# Project: Richmond Community Centre

## Qualitative Engineering Evaluation

**Prepared for:** Christchurch City Council

**Project:** 228360

**Date:** 28 June 2013

Building Functional Location ID : PRO0684 002

Building Name : Richmond Community Centre

Building Address : 78 London Street

# Document Control Record

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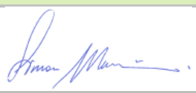
| Document control | | | | | | aurecon |
|---|---|---|---|---|---|---|
| **Report Title** | | Qualitative Engineering Evaluation | | | | |
| **Document ID** | | | **Project Number** | | 228360 | |
| **File Path** | | P:\228360 | | | | |
| **Client** | | Christchurch City Council | **Client Contact** | | Micheal Sheffeild | |
| **Rev** | **Date** | **Revision Details/Status** | **Prepared by** | **Author** | **Verifier** | **Approver** |
| 1 | 12 June 2012 | Draft | S. Manning | S. Manning | L. Howard | L. Howard |
| 2 | 28 June 2013 | Final | S. Manning | S. Manning | L. Howard | L. Howard |
| | | | | | | |
| | | | | | | |
| **Current Revision** | | **2** | | | | |

| Approval | | | |
|---|---|---|---|
| Author Signature | | Approver Signature | |
| Name | Simon Manning | Name | L. Howard |
| Title | Senior Structural Engineer | Title | Senior Structural Engineer |

# Contents

# 1. Executive Summary

This is a summary of the Qualitative Report for the Richmond Community Centre building structure and is based on the Detailed Engineering Evaluation Procedure document issued by the Structural Advisory Group on 19 July 2011, visual inspections, available structural documentation and summary calculations as appropriate.

| | | | | | |
|---|---|---|---|---|---|
| **Building Details** | **Name** | Richmond Community Centre | | | |
| **Building Location ID** | PRO 0684 002 | | | **Multiple Building Site** | N |
| **Building Address** | 78 London Street | | | **No. of residential units** | 0 |
| **Soil Technical Category** | TC2 | **Importance Level** | 2 | **Approximate Year Built** | 1900's |
| **Foot Print (m²)** | 110 | **Stories above ground** | 1 | **Stories below ground** | 0 |
| **Type of Construction** | Light roof, light timber framed walls, concrete perimeter foundation, timber floor on isolated piles. | | | | |
| **Qualitative L4 Report Results Summary** | | | | | |
| **Building Occupied** | Y | The Richmond Community Centre is currently in use. | | | |
| **Suitable for Continued Occupancy** | Y | The Richmond Community Centre is suitable for continued occupation. | | | |
| **Key Damage Summary** | Y | Refer to summary of building damage section 4.1 report body. | | | |
| **Critical Structural Weaknesses (CSW)** | N | There were no critical structural weaknesses found. | | | |
| **Levels Survey Results** | Y | The floor was found to be out of level by up to 98mm. | | | |
| **Building %NBS From Analysis** | >67% | Building capacity assessed as approximately 67%NBS | | | |
| **Qualitative L4 Report Recommendations** | | | | | |
| **Geotechnical Survey Required** | Y | Land is categorised as TC2 but adjacent to TC3. A geotechnical investigation is required to determine suitability of repair. | | | |
| **Repair Recommendations** | Y | Re-levelling of building required some pile/perimeter foundation wall replacement likely. Geotechnical investigation required to confirm suitability of repair proposal. | | | |
| **Approval** | | | | | |
| **Author Signature** |  | | **Approver Signature** |  | |
| **Name** | Simon Manning | | **Name** | L. Howard | |
| **Title** | Senior Structural Engineer | | **Title** | Senior Structural Engineer | |

# 2. Introduction

## 2.1 General

On 13 January 2012 Aurecon engineers visited the Richmond Community Centre to carry out a qualitative building damage assessment on behalf of Christchurch City Council. Detailed visual inspections were carried out to assess the damage caused by the earthquakes on 4 September 2010, 22 February 2011, 13 June 2011, 23 December 2011 and related aftershocks.

The scope of work included:

- Assessment of the nature and extent of the building damage.
- Visual assessment of the building strength particularly with respect to safety of occupants if the building is currently occupied.
- Assessment of requirements for detailed engineering evaluation including geotechnical investigation, level survey and any areas where linings and floor coverings need removal to expose structural damage.

This report outlines the results of our Qualitative Assessment of damage to the Richmond Community Centre and is based on the Detailed Engineering Evaluation Procedure document issued by the Structural Advisory Group on 19 July 2011, visual inspections, available structural documentation and summary calculations as appropriate.

# 3. Description of the Building

## 3.1 Building Age and Configuration

Richmond Community Centre is an early 1900's single storey colonial cottage. It has a light weight corrugated iron roof, weatherboard clad timber framed walls, a concrete perimeter foundation and a suspended timber floor on piles. The approximate floor area of the building is 110 square metres. It is an importance level 2 structure in accordance with AS/NZ 1170.

## 3.2 Building Structural Systems Vertical and Horizontal

Richmond Community Centre is a very simple structure. Its light weight iron roof is supported on timber rafters that transfer loads to both internal and external load bearing walls. Load bearing walls are supported on timber bearers and either isolated piles for the internal walls or the concrete perimeter foundation for the external walls. Lateral loads are resisted by lined timber framed walls in each direction. Internal walls are either sarked with horizontal timber boards or lined with plaster board. External walls are either sarked or lined with plaster board internally and clad with weather boards externally. No plans were available for this structure.

## 3.3 Reference Building Type

Richmond Community Centre is a basic colonial cottage typical of its age and style. It was not subject to specific engineering design; rather it was constructed to a reliable formula known to achieve the performance and aesthetic objectives of the time it was built. That it is still in use more than 100 years after it was built is testimony to the skill understanding of its builders. Richmond Community Centre does however suffer from significant deferred maintenance issues. Timber decay was observed in several locations on the building exterior.

### 3.4 Building Foundation System and Soil Conditions

Richmond Community Centre has, as discussed above, a concrete perimeter foundation and isolated piles supporting a suspended timber floor. The land and surrounds of Richmond Community Centre are zoned technical category two or TC2 and minor to moderate land damage from liquefaction is possible in future large earthquakes. It should be noted that the land to the east is categorised as TC3 Additionally there are signs in the vicinity of Richmond Community Centre of liquefaction bulges or boils and possible subsidence.

### 3.5 Available Structural Documentation and Inspection Priorities

No architectural drawings were available for the Richmond Community Centre. Inspection priorities related to a review of potential damage to foundations and consideration of wall bracing adequacy. Additionally there was potential for non-structural damage to brittle linings such as lath and plaster walls and ceilings.

### 3.6 Available Survey Information

We undertook a floor level survey to establish the amount of settlement that has occurred. The results of the survey are presented on the attached sketch in Appendix A.  All of the levels were taken on top of the existing floor coverings which will have introduced some variation.

The Department of Building and Housing (DBH) published “Revised guidance on repairing and rebuilding houses affected by the Canterbury earthquake sequence” in November 2011. This document recommends some form of re-levelling or rebuilding of the floor if the slope is greater than 0.5% for any two points more than 2m apart, or there is significant cracking of the floor or the variation in level over the floor plan is greater than 50mm.

The floor levels for the Richmond Community Centre were found to be outside acceptable limits. The entire building is leaning in the North-West direction with a change in level of 98mm recorded on the southern wall line.

## 4. Structural Investigation

### 4.1 Summary of Building Damage

The Richmond Community Centre is currently in use and was occupied at the time the damage assessment was carried out.

The main areas of seismic damage that were noted are summarized as follows;

- Liquefaction and differential settlement in property and surrounds;
- Cracks in perimeter foundation;
- Cracks in Footpath; and
- Cracking in gypsum (roof and walls).

In general damage was evenly distributed and apart from settlement issues relatively minor.

### 4.2 Record of Intrusive Investigation

No intrusive investigation was carried out for Richmond Community Centre.

### 4.3 Damage Discussion

The most significant damage observed to Richmond Community Centre was to the surrounding land due to liquefaction and subsequent settlement. In addition to this there were cracks in foundations and pavement and internally cracking to ceilings and walls. The damage to ceilings and walls was relatively minor. This is possibly due to the presence of more fibrous plaster linings and less of the more brittle lath and plaster.

Perimeter foundation damage is likely due to a combination of differential settlement due to liquefaction and shear and flexural seismic loads transferred into it from walls and the floor. Although the Richmond Community Centre has suffered damage, at present it is considered that the damage has not reduced residual seismic capacity sufficiently to warrant building closure.

# 5. Building Review Summary

### 5.1 Building Review Statement

As noted above no intrusive investigations were carried out for the Richmond Community Centre. Because of the generic nature of the building a significant amount of information can be inferred from an external and internal inspection.

### 5.2 Critical Structural Weaknesses

No specific critical structural weaknesses were identified as part of the building qualitative assessment.

# 6. Building Strength Assessment (Refer to Appendix C for background information)

### 6.1 General

The Richmond Community Centre is, as discussed above, a typical example of an early colonial cottage built from timber. It is of a type of building that, due to its light weight, flexibility and natural ductility, has typically performed well. The Richmond Community Centre is not an exception to this. It has however suffered damage as noted above.

### 6.2 Initial %NBS Assessment

As the Richmond Community Centre has not been subject to specific engineering design the IEP process does not give a useful estimate of building capacity in terms of percentage of new building strength.

An estimate of building strength can be made by assigning assessed material capacities to the existing walls, calculating capacity and comparing this to codified demand. This analysis has been carried out for the structure as a whole and has resulted in an estimated percentage new building standard in excess of 67%NBS. This value is places the structure in the category of ‘low earthquake risk’ in accordance with NZSEE guidelines.

### 6.3 Results Discussion

As noted above it is the judgement of the writer that the existing lateral load capacity of the structure exceeds 67%NBS and as such can be considered suitable for continued occupancy; however the building has damage to internal linings and to foundations. Any repair strategy will require rebuilding/re-levelling of the foundations and this will need to be informed by a geotechnical investigation. The geotechnical study will require a specific site investigation.

# 7. Conclusions and Recommendations

It is recommended that the building be re-levelled with new piles and an enhanced perimeter footing installed, where required, in accordance with section 4.2 of DBH “Revised guidance on repairing and rebuilding houses affected by the Canterbury earthquake sequence” (November 2011). **It is recommended that a geotechnical investigation is carried out** to confirm the suitability of this repair approach.

The Richmond Community Centre building is currently occupied and in use and in our opinion it is **suitable for continued occupation.**

# 8. Explanatory Statement

The inspections of the building discussed in this report have been undertaken to assess structural earthquake damage. No analysis has been undertaken to assess the strength of the building or to determine whether or not it complies with the relevant building codes, except to the extent that Aurecon expressly indicates otherwise in the report. Aurecon has not made any assessment of structural stability or building safety in connection with future aftershocks or earthquakes – which have the potential to damage the building and to jeopardise the safety of those either inside or adjacent to the building, except to the extent that Aurecon expressly indicates otherwise in the report.

This report is necessarily limited by the restricted ability to carry out inspections due to potential structural instabilities/safety considerations, and the time available to carry out such inspections. The report does not address defects that are not reasonably discoverable on visual inspection, including defects in inaccessible places and latent defects. Where site inspections were made, they were restricted to external inspections and, where practicable, limited internal visual inspections.

To carry out the structural review, existing building drawings were obtained from the Christchurch City Council records. We have assumed that the building has been constructed in accordance with the drawings.

While this report may assist the client in assessing whether the building should be strengthened, that decision is the sole responsibility of the client.

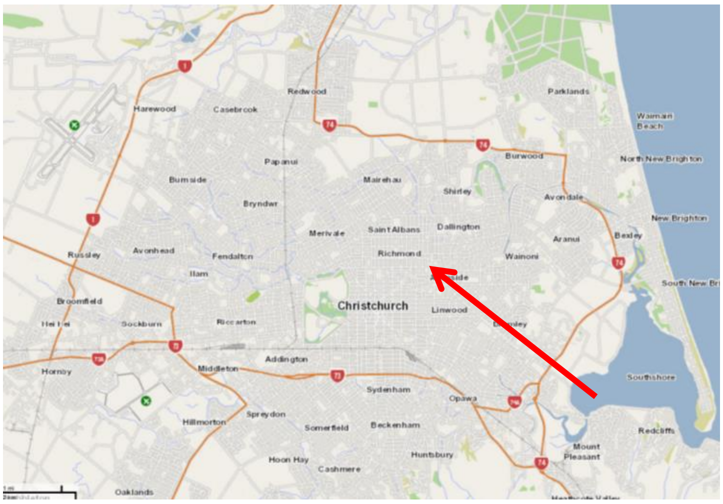
This review has been prepared by Aurecon at the request of its client and is exclusively for the client’s use. It is not possible to make a proper assessment of this review without a clear understanding of the terms of engagement under which it has been prepared, including the scope of the instructions and directions given to and the assumptions made by Aurecon. The report will not address issues which would need to be considered for another party if that party’s particular circumstances, requirements and experience were known and, further, may make assumptions about matters of which a third party is not aware. No responsibility or liability to any third party is accepted for any loss or damage whatsoever arising out of the use of or reliance on this report by any third party.

Without limiting any of the above, Aurecon’s liability, whether under the law of contract, tort, statute, equity or otherwise, is limited as set out in the terms of the engagement with the client.

# Appendices

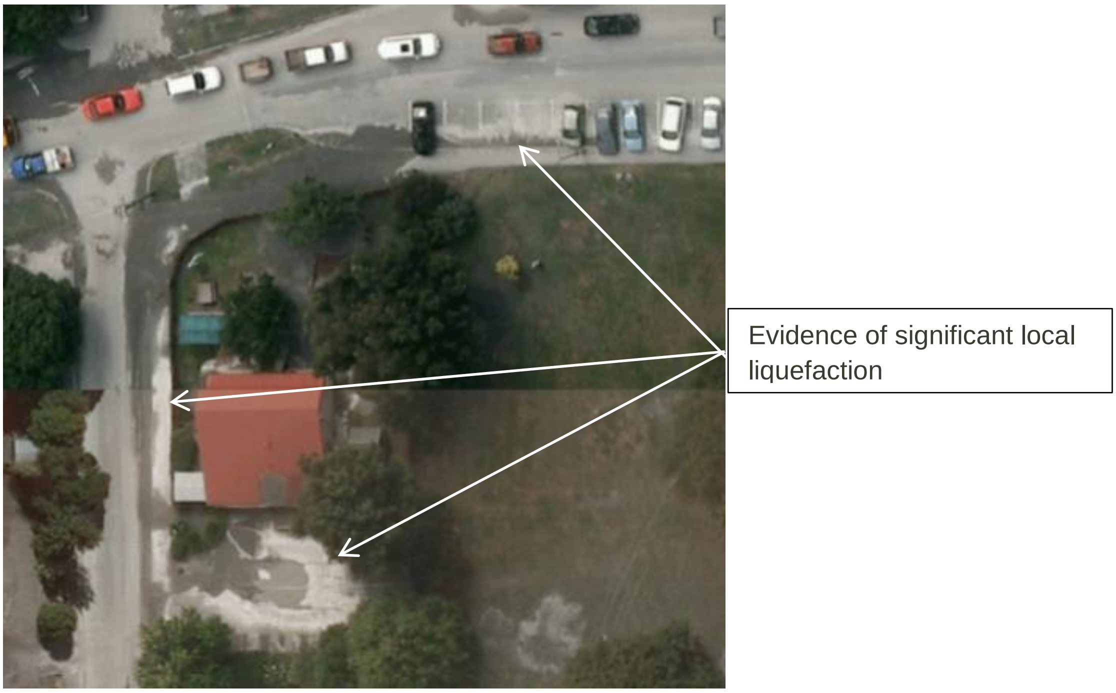
# Appendix A

## Site Map, Photos and Levels Survey Results




Location of Richmond Community Centre

**Site photographes (13 January 2012)**




Aerial photo taken post 22nd February

Building north elevation

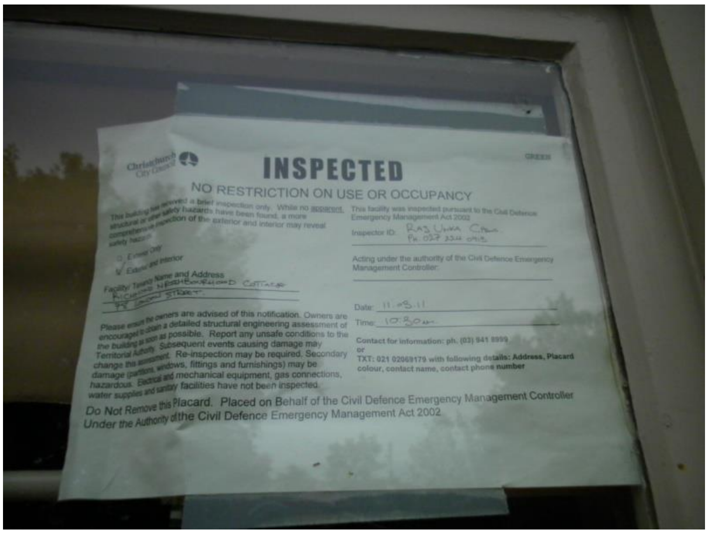
Building south elevation

Sizable liquefaction boil below asphalt

Crack in concrete perimeter foundation

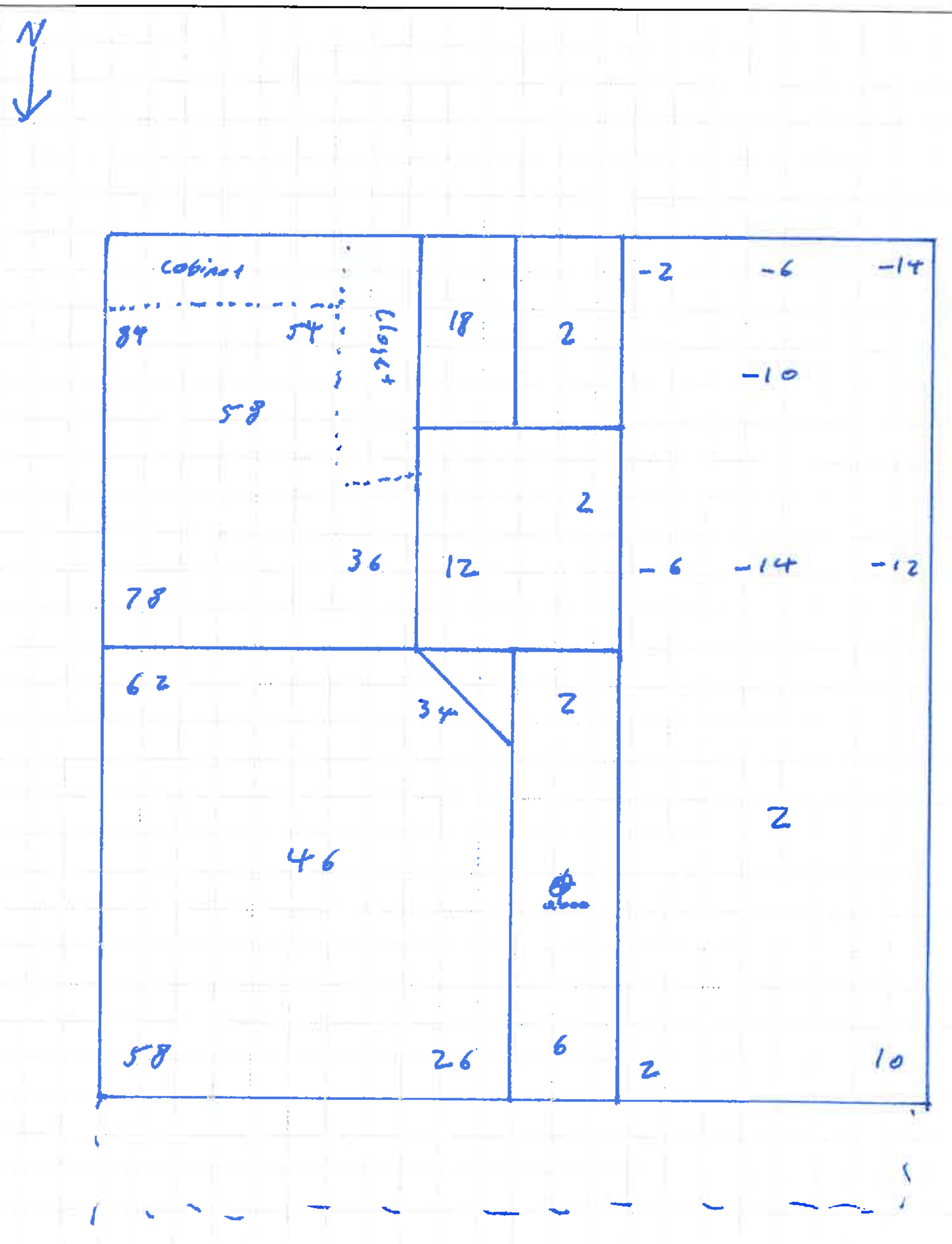
Lining damage at ceiling wall intersection

Lining damage at floor level




Green inspection sticker.

| | | | |
|---|---|---|---|
| Client: CCC | | | Date: 17/05/12 |
| Project/Job: Richmond Community Centre | | Job No: 228360 | |
| Subject: Level Survey | | Sheet No: 1 | By: DL |



# Appendix B

## Reference Documents and Material

- AS/NZS 1170.0,1,5 and commentaries;
- New Zealand Society for Earthquake Engineering (NZSEE) 2006 Study Group Recommendations "Assessment and Improvement of the Structural Performance of Buildings in Earthquakes" – June 2006
- Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-Residential Buildings in Canterbury. Part 2 Evaluation Procedure. Draft prepared by Engineering Advisory Group, Revision 5, 19 July 2011.

# Appendix C

# Explanation of Strength Assessment

## New building standard (NBS)

New building standard (NBS) is the term used with reference to the earthquake standard that would apply to a new building of similar type and use if the building was designed to meet the latest design Codes of Practice. If the strength of a building is less than this level, then its strength is expressed as a percentage of NBS.

## Earthquake prone buildings

A building can be considered to be high risk or earthquake prone if its strength is less than one third of the strength to which an equivalent new building would be designed, that is, less than 33%NBS (as defined by the New Zealand Build Act). If the building strength exceeds 33%NBS but is less than 67%NBS the building is considered a moderate risk building. Above 67%NBS is considered low risk.

## Christchurch City Council Earthquake Prone Building Policy 2010

The Christchurch City Council (CCC) already had in place an Earthquake Prone Building Policy (EPB Policy) requiring all earthquake-prone buildings to be strengthened within a timeframe varying from 15 to 30 years. The level to which the buildings were required to be strengthened was 33%NBS.

As a result of the 4 September 2010 Canterbury earthquake the CCC raised the level that a building was required to be strengthened to from 33% to 67% NBS but qualified this as a target level and noted that the actual strengthening level for each building will be determined in conjunction with the owners on a building-by-building basis. Factors that will be taken into account by the Council in determining the strengthening level include the cost of strengthening, the use to which the building is put, the level of danger posed by the building, and the extent of damage and repair involved.

Irrespective of strengthening level, the threshold level that triggers a requirement to strengthen is 33%NBS.

As part of any building consent application fire and disabled access provisions will need to be assessed.

## Christchurch Seismicity

The level of seismicity within the current New Zealand loading code (AS/NZS 1170) is related to the seismic zone factor. The zone factor varies depending on the location of the building within NZ. Prior to the 22nd February 2011 earthquake the zone factor for Christchurch was 0.22. Following the earthquake the seismic zone factor (level of seismicity) in the Christchurch and surrounding areas has been increased to 0.3. This is a 36% increase.

For this assessment, the building's earthquake resistance is compared with the current New Zealand Building Code requirements for a new building constructed on the site. This is expressed as a percentage of new building standard (%NBS). The new building standard load requirements have been determined in accordance with the current earthquake loading standard (NZS 1170.5:2004 Structural design actions - Earthquake actions - New Zealand).

## Earthquake Resistance Standards

The likely capacity of this building has been derived in accordance with the New Zealand Society for Earthquake Engineering (NZSEE) guidelines 'Assessment and Improvement of the Structural Performance of Buildings in Earthquakes' (AISPBE), 2006. These guidelines provide an Initial Evaluation Procedure that assesses a buildings capacity based on a comparison of loading codes from when the building was designed and currently. It is a quick high-level procedure that can be used when undertaking a Qualitative analysis of a building. The guidelines also provide guidance on calculating a modified Ultimate Limit State capacity of the building which is much more accurate and can be used when undertaking a Quantitative analysis.

The New Zealand Society for Earthquake Engineering has proposed a way for classifying earthquake risk for existing buildings in terms of %NBS and this is shown in Figure 3.1 below.

| Description | Grade | Risk | %NBS | Existing Building Structural Performance |
|---|---|---|---|---|
| Low Risk Building | A or B | Low | Above 67 | Acceptable (improvement may be desirable) |
| Moderate Risk Building | B or C | Moderate | 34 to 66 | Acceptable legally. Improvement recommended |
| High Risk Building | D or E | High | 33 or lower | Unacceptable (Improvement |

| Improvement of Structural Performance | |
|---|---|
| Legal Requirement | NZSEE Recommendation |
| The Building Act sets no required level of structural improvement (unless change in use) This is for each TA to decide. Improvement is not limited to 34%NBS. | 100%NBS desirable. Improvement should achieve at least 67%NBS |
| | Not recommended. Acceptable only in exceptional circumstances |
| Unacceptable | Unacceptable |

Figure 3.1: NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE Guidelines

Table 3.1 below compares the percentage NBS to the relative risk of the building failing in a seismic event with a 10% risk of exceedance in 50 years **(i.e. 0.2% in the next year).** It is noted that the current seismic risk in Christchurch results in a **6% risk of exceedance** in the next year.

**Table 3.1: %NBS compared to relative risk of failure**

| Percentage of New Building Standard (%NBS) | Relative Risk (Approximate) |
|---|---|
| >100 | <1 time |
| 80-100 | 1-2 times |
| 67-80 | 2-5 times |
| 33-67 | 5-10 times |
| 20-33 | 10-25 times |
| <20 | >25 times |

# Appendix D
## Background and Legal Framework

**1 Background**

Aurecon has been engaged by the Christchurch City Council (CCC) to undertake a detailed engineering evaluation of the building

This report is a Qualitative Assessment of the building structure, and is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011.

A qualitative assessment involves inspections of the building and a desktop review of existing structural and geotechnical information, including existing drawings and calculations, if available.

The purpose of the assessment is to determine the likely building performance and damage patterns, to identify any potential critical structural weaknesses or collapse hazards, and to make an initial assessment of the likely building strength in terms of percentage of new building standard (%NBS).

At the time of this report, no intrusive site investigation, detailed analysis, or modelling of the building structure had been carried out. Construction drawings were made available, and these have been considered in our evaluation of the building. The building description below is based on a review of the drawings and our visual inspections.

**2 Compliance**

This section contains a brief summary of the requirements of the various statutes and authorities that control activities in relation to buildings in Christchurch at present.

**2.1 Canterbury Earthquake Recovery Authority (CERA)**

CERA was established on 28 March 2011 to take control of the recovery of Christchurch using powers established by the Canterbury Earthquake Recovery Act enacted on 18 April 2011. This act gives the Chief Executive Officer of CERA wide powers in relation to building safety, demolition and repair. Two relevant sections are:

Section 38 – Works

This section outlines a process in which the chief executive can give notice that a building is to be demolished and if the owner does not carry out the demolition, the chief executive can commission the demolition and recover the costs from the owner or by placing a charge on the owners' land.

Section 51 – Requiring Structural Survey

This section enables the chief executive to require a building owner, insurer or mortgagee carry out a full structural survey before the building is re-occupied.

We understand that CERA will require a detailed engineering evaluation to be carried out for all buildings (other than those exempt from the Earthquake Prone Building definition in the Building Act). It is anticipated that CERA will adopt the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011. This document sets out a methodology for both qualitative and quantitative assessments.

The qualitative assessment is a desk-top and site inspection assessment. It is based on a thorough visual inspection of the building coupled with a review of available documentation such as drawings and specifications. The quantitative assessment involves analytical calculation of the buildings strength and may require non-destructive or destructive material testing, geotechnical testing and intrusive investigation.

It is anticipated that factors determining the extent of evaluation and strengthening level required will include:
• The importance level and occupancy of the building
• The placard status and amount of damage
• The age and structural type of the building
• Consideration of any critical structural weaknesses
• The extent of any earthquake damage

**2.2 Building Act**
Several sections of the Building Act are relevant when considering structural requirements:

Section 112 – Alterations

This section requires that an existing building complies with the relevant sections of the Building Code to at least the extent that it did prior to any alteration. This effectively means that a building cannot be weakened as a result of an alteration (including partial demolition).

Section 115 – Change of Use

This section requires that the territorial authority (in this case Christchurch City Council (CCC)) be satisfied that the building with a new use complies with the relevant sections of the Building Code 'as near as is reasonably practicable'. Regarding seismic capacity 'as near as reasonably practicable' has previously been interpreted by CCC as achieving a minimum of 67%NBS however where practical achieving 100%NBS is desirable. The New Zealand Society for Earthquake Engineering (NZSEE) recommend a minimum of 67%NBS.

**2.2.1 Section 121 – Dangerous Buildings**
The definition of dangerous building in the Act was extended by the Canterbury Earthquake (Building Act) Order 2010, and it now defines a building as dangerous if:

- in the ordinary course of events (excluding the occurrence of an earthquake), the building is likely to cause injury or death or damage to other property; or
- in the event of fire, injury or death to any persons in the building or on other property is likely because of fire hazard or the occupancy of the building; or
- there is a risk that the building could collapse or otherwise cause injury or death as a result of earthquake shaking that is less than a 'moderate earthquake' (refer to Section 122 below); or
- there is a risk that that other property could collapse or otherwise cause injury or death; or
- a territorial authority has not been able to undertake an inspection to determine whether the building is dangerous.

Section 122 – Earthquake Prone Buildings

This section defines a building as earthquake prone if its ultimate capacity would be exceeded in a 'moderate earthquake' and it would be likely to collapse causing injury or death, or damage to other property. A moderate earthquake is defined by the building regulations as one that would generate ground shaking 33% of the shaking used to design an equivalent new building.

Section 124 – Powers of Territorial Authorities

This section gives the territorial authority the power to require strengthening work within specified timeframes or to close and prevent occupancy to any building defined as dangerous or earthquake prone.

Section 131 – Earthquake Prone Building Policy

This section requires the territorial authority to adopt a specific policy for earthquake prone, dangerous and insanitary buildings.

### 2.3 Christchurch City Council Policy

Christchurch City Council adopted their Earthquake Prone, Dangerous and Insanitary Building Policy in 2006. This policy was amended immediately following the Darfield Earthquake of the 4th September 2010.

The 2010 amendment includes the following:

- A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;
- A strengthening target level of 67% of a new building for buildings that are Earthquake Prone;
- A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,
- Repair works for buildings damaged by earthquakes will be required to comply with the above.

The council has stated their willingness to consider retrofit proposals on a case by case basis, considering the economic impact of such a retrofit.

We anticipate that any building with a capacity of less than 33%NBS (including consideration of critical structural weaknesses) will need to be strengthened to a target of 67%NBS of new building standard as recommended by the Policy.

If strengthening works are undertaken, a building consent will be required. A requirement of the consent will require upgrade of the building to comply 'as near as is reasonably practicable' with:

- The accessibility requirements of the Building Code.
- The fire requirements of the Building Code. This is likely to require a fire report to be submitted with the building consent application.

### 2.4 Building Code

The building code outlines performance standards for buildings and the Building Act requires that all new buildings comply with this code. Compliance Documents published by The Department of Building and Housing can be used to demonstrate compliance with the Building Code.
After the February Earthquake, on 19 May 2011, Compliance Document B1: Structure was amended to include increased seismic design requirements for Canterbury as follows:

a. Hazard Factor increased from 0.22 to 0.3 (36% increase in the basic seismic design load)
b. Serviceability Return Period Factor increased from 0.25 to 0.33 (80% increase in the serviceability design loads when combined with the Hazard Factor increase)

The increase in the above factors has resulted in a reduction in the level of compliance of an existing building relative to a new building despite the capacity of the existing building not changing.

# Appendix E

## Standard Reporting Spread Sheet

**Detailed Engineering Evaluation Summary Data** V1.11

## Location

| | | | | | |
|---|---|---|---|---|---|
| Building Name: | Richmond Community Centre | | | Reviewer: | Simon Manning |
| | Unit | No: | Street | CPEng No: | 132053 |
| Building Address: | | 78 | London Street | Company: | Aurecon |
| Legal Description: | | | | Company project number: | 227052 |
| | | | | Company phone number: | 03 375 0761 |
| | Degrees | Min | Sec | | |
| GPS south: | 43 | 31 | 12.53 | Date of submission: | June 2013 |
| GPS east: | 172 | 39 | 20.13 | Inspection Date: | January |
| | | | | Revision: | 2 |
| Building Unique Identifier (CCC): | PRO 0684 002 | | | Is there a full report with this summary? | yes |

## Site

| | | | |
|---|---|---|---|
| Site slope: | flat | Max retaining height (m): | 0 |
| Soil type: | mixed | Soil Profile (if available): | |
| Site Class (to NZS1170.5): | D | | |
| Proximity to waterway (m, if <100m): | | If Ground improvement on site, describe: | |
| Proximity to clifftop (m, if < 100m): | | | |
| Proximity to cliff base (m,if <100m): | | Approx site elevation (m): | 4.00 |

## Building

| | | | | |
|---|---|---|---|---|
| No. of storeys above ground: | 1 | single storey = 1 | Ground floor elevation (Absolute) (m): | 4.40 |
| Ground floor split? | no | | Ground floor elevation above ground (m): | 0.40 |
| Storeys below ground | 0 | | | |
| Foundation type: | timber piles | | if Foundation type is other, describe: | |
| Building height (m): | 4.50 | | height from ground to level of uppermost seismic mass (for IEP only) (m): | |
| Floor footprint area (approx): | 140 | | | |
| Age of Building (years): | 100 | | Date of design: | Pre 1935 |
| Strengthening present? | no | | If so, when (year)? | |
| | | | And what load level (%g)? | |
| Use (ground floor): | educational | | Brief strengthening description: | |
| Use (upper floors): | | | | |
| Use notes (if required): | Public and School Library | | | |
| Importance level (to NZS1170.5): | IL2 | | | |

Gravity Structure

| | | | |
|---|---|---|---|
| Gravity System: | load bearing walls | | |
| Roof: | timber framed | rafter type, purlin type and cladding | Iron on timber framing |
| Floors: | timber | joist depth and spacing (mm) | |
| Beams: | timber | type | |
| Columns: | timber | typical dimensions (mm x mm) | |
| Walls: | | | |

Lateral load resisting structure

| | | | | |
|---|---|---|---|---|
| Lateral system along: | lightweight timber framed walls | **Note: Define along and across in detailed report!** | note typical wall length (m) | |
| Ductility assumed, μ: | 3.00 | | | |
| Period along: | 0.40 | 0.00 | estimate or calculation? | estimated |
| Total deflection (ULS) (mm): | 35 | | estimate or calculation? | estimated |
| maximum interstorey deflection (ULS) (mm): | 35 | | estimate or calculation? | estimated |

| | | | | |
|---|---|---|---|---|
| Lateral system across: | lightweight timber framed walls | | note typical wall length (m) | |
| Ductility assumed, μ: | 3.00 | | | |
| Period across: | 0.40 | 0.00 | estimate or calculation? | estimated |
| Total deflection (ULS) (mm): | 35 | | estimate or calculation? | estimated |
| maximum interstorey deflection (ULS) (mm): | 35 | | estimate or calculation? | estimated |

Separations:

| | | |
|---|---|---|
| north (mm): | | leave blank if not relevant |
| east (mm): | | |
| south (mm): | | |
| west (mm): | | |

Non-structural elements

| | | | |
|---|---|---|---|
| Stairs: | | | |
| Wall cladding: | other light | describe | Timber weatherboards |
| Roof Cladding: | Metal | describe | Corrugated Iron |
| Glazing: | timber frames | | |
| Ceilings: | plaster, fixed | | |
| Services(list): | | | |

**Available documentation**

| | | | |
|---|---|---|---|
| Architectural | none | original designer name/date | |
| Structural | none | original designer name/date | |
| Mechanical | | original designer name/date | |
| Electrical | | original designer name/date | |
| Geotech report | | original designer name/date | |

**Damage**

Site:
(refer DEE Table 4-2)

| | | | |
|---|---|---|---|
| Site performance: | Poor | Describe damage: | settlement |
| Settlement: | 25-100m | notes (if applicable): | |
| Differential settlement: | 1:350-1:250 | notes (if applicable): | |
| Liquefaction: | 2-5 $m^2/100m^3$ | notes (if applicable): | |
| Lateral Spread: | none apparent | notes (if applicable): | |
| Differential lateral spread: | none apparent | notes (if applicable): | |
| Ground cracks: | none apparent | notes (if applicable): | |
| Damage to area: | moderate to substantial (1 in 5) | notes (if applicable): | |

Building:

| | | | | |
|---|---|---|---|---|
| | Current Placard Status: | green | | |
| Along | Damage ratio: | 0% | Describe how damage ratio arrived at: | |
| | Describe (summary): | 0 | | |
| Across | Damage ratio: | 0% | | |
| | Describe (summary): | 0 | | |
| Diaphragms | Damage?: | no | Describe: | |
| CSWs: | Damage?: | no | Describe: | |
| Pounding: | Damage?: | no | Describe: | |
| Non-structural: | Damage?: | yes | Describe: | Moderate damage to interior linings |

$$Damage\_Ratio = \frac{(\%NBS(before) - \%NBS(after))}{\%NBS(before)}$$

**Recommendations**

| | | | | |
|---|---|---|---|---|
| | Level of repair/strengthening required: | significant structural | Describe: | Re-leveling |
| | Building Consent required: | yes | Describe: | |
| | Interim occupancy recommendations: | full occupancy | Describe: | |
| Along | Assessed %NBS before: | 84% | ##### %NBS from IEP below | If IEP not used, please detail assessment methodology: By Caculation |
| | Assessed %NBS after: | 84% | | |
| Across | Assessed %NBS before: | 67% | ##### %NBS from IEP below | |
| | Assessed %NBS after: | 67% | | |

**IEP** **Use of this method is not mandatory - more detailed analysis may give a different answer, which would take precedence. Do not fill in fields if not using IEP.**

Period of design of building (from above): Pre 1935

$h_n$ from above: m

Seismic Zone, if designed between 1965 and 1992:

not required for this age of building

not required for this age of building

| | along | across |
|---|---|---|
| Period (from above): | 0.4 | 0.4 |
| (%NBS)nom from Fig 3.3: | | |

| | |
|---|---|
| Note:1 for specifically design public buildings, to the code of the day: pre-1965 = 1.25; 1965-1976, Zone A =1.33; 1965-1976, Zone B = 1.2; all else 1.0 | 1.00 |
| Note 2: for RC buildings designed between 1976-1984, use 1.2 | 1.0 |
| Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (1.0) | 1.0 |

| | along | across |
|---|---|---|
| **Final $(\%NBS)_{nom}$:** | **0%** | **0%** |

**2.2 Near Fault Scaling Factor**

Near Fault scaling factor, from NZS1170.5, cl 3.1.6: 1.00

| | along | across |
|---|---|---|
| Near Fault scaling factor (1/N(T,D), **Factor A**: | 1 | 1 |

**2.3 Hazard Scaling Factor**

| | |
|---|---|
| Hazard factor Z for site from AS1170.5, Table 3.3: | |
| $Z_{1992}$, from NZS4203:1992 | |
| Hazard scaling factor, **Factor B:** | #DIV/0! |

**2.4 Return Period Scaling Factor**

| | |
|---|---|
| Building Importance level (from above): | 2 |
| Return Period Scaling factor from Table 3.1, **Factor C**: | |

**2.5 Ductility Scaling Factor**

| | along | across |
|---|---|---|
| Assessed ductility (less than max in Table 3.2) | 1.00 | 1.00 |
| Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3: | | |
| Ductiity Scaling Factor, **Factor D**: | 0.00 | 0.00 |

**2.6 Structural Performance Scaling Factor:**

| | along | across |
|---|---|---|
| Sp: | 1.000 | 1.000 |
| Structural Performance Scaling Factor **Factor E**: | 1 | 1 |

**2.7 Baseline %NBS, $(NBS\%)_b = (\%NBS)_{nom} \times A \times B \times C \times D \times E$**

| | along | across |
|---|---|---|
| **$\%NBS_b$:** | **#DIV/0!** | **#DIV/0!** |

Global Critical Structural Weaknesses: (refer to NZSEE IEP Table 3.4)

**3.1. Plan Irregularity, factor A:** 1

**3.2. Vertical irregularity, Factor B:** 1

**3.3. Short columns, Factor C:** 1

**3.4. Pounding potential**

Pounding effect D1, from Table to right 1.0

Height Difference effect D2, from Table to right 1.0

Therefore, Factor D: 1

**3.5. Site Characteristics** 1

| **Table for selection of D1** | Severe | Significant | Insignificant/none |
|---|---|---|---|
| Separation | 0<sep<.005H | .005<sep<.01H | Sep>.01H |
| Alignment of floors within 20% of H | **0.7** | **0.8** | **1** |
| Alignment of floors not within 20% of H | **0.4** | **0.7** | **0.8** |

| **Table for Selection of D2** | Severe | Significant | Insignificant/none |
|---|---|---|---|
| Separation | 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 |

**3.6. Other factors, Factor F**

| | Along | Across |
|---|---|---|
| For ≤ 3 storeys, max value =2.5, otherwise max valule =1.5, no minimum | | |
| Rationale for choice of F factor, if not 1 | | |

Detail Critical Structural Weaknesses: (refer to DEE Procedure section 6)

List any:

Refer also section 6.3.1 of DEE for discussion of F factor modification for other critical structural weaknesses

| | Along | Across |
|---|---|---|
| **3.7. Overall Performance Achievement ratio (PAR)** | **0.00** | **0.00** |
| **4.3 PAR x (%NBS)b:** PAR x Baselline %NBS: | **#DIV/0!** | **#DIV/0!** |
| **4.4 Percentage New Building Standard (%NBS), (before)** | | **#DIV/0!** |

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