Report

YWCA Units 1-4 BU 2311-001 EQ2 YWCA Units 5-9 BU 2311-002 EQ2 Detailed Engineering Evaluation Quantitative Report

Prepared for Christchurch City Council (Client)

By Beca Carter Hollings & Ferner Ltd (Beca)

4 July 2013

Revision History

Revision Nº	Prepared By	Description	Date
A	Zahid Hanif	Draft for CCC review	27 June 2013
B	Zahid Hanif	Final issue	4 July 2013

Document Acceptance

Action	Name	Signed	Date
Prepared by	Zahid Hanif		4 July 2013
Reviewed by	Jonathan Barnett	J Barnett	4 July 2013
Approved by	David Whittaker	D Whittaker	4 July 2013
on behalf of	Beca Carter Hollings & Ferner Ltd		

YWCA Units 1-4
BU 2311-001 EQ2

YWCA Units 5-9
BU 2311-002 EQ2

Detailed Engineering Evaluation
Quantitative Report – SUMMARY
Version 1

Address

285 Hereford Street
Christchurch

Background

This is a summary of the Quantitative Assessment for the building structure, and is based on the document 'Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury – Part 2 Evaluation Procedure' (draft) issued by the Engineering Advisory Group (EAG) on 19 July 2011.

Two Qualitative Reports were issued to CCC on 4 October 2012; one each for Units 1-5 and Units 5-9.

The YWCA Units (Units 1-4, Units 5-9) are located at 285 Hereford Street, Christchurch. The housing consists of two separate buildings. Units 1-4 are situated on east side and consist of three residential units and one office, whereas Units 5-9 are on west side and consist of three residential units and two offices. Refer to Figure A1 in Appendix A for location of buildings.

It is assumed the units were built between 1965 & 1970 based on information from the tenants and type of construction. Unit 1 (east building) underwent some alterations in 1989 and was converted into an office. Unit 4 (east building) has been refurbished recently as a consequence of fire.

Units 1-4 and Units 5-9 have an approximate internal floor area of 550m^2 and 340m^2 respectively.

The East building (Units 1-4) is C shaped in plan, whereas the west building (Units 5-9) is rectangular in plan. Both buildings are single storey. Refer to building plans in Appendix A.

Construction typically comprises of metal-clad lightweight timber roof supported on timber-framed walls & 190 thick concrete hollow block masonry walls between units. Cladding consists of 90mm thick block wall. Brick veneer cladding is also present in some places.

The foundation structure consists of concrete perimeter foundation walls assumed to be founded on shallow strip foundation, and concrete piles internally.

The format and content of this report follows a template provided by CCC, which is based on the EAG document.

Key Damage Observed

Visual inspections on 7 August 2012 indicate that both buildings have suffered minor earthquake damage. Key damage observed includes:

Units 1-4

- Cracking to plasterboard wall linings, particularly at locations of joints and fixing.
- Separation of brick veneer cladding from the timber framed walls in some locations.
- Stepped cracking in the mortar joints of brick veneer walls. In some places the cracking is up to 5mm in width.
- Minor cracking to the raised concrete footpath.
- Stepped cracking in the mortar joints of the unfilled unreinforced concrete hollow block masonry wall between Units 2 and 3.

Units 5-9

- Cracking to the brick veneer mortar joints.
- Minor cracking to plasterboard wall linings.
- Separation between the timber-framed wall and ground slab at the entrance to Unit 6.

Critical Structural Weaknesses (CSW)

Units 1-4

- Plan irregularity identifying potential torsional behaviour.
- unfilled unreinforced concrete hollow block masonry walls

Units 5-9

- Few lateral load-resisting walls along the perimeter of the building.
- unfilled unreinforced concrete hollow block masonry walls.

Indicative Building Strength (from Detailed Assessment)

Units 1-4 and Units 5-9

The buildings have been assessed to have seismic capacity of approximately 40%NBS using the New Zealand Society for Earthquake Engineering (NZSEE) Detailed Assessment guideline ‘Assessment and Improvement of the Structural Performance of Buildings in Earthquakes’ (AISPBE), 2006, and is therefore not classified as Earthquake Prone, but is considered to be Earthquake Risk and Seismic Grade C.

The damage observed to the structure is not considered to have significantly reduced its ability to resist seismic loads. The structural damage is considered minor.

Our assessment has identified the following structural components that govern the building’s seismic performance.

- Out of plane capacity of 190 thick unfilled unreinforced concrete hollow block masonry walls.

Recommendations

In order that the owner can make an informed decision about the on-going use and occupancy of their building, the following information is presented in line with the Department of Building and Housing document 'Guidance for engineers assessing the seismic performance of non-residential and multi-unit residential buildings in greater Christchurch', June 2012.

For greater Christchurch the definition of a "dangerous" building in the Building Act has been extended (by the Canterbury Earthquake (Building Act) Order 2011) to include buildings at risk of collapsing in a moderate earthquake, that is earthquake prone buildings with a capacity at or below 33%NBS. Where council requires a dangerous building or an earthquake prone building to be upgraded, it may prohibit the use of the building until the works are carried out.

No significant damage or hazards were identified to the seismic or gravity load resisting system that would further reduce its ability to resist further loads.

Our recommendations are as follows:

- In accordance with CCC guidance/policy document 'Guidance for Engineers 2' dated 10 May 2012; no restrictions are required to the occupancy of the building.
- Foundations are exposed to confirm suitability of assumptions and damage as part of a subsequent Damage Assessment reporting.
- A verticality and level survey could be carried out to determine the extent of settlement of the building for insurance purposes.
- Repairs that would bring the building back to an "as new" condition are typically entitled under typical replacement insurance policies. We suggest you consult with your insurance advisor as to how you wish to proceed.

Table of Contents

Appendices

Appendix A – Building Plans and Photographs

Appendix B - CERA DEE Summary Data

Appendix C - Previous Reports and Assessments

1 Background

Beca Carter Hollings & Ferner Ltd (Beca) has been engaged by the Christchurch City Council (CCC) to undertake a Quantitative Detailed Engineering Evaluation (DEE) of the YWCA Units 1-4 & Units 5-9 located 285 Hereford Street, Christchurch.

This report is a Quantitative Assessment of the building structure, and is based on the document 'Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury – Part 2 Evaluation Procedure' (draft) issued by the Engineering Advisory Group (EAG) on 19 July 2011.

A quantitative assessment involves analytical calculations of the building's strength and may involve material testing, geotechnical testing and intrusive investigation. The qualitative assessment previously carried out involved inspections of the building, a desktop review of existing structural and geotechnical information, including existing drawings and calculations, if available and an assessment of the level of seismic capacity against current code using the Initial Evaluation Procedure (IEP).

The purpose of these assessments is to determine the likely building performance and damage patterns, to identify any potential Critical Structural Weaknesses (CSW) or collapse hazards, and to make an assessment of the likely building strength in terms of percentage of New Building Standard (%NBS).

The building description below is based only on our intrusive and visual inspections as only 1 No. drawing was made available.

The format and content of this report follows a template provided by CCC, which is based on the EAG document.

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 understood that CERA is adopting the Detailed Engineering Evaluation Procedure document (draft) issued by the Engineering Advisory Group on 19 July 2011, which sets out a methodology for both qualitative and quantitative assessments. We understand this report will be used in response to CERA Section 51.

The qualitative assessment includes a thorough visual inspection of the building coupled with a desktop review of available documentation such as drawings, specifications and IEP's. The quantitative assessment involves analytical calculation of the building's 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 that was assigned during the state of emergency following the 22 February 2011 earthquake.
- 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.

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.

It is understood 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.

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.

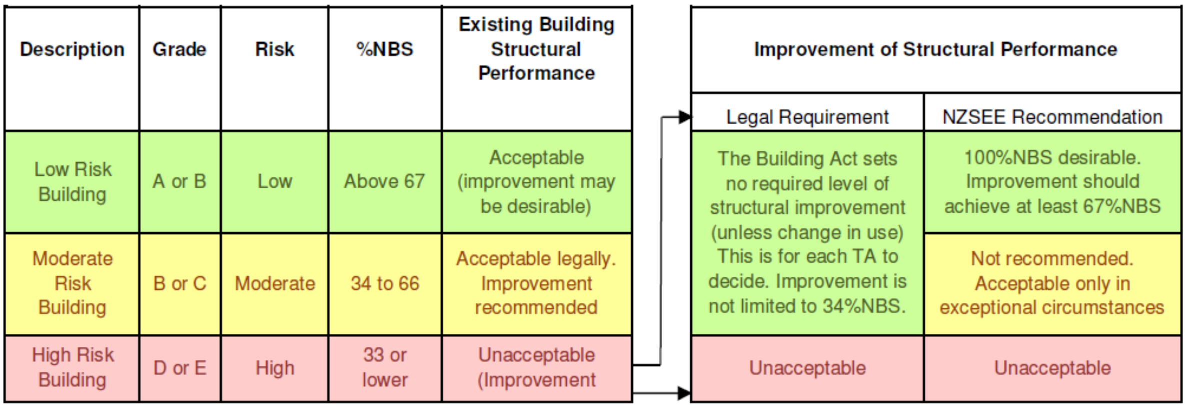
3 Earthquake Resistance Standards

For this assessment, the building's Ultimate Limit State 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).

No consideration has been given at this stage to checking the level of compliance against the increased Serviceability Limit State requirements.

The likely ultimate 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 building's 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	Improvement of Structural Performance	
					Legal Requirement	NZSEE Recommendation
Low Risk Building	A or B	Low	Above 67	Acceptable (improvement may be desirable)	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
Moderate Risk Building	B or C	Moderate	34 to 66	Acceptable legally. Improvement recommended		Not recommended. Acceptable only in exceptional circumstances
High Risk Building	D or E	High	33 or lower	Unacceptable (Improvement	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. on average 0.2% in any 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

Building Grade	Percentage of New Building Standard (*%NBS*)	Approx. Risk Relative to a New Building
A+	>100	<1
A	80-100	1-2 times
B	67-80	2-5 times
C	33-67	5-10 times
D	20-33	10-25 times
E	<20	>25 times

4 Building Description

4.1 General

Summary information about the building is given in the following table. No structural drawings have been made available, therefore the building information is assumed from our visual inspections and intrusive investigation only.

Table 4.1 and Table 4.2 contain building information for Units 1-4 and Units 5-9 respectively.

Table 4.1: Building Summary Information for Units 1-4

Item	Details	Comment
Building name	YWCA Units 1-4	Unit 1 is an office. Units 2-4 are residential
Street Address	285 Hereford Street, Christchurch	
Age	~45 years Construction between 1965 & 1970	No drawings available. Assumed based on method of construction and information obtained from tenants.
Description	The building is C shaped in plan and is single storey. The building is currently being used as residential apartments apart from Unit 1 which has been converted to office.	Unit 4 recently refurbished as a consequence of a fire
Building Footprint / Floor Area	Approx. 550m^2	
No. of storeys / basements	1 storey / no basement	
Occupancy / use	Multi-unit residential, Office	Importance Level 2
Construction	-timber framed walls with plasterboard linings -GIB-lined timber-framed walls (new refurbishment)	Based on intrusive site investigation

Item	Details	Comment
	-unfilled unreinforced concrete hollow block masonry walls 190mm -lightweight timber roof -blockwork cladding 90mm -brick veneer cladding -subfloor supported on short piles	
Gravity load resisting system	Duo-pitched metal-clad light-weight timber roof supported on ridge and external walls. Ridge beam is supported on unreinforced masonry walls.	No structural drawings available
Seismic load resisting system	Lateral loads are transferred through diaphragm made of ceiling plasterboard to; - predominantly unreinforced blockwork masonry walls, and timber framed walls with plasterboard linings in transverse direction (E-W). - timber framed walls with plasterboard linings in the longitudinal direction (N-S).	No structural drawings available
Foundation system	Timber sub-floor supported on concrete piles. Strip footing assumed for unreinforced masonry wall.	No drawings available. Based on intrusive investigation.
Stair system	None	
Other notable features	None	
External works	Brick veneer cladding	
Construction information	Visual inspection only, no drawings available.	
Likely design standard	NZS 1900, Part 8:1965	Inferred from age of building
Heritage status	No heritage status	
Other	None	

Table 4.2: Building Summary Information for Units 5-9

Item	Details	Comment
Building name	YWCA Units 5-9	Units 8-9 are offices. Units 5-7 are residential.
Street Address	285 Hereford Street Christchurch	

Item	Details	Comment
Age	~45 years Construction between 1965 & 1970	No drawings available. Assumed based on method of construction and information obtained from tenants.
Description	Unit 8-9 are offices. Units 5-7 are residential.	Based on single available drawing
Building Footprint / Floor Area	Approx. 340 m^2	Building is rectangular.
No. of storeys / basements	1 storey / no basement	
Occupancy / use	Multi-unit residential, Office	Importance Level 2
Construction	-timber framed walls with plasterboard linings -unfilled unreinforced concrete hollow block masonry walls 190mm -lightweight timber roof -blockwork cladding 90mm -brick veneer cladding -subfloor supported on short piles	Based on site inspection.
Gravity load resisting system	Duo-pitched metal-clad light-weight timber roof supported on ridge and external walls. Ridge beam is supported on unreinforced masonry walls.	No structural drawings available
Seismic load resisting system	Lateral loads are transferred through diaphragm made of ceiling plasterboard to; - predominantly unreinforced blockwork masonry walls, and timber framed walls with plasterboard linings in transverse direction (E-W). - plasterboard linings in the longitudinal direction (N-S).	No structural drawings available
Foundation system	Timber subfloor supported on concrete piles. Strip footing assumed for unreinforced masonry wall.	No drawings available. Based on intrusive investigation.
Stair system	None	
Other notable features	None	
External works	Brick veneer cladding	
Construction information	None.	
Likely design standard	NZS 1900, Part 8:1965	
Heritage status	No heritage status	
Other	None.	

4.2 Structural 'Hot-spots'

Areas in which damage may be expected to occur from earthquake shaking are outlined below:

- Inadequate shear or flexural strength of concrete masonry walls.
- Out of plane restraint of unreinforced masonry walls due to lack of edge connection.
- Connections between the roof diaphragm and the walls.
- Connections between walls, timber floor and foundations/substructure.
- Adequacy of foundations.
- Restraint of brick veneer.

5 Site Investigations

5.1 Previous Assessments

The building had a Level 2 Rapid Assessment undertaken following the February 2011 earthquake (refer Appendix C). The level 2 report highlights cracking damage to the building's chimney and the collapse of the block walls forming a garage/shed at the rear of the site. At the time of a previous inspection on 7 August 2012 the damaged chimney and the collapsed garage had been removed from site.

5.2 Level 4 Damage Inspection

Visual inspections as part of the Level 4 Damage Assessment were undertaken on 7 August 2012. Photographs were taken as a record of inspection.

5.3 Level 5 Intrusive Investigations

The following intrusive investigation was carried out as part of the Level 5 Quantitative Assessment.

- Testing using HILTI PS35 Ferrodetector indicated that there is no reinforcement in the masonry block walls.
- Confirmation of connection of brick veneer cladding to the main structure. The investigation involving making a hole in a timber-framed wall (Units 1-4 only) indicated the presence of ties connecting brick veneer cladding to the timber-framed walls.
- A part of the roof was stripped off to confirm the roofing structure. Also it was observed that masonry block walls are unfilled.

6 Damage Assessment

6.1 Damage Summary

The tables below provide a summary of the damage observed during our inspection. Refer to Appendix A for photographs of the observed damage.

Table 6.1: Damage Summary for Units 1-4

Damage type	Unknown	Minor	Moderate	Major	Comment
settlement of foundations		✓			Cracking to perimeter foundations was observed during visual inspection. Level survey may be required to confirm.
tilt of building		✓			Movement of window on back wall and 2-5mm crack to brick veneer. Verticality survey might be required to confirm.
liquefaction	✓				None observed during visual inspection. From aerial photos taken on 24 February 2011 no liquefaction appears evident in the area.
settlement of external ground		✓			Cracking to external concrete pavement during visual inspection may indicate settlement.
lateral spread / ground cracks		✓			Cracking to pavement observed during visual inspection.
frame					No damage observed during visual inspection.
masonry walls		✓			Stepped cracking was observed in the mortar joints of the concrete masonry wall between units 2 and 3.
cracking to concrete floors		✓			Minor cracking was observed in the external concrete slab.
bracing		✓			Cracking of plasterboard lining along joints was observed.
precast flooring seating					Not applicable.
stairs					Not applicable (external concrete steps only).
cladding /envelope		✓			Minor cracking damage was observed in the brick veneer cladding mortar joints.
internal fit out		✓			Minor cracking damage was observed to the internal plasterboard wall linings and along the connection between the plasterboard ceiling and masonry walls.
building services	✓				The building services were not inspected.
other					The previous level 2 inspection noted damage to the building's chimney and the collapse of the garage at the rear of the site. However both have been removed since the level 2 inspection.

Table 6.2: Damage Summary for Units 5-9

Damage type	Unknown	Minor	Moderate	Major	Comment
settlement of foundations		✓			Cracking to perimeter foundations was observed during visual inspection. Level survey may be required to confirm.
tilt of building		✓			Evidence of building tilt (cracking to walls, warping of door frames) was observed during the inspection. Verticality survey may be required to confirm.
liquefaction	✓				None observed during visual inspection. From aerial photos taken on 24 February 2011 no liquefaction appears evident in the area.
settlement of external ground		✓			Cracking to external concrete pavement during visual inspection may indicate settlement.
lateral spread / ground cracks		✓			Cracking to pavement observed during visual inspection.
frame					No damage observed during visual inspection.
masonry walls	✓				Not inspected due to linings in place.
cracking to concrete floors					Not Applicable.
bracing		✓			Cracking to plasterboard lining along joints was observed.
precast flooring seating					Not Applicable.
stairs					Not Applicable (external concrete steps only)
cladding /envelope		✓			Minor cracking was observed in the blockwork cladding mortar joints.
internal fit out		✓			Minor cracking damage was observed between internal plasterboard linings and their connection to the plasterboard ceiling.
building services	✓				Building services were not inspected.
other					The previous level 2 inspection noted damage to the building's chimney and the collapse of the garage at the rear of the site, however both have been removed since the level 2 inspection.

6.2 Key Damage Observed

Refer to Appendix A for photos showing following damage.

Units 1-4

- Cracking to plasterboard wall linings, particularly at locations of joints and fixing.
- Separation of brick veneer cladding from the timber framed walls in some locations.
- Stepped cracking in the mortar joints of brick veneer walls. In some places the cracking is up to 5mm in width.
- Minor cracking to the raised concrete footpath.
- Stepped cracking in the mortar joints of the concrete masonry wall between units 2 and 3.

Units 5-9

- Cracking to the brick veneer mortar joints.
- Minor cracking to plasterboard linings.
- Separation between the timber-framed wall and ground slab at the entrance to unit 6.

6.3 Surrounding Buildings

There are buildings in the general vicinity but neighbouring buildings are sufficiently separated such that they will not impact upon the YWCA Units during a seismic event.

6.4 Residual Displacements and General Observations

Evidence of minor permanent settlement or displacements was observed during our visual inspection. A global settlement survey may reveal movement to the building that may have resulted in a change to its original condition and may be considered a loss.

6.5 Implications of Damage

The structure has suffered minor visible structural damage only and therefore we believe the structural capacity has not been significantly affected.

7 Generic Issues

The following generic issues referred to in Appendix A of the EAG guideline document have been identified as applicable to all the YWCA Units:

Unfilled Unreinforced Concrete Hollow Block Masonry Walls

- Inadequate shear or flexural strength of unreinforced masonry walls.
- Inadequate out of plane strength of concrete masonry walls.
- Inadequate connections of roof diaphragms to the walls.
- Inadequate foundations.
- Plan irregularity (for Units 1-4 only).

Appendix A of the DEE guideline does not address generic issues of timber framed buildings.

8 Geotechnical Consideration

No Geotechnical information was available for this site.

During the inspection, no damage to the surrounding ground was noted.

9 Survey

There was some evidence of settlement and displacement observed during our inspection however no level or verticality surveys were carried out. CCC may wish to undertake a level survey as part of their damage assessment and reinstatement.

10 Detailed Seismic Capacity Assessment

10.1 Assessment Methodology

The seismic capacity of the buildings has been assessed using the Detailed Assessment Procedures in the NZSEE AISPBE guidelines, based on the site measurements and intrusive investigations undertaken. The structure has suffered minor damage.

10.2 Assumptions

The following assumptions were used in our quantitative assessment:

- 50% reduction in capacity assumed to account for potentially older style fibrous plaster gypsum wall board.
- Adequate diaphragm action is available.
- Building dimensions are scaled from available plan drawing.
- Strength parameters for mortar and bricks were assumed for “soft” material as per Table 10.2 of NZSEE AISPBE (April 2012) guidelines.

10.3 Critical Structural Weaknesses

Units 1-4

- Plan irregularity identifying potential torsional behaviour.
- unfilled unreinforced concrete hollow block masonry walls.

Units 5-9

- Fewer lateral load-resisting walls along the perimeter of the building.
- unfilled unreinforced concrete hollow block masonry walls.

10.4 Seismic Parameters

The seismic design parameters based on current design requirements from NZS 1170.5:2004 and the NZBC clause B1 for this building are:

- Site soil class: D – NZS 1170.5:2004, Clause 3.1.3, Soft Soil.
- Site hazard factor, Z = 0.3 – NZBC, Clause B1 Structure, Amendment 11 effective from 19 May 2011.
- Return period factor R_u = 1 – NZS 1170.5:2004, Table 3.5, Importance Level 2 structure with a 50 year design life.
- Near fault factor N(T,D) = 1 – NZS 1170.5:2004, Clause 3.1.6, Distance more than 20 km from fault line.

10.5 Results of Seismic Assessment

Units 1-4

The results of our quantitative assessment indicate the building has a seismic capacity of approximately 40%NBS and is governed by out of plane capacity of the unreinforced and unfilled concrete block masonry walls. This is lower than the value of 45%NBS stated in our previous Qualitative Report dated 4 Oct 2012. Table 10.1 presents the evaluated seismic capacity in terms of %NBS of the individual structural systems in each building direction.

Table 10.1: Summary of Seismic Assessment of Structural Systems for Units 1-4

Item	Loading Direction	Ductility μ	Seismic Performance	Notes
Overall %NBS adopted from DEE	**Face Loading**	**1.0**	**42%NBS**	**Governed by rocking of URM wall**
Unfilled URM Walls (in-plane)	Transverse (E-W)	1.0	48%NBS	Governed by shear capacity of wall
Unfilled URM Walls (out-of plane)	Face loading	1.0	42%NBS	Assessed as per Section 10.3 of NZSEE AISPBE guidelines April 2012
Timber framed walls with plasterboard linings (in-plane)	Longitudinal N-S	2.0	53%NBS	-

Note: Ductility factors are based on NZSEE recommendations.

Units 5-9

The results of our quantitative assessment indicate the building has a seismic capacity of approximately 40%NBS and is governed by out of plane capacity of the unreinforced and unfilled concrete block masonry walls. This is lower than the value of 45%NBS stated in our previous Qualitative Report dated 4 Oct 2012. Table 10.2 presents the evaluated seismic capacity in terms of %NBS of the individual structural systems in each building direction.

Table 20.2: Summary of Seismic Assessment of Structural Systems for Units 5-9

Item	Loading Direction	Ductility μ	Seismic Performance	Notes
Overall %NBS adopted from DEE	**Face Loading**	**1.0**	**42%NBS**	**Governed by rocking of URM wall**
URM Walls (in-plane)	Transverse (E-W)	1.0	54%NBS	Governed by shear capacity of wall
URM Walls (out-of plane)	Face loading	1.0	42%NBS	Assessed as per Section 10.3 of NZSEE AISPBE guidelines April 2012
Timber framed walls with plasterboard linings (in-plane)	Longitudinal N-S	2.0	48%NBS	-

Note: Ductility factors are based on NZSEE recommendations.

11 Recommendations

11.1 Occupancy

In order that the owner can make an informed decision about the on-going use and occupancy of their building the following information is presented in line with the Department of Building and Housing document ‘Guidance for engineers assessing the seismic performance of non-residential and multi-unit residential buildings in greater Christchurch’, June 2012.

Both buildings are not considered to be Earthquake Prone, but are considered to be Earthquake Risk, having an assessed capacity of approximately 40%NBS, and are classified as Seismic Grade C. The risk of collapse of an earthquake prone building of this grade is considered to be 5 to 10 times greater than that of an equivalent new building.

For greater Christchurch the definition of a “dangerous” building in the Building Act has been extended (by the Canterbury Earthquake (Building Act) Order 2011) to include buildings at risk of collapsing in a moderate earthquake, that is earthquake prone buildings with a capacity at or below 33% NBS. Where council requires a dangerous building or an earthquake prone building to be upgraded, it may prohibit the use of the building until the works are carried out.

No significant damage or hazards were identified to the seismic or gravity load resisting system that would further reduce its ability to resist further loads.

In accordance with CCC guidance/policy document ‘Guidance for Engineers 2’ dated 10 May 2012; no restrictions are required to the occupancy of the building.

11.2 Further Investigations, Survey or Geotechnical Work

Our recommendations are as follows:

- Foundations are exposed to confirm suitability of assumptions and damage as part of a subsequent Damage Assessment reporting.

- A verticality and level survey could be carried out to determine the extent of settlement of the building for insurance purposes.

11.3 Damage Reinstatement

Repairs that would bring the building back to an “as new” condition are typically entitled under typical replacement insurance policies. We suggest you consult with your insurance advisor as to how you wish to proceed.

12 Design Features Report

Repairs will be required to reinstate the existing structural system. A repair methodology has not been prepared at this stage. No new load paths are expected as a result of the repairs required.

13 Limitations

The following limitations apply to this engagement:

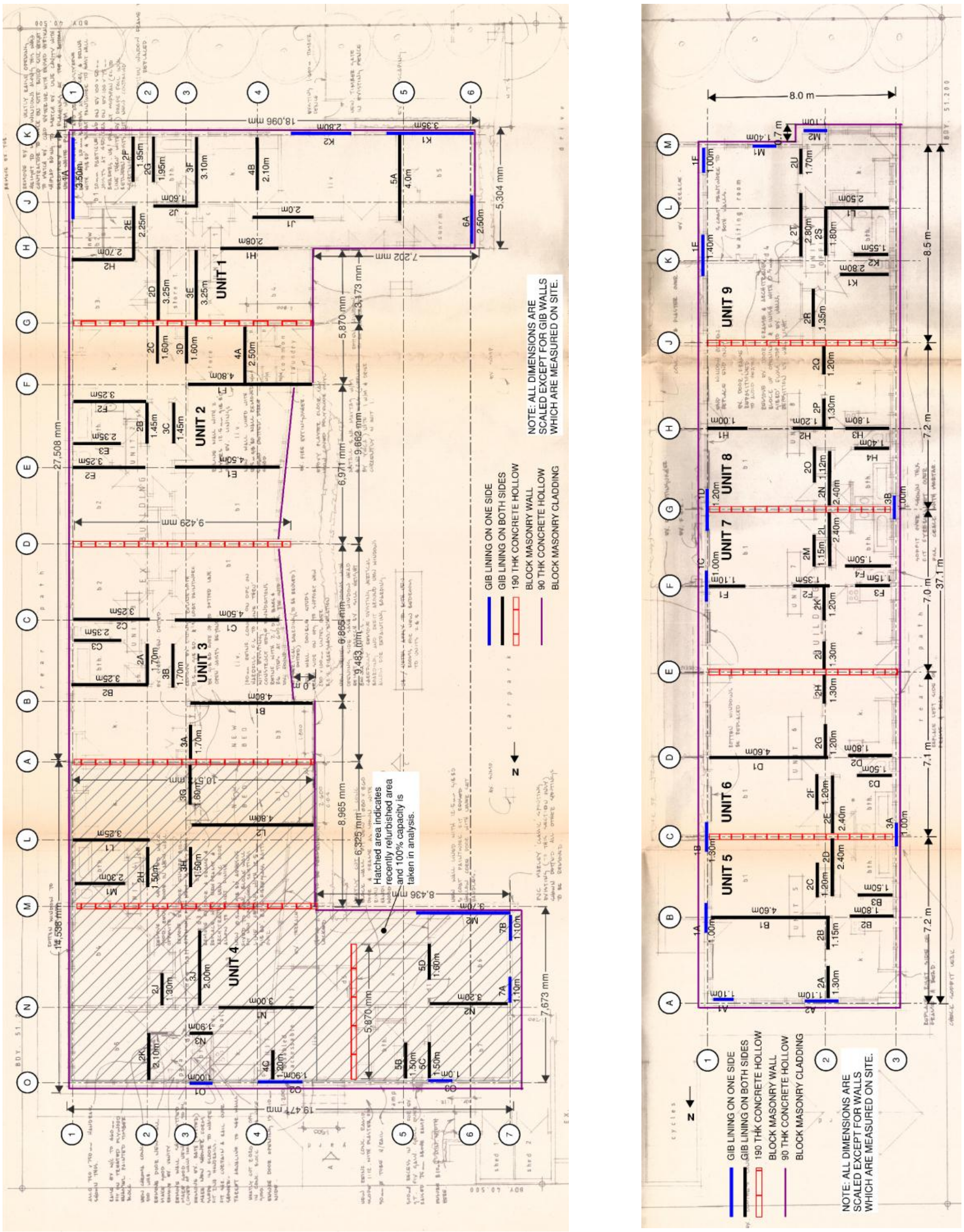
- Beca and its employees and agents are not able to give any warranty or guarantee that all defects, damage, conditions or qualities have been identified.
- Inspections are primarily limited to visible structural components. Appropriate locations for invasive inspection, if required, will be based on damage patterns observed in visible elements, and review of the construction drawings and structural system. As such, there will be concealed structural elements that will not be directly inspected.
- The inspections are limited to building structural components only.
- Inspection of building services, pipework, pavement, and fire safety systems is excluded from the scope of this report.
- Inspection of the glazing system, linings, carpets, claddings, finishes, suspended ceilings, partitions, tenant fit-out, or the general water tightness envelope is excluded from the scope of this report.
- The assessment of the lateral load capacity of the building is limited by the completeness and accuracy of the drawings provided. Assumptions have been 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 further investigations may be recommended. It is noted the assessment has not been exhaustive, our analysis and calculations have focused on representative areas only to determine the level of provision made. At this stage we have not undertaken any checks of the gravity system, wind load capacity, or foundations.
- The information in this report provides a snapshot of building damage at the time the detailed inspection was carried out. Additional inspections required as a result of significant aftershocks are outside the scope of this work.

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

Appendix A

Building Plans and Photographs

Figure A1: Site plan for YWCA housing blocks



Plan of Units 1-4

Plan of Units 5-9

Figure A2: Building Plans

Units 1-4

Photo 1: External view of YWCA Units 1-4

Photo 2: Damage to 90 block wall cladding

Damage: Stepped cracking in block wall (crack width up to 5mm)

Units 1-4 (cont'd)

Photo 3: Damage to external raised slab.

Damage: Cracking to concrete slab and minor spalling.

Photo 4: Damage to plasterboard wall lining.

Damage: Cracking to plasterboard due to seismic displacement.

Units 1-4 (cont'd)

Photo 5: Typical damage at plasterboard ceiling connection to masonry walls.

Damage: Cracking to plasterboard due to relative movement between ceiling and concrete masonry wall.

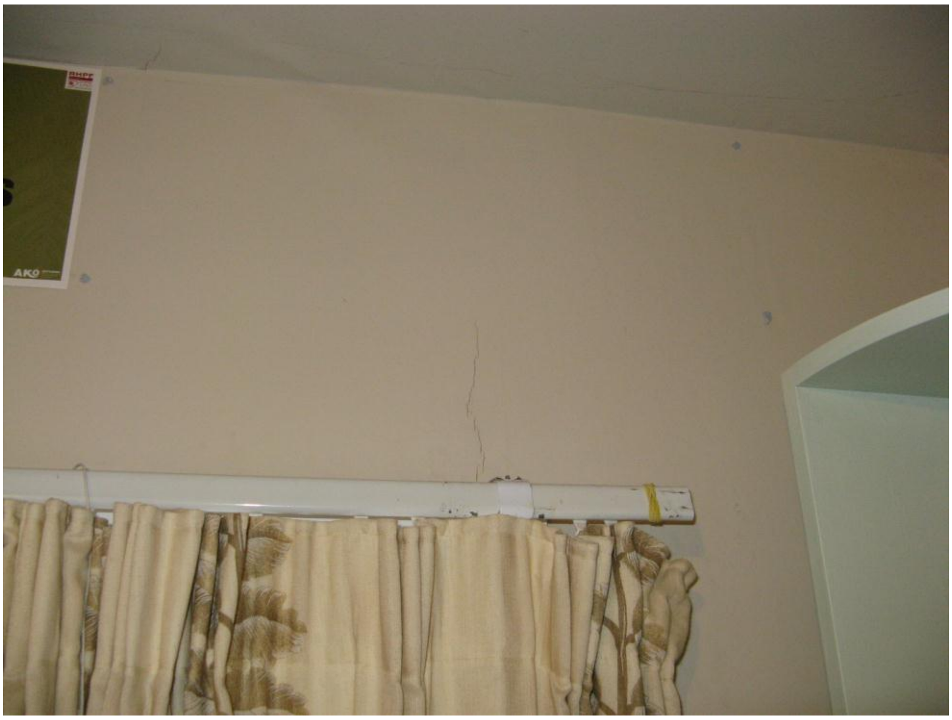


Photo 6: Damage to plasterboard wall lining.

Damage: Cracking to plasterboard due to seismic displacement.

Units 1-4 (cont'd)

Photo 7: Separation of brick veneer cladding from timber framed wall.

Damage: Movement of brick veneer cladding due to damage to ties.

Photo 8: Damage to block wall and foundation wall.

Damage: Stepped cracking through mortar joints in block wall and cracking through foundation wall.

Units 1-4 (cont'd)

Photo 9: Damage to block wall cladding.

Damage: Stepped cracking in block wall (width of up to 5mm) and cracking to sill tiles.

Photo 10: Damage to raised concrete slab.

Damage: Cracking to concrete slab.

Units 1-4 (cont'd)

Photo 11: Damage to concrete masonry walls between units 2 and 3.

Damage: Stepped cracking through concrete masonry mortar joints.

Units 5-9

Photo 12: External view of YWCA Units 5-9 (front)

Photo13: External view of YWCA Units 5-9 (Side)

Units 5-9 (cont'd)

Photo 14: Separation of wall from ground slab at the entrance to unit 6. Shows differential settlement may have occurred.

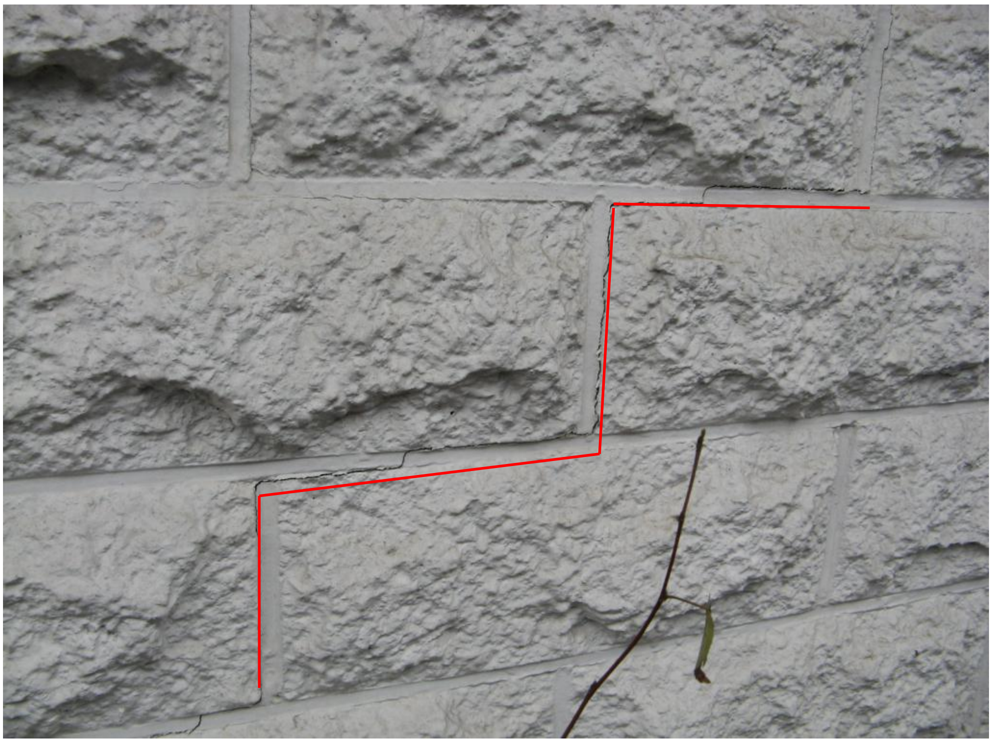


Photo 15: Damage to block wall

Damage: Stepped cracking in brick veneer.

Units 5-9 (cont'd)

Photo 16: Damage to perimeter foundation.

Damage: Cracking to concrete perimeter strip foundation.

Photo 17: Damage to internal fit out.

Damage: Cracking of plasterboard lining at joint due to movement.

Units 5-9 (cont'd)

Photo 18: Typical damage at plasterboard ceiling connection to masonry walls.

Damage: Opening of joint due to relative movement between ceiling and concrete masonry.

Appendix B

CERA DEE Summary Data

Detailed Engineering Evaluation Summary Data

V1.11

Location

Building Name: YWCA Units 2-4 and Office
Unit No: Street
Building Address: 285 Hereford Street, Christchurch
Legal Description:
Degrees Min Sec
GPS south:
GPS east:
Building Unique Identifier (CCC): BU2311-001

Reviewer: David Whittaker
CPEng No: 123089
Company: Beca
Company project number: 5323355
Company phone number: 03 3663521
Date of submission: 27/06/2013
Inspection Date: 7/08/2012
Revision:
Is there a full report with this summary? yes

Site

Site slope: flat
Soil type:
Site Class (to NZS1170.5): D
Proximity to waterway (m, if <100m):
Proximity to clifftop (m, if < 100m):
Proximity to cliff base (m,if <100m):

Max retaining height (m): 0
Soil Profile (if available):
If Ground improvement on site, describe: N/A
Approx site elevation (m):

Building

No. of storeys above ground: 1 single storey = 1
Ground floor split? no
Storeys below ground: 0
Foundation type: other (describe)
Building height (m):
Floor footprint area (approx): 550
Age of Building (years): 47

Ground floor elevation (Absolute) (m):
Ground floor elevation above ground (m): 0.00
if Foundation type is other, describe: Unknown; timber piles assumed
height from ground to level of uppermost seismic mass (for IEP only) (m): 3
Date of design: 1965-1976

Strengthening present? no

If so, when (year)?
And what load level (%g)?
Brief strengthening description:

Use (ground floor): multi-unit residential
Use (upper floors):
Use notes (if required): 3 units plus small office
Importance level (to NZS1170.5): IL2

Gravity Structure

Gravity System: load bearing walls
Roof: timber framed
Floors: timber
Beams: timber
Columns: load bearing walls
Walls: partially filled concrete masonry

rafter type, purlin type and cladding:
joist depth and spacing (mm):
type:
typical dimensions (mm x mm):
thickness (mm):

Lateral load resisting structure

Lateral system along: lightweight timber framed walls
Ductility assumed, μ: 2.00
Period along: 0.40 0.00
Total deflection (ULS) (mm):
maximum interstorey deflection (ULS) (mm):

Note: Define along and across in detailed report!

note typical wall length (m):
estimate or calculation? estimated
estimate or calculation?
estimate or calculation?

Lateral system across: other (note)
Ductility assumed, μ: 2.00
Period across: 0.40 0.00
Total deflection (ULS) (mm):
maximum interstorey deflection (ULS) (mm):

describe system: partial filled CMU and timber framed wall
estimate or calculation? estimated
estimate or calculation?
estimate or calculation?

Separations:

north (mm):
east (mm):
south (mm):
west (mm):

leave blank if not relevant

Non-structural elements

Stairs:
Wall cladding: brick or tile
Roof Cladding: Metal
Glazing: timber frames
Ceilings: plaster, fixed
Services(list):

none
describe (note cavity if exists): Brick Veneer
describe: Lightweight profiled metal sheeting

Available documentation

Architectural: none
Structural: none
Mechanical: none
Electrical: none
Geotech report: none

original designer name/date:
original designer name/date:
original designer name/date:
original designer name/date:
original designer name/date:

Damage

Site:
(refer DEE Table 4-2)

Site performance: Good
Settlement: 0-25mm
Differential settlement: 0-1:350
Liquefaction: none apparent
Lateral Spread: none apparent
Differential lateral spread: none apparent
Ground cracks: none apparent
Damage to area: none apparent

Describe damage:
notes (if applicable):
notes (if applicable):
notes (if applicable):
notes (if applicable):
notes (if applicable):
notes (if applicable):
notes (if applicable):

Building:

Current Placard Status: green

Along Damage ratio: 100%
Describe (summary):
Describe how damage ratio arrived at: Minor damage not considered to reduce capacity

Across Damage ratio:
Describe (summary):

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

Diaphragms Damage?: yes Describe: Cracking in plasterboard linings

CSWs: Damage?: no Describe:

Pounding: Damage?: no Describe:

Non-structural: Damage?: yes Describe: Cracking in plasterboard linings and brick veneer

Recommendations

Level of repair/strengthening required: minor structural Describe: Cracking to brick veneer and plasterboard linings
Building Consent required: no Describe:
Interim occupancy recommendations: full occupancy Describe:

Along Assessed %NBS before: 42% ##### %NBS from IEP below
Assessed %NBS after:

If IEP not used, please detail assessment methodology: Quantitative Assessment

Across Assessed %NBS before: 53% ##### %NBS from IEP below
Assessed %NBS after:

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): 1965-1976

h_n from above: 3m

Seismic Zone, if designed between 1965 and 1992: B

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
Note 2: for RC buildings designed between 1976-1984, use 1.2
Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (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:

	along	across
Near Fault scaling factor (1/N(T,D), **Factor A**:	#DIV/0!	#DIV/0!

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)		
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:

Sp:		
Structural Performance Scaling Factor**Factor E**:	#DIV/0!	#DIV/0!

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

$\%NBS_b$: **#DIV/0!** **#DIV/0!**

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

3.1. Plan Irregularity, factor A: insignificant 1

3.2. Vertical irregularity, Factor B: insignificant 1

3.3. Short columns, Factor C: insignificant 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 insignificant 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

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!**

Official Use only:
Accepted By
Date:

Detailed Engineering Evaluation Summary Data

V1.11

Location

Building Name: YWCA Units 5-8

Unit No: Street

Building Address: 285 Hereford Street, Christchurch

Legal Description:

Degrees Min Sec

GPS south:

GPS east:

Building Unique Identifier (CCC): BU2311-002

Reviewer: David Whittaker

CPEng No: 123089

Company: Beca

Company project number: 5323355

Company phone number 03 3663521

Date of submission: 27/06/2013

Inspection Date: 7/08/2012

Revision:

Is there a full report with this summary? yes

Site

Site slope: flat

Soil type:

Site Class (to NZS1170.5): D

Proximity to waterway (m, if <100m):

Proximity to clifftop (m, if < 100m):

Proximity to cliff base (m,if <100m):

Max retaining height (m): 0

Soil Profile (if available):

If Ground improvement on site, describe: N/A

Approx site elevation (m):

Building

No. of storeys above ground 1 single storey = 1

Ground floor split? no

Storeys below ground 0

Foundation type: other (describe)

Building height (m): 3.50

Floor footprint area (approx) 340

Age of Building (years): 47

Ground floor elevation (Absolute) (m):

Ground floor elevation above ground (m): 0.00

if Foundation type is other, describe: Unknown, timber piles assumed

height from ground to level of uppermost seismic mass (for IEP only) (m): 3.5

Date of design: 1965-1976

Strengthening present? no

If so, when (year)?

And what load level (%g)?

Brief strengthening description:

Use (ground floor): multi-unit residential

Use (upper floors):

Use notes (if required):

Importance level (to NZS1170.5) IL2

Gravity Structure

Gravity System: load bearing walls

Roof: timber framed

Floors: timber

Beams: timber

Columns: load bearing walls

Walls: partially filled concrete masonry

rafter type, purlin type and claddin

joist depth and spacing (mm)

type

typical dimensions (mm x mm)

thickness (mm)

Lateral load resisting structure

Lateral system along: lightweight timber framed walls

Ductility assumed, μ: 2.00

Period along: 0.20 0.00

Total deflection (ULS) (mm):

maximum interstorey deflection (ULS) (mm):

Note: Define along and across in detailed report!

note typical wall length (m) Approx. 40m

estimate or calculation? estimated

estimate or calculation?

estimate or calculation?

Lateral system across: other (note)

Ductility assumed, μ: 2.00

Period across: 0.40 0.00

Total deflection (ULS) (mm):

maximum interstorey deflection (ULS) (mm):

describe system Partially filled CMU and timber framed walls

estimate or calculation? estimated

estimate or calculation?

estimate or calculation?

Separations:

north (mm):

east (mm):

south (mm):

west (mm):

leave blank if not relevant

Non-structural elements

Stairs:

Wall cladding: brick or tile

Roof Cladding: Metal

Glazing: timber frames

Ceilings: plaster, fixed

Services(list): Electrical, plumbinc

describe (note cavity if exists) Brick Veneer

describe Lightwight profiled metal sheeting

Available documentation

Architectural none

Structural none

Mechanical none

Electrical none

Geotech report none

original designer name/date

original designer name/date

original designer name/date

original designer name/date

original designer name/date

Damage

Site:

(refer DEE Table 4-2)

Site performance: Good

Settlement: 0-25mm

Differential settlement: 0-1:350

Liquefaction: none apparent

Lateral Spread: none apparent

Differential lateral spread: none apparent

Ground cracks: none apparent

Damage to area: none apparent

Describe damage:

notes (if applicable):

notes (if applicable):

notes (if applicable):

notes (if applicable):

notes (if applicable):

notes (if applicable):

notes (if applicable):

Building:

Current Placard Status: green

Along Damage ratio: 100%

Describe (summary):

Describe how damage ratio arrived at: Minor damage not considered to reduce capacity

Across Damage ratio:

Describe (summary):

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

Diaphragms Damage?: yes Describe: Cracking in plasterboard linings

CSWs: Damage?: no Describe:

Pounding: Damage?: no Describe:

Non-structural: Damage?: yes Describe: Cracking to brick veneer and plasterboard linings

Recommendations

Level of repair/strengthening required: minor structural Describe: Cracking to brick veneer and plasterboard linings

Building Consent required: no Describe:

Interim occupancy recommendations: full occupancy Describe:

Along Assessed %NBS before: 42% ##### %NBS from IEP below

Assessed %NBS after:

If IEP not used, please detail assessment methodology: Quantitative Assessment

Across Assessed %NBS before: 48% ##### %NBS from IEP below

Assessed %NBS after:

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): 1965-1976

h_n from above: 3.5m

Seismic Zone, if designed between 1965 and 1992: B

not required for this age of building

not required for this age of building

	along	across
Period (from above):	0.2	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
Note 2: for RC buildings designed between 1976-1984, use 1.2
Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (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:

	along	across
Near Fault scaling factor (1/N(T,D), **Factor A**:	#DIV/0!	#DIV/0!

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)		
Ductility scaling factor: =1 from 1976 onwards; or =μ, if pre-1976, fromTable 3.3:		
Ductiity Scaling Factor, **Factor D**:	0.00	0.00

2.6 Structural Performance Scaling Factor:

Sp:		
Structural Performance Scaling Factor **Factor E**:	#DIV/0!	#DIV/0!

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

%NBS$_b$: **#DIV/0!** **#DIV/0!**

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

3.1. Plan Irregularity, factor A: insignificant 1

3.2. Vertical irregularity, Factor B: insignificant 1

3.3. Short columns, Factor C: insignificant 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 insignificant 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

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!**

Official Use only:
Accepted By
Date:

Appendix C

Previous Reports and Assessment

Christchurch Eq. RAPID Assessment Form - LEVEL 1

Inspector Initials: RFU
Territorial Authority: Christchurch City
Date of Inspection: 25/3/11
Time: 2:00pm
Exterior Only ☑
Exterior and Interior ☑

Building Name: YWCA Welfare
Short Name: Housing.
Address: 285 Hereford St

GPS Co-ordinates: S° E°
Contact Name: CCC
Contact Phone:

Storeys at and above ground level: 1
Below ground level: –
Total gross floor area (m²):
Year built: 1970's
No of residential Units: 10 approx.

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 Veneer
- ☐ 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 below:

Overall Hazards / Damage	Minor/None	Moderate	Severe	Comments
Collapse, partial collapse, off foundation	☑	☐	☐	
Building or storey leaning	☑	☐	☐	
Wall or other structural damage	☑	☐	☐	Minor cracks to Veneer + GRD slabs + Chimney.
Overhead falling hazard	☑	☐	☐	
Ground movement, settlement, slips	☑	☐	☐	
Neighbouring building hazard	☑	☐	☐	
Other	☑	☐	☐	Garage/Shed at rear collapsed. Block walls.

Choose a posting based on the 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.

INSPECTED GREEN ☑
RESTRICTED USE YELLOW ☐
UNSAFE RED ☐

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):
- ☐ Level 2 or detailed engineering evaluation recommended
  - ☐ Structural
  - ☐ Geotechnical
  - ☐ Other:
- ☐ Other recommendations:

60079.

Estimated Overall Building Damage (Exclude Contents)

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

R. Uluka Opus CPEng

Sign here on completion
R. F. Uluka.

Date & Time: 25/3/11 2:00pm
ID

Inspection ID ________ *(Office Use Only)*

Christchurch Eq RAPID Assessment Form - LEVEL 2

Inspector Initials
Territorial Authority: Christchurch City

Date
Time

Final Posting (e.g. UNSAFE)

Building Name
Short Name
Address

GPS Co-ordinates S° E°
Contact Name
Contact Phone

Storeys at and above ground level
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:

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	☐	☐	☐	
Overhead falling hazard	☐	☐	☐	
Ground movement, settlement, slips	☐	☐	☐	
Neighbouring building hazard	☐	☐	☐	
Electrical, gas, sewerage, water, hazmats	☐	☐	☐	

Record any existing placard on this building:

Existing Placard Type (e.g. UNSAFE)

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:

Estimated Overall Building Damage (Exclude Contents)

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

Sign here on completion

Date & Time
ID

Inspection ID: __________ *(Office Use Only)*

PRUP1:

Structural Hazards/ Damage	Minor/None	Moderate	Severe	Comments
Foundations	☑	☐	☐	
Roofs, floors (vertical load)	☑	☐	☐	
Columns, pilasters, corbels	☑	☐	☐	
Diaphragms, horizontal bracing	☑	☐	☐	
Pre-cast connections	☑	☐	☐	
Beam	☑	☐	☐	
Non-structural Hazards / Damage				
Parapets, ornamentation	☑	☐	☐	Cracks in Chimney - Front.
Cladding, glazing	☑	☐	☐	Minor cracks to Veneer + Foundatn
Ceilings, light fixtures	☑	☐	☐	Cracks to Slabs.
Interior walls, partitions	☑	☐	☐	
Elevators	n/a ☐	☐	☐	
Stairs/ Exits	☑	☐	☐	
Utilities (eg. gas, electricity, water)	☑	☐	☐	
Other	☑	☐	☐	Back Garage walls collapsed.
Geotechnical Hazards / Damage				
Slope failure, debris	☑	☐	☐	
Ground movement, fissures	☑	☐	☐	
Soil bulging, liquefaction	☑	☐	☐	

General Comment ____________________

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	
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	

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

Recommendations for Repair and Reconstruction or Demolition (Optional)