TIMBER, TIN AND MASONRY: EARLY LESSONS IN SEISMIC RISK MITIGATION IN WHANGANUI, NEW ZEALAND

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ABSTRACT

New Zealand’s Canterbury earthquake sequence (Mₘ 7.1 Darfield earthquake and Mₘ 6.3 Christchurch earthquake), and the subsequent Canterbury Earthquakes Royal Commission (2012) revealed that the collapsed historic unreinforced masonry (URM) building stock was responsible for a high proportion of deaths that occurred in public places. Heritage conservation through seismic strengthening is explored as a topic of ongoing research that addresses urban safety concerns, whilst privileging the predominant historic URM building fabric. The Whanganui town centre features the designated historic ‘Old Town Conservation’ precinct and ‘Regeneration’ precinct showcasing an eclectic blend of architectural styles. However, the town is currently confronted by the threat of moderate to large earthquakes due to being located within a region of moderately high seismic hazard. A study was undertaken to explore Whanganui’s early seismic risk mitigation during the 1930s, in an effort to trace the development of a local retrofit practice and early attitudes to heritage conservation for URM buildings.

The following overall questions are posed: to what extent does Whanganui’s history of seismic risk mitigation technologies embody both architectural heritage conservation considerations and structural requirements? More specifically, how have Whanganui’s historic architect-engineers contributed to the development of retrofit practice for the local URM streetscapes? Lastly, what do the retrofits reveal about early collaborations between architects, engineers and building owners? Archival research and onsite visual survey informed a thematic analysis focusing on a range of technological solutions implemented for three selected buildings. The study forms part of an ongoing research project where a fundamental objective is to help ensure successful conservation outcomes for one of New Zealand’s earthquake-prone albeit historic urban ensembles.

Keywords: Unreinforced Masonry; Architectural Heritage; Retrofit; New Zealand; Conservation

1. INTRODUCTION

The North Island township of Whanganui is located on the banks of the Whanganui River and historically bore a reputation as a thriving rural service centre and port. A record of damaging fires and floods, in addition to increasing economic prosperity, initiated an architectural transition from the original modest timber structures to a more ornate, clay-brick masonry building stock (Cochran et al. 1990). Today the Whanganui town centre is confronted by the threat from moderate to large earthquakes as it is situated within a region of high seismic hazard (American Society of Civil Engineers 2014), also defined as a medium seismic hazard, using customary New Zealand designation (Ministry of Business Innovation and Employment 2017) (Figure 1). The Canterbury earthquake sequence (Mₘ 7.1 Darfield earthquake and Mₘ 6.3 Christchurch earthquake) served as catalysts to explore a recent shift in focus for seismic strengthening in New Zealand, away from the treatment of individual buildings and towards the consideration of historic precincts. Whanganui’s town centre currently features two designated precincts: the ‘Old Town Conservation Zone’ (Figure 2) and the

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'Regeneration Zone' (Urbanismplus et al. 2016). In order to examine the development of local retrofit practice, three historic retrofit schemes that were undertaken by prominent architects and engineers during the 1930s were identified. The following questions emerged: to what extent does Whanganui’s history of seismic risk mitigation technologies embody both architectural heritage conservation considerations and structural requirements? More specifically, how have Whanganui’s historic architect-engineers contributed to the development of retrofit practice for the historic URM streetscapes? Lastly, what do the retrofits reveal about early collaborations between architects and engineers? The three selected works of R.G. Talboys, T.H. James, and John Campbell/A.G. Bignell are examined via thematic analysis, informed by archival research and an onsite visual survey. This discussion forms part of an ongoing study exploring the conservation of New Zealand’s historic streetscapes and the provision of public urban safety.

2. LITERATURE REVIEW

Past and ongoing approaches to heritage conservation with specific reference to seismic risk mitigation in Whanganui were initially explored in the form of a brief literature review. The primary question remained: to what extent does the body of existing local literature address the heritage conservation and seismic retrofitting of Whanganui’s historic URM building precincts? In addition, to what extent do existing retrofits or strengthening measures privilege the historic architectural and urban qualities (Figure 3)? Lastly, what is the scope of heritage management initiatives undertaken by local authorities to mitigate the risk posed by Whanganui’s seismic hazard? Therefore, the presented literature review was specifically focused on the writing of local historians, scholars, and practitioners, in order to gauge the scope of local commentary on the aforementioned subjects.

Local architectural discourse foregrounds the significance of the Whanganui township, primarily focusing on patterns of urban development and deployment of local construction materials or technologies. D.A. Quinn offered an early insight by acknowledging Whanganui’s unique architectural features along with the accompanying neglect of the historic building stock, followed by a burgeoning interest in preserving townscape qualities rather than focusing on single buildings (Quinn 1968). Various monographs identify Victoria Avenue and Taupo Quay as hubs of activity, situated within the wider historic urban layout (Smart et al. 2nd ed. 1973) (Kirk 1978). Of especial significance are references to the early architectural transition from timber to masonry in order to mitigate risk from fires and earthquakes, thereby resulting in the surviving form and materiality of Whanganui’s current historic building stock (Cochran et al. 1990). Porter also suggests that the view of masonry as a more “worthy” and permanent construction material was another incentive for the evident variations in construction typology (Porter et al. 1979). An interesting practice of replicating Classical detailing in timber also soon arose, in order to project images of prosperity, and is legible across the town centre (Porter et al. 1979). However, discussion of seismic vulnerabilities or reference to specific historic seismic activity remains scarce.
Whanganui has been the subject of townscape-wide heritage assessment and studies conducted by local authorities, in conjunction with the national heritage conservation organization, Heritage New Zealand Pouhere Taonga. ‘The Whanganui Heritage Study’ was undertaken by Chris Cochran Conservation Architect and Murray North Limited in 1990, addressing a dense concentration of listed heritage buildings in the town centre (Cochran et al. 1990). Cochran and North reported on various historic and social developments underpinning the emergence of a distinctive architectural building stock, followed by a series of recommendations to retain the designated ‘Old Town Conservation Zone’ (Figure 2). Whilst their report contained a consolidation of the research and an existing register of listed buildings collectively as urban blocks, there is little reference to structural seismic upgrades. The authors do suggest the adoption of the MainStreet heritage conservation-led and community-based urban regeneration methodology, popular in North America (Cochran et al. 1990). The establishment of the MainStreet Whanganui community organization is based on North American precedents. Local authority policies also offer the reader insight into the management of the earthquake-prone historic building stock. The general approach and management strategy for earthquake-prone heritage buildings adopted by the local authority is presented in the ‘Earthquake-prone Buildings Policy 2009’ (Wanganui District Council 2009). The risk posed by parapets and facades, that are either poorly constructed or poorly tied back, potentially resulting in their collapse into accessways or against adjacent buildings during earthquakes, was highlighted by the 2007 Gisborne earthquake (Wanganui District Council 2009).

Figure 1. Whanganui is located in the medium risk seismic zone (Defined by Institute of Geological and Nuclear Sciences). Map adapted from MBIE, 2016

![Map of New Zealand showing seismic risk zones](image-url)
The need for earthquake-strengthening via prioritisation of the building stock into three tiers of importance is presented in the *Whanganui Regeneration Strategy* (Urbanismplus et al. 2016). Coordination and collaboration between owners of adjacent buildings that share walls is encouraged, as well as adherence to existing urban design guidelines. The role of the Whanganui Earthquake-Prone Buildings Community Taskforce is acknowledged as a group consisting of various community stakeholders such as council members, building owners, architects and engineers.

The evolution of the town centre is partly due to Whanganui’s susceptibility to natural disasters such as floods, fires, and earthquakes. The town’s location within a region of high seismic activity has resulted in a series of earthquakes, dating from as early as 1843 onwards. Recorded examples include the following: 8 July 1843 (Mw 7.5), 16 October 1848 (Mw 7.8), 23 January 1855 (Mw 8.2), 8 December 1897 (Mw 7.0) and 5 March 1934 (Mw 7.6) (Wanganui District Council 2012). Major central faults of the North Island or the Hikurangi Trough are likely to affect Whanganui, but there are no known active faults under the city itself (Wanganui District Council 2012). The common occurrence of fires within the town centre eventually resulted in the passing of Borough Council by-laws.
requiring the construction of brick side walls for all new buildings (Pettigrew 2009). A visual survey of the town centre accordingly revealed various buildings with timber front and rear elevations but constructed with masonry side walls (Figure 4). The case studies discussed in Section 4.0 featured processes of rebuilding after one or more fires, and hence are indicative of a town-wide transition from timber to masonry construction.

![Exposed URM brick historic construction characteristics in Whanganui](image)

Figure 4. Exposed URM brick historic construction characteristics in Whanganui

4. LESSONS FROM EARLY RETROFIT PRACTICE IN WHANGANUI, 1930-1937

Examination of existing local authority building inventories and archival records revealed a few notable undertakings during the early-mid twentieth century, whereas more recent times have seen the development of town-wide schemes. Nonetheless, the study of three selected examples of retrofit practice demonstrated early risk mitigation through the adoption of different technologies in relation to various structural weaknesses, as conceived by local architect-engineers. The work of R.G. Talboys, T.H. James and John Campbell/A.G. Bignell is highlighted, between the years of 1930—1937 in an effort to examine historic attitudes to seismic retrofit and heritage conservation. All three firms were active contributors to Whanganui’s streetscapes, and responsible for the design, alteration, and retrofit of civic and commercial buildings. Key themes for the following analysis included scope/volume of work undertaken by each of the aforementioned groups, range of the selected technological solutions adopted, and any legislative catalysts. The relationship to primary heritage considerations such as the
degree of invasiveness versus integration, reversibility, and methods of installation were highlighted, in order to reveal the development of a local heritage conservation practice (Robinson 2000).

4.1 R.G. Talboys: Rutland Hotel (Built 1899, Retrofit 1932/1933)

The work of Robert G. Talboys (1892-1971) permeates the Whanganui streetscapes, featuring domestic and civic buildings (Young et al. 2003). A number of these structures were designed, altered, and retrofitted under the name of Talboys & Associates, later operated by his son Michael Talboys (Young et al. 2003)(Table 1).

Table 1. Historic buildings designed, altered, and retrofitted (shaded in blue) by R.G. Talboys’ practice (Whanganui District Council 2018)

<table>
<thead>
<tr>
<th>Buildings</th>
<th>Date of Completion</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Fire Station</td>
<td>1921</td>
<td>Ford &amp; Talboys</td>
</tr>
<tr>
<td>Broadway Buildings</td>
<td>1928</td>
<td>Architect (RG Talboys)</td>
</tr>
<tr>
<td>Wakefield Chambers</td>
<td>1929</td>
<td>Architect (RG Talboys)</td>
</tr>
<tr>
<td>Rutland Hotel</td>
<td>1933</td>
<td>R.G. Talboys &amp; Associates, Architects and Structural Engineers</td>
</tr>
<tr>
<td>Cinema 3 (Embassy Theatre)</td>
<td>1934</td>
<td>R.G. Talboys &amp; Associates, Architects and Structural Engineers</td>
</tr>
<tr>
<td>AD Willis Factory</td>
<td>1952</td>
<td>R.G. Talboys &amp; Associates</td>
</tr>
<tr>
<td>Kitchen’s Pharmacy</td>
<td>1953/54</td>
<td>Talboys &amp; Associates</td>
</tr>
<tr>
<td>Imperial Buildings</td>
<td>1957</td>
<td>Architect (Michael Talboys)</td>
</tr>
<tr>
<td>Old National Bank</td>
<td>1957</td>
<td>RG Talboys &amp; Associates</td>
</tr>
<tr>
<td>Photography &amp; Painting Studio</td>
<td>1957</td>
<td>RG Talboys &amp; Associates</td>
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<td>and Gallery</td>
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The Rutland Hotel has a dominating presence along Whanganui’s main thoroughfare of Victoria Avenue and embodies a history of removal, reinstatement, and retrofit, following construction in 1899 (Figure 5). R.G. Talboys was responsible for an intermediary stage of the Rutland’s history, following design by Alfred Atkins (1899/1903) and prior to redevelopment by Dickson Lonegran (1992-1993) (Pettigrew 2008). In keeping with local historical record, a number of fires from as early as 1910 and subsequently in 1947, resulted in substantial alterations to the timber and brick masonry structure, including the removal of a third storey (Pettigrew 2008).

One of the most invasive and destructive examples of seismic risk mitigation was undertaken in 1934, when the corner octagonal tower was removed (RG Talboys and Associates Architects and Structural Engineers 1934). By this time, Talboys’ firm had expanded to embody architectural and engineering practice, as a result of the previous partnership with C.R. Ford in 1919 (Lowe 1998). Archived tower removal plans dating to 1934 illustrate the design and detailing for a truncated street frontage and
building form (RG Talboys and Associates Architects and Structural Engineers 1934). However, the Rutland Hotel was not an isolated case, as widespread practice of demolishing parapets, pediments and chimneys was adopted in response to the 1931 Hawkes’ Bay earthquake (Whanganui District Council 2018). Another comparable example is the 1931 tower removal from the Post and Telegraph Office (Pettigrew 2004/2005) (Figure 6). From the perspective of heritage conservation, the fixtures and fittings were admittedly reused, yet historical newspaper reports acknowledge that the tower itself was not deemed dangerous but that the removal was a commonplace mitigation measure against general earthquake risk (Stratford Evening Post 1931). Such drastic town-wide initiatives hence contributed to an evolving urban streetscape, resulting in today’s form. The Rutland tower was reinstated during the 1990s redevelopment scheme.

![Figure 5. Rutland Hotel Seismic Risk Mitigation and Retrofit](image)

![Figure 6. Examples of Whanganui’s early seismic risk mitigation via demolition](image)

Archival drawings also display a more conservative approach undertaken for the retrofit at roof level, contrasting with the solution of complete removal, as demonstrated by the historic risk mitigation measures. The concealed installation of a concrete beam at roof level, housed behind a timber parapet for example, appears to not greatly alter the original fabric or visually alter the Hotel’s principal
4.2 T.H. James: Dental Clinic and Studio (Built 1902, Retrofitted 1934)

The Dental Clinic & Studio is also located on Victoria Avenue and features repair and retrofit, carried out by architect T.H. James and W. Laird (builder/contractor) in 1934 (Pettigrew 2004). External visual survey and recent heritage reports compiled by local historian Wendy Pettigrew confirm the use of concrete and steel rail stanchions as well as tie rods, in addition to general repairs following earthquakes in 1929 and 1931 (Pettigrew 2004) (Figure 7).

Onsite survey and study of archival drawings present a highly expressed retrofit scheme for the historic brick masonry building fabric. In accordance with the 1934 specifications, the installation of a new “concrete belt course” above the existing bay windows and the new introduction of the steel rail stanchions in concrete housing, to the building’s principal elevations, demonstrate a low level of integration with the existing structural matrix (James 1934). As the proposed strengthening measures, the chosen solutions maybe viewed as completely new additions versus supplementary building elements that complement the existing structure. Therefore, the new concrete elements constitute significant portions of the building facades alongside the original Flemish and English bond masonry. Conversely, internal measures include the installation of ‘union shackles’ across the width of the building and roughly following the transverse wall configuration, on the first and second storeys (James 1934). Nevertheless, the archived retrofit specifications also discuss repair and rebuilding of brickwork and window lintels, noting that finishes “match present work” hence suggesting very early consideration of compatibility with original historic fabric (James 1934). Historic architectural drawings also reveal the introduction of ‘S-Anchors’ along the side elevations (James 1934). Almost a century later, these early retrofit interventions results in both, the original brick fabric and concrete additions being perceived as historic fabric and showcase of historic building technologies, therefore requiring consideration during any contemporary alterations or conservation decision-making.
John Campbell (1857-1942) was most widely known for his design of government buildings across New Zealand, resulting in his appointment as the first designated Government Architect (Bowman et al. 2012). Over the course of his term between 1909-1922, Campbell was responsible for a number of government schemes, including the Parliament Building in the nation’s capital city Wellington. Campbell was joined by his deputy Llewellyn Richards, Claude Paton (1881-1953) as architectural draughtsman, and prominent local contractor Arthur Bignell for the Whanganui commission of the Native Land Court and Aotea Maori Land Board Building (Pettigrew 2005/2007). The Art-Deco style building was constructed in 1921 and replaced a historic two-storey hotel that burnt down in 1891 (Figure 8). The undertaken retrofits have perhaps gained attention as a result of the local and nationwide significance attached to the building possibly as the country’s only purpose-built Native Land Court building (Bowman et al. 2012). Historical significance derived from use to carry out discussions concerning changes to the legal status of Maori-owned land, such as the transfer of Maori land to the Crown and private purchasers (Bowman et al. 2012).

The construction typology is classed as single storey masonry with reinforced concrete retrofits and with a cement plastered finish. Archived records reveal that repairs were undertaken in 1925 addressing cracking plaster and the percolation of rain water into the parapet walls. Seismic issues were specifically highlighted following the 1931 Hawke’s Bay earthquake and included brick and concrete fracture and foundation settlement, in addition to the lack of continuous reinforced concrete bonds, and along with roof plates that were not bolted into position (Pettigrew 2005/2007). Of these, subsidence issues were acknowledged as the most severe, with some suggestions that the original foundations were not tested adequately before erection, however it was later discovered that the building was in fact constructed on the foundations of the original hotel cellar (Pettigrew 2005/2007). The designed retrofits proposed demolishing and rebuilding the parapets, inclusion of mild steel wall ties and addressing the building foundations (Murray 1932) (Figure 9). The main strengthening work took place in 1933 and was carried out by A.G. Bignell (Figure 9). Unlike the Rutland Hotel and Dental Clinic buildings and despite the variety of changes required, the external visual appearance is retained whilst the retrofit solutions are integrated within the building’s structural matrix.

(a) Native Land Court Building, View from Market Place
The removal and replacement of the original parapets in reinforced concrete displays an early use of replica ornament, constituting a significant topic of discussion in current heritage conservation theory and practice. An alternative option identified within the 1930s specifications included a lightweight timber plastered timber structure replica to replace the high and heavy brick masonry parapet. Prioritization of restraining falling hazards is also evident through the use of chimney stays versus demolition that was commonplace practice (Figure 10), discussed above. Further alteration to the building’s stylistic form and qualities include trimming and underpinning the front porch. The main internal structural systems adopted include the use of mild steel wall tie rods across the width of the building. Archival drawings present a concealed scheme where the rods are supported on new timber dwangs installed within the existing concrete ceiling structure (Murray 1932).
Overall, an important point to note is the interdisciplinary architect-engineering practice structures within which the retrofits were designed, as displayed by the Rutland Hotel, Dental Clinic and Native Land Court. Other contemporary examples, also working within the Whanganui context included C Newton Hood (Registered Architect and Structural Engineer), Alfred Atkins (civil engineer, Royal Institute of British Architects) and A. C. Mannington (Cochran et al. 1990).

5. CONCLUSIONS

The preceding discussion foregrounds the early stages of study into the history of seismic retrofit practice in Whanganui, New Zealand by examining three case studies during the 1931-1937. Whilst the range, development and scope of early retrofit technologies remains to be explored against the whole town and nationally, the discussed examples present varying design philosophies of treating historic brick masonry building fabric. Ranging from demolition through highly expressed, interventionist solutions, the spectrum also includes those that are fully concealed. Despite the primary concern being the mitigation of seismic risk over heritage conservation, shifts in attitude are apparent, especially through subsequent reinstatements during the late twentieth century. Furthermore, the longevity and performance of the historic technologies to the present-day is another subject for analysis. A brief insight into the relationship between prominent local architects and engineers is offered, as two primary stakeholders during the seismic retrofit design process. Therefore, whether Whanganui is overall representative of New Zealand-wide seismic retrofit practice at this time remains to be examined.

6. ACKNOWLEDGMENTS

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7. REFERENCES


RG Talboys and Associates Architects and Structural Engineers. 1934. Alterations to the Rutland Hotel for District Public Trustee. Whanganui, New Zealand: RG Talboys & Associates Architects and Structural Engineers. Currently held in Whanganui District Council Building Files-papers from 1925, including 1934 tower removal plans; 1948/49 plans to reinstate hotel after fire, and remove third storey


