project by adapting the Italian model for the New Zealand situation and using existing environmental risk layers held within local authority GIS systems. This pilot project could be developed in conjunction with NZHPT-local authority State of the Environment historic monitoring systems.

<u>National guidance</u>: The NZHPT's existing national guidance for earthquake-risk heritage buildings should be updated and expanded

The NZHPT's existing guidance for earthquake strengthening requires updating and expansion in light of the new Building Act 2004, CDEM Act, local government policies

and developments in earthquake engineering of heritage buildings.[166] New guidance should integrate both policy and practical advice by ensuring the key recommendations of the NZHPT's 2006 guidance for earthquake prone policies are fully developed and made available to the public.[167] The new document would establish a national guidance manual for managing earthquake-risk heritage buildings. It should be made available to all local authorities. The key themes of the manual would include:

1. Building Act 2004 and related legislation.
2. CDEM Act and related strategy and plans.
3. Performance targets for earthquake-prone heritage buildings.
4. Guidance for local authority earthquake-prone policies.
5. Incentives to support owners of earthquake-prone heritage buildings.
6. Rapid emergency response strategies for historic heritage.
7. Planning for the management of earthquake-prone heritage buildings (developing a seismic building plan).
8. Principles and guidance for undertaking maintenance and earthquake strengthening work to heritage buildings.

In addition, the manual could examine issues relating to:

- The need for additional public information on earthquake risk to heritage buildings.
- Improved guidance for architects and builders on seismic resistant design and inspection for heritage buildings.
- Training opportunities for architects and engineers on seismic resistant design, emergency response and inspection for heritage buildings.
- Detailed studies on the nature of risk to heritage buildings at a national and local level.
- Seismic safety plans as part of a wider conservation plan for individual heritage buildings.

Developing explicit performance targets for heritage buildings will be an important consideration of the manual. As discussed in this report, the Italian guidance contains explicit performance targets for heritage buildings. This guidance means uncertainty is reduced in the planning process for owners, stakeholders, and government. New Zealand does not provide any clearly stated performance targets for heritage buildings.

The NZHPT position, in line with international best practice, considers that the most appropriate performance target for engineering strengthening of heritage buildings will

[166] Lou Robinson and Ian Bowman, *Guidelines for Earthquake Strengthening*, NZHPT, 2000
[167] NZHPT Sustainable Management of Historic Heritage Guidance Series, *Guide to Heritage Provisions Dangerous. Earthquake Prone, Insanitary Buildings and Dangerous Dams Policies: Building Act 2004*, September 2007.

need to be determined on a case by case basis considering the range of costs and benefits for owners and the public of various options and targets. At a minimum, heritage buildings should not be dangerous – they should be strengthened in an appropriate manner to achieve basic life safety of the public and occupants. They should not, however, be demolished as result of public or owner safety perceptions.

While the basic life safety objective will not achieve wholesale countrywide strengthening to a level that will ensure absolute preservation of building fabric, it is a realistic position in view of the level of earthquake risk in New Zealand, the existing building stock, and the available resources. Buildings will get damaged in earthquakes and buildings can be repaired (rather than demolished). It is hoped, however, that fewer people will be harmed or killed in the event of moderate or even large earthquakes. As FEMA has noted, this 'approach will help preserve historic buildings from earthquakes, even if they are strengthened only up to a minimum life-safety level, and prevent the situation from developing where the historic buildings will be the most hazardous in a community.'[168]

When resources and circumstances permit, heritage buildings should also be strengthened to achieve basic life safety and a degree of fabric preservation (enhanced life safety or enhanced damage control). This is especially in cases of those heritage buildings that contain crowds and have a high functional public or post-disaster response role. Recent examples include the substantial earthquake strengthening of the Wellington Railway Station, Parliament Buildings and the proposed strengthening of the original Supreme Court building in Wellington. It will often be the case that public incentive funding will be necessary to achieve enhanced life safety performance for heritage buildings.

<u>Local Government Planning</u>: Local government policies should be informed by sufficient information and detailed cost/benefit analysis relating for earthquake-prone heritage buildings

In terms of the EPBs policies prepared under the Building Act 2004, many territorial authorities have included priorities for the identification and strengthening of earthquake-prone heritage buildings. While these priorities are admirable, it appears the targets have been established in the absence of hard data on the numbers of earthquake-prone heritage buildings within the districts and the possible costs (including detailed cost\benefit analysis).

Many hundreds of public and commercial heritage buildings have been strengthened in New Zealand over the past 20-30 years. Based on the NZHPT's experience, it appears that the strengthening works have been focused within the main and larger urban centres, especially Wellington. Provincial urban centres (such as Wanganui) and rural towns may be the critical areas for earthquake-prone heritage buildings.

The first generation of EPBs policies have been largely prepared in the context of limited research and information on the state of the problem at either the national or local level. There is a critical need to fill the research gap on numbers and location of earthquake-prone heritage buildings in each district and so providing a national picture of the state of the earthquake-prone heritage environment.

It is anticipated that within the next few years many local authorities will begin to construct a clearer picture of the numbers and location of earthquake-prone buildings, including heritage buildings. The NZHPT is interested in receiving general information on earthquake-prone heritage buildings to enable the NZHPT to build up a national

[168] NEHRP, *Guidelines and Commentary for the Seismic Rehabilitation of Buildings* (FEMA 273), p 80

picture of the issue for the government and the public – to work towards a national risk map of historic heritage.

Until research is available on actual location and numbers of earthquake-prone heritage buildings, efforts to develop priorities for action will be hampered at both a local and national level.

***Local Government Policy Provisions*: Local government Building Act policies must contain adequate provisions for historic heritage**

The NZHPT is encouraged that the majority (est.' 80%+) of EPBs policies prepared by territorial authorities provide positive provisions for the management of earthquake-prone heritage buildings. These provisions generally provide greater flexibility for managing earthquake-prone heritage buildings as opposed to other general buildings in the interests of preservation and the public interest in heritage conservation. These special provisions include:

- Initiation of discussions with the NZHPT.
- Seeking advice from NZHPT and/or heritage professionals.
- Consultation processes with all stakeholders
- Extended timeframes for engineering assessments and structural upgrade works
- Public consultation
- Upgrading work to comply with ICOMOS NZ Charter or other standards.
- Use of waivers and modifications to the building code.
- Financial assistance.
- Risk and recovery management and pre-disaster planning assistance
- Demolition as the last option (or avoiding demolition).

The adoption of these special provisions is consistent with international guidance and would place New Zealand as a leading country in the development of policies for the management of earthquake-prone buildings and historic heritage at the local territorial level. The preparation of these policies over the last two years has clearly filled a major policy gap and no doubt these policies will be improved in the future as the various territorial authorities gain experience and a greater understanding in this issue.

This report notes that a few territorial authorities have decided to provide no special provisions for heritage buildings in the EPBs policies. These policies are a concern for the NZHPT, especially in those districts that have adopted an active policy approach.

***Incentives for Heritage Buildings*: Central and local government must provide sufficient incentives to owners to facilitate appropriate strengthening of heritage buildings.**

Existing incentives for private owners of heritage buildings to undertake earthquake strengthening work are inadequate in many districts. Some territorial authorities such as Wellington City Council have recently taken a primary role in offering incentives to help

protect and conserve earthquake-prone heritage buildings. Many smaller territorial authorities, however, do not have the necessary funds or resources to provide incentives for private building owners to earthquake-strengthen their buildings. This report highlights the need for detailed benefit-cost analysis to inform the development of incentives provided by both central and local government.

The issue raises the need for expanded general incentives at a national level such as tax relief to support owners to repair and maintain heritage buildings. In relation to earthquake-prone heritage buildings, there is a need for more targeted incentive programmes. It is considered the most efficient approach is for incentive programmes to be led at the district level by territorial authorities with the support of central government agencies. A local and central government partnership approach should be developed to identify support for districts which contain large numbers of earthquake-prone heritage buildings, which have limited financial resources, and where the threat of earthquakes is high.

There is a need to explore improved assistance initiatives for owners acknowledging both the local and national interests of historic preservation and public safety. An effective approach would be to promote local and central government partnerships to provide integrated assistance. Positive outcomes will be undermined if national or local initiatives operate in isolation.

A local and central partnership approach could involve identifying particular districts or regions for project management. It is recommended that such a method should focus on districts that:

1. Experience high risk of earthquakes.

2. Have high numbers (clusters) of earthquake-prone heritage buildings.

3. Have limited financial resources.

As an example, the region of Manawatu-Wanganui is a high risk earthquake region. The region also has a number of important clusters of earthquake-prone heritage buildings especially in the towns of Wanganui, Marton, Mangaweka, Taihape, Feilding, and Bulls. The territorial authorities in the region have limited resources for supporting owners of heritage buildings and there are no substantial heritage funding sources currently in operation. A local and central government partnership approach could work in the region in an integrated matter and involve other supporting agencies such as NZHPT.

7 Appendix 1. Recommendations for earthquake emergency response and historic heritage protection strategies

The following draft recommendations have been developed for immovable historic heritage (buildings, structures, areas and sites). For information about disaster recovery of moveable historic heritage (cultural materials and collections), contact: National Library of New Zealand (conservation services), Te Papa Tongarewa or the Canterbury Disaster Salvage Team.

1. Establish formal networks and relationships at the national, regional and local level.

The networks and relationships would involve:

- At the national level: Ministry of Civil Defence and Emergency Management; Earthquake Commission, Department of Conservation, Local Government NZ, NZSEE, NZ Urban Search and Rescue, GNS, Ministry of Culture and Heritage, NZHPT (National Office).

- At the regional level: Ministry of Civil Defence and Emergency Management Regional Sector, regional authorities, territorial authorities, Department of Conservation Conservancy, NZHPT (Regional Office and/or Area Office).

- At the local level: Territorial authority (Civil Defence Emergency Management Group), Department of Conservation Area Office, NZHPT (Regional and/or Area Office), Earthquake Commission.

2. Civil Defence Emergency Policy and Plans

Historic heritage matters must be explicitly provided for in all civil defence strategies and policies under the Civil Defence Emergency Management Act 2002. In particular, all Civil Defence Emergency Management Group Plans should consider implications for historic heritage with regard to earthquakes. This may involve:

- Inclusion of NZHPT as a strategic partner or response agency.

- Inclusion of historic heritage within strategic principles for civil defence.

- Inclusion of historic heritage matters as part of operational requirements and priorities for response.

3. Preparation of earthquake management plans for historic central business districts

Historic central business districts require coordinated earthquake management planning. This planning should examine issues such as:

- Heritage significance and risk.

- Options for coordinated identification of earthquake-prone buildings, pre-disaster risk mitigation and earthquake strengthening.

- Incentives and funding.

- Post-disaster response strategies.

Provision for earthquake management plans should be provided for in earthquake-prone heritage buildings policies prepared under the Building Act 2004 and Long Term Council Community Plans (LTCCPs) prepared under the Local Government Act 2002.

4. Rapid response in a civil defence emergency.

All heritage professionals (heritage engineers, architects, archaeologists, planners and Maori heritage advisers) should be ready, at short notice, to provide assistance in an emergency situation following an earthquake. The ability and effectiveness of response, however, depends on coordination, training, resources and individual/personal circumstances.

It is suggested that the NZHPT should take the lead in the coordination of rapid response for historic heritage in a civil defence emergency at a national level. National coordination responsibilities would involve:

- Maintaining relationships with civil defence organisations and personnel.
- Maintaining up-to-date on literature relating to civil defence, emergency management and historic heritage.
- Maintaining contact details of heritage professionals for contact in an emergency.
- Undertaking and promoting building safety evaluation and emergency training and drills.
- Providing information on disaster planning and historic heritage.
- Identifying essential sources such as shoring materials and lists of professional and materials suppliers.
- Being able to establish a team at short notice to respond to an earthquake emergency.
- Assisting building safety evaluation in an event of an emergency.
- Providing advice to the Civil Defence Controller and other civil defence personnel on historic heritage matters in the event of an emergency.
- Coordinating regulatory matters, including any archaeological authority matters required under the Historic Places Act 1993.
- Providing ongoing post-disaster advice and assistance.

Funding should be set aside for these coordination responsibilities.

5. Identification of historic heritage.

All historic heritage should be identified in local authority inventories and GIS. Historic heritage may include:

- Historic places, areas, wahi tapu and wahi tapu areas registered under the Historic Places Act 1993.

- Historic items listed in any district or regional plan prepared under the Resource Management Act 1991 and places listed in heritage inventories prepared by local authorities.

- Historic places and/or Actively Managed Historic Sites listed in a Historic Resources Strategy or Conservation Management Strategy and Conservation Management Plan prepared under the Conservation Act 1987.

- Archaeological sites recorded by the New Zealand Archaeological Association (NZAA).

- Historic items within a historic reserve or listed in a reserve management plan prepared under the Reserves Act 1977.

- Places and areas of importance to Maori, including traditional Maori buildings, including those set aside for historic and cultural purposes under the Te Turi Whenua Maori Land Act 1993 or other legislation and places listed in iwi management plans or other inventories.

- Historic cemeteries and memorials.

- Places managed for heritage purposes by agencies such as NZHPT, Ministry of Culture and Heritage, the Department of Conservation, and local authorities.

- Places that are subject to a heritage order, heritage covenant or other protective covenant.

- Other historic heritage deemed to have heritage value identified using best practice criteria and research, including buildings identified within national or district heritage inventories or heritage policy, including:

    - Places listed by the Rail Heritage Trust of New Zealand.
    - Places listed by the Heritage Group, IPENZ.

Any building associated with the above list of historic heritage should be considered a heritage building under the Building Act 2004.

Heritage buildings should be identified, if possible, by the prominent display of a plaque.

Unless considered to be culturally inappropriate, plaques should be installed at the front of the heritage building.

Advice on the proper installation of plaques should be sought from the NZHPT.

6. Emergency Building Safety Evaluation

All building safety evaluation procedures should be informed by best practice historic heritage information, including:

- Provision of hard copy maps showing location of historic heritage from territorial authority GIS.
- Lists of all identified historic heritage, indicating name and location.
- Early identification of damaged historic heritage.
- Inclusion of NZHPT and heritage professionals in building safety evaluation training and emergency procedures.
- Inclusion of NZHPT and heritage professionals in all building safety-related meetings and conferences.
- Ensuring all decisions regarding demolition, partial demolition or repair methods resulting in significant loss to historic heritage should be subject to a qualified second opinion.
- Ensuring all alterations and additions meet best practice standards, including NZHPT guidance.
- All historic fabric should be salvaged and stored, including loose or fallen debris.
- All identified heritage buildings should be subject to Level 2 Rapid Assessments.
- As part of Level 2 Rapid Assessments, a separate advisory report (heritage impact assessment or HIA) should be prepared to accompany the rapid assessment forms. The report should briefly state:
    - The status and significance of the place.
    - Risk to the place, including loss or damage to significance.
    - Statutory requirements (i.e. RMA and Historic Places Act 1993).
    - Recommendations to mitigate and remedy risks.

Following the Level 2 Rapid Assessments, it is likely most heritage buildings will require detailed engineering evaluation and remedial work.

7. Issuing of Section 124 notices under the Building Act 2004

Robust building safety evaluation should inform the preparation and issuing of section 124 notices under the Building Act. For a heritage building, the building safety evaluation should be accompanied by a heritage impact assessment and be informed by best practice historic heritage advice and information.

Copies of all section 124 notices must be sent to the NZHPT if the building is a heritage building (see section 125(2)(f) of the Building Act 2004).

It is accepted that in an emergency situation the coping of these notices to the NZHPT may be delayed. For this reason, it is important to obtain historic heritage advice and information during the building safety evaluation process.

It is noted that an archaeological authority under the Historic Places Act 1993 may be required in relation to the demolition or earthworks associated with pre-1900 heritage buildings and sites.

8. Post-emergency reconstruction

Regular updating meetings should be held involving the territorial authority, Department of Conservation Area Office (if relevant), NZHPT (Regional and/or Area Office), Earthquake Commission and Insurance Assessors.

The NZHPT should be involved at an early stage to provide advice on the repair and restoration of damaged places and archaeological sites.

All major reconstruction works involving historic heritage should be informed by a professional heritage impact assessment.

Damage to historic heritage fabric should be avoided during clean up operations.

Appropriate shoring and stabilisation techniques are promoted and adopted.

Incentives and funding assistance should be available for owners of historic heritage.

Key Information Sources:

- Dave Brunsdon, 'Rapid Evaluation of Building Safety: Learnings from the December 2007 Gisborne Earthquake' *Paper to the 2008 Australian Earthquake Engineering Society Conference*, Ballarat, Victoria
- Dirk H.R. Spennemann and David W. Look (eds), *Disaster Management Programs for Historic Sites*, digital edition, 2004
- FEMA 386-6, *Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning*, May 2005
- Jeff Eichenfield, *20 Tools that protect historic resources after an earthquake: Lessons Learned from the Northridge Earthquake,* California Preservation Foundation.
- Herb Stovel, *Risk Preparedness: A Management Manual for World Cultural Heritage*, ICCROM, Rome 1998.
- Milford W. Donaldson, 'Tools that Protect Historic Resources after a Disaster' California State Parks, October 2007
- Paige Swartley, *Model Ordinance: Post-Disaster Alteration, Repair, Restoration, Reconstruction and Demolition of Historic and Cultural Resources*, California Preservation Foundation
- Roy W. Harthorn, *Temporary Shoring and Stabilisation of Earthquake Damaged Historic Buildings*, California Preservation Foundation
- US National Parks Service, *Emergency Preparedness for Historic Sites*, bibliography, 2002

8 Appendix 2. The Gisborne Earthquake, 20 December 2007: Summary of Events

The Central Business District (CBD) of Gisborne has a special collection of historic buildings dating from the mid 19th Century. The CBD includes the streets of Gladstone, Childers, Palmerston, Customhouse, Lowe, Peel and Derby. Some 83 buildings are individually listed in the Gisborne Combined Regional Land and District Plan (the district plan). Many of the listed buildings are historic places registered under the Historic Places Act 1993. Some of the most significant historic buildings include:

- Coronation Building, 24-28 Gladstone Road.
- Gisborne Herald Building, 64-66 Gladstone Road.
- Townley Building, 98-102 Gladstone Road.
- Former Thomas Adams Building, 37 Gladstone Road.
- AMP Building, 157 Gladstone Road.
- Holy Trinity Anglican Church, Cnr Derby Street & Palmerston Road.
- Union Steamship Co. Building, 12-16 Childers Road.
- Poverty Bay Club Buildings, Cnr Childers Road and Customhouse Street.
- Lancaster House, 57 Customhouse Street.
- Albert Buildings, 1-24 Peel Street.
- Peel Street Toilets, Peel Street.

Many of the historic buildings date from the 1880s and are built of unforced masonry and timber. A high proportion are designed in the Edwardian style of the early 20th Century. Some buildings have been subject to earthquake-strengthening work in association with various fit outs and alterations and additions.

On 20 December 2007 at 8.55 pm (NZ time), an earthquake of Richter magnitude 6.8 occurred some 50 km south-east of Gisborne. The earthquake was felt widely, especially along the east coast of the North Island.

Gisborne Earthquake and Historic Heritage: Timeline

Thursday 20 December 2007

8.55 pm (NZ time) earthquake of Richter magnitude 6.8 occurred some 50 km south-east of Gisborne.

CBD evacuated and cordoned off by the Police.

Friday 21 December 2007

1 am. State of local emergency declared by Civil Defence Controller (the Controller).

NZ Fire Service and Police identify buildings that were considered dangerous during the night.

6.00 am. Civil Defence Press Release: Two buildings collapsed.

7.30 am. Urban Search and Research (USAR) Task Force 1 arrives from Palmerston North.

8.30 am, Friday 21 December, Gisborne District Council officers identified most seriously damaged buildings within CBD.

9.00 am. Controller and Gisborne District Council decide to implement draft updated NZSEE Building Safety placarding system.

9.30 am. Building Safety Evaluation Process underway (Rapid Building Safety Evaluation or Triaging). Four Field Inspection Teams formed comprising a structural engineer, 2 Council building control officers and 2 USAR Task Force Technicians.

Removal of hazards work begins, involving largely removal of damaged parapets, loose brickwork on roofs, shoring wall corners.

1.00 pm: 23 Red (unsafe) and 11 Yellow (restricted entry) placards issued. Also Green placards issued. Green signals inspected with no restriction on use or occupancy, but owners still need to prepare detailed engineering assessment and report to Council.

1.30 pm. Walk-through of CBD main street with Controller, Policy, USAR Task Force and engineers.

3.00 pm. CBD tenants and owners allowed into cordoned area to assess damage and start initial clean up.

During Friday, other engineers arrive including GNS Science, BRANZ, Dept of Building and Housing and volunteers (total of about 15 engineers).

Saturday 22 December 2007

8.00 am. CBD open to the public. Barricades remain around Red tagged buildings.

Structural re-assessments undertaken by engineers.

2.00 pm USAR Task Force departs.

3.00 pm. Section 124 Building Act notices issued to remaining Red and Yellow placarded premises by Council.

5.15 pm. Declaration of state of local emergency lifted.

February 2008

Meeting between Gail Henry (NZHPT), James Blackburne (NZHPT Gisborne Branch Committee), Keith Penny (Chartered Loss Adjuster), Allen Baker (Contracted Loss Adjuster), Terry Johns (Contracted Certified Builder for EQC).

April 2008

List of 46 historic buildings damaged by earthquake prepared by Gisborne District Council.

August 2008

11 commercial buildings in CBD still dangerous buildings requiring major structural repairs and remained unoccupied.

60-100 other buildings damaged, but Section 124 Building Act notices not issued.

Repair and demolition work begins on large CBD buildings. Gisborne Deli demolished. Repairs start on Marinaview Conference Centre and apartments.

January 2009

1,949 claims for damage lodged with Earthquake Commission (EQC).

8 commercial buildings in CBD still classified as dangerous.

Summary of RMA consent-related works and repairs to heritage buildings (as notified to the NZHPT, February 2009):

Building name	Address	Works
Bain & Shepherd Building	Customhouse Street	Repairs to damaged facade
Lancaster House	57 Customhouse Street	Various repairs
Allen Trading	64 Customhouse Street	Rear wall repairs
Masonic Building	Gladstone Road	Parapet damaged and removed
Eastern Co-operative Building	9-11 Gladstone Road	Various repairs
Rod McCulloch Jewelers	78 Gladstone Road	Façade repairs
Adairs Building	126-134 Gladstone Road	Various repairs
Moleta Bros Building	167-171 Gladstone Road	Parapet repairs
Allen Trading Building	255-267 Gladstone Road	Demolished (not high heritage value)
	265-267 Gladstone Road	Demolished
Mitchell's Cameras	201 Gladstone Road	?
House	116 Stout Street	Chimneys and roof repairs
Union Steamship Co.	12-16 Childers Road	Parapet repairs

Te Rau Press Building	26 Peel Street	Various repairs
Gisborne Herald Building	64 Gladstone Road, 62 Peel Street	Various repairs
Radioworks House	94 Peel Street	Parapet repairs
Action House	Ormond Road	Various repairs
St Andrews Church	176 Cobden Street	Various repairs

Commentary on damage:

GNS Science sent two staff to Gisborne the day after the earthquake to carry out a preliminary assessment of the level of damage to buildings. They found that while there were certainly instances of broken shop windows, cracked walls and partial collapse in mainly older brick and concrete buildings, most houses and commercial buildings appeared not to have suffered significant damage. Very few chimneys were broken. In a few places brick parapets from two-storey buildings had fallen through the roofs of adjacent single-storey buildings. Perhaps the only major surprise was apparent serious damage to a brand-new apartment building.

It [ground motion recordings] indicated that the shaking in Gisborne was rich in energy at medium frequencies, which affect medium-rise buildings (four to ten storeys). This helps explain why there was considerable damage to the modern medium-rise apartment building, but relatively little damage overall to low-rise houses and other buildings [GNS, *Geonet News*, Issue 10, August 2008, p 4].

Buildings strengthened above the one-third current Building Code threshold fared well in the earthquake, whereas those identified as earthquake-prone suffered significant damage [Kathrine Wheeler, 'Earthquake-Prone Buildings', *Build*, BRANZ, December 2008-January 2009, p 81].

Significant damage occurred to many buildings in the CBD. Much of this damage was caused by the failure of transverse parapets (north-south axis) which had been unaffected by previous earthquakes. Very few buildings that had been strengthened, either to two thirds NZS 1900 or two thirds NZS 4203, suffered any damage. Up to 90% of the building damage in the City can be attributed to over-topped parapets [Ian Petty, Revision to Earthquake-Prone Building Policy, Report to Council, 11 November 2008].

Information sources:

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9 Appendix 3. Heritage Loan Subsidy Scheme: Western Australia

Local Councils in Western Australia have adopted a Heritage Loan Subsidy Scheme, to assist owners of heritage places with funds to undertake conservation works. The scheme encourages owners of heritage places to undertake conservation works by offering significant savings in the cost of a loan, a subsidy (currently set at four percent) on the interest rate on loans for conservation work.[169]

The Heritage Council of Western Australia and the Western Australian Local Government Association underwrites the subsidy and administers the scheme.

Owners of places listed in a local government's Municipal Inventory, State Government's Register of Heritage Places, Commonwealth's Register of National Estate, or National List, or National Trust's List of Classified Places, within participating local government areas are eligible to apply.

In the first three years of funding offered, loans ranging from $5,000 to $50,000 were established to undertake wall restoration, tuckpointing, works to verandahs, fencing and chimney flashings.[170]

The Heritage Council has contributed $270,000 to the programme to date, and almost 70 low-interest loans have been offered to property owners to undertake conservation works since the scheme commenced in 2003.[171]

An important point to note is that 21 local governments throughout Western Australia are participating in the scheme. Particular economic circumstances are not a factor, as both the largest Council, in terms of total operating revenue, in the City of Stirling and the smallest in the Shire of Broomehill, are both participants. Participation in the scheme demonstrates Western Australian Councils commitment to heritage values. It shows that these councils are prepared to recognise the significance of heritage not only through a Municipal Inventory but also through real efforts to preserve identified sites.[172]

The Heritage Loan Subsidy Scheme Information for Applicants brochure notes:

> This partnership between Local Government and the State Government reflects a need to invest in the long term future of the State's local heritage and rich cultural history.[173]

Cities in Western Australia also offer annual and biennial Heritage Awards to recognise the efforts made by individuals and groups in conservation, promotion and enhancement

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[169] Heritage Council of Western Australia, 'Heritage Loan Subsidy Scheme', http://www.heritage.wa.gov.au/d_hls.html (3 August 2006)
[170] ibid.
[171] WA Local Government Association, 'Smart money – Councils sign up for heritage scheme', *Heritage Matters: Official Newsletter of the Heritage Council of Western Australia*, Issue 20 April 2006, p 6.
[172] ibid.
[173] 'Heritage Loan Subsidy Scheme: Information for Applicants', http://www.heritage.wa.gov.au/pdfs/pubList/section1/HLSSLoanBookletweb.pdf (3 August 2006)

of the various cities' heritage. One of the categories of these awards is the 'conservation of masonry heritage place'.[174]

The City of Perth Heritage Award offers a cash prize of $10,000 to the winner who has worked to conserve, promote and enhance the city's heritage, with a section of the award featuring conservation/restoration of a heritage place.[175]

To further demonstrate the superiority of its heritage programme, the City of Perth has prepared a smart series of brochures for the public. The brochures address:

- The History of the City of Perth
- Heritage Grants
- Heritage Awards
- Development-Based Incentives
- Organisations and Registers
- Funding sources
- Ongoing Development of Incentives

The approach to heritage management and conservation that the City of Perth takes 'goes above and beyond that normally undertaken by a local government authority.'

[174] WA Local Government Association, 'Awards open', *Heritage Matters: Official Newsletter of the Heritage Council of Western Australia,* Issue 20 April 2006, p 16.
[175] ibid.

10 Appendix 4. Local Authority Heritage Grant Schemes, as at June 2006

Local Authority Heritage Grant Schemes, As at June 2006 [Note: 0 = indicates no fund in operation or no policy relating to maximum grants]		
District	**Total fund ($)**	**Max Grant ($)**
NPDC	50000	15000
Stratford DC	0	0
South Taranaki	0	0
Wanganui DC	0	1500
PNCC	35000	5000
Manawatu DC	73000	0
Ruapehu DC	0	0
Rangitikei DC	0	0
Horowhenua DC	0	0
Tararua DC	20000	0
Wairoa DC	0	0
CHBDC	0	0
Hastings DC	30000	0
Napier CC	70000	0
Wellington CC	350000	0
SWDC	0	0
Masterton DC	5000	50
Carterton DC	0	0
Hutt CC	70000	15000
Porirua CC	0	0
UHCC	0	0
KCDC	25000	5000
Tasman DC	5000	200
Marlborough DC	0	0
Nelson CC	0	0
Chatham Islands	0	0
Far North DC	25000	5000
Kaipara DC	10000	0
Whangarei DC	0	0
Rodney DC	20000	5000
Auckland RC	500000	0
Auckland CC	50000	0
North Shore CC	65000	5000
Waitakere CC	100000	0
Papakura	0	0
Manukau CC	80000	0
TCDC	0	0
Franklin DC	0	0
Rotorua DC	0	0
Opotiki DC	0	0
Kawerau DC	0	0
Whakatane DC	0	0
Bay of Plenty RC	400000	0

Western BOP DC	0	0
Tauranga CC	0	0
Waipa DC	0	0
Hamilton CC	0	0
Waitomo DC	0	0
Waikato DC	0	0
South Waikato DC	0	0
Matamata-Piako DC	0	0
Taupo DC	0	0
Otorohanga DC	0	0
Gisborne DC	0	0
Kaikoura DC	0	0
Hurunui DC	5000	0
Ashburton DC		5000
Waimate DC	5000	1000
Selwyn DC	10000	2500
Waimakariri DC	0	0
Christchurch CC	595000	0
Timaru DC	0	0
Mackenzie DC	5000	0
Waitaki DC	0	0
Central Otago DC	0	0
QLDC	15000	4000
Dunedin CC	40000	0
Clutha DC	0	0
Southland RC	150000	0
Southland DC	0	0
Invercargill CC	0	0
Gore DC	0	0
Grey DC	0	0
Buller DC	0	0
Westland DC	0	0