SUMMARY STATEMENT

1. My name is Clara Caponi. I am a Chartered Professional Engineer specialised in Heritage Structures. I am employed at Egis NZ Limited where I hold the position of Associate Engineer.

Scope of evidence

2. I have prepared evidence on behalf of the **Christchurch City Council** in respect of matters arising from submissions on Plan Change 14 to the Christchurch District Plan (the **District Plan**; **PC14**).

3. My evidence relates to site specific heritage engineering matters raised in the submissions seeking changes to the Schedule of Significant Historic Heritage Places (**Schedule**). Specifically, the submissions considered in this evidence are:

   (a) Submission #824 – The Blue Cottage (325 Montreal Street);

   (b) Submission #825 – St James' Church (65-69 Riccarton Road);

   (c) Submission #1043 – Portstone Cottage (471 Ferry Road, Woolston); and

   (d) Submission #1056 – Mitre Hotel (40 Norwich Quay, Lyttelton).

SUBMISSION #824 – THE BLUE COTTAGE

4. In respect to Submission #824 – The Blue Cottage, I consider that

   (a) The building dates from the 1870's, rather than 1885 as originally indicated by Dave Pearson in his Conservation Plan (and reported in my primary evidence). This is documented in the Council's Statement of Significance and heritage files for the property.

   (b) Site observations indicate consistency in the character and construction detailing of both the lean-tos and main cottage structures. Therefore, it is very likely that the lean-tos additions on the South-West Elevation were added within a few years of the cottage's original construction. Based on the above observations, the lean-tos structures on the South-West Elevation should be then considered as an integral part of the original heritage structure and not simply later additions.

(c) The Blue Cottage currently retains most of its original heritage features.

(d) The damage to the existing heritage fabric is mainly due to lack of maintenance.

(e) The information available at the time of writing is not sufficient to ascertain the extent and severity of the damage to the internal linings, flooring and internal structural elements, nor whether strengthening and repair works would lead to the loss of significant heritage fabric.

(f) The photos included in Mr Brookland Building Inspection Report indicate some water ingress at certain internal locations. The roofing iron, however, does not show any major faults at the ridge line or on the sloping surfaces. Although gutters and valleys may have some leaks, there is no evidence that diffused leakage has occurred and caused widespread deterioration of the walls and roof internal timber structures.

(g) Considering the age of construction, the cottage was likely built using timber from old-growth native forests and so inherently more stable and durable than conventional plantation timber. Old-growth native timber species such as Kauri, Rimu, Matai or Southern White Silver Beech are also renown to be exceptionally robust and usually characterised by a low susceptibility to water damage. The heartwood of these species is also less vulnerable to borer and fungi attack than conventional plantation timber.
Based on these considerations and upon review of the documentation currently available (including Mr Brookland's Building Inspection Report), there is no obvious evidence that widespread deterioration of the walls and roof internal timber structures has occurred.

5. Based on the above observations, Mr Brookland's conclusion that "*an almost complete replacement of all of the building components*" is required to reinstate the property is not justifiable on the basis of the data currently available.

SUBMISSION #825 – ST JAMES' CHURCH

6. In respect to Submission #825 – St James' Church, I consider that:

(a) The building has suffered only minor earthquake damage as a result of the Canterbury Earthquake Sequence.

(b) In the last few years, lack of maintenance and care have caused the onset of minor damage to the heritage fabric. The building, however, appears still in very good condition. Basic and economic repairs would address most of the issues currently causing deterioration to the building fabric. These works can be easily undertaken as temporary securing works were installed immediately after the Canterbury earthquake sequence and are still in place, continuing to ensure safe access and work condition on site.

(c) St James' performed extremely well during the Canterbury Earthquake Sequence. The churches heritage fabric has proved to have a high level of inherent robustness as the damage did not worsen over the earthquake swarm and following events.

(d) The strengthening scheme concept proposed by Aurecon and by Mr° Carney are based on initial engineering considerations. No Detailed Seismic Assessment (in accordance with the 2017 MBIE guidelines "Seismic Assessment of existing building" [1]) has been presented to ascertain the effective capacity of the existing structures.

(e) Numerical analysis and an in-depth understanding of the building construction detailing may prove that high-level remedial strengthening solutions for the gable end walls and the chancel arch might suffice to achieve an acceptable level of seismic resistance capacity when considered with the inherent capacity of the existing structures.

(f) Site observations have indicated adequate performance of the existing foundation system. No liquefaction or significant ground movements were recorded at the site following the Canterbury Earthquake Sequence. Initial geotechnical investigations performed in 2012 suggested also good ground conditions at shallow depth[2].

(g) Considering the significant level of intensity and the number of earthquakes already sustained by St James' Church, any poor

[1] https://www.building.govt.nz/building-code-compliance/b-stability/b1-structure/seismic-assessment-existing-buildings/

[2] "Consent Documentation for Remediation of St James' Church, Riccarton – Concept Issue", Aurecon, April 2013

foundation performance or geotechnical issue should have already been manifested, if likely potential. Based on the above observation, in my opinion a preliminary allowance for additional strengthening work to the foundations is not justifiable with the data available at this stage.

(h) In the case where change of use for the building is pursued, Section 115 of the Building Act 2004 requires an upgrade of the existing building in terms of means of escape from fire, protection of other property, sanitary facilities, structural performance, and fire-rating performance. However, no predetermined target levels are defined for the upgrade, as the building in its new use is required to comply with the Building Code "*as nearly as is reasonably practicable*" only.

(i) Based on my professional experience in heritage projects, Local Authorities do not necessarily impose the achievement of 100%NBS seismic capacity as a requisite to grant a Building Consent. They usually positively consider strengthening solutions aiming to achieve a seismic capacity equal or above 67%NBS, even if change of use is proposed.

In Appendix A, I have included, for example, some projects in the Canterbury region involving adaptive re-use of heritage or existing buildings. These projects have been granted with Building Consent despite the strengthening works were designed to achieve a seismic capacity lower than 100%NBS.

(j) Based on the above observations, I consider that it is premature to raise concerns on the effective extent of strengthening works required if a change of use is to be pursued for St James' Church.

7. In conclusion, there is no engineering reason why the building should be removed from the Schedule in my opinion.

SUBMISSION #1043 – PORTSTONE COTTAGE

8. In respect to Submission #1043 – Portstone Cottage, I consider that:

(a) the building suffered moderate damage as a result of the 4 September and 26 December earthquakes in 2010, with damage becoming more extensive and pronounced over the earthquake swarm and following events.

(b) Although damaged, the walls have however resisted a significant number of 5Mw magnitude earthquakes from 2010 to present day without collapsing completely. This indicates that the structure still retains an inherent level of robustness.

(c) I generally agree with the strengthening approach and solutions proposed in 2013 by Dunning and Thornton Consultants, with the addition of internal grouting of perimeter masonry walls to stabilise the infill rubble. The proposed repair methodology will structurally strengthen the cottage to a standard greater than the minimum requirement of the New Zealand Building Code, minimising the works' invasiveness and retaining the heritage features of the building.

(d) If reinstatement is pursued, the repairs and strengthening works can be combined with an adaptive reuse of the building spaces. This would open up to a wider range of possible uses of the building, including those not directly associated with the former residential and commercial use.

9. Based on the above matters and considering that there are viable engineering options to repair the building to a safe and useable condition, in my opinion there is no engineering reason why the building should be removed from the Schedule.

SUBMISSION #1056 – MITRE HOTEL

10. In respect to Submission #1056 – Mitre Hotel, I have been informed that the building was demolished in August 2023.

Date: 28 November 2023

Clara Caponi

APPENDIX A

Heritage and existing Building: Change of Use and %NBS Seismic Rating

- **Milton St Substation**

259 Milton Street, Sydenham, Christchurch

The Milton Street (former) substation is scheduled as a ‘Significant’ heritage item in the Christchurch District Plan Schedule of Significant Historic Heritage Places (#601).

In March 2018 Clark Mauger lodged a Building Consent (BC) application for building alterations and change of use. The BC application included structural strengthening works to achieve an overall **67% NBS** seismic capacity.

The BC application was successful and the CCC granted a Building Consent for this project in August 2018.

- **Provincial Council Building**

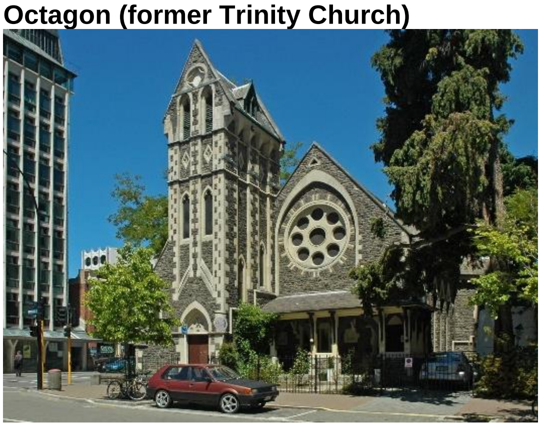
282 Durham Street North Central, Christchurch

In December 2017, the Huadu International Education Hub Limited lodged a BC application for alterations and change of use for this multi-storey building. The BC application included structural strengthening works to achieve an overall **80% NBS** seismic rating.

Although the applicant ended up withdrawing the BC application, **the structural review undertaken by the BC office during the RFI process did not express any reserve regarding the proposed seismic rating target (80%NBS)**.

This building is not currently listed in the CCC District Plan Schedule of Significant Historic Heritage Places or in the HNZPT register, but it has heritage value.

- **Octagon (former Trinity Church)**



124 Worcester Street, Christchurch

The Octagon (the former Trinity Church) was designed by Benjamin Mountfort in 1864 and it is a Category I heritage building listed with Heritage New Zealand Pouhere Taonga (HNZPT) and scheduled in the Christchurch District Plan as a ‘Highly Significant’ heritage item (#580). Damaged during the Canterbury Sequence, this building has been recently strengthened to achieve **67%NBS.**

Although no change of use was required in this case (as the premises was already converted into a restaurant since 2006), this project is a successful example of adaptive re-use of heritage structures. It also provides positive reassurance that 67%NBS can be considered as an adequate target by the Local Authority for the seismic strengthening of heritage buildings repurposed for commercial activities.

- **Temuka Courthouse Museum**

2 Domain Avenue, Temuka

The Temuka Courthouse Museum is a Category A listed item with the Timaru District Council (TDC) and a Category II in the Heritage New Zealand Pouhere Taonga (HNZPT) list of historic places.

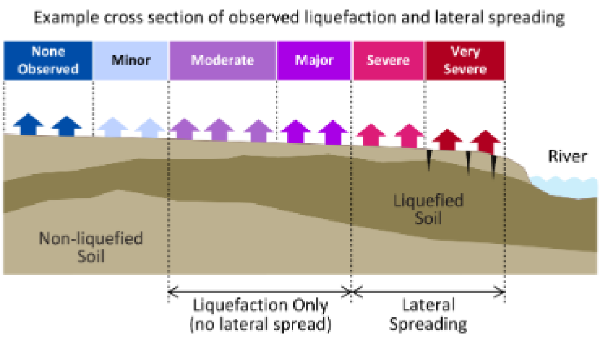
Assessed as an Earthquake Prone Building (EPB), this building has been recently strengthened to achieve **67%NBS.**

Although no change of use was required in this case (as the premises was already converted into a museum since 1982), this project is another successful example of adaptive re-use of heritage structures. It also provides positive reassurance that 67%NBS can be considered as an adequate target by the Local Authority for the seismic strengthening of heritage buildings repurposed for commercial activities.

APPENDIX A

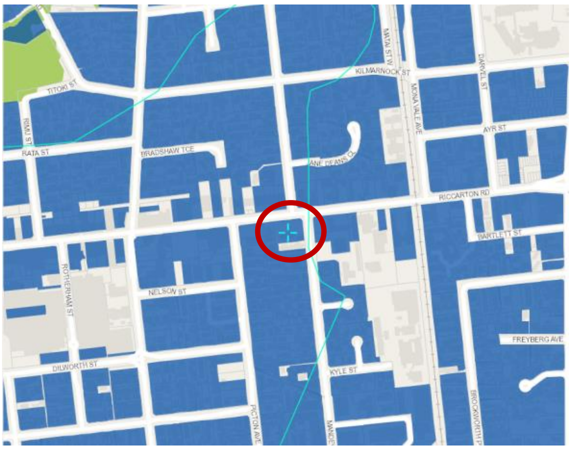
Observed liquefaction in Christchurch urban areas during the Canterbury Earthquakes[1]

Map Legend:

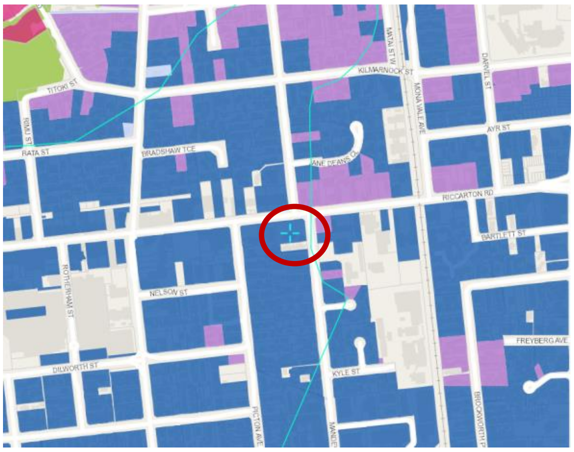


The following maps confirm that no liquefaction was observed at the site following the Canterbury Earthquake Sequence.

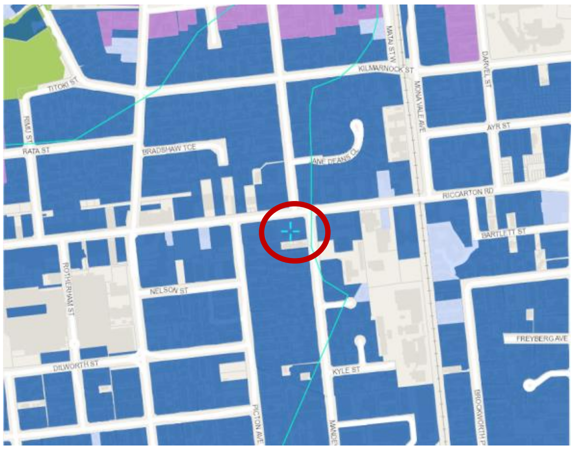
St James Church



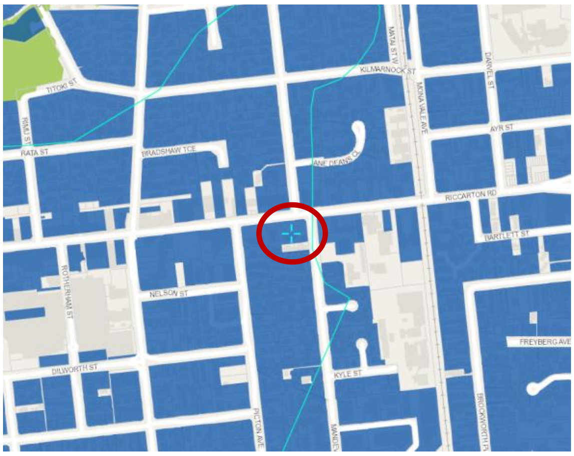
February 2010



February 2011



June 2011



December 2011

[1] https://apps.canterburymaps.govt.nz/ChristchurchLiquefactionViewer/

Observed lateral spreading in Christchurch urban areas during the Canterbury Earthquakes[2]

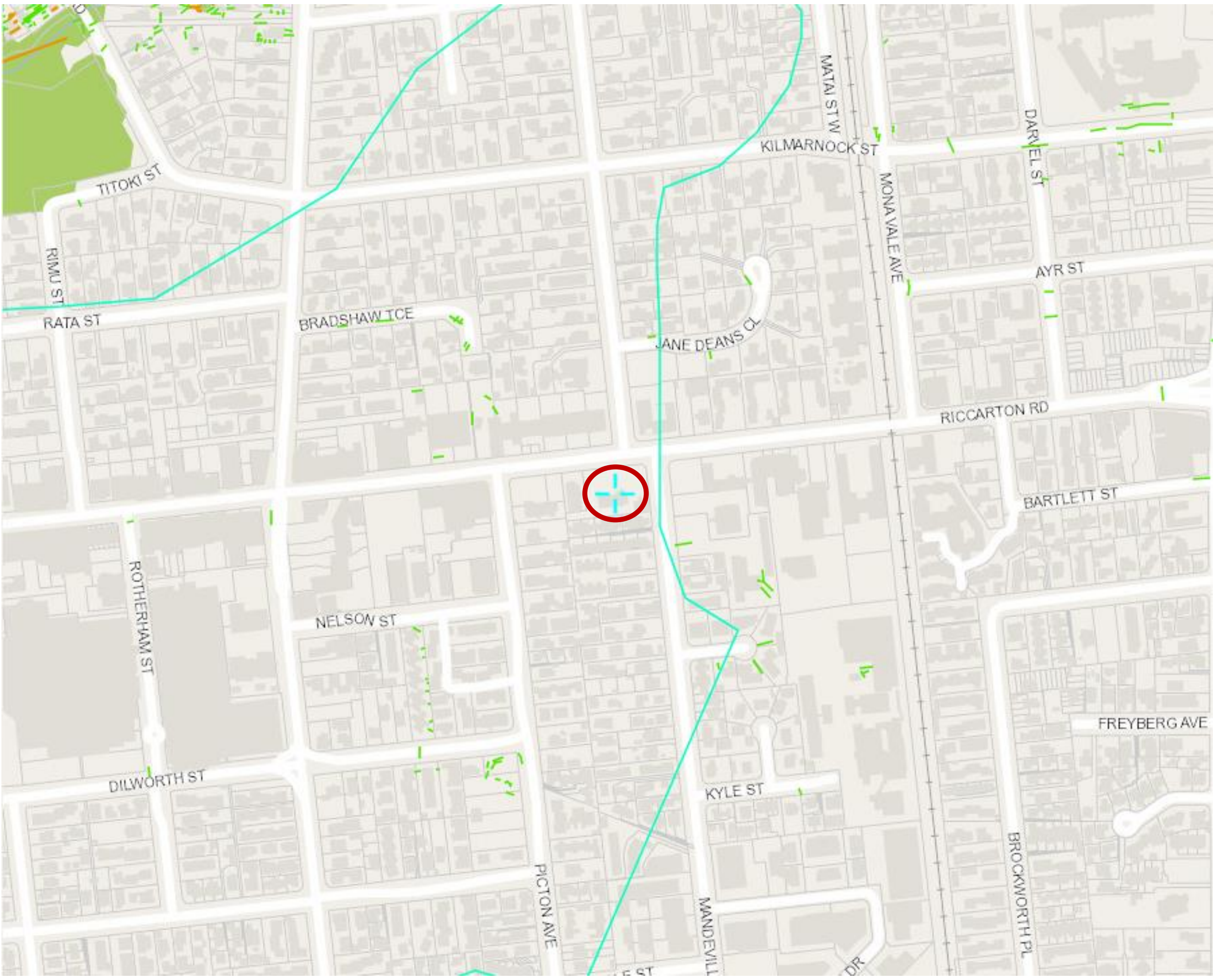
Map Legend:

Mapped ground cracks

- Crack width less than 50mm
- Crack width more than 50mm
- Crack width not recorded

St James Church

The following maps confirm that significant ground movements were observed at the site following the Canterbury Earthquake Sequence.

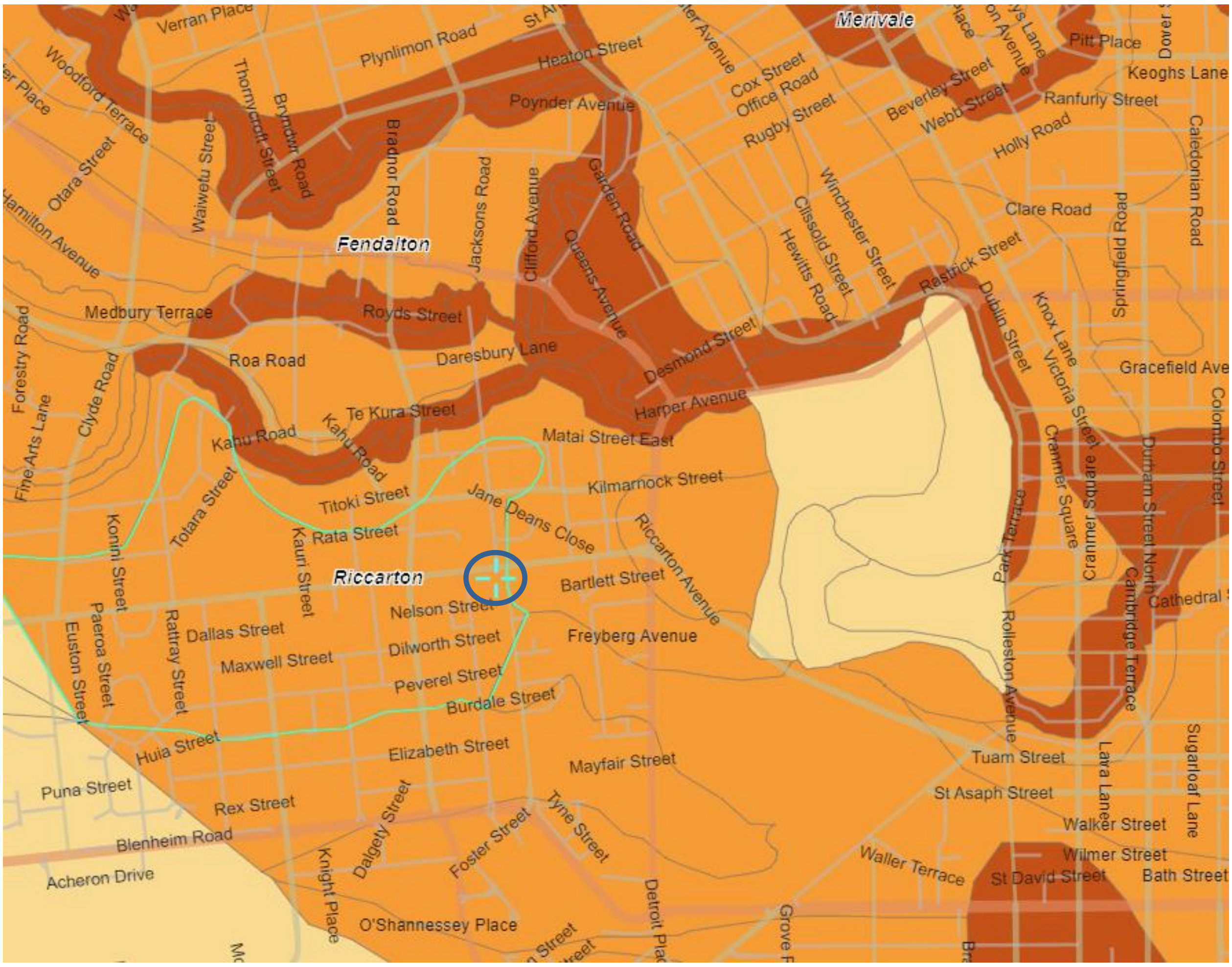


[2] https://apps.canterburymaps.govt.nz/ChristchurchLiquefactionViewer/

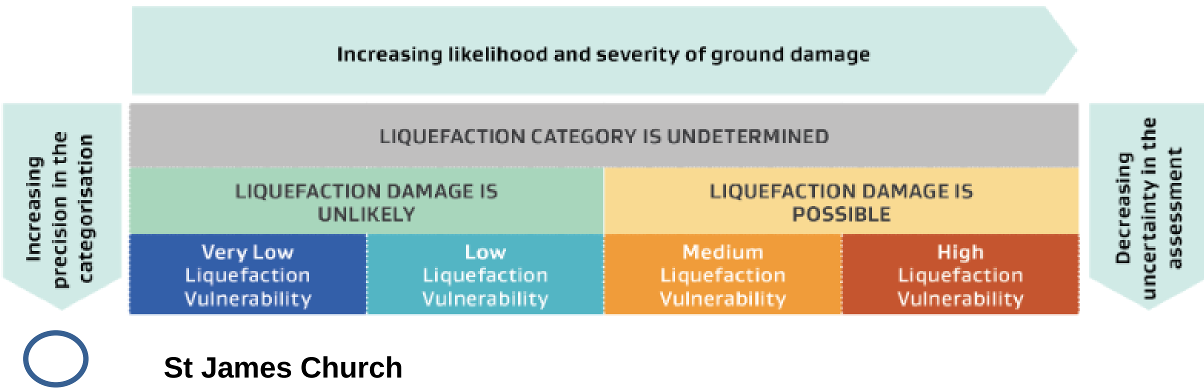
Liquefaction Vulnerability[3]

Based on the information provided by the CCC regarding the liquefaction hazard in Christchurch City, St James Church is located in an area where liquefaction vulnerability is currently considered “Medium”. The contours of this area has been defined considering the ground investigation data available on the New Zeland Geotechnical Database at discrete locations within the Christchurch city arban area.

As mentioned in the Canterbury Map website, when more detailed information becomes available (e.g. new ground investigations), the liquefaction assessment can be reviewed to show the actual vulnerability expected at the site. New ground investigations at St James Church may therefore prove that the liquefaction vulnerability is low at this site and liquefaction damage is unlikely.



Map Legend



St James Church

[3] https://apps.canterburymaps.govt.nz/ChristchurchLiquefactionViewer/

St John the Baptist Church (324 Hereford Street, Christchurch).

Fig 1. West gable end
- External View - .
Out-of-Plane (partial) local failure of the gable end masonry wall. In this case, the installation of the external temporary securing works (steel frame strutting) was not sufficient to prevent further damage to the structure during the 22 February 2011.

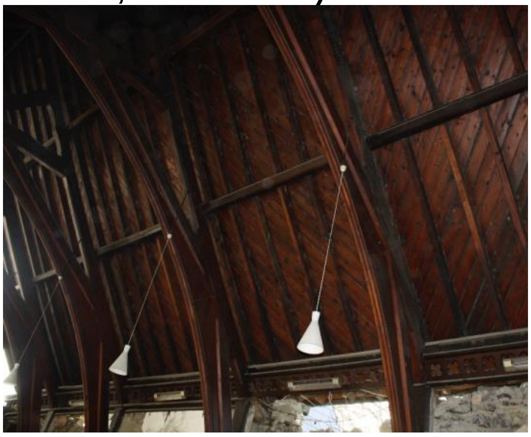


Fig 2. Church Roof Structure
- Internal View-.
Minor to negligible damage to the roof timber structure following the 4th of September 2010 and the 22nd of February 2011 earthquakes.

Fig 3. Church North- West Corner
- Internal View -.
Out-of-Plane (partial) local failure of the West gable end masonry wall. In the picture it is also possible to observe, the material failure of the stone masonry installed at the building south-west corner.

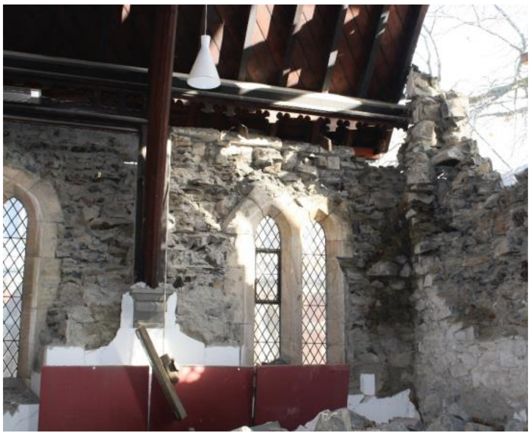


Fig 4. Church South-West Corner
- Internal View-.
Out-of-Plane (partial) local failure of the West gable end masonry wall. In the picture it is also possible to observe, the material failure of the stone masonry installed at the building south-west corner.

Fig 5. Church Nave (Sorth side)
- Internal View -.
Out-of-Plane local failure of the masonry spandrel above nave window. Material failure of the pier internal layer.

Fig 6. Church Nave (Sorth side)
- Internal View -.
Out-of-Plane local failure of the masonry spandrel above nave window. Material failure of the pier internal layer.

St James Church (65 Riccarton Road, Christchurch).

Fig 1. East gable end
- External View -
No local or partial collapse of the East gable end wall occurred following the Canterbury Earthquake Sequence or successive high-magnitude earthquakes.

Fig 2. West gable end
- External View -
No local or partial collapse of the West gable end wall occurred following the Canterbury Earthquake Sequence or successive high-magnitude earthquakes.

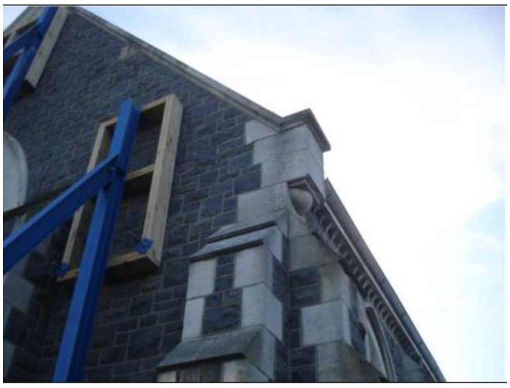


Fig 3. West Gable End
- External View -.

Damage consists of minor cracking of the mortar joints at eave level only.

Pictures from the 2011 Aurecon Report titled "*Strength and Repair Assessment for Godfrey & Company*"

Fig 4. West Gable End
- Internal View-.
Damage consists of minor cracking of the mortar joints at eave level and localised damage of the internal plaster.

Pictures from the 2011 Aurecon Report titled "*Strength and Repair Assessment for Godfrey & Company*"

Fig 5. Church Nave (Sorth side)
- Internal View -.
No local or partial collapse of the wall spandrels occurred following the Canterbury Earthquake Sequence or successive high-magnitude earthquakes..

Pictures from the 2011 Aurecon Report titled "*Strength and Repair Assessment for Godfrey & Company*"

Fig 6. East Gable End
- Internal View-.
Damage consists of minor cracking of the mortar joints at eave level only.

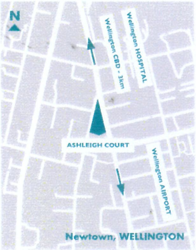
Pictures from the 2011 Aurecon Report titled "*Strength and Repair Assessment for Godfrey & Company*"

ASHLEIGH COURT

PRIVATE HOTEL

112-126 Riddiford Street & 1-3 Rintoul Street, Newtown, Wellington, NZ
Completed October 2020

Engineers: WIN CLARK & DIZHUR Consulting



Physical context & risk to public

Iconic masonry building with a distinctive triangular shape located at an intersection of one of the main arterial roads in Wellington, just outside the Wellington Regional Hospital and on the way to the International Airport.

The iconic Ashleigh Court building is a three-storey unreinforced clay-brick masonry Category 1 Heritage building built in 1907 as a private hotel with stores at the ground level. The architectural intrigue of this wedge-shaped building is obtained from its intricate Palladian neoclassical style: a particular Edwardian style typically reserved for public buildings, and similar to that used for the Wellington Town Hall. Along with its intact array of parapets and pediments and the stained-glass edging to the verandah, these qualities make it one of the most recognisable buildings in Newtown. Its prime corner location makes the building arguably the most important visual anchor in the Newtown Central Heritage Area.

Despite undergoing localised seismic retrofit in 1997, at least three structural engineering assessments commissioned since 2012 for the building declared it unsafe, with outcomes that ranged from suggesting full demolition to major earthquake retrofit work that would cost over NZ$2.1 million (approx. 60% of total building market value). The earthquake risk was exacerbated following the 2016 Kaikōura earthquakes when national experts predicted an increase in the likelihood of another earthquake occurring in the Wellington area. All owners of URM buildings in the nearby areas were notified and were required to secure street-facing parapets and facades on their buildings within 12 months. The Ashleigh Court building, with its street-facing URM parapets and facades on busy thoroughfares, therefore presented significant risks to life safety.

PROJECT APPROACH

Our team members are dedicated to the mitigation of earthquake risks for large-scale buildings and heritage structures. Being leaders in devising innovative stability-testing methods to simulate earthquake loads, as well as driving new thinking towards optimising solutions, we were approached to tackle this project. With a scarce budget and limited time frame due to elevated seismicity and government pressure for action, our team embarked on a major challenge to devise a cost-effective and heritage friendly solution. We engaged in state-of-the-art masonry modelling and retrofit design as well as using innovative in-house developed retrofit techniques. We performed detailed on-site investigation and material characterisation, which helped to tailor the seismic design and retrofit intervention. The building response due to earthquake loading was investigated using a Finite Element Model (FEM) and subjected to non-linear static analysis (pushover) and non-linear dynamic analysis (time-history). We wrestled night and day to make the complicated FEM analysis converge and provide outputs. The in-plane response of the building was evaluated based on force and displacement-based approaches, while the out-of-plane response was evaluated using the inelastic displacement-based approach. The building did not meet the minimum 34% New Building Standard (NBS) design level defined by New Zealand regulations and hence was deemed earthquake prone.

NSM-CFRP strips added to interior partition walls

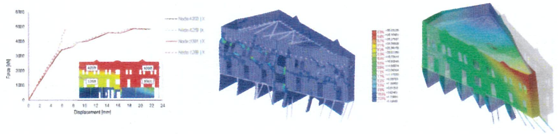
Steel frame at slender-most section of building

Steel elements added to brace parapets

New timber bracing installed inside roof to support parapet bracing

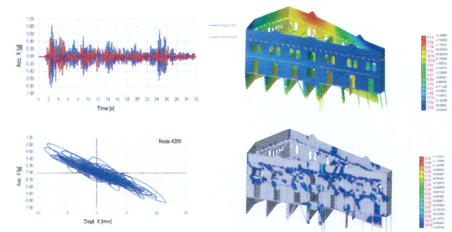
Timber strong-backs added to perimeter URM walls

FINITE ELEMENT MODEL (FEM) SUBJECTED TO PUSHOVER ANALYSES **(as-built)**

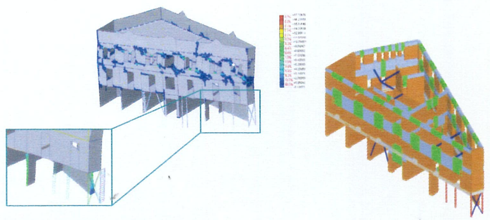


FINITE ELEMENT MODEL (FEM) SUBJECTED TO TIME HISTORY ANALYSIS **(as-built)**

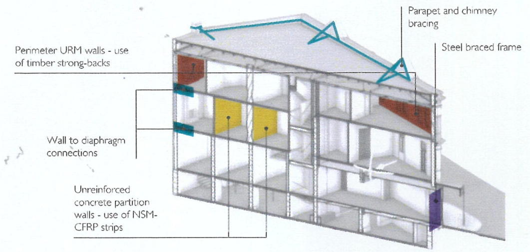
El Centro, Imperial Valley (USA) - 1940. Principal earthquake direction: X (IVX). Control Node: 4200.
Acceleration vs. Displacement



FINITE ELEMENT MODEL (FEM) RESPONSE **(after proposed retrofit)**



STRENGTHENING PHILOSOPHY TO REACH **67% NBS**



STRENGTHENING PHILOSOPHY

The existing structure was utilised as much as possible during the strengthening design process. Testing of in-situ materials and of existing anchors and investigation of the existing retrofit undertaken in 1997 (which included the use of post-tensioning of a cross-wall) was undertaken. The building's geometry and its location created additional obstacles in our path. For example, the design accelerations at the upper level of the building were over 2.0g magnitude, due to amplification and Wellington's high seismicity. We identified and tested innovative solutions, such as the use of near-surface-mounted (NSM) carbon fibre reinforced polymer (CFRP) strips measuring 1.2 mm x 15 mm, spaced at 600 mm centres for the slender partition walls on the upper floors. The upper perimeter walls were retrofitted using regularly placed vertical laminated veneer lumber (LVL) timber strong-backs interconnected with masonry using double threaded mechanical screws specifically designed for seismic application into URM. These solutions allowed the heritage value of the facades and interior spaces to be virtually unaffected by the retrofit. The innovative double threaded screws assisted in reducing installation time and overall cost, and to increase the quality of the structural connection.

The torsional response of the ground floor (due to the building's triangular footprint) was addressed by adding a slender steel braced frame carefully positioned in the slender-most portion of the building front.

In best practice, Wellington City Council requested a technical peer-review. Due to the sophistication of the analysis in involving a nonlinear time history of a complex building, we looked overseas. Following a challenging exercise, the peer-reviewers completed supplementary analysis and were satisfied with the outputs from our FEM models.

The retrofit implementation was organised in two stages: (1) address the immediate 12 month requirement set by the government to secure the parapets and façade, (2) retrofit the building to achieve 67% NBS. Both stages have now been completed. The total cost of the Stage 1 retrofit work was approximately NZ$240,000. The cost for Stage 2 was approximately a further NZ$500,000. This retrofit project was partially funded by the New Zealand government under the Built Heritage Incentive Fund of NZ$72,000 and Heritage EQUIP Fund of NZ$183,171, with the balance being funded privately by the building owners. The cost of upgrading the building was NZ$1.4 million less than that originally estimated due to the smart use of existing building fabric, and the application of 'simple' in-house solutions derived from the exceptional hard work of our dedicated team.

KEY ASPECTS LEADING TO PROJECT SUCCESS

- Close involvement and early discussions with all stakeholders.
- Close consultations with heritage experts and involvement of wider community.
- Involvement of contractor at concept design stage.
- Material testing and detailed on-site investigation early in the project to guide retrofit design.
- Working closely with contractor to identify construction, constructibility and implementation issues before they emerged.
- Agile provision of design modifications and remedial solutions as work progressed.
- Close on-site supervision by designer and strict quality control on-site.
- Building remained fully operational during the retrofit implementation. The apartments on the first floor remained occupied during retrofit work.
- Works are now completed, shops still operational and apartments are occupied.

Our success lay in a strong understanding of the building and of its seismic performance, combined with the use of innovative and cutting-edge in-house developed strengthening solutions and methodologies. These were tempered by the desire to preserve the building's appearance and appeal. Due to this, the Ashleigh Court building will be enjoyed by many future generations.

DIZHUR