Earthquake-strengthening policy for commercial buildings in small-town New Zealand

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New Zealand introduced a seismic retrofitting policy in the wake of the catastrophic Canterbury earthquakes of 2010–11. The aim was to enforce seismic strengthening of earthquake-prone commercial buildings throughout the country. This study focuses on regional urban centres and the economic obstacles to strengthening their aging building stock. In investigating one town, Whanganui, we describe conditions, analyse cases, and identify incentives that apply equally to many other towns in New Zealand. We argue that incentives that suit high-growth, high-value major urban centres are a poor fit for the periphery. Around the world, many places need to upgrade their privately-owned building stock to protect it from disasters, while governments face similar challenges as they struggle to initiate the strengthening of commercial buildings. We analyse the current incentive schemes that aim to support the achievement of policy goals and suggest alternative incentive schemes that can be implemented to improve strengthening outcomes.

Keywords: Canterbury earthquakes, earthquake insurance, earthquake strengthening, heritage buildings, incentives, retrofit, small towns, subsidy

Introduction

Like many other countries on the Pacific Rim and across other trans-tectonic plate boundaries, New Zealand experiences many earthquakes. Over the past decade, the ones that shook the country in 2010, 2011, 2013, and 2016 were the most destructive, in the sense that they destroyed a significant amount of private property. The earthquake that struck Christchurch on 22 February 2011 was especially devastating; it claimed 185 lives due to building failures and led to a reconstruction and recovery project whose costs surpassed NZD 40 billion (USD 9.1 billion), 17 per cent of New Zealand’s GDP at the time (Potter et al., 2015). The sequence of catastrophic earthquakes in Canterbury in 2010–11 led to a reconsideration of earthquake policy in New Zealand. These events eventually brought about changes in the government’s policy framework for dealing with existing earthquake-prone buildings—the focus of this paper.

Around the world, policy attention related to earthquake risk is generally directed at regulating the construction of new buildings. New Zealand introduced building standards designed to address earthquake risk after the destructive 1931 earthquake in Hawke’s Bay, an event that killed 256 people and destroyed much of the cities of...
Napier and Hastings (Hill and Gaillard, 2013). Over the ensuing decades, ongoing research about seismic risk informed a number of modifications to building standards. Systematic attempts to deal with the existing building stock that was built to earlier, lower standards, and to reduce associated seismic risks, came much later; these efforts have become more prominent in recent years, reflecting a growing public desire to preserve the historical heritage of the built environment (McClean, 2007).

**The Building (Earthquake-prone Buildings) Amendment Act 2016**

New Zealand’s government included specific measures to address existing earthquake-prone buildings in the Building Act of 2004, but these were perceived to be inadequate, especially after the earthquakes of 2010–11. The subsequent Building (Earthquake-prone Buildings) Amendment Act 2016 significantly tightened requirements for earthquake strengthening of existing buildings and shortened time frames in which these were mandated. The Act’s definition of earthquake proneness applies to buildings of a certain size, function, and location (New Zealand, 2016, s. 133). An earthquake-prone building is one whose designed capacity will be exceeded in a moderate earthquake. A ‘moderate earthquake’, as defined in the Act, is site- and risk-region-dependent. ‘Failure’ is likely to cause injury or death; this definition emphasises life safety and the safety of nearby properties and does not consider a building’s continuing functionality.

While the Act applies to the whole country, its implementation is left to the local territorial authorities. Specifically, they are tasked with identifying buildings that are earthquake-prone and communicating with building owners about their legal obligations to strengthen them. The Act defines three seismic risk categories—low, medium, and high—and sets corresponding deadlines for assessments and upgrades, which are significantly tighter for high-risk regions (MBIE, 2018).

The required strengthening is calculated based on a building’s ‘%NBS rating’, which is the percentage of the most recent new building standard (NBS) that the structure has achieved (MBIE, 2017b, p. 5). Specifically, %NBS is: ‘based on an assessment of the expected seismic performance of an existing building relative to the minimum that would apply [...] to a new building on the same site with respect to life safety [...]. The %NBS rating for the building as a whole takes account of, and may be governed by, the scores for individual building elements’ (MBIE, 2017b, p. 5).

A building is considered earthquake-prone if it is rated below 34%NBS. While the Act requires owners to strengthen their buildings up to at least 34%NBS, it does not allow territorial authorities to require strengthening above that rating (UC v. ICNZ, 2014). Local authorities may attempt to incentivise owners to strengthen their buildings to a higher standard, however (WCC, 2012). Meanwhile, new buildings must satisfy a minimum of 100%NBS.

Many of the buildings that are earthquake-prone are also designated as heritage buildings. Heritage status places limits on how owners may develop their buildings and what components of the building they are allowed to modify. Since strengthening an old, earthquake-prone building is often more expensive than demolishing it and erecting a new one in its place, heritage status typically conflicts with retrofitting
requirements (Goded et al., 2017; Henrich and McClure, 2017). The Resource Management Act 1991 places specific responsibilities on local authorities to protect historic heritage, including heritage buildings (New Zealand, 1991). The 2010–11 Canterbury earthquakes revealed the value and vulnerability of key heritage buildings, as councils sought to find a balance between retention and demolition. The demolition of buildings that are of international or national importance (Class A items, as determined by local authorities) typically triggers public consultation, while the demolition of structures that are of regional or local importance (Class B items) is generally publicly notified.

Owners of earthquake-prone buildings are thus likely to face a difficult dilemma. Strengthening their building, especially if it is a very old building, can be very costly (Al-Nammari and Lindell, 2009). For heritage buildings, retrofitting can be particularly expensive and demolition may not be a permissible option.

The deadlines imposed by the Act are still years away, but at the current annual rate of building strengthening, many hundreds of buildings nationwide will not have been strengthened by their government-mandated deadlines. McRae et al. (2018) report that if earthquake-prone buildings in New Zealand’s capital, Wellington, continue to be strengthened or demolished at the current rate, the deadline would be met. Outside of the country’s main centres, however, approval rates for seismic retrofitting suggest that voluntary compliance is much slower (Elcoat, 2016).

After the introduction of the Building Act 2004, and especially following the destructive Christchurch earthquake, tenants began to show a willingness to pay higher rents for apartments and offices in buildings that have higher NBS ratings. This safety premium has become especially noticeable in high-risk, high-value urban centres, such as Wellington (Filippova, Rehm, and Dibble, 2017). The safety premium outside of the high-value urban centres remains much lower (Hutching, 2019).

Meanwhile, the government and big commercial tenants have started to demand that buildings satisfy 67%NBS, rather than the legislated minimum of half that (34%NBS) (Property Council New Zealand, 2014). These large organisations are completely opposed to renting buildings that are less than 67%NBS, so the implied safety premium is quite high for properties that cater to these types of tenants. In high-value centres, these market imperatives have led to significant earthquake strengthening activity (CBRE, 2017).

Study objectives

The purpose of this paper is to focus on regional urban centres and smaller towns and the barriers they face in terms of strengthening their building stock. Our investigation focuses on one town, Whanganui, yet we describe conditions, analyse cases, and identify incentives that apply to many other towns in New Zealand and beyond.

As more and more people have been attracted to job opportunities and amenities in big cities, population and economic growth has been unequally distributed across New Zealand. Since the middle of the twentieth century, Auckland has been growing faster than any other place in the country (Polkinghorne, 2017); most other cities are experiencing either modest growth or stagnation (New Zealand Productivity...
Commission, 2017). Many places around the world face the need to upgrade their infrastructure for protection against disasters. Yet, in areas with limited growth prospects, the costs of strengthening privately owned assets may far outweigh the financial benefits that such investments might yield (Property Council New Zealand, 2014).

The next section describes the town of Whanganui in detail and analyses the economic realities faced by building owners who find that their earthquake-prone buildings need to be strengthened. The following section focuses on two case studies that provide general insights into the circumstances surrounding strengthening requirements. Next we analyse the current incentive schemes that can support achieving the policy goals laid out in the Act, and assess alternative incentive schemes that could be implemented. The final section presents summary observations about likely outcomes.

**New Zealand’s regional divergence**

New Zealand comprises 16 administrative regions, which are subdivided into 67 territorial authorities. The country is dominated by four core regions—Auckland, Canterbury, Waikato, and Wellington—which generate 70.5 per cent of the GDP and are home to two-thirds of the population (Nel, 2015), highlighting a high degree of concentration and regional inequality. The lion’s share of New Zealand positive population growth is taking place in Auckland and 13 other territorial authorities, which accounted for more than 90 per cent of the growth between 1996 and 2013 (Jackson, 2016). Over many decades, the economic progress of regions has diverged with some locations experiencing flat or contracting population and economy.

Indeed, Nel (2015) finds that 37 per cent of smaller urban centres and urban areas experienced population loss between 2006 and 2013, providing further evidence of the gravitational pull of the main cities, and their more dynamic economic trajectories. Changing agricultural practices resulted in fewer employment opportunities in peripheral and rural communities and accelerated the migration of people to the main urban centres. About two-thirds of the territorial authorities are expected to experience population stagnation or loss by the end of 2043. This will limit local councils’ ability to develop and maintain infrastructure, as they rely on revenue generated locally from property taxes to fund most of their expenditures (Jackson, 2016). The fiscal squeeze on local councils also hinders their ability to provide financial assistance to owners of seismically vulnerable buildings. At the same time, a slow rate or lack of seismic strengthening over time will place the sustainability of councils in doubt.

The national government is relieving some of this financial pressure through the Regional Culture and Heritage Fund (available for regional cultural assets such as Whanganui’s Sarjeant Gallery and the Opera House in Hawke’s Bay) and via the Heritage Earthquake Upgrade Incentive Programme (Heritage EQUIP) of the Ministry for Culture and Heritage, which supports the strengthening of privately owned, earthquake-prone heritage buildings.

Whanganui offers insights into the economic realities that distinguish the core urban concentrations of New Zealand (around Auckland, Christchurch, and Wellington)
from its peripheral centres. These differences between core and periphery are not unique to New Zealand; they are similarly present in earthquake-exposed countries as diverse as China, Israel, Japan, and the United States, where they also complicate efforts to incentivise seismic retrofitting (Negev et al., 2015).

**Whanganui**

Whanganui is located on the North Island of New Zealand and has a population of around 40,000 residents (Statistics New Zealand, 2013; see Figure 1). The agricultural sector underpins the local economy, which relies predominantly on the meat and dairy industries. Whanganui was once New Zealand’s fifth-largest town, yet the

**Figure 1. New Zealand and Whanganui**

Sources: authors, based on LINZ Data Service (n.d.); Stats NZ Geographic Data Service (n.d.).
1970s ushered in changes in the region’s fortunes. Like other secondary centres throughout the country, Whanganui has since gone into decline, beset by slow economic growth, a shrinking, aging population, a lack of skilled labour, and weakening prospects for career growth (Le Heron, 1979; Baxendine et al., 2004; see Figures 2 and 3).

**Figure 2. Population of Whanganui’s urban area**

![Graph showing population of Whanganui's urban area from 1901 to 2006.](attachment:population_graph.png)

**Source:** authors, based on Grimes and Tarrant (2013).

**Figure 3. Median age and total residential population count in Whanganui district**

![Graph showing median age and total population in Whanganui from 2001 to 2013.](attachment:population_age_graph.png)

**Source:** authors, based on Statistics New Zealand (2013).
The government’s earthquake-related legislation mainly targets older commercial building stock, which is frequently assessed to be below the 34%NBS threshold. In the 1960s and 1970s, urban centres such as Auckland and Wellington demolished older buildings and developed new, bigger ones in pursuit of economic opportunities. This was not the case on the periphery, so the stock of remaining buildings there is much older (Russell and Ingham, 2010). As a result, many older buildings that would otherwise have been replaced, still line the central streets of small towns such as Whanganui.

With the Act now in place, many owners of older buildings are under pressure to strengthen them. Unlike residential buildings, commercial property is typically leased rather than occupied by its owners (Dunstan and Skilling, 2015). Consequently, owners usually rely on rental income to cover building expenses, including costs of seismic strengthening. Yet, as discussed below, high vacancy rates in provincial towns limit owners’ ability to raise capital for seismic retrofitting. Buildings are thus left to deteriorate.

Whanganui’s district council has accorded heritage status to many of the city’s older, as yet unstrengthened buildings. Unless public funds can be made available to retrofit these buildings, the city may wind up losing much of its heritage, despite growing evidence that urban environments benefit from heritage preservation, including through the social revitalisation of communities, tourism, and improvement of the quality of life (Vicente, Ferreira, and da Silva, 2015). In addition, making the most of existing infrastructure and increasing the lifespan of buildings has sustainability benefits, such as lower material, transport, and energy consumption (Bullen and Love, 2010).

This problem, quite obviously, is not disappearing, and with deteriorating and underutilised building stock, it will be progressively harder to preserve old town centres. A study of one provincial town in New Zealand identifies a vacancy rate of 86 per cent on the main retail street (Yakubu et al., 2017). This situation calls for a better understanding of the problems faced by building owners and users, and of the economic and social consequences of earthquake-related policy and legislative changes.

As most of the affected building stock is located in the core of Whanganui, our study focuses on the commercial centre of the city. Whanganui District Council has identified the ‘Central Commercial Zone’ as a priority area for strengthening; the zone comprises city blocks along Victoria Avenue (see Figure 1). On average, there were 50 vacant shop fronts along Victoria Avenue from 2014 until 2017—about 30 per cent of the available space. Demand for second-floor commercial space in the commercial centre is almost non-existent, such that nearly 80 per cent of such spaces on Victoria Avenue stand empty (WDC, 2015).

Economic realities of the building owners within the Central Business District (CBD) can be gleaned from the employment index for occupations that require office and retail space. As businesses leave the CBD, vacancies in the area increase and the number of office workers—who once provided a ready market—continues to decline. Meanwhile, the ever-growing presence of big box retailing and online shopping is reducing demand for small retail shops in the centre, forcing closures, and driving up vacancies. As Figure 4 shows, Whanganui experienced economic growth in the
Figure 4. Employee count index of retail and office occupations in Cooks Gardens Area Unit

Note: the Cooks Gardens Area Unit, as defined by Statistics New Zealand, contains the Central Business District.

Source: authors, based on NZ.Stat (n.d.).

Figure 5. Buildings in the Central Commercial Zone, by date of construction and by use

Sources: authors, based on WDC (n.d.).
commercial and retail sectors in the period leading up to the global financial crisis. Although the number of employees has declined steadily since 2008, the city saw an uptick in commercial occupations in 2015–16.

Whanganui’s building stock was largely developed during its golden era of economic growth and prosperity, between the late 1800s and the early 1930s. The town’s built heritage is rich and is dominated by buildings from the early 1900s. Most of these structures (about 65 per cent) are used for retail, as, historically, town centres served as shopping and entertainment destinations for residents of adjacent rural settlements (see Figure 5). Many of the buildings on Victoria Avenue and the neighbouring blocks within the Central Commercial Zone are protected by the council or are on the New Zealand Heritage List (see Figure 6).

The New Zealand Heritage List identifies New Zealand’s significant and valued historical and cultural heritage places. The List is maintained by Heritage New Zealand, an autonomous Crown entity established in 2004 and includes: (1) historic places; (2) historic areas (groups of related historic places); (3) wāhi tūpuna—places important to Māori for ancestral significance and associated cultural and traditional values; (4) wāhi tapu—places sacred to Māori; and (5) wāhi tapu areas (areas that contain one or more wāhi tapu).

**Figure 6. Buildings with a heritage designation in the Whanganui District Plan**

![Map of Whanganui showing buildings with heritage designation](image)

*Source: authors, based on WDC (2019).*
The Heritage List is maintained as an information tool, as inclusion does not guarantee automatic protection, nor does it necessarily imply regulatory or legal obligations on property owners. The district plans, which are administered by local authorities, set out the changes that can be made to a Heritage List property. Most of these plans, including Whanganui’s, impose limits on proposed changes to heritage places and sites listed in their own heritage schedules.

The Building (Earthquake-prone Buildings) Amendment Act 2016 came into effect in July 2017. Accordingly, the Whanganui council has to set up a system for assessing vulnerable buildings, issuing notifications to owners, and, more broadly, complying with the requirements of the Act. In recognition of the town centre’s unique heritage and its strategic importance in Whanganui’s revitalisation, the local council is likely to set parts of Victoria Avenue (the town’s main commercial and retail street) as the priority area for earthquake strengthening (Wilson, 2017).

The Canterbury earthquakes and the subsequent announcement of the national earthquake-strengthening policy apparently slowed activity in the property market, especially with respect to older stock that requires seismic upgrades. Owners are facing pressure from their lenders and insurers to upgrade their buildings to maintain value; those who fail to comply are forced to accept significant discounts when selling such properties. Retail and office rents have generally remained flat since the Canterbury earthquakes, with annual rates as low as NZD 80 (USD 56) per m² in buildings requiring seismic retrofits, although they reached NZD 250 (USD 175) per m² for seismically upgraded and modernised commercial spaces. Average rental rates sit at around NZD 120 (USD 84) per m². If the high level of vacancies persists, however, rents will probably continue to fall below the current average (EQPB Community Taskforce, 2016).

Traditionally, investment in ‘bricks and mortar’ rewarded owners with generous returns. Nowadays, the requirement to strengthen an earthquake-prone building in a town like Whanganui can turn an asset into a financial liability. Banks and insurance companies reassessed their risks following the Canterbury earthquakes. Banks now generally restrict their lending to buildings at or above the 67%NBS rating; for buildings below that level, owners are required to demonstrate how they plan to strengthen the structures, by when they intend to do so, and that they are able to service higher levels of debt (EQPB Community Taskforce, 2016).

Meanwhile, insurance coverage generally is no longer available for earthquake-prone commercial buildings that are rated below 34%NBS. When it is, it is restricted to the indemnity value, which is far from sufficient to enable reconstruction and full recovery, particularly given today’s very low property values and high construction costs (EQPB Community Taskforce, 2016). In this context, buyers of older commercial buildings have struggled to source financing from conventional lenders; from 2011 to 2017, the majority of properties were purchased solely with cash, while only 37 per cent were partially financed by banks (LINZ Data Service, n.d.).

Financing woes seem to be affecting property values, as evidenced by a comparison of transactions before and after the Canterbury earthquakes (see Table 1). Using
Whanganui District Council’s District Valuation Roll and Sales Audit files (LINZ, n.d.), which cover the three latest revaluation cycles (2010–16), we divided commercial properties into two subsets based on their age—pre- and post-1976. As seen in Table 1, the number of pre-1976 properties recalled by mortgagees (lenders) and sold because borrowers (owners) failed to meet their obligations increased significantly after the Canterbury earthquake sequence, accounting for 26 per cent of sales, up from 11 per cent. There was no similar increase in the sale of post-1976 buildings; in fact, no such sales took place before or after the earthquakes. These findings indicate that the value of affected properties declined due to perceived earthquake risks—and that these fears were heightened after the Canterbury events.

Property values probably declined to the point where the outstanding debt on many properties actually exceeded their market value; in other words, there would be insufficient funds to cover debt obligations if a property were sold. This observation is reinforced by an examination of the difference between the realised sales price of properties and their assessed capital value (see Table 1). Whereas the market did not seem to discount the pre-1976 stock by much before the earthquakes, the average commercial building has since been sold at almost 30 per cent below their assessed value. No such trend is observable for the post-1976 buildings.

### Two case studies: Buildings #1 and #2

Whanganui’s Victoria Avenue is full of historic buildings—a reminder that Europeans settled in the area. Many of these buildings sit vacant and are in need of strengthening. The Whanganui District Council is in the process of identifying earthquake-prone buildings. Owners will then be given 12.5 or 25 years to strengthen or demolish their property, depending on the use of the building; priority buildings such as hospitals and schools will face tighter deadlines (MBIE, 2017a).

To avoid the financial burden of strengthening, some Victoria Avenue owners have applied for demolition consents since the legislation came into effect (Dudman, 2017). Yet others have been quick to initiate seismic retrofitting, notwithstanding that deadlines are not until 2040. We interviewed two such ‘retrofitting champions’ of buildings on Victoria Avenue (see Table 2). These owners were motivated by...
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divergent goals: one was aiming for positive investment returns while the other sought to secure accommodation for retirement.

**Building #1**

After retiring in 2015, the owner of Building #1 purchased the property with the knowledge that it was earthquake-prone and would require mandated strengthening. The purchase was partly motivated by the owner’s desire to live in the inner city. The building itself was completed in 1909 and is a 380 m², two-storey masonry structure with shops on the ground floor and vacant space upstairs. The building is a fine example of Edwardian Baroque architecture. It is listed in the Whanganui District Plan as a Class B heritage item, meaning that, ‘at a regional or local level it has several high heritage values and/or has good integrity’ (WDC, 2018, ch. 9, p. 9–5).

The owner engaged an engineering firm to develop a seismic strengthening solution to reach 34%NBS. The estimated cost of the seismic upgrade was nearly NZD 215,000 (USD 150,000). As the exterior and interior of the building were ‘tired’ and in need of an architectural ‘facelift’, the owner also employed an architect to restore the building while maintaining the integrity of the original design. The value of the architectural contract was NZD 440,000 (USD 308,000), double the budget of the seismic work. It included converting the second storey into an apartment for the owner.

The strengthening and restoration work started in early 2016 and was expected to take around 12 months. It was not without issues, including cost overruns and more than 50 applications to the local council regarding changes to the original retrofitting plans. The resulting delays added six months to the schedule and raised the total cost to nearly NZD 800,000 (USD 560,000): NZD 290,000 (USD 203,000) for seismic strengthening and NZD 510,000 (USD 357,000) for architectural work. To finance the retrofitting cost (both seismic and architectural), the owner relied on their own money and chose not to secure a mortgage against the property, so as

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**Table 2. Details of the two case study buildings on Victoria Avenue, Whanganui**

<table>
<thead>
<tr>
<th></th>
<th>Building #1</th>
<th>Building #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of construction</td>
<td>1909</td>
<td>1910</td>
</tr>
<tr>
<td>Architectural style</td>
<td>Edwardian Baroque</td>
<td>Edwardian Baroque</td>
</tr>
<tr>
<td>Building/construction type</td>
<td>Row/masonry</td>
<td>Stand-alone/masonry</td>
</tr>
<tr>
<td>Height/floor area</td>
<td>Two stories/380m²</td>
<td>Two stories/565m²</td>
</tr>
<tr>
<td>Building use</td>
<td>Retail/residential</td>
<td>Office</td>
</tr>
<tr>
<td>%NBS pre-/post-strengthening</td>
<td>19%/NBS/34%/NBS</td>
<td>16%/NBS/67%/NBS</td>
</tr>
<tr>
<td>Financial incentives</td>
<td>NZD 15,000 (USD 10,000) Heritage EQUIP grant</td>
<td>NZD 230,000 (USD 161,000) Heritage EQUIP grant</td>
</tr>
</tbody>
</table>

Source: authors.
to ‘keep it clean, free of debt’ for the children. It cost around NZD 760 (USD 532) per m² to seismically strengthen, while the overall cost was approximately NZD 2,100 (USD 1,470) per m².

Compared to other redevelopments in the CBD, these costs were clearly prohibitive. Around the same time, redevelopment of another earthquake-prone building on Victoria Avenue was also completed. The developer retained only the historic façade of the former retail edifice and built a brand-new structure behind it. The total cost per m² was approximately NZD 1,500 (USD 1,050). In contrast, the building cost per m² of a two-storey house with medium-quality fittings in New Zealand averages NZD 2,200 (USD 1,540) (QV Costbuilder, n.d.). The data suggests that the difference between refurbishment and new-build costs is negligible. Whanganui is the most affordable housing market in the country, with residential houses priced at an average of NZD 234,000 (USD 164,000) (QV.co.nz, n.d.). Retrofitting thus does not offer significant cost savings over new construction, with the result that it may not be attractive for a typical property owner.

During construction, the owner of Building #1 did not receive any financial incentives from the local council to help with the cost of earthquake strengthening. Towards completion of the project, a local heritage group helped the owner to secure a NZD 15,000 (USD 10,500) grant from Heritage EQUIP. The owner was not motivated by potential financial gain, but rather by the vision of delivering a ‘desirable, fine asset’ to the community. The owner was determined to complete the project with or without support.

The owner, who had no prior experience in managing a commercial property, had inadvertently become an investor since the ground floor of the building was rented out to two small retail spaces. Before the works started, the two shops paid around NZD 19,000 (USD 13,500) in rent per year. The owner observed that, given the economic realities in Whanganui, it would have been difficult to find tenants who would be willing to pay a higher rent, even though the space had been earthquake-proofed and remodelled. Assuming the owner then had to cover the operation costs of the rented space—such as insurance and property taxes—the owner would have netted around NZD 15,000 (USD 10,500), which is equivalent to a return on investment (the building purchase price plus the retrofitting costs) of just 1.4 per cent.

Building #2
The owner of Building #2 is a local businessman and property investor with ownership interests in several buildings on Victoria Avenue. He has owned this particular building since 2005, well before the Canterbury earthquakes affected the property market. Externally, the architectural style of this stand-alone, two-storey building has remained largely intact since it was designed in 1910 and expanded in 1927. As a result, and in recognition of its substantial heritage value, Heritage New Zealand designated it a Category 2 building. In the 1970s, internal alterations introduced new partitions and stairways, while fireplaces and other historic features were removed.
Further renovations were completed in 2007 to accommodate professional offices on both floors.

From 2007 until November 2014, two tenants occupied the building—one per floor. Due to the earthquake vulnerability of the building, the owner was not able to maintain the full insurance coverage on the building and the policy was reduced to the indemnity value of the building. This cutback exposed the tenants to additional risk and limited their ability to access business insurance, such as for business interruption. In 2014, the ground-floor tenant decided not to renew the lease and instead relocated to a seismically strengthened building in Whanganui’s town centre. The decision was largely due to Building #2’s NBS rating, as the tenant was a representative of a national company that required ratings of 67% NBS for all its offices.

Faced with the prospect of a half-empty building and the prolonged loss of rental income, the owner decided to investigate earthquake-strengthening options and commissioned a detailed engineering assessment, which gave the building a low rating of 17% NBS. Having lost one tenant to a retrofitted building and taking into account that quality tenants were generally adopting a new ‘pass mark’ of 67% NBS, the owner decided that it would be ‘commercially advantageous’ to strengthen the building to that standard.

Preliminary construction estimates put the strengthening cost at NZD 500,000 (USD 350,000), and additional restoration work required another NZD 250,000 (USD 175,000). Since the building had undergone renovation in 2007, the cost of architectural restoration was lower than for Building #1. However, since the owner decided to strengthen to a higher standard—67% NBS vs. 34% NBS—the cost of the structural upgrade was estimated at NZD 885 (USD 620) per m².

Given the significant outlay of capital for the building upgrade, the owner was seeking external funding from major banks. As one of the loan conditions, banks were looking for evidence of increased rental income and tenant pre-commitment. At the same time, the owner’s own test for the financial viability of a ‘go decision’ required post-remediation rental income sufficient to cover debt servicing of the construction loan and an investment return on the book value of the building.

Table 3. Assumptions used in scenario testing for Building #2

<table>
<thead>
<tr>
<th>Building floor area</th>
<th>565 m² (288 m² ground floor; 277 m² first floor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-remediation annual rental income</td>
<td>NZD 126.70 (USD 88.70) per m²</td>
</tr>
<tr>
<td>Post-remediation annual rental income</td>
<td>NZD 158 (USD 111) per m²</td>
</tr>
</tbody>
</table>
| Construction cost | Strengthening: NZD 500,000 (USD 350,000)  
Architectural restoration: NZD 250,000 (USD 175,000) |
| Debt service | Annual interest at 5.5% spread over 15 years and repaid on a table mortgage basis |
| Return on the building | 7.0% per year, based on the average yield achieved by commercial building owners in the Central Business District |

Source: authors.
With the help of a local heritage specialist, the owner applied for a major works grant from Heritage EQUIP.

In order to assess the financial viability of the strengthening and remediation programme for this building, we examined several scenarios with the information provided to us by the owner. Table 3 outlines the basic assumptions involved in the analysis.

The common assumption for these scenarios was that the building (both floors) would be fully tenanted and that the rental income would increase to NZD 158 (USD 111) per m$^2$ following remediation. The amount of debt service varies with the amount of assistance (via grants) available to the owner. The available grant from Heritage EQUIP would be capped at NZD 250,000 (USD 175,000), or 50 per cent of the strengthening cost. Therefore, the minimum required debt financing from a bank would be NZD 500,000 (USD 350,000): NZD 250,000 (USD 175,000) for strengthening plus NZD 250,000 (USD 175,000) for architectural restoration.

This scenario testing indicates that significant incentives are needed to meet the required financial viability of strengthening (see Table 4). In the absence of financial incentives, investment in retrofitting would result in significant losses to the building owner. The minimum grant amount that would result in a break-even outcome is NZD 220,000 (USD 154,000); this amount is close to the cap of the Heritage EQUIP grant that may be available for this strengthening project.

### Current incentive programmes

As described above, New Zealand’s national framework for addressing the earthquake vulnerability of existing buildings appears to have generated only limited strengthening activity outside the main urban centres. There is increasing awareness that more financial resources or other incentive schemes are needed in order to reward proactive building owners, given the long-term horizon of regulatory obligations (30–35 years for a medium-risk zone such as Whanganui) (Murphy, 2018). Most building owners appear to opt for a ‘wait and see approach’ to strengthening if,
economically, investment in strengthening is not likely to generate sufficient return; in New Zealand’s numerous smaller towns, the returns on investment in retrofitting through higher rents are rarely sufficient to justify—in financial terms—non-mandatory retrofitting.

The two case studies outlined above offer insight into the decision-making process of building owners who are affected by strengthening legislation. It may be assumed that a small minority of owners will decide to make structural repairs using their own funds, irrespective of associated costs, yet many more are likely to test the financial viability of such decisions. The overwhelming majority will perceive these investments as commercially viable only if significant subsidies and grants are available. In such cases, financial incentives could serve as tipping points for strengthening; they may also incentivise owners to take early action, rather than waiting for a deadline to draw near. Such public assistance programmes can help to ensure that retrofitted buildings are retained as important contributors to historic areas, where they can benefit community life while also securing commercial viability for building owners.

Whanganui’s stock of commercial buildings is rather old; up to two-thirds (100) of the buildings in the main street predate 1950 and will potentially require strengthening (see Figure 5) (New Zealand, 2016, s. 133). Moreover, unreinforced masonry buildings pose risks to adjacent (potentially structurally sound) buildings, whose side-walls, chimneys, and parapets can fail and collapse outwards (Ingham and Griffith, 2011). There are many challenges to strengthening historic buildings—raising funds, securing insurance, finding structural solutions—and at this point very few owners are taking the plunge and attempting to find ways to strengthen their buildings. The owners of Buildings #1 and #2 are pro-active; they are not typical Whanganui owners.

As noted earlier, the financial cost of retrofitting older buildings to the current non-prone standard (34%NBS) is prohibitive in provincial New Zealand. Only in the main high-value urban centres can costs of retrofitting be recouped through much higher rental income. For building owners who are not willing to invest in their properties as unreservedly as the owner of Building #1, there is a real need to incentivise earthquake retrofitting through various financial carrots. As of this writing, Heritage EQUIP was the main programme to fill this need.

Heritage EQUIP’s small retrofit grants provide up to 50 per cent of seismic strengthening costs, up to a maximum of NZD 25,000 (around USD 17,500), while the fund’s major works grants support seismic strengthening projects involving comprehensive solutions, including large-scale or staged projects. The latter provides up to 50 per cent of costs, up to a maximum of NZD 400,000 (around USD 280,000). Heritage EQUIP reported having provided 20 grants for 20 buildings by mid-2018; about half of the awarded NZD 2.2 million (about USD 1.5 million) went to the urban centres of Wellington and Christchurch (Heritage EQUIP, n.d.).

Funding for heritage building strengthening is also available from the National Heritage Preservation Incentive Fund, the Regional Culture and Heritage Fund, local councils, and the national lottery (the latter two fund retrofitting of non-heritage community buildings as well).
Heritage EQUIP was not designed to support only provincial towns. As noted above, the fund provides up to 50 per cent of strengthening costs, to be used for achieving the 34%NBS threshold, not more. In practice, however, it is difficult to distinguish between strengthening to 34%NBS and 67%NBS. As mentioned, the ‘quality’ rental market appears to be demanding 67%NBS, so strengthening to that level is substantially more profitable, while the financial returns associated with strengthening to 34%NBS are limited.

Both thresholds—the official 34%NBS and the 67%NBS dictated by the ‘market’—are arbitrary. Interestingly, it seems that various government departments unwittingly encouraged commercial entities to adopt the higher threshold, as they independently decided not to move into or remain in buildings under the 67%NBS rating (CBRE, 2017). The higher threshold was subsequently adopted by national retail chains, by insurers in their pricing decisions, and by banks in their lending guidelines. Ironically, the government itself advanced a de facto earthquake-prone threshold (67%NBS) that differs from the de jure threshold that it legislated (34%NBS).

Some local authorities have started to offer additional incentive schemes or subsidies for earthquake retrofitting (for example, in Dunedin in the South Island); in general, however, such assistance programmes are available only in the biggest urban conglomerations, such as Auckland and Wellington, where the economic imperatives are such that strengthening is much more likely to be undertaken. The funding that is currently available for retrofitting in smaller towns—including Heritage EQUIP support—falls far short of enabling a comprehensive programme, one that can achieve all or at least most of the required strengthening by the legislated deadlines.

The funding programmes currently provide direct transfers to building owners, who can then fully capture any benefits accrued from the funded strengthening. As a result, and given that owners tend to be relatively wealthy individuals, the funding allotted for this purpose in the general budget is not likely to increase, nor is the speed with which the buildings are being retrofitted. The next section thus examines what policy tools besides direct grants may be able to incentivise retrofitting.

**Possible other incentives**

The most obvious drawback of providing direct financial subsidies to owners for retrofitting is the high fiscal cost associated with that policy. In the New Zealand context, this cost is widely perceived as prohibitive, given the large number of early to mid-twentieth-century buildings that require strengthening.

It may thus be necessary to prioritise certain buildings and to be selective about which ones receive subsidies; since such an approach is politically risky, however, local councils are somewhat reluctant to pursue it. They are more likely to favour programmes that provide smaller subsidies to a greater number of buildings. While such subsidies typically are not sufficient to secure profitability on the balance sheet, they can serve to generate ‘nudges’ to prompt changes in behaviour and thus increase the overall likelihood of strengthening activities (Halpern, 2015).
This section considers several policy options that may be implemented to incentivise strengthening. Not all of these necessitate a significant or potentially prohibitive fiscal commitment.

Very few studies assess such possibilities comprehensively. Segal et al. (2017) and its companion report, Negev et al. (2015), are instructive exceptions. They analyse the circumstances of residential apartment buildings in Israel, a country that is vulnerable to infrequent but potentially destructive earthquakes along the Rift Valley, which could affect some of its poorer provincial towns. This problem—the concentration of the highest seismic risk in Israel’s disadvantaged areas—is not exactly comparable to that of New Zealand, where the absence of market-driven strengthening has placed disadvantaged areas at higher risk. A similar phenomenon has been documented elsewhere, including Tehran, where there is also a trade-off between ensuring equitable allocation of subsidies and resources, and achieving the most comprehensive earthquake strengthening (Vaziri et al., 2010; Zolfaghari and Peyghaleh, 2015).

In Israel, the main policy tool has been the allocation of further entitlements for apartment building owners who pursue strengthening; specifically, they are granted the right to add stories on top of buildings and expand existing stories’ floor area (subject to some restrictions). Since these entitlements are worth more in high-value major cities, it is only in those cities that the policy has had any real impact. Consequently, as in the New Zealand, only buildings in the high-density, high-value urban centres of Israel were strengthened; in the riskier periphery, retrofitting is rare due to prohibitive costs. In response to this failure, Israeli authorities decided to cancel the strengthening scheme, TAMA 38, in 2020 (Cohen and Melinzki, 2019).

One crucial difference between this analysis and that of Segal et al. (2017) is that the latter study focuses on residential buildings rather than commercial properties. The New Zealand government has long recognised residential accommodation as a protected class of buildings. Accordingly, the government has been providing an earthquake insurance scheme for residential buildings since the mid-1940s. This insurance cover is significantly more comprehensive and more affordable than earthquake insurance available elsewhere, as shown by Nguyen and Noy (forthcoming), who compare the price and penetration rates of earthquake insurance programmes in California, Japan, and New Zealand, and by Owen and Noy (2019), who provide a broader international comparison of catastrophe insurance programmes.

The most recent formulation of New Zealand’s public earthquake insurance programme—the 1993 Earthquake Commission Act—specifically excludes non-residential buildings from insurance cover. The political and ethical imperatives of protecting residential buildings are clearly different from those applied to commercial buildings. There is widespread acknowledgment of the individual’s right to housing, as enshrined in the United Nations’ International Covenant on Economic, Social and Cultural Rights, and there is therefore broad public support for providing earthquake protection for residential housing at affordable rates. Moreover, as noted above, commercial property owners tend to be relatively wealthy; not surprisingly, electoral support for significant funding streams for the wealthy is more limited.
In provincial cities such as Whanganui, however, significant social value is attached to maintaining a viable and successful central commercial district for residents (Mentz and Goble, 2015). Yet, without some kind of support, these provincial Main Streets may wither away, as government offices, large retail chains, and an increasing number of smaller organisations are unable or unwilling to locate their operations in earthquake-prone buildings.

These difficulties are not unique to New Zealand. Japan and California—two other earthquake hotspots—have also been struggling to initiate earthquake strengthening of existing buildings. While programmes in both locations offer building owners tax credits and subsidised loans to help pay for seismic retrofits, results have been limited (Comerio, 2004; Okazaki, 2010). The situation in Japan is very similar to that in New Zealand: older buildings are widely perceived to be more vulnerable, as they predate seismic regulations that followed more recent earthquakes. The Japanese government’s grant scheme for seismic retrofitting is less generous but also less selective than the Heritage EQUIP programme. In Japan, the local and central government together pay 23 per cent of retrofitting costs, while the owner is responsible for the rest. This programme is voluntary and uptake has been slow since it started in 1999; by 2010, funding had been provided for the strengthening of about 43,000 of the 11.5 million houses that were assessed to be at risk (Okazaki, 2010).

All of this suggests that if outright fiscal support is unlikely to be forthcoming, there is a need to develop other incentive programmes that can encourage and facilitate earthquake strengthening. We believe that such incentives—ones that do not involve significant fiscal outlays—are especially useful, as the availability of fiscal resources for this purpose is constrained by both economic and political realities. Below, we investigate three types of incentives that may be useful in achieving higher rates of seismic retrofitting.

**Grants for equity**

From the government’s perspective, the drawbacks associated with grants are their fiscal costs and the political fallout from the inevitably unequal distribution of funds. One way the government can minimise these downsides is by offering grants in return for partial ownership rights in the buildings that are to be retrofitted. Ownership shares can serve to lower the overall costs of the support programme, while also reducing the government’s exposure to criticism for using scarce fiscal resources to support wealthy building owners. Since retrofitting is likely to increase the resale value of a building, owners may be willing to accept that a funder of that retrofit will own some of the increase in value. If the government were to attempt to extract a full return (including interest) on any public investment in retrofitting, however, it might not generate enough uptake among building owners. This would defeat the purpose of such a scheme.
To be effective, the equity component of any proposed scheme must thus be able to strike a balance between generating sufficient return for the government (both politically and economically) and sustaining owners’ interest in developing and maintaining their property. Incentive mechanisms can ensure that such ‘grant-for-equity’ schemes provide just enough encouragement for owners to retrofit, while minimising the fiscal and political burden on the government.

For example, if retrofitting increases a building’s value from NZD 250,000 (USD 175,000) to twice that amount, and the government paid for 50 per cent of the strengthening costs, it could claim 50 per cent of the increased value. In order to discourage owners from receiving government grants with the aim of selling off retrofitted properties, the government’s ownership shares could be reduced if buildings are not sold within a specified time frame, or its ownership share could gradually decrease over time. More sophisticated ownership structures could also be devised and could be made conditional on developments in the commercial real estate market. In such a scheme, the grant provider (the government) obtains only some of the return if prices go up, but it takes on most of the risk if they drop.

Such arrangements can be put together using existing legal frameworks. Similar arrangements of joint ownership between the government and private households exist and can typically be legislated. In New Zealand, for example, the Housing New Zealand Corporation has shared equity schemes to enable low-income families to purchase a home (HNZC, n.d.).

Another option is for the government to provide subsidised loans or tax credits. Japan and California introduced such schemes to encourage seismic retrofitting, but, as noted above, their success is fairly limited (Comerio, 2004; Okazaki, 2010). In the global low-interest environment of the past decade, it is difficult to see how even no-interest loans can provide sufficient incentive to trigger significantly more retrofitting. Loans could be structured with negative interest rates, so that the debt automatically decreases over time, as long as ownership is maintained and servicing payments remain current.

If the government perceives the fiscal burden associated with these kinds of programmes as too high, even if it is spread out over time, it can limit itself to providing grants for the additional services that are required in the initial stages of a retrofit project. These can include a host of costs, such as for demolitions and stripping of unsafe non-structural components; seismic engineering assessments; or architectural design and engineering retrofitting plans. By covering such costs directly, rather than providing cost refunds, the government may be able to ‘nudge’ owners towards seismic strengthening of their buildings.

The main drawback of all of these suggestions is still their fiscal cost. However, public risk tolerance for earthquakes might differ from that for other natural and man-made hazards, and, with respect to earthquakes, the government’s preferred risk mitigation strategy appears to be increased funding (Henrich, McClure, and Doyle, 2018). The next two sections examine incentive schemes that do not involve substantial fiscal costs, at least not in most plausible scenarios.
Insurance warranty
A crucial component of owning a building is the ability to insure it. In Whanganui, as in other, similar small towns in New Zealand, insurance for earthquake-prone commercial buildings is no longer affordable; in many cases, including those of the two owners described above, it is not even available. One incentive of retrofitting is that it enables owners to purchase insurance again, yet even that incentive appears too weak to motivate most owners. A possible solution is for the government to subsidise post-retrofit insurance premiums, or to provide a free insurance product to owners who retrofit their buildings by a specified deadline (Fujimi and Tatano, 2013).

Insurance premium subsidies for safer assets are not unusual in insurance markets, but the tying of lower (or zero) premiums to retrofitting actions—rather than just the safety of the building—necessitates some government intervention. Given the large difference between the costs and benefits of unsubsidised retrofitting, as evidenced in Building #2, it is unlikely that the mere provision of subsidised or free insurance can serve as a sufficient incentive to generate a significant increase in the motivation to retrofit.

The government could therefore attempt to lower the costs of other parts of the retrofitting process, notably by providing further insurance. For example, it could provide insurance for building contractors to cover their retrofitting work, so that if the retrofitting fails in an earthquake, it does not impose a liability on the entities that were involved in the work (such as the architect, the engineer, the builder, and the contractor). Beyond insuring their work, the government could provide further legal protection from potential liability if a retrofitted building fails to withstand an earthquake. Since the government of New Zealand is already insuring residential properties through a public insurer (the Earthquake Commission), extending the insurance programme to retrofitted older commercial buildings outside of the main urban centres would not require new institutions.

Technical knowledge and the provision of information
In the United States, the Federal Emergency Management Agency helps to fund the development, socialisation, and adoption of new, more affordable technologies for disaster risk reduction. According to a survey conducted by Kohiyama et al. (2008), one of the main barriers to wider adoption of retrofitting is a perceived lack of information about available technologies and reliable, knowledgeable, and trustworthy contractors who can deploy these technologies in retrofitting projects. A perceived lack of information might also be deterring owners in New Zealand. One of the building owners we spoke to in Whanganui expressed frustration at the perceived lack of trustworthy contractors who might be willing to bid for retrofitting work.

The government can step forward to fill this information gap, both by funding research into retrofitting technology, and by collecting and coordinating the dissemination of information about available contractors. Covering these costs—however small—will enable owners to overcome some of the barriers to completing retrofitting. In New Zealand, the government is already making such investments (WCC, n.d.).
Another option is for the government to focus its efforts on developing more affordable technologies that can achieve minimum life safety requirements, possibly even below the 34%NBS threshold. These technologies could change some owners’ calculations by nudging them towards more ‘safety-friendly’ actions. This funding effort can encourage the development of partial solutions that do not bring heritage buildings quite up to the required NBS, but that the public may deem sufficiently protective for heritage buildings whose preservation is valued by society. Since such an approach would require exempting some heritage buildings from the full strengthening requirements, it is likely to come up against both legal and ethical barriers.

**Conclusion**

Which policy options can significantly spur the earthquake retrofitting process or, at a minimum, lead to a considerable amount of strengthening before the legislative deadlines? This paper begins by describing the financial dilemma faced by owners of earthquake-prone buildings outside the main urban centres in New Zealand and then presents two case studies of buildings in the provincial town of Whanganui. One important insight from this analysis is that the financial barriers to retrofitting are formidable, and that without public financial support, most buildings—including heritage ones—will not be retrofitted by their owners.

The next part of the analysis evaluates several retrofitting incentive schemes that are available to the government. These options focus on liquidity and equity support, the provision of warranties, and support for scientific and technical knowledge. No single one of these schemes is likely to bring about a real transformation on its own; taken together, however, they might tip the scales in favour of retrofits.

Other policy tools have yet to be explored. One suggestion is to differentiate the legal requirements in areas with weaker economic environments from the ones in the main urban centres. For example, the law could specify that towns whose size is below a certain threshold must meet deadlines imposed on the lowest-risk areas, irrespective of their actual location (or their actual risk). The clear downside to this approach is that peripheral centres will remain less safe, which may exacerbate their economic decline.

One last possibility is for strengthening to be undertaken directly by a public entity, with the aim of minimising retrofitting costs through economies of scale, such as by working on multiple buildings at the same time and with the same technology. In New Zealand, the Wellington City Council has only recently implemented this option through a short-term programme to strengthen unreinforced masonry facades on major pedestrian thoroughfares in selected locations (Falcon Consulting, 2019). It is not yet clear, however, whether the construction sector that specialises in seismic retrofits is indeed characterised by scale economies that can make serial retrofitting significantly cheaper to implement. Even if it is, it is not clear whether such a concerted programme of publicly managed and directed retrofits can pass legal muster.
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Endnotes

1 Unpublished data from Whanganui District Council, seen by the authors.

References


QV Costbuilder (n.d.) QV Costbuilder database. Subscription only. https://qvcostbuilder.co.nz (last accessed on 1 August 2019).


