Christchurch City Council

Bruce Terrace Cottages Housing Complex PRO 3652

Detailed Engineering Evaluation

Quantitative Assessment Report

Christchurch City Council

Bruce Terrace Cottages Housing Complex

Quantitative Assessment Report

20 Bruce Terrace, Akaroa

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Status: Final

Summary

Bruce Terrace Cottages Housing Complex
PRO 3652

Detailed Engineering Evaluation
Quantitative Report - Summary
Final

Background

This is a summary of the quantitative report for the Bruce Terrace Cottages Housing Complex, and is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011. This assessment covers the 3 residential units on the site.

Key Damage Observed

The residential units have suffered moderate damage to structural and non-structural elements. This included cracking of the double concrete block walls through both wythes. Significant step cracking was observed at the ends of the residential block. Cracking of internal linings was not observed on site due to repairs being completed prior to inspection. Settlement was observed at the end of unit 1, closest to the river. Some of this is movement pre-dates the earthquakes and is thought to be caused by flood events and building subsidence.

Level Survey

A floor level survey was not deemed necessary for this site.

Internal Lining Nail Spacings

The internal lining nail spacings were not measured on site.

Critical Structural Weaknesses

The double skin block walls have a brittle failure mechanism. On site damage indicates that the two skins are not adequately tied. This may be a critical structural weakness depending upon the number of veneer ties.

Indicative Building Strength

Table A: Summary of Seismic Performance by Blocks

Block	NBS%
PRO 3652 B001 (Block A)	22%*

*This value is dependent on the quality of ties between the two skins of veneer.

The residential units have a capacity of 22% NBS as limited by the out of plane rocking mode of the double skin block walls.

Increasing the number of nails in the plasterboard will not significantly improve the strength of the buildings.

Recommendations

It is recommended that;

- Structural schemes be developed to increase the seismic capacity of the building to at least 67%NBS. Temporary propping may be installed in the short term.
- A veneer tie investigation be carried out to determine the frequency of ties and assist with the temporary strengthening solution.
- A geotechnical investigation be conducted to investigate the bank stability to provide foundation recommendations for remediation works.
- Cosmetic repairs be undertaken as required.

Contents

1 Introduction

Opus International Consultants Limited has been engaged by Christchurch City Council to undertake a detailed seismic assessment of the Bruce Terrace Cottages Housing Complex, located at 20 Bruce Terrace, Akaroa following the Canterbury earthquake sequence since September 2010. The site was visited by Opus International Consultants on 2 October 2013.

The purpose of the assessment is to determine if the building is classed as being earthquake prone in accordance with the Building Act 2004.

The seismic assessment and reporting have been undertaken based on the qualitative and quantitative procedures detailed in the Detailed Engineering Evaluation Procedure (DEEP) document (draft) issued by the Structural Engineering Society (SESOC) [2] [3] [4] [5].

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 to carry out a full structural survey before the building is re-occupied.

We understand that CERA 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). CERA have adopted the Detailed Engineering Evaluation Procedure (DEEP) document (draft) issued by the Structural Engineering Society (SESOC) on 19 July 2011. This document sets out a methodology for both initial qualitative and detailed quantitative assessments.

It is anticipated that a number of factors, including the following, will determine the extent of evaluation and strengthening level required:

1. The importance level and occupancy of the building.

2. The placard status and amount of damage.
3. The age and structural type of the building.
4. Consideration of any critical structural weaknesses.

Christchurch City Council requires any building with a capacity of less than 34% of New Building Standard (including consideration of critical structural weaknesses) to be strengthened to a target of 67% as required under the CCC Earthquake Prone Building Policy.

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 the alteration. This effectively means that a building cannot be weakened as a result of an alteration (including partial demolition).

The Earthquake Prone Building policy for the territorial authority shall apply as outlined in Section 2.3 of this report.

Section 115 – Change of Use

This section requires that the territorial authority is satisfied that the building with a new use complies with the relevant sections of the Building Code 'as near as is reasonably practicable'.

This is typically interpreted by territorial authorities as being 67% of the strength of an equivalent new building or as near as practicable. This is also the minimum level recommended by the New Zealand Society for Earthquake Engineering (NZSEE).

Section 121 – Dangerous Buildings

This section was extended by the Canterbury Earthquake (Building Act) Order 2010, and defines a building as dangerous if:

1. 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
2. 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
3. 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
4. There is a risk that other property could collapse or otherwise cause injury or death; or
5. 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 (EPB) 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 loads 33% of those 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 October 2011 following the Darfield Earthquake on 4 September 2010.

The policy includes the following:

1. A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;

2. A strengthening target level of 67% of a new building for buildings that are Earthquake Prone;

3. A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,

4. 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.

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.

Where an application for a change of use of a building is made to Council, the building will be required to be strengthened to 67% of New Building Standard or as near as is reasonably practicable.

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:

- Increase in the basic seismic design load for the Canterbury earthquake region (Z factor increased to 0.3 equating to an increase of 36 – 47% depending on location within the region);
- Increased serviceability requirements.

2.5 Institution of Professional Engineers New Zealand (IPENZ) Code of Ethics

One of the core ethical values of professional engineers in New Zealand is the protection of life and safeguarding of people. The IPENZ Code of Ethics requires that:

Members shall recognise the need to protect life and to safeguard people, and in their engineering activities shall act to address this need.

1.1 Giving Priority to the safety and well-being of the community and having regard to this principle in assessing obligations to clients, employers and colleagues.

1.2 Ensuring that responsible steps are taken to minimise the risk of loss of life, injury or suffering which may result from your engineering activities, either directly or indirectly.

All recommendations on building occupancy and access must be made with these fundamental obligations in mind.

3 Earthquake Resistance Standards

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 loadings are in accordance with the current earthquake loading standard NZS1170.5 [1].

A generally accepted classification of earthquake risk for existing buildings in terms of %NBS that has been proposed by the NZSEE 2006 [2] is presented in Figure 1 below.

Description	Grade	Risk	%NBS	Existing Building Structural Performance	Improvement of Structural Performance: Legal Requirement	Improvement of Structural Performance: 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 required under Act)	Unacceptable	Unacceptable

Figure 1: NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE Guidelines [2]

Table 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).

Table 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

3.1 Minimum and Recommended Standards

Based on governing policy and recent observations, Opus makes the following general recommendations:

3.1.1 Occupancy

The Canterbury Earthquake Order[1] in Council 16 September 2010, modified the meaning of "dangerous building" to include buildings that were identified as being EPB's. As a result of this, we would expect such a building would be issued with a Section 124 notice, by the Territorial Authority, or CERA acting on their behalf, once they are made aware of our assessment. Based on information received from CERA to date and from the MBIE guidance document dated December 2012 [6], this notice is likely to prohibit occupancy of the building (or parts thereof), until its seismic capacity is improved to the point that it is no longer considered an EPB.

3.1.2 Cordoning

Where there is an overhead falling hazard, or potential collapse hazard of the building, the areas of concern should be cordoned off in accordance with current CERA/territorial authority guidelines.

3.1.3 Strengthening

Industry guidelines (NZSEE 2006 [2]) strongly recommend that every effort be made to achieve improvement to at least 67%NBS. A strengthening solution to anything less than 67%NBS would not provide an adequate reduction to the level of risk.

It should be noted that full compliance with the current building code requires building strength of 100%NBS.

3.1.4 Our Ethical Obligation

In accordance with the IPENZ code of ethics, we have a duty of care to the public. This obligation requires us to identify and inform CERA of potentially dangerous buildings; this would include earthquake prone buildings.

[1] This Order only applies to buildings within the Christchurch City, Selwyn District and Waimakariri District Councils authority.

4 Background Information

4.1 Building Descriptions

The site contains 3 residential units which are thought to have been constructed in 1959. A site plan showing the location of the units, numbered 1 to 3, is shown in Figure 2. Figure 3 and Figure 4 show the location of the site in relation to Christchurch City and Akaroa Township respectively. The units are grouped together in one block of three units.

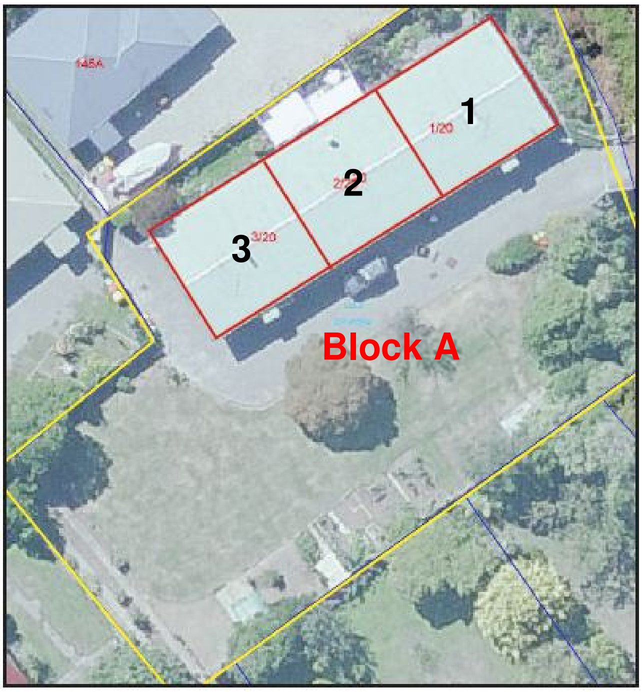

Figure 2: Site plan of Bruce Terrace Cottages Housing Complex.

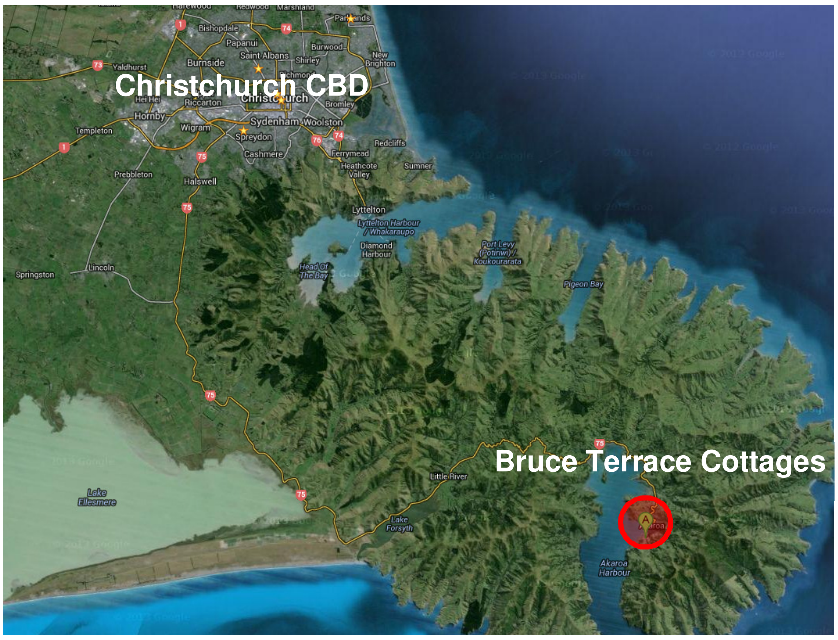

Figure 3: Location of Bruce Terrace Cottages (circled) relative to Christchurch CBD (Source: Google Earth).

Figure 4: Location of Bruce Terrace Cottages (circled) relative to Akaroa Township (Source: Google Earth).

The residential units have external concrete block walls consisting of two skins of 90mm concrete block which are potentially unreinforced and tied together using veneer ties. A reinforced concrete bond beam runs around the top of these walls. The internal walls are timber framed and lined with fibrous plaster. The wall on the terrace side of the building consists of reinforced concrete columns, return walls and large windows.

The roof structure comprises of timber rafters which are half checked into each other at the apex, as shown in Figure 5, supporting light-weight metal roofs with rebated timber sarking which is raked to follow the roofline. The timber framed walls are lined with plasterboard.

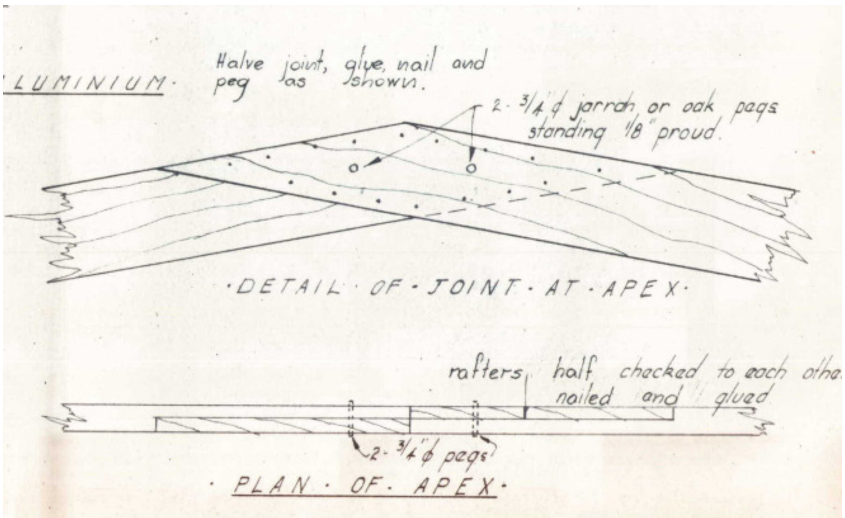

Figure 5: Detail of rafter apex at Bruce Terrace Cottages Housing Complex.

The units are separated by 200mm block masonry fire walls which is probably unreinforced. A reinforced bond beam is located at the roofline within the block fire wall.

Foundations are strip footings under fire walls and around the perimeter of reinforced concrete slabs.

Unit 2 is smaller than the end units as it was converted from the garages of the original 2 units. Unit 2 also has a conservatory extension constructed in 1993.

Figure 6 shows a typical floor plan of a residential unit from original site plans (refer to section 4.3). Figure 7 shows a cross section used in calculations.

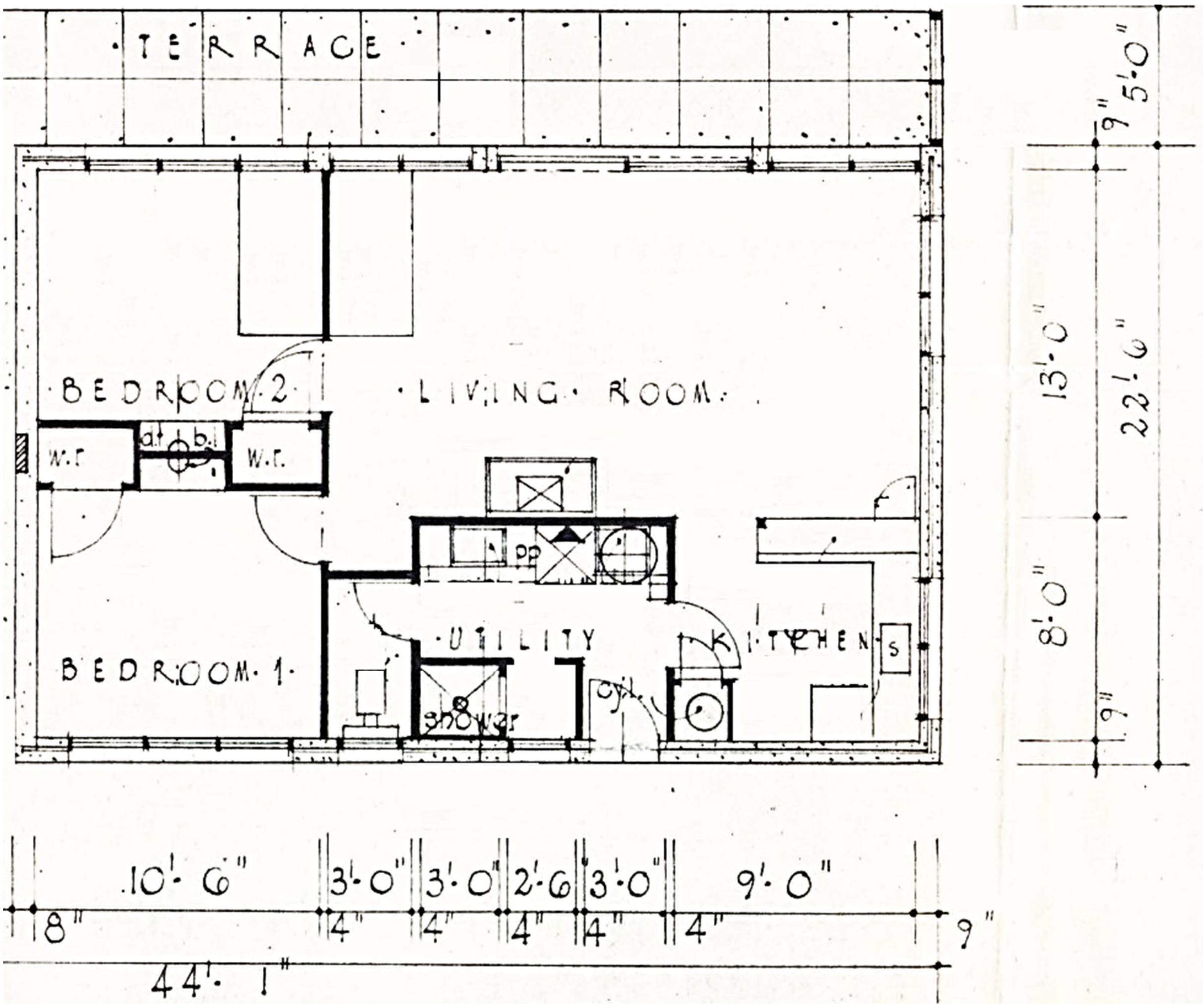

Figure 6: Typical partial floor plan of residential unit blocks.

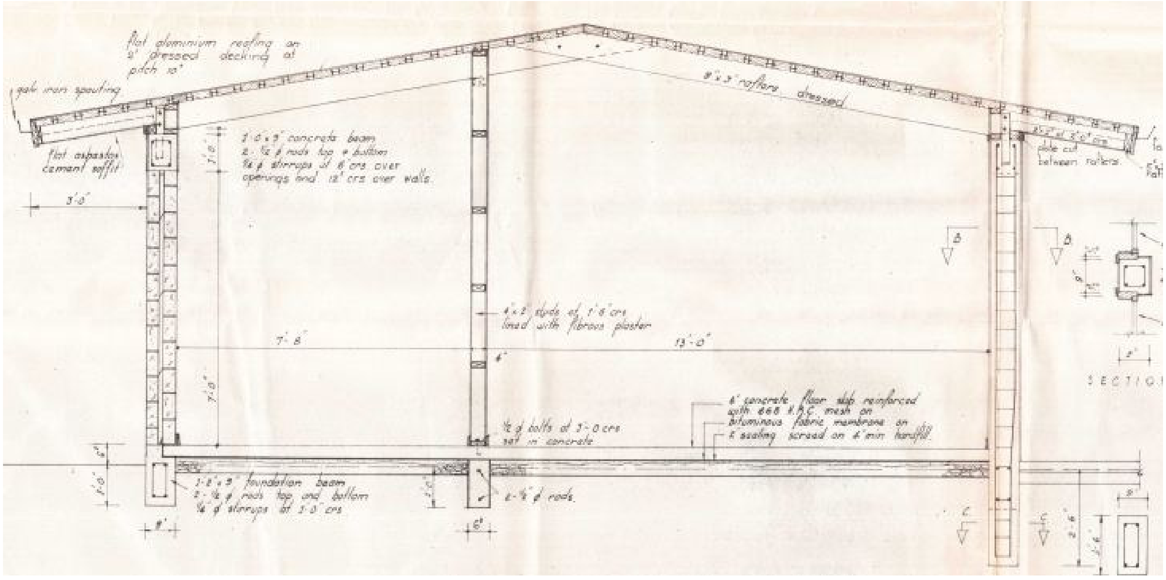

Figure 7: Cross section of Bruce Terrace Cottages.

4.2 Survey

4.2.1 Post 22 February 2011 Rapid Assessment

A structural (Level 2) assessment of the buildings/property was undertaken on 3 March 2011 by Opus International Consultants.

4.2.2 Level Survey

A level survey was not deemed to be necessary at Bruce Terrace Cottages

4.3 Original Documentation

The following documentation was provided by the Christchurch City Council:

- 3249 – Design and Engineering Group – Flats for M.A Scandrett Esq – p. 1-2/2 – Elevations; Sections and Details – 1959.

Copies of the design calculations were not provided.

5 Damage

This section outlines the damage to the buildings that was observed during the site visits. It is not intended to be a complete summary of the damage sustained by the buildings due to the earthquakes. Some forms of damage may not be able to be identified with a visual inspection only.

Significant cracking was observed to structural elements of the residential units. The end units (Units 1 and 3) suffered more damage than the middle unit.

Note: Any photo referenced in this section can be found in Appendix A.

5.1 Residual Displacements

No residual displacements were observed within residential units. Ground subsidence was observed at the end of Unit 1, sloping toward the creek (photo 16).

5.2 Foundations

Minor cracking was observed in the render on the concrete pad foundation in Unit 1 (photo 12).

5.3 Primary Gravity Structure

Cracking to the concrete block exterior walls and block firewall was observed in all units. This was most severe in Unit 1 where cracking has propagated through both skins of block wall (photo 13). Significant stepped cracking was observed at the ends of Units 1 and 3 (photo 11).

5.4 Primary Lateral-Resistance Structure

Severe cracking of the concrete block walls and firewalls reduce the lateral-resistance capacity of the structure. Cracking in the internal linings was expected to be observed however these have been repaired prior to the inspection.

5.5 Non Structural Elements

Ground settlement around Unit 1 has caused a gap to form under the corner of the concrete entrance patio (photo 15). Cracking of the concrete entrance patios was observed in all units (photo 12).

5.6 General Observations

The residential units performed adequately as would be expected from the construction type and location. The residential units suffered moderate structural damage due to the construction type and proximity to a watercourse (photo 5).

6 Detailed Seismic Assessment

The detailed seismic assessment has been based on the NZSEE 2006 [2] guidelines for the "Assessment and Improvement of the Structural Performance of Buildings in Earthquakes" together with the "Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury, Part 2 Evaluation Procedure" [3] draft document prepared by the Engineering Advisory Group on 19 July 2011, and the SESOC guidelines "Practice Note – Design of Conventional Structural Systems Following Canterbury Earthquakes" [5] issued on 21 December 2011.

As the residential units have the same floor plan, the analysis was simplified by conducting the analysis of one multi-unit block with similar cladding and using this for all multi-unit blocks.

6.1 Critical Structural Weaknesses

The term Critical Structural Weakness (CSW) refers to a component of a building that could contribute to increased levels of damage or cause premature collapse of a building.

It is difficult to determine if the double skin block walls are a critical structural weaknesses as their stability is governed by the number of veneer ties. A veneer tie investigation would need to be undertaken to find the tie frequency.

6.2 Quantitative Assessment Methodology

The assessment assumptions and methodology have been included in Appendix B. A brief summary follows:

Hand calculations were performed to determine seismic forces from the current building codes. These forces were applied globally to the structure and the capacities of the walls were calculated and used to estimate the %NBS. The walls, highlighted in Figure 8 and Figure 9, were used for bracing in their respective directions. The frame action along the terrace has been ignored due to its flexibility.

Rocking modes of the double skin concrete block walls were also considered. This is demonstrated in Figure 10.

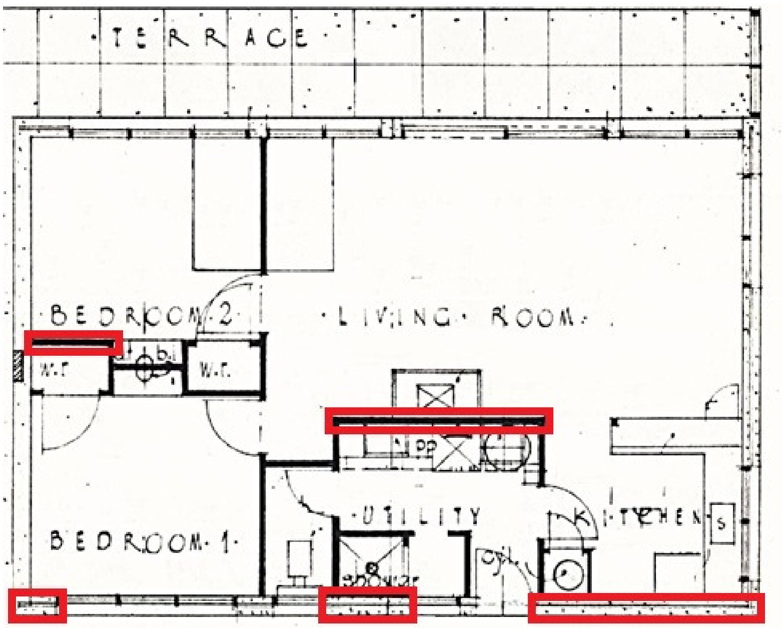

Figure 8: Walls used for bracing in the longitudinal direction.

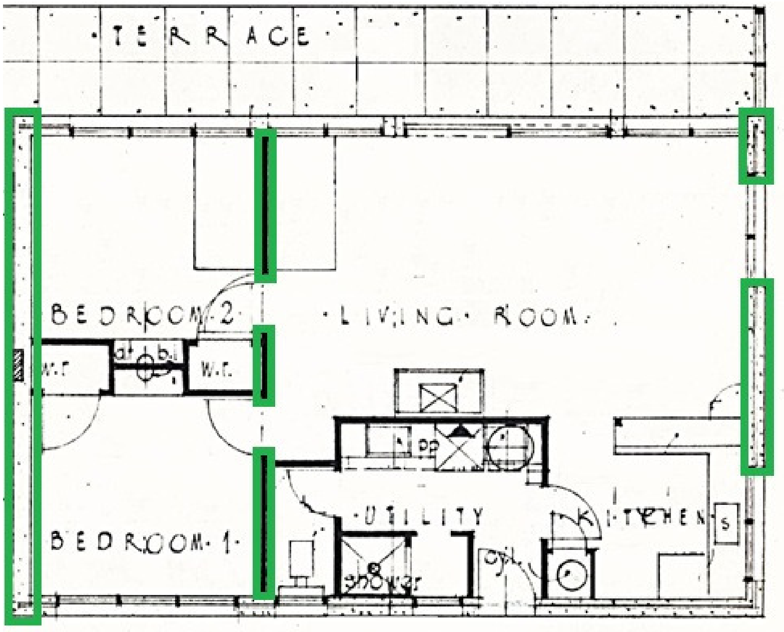

Figure 9: Walls used for bracing in the transverse direction.

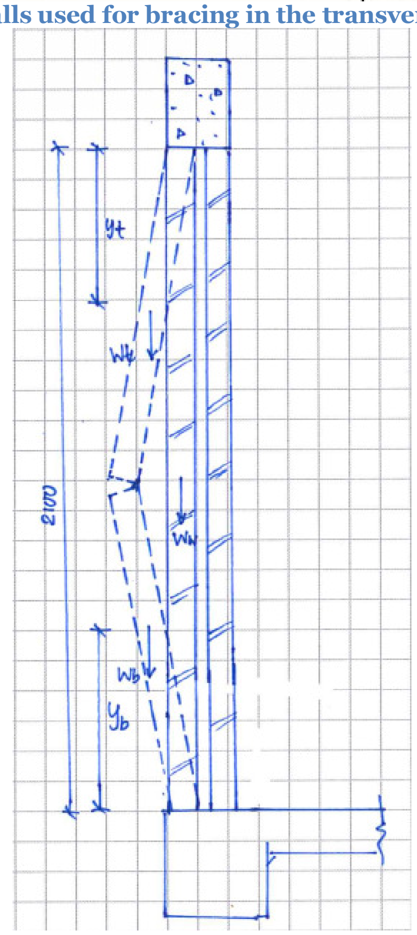

Figure 10: Rocking mode for one skin in the double concrete block wall.

6.3 Limitations and Assumptions in Results

There may have been damage to the buildings that was unable to be observed that could cause the capacity of the buildings to be reduced further; therefore the current capacity of the buildings may be lower than that stated.

The results have been reported as a %NBS and the stated value is that obtained from our analysis and assessment. Despite the use of best national and international practice in this analysis and assessment, this value contains uncertainty due to the many assumptions and simplifications which are made during the assessment. These include:

- Simplifications made in the analysis, including boundary conditions such as foundation fixity.
- Assessments of material strengths based on limited drawings, specifications and site inspections.
- The normal variation in material properties which change from batch to batch.
- Approximations made in the assessment of the capacity of each element, especially when considering the post-yield behaviour.
- Construction is consistent with normal practise of the era in which constructed.

6.4 Assessment

A summary of the structural performance of the buildings is shown in Table 2. Note that the values given represent the worst performing elements in the building, where these effectively define the building's capacity. Other elements within the building may have significantly greater capacity when compared with the governing elements.

Table 2: Summary of Seismic Performance

Building Description	Critical element	% NBS based on calculated capacity in longitudinal direction	% NBS based on calculated capacity in transverse direction.
Residential Units	Rocking mode of the double block walls – Out of plane	22%	22%
	Diagonal shear failure of double block wall	100%	100%
	Timber framed shear walls	100%	100%
	190 block wall out of plane	49%	100%

7 Geotechnical Summary

CERA indicates that Bruce Terrace Cottages is located in a Port Hills & Banks Peninsula zone (as shown in Figure 11).

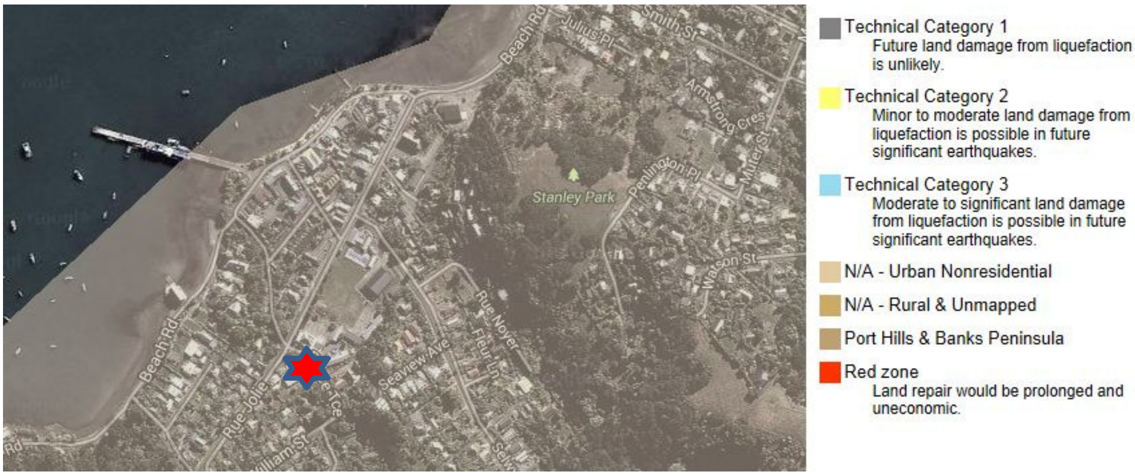

Figure 11: CERA Technical Categories map (loc. starred).

A desktop study for Bruce Terrace Cottages was conducted by GHD in 2013. The following sections are summarised from this study.

7.1 Liquefaction Potential

The site is considered to have negligible liquefaction potential caused by shallow bedrock and deep groundwater levels.

7.2 Summary

The site slope is thought to be stable in regards to earthquake movements. Flood events are thought to cause bank subsidence and erosion.

7.3 Further Work

Further investigation is warranted into the causes of the banks instability, and is recommended to provide foundation recommendations for the remediation of the gable end of Unit 1.

8 Conclusions

- The residential units have a capacity of 22% NBS, as limited by the out of plane rocking mode of the double skin block wall. They are deemed to be a 'high risk' in a design seismic event according to NZSEE guidelines. Their level of risk is 10-25 times that of a 100% NBS building (Figure 1).

9 Recommendations

It is recommended that;

- Structural schemes be developed to increase the seismic capacity of the building to at least 67%NBS. Temporary propping may be installed in the short term.
- A veneer tie investigation be carried out to determine the frequency of ties and assist with the temporary strengthening solution.
- A geotechnical investigation be conducted to investigate the bank stability to provide foundation recommendations for remediation works.
- Cosmetic repairs be undertaken as required.

10 Limitations

- This report is based on an inspection of the buildings and focuses on the structural damage resulting from the Canterbury Earthquake sequence since September 2010. Some non-structural damage may be described but this is not intended to be a complete list of damage to non-structural items.
- Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time.
- This report is prepared for the Christchurch City Council to assist in the assessment of any remedial works required for the Bruce Terrace Cottages Housing Complex. It is not intended for any other party or purpose.

11 References

[1] NZS 1170.5: 2004, Structural design actions, Part 5 Earthquake actions, Standards New Zealand.

[2] NZSEE (2006), Assessment and improvement of the structural performance of buildings in earthquakes, New Zealand Society for Earthquake Engineering.

[3] Engineering Advisory Group, Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury, Part 2 Evaluation Procedure, Draft Prepared by the Engineering Advisory Group, Revision 5, 19 July 2011.

[4] Engineering Advisory Group, *Guidance on Detailed Engineering Evaluation of Non-residential buildings, Part 3 Technical Guidance*, Draft Prepared by the Engineering Advisory Group, 13 December 2011.

[5] SESOC (2011), Practice Note – Design of Conventional Structural Systems Following Canterbury Earthquakes, Structural Engineering Society of New Zealand, 21 December 2011.

[6] MBIE (2012), Repairing and rebuilding houses affected by the Canterbury earthquakes, Ministry of Building, Innovation and Employment, December 2012.

[7] GHD (2013), Bruce Terrace, Akaroa Draft Geotechnical Desk study, GHD, September 2013.

Appendix A – Photographs

Bruce Terrace Cottages Housing Complex		
No.	Item description	Photo
Residential Units Layout		
1.	Exterior view (west end)	
2.	Exterior view (front)	

3.	Exterior view (front and east end)	
4.	Exterior view (east end)	
5.	Nearby stream and bank protection	

6.	Typical lounge view	
7.	Typical bedroom view	
8.	Typical second bedroom view	

9.	Typical kitchen view	
10.	Conservatory of Unit 2	
11.	Stepped cracking of the double block walls (Unit 3)	

12.	Cracking of the concrete entrance patio	
13.	Cracking through both brick wythes (Unit 1)	
14.	Minor cracking of concrete pad foundations (Unit 1)	

15.	Gap under concrete patio (Unit 1)	
16.	Settlement at the end of Unit 1	

Appendix B – Methodology and Assumptions

Seismic Parameters

As per NZS 1170.5:

- T < 0.4s (assumed)
- Soil: Category C
- Z = 0.3
- R = 1.0 (IL2, 50 year)
- N(T,D) = 1.0

For the analyses, a μ of 1 was assumed for the block walls in the residential units and a μ of 2 was used for timber stud walls.

Analysis Procedure

As the units are small and have a number of closely spaced walls in both directions, the fibrous plaster board ceilings are assumed to be capable of transferring loads to all walls. It was therefore assumed that a global method could be used to carry the forces down to ground level in each direction. Bracing capacities were found by assuming a certain kN/m rating for the walls along each line. For timber walls this was 3 kN/m and block walls were calculated using the NZSEE guidelines for diagonal tension failure and in plane shear.

The block walls were analysed out of plane using the NZSEE guidelines for unreinforced masonry

Additional Assumptions

Further assumptions about the seismic performance of the buildings were:

- Foundations and foundation connections had adequate capacity to resist and transfer earthquake loads.
- Connections between all elements of the lateral load resisting systems are detailed to adequately transfer their loads sufficiently and are strong enough so as to not fail before the lateral load resisting elements.

Appendix C – CERA DEE Spreadsheet

Detailed Engineering Evaluation Summary Data V1.14

Location

Building Name:	Bruce Terrace Cottages	Reviewer:	Mary Ann Halliday
	Unit / No: 20 / Street: Bruce Terrace	CPEng No:	67073
Building Address:	20 Bruce Terrace	Company:	Opus International Consultants
Legal Description:		Company project number:	6-QC321.00
		Company phone number:	
GPS south:	Degrees 43, Min 48, Sec 42.05	Date of submission:	26-Feb-14
GPS east:	Degrees 172, Min 57, Sec 43.92	Inspection Date:	2/10/2013
		Revision:	1
Building Unique Identifier (CCC):	PRO3652	Is there a full report with this summary?	yes

Site

Site slope:	slope < 1in 10	Max retaining height (m):	
Soil type:		Soil Profile (if available):	
Site Class (to NZS1170.5):	C		
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):	

Building

No. of storeys above ground:	1	single storey = 1 / Ground floor elevation (Absolute) (m):	
Ground floor split?	no	Ground floor elevation above ground (m):	
Storeys below ground	0		
Foundation type:	strip footings	if Foundation type is other, describe:	
Building height (m):	3.00	height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	185		
Age of Building (years):	54	Date of design:	1935-1965
Strengthening present?	no	If so, when (year)?	
		And what load level (%g)?	
Use (ground floor):	multi-unit residential	Brief strengthening description:	
Use (upper floors):			
Use notes (if required):			
Importance level (to NZS1170.5):	IL2		

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	none	overall depth x width (mm x mm)	
Columns:	load bearing walls	typical dimensions (mm x mm)	
Walls:	partially filled concrete masonry	thickness (mm)	

Lateral load resisting structure

Lateral system along:	unreinforced masonry bearing wall - brick	**Note: Define along and across in detailed report!**	note wall thickness and cavity	
Ductility assumed, μ:	1.25			
Period along:	0.90	0.40 from parameters in sheet	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	unreinforced masonry bearing wall - brick		note wall thickness and cavity	
Ductility assumed, μ:	1.25			
Period across:	0.90	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	

Separations:

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

Non-structural elements

Stairs:			
Wall cladding:	exposed structure	describe	Double concrete block
Roof Cladding:	Metal	describe	
Glazing:	timber frames		
Ceilings:	strapped or direct fixed		
Services(list):			

Available documentation

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

Damage

Site: (refer DEE Table 4-2)

Site performance:	Good	Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	none apparent	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:	none apparent	notes (if applicable):	

Building:

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

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

Recommendations

	Level of repair/strengthening required:	minor structural	Describe:	
	Building Consent required:	yes	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	22% ##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	Equivalent Static
	Assessed %NBS after e'quakes:	22%		
Across	Assessed %NBS before e'quakes:	100% ##### %NBS from IEP below		
	Assessed %NBS after e'quakes:	100%		

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