Canterbury Earthquakes Royal Commission
Te Komihana Rūwhenua a te Karauna

9 November 2011

Beca Carter Hollings & Ferner
Structural Engineers
410 Colombo Street
CHRISTCHURCH 8011

Attention: Mr Mark Humphery
Senior Structural Engineer

By Email: mark.humphery@beca.com

Dear Mr Humphery

617-625 Colombo St

The Royal Commission is inquiring into the building failure of the building that was located at 617-625 Colombo St, in particular 625 Colombo St, the failure of which resulted in the death of a pedestrian.

We have obtained the Christchurch City Council file on the building. We have also received from the owners' representative Mr D Ehlers, copies of reports by your firm dated 10 December 2010 and 26 May 2011.

The hearing for this building is set down for Tuesday 13 December 2011 at 2.15pm. It will be necessary for you to attend and give brief evidence of your involvement with the building.

For that purpose I **enclose** a letter and summons. If you have any questions in relation to this please contact the writer (phone: 741-3014, email: mark.zarifeh@royalcommission.govt.nz)

In the meantime would you please provide an outline of your involvement with the building by **18 November** 2011, which outline should include:

1. Your full name, qualifications and years of experience.

2. Details of the instructions you received in relation to the building ie. what you were asked to do.

3. Copies of any advice you gave in addition to that contained in the two reports referred to above.

4. Details of any verbal advice or discussions you had with anyone in relation to the building's structural integrity.

5. An issue which the Commission will have to consider in relation to the building (and all URM buildings) is the standard applied in assessing the building post the September earthquake.

   (a) Please comment on the standard you applied in your assessment, in particular whether you took into account the likelihood of a significant aftershock and the effect that might have on the structural integrity of the building.

   (b) How your finding that the building had lateral load capacity of 11% NBS related to the issue of whether the building was safe to occupy or safe to the public.

6. In paragraph 7.2 of your report of 10 December 2010 you recommended repairs "essential to ensure the operation and immediate safety of the buildings and their occupants"

   (a) What were these?

   (b) Do you know if they were carried out and it so, when?

   (c) How was the safety of the occupants at risk without the repairs having been completed?

   (d) Do you know if the recommendation in paragraph 7.1 – to stabilise the parapets of 143 Tuam Street for public safety purposes was carried out and, if so, when?

7. You noted in paragraph 7.2 that: "to determine the full extent of the building damage, areas that could not readily be accessed and areas where the structure was covered should be opened up to allow full inspection and assessment".

   (a) Do you know if this was done and, if so, when?

   (b) Did the fact there were areas you could not access affect your ability to come to conclusions as to the safety to occupy? Please explain.

8. Any comment you can make as to why 623 and 625 appear to have been much more extensively damaged than the other two addresses 617 Colombo St and 143 Tuam St.

9. Did your firm carry out any inspection/assessment of the building after the aftershock on 26 December 2010? If so, please advise details.

10. Apart from reporting to the owners of the building, did you have any contact with the Council in relation to your assessments of the building? If so, please advise details.

11. Any other relevant comments you wish to make.

The above information is requested pursuant to the Royal Commission's powers of investigation under s 4C Commissions of Inquiry Act 1908.

Thank you for your assistance.

Yours faithfully

Mark Zarifeh
Counsel Assisting
Canterbury Earthquakes Royal Commission

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Canterbury Earthquakes Royal Commission
PO Box 14053
CHRISTCHURCH MAIL CENTRE

25 November 2011

Attention: Counsel Assisting: Mark Zarifeh

Dear Mark,

Canterbury Earthquakes Royal Commission: 617-625 Colombo Street, Christchurch

Further to your letter of 9 November 2011 advising that you require further information, please find our response to your queries as follows. At the time of issuing this letter, we have managed to make brief contact with Mark Humphery (yesterday). Accordingly, although we have obtained Mark's initial input into the answers below, Mark still has to review the file and so may wish to provide additional comments next week. In the meantime, he understands he has been summoned and has initially indicated he is available on the hearing date. However, for the reasons given in Mr Parmenter's letter to you and given that Mark is not at the level of seniority that we would normally nominate for a person to attend Court and speak to a Beca report, we would like you to consider our suggestion that an Associate Director (Structural Engineering), Jonathan Barnett, give evidence instead. Mr Barnett reviewed Mark's report during its preparation and would be able to speak to the content of the report and Beca's approach, Although Mr Barnett did not visit the buildings, we trust that the responses below answer satisfactorily the Commission's questions that relate to building visits. Of course, if the answers are inadequate for your purposes, we would appreciate you considering having both Mr Humphery and Mr Barnett attend the hearing, with Mr Barnett to answer most of the questions and Mr Humphery to answer any specific questions relating to site visits

1. *Your full name, qualifications and years of experience.*

   While Mark Humphery prepared the report, it was reviewed by Jonathan Barnett (an Associate Director Structural Engineering) and approved by Samir Govind (a Technical Director for structural engineering). Their respective details are:

   Jonathan Barnett MEng (Hons), MIPENZ, CPEng, IntPE

   Member, Institution of Professional Engineers New Zealand
   Member, New Zealand Institute of Building
   16 years' experience

   Samir Govind ME, MIPENZ, CPEng

   Member, Institution of Professional Engineers New Zealand
   Member, New Zealand Institute of Building
   Board member of Association of Consulting Engineers New Zealand
   15 years' experience

   Mark T Humphery BEng (Hons), MIStructE, CEng

   Member, Institute of Structural Engineers
   Member, Engineering Council UK

Member, Structural Engineering Society New Zealand
13 years' experience.

2. *Details of the instructions you received in relation to the building ie. what you were asked to do.*

   The buildings located at 617 to 625 Colombo Street and 143 Tuam Street are collectively known as The Best Little Law House. Beca were initially requested by Colliers International Property Management Ltd (Colliers) to conduct a visual inspection (Level 2 Rapid Assessments) of the Building at 143 Tuam Street (on 7 September 2010). Following a series of aftershocks, 143 Tuam Street was again inspected on 10 September 2010.

   On 15 September 2010, a visual inspection was undertaken for 625 Colombo Street. As a result of this inspection a Level 2 Rapid Assessment form was completed and submitted to CCC.

   Beca were then engaged by Best Little Law House Ltd, to undertake a more thorough survey of the building damage, and to complete a preliminary assessment of the lateral load capacity of the existing building. Our report extended to an outline description of recommended remedial works. Refer enclosed report entitled "617-625 Colombo Street & 143 Tuam Street (Best Little Law House) Detailed Structural Evaluation" dated 10 December 2010.

   Beca were asked verbally by Colliers on 25 January 2011 to undertake a further visual inspection of the building following the 26 December 2010 aftershock.

   Following the 22 February 2011 earthquake and subsequent aftershocks, Beca were requested to undertake further inspections and an initial structural damage assessment on 2 May 2011. The findings of this assessment are set out in our report dated 6 May 2011 (copy attached).

   All requests and instructions relating to this building were by Colliers who were acting for the building owner.

3. *Copies of any advice you gave in addition to that contained in the two reports referred to above.*

   Refer attached parapet restraint sketch details dated 3 February 2011.

4. *Details of any verbal advice or discussions that you had with anyone in relation to the building's structural integrity.*

   Immediately following the issue of the temporary parapet restraint details for 143 Tuam Street, we highlighted that this was a temporary safety measure and reiterated the need for a full building assessment and that a fully engineered solution for strengthening the external masonry (and the rest of the building structure) should be undertaken as soon as possible.

5. *An issue which the Commission will have to consider in relation to the building (and all URM buildings) is the standard applied in assessing the building post the September earthquake.*

   (a) Please comment on the standard you applied in your assessment, in particular whether you took into account the likelihood of a significant aftershock and the effect that might have on the structural integrity of the building.

The standard that was applied to the initial Level 2 Rapid assessments undertaken in September was the "Building Safety Evaluation During a State of Emergency Guidelines for Territorial Authorities" prepared by the New Zealand Society of Earthquake Engineering with support from the Department of Building and Housing and the Ministry of Civil Defence and Emergency Management. The Building Safety Evaluation Notices were issued by CCC under the Civil Defence and Emergency Management Act.

Our assessment of the expected seismic performance of the building structure followed the Initial Evaluation Procedure set out in the NZ Society for Earthquake Engineering publication titled "Assessment and Improvement of the Structural Performance of Buildings in Earthquakes", dated June 2006.

In section 7.1 we describe how the building has been weakened and note that "this has the potential to cause structural failure of the building in a significant future earthquake". In terms of more immediate aftershocks, we were generally aware that aftershocks are likely to follow an earthquake event (albeit with an expectation subsequent aftershocks normally reduce in size and frequency), and our advice concerning further investigations, recommendations and interim securing works was given with a view to rectifying damage and mitigating localised hazards arising from the earthquake-induced damage. The nature of this work was confined to restoring the building as near as practicable to its pre-Sept 2010 earthquake condition.

(b) *How your finding that the building has a lateral load capacity of 11% NBS related to the issue of whether the building was safe to occupy or safe to the public.*

It is important to note that the CCC policy in operation at the time was largely concerned with identifying and addressing damage levels (ie: what impact any damage may have had on the underlying strength of the building) rather than the estimated lateral load resistance of buildings (ie: what the strength of the building was prior to the earthquake, which may well have been low). For example, the placard system is primarily concerned with observed damage rather than assessed lateral load capacity.

While all work regarding damage and load capacities of buildings is ultimately concerned with safety, we did not specifically advise the owner on whether the building was 'safe', which is a subjective term, but rather identified what impact damage may have had on the underlying strength of the building, whether their building was considered to be earthquake prone, and what their obligations were concerning CCC approvals, etc. such that they could make informed decisions regarding their building. We did advise on immediate safety concerns associated with unstable elements of the building (eg: 143 Tuam Street parapets).

Our report of 10 December 2010 stated the building had both sustained damage and was considered potentially earthquake prone. The levels of damage observed were such that, subject to interim securing and implementation of repairs within a reasonable timeframe, the relative risk to the occupants was not considered to be substantially increased from that which existed prior to the 4 September earthquake.

In our report we noted the IEP indicated an estimated lateral load capacity of 11%*NBS*. Given this was less than 33%*NBS* we noted the building was considered to be potentially earthquake prone, with a requirement to bring the building up to a higher standard. Our report went on to recommend the building owner engage with CCC concerning Building

Consent requirements for repairs (and the likely requirement to strengthen the building). Our report included a copy of the CCC earthquake prone building policy published mid-September 2010 which stated their objective was to strengthen buildings that had sustained damage to 67%NBS.

6. *In paragraph 7.2 of your report of 10 December 2010 you recommended repairs 'essential to ensure the operation and immediate safety of the buildings and their occupants'.*

   (a) What were these?

   Subparagraphs 7.2.1 to 7.2.4 identify various structural repairs that were recommended to be undertaken in the short term. In the majority of cases it was noted that further investigation would be required to develop the inputs required to permit construction details of the repairs to be implemented.

   We also noted that attention should be given to stabilising the parapets of 143 Tuam Street for public safety purposes.

   (b) Do you know if they were carried out and if so, when?

   We possess photographic evidence the temporary restraint to the parapets of 143 Tuam Street was implemented – and proved effective in the 22 February earthquake. Refer attached photographs.

   To our knowledge there were no structural repairs or strengthening undertaken to the remaining buildings.

   (c) How was the safety of the occupants at risk without the repairs having been completed?

   Section 7.1 of our December 2010 report details that: "The damage noted in this report has reduced the ultimate limit state strength of the structural load resisting systems of the buildings' structure …

   … This has the potential to cause structural failure of the building in a significant future earthquake.

   …

   With regard to the low result of the Initial Evaluation Procedure assessment, any earthquake damage repairs carried out to the buildings will still not bring them in line with the latest Building Standard or the Christchurch City Councils earthquake prone buildings policy. Unless specifically designed structural repairs carried out to bring the building back to its pre-earthquake condition, the seismic capacity of the buildings would likely to be lower than the current IEP suggests.

   …

   As outlined in Section 6 of this report, it is prudent to initially involve the Council in dialogue to determine the most suitable course of action for these buildings.

   …

In the short term, the damaged elements of the building should be repaired in order to restore the building, to as near as possible, its pre-earthquake condition to prevent the propagation of damage and for aesthetic purposes. We do not consider the earthquake damage to the buildings to be so significant as to pose a danger to the buildings general stability, however attention should be given to stabilising the parapets of 143 Tuam Street for public safety purposes.

...

In the medium term, we recommend that the buildings should be fully assessed and strengthened as required to bring them in line with the current Christchurch City Council Policy. The extent of the strengthening should be agreed with the Council prior to any design being undertaken. The strengthening work is likely required to be completed by 3 September 2013. "

(d) *Do you know if the recommendation in paragraph 7.1 – to stabilise the parapets of 143 Tuam Street for public safety purposes was carried out and, if so, when?*

See answer to question 6(b) above.

7. *You noted in paragraph 7.2 that: 'to determine the full extent of the building damage, areas that could not readily be accessed and areas where the structure was covered should be opened up to allow full inspection and assessment.'*

(a) *Do you know if this was done and, if so, when?*

We were not instructed to undertake this inspection.

(b) *Did the fact that there were areas you could not access affect your ability to come to conclusions as to the safety to occupy? Please explain.*

The form of construction of the building lateral load resisting system (ie: unreinforced masonry walls) was such that the primary structural elements are largely visible and were able to be inspected following the 4 September earthquake.

In accordance with the standard Christchurch EQ RAPID Assessment Form – Level 2, the placard status was predominantly based upon the extent of damage sustained by the building (based upon visual observation only). The form documenting our inspection of 15 September 2010, notes the level of damage as 2-10%. Accordingly, the building was assigned a usability category of "G2 – Occupiable, repairs required".

Our report notes that further inspection was appropriate to identify the full extent of damage. This was primarily for the purposes of effecting comprehensive repairs. For the reasons noted above, at the time it was not considered that further inspection was likely to have a substantial impact upon the usability category assigned to the building.

8. *Any comment you can make as to why 623 and 625 appear to have been much more extensively damaged than the other two addresses 617 Colombo St and 143 Tuam St.*

We were able to retrieve some drawings of the building from the CCC archives to assist with the main report. These were generally of an architectural nature and included some details of the strengthening work undertaken in the 1990's. There is evidence to suggest they have

been modified over time. It is possible these alterations have exacerbated the performance of 625 Colombo Street, and enhanced the performance of 617 Colombo Street and 143 Tuam Street.

What is known, is that the shaking associated with the earthquake on 22 February was more intense in the east-west direction and essentially orthogonal to that of the 4 September earthquake. The configuration and orientation of 625 Colombo Street is such that the front façade is subject to face-loading from shaking in the east-west direction. This, coupled with the fact there is likely to be minimal connection between the first floor and the front façade, will have contributed to the failure of the front wall in the 22 February event. Following the February 2011 earthquake we were able to access 143 Tuam Street for a Level 2 assessment. Access to the other buildings was not possible due to their damage.

9. *Did your firm carry out any inspection/assessment of the building after the aftershock on 26 December 2010? If so, please advise details.*

   Yes. We were requested by Colliers to undertake a visual inspection of 143 Tuam Street on 25 January 2011 this revealed no further damage to the building in general, however the cracking to the parapets of 143 Tuam Street had worsened. A closer external inspection using a hydraulic lift was undertaken and temporary restraint details for these parapets were then detailed and issued on 3 February 2011. These were installed soon after.

10. Apart *from reporting to the owners of the building, did you have any contact with the Council in relation to your assessments of the building? If so, please advise details.*

    The Level 2 Rapid Assessments undertaken in September 2010 were hand delivered to Christchurch City Council in order for them to undertake the issuing of the building safety evaluation notices. The December 2010 report was delivered by hand to and discussed with Colliers, the owner's property managers, but Beca had no contact with the Council

11. *Any other relevant comments you wish to make.*

    No.

We trust that we have interpreted your request correctly.

Yours sincerely

Jonathan Barnett
Associate – Structural Engineering

on behalf of
Beca Carter Hollings & Ferner Ltd
Direct Dial: +64 3 471 7490
Email: jonathan.barnett@beca.com

Encl.

1. 617 – 625 Colombo Street & 143 Tuam Street (Best Little Law House) Detailed Structural Evaluation report dated 10 December 2010.
2. 143 Tuam Street & 617-625 Colombo Street – Preliminary Structural Damage Assessment, letter dated 6 May 2011.
3. 143 Tuam Street interim restraint sketch details dated 3 February 2011.
4. Photographs of 143 Tuam Street parapet interim restraint installation.

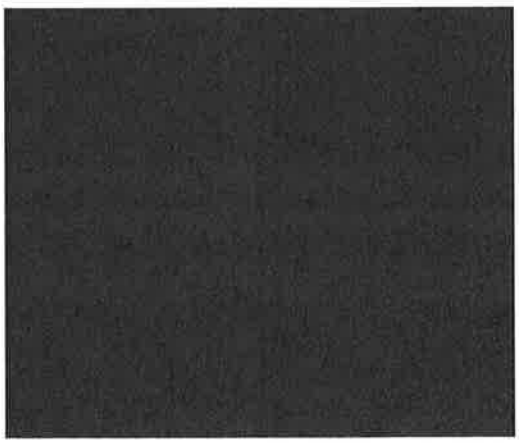
Report

617-625 Colombo Street & 143 Tuam Street (Best Little Law House) Detailed Structural Evaluation

Prepared for Best Little Law House Ltd

By Beca Carter Hollings & Ferner Ltd (Beca)

10 December 2010



Revision History

Revision N°	Prepared By	Description	Date
A	Mark Humphery	Final Issue	10/12/2010

Document Acceptance

Action	Name	Signed	Date
Prepared by	Mark Humphery		10/12/2010
Reviewed by	Jonathan Barnett		10/12/2010
Approved by	Samir Govind		10/12/2010
on behalf of	Beca Carter Hollings & Ferner Ltd		

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Appendices

0 Executive Summary

In line with the Christchurch City Council's Earthquake Prone Buildings Policy Draft Notes (refer to Appendix D) this Detailed Engineering Evaluation Report has been prepared under the direction of a Chartered Professional Engineer (Structural) and summarises the following information:

- ☑ *The principal lateral and vertical load resisting systems*
- ☑ *The principal structural damage sustained*
- ☑ *The estimated level of lateral load resistance of the overall structure in its current form*
- ☑ *What will be the overall philosophy of how the building can be brought up to meet the 67% NBS objective, including proposed changes lateral load paths*
- ☑ *The specific structural repairs proposed*
- ☑ *Prioritisation if it is to be staged in any way*
- ☑ *Sketch (at least) plans for any proposed retrofit*
- ☑ *For Heritage Buildings a more detailed level of reporting will be required*

These two storey buildings are of varying dates of construction from the 1950's and have undergone various modifications throughout their history. Generally they are of unreinforced masonry construction with timber first floors and trussed roofs. Some of the buildings have cast iron internal structural columns and beams supporting the first floor. They have been connected together in their past and now behave as one structural unit. In 1994 the buildings were refurbished and seismically strengthened to meet the performance requirements of that time.

The buildings have suffered some earthquake related damage. This comprises damage to unreinforced masonry party walls, damage to reinforced blockwork walls and damage to masonry parapets.

Immediately following the earthquake these buildings were inspected for a Level 2 Assessment and a Green (G2) placard was posted.

The buildings do not pose an immediate risk to their occupants, however repairs will be required to the damaged walls and to prevent further collapse of the masonry parapets.

Preliminary Assessment of Existing Lateral Load Capacity using the Initial Evaluation Procedure (IEP) has been undertaken. The IEP is an approximate estimation of the seismic capacity of a building. The IEP of the building, in its current form, has resulted in an estimate of lateral load capacity of **11%*NBS***.

These building are therefore considered to be earthquake prone. Since the estimated level of lateral load resistance of the overall structure in its current form is <33%*NBS* there is a requirement to bring the building up to a higher standard.

The buildings **do not** have a heritage listing in the Christchurch City Plan and the properties **are not** listed by the New Zealand Historic Places Trust.

The Schedule 1 of the Building Act 2004 states "*a building consent is not required for any lawful repair and maintenance using comparable materials, or replacement with a comparable component or assembly in the same position, of any component or assembly incorporated or associated with a building*", refer to Appendix E for a detailed summary of the Building Act in relation to earthquake works.

These buildings are considered to be earthquake prone and, in accordance with CCC Earthquake Prone, Dangerous and Insanitary Buildings Policy 2010, applications for Building Consent will be required for repairs. However this should be confirmed through discussions with CCC.

With regard to the low result of the Initial Evaluation Procedure assessment, any earthquake damage repairs carried out to the buildings will not bring them in line with the latest Building Standard or the Christchurch City Councils earthquake prone buildings policy. In summary, the factors influencing the current and future structural repairs and performance of the buildings are as follows:

- The earthquake damage to the buildings primary lateral loadbearing elements
- The magnitude and nature of repairs required to the remediate the earthquake damage
- The buildings are potentially "earthquake prone"

As outlined in Section 6 of this report, it is prudent to initially involve the Council in dialogue to determine the most suitable course of action for these buildings.

This summary is a limited précis of our observations and conclusions. Where any question arises as to the scope of the assessment undertaken by us, or the interpretation of this summary, the full report should be reviewed, or Beca Carter Hollings & Ferner Ltd consulted.

1 Introduction

1.1 Background

Beca Carter Hollings and Ferner Ltd (Beca) have been engaged by The Best Little Law House Ltd to undertake a post-earthquake structural assessment for 617-625 Colombo Street & 143 Tuam Street, Christchurch also known as "The Best Little Law House Ltd". This assessment follows the Christchurch earthquake on 4 September 2010 and subsequent aftershocks. The initial earthquake was of significant magnitude measuring 7.1 on the Richter Scale, and resulted in widespread damage to buildings and infrastructure.

Immediately after the earthquake a Level 1 Rapid Assessment of all buildings in the Central Business District (CBD) was completed by Christchurch City Council's (CCC) Civil Defence emergency response team. These buildings received a GREEN (inspected) placard.

Authority for Territorial Authorities to undertake the activity of building safety evaluations during a state of emergency is generally provided for in the Civil Defence Emergency Management Act 2002 and the Building Act 2004 (refer Section Two). The Level 1 Rapid Assessments were prepared in accordance with guidelines prepared by the New Zealand Society for Earthquake Engineering (refer www.nzsee.org.nz) when the state of emergency was declared under the Civil Defence Emergency Act 2002. Level 1 inspections are intended to provide an initial evaluation of building safety for life safety and access purposes and assessments are generally based on an exterior inspection only. The more considered Level 2 Rapid Assessments generally follow, based on internal and external inspections in order to confirm or revise the Level 1 assessment. These assessments may be carried out by the Civil Defence emergency response team or suitably qualified engineers engaged by a building owner.

On 7 September 2010, Beca received a request from Colliers International Property Management Ltd (Colliers) to conduct a visual inspection of the building at 143 Tuam Street. As a result of this inspection, a Level 2 Rapid Assessment form was completed by Beca and submitted to CCC. A copy of the Level 2 Rapid Assessment for this property is provided in Appendix B. The Level 2 Rapid Assessment was delivered to the Civil Defence emergency response team and resulted in the posting of a GREEN G2 (Occupiable, repairs required) placard. The assessment listed a number of observed hazards/damage including minor cracking to an external concrete beam, superficial cracking to some internal partition walls and cracking to the masonry parapets at the corners of the building.

On 10 September 2010, and following a number of large aftershocks, Colliers requested a re-inspection of the building. A second Level 2 Rapid Assessment form was completed by Beca, and this recommended the posting of a GREEN G2 (Occupiable, repairs required) placard. However, the isolation and repair to the damage to three of the corner parapets was recommended (by this time the South West corner parapet had collapsed.

On 15 September 2010, a visual inspection was undertaken for 625 Colombo Street. As a result of this inspection, a Level 2 Rapid Assessment form was completed by Beca and submitted to CCC. A copy of the Level 2 Rapid Assessment for this property is provided in Appendix B. The Level 2 Rapid Assessment was delivered to the Civil Defence emergency response team and resulted in the posting of a GREEN G2 (Occupiable, repairs required) placard. The assessment noted the observed hazards/damage being the cracking to the internal blockwork walls. A subsequent visit to inspect the party wall between 623/625 and 627 Colombo Street (from 627 side), revealed a number of cracks within the wall which were not evident from 623/625 Colombo Street. No cracking

was observed from ground floor level. The walls were lined with plasterboard lined stud and soundproofing material at first floor level preventing inspection of the masonry wall.

Typically, depending on the nature of any damage found during the Level 2 Rapid Assessment, buildings may require further more detailed engineering evaluations, and this is likely to involve more invasive inspections and/or destructive testing.

On the 13th September CCC provided some Draft Notes detailing the CCC's earthquake prone building policy and the process to be followed by Building Owners (Refer to Appendix D). The key points contained in the CCC's 13th September memo include:

- *Buildings that have sustained structural damage in the earthquake are to be assessed and strengthened to 67% of Full Code Level (FCL).* [67%*NBS* (New Build Standard)]
- *Detailed Engineering Evaluation Reports are to be provided by the Owner to the Council.*
- *Detailed Engineering Evaluation Reports can be submitted with a Building Consent application or as a draft to use as the basis for discussion with Council prior to the preparation of the Building Consent documentation.*

Since 4 September 2010, there have been a number of aftershocks. It is important to note that Beca carried out the building inspections on 7, 10 & 15 September 2010 with a follow up on the 2 November. Since that date there have been a number of smaller aftershocks of varying magnitude. No further inspections have been completed since this date. Any questions regarding this report's validity should be referred to Beca in the first instance.

1.2 Scope of Work

The purpose of this document is to serve as a record of the inspections undertaken, and to identify areas requiring remedial work. It may also be submitted to the Christchurch City Council as a basis for initial discussion prior to preparation of Building Consent documentation. A repair methodology is proposed for each typical defect in order to bring the building back to, or as near as reasonably practical to, the building condition prior to the earthquake event.

As stated in our commissioning letter with Colliers dated 27 September 2010, the specific Beca scope of work is as follows:

- Detailed structural inspections and a damage survey of structural elements for the building will be undertaken. Recommendations for destructive testing and/or repair may also be required.
- A review of the original construction drawings for the building will be conducted. The purpose of this review will be to identify concealed structural components of the building that may have suffered damage and therefore warrant inspection. In this review we will also look for evidence the original design adhered "in general terms" to good seismic design principles and detailing practice.
- A desktop assessment will be undertaken for the purposes of confirming an expected seismic performance level for the building relative to the current Loading Standard requirement for an equivalent new building at the site (AS/NZS 1170). In our assessment we will be reliant on the accuracy of the drawings provided. Assumptions will be made in respect of the geotechnical conditions at the site and any aspects or material properties not clear on the drawings. Where these assumptions are considered material to the outcome we will raise these with you and further investigations may be recommended. It is noted the assessment will not be exhaustive, our analysis and calculations will focus on representative areas only to determine the level of provision made. We have not allowed to undertake a comprehensive check and therefore any errors or inconsistencies in the design (albeit unlikely) may not be found. At this stage we have not allowed to undertake any checks of the gravity system, wind load capacity, or foundations.

- A report will be prepared upon completion of the above to serve as a record of the inspections undertaken, actions taken, assessment findings, test results, etc. We will include photos of the various areas of damage and repairs. It is envisaged this report will form the basis of any retrospective Building Consent application required to formalise the repairs with Christchurch City Council.

1.3 Limitations

The following limitations apply to this engagement:

- Beca and its employees and agents are not able to give any warranty or guarantee that all defects, damage, conditions or qualities have been identified.
- Beca liability for any loss, damage, costs, or claim arising due to, or in connection with the assessments and any related advice is limited to direct property damage and shall not exceed the fees rendered by Beca for this building assignment.
- The inspections will not cover building services or fire safety systems however such inspections and any advice on detailed repair or remedial work for these systems can be undertaken in association with other post disaster engineering advice at your request.
- The inspection of the glazing system, lifts, finishes, suspended ceilings, partitions, or the general water tightness envelope is excluded.

This report is of defined scope and is for reliance by The Best Little Law House Ltd only, and only for this commission. Beca should be consulted where any question regarding the interpretation or completeness of our inspection or reporting arises.

2 Building Description

2.1 Location

The subject building property of this report is 617-615 Colombo Street and 143 Tuam Street, Christchurch as indicated in the below figure.

These buildings are of varying dates of construction and have undergone various modifications in their history. They have been connected together in their past and now behave as one structural unit. In 1994 the buildings were refurbished and seismically strengthened to meet the performance requirements of that time.

Figure 2.1 – Building Location Plan

A description of the properties and their structural systems is given below, and for clarity are described as two separate buildings:

2.2 Property Description

Property Address: 617-625 Colombo Street and 143 Tuam Street, Christchurch
Legal description: LOT 3 & 4 DP13211

2.3 617-625 Colombo Street

These two storey buildings are of unreinforced masonry construction with timber floors and trussed rafter roofs. The ground floor level of 617 to 621 is currently occupied and used as a restaurant

(Sampan House). The upper floor of this building (numbered 623), is a separate property accessed by a stairway from Colombo Street and is currently used as a club (JJ Club). This property also extends over the top of number 625 on the ground floor. The ground floor of 625 Colombo Street is currently occupied and used as a restaurant (The Silk Road).

Original construction drawings of these properties could not be found, however it is assumed that the buildings were constructed pre 1950 as the oldest record information available was from 1958. Record drawings indicate that 617 Colombo Street was originally constructed separately from, and was independent to 619 next door. However due to later construction and alterations the building now share a common lateral restraint system.

Later record drawings obtained from the Council archive show that these buildings have undergone a number of alterations and modifications over time and have been seismically strengthened.

2.3.1 Gravity Load Resisting System

The gravity load resisting system comprises external and internal unreinforced masonry walls supporting a timber first floor. A pitched trussed timber roof spans onto the perimeter walls. The ground floor slab is concrete bearing directly onto the ground, however its thickness and the presences of reinforcement could not be confirmed.

The size, type and depth of the foundations could not be determined either, however they are assumed to be mass concrete or masonry strip footings below the loadbearing walls.

The shop frontages along Colombo and Tuam Streets are understood to have structural steel beam lintels over supported by a series of cast iron columns. The first floor of 617 Colombo Street is supported at mid-span by steel beams and columns.

2.3.2 Lateral Load Resisting System

The main lateral load (earthquake and wind load) resisting system of the building comprises unreinforced masonry walls acting in orthogonal directions. The roof and first floor structures provide a small degree of diaphragm action which ties the walls together and distributes the lateral forces to the walls.

Masonry party walls between properties provide lateral load resistance in the East/West direction, however due to open shop frontages the North/South lateral resistance is considerably lower.

The construction of additional internal walls and the strengthening of the floor and roof diaphragms were undertaken during a refurbishment in 1994, which is described in more detail later in this report.

2.3.3 Drawing Review

A Council archive search for documents relating to these buildings was undertaken, and produced a number of record drawings of past alterations. No drawings of the original buildings construction were present, however the more recent drawings and information discovered provide an insight into the buildings construction and structural behaviour.

2.3.4 Previous Structural Report & Seismic Strengthening

A "Preliminary Earthquake Report" dated 4 August 1994 by Powell Fenwick Consultants Ltd, was obtained from the Council Archives and describes seismic strengthening work carried out to these buildings around 1994. A copy of this report is in Appendix A.

As a result of the strengthening work, the Powel Fenwick report states that *"...provided that there was no change of use to a higher risk category, it would be satisfactory to remove hazards and ensure the buildings can withstand Earthquake forces relating to the seismic coefficient of 0.1g".*

The legislation at the time of this report for the seismic strength requirements of buildings was the Building Act of 1991. The Act stipulated that, *"...a building shall be deemed to be earthquake prone...if, having regard to its condition and to the ground on which it is built and because of its construction being either wholly or substantially of unreinforced concrete or unreinforced masonry, the building will have its ultimate load capacity exceeded in a moderate earthquake".*

A moderate earthquake is defined by the Act as, *"...an earthquake that would subject a building to seismic forces one-half as great as those specified in...NZS 1900 (Chapter 8: 1965)..."*

The implications of this report, the seismic strengthening work carried out and its relation to the current Building Act and the recent Christchurch City Council requirements for Earthquake Prone Buildings, will be discussed in more detail later in this report.

2.3.5 Heritage Classification

The buildings at 617-625 Colombo Street **do not** have a heritage listing in the Christchurch City Plan. The properties **are not** listed by the New Zealand Historic Places Trust.

2.4 143 Tuam Street

This is a two storey building pre-dating 1958 constructed of perimeter unreinforced masonry loadbearing walls with internal cast iron columns and beams supporting a timber first floor. The roof is of pitched trussed rafter construction. The ground floor is a concrete ground bearing slab. Various alterations to this building have been undertaken throughout its history. This includes seismic strengthening of the building and the connection of the building structure to the adjacent 617-619 Colombo Street.

The building is currently occupied and being used as separate retail units on the ground (S.O.G.) and first floor. Previously this building was referred to as the "Nuttal Building".

2.4.1 Gravity Load Resisting System

Gravity loads from the timber first floor and roof are supported by the external masonry walls and by cast iron beams and columns internally. The ground floor slab is concrete bearing directly onto the ground, however its thickness and the presences of reinforcement could not be confirmed.

The size, type and depth of the foundations could not be determined either, however they are assumed to be mass concrete or masonry strip footings below the loadbearing walls and columns.

2.4.2 Lateral Load Resisting System

The main lateral load (earthquake and wind load) resisting system of the building comprises unreinforced masonry walls acting in orthogonal directions. The roof and first floor structures provide a small degree of diaphragm action which ties the walls together and distributes the lateral forces to the walls.

The building has been connected to the adjacent 617-619 Colombo Street by a single storey reinforced concrete frame, which effectively connects the buildings together and transfers lateral loads between them.

The strengthening of the floor and roof diaphragms was undertaken during a refurbishment in 1994, which is described in more detail later in this report.

2.4.3 Drawing Review

A Council archive search for documents relating to the building was undertaken, and produced a number of record drawings of past alterations. No drawings of the original buildings construction were present, however the more recent drawings and information discovered provide an insight into the buildings construction and structural behaviour.

2.4.4 Previous Structural Report & Seismic Strengthening

A "Preliminary Earthquake Report" dated 4 August 1994 by Powell Fenwick Consultants Ltd, was obtained from the Council Archives and describes seismic strengthening work carried out to these buildings around 1994. A copy of this report is in Appendix A.

As a result of the strengthening work, the Powel Fenwick report states that *"...provided this upgrading work is done the building will satisfactory [sic] resist forces relating to an earthquake seismic coefficient of 0.14".* The strengthening was undertaken to ensure the building would withstand a moderate earthquake required by section 66 of the Building Act 1991 (as described in section 2.3.4 above).

However, the covering letter summary of this and the report for 617-627 Colombo Street suggests a seismic coefficient of 0.1g should be used throughout, presumably since the buildings are combined.

2.4.5 Heritage Classification

The building at 143 Tuam Street **does not** have a heritage listing in the Christchurch City Plan. The property **is not** listed by the New Zealand Historic Places Trust.

2.5 History of Structural Alterations & Strengthening

The summary below describes the major building alterations and seismic strengthening undertaken to both buildings. This information is based upon a review of the record drawings from the Council archives, and as such may not be complete, as some work may not have been submitted for consent, there are no records of early work, or the drawings have been lost.

- In 1958 the buildings of 143 Tuam Street and 617 Colombo Street were connected by a number of reinforced concrete frames from ground to first floor level. A new 75mm thick concrete floor slab on a damp proof course was placed over the existing ground floor slab over the front half of the building. This construction work appears to have been carried out to combine the buildings into one property.
- In 1965, alterations were made to 143 Tuam Street including thickening of the ground floor slab, infilling existing door and window openings (bricking up), and the installation of new doors and windows in the external walls.
- In 1994 (most likely from the advice of the Powell Fenwick earthquake reports), a series of seismic strengthening methods were constructed for all buildings. This involved; (i) tying the roof truss supports to the masonry walls with steel tie rods and plates, (ii) installing a particle board overlay to the first floor and fixing to the perimeter walls with a continuous steel angle and (iii) the construction of new internal reinforced concrete filled blockwork lateral load resisting walls.

It is important to note that although previous seismic strengthening was undertaken on these buildings, it was done to a lower standard than that required by current legislation.

3 Building Structure Inspection

The buildings have obviously undergone some movement as a result of the earthquake and aftershocks noted by the presence of internal and external damage to the building fabric. A description of the damage noted during the initial Level 2 assessments is summarised below. Photographs have been included for further reference.

It was noted that several buildings in the vicinity of similar age and construction were observed to have suffered significant damage due to the earthquake. This ranged from collapse of the entire outer leaf of the gable wall of the building opposite, to parapet and canopy collapses.

Generally the buildings being assessed in this report performed reasonably well, suffering some damage but were able to remain open for access.

3.1 Assessment Overview

During the course of the ground shaking, the masonry walls resisted the majority of the lateral momentum of the floor and roof structures, in addition to momentum from their own self weight. The unreinforced masonry walls in these buildings rely on their mass and strength in the direction of the wall to resist lateral forces. The nature of masonry as a building material is particularly 'non-ductile', meaning that it does not flex and that it is prone to brittle shear failure along its mortar bed joints and through the brick units. Unreinforced masonry walls orientated perpendicular to the direction of lateral forces are particularly weak, relying on the tensile capacity of the mortar bed joint or the provision of return walls or buttresses for strength.

As a result of this, damage to the masonry walls observed at these properties fall under three categories;

i. **Cracking of walls due to racking**. This is due to the shear capacity of the masonry walls being exceeded causing vertical or horizontal cracking as they were subjected to loads in the direction of the wall. This was evident within 625 Colombo Street where the new reinforced blockwork walls, installed in 1994 as part of the strengthening works, had vertical shear cracking where the walls rotated as they were subjected to the seismic loads in the plane of the wall. Cracking of the unreinforced masonry party wall between 623/625 and 627 Colombo Street was observed adjacent to the front of the building and is likely caused by racking of the party wall in the East/West direction.

ii. **Cracking of party wall due to lateral loading**. The construction of the seismic strengthening walls within 623 and 625 Colombo Street attracted the earthquake loading as intended. However the movement of these walls in the North/South direction as they absorbed the seismic loads is likely to have pushed against (perpendicular) the unreinforced masonry party wall between 627 Colombo Street next door causing damage.

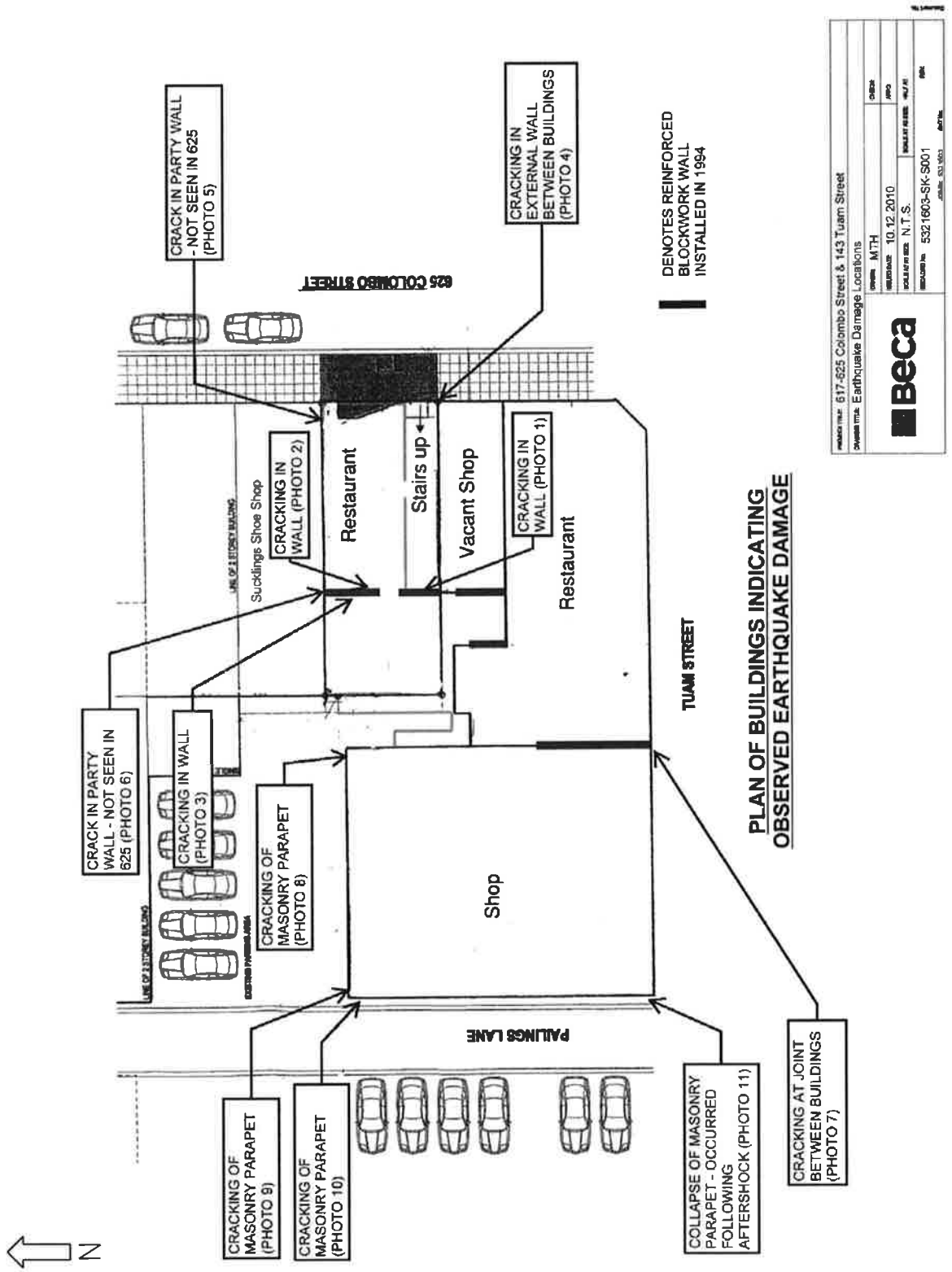
iii. **Failure of masonry rooftop parapets**. Part of the masonry parapet on the Western wall of 143 Tuam Street collapsed as its mass was mobilised in the direction perpendicular to its face. Cracking of the three corner parapets was noted following the initial 4 September earthquake and aftershocks, with subsequent aftershock causing the collapse to the South West corner parapet.

3.2 Surveyed Damage

The following sketch plan of the buildings indicated the areas of observed earthquake damage and their corresponding photographic references. The damage noted and photographs taken are collated from all the inspections undertaken following the earthquake. For clarity, the cracks have been overdrawn in red for this report.

Some areas of the buildings could not be accessed and in some cases access to inspect the main structural elements was not possible due to them being within or behind secondary building fabric. The building occupant generally pointed out the areas where they had observed earthquake damage. No structural damage was reported within the ground floor restaurant of 617 Colombo Street or the first floor nightclub of 623 Colombo Street.

A later survey revealed that the damage to the internal blockwork walls of 625 Colombo Street had been repaired, however the nature of the repairs could not be determined (i.e. if they were structural or non-structural).


PLAN OF BUILDINGS INDICATING
OBSERVED EARTHQUAKE DAMAGE
DENOTES REINFORCED
BLOCKWORK WALL
INSTALLED IN 1994
625 COLOMBO STREET
TUAM STREET
PALLINGS LANE
Restaurant
Stairs up
Vacant Shop
Restaurant
Shop
Sucklings Shoe Shop
CRACK IN PARTY WALL - NOT SEEN IN 625 (PHOTO 5)
CRACKING IN EXTERNAL WALL BETWEEN BUILDINGS (PHOTO 4)
CRACKING IN WALL (PHOTO 2)
CRACKING IN WALL (PHOTO 1)
CRACK IN PARTY WALL - NOT SEEN IN 625 (PHOTO 6)
CRACKING IN WALL (PHOTO 3)
CRACKING OF MASONRY PARAPET (PHOTO 8)
CRACKING OF MASONRY PARAPET (PHOTO 9)
CRACKING OF MASONRY PARAPET (PHOTO 10)
COLLAPSE OF MASONRY PARAPET - OCCURRED FOLLOWING AFTERSHOCK (PHOTO 11)
CRACKING AT JOINT BETWEEN BUILDINGS (PHOTO 7)
N
617-625 Colombo Street & 143 Tuam Street
Earthquake Damage Locations
MTH
10.12.2010
N.T.S.
5321603-SK-S001
Beca

3.2.1 625 Colombo Street: Damage and Observations

Cracking was observed below the stairs adjacent to the restaurant area, caused by in-plane racking of new reinforced blockwork walls.

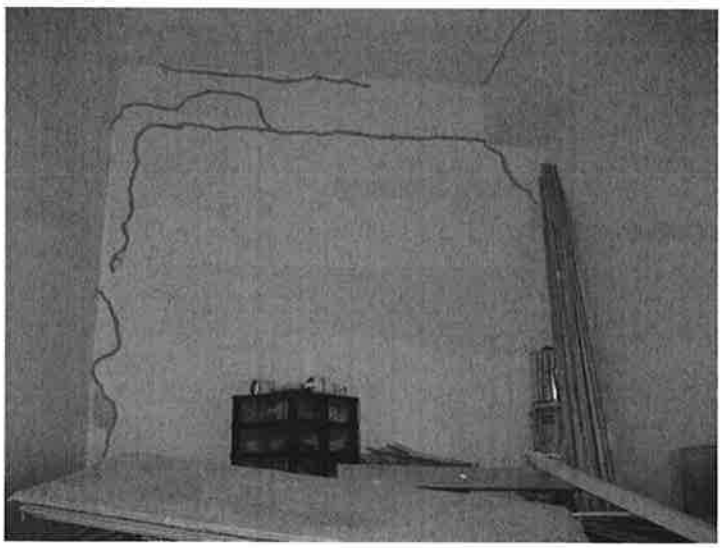


Photo 1: Cracking in wall

Cracking was observed in the new reinforced blockwork wall between restaurant serving area and rear kitchen. The photographs show cracking to both sides of wall.

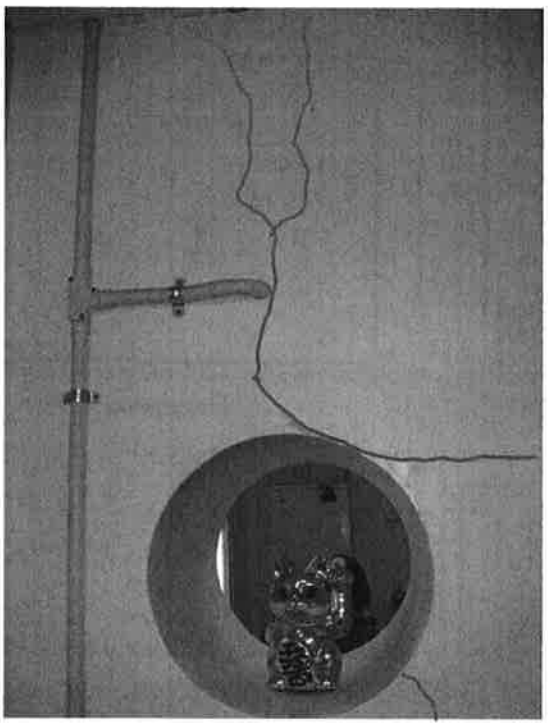


Photo 2: Cracking in wall

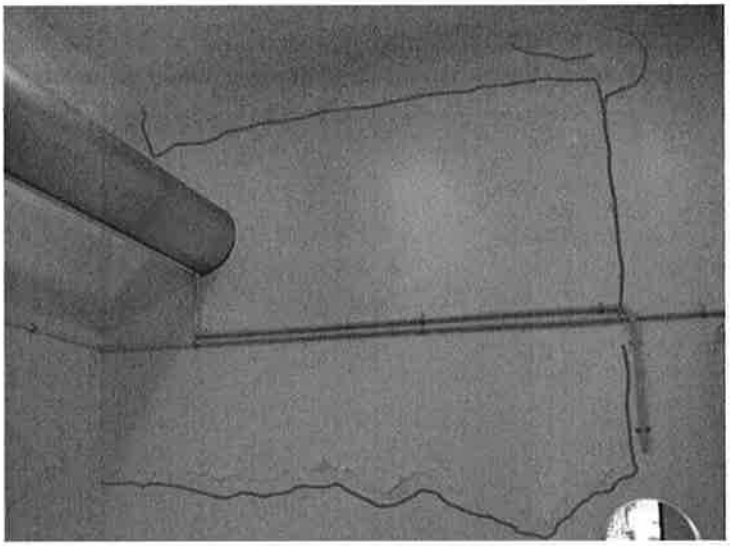


Photo 3: Cracking in wall

A crack was observed at the joint between 619 and 625 Colombo Street at first floor level.

Photo 4: Crack between buildings

A crack in the party wall (taken from 627 Colombo), first floor level at the front of the building. This cracking could not be observed on the opposite side of the wall due to the presence of wall linings.

Photo 5: Crack in first floor party wall between 623 & 627 Colombo Street (taken within 627)

Cracking was observed at the first floor level in party wall, possibly caused by loading from new perpendicular wall within 625 Colombo Street. This cracking could not be observed on the opposite side of the wall due to the presence of wall linings.

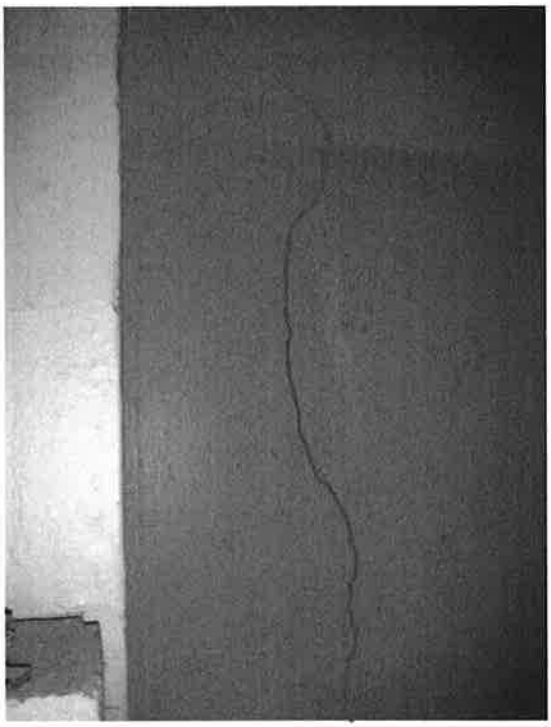


Photo 6: Crack in first floor party wall between 623 & 627 Colombo Street (taken within 627)

3.2.2 617-619 Colombo Street: Damage & Observations

No observed or reported structural damage within building. Cracking was observed at the joint between 617 Colombo and 143 Tuam Street however.

Photo 7: Cracking at joint between 617 Colombo Street & 143 Tuam Street

3.2.3 143 Tuam Street: Damage & Observations

Cracking was observed within masonry parapets at the corners of the building with the Southwest parapet being partially collapsed.

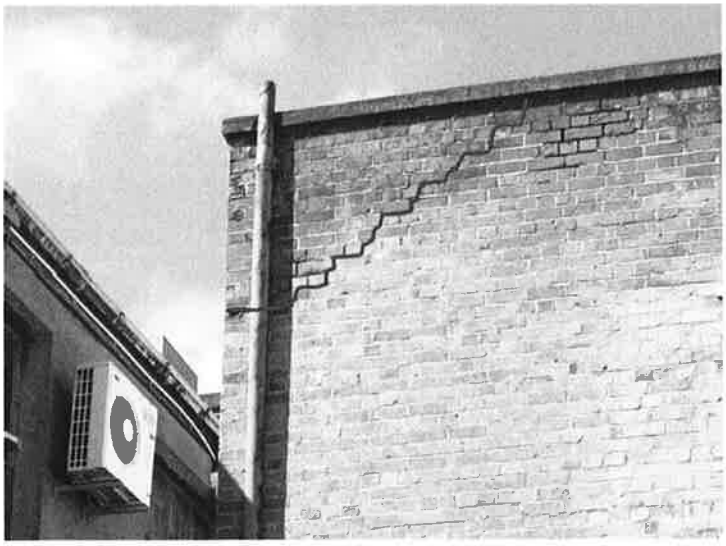


Photo 8: Masonry crack at NE parapet

Photo 9: Masonry crack at NW parapet

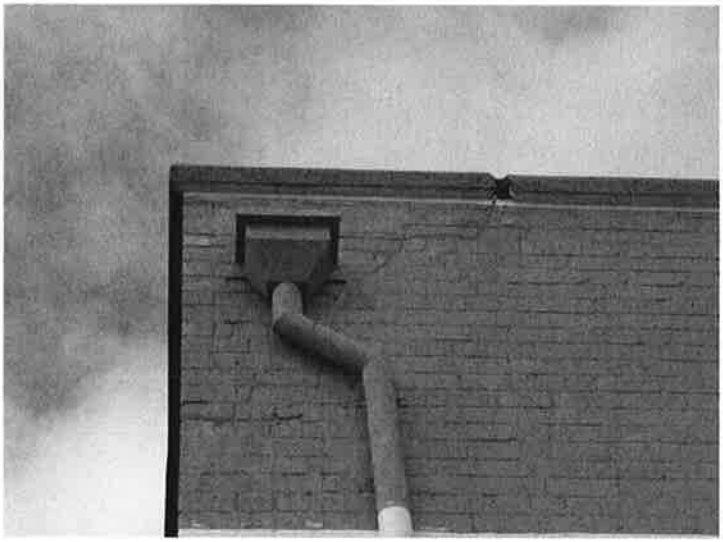


Photo 10: Masonry crack at NW parapet

Photo 11: Partial collapse of SW parapet following aftershock

4 Estimated Shaking at the Site during 4 September 2010 Earthquake

The information from a number of strong motion station spectra recorders from the region have been considered in order to make a comparison of the earthquake's intensity against the NZS 1170.5 design spectrum.

For the inner-city region the records which best represent the soil conditions on this site are Christchurch Hospital, Botanic Gardens and Cathedral College. Soil Type D is considered likely to be applicable in this area of the city. The black plot on Figure 1 represents the current code requirements for the Ultimate Limit State (ULS) for a new building located on Soil Type D. Serviceability requirements are approximately 25% of the ULS values. Generally these records show the recorded spectra are at some 70% of current design ULS value for structures with periods of under 1.5 seconds but that for periods of above 1 second the level rises to over 100% of the design value. The shaking recorded during the 4 September 2010 earthquake on a strong motion instrument located near Christchurch Hospital is shown in Figure 1.

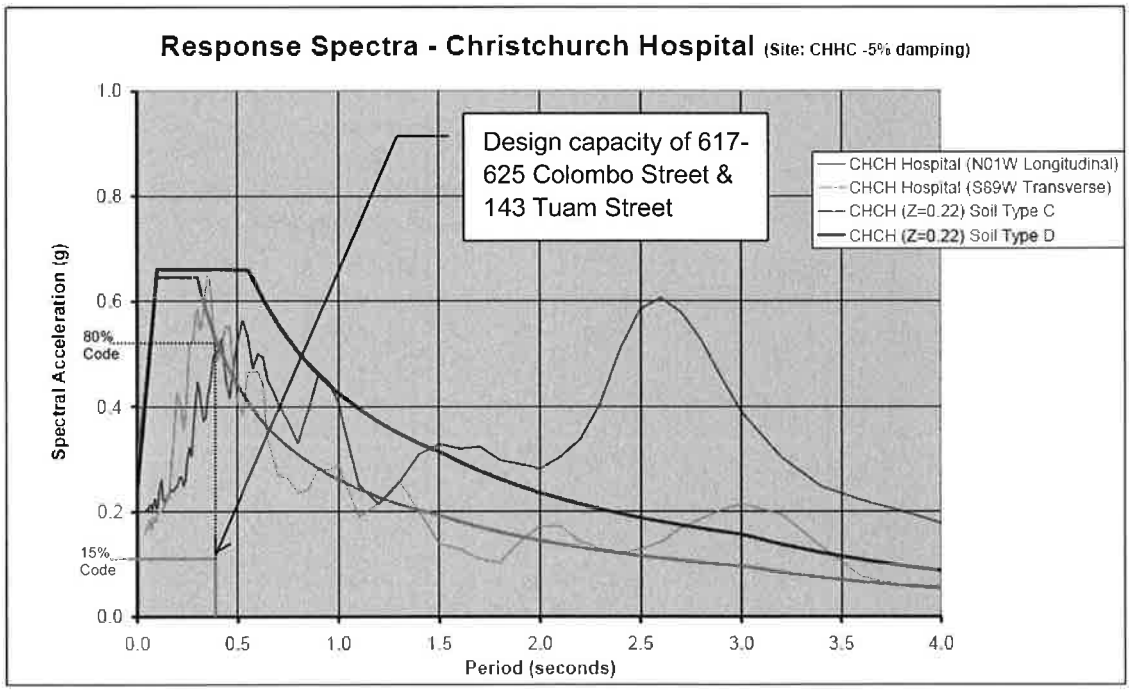


Figure 1 – Comparison of recorded shaking with at Christchurch Hospital with NZS1170 design 1/500 year modal response spectra for both class C and D soils

Preliminary processing of the shaking was recorded during the 4 September 2010 earthquake on a strong motion instrument located near Christchurch Hospital, approximately 1.0km to the West of these buildings. The data indicates that there was about 80% of the shaking prescribed in the current earthquake design standard (NZS1170.5:2004) for the Ultimate Limit State (ULS) for a building with an assumed period of around 0.4 seconds for a 1/500 year return period earthquake. Refer to Figure 1 where the recorded shaking is compared with the level of shaking assumed in the design of a modern building designed in accordance with the current Building Standard (the appropriate design curve is labelled CHCH (Z=0.22) Soil Type D).

The design capacity of 617-625 Colombo Street and 143 Tuam Street has also been indicated on the graph in green, and demonstrates the buildings' design strength. The period of 0.4 seconds is a value typical for a building constructed from unreinforced masonry, and the spectral acceleration of 0.1g is taken from the assessed building capacity from the 1994 strengthening work. This is around 15% of the spectral acceleration for which a modern building would be designed.

5 Preliminary Assessment of Existing Lateral Load Capacity – Initial Evaluation Procedure

5.1 IEP Assessments

In this investigation, the Initial Evaluation Procedure (IEP) prescribed by the New Zealand Society for Earthquake Engineering (NZSEE) guideline document, "Assessment and Improvement of structural Performance of Building Structures in Earthquakes" has been used to establish the degree of code compliance from a structural viewpoint. This assessment procedure derives a score for the building based primarily on a visual inspection of the building supplemented with information obtained from drawings where these are available for inspection. The score is in terms of the percentage of new building standard achieved *(%NBS*). New Building Standard is that required in current building standards for a new building of similar type to the building being assessed.

The score produced by the IEP can be used to identify and prioritise development and retrofit works. It can also be used to evaluate if the building is potentially *Earthquake Prone* as defined by the NZ Building Act or potentially *Earthquake Risk* as defined by the NZSEE guideline document.

Any building for which the IEP indicates a score of less than or equal to 33*%NBS* is considered to be potentially an Earthquake Prone Building. The categorization, "potentially", reflects that the score is provisional and could be revised after a more detailed assessment.

The earthquake prone standard is low (the risk is greater than 10 times that for a new building) and it is the view of the NZSEE that buildings that do not meet 67*%NBS* should still be considered an earthquake risk. At 67*%NBS* the risk is approximately five times that for a new building.

5.2 Result of the IEP

The result of this IEP investigation is summarised in Table 2 below. Refer to Appendix C for the IEP Assessment calculations.

Table 2 – Summary of IEP Assessment Score

Building Name	Year of Design	IEP Score (%NBS)	Potentially Earthquake Prone?	Potentially Earthquake Risk?
617-625 Colombo Street & 143 Tuam Street	Pre 1958 + (10% 1991 Building Standard)	11	YES	YES

Note: Buildings that are considered potentially earthquake prone have building scores of *%NBS*<33%. Buildings that are considered potentially earthquake risk have building scores of 33%<*%NBS*<67%. Therefore the 617-625 Colombo Street and 143 Tuam Street buildings are considered to be potentially earthquake prone.

In summary, despite the strengthening work undertaken in 1994 the buildings are significantly below the requirements of the current Building Standard. This is primarily due to the strengthening code requirements of that time being far less than the current standards and the nature of the buildings

construction. The recent strengthening work appears to have absorbed the effects of the earthquake as intended as can be deduced by the damage to some of the new blockwork walls, however they may have caused some damage to the existing party wall.

Additional building strengthening must be considered to ensure the buildings comply with Christchurch City Council's Earthquake-prone, Dangerous and Insanitary Buildings Policy.

Further detailed seismic assessment should be carried out on selected structural elements in order to ascertain critical weaknesses and to establish the criteria for structural strengthening works.

6 Christchurch City Council's revised policy for the repair of earthquake prone buildings

At an extraordinary Council meeting on 10 September 2010, the Council unanimously agreed to adopt a revised Earthquake Prone, Dangerous and Insanitary Buildings Policy for earthquake prone buildings. The original 2006 policy did not have any provisions specifically relating to repair of damage caused by a seismic event. Building owners were only required to undertake structural strengthening when significant alterations to an earthquake prone building were planned or within a time frame that was to be ratified with subsequent revisions to the policy.

The revised policy now requires the owner of an earthquake prone building damaged as a result of a seismic event to the extent that any repairs need a building consent, to target structural strengthening to 67% of the seismic loading standard defined in the Building Code. If, as a result of the earthquake, a building listed as earthquake prone is undamaged and does not need repair, or is damaged but the repairs do not require a building consent, the new policy does not require the building to be seismically upgraded. In these circumstances upgrading requirements will be as set out in the significant upgrade or time frame provisions which have been retained in the current policy.

The Council acknowledges it may not be practicable for some repairs to meet the 67% target and proposes to work closely with building owners to achieve sensible, appropriate outcomes.

At an IPENZ briefing meeting attended by the Council on 13 September 2010, the Council provided draft notes for engineers in relation to buildings captured by the revised policy. These include proposed processes that require detailed engineering evaluation and reporting for earthquake prone buildings structurally damaged as a result of the seismic event. The reporting is required to identify the seismic strength of the building, together with the structural work proposed to rectify the damage and strengthen the building to meet the 67% target.

In our view, where an earthquake prone building has suffered minor damage, which is easily repaired but requires a building consent, it is important to engage in open dialogue with Council to potentially agree a sensible level of repair to allow full and speedy reoccupation of the building. The context for such dialogue is that prior to the earthquake, the Council intended to allow anywhere between 15 to 20 years for earthquake strengthening to be carried out and enable small non-structural works to be done in the interim without requiring a full seismic upgrade.

Refer to Appendix D for the CCC Earthquake Prone, Dangerous and Insanitary Buildings Policy 2010 issued on 10 September 2010 and the draft notes for engineers issued by CCC on 13 September 2010.

7 Recommended Remedial Works

7.1 General

The damage noted in this report has reduced the ultimate limit state strength of the structural load resisting systems of the buildings' structure and also the overall building stiffness, which has affected is the way the structure now responds to loading.

Cracking within the primary lateral loadbearing walls constructed of unreinforced masonry has the potential to significantly reduce the walls capacity. The weakened walls are no longer likely to provide as much lateral load resistance which means that any future seismic loading would be transferred to the weaker structural elements. This has the potential to cause structural failure of the building in a significant future earthquake.

With regard to the low result of the Initial Evaluation Procedure assessment, any earthquake damage repairs carried out to the buildings will still not bring them in line with the latest Building Standard or the Christchurch City Councils earthquake prone buildings policy. Unless specifically designed structural repairs carried out to bring the building back to its pre-earthquake condition, the seismic capacity of the buildings would likely to be lower than the current IEP suggests.

In summary, the factors influencing the current and future structural repairs and performance of the buildings are as follows:

- The earthquake damage to the buildings primary lateral loadbearing elements
- The magnitude and nature of repairs required to the remediate the earthquake damage
- The buildings are potentially "earthquake prone"

As outlined in Section 6 of this report, it is prudent to initially involve the Council in dialogue to determine the most suitable course of action for these buildings.

In the short term, the damaged elements of the building should be repaired in order to restore the building, to as near as possible, its pre-earthquake condition to prevent the propagation of damage and for aesthetic purposes. We do not consider the earthquake damage to the buildings to be so significant as to pose a danger to the buildings general stability, however attention should be given to stabilising the parapets of 143 Tuam Street for public safety purposes. Suggestions for short term damage repairs are given in the following sections.

In the medium term, we recommend that the buildings should be fully assessed and strengthened as required to bring them in line with the current Christchurch City Council Policy. The extent of the strengthening should be agreed with the Council prior to any design being undertaken. The strengthening work is likely required to be completed by 3 September 2013.

7.2 Structural Damage

As mentioned above, when the repairs to the current damage listed below are carried out, the building will still not comply with the current Council policy's requirements for lateral load capacity. Some repairs are essential to ensure the operation and immediate safety of the buildings and their occupants so should be carried out as soon as possible. To determine the full extent of the building damage, areas that could not readily be accessed and areas where the structure was covered should be opened up to allow full inspection and assessment.

7.2.1 Internal wall damage

The damage generally falls under two categories, (i) the cracking of reinforced blockwork walls and, (ii) the cracking of unreinforced masonry brickwork walls. The suggested type of repair for each scenario is given below:

7.2.2 Repairs to reinforced blockwork walls

The reinforced blockwork walls installed in 1994 were added to the buildings to provide enhanced lateral capacity. Details of the type of blockwork, its reinforcement and construction could not be found. It is therefore not possible to determine if the wall reinforcement has been over stressed during the earthquake.

Any spalled or cracked blockwork should be repaired with a suitable concrete repair mortar such as Sika Monotop. This will provide a repair for aesthetic purposes only.

A full repair will first entail the investigation of the internal steel reinforcement and its connection to the original structure. If the reinforcement or its connection to the surrounding structure is found to have failed, the removal and re-building of the wall panels will be the most cost effective solution.

7.2.3 Repairs to unreinforced masonry walls

The extent of the cracking should first be determined with closer inspection and the removal of wall linings and structural coverings. Brickwork walls typically fail at the mortar bed joints especially if a weaker lime mortar or mortar with a low cement content was used. In some situations the clay itself may crack through the depth of the entire brick.

For cracking perpendicular to the bed joints, stainless steel helical tie rods should be installed in the bed joints along and beyond the length of the crack to ensure continuity of the wall panel. The joint should then be re-pointed to encase the tie rods. This type of operation is typically undertaken by specialist contractors.

For cracking of the brickwork units themselves, the damaged brick should be removed and replaced with a similar clay brick, or if it is difficult to match the size, a brick made of concrete to suit. The bed joints around the brick should be re-pointed with mortar of a similar strength to the existing mortar.

7.2.4 Parapet damage

Initially, the cracked parapets should be inspected more closely using a suitable access method. Cracks within the mortar bed joints should be repaired with the helical stainless steel tie rods as described above to tie them into the surrounding parapet masonry. The remainder of the masonry parapet should be surveyed and re-pointed as required.

A general review of the overall stability of the parapet itself and the provision of any additional support should also be undertaken to prevent the risk of further collapse.

7.3 Strengthening works

The buildings will be required to be strengthened to meet current CCC requirements. The level to which the strengthening should be designed is not clear and should be established through dialogue with CCC (i.e. if they require the strengthening to be at least 67% of current NBS).

Specific structural strengthening design will be required, and this is likely to include some or all of the following options depending upon the strength target required:

- The addition of a plan diaphragm at roof level
- The addition of a plan diaphragm at first floor level

- The connection of new structural diaphragms into the lateral load resisting system (walls)
- Installation of structural ties through brick walls in order to improve their lateral load capacity
- Application of a sprayed and reinforced concrete layer to the inside face of the masonry walls in order to improve their lateral loadbearing capacity
- Construction of new strip footings cast alongside and connected to the existing foundations
- Strengthening or provision of restraint for the masonry parapets

7.4 Cost of remedial works

A cost estimate of the repairs has not been provided due to the need of a more detailed investigation and assessment of the extent of the repairs required. We recommend that a specialist cost consultant with building repairs expertise be appointed to provide the detailed cost estimate, refer below for our recommendation.

Rawlinsons Ltd
Address: 119 Armagh Street, Christchurch
Contact: Peter Eggleton
Email: p.eggleton@rawlinsons.co.nz
Phone: 64 3 445 1826

Rider Levett Bucknall (NZ)
Address: 250 Oxford Terrace, Christchurch
Contact: Neil O'Donnell
Email: neil.odonnell@nz.rlb.com
Phone: 64 + 365 0570

Davis Langdon
Address: 93-95 Cambridge Terrace, Christchurch
Contact: Ross Davidson
Email: rdavidson@davislangdon.co.nz
Phone: 64 3 366 2669

8 Building Act 2004

The changes to the Building Act relevant to earthquake risk buildings are discussed in the following sections.

Earthquake prone buildings (Section 122)

In the Building Act 2004, buildings with low earthquake resistance and therefore of high risk are defined as Earthquake Prone Buildings (EPB). The definition of an EPB is provided in Section 122.

In summary, a building is earthquake prone if, having regard to its condition and to the ground on which it is built, and because of its construction, the building:

a. Will have its ultimate capacity exceeded in a moderate earthquake, and

b. Would be likely to collapse causing

- Injury or death to persons in the building or to persons on any other property, or

- damage to any other property..."

For the purposes of Section 122 of the Act, 'moderate earthquake', in relation to a building, is defined in Regulations as an earthquake that would generate shaking at the site of the building that is of the same duration, but that is one third as strong as, the earthquake shaking (determined by normal measures of acceleration, velocity, and displacement) that would be used to design a new building at the site...".

In terms of the previous Building Act 1991, Section 66, a building was considered to be *Earthquake* Prone if "... it is constructed substantially of unreinforced masonry or concrete, and it does not exhibit sufficient capacity to withstand without collapse the lateral seismic forces associated with a *moderate earthquake*...". A moderate earthquake was defined in the 1991 Building Act to be one half of the seismic forces specified in NZS 1900, Chapter 8:1965.

The major differences in the definition of an EPB between the 1991 and 2004 Building Acts are as follows:

a. Threshold level
   The Building Act 2004 requires a higher level of performance for buildings than that provided by the Building Act 1991.
   The Building Act 1991 threshold limit was set to be one half of the seismic forces specified in NZS 1900, Chapter 8:1965. NZS 1900 was superseded by NZS 4203 and is no longer current except for reference purposes. Seismic forces specified in NZS 1900 for new buildings were significantly lower than those specified in the current loadings Standard.
   The Building Act 2004 threshold limit is effectively one third of the seismic forces specified in current loading standard.

b. Construction of the building
   The new Act encompasses all building types, not simply those constructed of (substantially) unreinforced masonry or concrete, as defined in the 1991 version.

c. Reference Standard

The definition of an EPB in Building Act 2004 is linked to the most current Loadings Standard, which is presently AS/NZS 1170.5.

In summary: Many buildings which may have passed scrutiny under the previous Act may not comply with the Building Act 2004. But also, some that were strengthened under the old EPB policy, but to a level lower than new Building Act 2004 threshold, may find themselves again an EPB, depending on the Territorial Authorities' policy. It is also possible that if a more onerous standard is introduced in the future the strength limit will increase (or decrease as the case may be).

EPB policy (Sections 131 and 132)

Sections 131 and 132 of the Building Act 2004 require Territorial Authorities to develop and adopt a policy on EPBs. The main purpose of the legislation, which will be reflected through the TA's EPB policies, is to reduce the earthquake risk in the community.

In the policy the TAs are required to state:

1 The approach the TA will take in performing functions under the relevant part of the Building Act 2004,

2 TA priorities in performing these functions, and

3 How this policy will apply to heritage buildings.

The Building Act 2004 requires TAs to adopt their EPB policies, after community consultations, by the end of May 2006.

Powers of territorial authorities (TAs) in respect to EPBs (Sections 124 to 130)

Sections 124 to 130 of the Building Act 2004 define the powers of the TAs in relation to EPBs. These include:

4 To give written notice requiring work to be carried out on the building, within a time stated in the notice, to reduce or remove the danger. This work may include the demolition of all or part of a building.

5 To apply to a District Court for an order authorising the TA to carry out building work if any work required under notice given by the TA is not completed or not proceeding with reasonable speed, where the owner of the building is liable for the cost of the work.

6 To attach a notice that warns people not to approach the building.

7 To place hoardings to prevent people from approaching the building. No person may use or occupy such a building or permit another person to use or occupy the building.

These powers are similar to those in the previous Act. (The past experience has been that TA's have rarely exercised all these powers and are unlikely to do so without first consulting with the building owners.)

Alterations to existing buildings (Section 112)

The Building Act 2004 makes it clear that if part of a building is altered, various upgrade provisions are triggered for the whole building. These requirements are similar to the previous act.

These upgrade provisions (i.e. requirement that the building shall comply, as nearly as reasonably practicable with the provisions of the Building Code) include means of escape form fire and access and facilities for people with disabilities (if relevant). The other aspects of the building (including structural performance) must continue to comply with the Building Code to at least the same extent as before the alteration.

It is expected that TAs will ensure that applications for building consent involving alterations are considered in the context of its EPB policy.

Territorial authorities have discretion to allow alterations to take place without the building complying with the relevant provisions of the Building Code, but only if they are satisfied that:

8 if the building were required to comply with the relevant provisions of the Building Code, the alteration would not take place, and

9 the alteration will result in improvement to attributes of the building that relate to means of escape from fire, and access and facilities for persons with disabilities, and

10 the improvements outweigh any detriment that is likely to arise as a result of the non-compliance with the Building Code.

Change of use, Extension of life or subdivision of buildings (Sections 114 to 116 and 116a)

d. Change of use

The Building Act 2004 introduces a new definition for 'change of use', i.e. when a change in a building's use will require upgrading of certain systems and elements. Similar to the previous Act, when it comes to the structural performance of the building, the TA, in order to issue a building consent for the proposed change of use, must be satisfied the building will comply, as nearly as is reasonably practicable, with every provision of the Building Code relating to the new use (i.e. including structural performance).

The previous wording in the Building Act 1991 was ".., as nearly as reasonably practicable, *to the same extent as if it were a new building..",* but the meaning is effectively the same.

e. Extension of Life

The requirements on the owners and TAs are similar to those as for Alterations

f. Subdivision

In this case the upgrade provisions (i.e., the requirement that the building shall comply, as nearly as reasonably practicable with the provisions of the Building Code) relate only to means of escape form fire, access and facilities for people with disabilities (if relevant) and protection of other property. The other aspects of the building (including structural performance) must continue to comply with the Building Code to at least the same extent as before the alteration.

Exempt Building Work (Schedule 1)

a. lawful repair

In this case a building consent is not required for any lawful repair and maintenance using comparable materials, or replacement with a comparable component or assembly in the same position, of any component or assembly incorporated or associated with a building. The exception being any repair or replacement (other than maintenance) of any component or assembly that has failed to satisfy the provisions of the building code for durability.

Appendix A

Powell Fenwick Report on 1994 Structural Strengthening

POWELL FENWICK CONSULTANTS LTD
Consulting Engineers
Structural, Civil, Acoustic
Electrical, Mechanical
Heating and Ventilation

Unit 3, Amuri Park
Cnr Bealey Avenue and Churchill Street
P.O. Box 25-108. Fax (03) 379-1626
Telephone (03) 366-1777
Christchurch, New Zealand

ILF:PMJ

4th August 1994

Turners Limited
P O Box 1021
CHRISTCHURCH

ATTENTION: MR ALAN TURNER

Our Ref. 94/604/01.L1

Dear Sir,

RE: EARTHQUAKE REPORTS

FOR "NUTTAL" BUILDING AND 617-627 COLOMBO STREET

Our preliminary reports for these buildings accompany this letter.

We have had a preliminary discussion with Mr J Taylor of the Christchurch City Council regarding the requirements for these buildings.

Our reports reflect the content of this discussion.

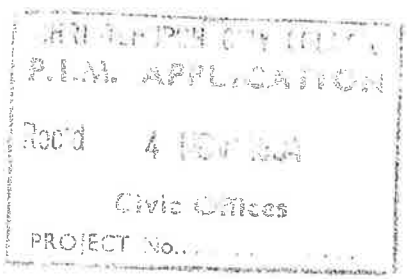
It was stressed, during discussion, that provided there was no change of use to a higher risk category, it would be satisfactory to remove hazards and ensure that the buildings can withstand Earthquake forces relating to the seismic coefficient of 0.1g.

We believe our proposal which, of course, is not detailed, will enable this to be done without significant additional strengthening and without alterations to the shopfront along Colombo Street.

Please advise us if you require more information or detail.

Yours faithfully,
POWELL FENWICK CONSULTANTS LIMITED

I.L. Ford



encl.

POWELL FENWICK CONSULTANTS LTD

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Telephone (03) 366-1777
Christchurch, New Zealand

94/604/01.R1

STRUCTURAL REPORT

ON

617 TO 629 COLOMBO STREET

FOR

TURNERS LIMITED

1.0 BUILDING CONSTRUCTION

1.1 Structure

There are two buildings of different front appearances and different ages which can be treated as one because of the common party wall system which has been adopted for the construction.

The buildings are constructed of brick bearing walls with a timber first floor and an open shop front along Colombo and Tuam Street. There are structural steel beams over these shop fronts with some cast iron columns at ground floor. There is also some reinforced concrete bands at roof level and first floor level.

1.2 Condition

The general condition of the brick work appears to be reasonable with not much loss of integrity of the mortar.

Timber floors vary in quality and are generally sound.

2.0 EARTHQUAKE RESISTANCE

2.1 Total Building

If the total combined buildings are considered the resistance to earthquake forces in an East/West direction could be satisfactory provided the first floor is an adequate diaphragm and the roof over the corner building can be used either as a diaphragm or appropriate fixed and braced to transfer loads of the wall between 621 and 623 Colombo Street.

Forces in a North/South direction are not as well resisted as there are few walls in this direction and both the street frontage are open.

Because of the wall arrangement, particularly at ground floor level, there will be large torsion induced forces to be resisted if the first floor diaphragm functions satisfactorily.

2.2 Work Required

To ensure that the building will withstand a moderate earthquake a required by the Section 66 of the Building Act the following work will be required.

2.2.1 Walls

Upgrade or add walls as indicated on the marked up plan. note that his amount of wall will be satisfactory for 617-625 Colombo Street. The remainder is owned by others and is therefore their responsibility.

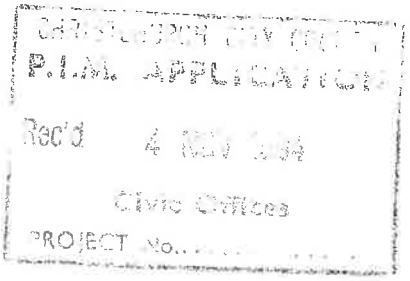
2.2.2 First Floor

Overlay the existing floor with particle board to provide a satisfactory diaphragm. Connect this diaphragm to all walls with particular attention to walls on Lines A, B and D.

2.2.3 Roof

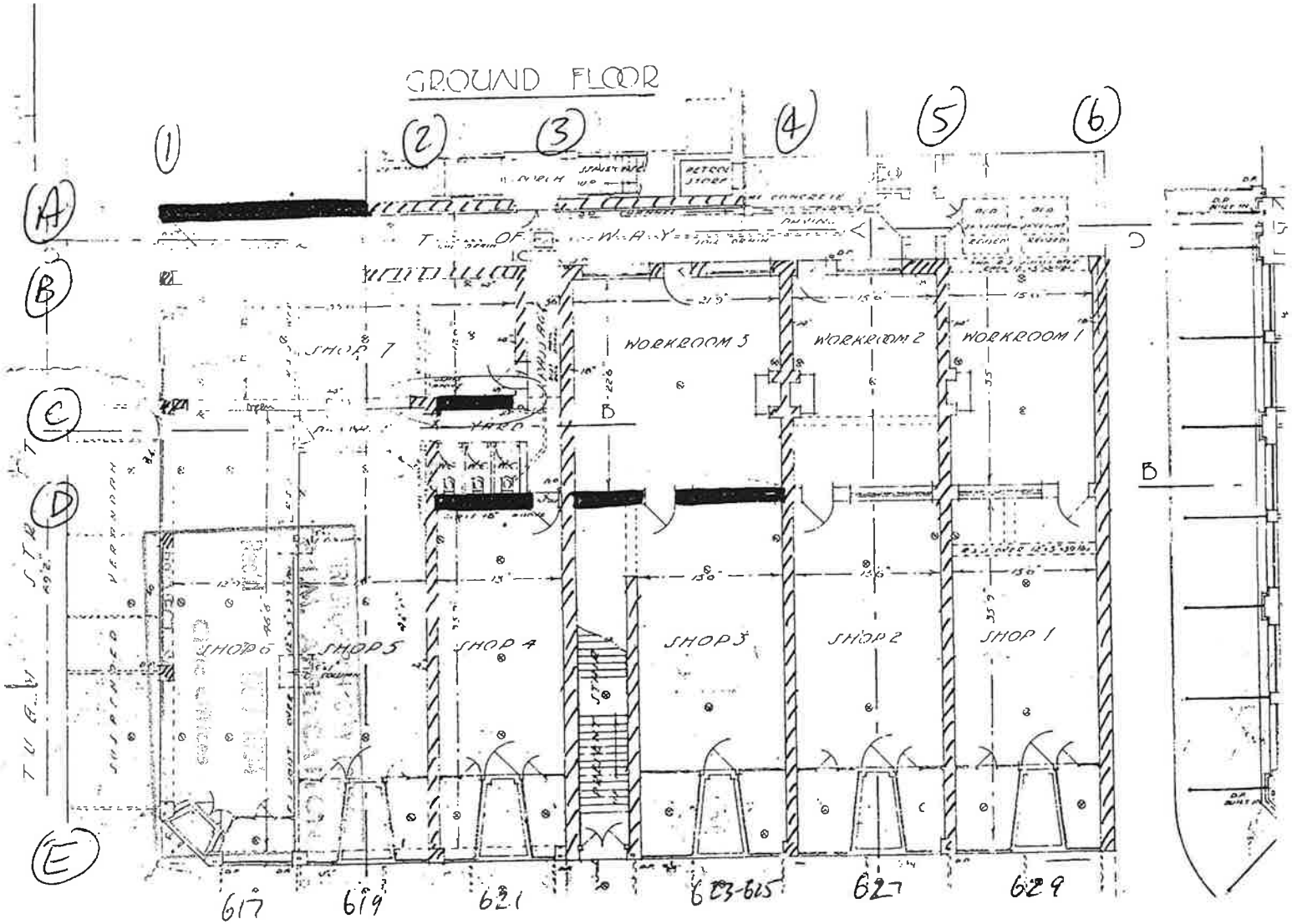
Tie existing brick parapets back into the roof system by steel rods through the bricks and connected to trusses or main rafters.

Note that it may be necessary to add diagonal bracing in the roof ceilings place over 617 to 621 Colombo Street to give adequate stability to the facade along Tuam Street.



Existing brick walls

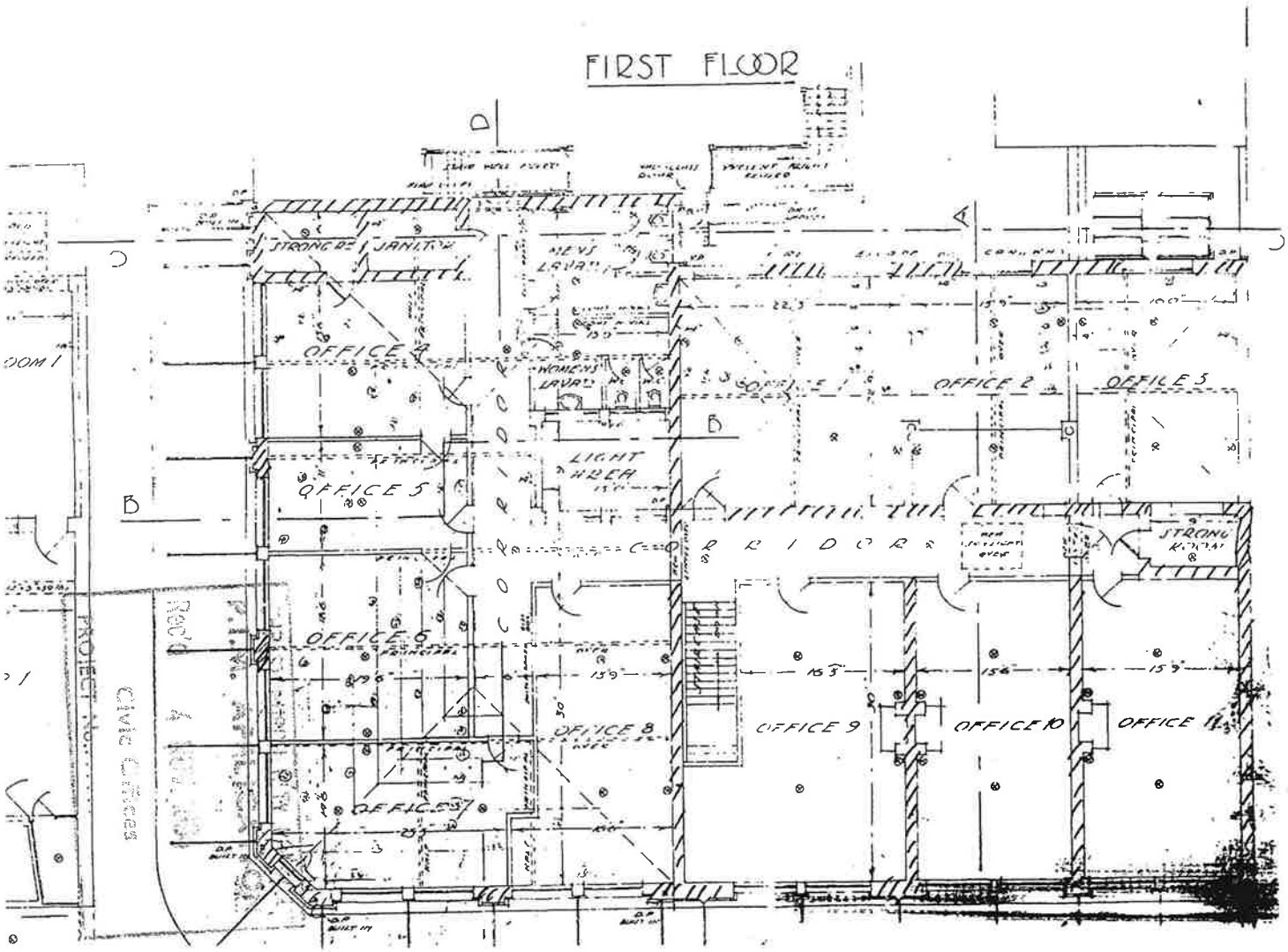
Proposed new brick or block walls



617 to 629 Colombo St

94/604

existing brick walls



617 to 629 Colombo St

94/604

POWELL
FENWICK
CONSULTANTS LTD

Consulting Engineers
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Telephone (03) 366-1777
Christchurch, New Zealand

94/604/01.R2

STRUCTURAL REPORT

ON

"NUTTALL" BUILDING

FOR

TURNERS LIMITED

1.0 BUILDING CONSTRUCTION

1.1 Structure

This building is approximately 18.5m x 16m two storey construction and at least 100 years old.

The roof is cgi on timber trusses with sarking. First floor is timber construction supported on timber beams and internal columns at ground floor.

There is a concrete band at first floor level and steel ties into the floor.

1.2 Condition

The brickwork is in reasonably good condition.

The timber floor has been designed to carry very heavy loads, probably greater than 5-10kPA but boards are loose in many areas.

2.0 EARTHQUAKE RESISTANCE

2.1 The square shape of the building plus the relatively long length of the brick exterior walls give the building a good earthquake resistance provided certain work is done.

2.2 **Work Required**

Ensure that the building will withstand a moderate earthquake as required by Section 66 of the Building Act is as discussed below:-

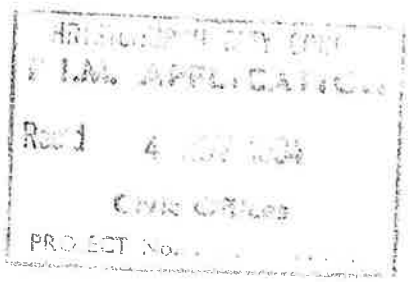
2.2.1 Upgrade the first floor with a particle board overly and ensure adequate connection of the floor to the exterior walls. This may require bolts to be drilled into the wall to attach the floor joists to the wall. Investigation of the present connection will be required before a decision can be made.

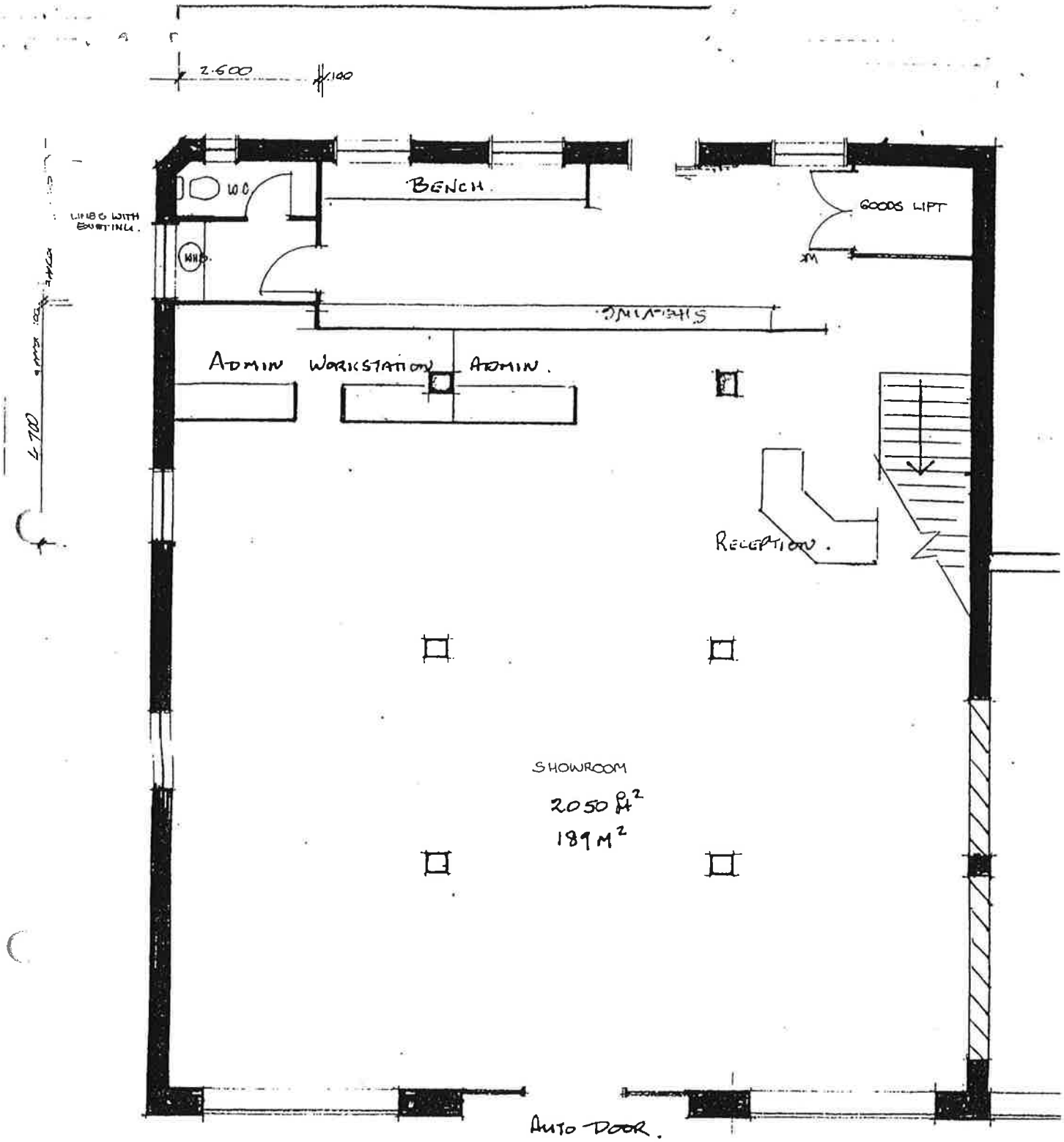
2.2.2 Ensure that the roof trusses are properly attached to the brick walls. This may require bolts through the wall to connect to the trusses and other appropriate members such as hip rafters.

A detailed inspection of the roof structure will be required to ascertain the extent of work required.

2.2.3 Provided this upgrading work is done the building will satisfactory resist forces relating to an earthquake seismic coefficient of 0.14.

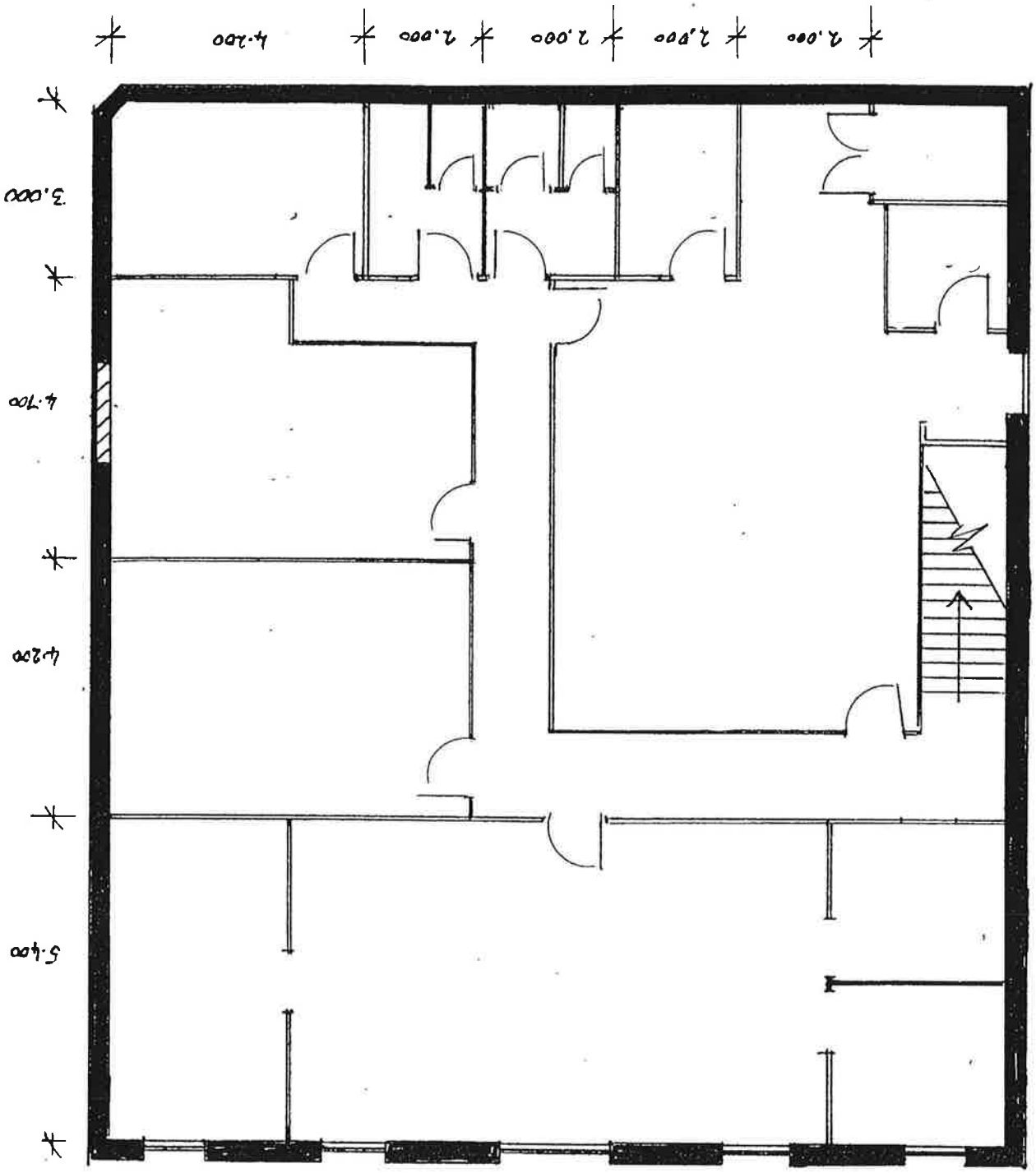
This level of resistance should be acceptable to the Local Authority provided there is no change of use of the building which would increase the risk to life or property.





'Nuttall' Building Ground Floor

91/604



'Nuttal' Building - First Floor

N

94/604

Appendix B

Level 2 Assessment Forms

Christchurch Eq RAPID Assessment Form - LEVEL 2

re-inspected 10/9/10 . 2:30pm

Inspector Initials: MWC
Territorial Authority: Christchurch City
Date: 7/9/10
Time: 2:30pm
Final Posting (e.g. UNSAFE): INSPECTED 4

Building Name: Switched on Gardner
Short Name:
Address: 143 Truman St
GPS Co-ordinates: S° E°
Contact Name: COLLIERS
Contact Phone: 379 6280
Storeys at and above ground level: 2
Below ground level:
Total gross floor area (m²):
Year built:
No of residential Units:
Photo Taken: (Yes) No

Type of Construction

- ☐ Timber frame
- ☐ Steel frame
- ☐ Tilt-up concrete
- ☑ Concrete frame
- ☐ RC frame with masonry infill
- ☐ Concrete shear wall
- ☑ Unreinforced masonry
- ☐ Reinforced masonry
- ☐ Confined masonry
- ☐ Other:

ORIGINAL

Primary Occupancy

- ☐ Dwelling
- ☐ Other residential
- ☐ Public assembly
- ☐ School
- ☐ Religious
- ☑ Commercial/ Offices
- ☐ Industrial
- ☐ Government
- ☐ Heritage Listed
- ☐ Other

Investigate the building for the conditions listed on page 1 and 2, and check the appropriate column. A sketch may be added on page 3

Overall Hazards / Damage	Minor/None	Moderate	Severe	Comments
Collapse, partial collapse, off foundation	☑	☐	☐	SW Parapet damaged & requires stabilisation and repair
Building or storey leaning	☑	☐	☐	
Wall or other structural damage	☑	☐	☐	SOME MINOR CRACKING TO WALL (Rear wall)
Overhead falling hazard	☑	☐	☐	
Ground movement, settlement, slips	☑	☐	☐	
Neighbouring building hazard	☑	☐	☐	~~NO SIGNS OF DAMAGE FROM OUT SIDE~~
Electrical, gas, sewerage, water, hazmats	☐	☐	☐	NOT INSPECTED

Record any existing placard on this building:

Existing Placard Type (e.g. UNSAFE): GREEN

Choose a new posting based on the new evaluation and team judgement. Severe conditions affecting the whole building are grounds for an UNSAFE posting. Localised Severe and overall Moderate conditions may require a RESTRICTED USE. Place INSPECTED placard at main entrance. Post all other placards at every significant entrance. Transfer the chosen posting to the top of this page.

INSPECTED — GREEN: G1 | (G2)
RESTRICTED USE — YELLOW: Y1 | Y2
UNSAFE — RED: R1 | R2 | R3

Record any restriction on use or entry:

Further Action Recommended:

Tick the boxes below only if further actions are recommended

- ☐ Barricades are needed (state location):
- ☐ Detailed engineering evaluation recommended
  - ☑ Structural
  - ☐ Geotechnical
  - ☐ Other:
- ☑ Other recommendations: Isolate parapet, prompt repairs/stabilisation required

LBECA

Estimated Overall Building Damage (Exclude Contents)

None	☐		
0-1 %	☑	31-60 %	☐
2-10 %	☐	61-99 %	☐
11-30 %	☐	100 %	☐

Sign here on completion: ME
Date & Time: 7/9/10 4:30pm
ID:

Inspection ID: _____ (Office Use Only)

Structural Hazards/ Damage	Minor/None	Moderate	Severe	Comments
Foundations	☑	☐	☐	
Roofs, floors (vertical load)	☑	☐	☐	
Columns, pilasters, corbels	☑	☐	☐	
Diaphragms, horizontal bracing	☑	☐	☐	
Pre-cast connections	☐	☐	☐	
Beam	☑	☐	☐	- SOME VERY MINOR CRACKING.
Non-structural Hazards / Damage				
Parapets, ornamentation	☑	☐	☐	Parapet on SW corner has moved, requires isolation and prompt repair.
Cladding, glazing	☑	☐	☐	
Ceilings, light fixtures	☑	☐	☐	
Interior walls, partitions	☑	☐	☐	SOME SUPERFICIAL CRACKS.
Elevators	☑	☐	☐	NONE
Stairs/ Exits	☐	☐	☐	NOT INSPECTED
Utilities (eg. gas, electricity, water)	☐	☐	☐	" "
Other	☑	☐	☐	
Geotechnical Hazards / Damage				
Slope failure, debris	☑	☐	☐	
Ground movement, fissures	☑	☐	☐	
Soil bulging, liquefaction	☑	☐	☐	

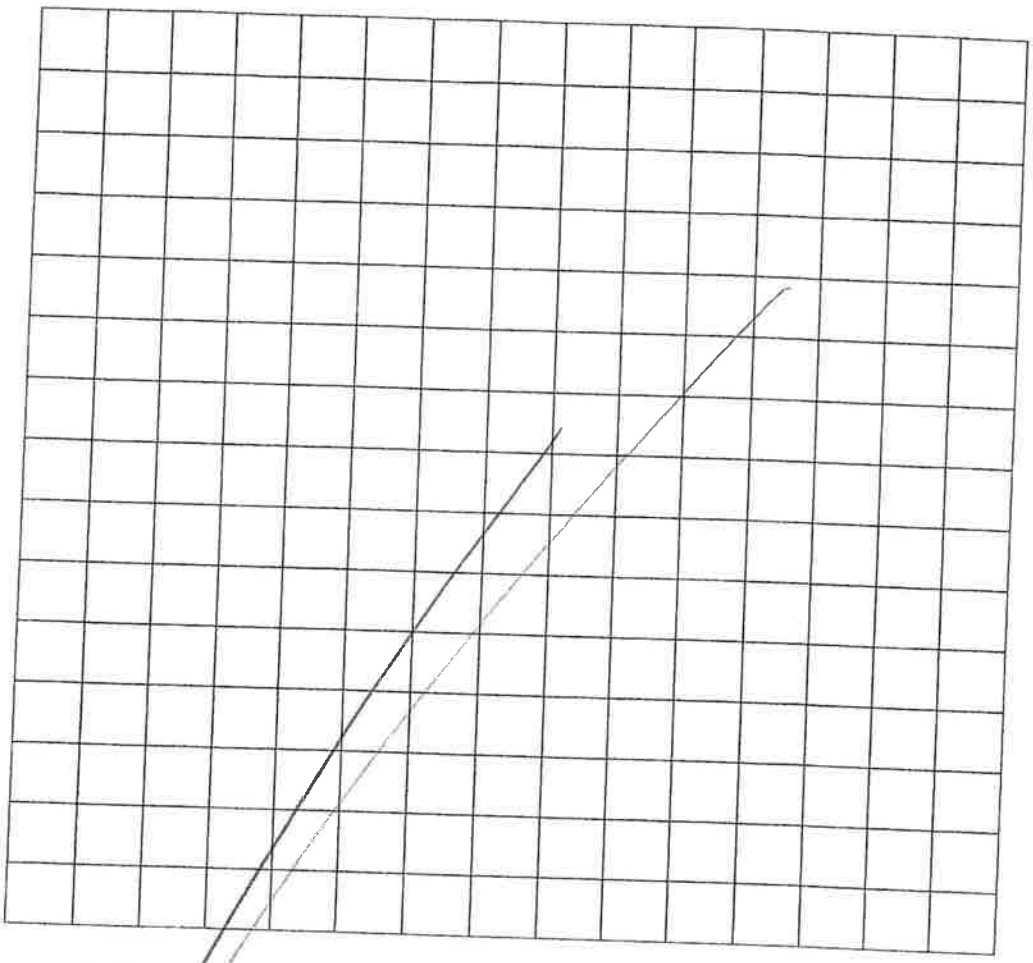
General Comment Recommend inspection of upper level and repair of cracks in brick walls.
Inspection of #1613 only.

Usability Category

Damage Intensity	Posting	Usability Category	Remarks
Light damage *Low risk*	Inspected (Green)	G1. Occupiable, no immediate further investigation required	
		G2. Occupiable, repairs required.	Parapet on SW corner requires stabilisation & repair
Medium damage *Medium risk*	Restricted Use (Yellow)	Y1. Short term entry	
		Y2. No entry to parts until repaired or demolished	
Heavy damage *High risk*	Unsafe (Red)	R1. Significant damage: repairs, strengthening possible	
		R2. Severe damage: demolition likely	
		R3. At risk from adjacent premises or from ground failure	

 Inspection ID: _____ *(Office Use Only)*

Sketch (optional)
Provide a sketch of the entire building or damage points. Indicate damage points.



Recommendations for Repair and Reconstruction or Demolition (Optional)

Christchurch Eq RAPID Assessment Form - LEVEL 2

Inspector Initials: MTH
Territorial Authority: Christchurch City
Date: 15/9/10
Time: 9:30 AM
Final Posting (e.g. UNSAFE): G2

Building Name
Short Name: 625 COLUMBO STREET
Address: (DOWNSTAIRS RESTAURANT)
GPS Co-ordinates: S° E°
Contact Name: Colliers
Contact Phone:

Storeys al and above ground level: 2
Below ground level: 0
Total gross floor area (m²):
Year built:
No of residential Units:
Photo Taken: (Yes) No

ORIGINAL

Type of Construction
- ☐ Timber frame
- ☐ Steel frame
- ☐ Tilt-up concrete
- ☐ Concrete frame
- ☐ RC frame with masonry infill
- ☐ Concrete shear wall
- ☑ Unreinforced masonry
- ☐ Reinforced masonry
- ☐ Confined masonry
- ☐ Other:

Primary Occupancy
- ☐ Dwelling
- ☐ Other residential
- ☐ Public assembly
- ☐ School
- ☐ Religious
- ☑ Commercial/ Offices
- ☐ Industrial
- ☐ Government
- ☐ Heritage Listed
- ☐ Other

Investigate the building for the conditions listed on page 1 and 2, and check the appropriate column. A sketch may be added on page 3

Overall Hazards / Damage	Minor/None	Moderate	Severe	Comments
Collapse, partial collapse, off foundation	☑	☐	☐	
Building or storey leaning	☑	☐	☐	
Wall or other structural damage	☐	☑	☐	CRACKING TO INTERNAL PARTITION WALL & WALL BELOW STAIRS
Overhead falling hazard	☑	☐	☐	
Ground movement, settlement, slips	☑	☐	☐	
Neighbouring building hazard	☑	☐	☐	ADJACENT BUILDING PARAPET BEING REMOVED
Electrical, gas, sewerage, water, hazmats	☑	☐	☐	NOT INSPECTED

Record any existing placard on this building:

Existing Placard Type (e.g. UNSAFE): GREEN / INSPECTED

Choose a new posting based on the new evaluation and team judgement. Severe conditions affecting the whole building are grounds for an UNSAFE posting. Localised Severe and overall Moderate conditions may require a RESTRICTED USE. Place INSPECTED placard at main entrance. Post all other placards at every significant entrance. Transfer the chosen posting to the top of this page.

INSPECTED		RESTRICTED USE		UNSAFE		
GREEN	G1 (G2)	YELLOW	Y1 Y2	RED	R1 R2 R3	

Record any restriction on use or entry:

Further Action Recommended:

Tick the boxes below only if further actions are recommended

- ☐ Barricades are needed (state location):
- ☐ Detailed engineering evaluation recommended
  - ☐ Structural ☐ Geotechnical ☐ Other:
- ☐ Other recommendations:

Estimated Overall Building Damage (Exclude Contents)

None	☐		
0-1 %	☐	31-60 %	☐
2-10 %	☑	61-99 %	☐
11-30 %	☐	100 %	☐

Sign here on completion: (BECA)
Date & Time: 15/9/10.
ID:

Inspection ID: _____ (Office Use Only)

Structural Hazards/ Damage	Minor/None	Moderate	Severe	Comments
Foundations	☑	☐	☐	
Roofs, floors (vertical load)	☑	☐	☐	
Columns, pilasters, corbels	☑	☐	☐	
Diaphragms, horizontal bracing	☐	☑	☐	MAIN BLOCK PARTITION CRACKED DUE TO RACKING
Pre-cast connections	☑	☐	☐	CRACKING TO PARTITION WALL MOST LIKELY
Beam	☑	☐	☐	
Non-structural Hazards / Damage				
Parapets, ornamentation	☑	☐	☐	
Cladding, glazing	☑	☐	☐	
Ceilings, light fixtures	☑	☐	☐	
Interior walls, partitions	☐	☑	☐	SEE NOTE ABOVE
Elevators	☐	☐	☐	N/A
Stairs/ Exits	☑	☐	☐	CRACKING TO BLOCK WALL BELOW STAIRS
Utilities (eg. gas, electricity, water)	☐	☐	☐	
Other	☐	☐	☐	
Geotechnical Hazards / Damage				
Slope failure, debris	☐	☐	☐	
Ground movement, fissures	☐	☐	☐	
Soil bulging, liquefaction	☐	☐	☐	

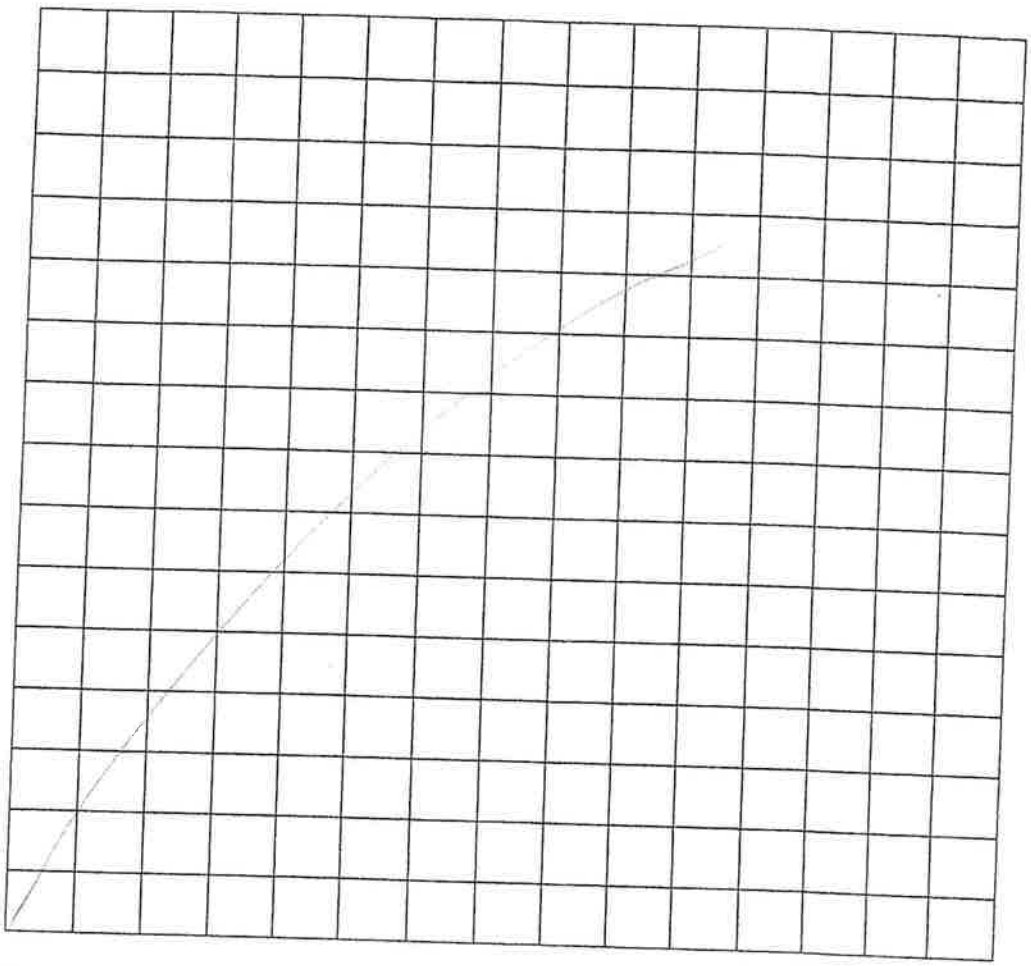
General Comment RECENT ~~PAR~~ BLOCK PARTITION HAS CRACKING DUE TO RACKING LOADS. THIS WALL HAS LIKELY CAUSED CRACKING IN PARTY WALL. NO EXTERNAL CRACKING OBSERVED. INACCESSED BUILDING AREA - COULD NOT ASSESS CRACKING DUE TO WALLS BEING LINED.

Usability Category

Damage Intensity	Posting	Usability Category	Remarks
Light damage *Low risk*	Inspected (Green)	G1. Occupiable, no immediate further investigation required	
		G2. Occupiable, repairs required.	STITCH CRACKING IN WALLS
Medium damage *Medium risk*	Restricted Use (Yellow)	Y1. Short term entry	
		Y2. No entry to parts until repaired or demolished	
Heavy damage *High risk*	Unsafe (Red)	R1. Significant damage: repairs, strengthening possible	
		R2. Severe damage: demolition likely	
		R3. At risk from adjacent premises or from ground failure	

 Inspection ID: _____ *(Office Use Only)*

Sketch (optional)
Provide a sketch of the entire building or damage points. Indicate damage points.



Recommendations for Repair and Reconstruction or Demolition (Optional)

Appendix C

Initial Evaluation Procedure (IEP)

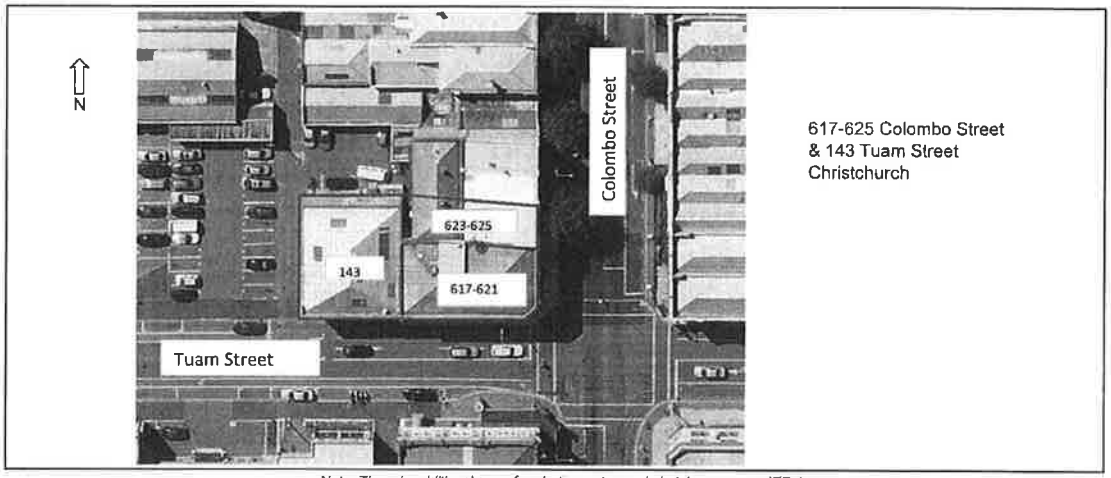
Table IEP-1 Initial Evaluation Procedure Step 1

(Refer Table IEP - 2 for Step 2; Table IEP - 3 for Step 3, Table IEP - 4 for Steps 4, 5 and 6)

Building Number:	**617-625 Colombo St. & 143 Tuam St.**	**Ref:**	**5321603**
AKA:	**Best Little Law House**		
Name of building:		**By:**	**Beca - MTH**
Suburb:	**Christchurch City**	**Date:**	**10/12/2010**

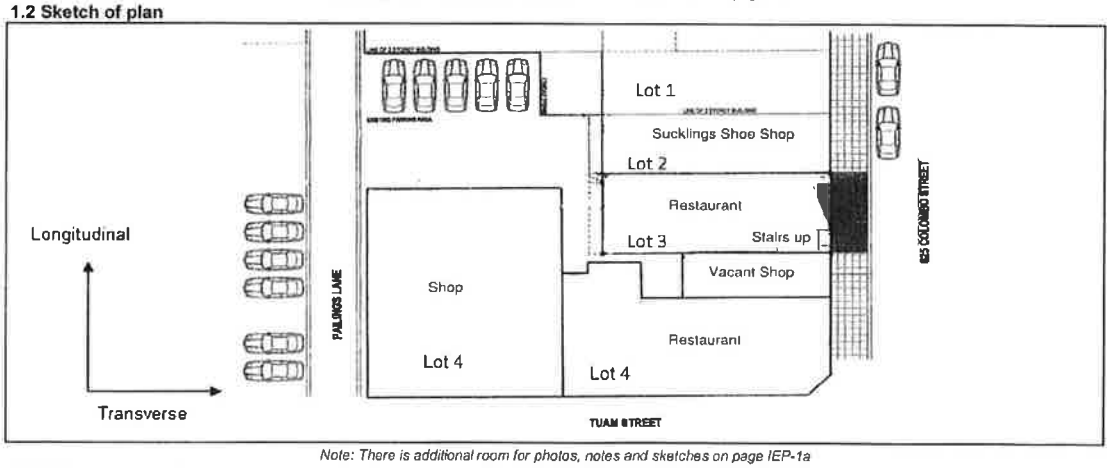
Step 1 - General Information

1.1 Photos (attach sufficient to describe building)



Note: There is additional room for photos, notes and sketches on page IEP-1a

1.2 Sketch of plan



Note: There is additional room for photos, notes and sketches on page IEP-1a

1.3 List relevant features

3 No. two storey unreinforced masonry buildings which have been modified and combined throughout their history. Present usage is as follows: 625 (Ground Floor) = Fast food take-away. 617-621 (Ground Floor) = Restraurant. 617-623 (1st Floor) = Club & Bar. 143 Tuam Street (Ground Floor) = Retail. 143 Tuam Street (1st Floor) = Retail (unoccupied)

143 Tuam Street is at least 70 years old.

1.4 Note information sources

	tick as appropriate	
Visual Inspection of Exterior	☑	
Visual Inspection of Interior	☑	621 & 143 Only
Drawings (note type)	☑	From council records
Specifications	☐	
Geotechical Reports	☐	
Other (list)	☐	

Table IEP-2 **Initial Evaluation Procedure Step 2**

(Refer Table IEP - 1 for Step 1; Table IEP - 3 for Step 3; Table IEP - 4 for Steps 4, 5 and 6)

Street Number & Name:	617-625 Colombo St. & 143 Tuam St.	**Ref.**	5321603
AKA:	Best Little Law House	**By**	Beca - MTH
Direction Considered:	**a) Longitudinal & b) Transverse**		
(Choose worse case if clear at start.	*Complete IEP-2 and IEP-3 for each if in doubt)*	**Date:**	10/12/2010

Step 2 - Determination of $(\%NBS)_b$

2.1 Determine nominal $(\%NBS) = (\%NBS)_{nom}$

(Baseline (%NBS) for particular building - refer Section B5)

a) Date of Design and Seismic Zone

Date of Design: *(or date of code strengthened to)*

- ○ Pre 1935
- ◉ 1935-1965
- ○ 1965-1976
- ○ 1976-1992
- ○ 1992-2004

Strengthening

☑ Tick if building has been strengthened

If strengthened enter original design date: 1994

See Note 4 below also

Building Category: Public Buildings

Seismic Zone:

b) Soil Type

From NZS1170.5:2004, Cl 3.1.3 :

NZS1170.5:2004

- ○ A or B Rock
- ○ C Shallow Soil
- ◉ D Soft Soil
- ○ E Very Soft Soil

From NZS4203:1992, Cl 4.6.2.2 : (for 1992 to 2004 only and only if known)

NZS4203:1992

- ○ Rigid
- ◉ Intermediate or Not Known

c) Estimate Period, *T*

Comment: **Unreinforced masonry building - 2 storeys**

		Longitudinal	Transverse
		h_n = 36.5	20 m
		A_c = 1.03	1.00 m^2
Moment Resisting Concrete Frames:	$T = 0.09h_n^{0.75}$	○ MRCF	○ MRCF
Moment Resisting Steel Frames:	$T = 0.14h_n^{0.75}$	○ MRSF	○ MRSF
Eccentrically Braced Steel Frames:	$T = 0.08h_n^{0.75}$	○ EBSF	○ EBSF
All Other Frame Structures:	$T = 0.06h_n^{0.75}$	○ Others	○ Others
Concrete Shear Walls	$T = 0.09h_n^{0.75}/A_c^{0.5}$	○ CW	○ CW
Masonry Shear Walls:	$T \leq 0.4$sec	◉ MSW	◉ MSW
User Defined (input Period):		○ Defined	○ Defined
		0.40	0.40 Seconds

Where h_n = height in m from the base of the structure to the uppermost seismic weight or mass.

d) $(\%NBS)_{nom}$ determined from Figure 3.3

Longitudinal:	2.86%
Transverse:	2.86%

Note 1: For buildings designed prior to 1965 and known to be designed as public buildings in accordance with the code of the time, multipy $(\%NBS)_{nom}$ by 1.25.
For buildings designed 1965 - 1976 and known to be designed as public buildings in accordance with the code of the time, mulitply $(\%NBS)_{nom}$ by 1.33 - Zone A, or by 1.2 - Zone B — 1.25

Note 2: For reinforced concrete buildings designed between 1976-84 multiply $(\%NBS)_{nom}$ by 1.2 — N/A

Note 3: For buildings designed prior to 1935 multiply $(\%NBS)_{nom}$ by 0.8 except for Wellington where the factor may be taken as 1. — N/A

Note 4: If the building is known to have been strengthened, enter the percentage of the code selected in 2.1 a) that the building has been strengthened to for each direction.

100%	Longitudinal Direction	
100%	Transverse Direction	**(%NBS)nom**
	Longitudinal:	3.57%
	Transverse:	3.57%

(Scaled as per Notes 1 to 4)

Continued over page.....

Table IEP-2 Initial Evaluation Procedure Step 2 continued

2.2 Near Fault Scaling Factor, Factor A

If $T \leq 1.5$sec, Factor A = 1

a) **Near Fault Factor, *N(T,D)*** (from NZS1170.5:2004, Cl 3.1.6) — Longitudinal: 1; Transverse: 1

b) **Near Fault Scaling Factor** = 1/N(T,D)

Factor A

Longitudinal: 1.00

Transverse: 1.00

2.3 Hazard Scaling Factor, Factor B

a) **Hazard Factor, *Z, for site*** (from NZS1170.5:2004, Table 3.3) — Site Area : Christchurch; Z = 0.22; Z_{1992} = 0.8

b) **Hazard Scaling Factor**

For pre 1992 = 1/Z

For 1992 onwards = Z_{1992}/Z

(Where Z_{1992} is the NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))

Factor B

4.55

2.4 Return Period Scaling Factor, Factor C

a) **Building Importance Level** (from NZS1170.0:2004, Table 3.1 and 3.2) — *Choose Importance Level*: ○ 1 ◉ 2 ○ 3 ○ 4

Comment: Small retail / commercial building

b) **Return Period Scaling Factor from accompanying Table 3.1**

Factor C

1.00

2.5 Ductility Scaling Factor, D

a) **Assessed Ductility of Existing Structure, μ** (shall be less than maximum given in accompanying Table 3.2) — μ = 1.00 Longitudinal Direction; μ = 1.00 Transverse Direction; max = [redacted]

Comment: URM and timber

b) **Ductility Scaling Factor**

		Longitudinal	Transverse
For pre 1976	=	k_μ	k_μ
	=	1.00	1.00
For 1976 onwards	=	1	1

(where k_μ is NZS1170.5:2004 Ductility Factor, from accompanying Table 3.3)

Factor D

Longitudinal: 1.00

Transverse: 1.00

2.6 Structural Performance Scaling Factor, Factor E

a) **Structural Performance Factor, S_p from accompanying Figure 3.4** — S_p = 1 Longitudinal Direction; S_p = 1 Transverse Direction

b) **Structural Performance Scaling Factor** = $1/S_p$

Factor E

Longitudinal: 1.00

Transverse: 1.00

2.7 Baseline %NBS for Building, $(\%NBS)_b$

(equals $(\%NSB)_{nom}$ x A x B x C x D x E)

Longitudinal : 16%

Transverse : 16%

Table IEP-3 Initial Evaluation Procedure Step 3

(Refer Table IEP - 1 for Step 1; Table IEP - 2 for Step 2; Table IEP - 4 for Steps 4, 5 and 6)

Street Number & Name:	617-625 Colombo St. & 143 Tuam St.	**Ref.** 5321603
AKA:	Best Little Law House	**By:** Beca - MTH
Direction Considered:	**a) Longitudinal & b) Transverse**	
(Choose worse case if clear at start. Complete IEP-2 and IEP-3 for each if in doubt)		**Date:** 10/12/2010

a) Longitudinal Direction

Step 3 - Assessment of Performance Achievement Ratio (PAR)

(Refer Appendix B - Section B3.2)

Critical Structural Weakness	Effect on Structural Performance (Choose a value - Do not interpolate)	Building Score
3.1 Plan Irregularity		
Effect on Structural Performance	○ Severe ◉ Significant ○ Insignificant	**Factor A** 0.7
Comment	**Buildings combined and siesmically act as one**	
3.2 Vertical Irregularity		
Effect on Structural Performance	○ Severe ○ Significant ◉ Insignificant	**Factor B** 1.0
Comment		
3.3 Short Columns		
Effect on Structural Performance	○ Severe ○ Significant ◉ Insignificant	**Factor C** 1.0
Comment	**N/A**	

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or =1.0 if no potential for pounding)

a) Factor D1: - Pounding Effect

Select appropriate value from Table

Note:
Values given assume the building has a frame structure. For stiff buildings (eg with shear walls), the effect of pounding may be reduced by taking the co-efficient to the right of the value applicable to frame buildings.

Factor D1 For Longitudinal Direction: 1.0

Table for Selection of Factor D1	Severe	Significant	Insignificant
Separation	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height	○ 0.7	○ 0.8	◉ 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

Comment:

b) Factor D2: - Height Difference Effect

Select appropriate value from Table

Factor D2 For Longitudinal Direction: 1.0

Table for Selection of Factor D2	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	○ 0.4	○ 0.7	◉ 1
Height Difference 2 to 4 Storeys	○ 0.7	○ 0.9	○ 1
Height Difference < 2 Storeys	○ 1	○ 1	○ 1

Comment:

Factor D 1.0

(Set D = lesser of D1 and D2 or..
set D = 1.0 if no prospect of pounding)

3.5 Site Characteristics - *(Stability, landslide threat, liquefaction etc)*

Severe	Significant	Insignificant	
○ 0.5max	○ 0.7	◉ 1	**Factor E** 1.0

Comment: **Assume 'good ground'**

3.6 Other Factors

For ≤ 3 storeys - Maximum value 2.5,
otherwise - Maximum value 1.5. No minimum. **Factor F** 1.0

Record rationale for choice of Factor F:

Structure has damage following Septmber 4 2010 earthquake. Part of parapet of 143 Tuam fallen and cracking or internal walls af 621 Columbo

3.7 Performance Achievement Ratio (PAR)
(equals A x B x C x D x E x F)

PAR (Longitudinal): 0.70

b) Transverse Direction

Step 3 - Assessment of Performance Achievement Ratio (PAR)

(Refer Appendix B - Section B3.2)

Critical Structural Weakness	Effect on Structural Performance (Choose a value - Do not interpolate)	Building Score

3.1 Plan Irregularity

Effect on Structural Performance: ○ Severe ◉ Significant ○ Insignificant

Comment: Buildings combined and seismically act as one

Factor A: 0.7

3.2 Vertical Irregularity

Effect on Structural Performance: ○ Severe ○ Significant ◉ Insignificant

Comment:

Factor B: 1.0

3.3 Short Columns

Effect on Structural Performance: ○ Severe ○ Significant ◉ Insignificant

Comment: N/A

Factor C: 1.0

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or =1.0 if no potential for pounding)

a) **Factor D1: - Pounding Effect**

Select appropriate value from Table

Note:
Values given assume the building has a frame structure. For stiff buildings (eg with shear walls), the effect of pounding may be reduced by taking the co-efficient to the right *of the value applicable to frame buildings.*

Factor D1 For Transverse Direction: 1

Table for Selection of Factor D1	Severe	Significant	Insignificant
Separation	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height	○ 0.7	○ 0.8	◉ 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

Comment:

b) **Factor D2: - Height Difference Effect**

Select appropriate value from Table

Factor D2 For Transverse Direction: 1

Table for Selection of Factor D2	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	○ 0.4	○ 0.7	◉ 1
Height Difference 2 to 4 Storeys	○ 0.7	○ 0.9	○ 1
Height Difference < 2 Storeys	○ 1	○ 1	○ 1

Comment:

Factor D: 1.0

(Set D = lesser of D1 and D2 or.. set D = 1.0 if no prospect of pounding)

3.5 Site Characteristics - *(Stability, landslide threat, liquefaction etc)*

Severe	Significant	Insignificant
○ 0.5max	○ 0.7	◉ 1

Factor E: 1.0

Comment: Assume 'good ground'

3.6 Other Factors

For ≤ 3 storeys - Maximum value 2.5, otherwise - Maximum value 1.5. No minimum.

Factor F: 1.0

Record rationale for choice of Factor F:

As for longitudinal

3.7 Performance Achievement Ratio (PAR) (equals A x B x C x D x E x F)

PAR (Transverse): 0.70

Table IEP- 4 Initial Evaluation Procedure Steps 4, 5 and 6

(Refer Table IEP - 1 for Step 1; Table IEP - 2 for Step 2; Table IEP - 3 for Step 3)

Street Number & Name:	617-625 Colombo St. & 143 Tuam St.	**Ref.**	5321603
AKA:	Best Little Law House	**By:**	Beca - MTH
		Date:	10/12/2010

Step 4 - Percentage of New Building Standard (%NBS)

	Longitudinal	Transverse
4.1 Assessed Baseline (%NBS)$_b$ (from Table IEP - 1)	16%	16%
4.2 Performance Achievement Ratio (PAR) (from Table IEP - 2)	0.70	0.70
4.3 PAR x Baseline (%NBS)b	11%	11%
4.4 Percentage New Building Standard (%NBS) (Use lower of two values from Step 3.3)		11%

Step 5 - Potentially Earthquake Prone? (Mark as appropriate) **%NBS ≤ 33** YES

Step 6 - Potentially Earthquake Risk? (Mark as appropriate) **%NBS < 67** YES

Step 7 - Provisional Grading for Seismic Risk based on IEP

Seismic Grade E

Evaluation Confirmed by ..... **Signature**

Samir Govind **Name**

167736 **CPEng. No**

Relationship between Grade and SPS:

Grade:	A+	A	B	C	D	E
%NBS:	> 100	100 to 80	80 to 67	67 to 33	33 to 20	< 20

Appendix D

Christchurch City Council's Earthquake Prone Buildings Policy

Draft notes for engineers meeting 13/9/2010

CHRISTCHURCH CITY COUNCIL'S EARTHQUAKE PRONE BUILDINGS POLICY

POST-EARTHQUAKE OBJECTIVE

Buildings that have sustained structural damage are assessed and strengthened to 67% of Full Code Level (FCL).

PROPOSED PROCESS

Situation (1) Buildings with a Yellow or Red placard

- It is intended that these placards will be converted to Dangerous and Insanitary Building notices by the time the declaration is lifted midday Wednesday 15th September.
- Detailed Engineering Evaluation reports are required to be provided by the Owner to Council
- This report is to be prepared by a Chartered Professional Engineer (Structural) and should summarise:
    - The principal lateral and vertical load resisting systems
    - The principal structural damage sustained
    - The estimated level of lateral load resistance of the overall structure in its current form (only in broad terms, e.g. <33% between 33% and 67%, or >67% FCL)
    - What will be the overall philosophy of how the building can be bought up to meet the 67% of FCL objective including proposed changed lateral load paths
    - The specific structural repairs proposed
    - Prioritisation if it is to be staged in any way
    - Sketch (at least) plans for any proposed retrofit
    - For Heritage Buildings a more detailed level of reporting will be required

Situation (2) Buildings with a Green or no placard

- If the owner, insurance assessor or engineer identifies structural damage, a detailed Engineer's Evaluation report (as outlined above) is required

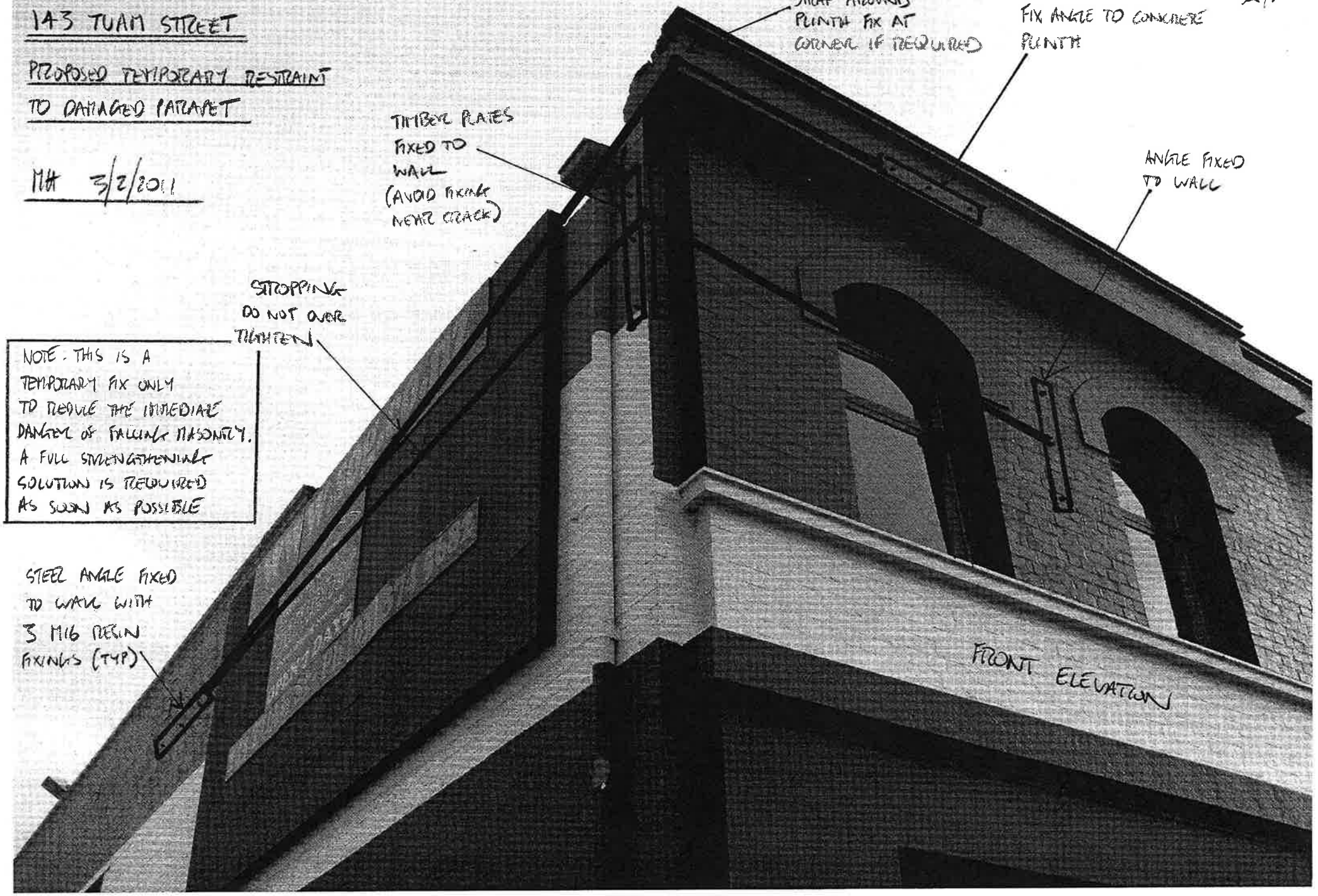
Detailed Engineering Evaluation reports can be submitted with a Building Consent application or as a draft to use as the basis for discussion with Council prior to preparation of the Building Consent documentation.

Sk/1

143 TUAM STREET

PROPOSED TEMPORARY RESTRAINT TO DAMAGED PARAPET

MH 3/2/2011

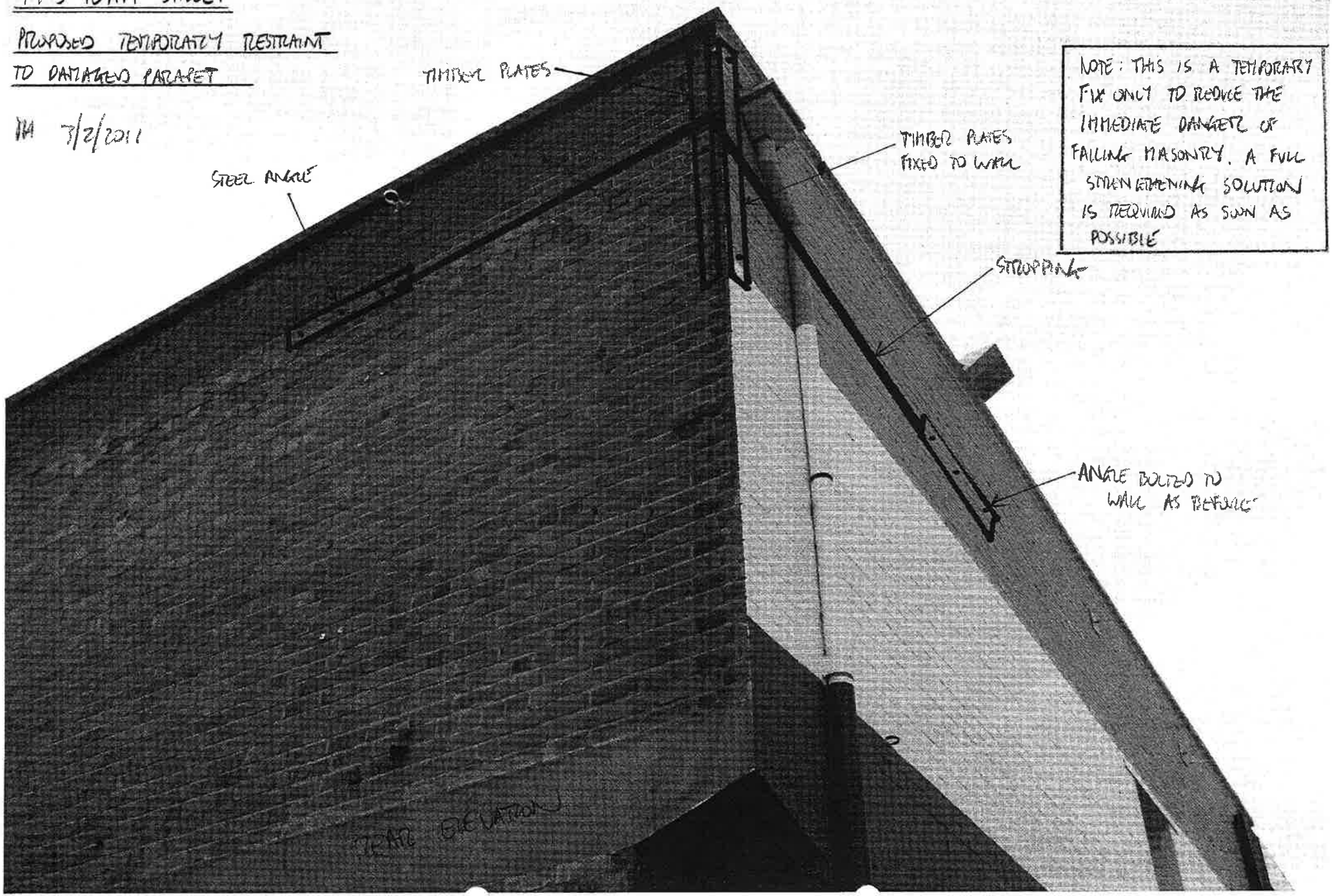


143 TUAM STREET

PROPOSED TEMPORARY RESTRAINT TO DAMAGED PARAPET

NA 7/2/2011

Sk/2



NOTE: THIS IS A TEMPORARY FIX ONLY TO REDUCE THE IMMEDIATE DANGER OF FALLING MASONRY. A FULL STRENGTHENING SOLUTION IS REQUIRED AS SOON AS POSSIBLE

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, Christchurch , New Zealand
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Best Little Law House Ltd
C/- Colliers, Unit A
15 Sir Gil Simpson Drive
Christchurch
New Zealand

6 May 2011

Attention: Graham Joseph

Dear Graham

143 Tuam Street & 617-625 Colombo Street - Preliminary Structural Damage Assessment

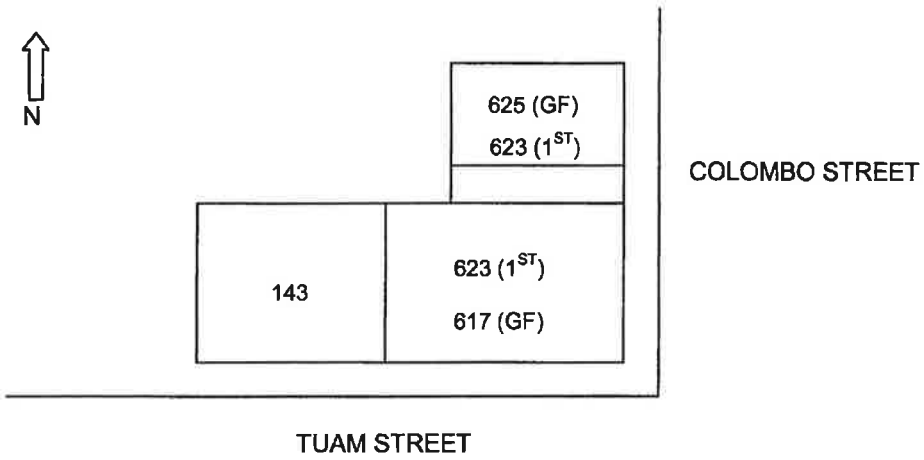
Introduction

As requested Beca undertook an inspection of the above properties on the 2 May 2011 to provide an initial structural assessment of the building damage following the 22 February 2011 earthquake and subsequent aftershocks.

The buildings comprise of three individual structures built prior to 1960 that have since been structurally strengthened. The buildings are primarily constructed of unreinforced masonry with timber floors and trussed timber roofs. Beca were previously commissioned to undertake a Detailed Structural Evaluation of these building following the 4 September 2010 earthquake (refer to Beca report dated 10 December 2010). The report estimated the buildings to have a structural lateral load resisting capacity of 11% of the New Building Standard, and as such were considered to be 'earthquake prone'.

The buildings are currently in the 'Red Zone' of the City Councils cordon, so are inaccessible unless accompanied by an Engineer. As of writing, it is unknown when the cordon will be lifted or reduced.

A simple plan and description of the extent of the damage and the likely action required for each building is outlined below:



143 Tuam Street (Switched on Gardener)

Both tenancies (ground and first floor) were placarded with yellow Restricted Access notices from the earlier Level 2 rapid assessments.

The property appeared to have performed well in the recent earthquake with the only obvious damage being to the masonry parapet on the front elevation and some minor internal damage to the buildings linings.

The cracking of the masonry parapets had worsened, with a predominant horizontal crack of the mortar bed joints evident above the window lintels on the front elevation. A vertical crack through the concrete parapet corbel was also noted, with some spalled concrete from it found on the pavement.

Minor cracking of the concrete foundation beam was noted at the north-west corner. The pre-earthquake cracking of the concrete floor beam on the rear elevation did not appear to have worsened.

The temporary strapping installed just prior to the earthquake appears to have restrained the damaged masonry parapets preventing them from falling. The cracked masonry parapets at the rear corners of the buildings do not appear to have worsened.

The side access road to the west of the building was noted to be partially flooded due to a slowly leaking underground water main. There was no evidence of building settlement or ejected liquefied material in the vicinity of this building. The buildings on the opposite side of Tuam Street were either completely collapsed or have been severely damaged and likely require demolition.

An inspection of the ground floor tenancy did not reveal any structural damage, however the plasterboard linings to the main columns and some of the suspended ceiling should be removed and opened up to investigate further.

An inspection of the upper floor tenancy did not reveal any structural damage. Some displaced ceiling tiles were noted, some of which had been caused by masonry or rubble falling into the building. It could not be determined at the time where exactly the rubble had come from, and again it is recommended that a more detailed investigation of the roof structure is undertaken.

625 Colombo Street (Silk Road Restaurant)

This building and the adjacent block of buildings to the north had suffered a catastrophic collapse of their front elevations. Due to the extent of this damage it was not possible to inspect this property further due to safety concerns. It is understood that these buildings are to be completely demolished as they are in a dangerous condition.

623 Colombo Street (JJ Club)

Access to this property from the front entrance on Colombo Street was not possible due to a partially collapsed wall jamming the doorway.

Access to this property from the rear fire escape exist was also not possible as this lead through the partially collapsed upper floor of 625 Colombo Street.

It was therefore not possible to safely access this floor of the JJ Club with the access-ways available. The first floor and roof structure of this property (which is also the floor above Sampan House restaurant) could therefore not be inspected at this time.

617 Colombo Street (Sampan House Restaurant)

Access keys were not available to undertake an internal inspection of this building. An external visual survey revealed only minor damage to the external envelope. Minor cracking was noted to the masonry columns around the front perimeter of the building, however this did not appear to be of concern.

The greatest damage was observed at the interface of the adjacent property of 623 & 625 Colombo Street. Due to the partial collapse of this building, damage has occurred to the parapet and inter-tenancy wall. The masonry parapet was cracked and appeared to now be unrestrained where it was connected to the 625 Colombo Street parapet and return wall. Whilst this parapet does not appear to pose an immediate risk of falling, vibrations related to the demolition of the adjacent building will possibly destabilise it due to its close proximity.

This and the adjacent building are understood to have been constructed separately with independent inter-tenancy walls and foundations. At some point in their history, the buildings had become connected, with access-ways installed between them along with various other structural modifications. It is not clear if any other structural connections were made between these buildings, however it is assumed from the earlier strengthening work that both buildings rely on each other for lateral seismic load resistance in the north-south direction.

Conclusions & Recommendations

Below are our initial conclusions and recommendations based upon our previous assessment of the buildings and the recent inspections.

143 Tuam Street

This property appears to have performed well during the earthquake. However, damage to the masonry parapets and cracking of the wall elevations that existed prior to the February earthquake have worsened and still require investigation and repair.

A thorough investigation of the internal structure is recommended to determine if the gravity load resisting structure (columns and floor beams) are damaged. An inspection of the roof structure and in particular its connection to the perimeter walls is also recommended.

Due to the current extent of this damage, the detailed inspection and repairs should be undertaken prior to re-occupation of the building, therefore the current status of "Restricted – Y2" for both ground and upper floor tenancies should remain.

The feasibility and options for strengthening this building would be the next step after a more detailed structural investigation, if required.

625 Colombo Street

This building is partially collapsed and it is understood that it will be completely demolished.

As part of the seismic strengthening of these buildings 17 years ago, a new diaphragm floor and internal shear walls were constructed to provide enhanced lateral seismic resistance for this building, 617 Colombo Street and 143 Tuam Street. The demolition of this building and these walls will reduce the seismic resistance of all these buildings, however since the total seismic resistance compared to the current code has been estimated as very low, it will have a negligible effect on the overall buildings performance in a future seismic event.

Notwithstanding, a seismic strengthening scheme for the remaining buildings should be undertaken and the sooner it is in place, the less chance the buildings will be severely affected by an earthquake.

623 Colombo Street

Access for inspection of this building should be gained following demolition of the adjacent property and making safe. The part of the first floor which extends over 625 Colombo Street will be demolished. The remaining area over 617 Colombo Street will require further structural investigation from within.

The demolition of 625 Colombo Street may impact upon the structure of 623 Colombo Street depending on how they have been connected together. The party wall between these buildings comprises of both original adjoining walls, so it may be possible to demolish one while leaving the other standing although this may prove difficult. The remaining wall is likely to require strengthening or temporary support particularly near the parapet on the front elevation. Demolition of the adjacent building may also destabilise the adjacent masonry parapet.

Summary

A detailed structural investigation of the 143 Tuam Street and 617 Colombo Street buildings should be undertaken to determine the extent of damage and to provide options for strengthening. This should be carried out prior to re-occupation of the buildings, therefore the current status of "Restricted – Y2" should remain.

The buildings remain earthquake prone and therefore require strengthening in line with Christchurch City Council's policy. As of writing, the Council is considering increasing the seismic design coefficients for Christchurch which would entail a higher level of strengthening than before to meet their requirements for earthquake prone buildings. Beca can provide options for strengthening the buildings if required.

625 Colombo Street has suffered significant damage and partial collapse. It is likely that this building will be completely demolished.

Limitations

Our inspection/recommendations of relevant aspects of these buildings as outlined above cannot guarantee that all possible facilities, defects, conditions and qualities are identified in this report. No underground services, hazardous material, geotechnical or subsurface investigations were undertaken.

This report is of defined scope and is for reliance by Best Little Law House Ltd only, and only for this commission. Beca should be consulted where any question regarding the interpretation or completeness of our inspection or report arises.

Yours sincerely

Mark Humphery
Senior Structural Engineer

on behalf of
Beca Carter Hollings & Ferner Ltd
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Yours sincerely

Samir Govind
Technical Director Structural Engineering

on behalf of
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Direct Dial: +64 3 374 3718
Email: mark.humphery@beca.com

Photographs

Photo 1 – View from Colombo Street

Photo 2 – No access to 623 Colombo St

Photo 3 – Wall between 617 & 623 Colombo St

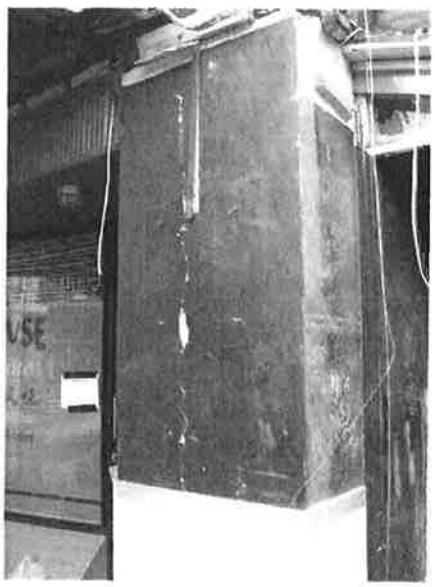

Photo 4- Cracked column between buildings

Photo 5- Crack at party wall interface.

Photo 6- Colombo Street view

Photo 7- Damaged parapet 143 Tuam Street

Photo 8 – Damaged tiles from fallen debris