Christchurch City Council

Alma Place Housing Complex PRO 0715

Detailed Engineering Evaluation

Quantitative Assessment Report

Christchurch City Council

Alma Place Housing Complex

Quantitative Assessment Report

1 - 25 Alma Place, Shirley, Christchurch

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Status: Final

Summary

Alma Place Housing Complex
PRO 0715

Detailed Engineering Evaluation
Quantitative Report - Summary
Final

Background
This is a summary of the quantitative report for the Alma Place 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 24 residential units and 6 garages on site.

Key Damage Observed
No damage was observed to have been sustained by the garages.

The residential units suffered minor damage to non-structural elements.

Structural damage to the residential units was generally minor and was limited to the cracking of the wall and ceiling linings and concrete perimeter foundation in some of the residential units.

Critical Structural Weaknesses
No critical structural weaknesses were found in any of the buildings.

Level Survey
All floor slopes assessed were less than the 5mm/m limitation set out in the MBIE guidelines [6].

Indicative Building Strength
No buildings on the site are considered to be earthquake prone.

Block	NBS%	Floor Levels	Nail Spacings
PRO 0715 B001 (Block A)	58%	Pass	Pass
PRO 0715 B002 (Block B)	58%	Pass	Pass
PRO 0715 B003 (Block C)	58%	Pass	Pass
PRO 0715 B004 (Block D)	58%	Pass	Pass
PRO 0715 B005 (Block E)	58%	Pass	Pass
PRO 0715 B006 (Block E)	58%	Pass	Pass
PRO 0715 B007 (Block G – Garages)	39%	Pass	N/A

The storage garages have a capacity of 39% NBS as limited by the in-plane capacity of columns in the front wall in the longitudinal direction. The residential units have capacities of 58% NBS and are limited by the in-plane shear capacity lined timber-framed shear walls in the longitudinal direction.

Recommendations

It is recommended that;

- A strengthening works scheme be developed to increase the seismic capacity of all buildings to at least 67% NBS. This will need to consider compliance with accessibility and fire requirements.
- Cosmetic repairs be undertaken.
- Veneer at height (gable ends) have their veneer ties checked.

Contents

1 Introduction

Opus International Consultants Limited has been engaged by Christchurch City Council to undertake a detailed seismic assessment of the Alma Place Housing Complex, located off Marshland Road, Shirley, Christchurch, following the Canterbury Earthquake Sequence since September 2010. The site was visited by Opus International Consultants on 28 June 2013.

The purpose of the assessment is to determine if the buildings in the village are 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 24 residential units which were constructed in 1963 and a block of 6 storage garages. A site plan showing the locations of the units, numbered 1 to 25 (excluding unit 13), and garages is shown in Figure 2. There are 6 residential blocks on site with each block containing 4 units. Figure 3 shows the location of the site in Christchurch City.

Figure 2: Site plan of Alma Place Housing Complex.

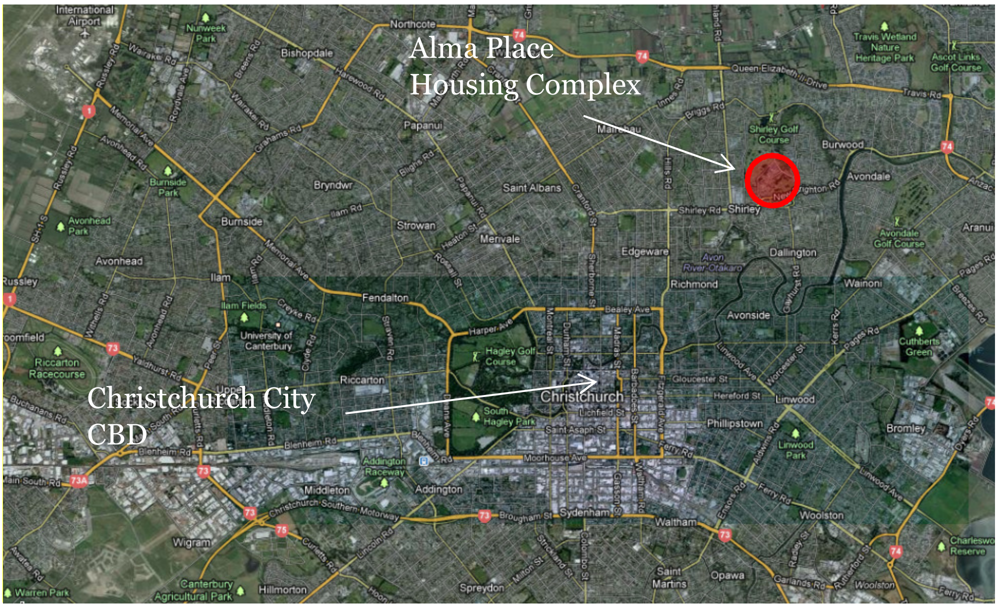

Figure 3: Location of site relative to Christchurch City CBD *(Source: Google Maps).*

The residential units are timber-framed buildings with diagonal timber braces. The roof structure comprises of timber roof framing supporting light-weight metal roofs. Internal walls and ceilings are lined with plasterboard and external walls are clad with a brick veneer. The foundations are made up of concrete piles with a reinforced concrete perimeter foundation and timber flooring. Figure 4 shows a typical floor plan of two residential units based on site measurements by Opus.

The units are separated by 190mm concrete block fire walls which (based on information available for other similar blocks of the same era) is potentially filled with reinforcement to its perimeter.

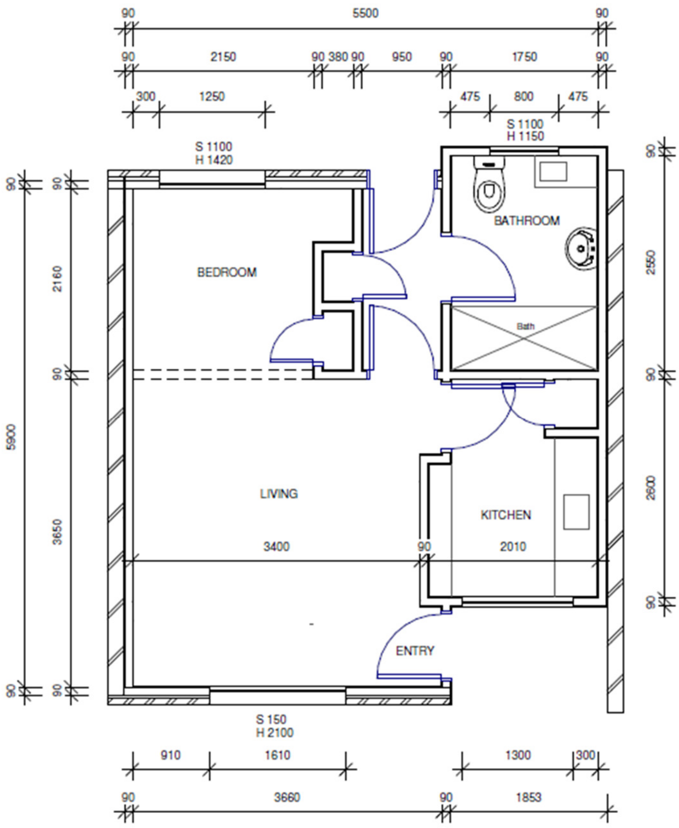

Figure 4: Typical floor plan of a residential unit within each block.

The storage garages were built in 1996 and are made from pre-cast concrete panels bolted into a concrete pad foundation with reinforced concrete ground beams. The concrete panels are singly reinforced with 665 mesh and the pillars surrounding the tilting doors are reinforced with four H12 bars lengthwise and R6 bars at 150mm centres. The roof is a light-weight metal roof supported on timber framing spanning between the garage walls. A cross section through the garage is shown in Figure 5.

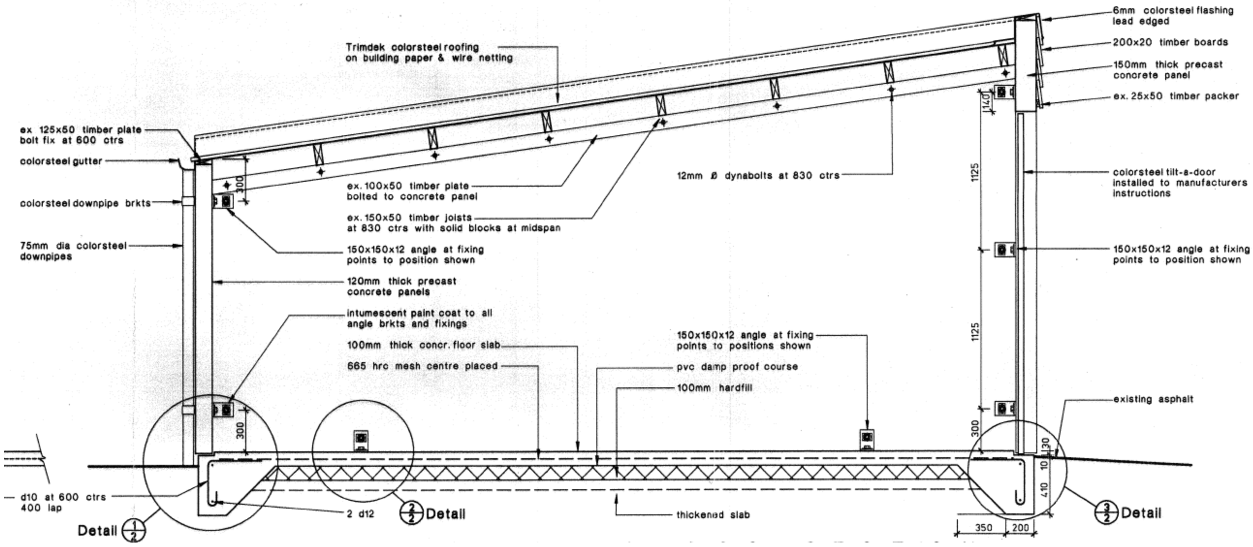

Figure 5: Cross section of panels and fixing for garages.

4.2 Survey

4.2.1 Post 22 February 2011 Rapid Assessment

A structural (Level 1) assessment of the buildings/property was undertaken on March 7th, 2011 by Opus International Consultants.

4.2.2 Level Survey

A full level survey was not deemed to be necessary at Alma Place Housing Complex as it is located in a TC2 zone (Figure 8). Properties in TC2 zones suffered minor to moderate amounts of damage due to liquefaction and/or settlement. In lieu of a full level survey, a laser level was placed in each unit so that differentials in vertical levels could be measured at the extreme ends of the unit. These values could then be used to determine the floor slope of the entire unit. For this site, all floor slopes were less than the 5mm/m limitation imposed by CERA [6].

4.2.3 Nail Spacing

Nail spacings were checked and were less than 250mm.

4.3 Original Documentation

Copies of the following construction drawings were provided by CCC:

- A146/1 – Christchurch City Council – Pensioners Cottage Marshlands Road – site plan – July 1961
- 508.92 – Christchurch City Council – Alma Place – Six New Garages – Pre-Cast Concrete Elevations and Details – February 1996

The drawings have been used to confirm the structural systems, investigate potential critical structural weaknesses (CSW) and identify details which required particular attention.

Copies of the design calculations were not provided.

5 Structural Damage

This section outlines the damage to the buildings that was observed during 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.

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

5.1 Residual Displacements

There are no indications of settlement due to earthquake imposed actions.

5.2 Foundations

Cracks around the vents to the foundations were observed on most of the residential units.

5.3 Primary Gravity Structure

No damage was observed to the timber framed walls or timber framed roof structure.

5.4 Primary Lateral-Resistance Structure

Some minor cracking of plasterboard-lined walls was observed in majority of the units that were inspected.

5.5 Non Structural Elements

A minor amount of cracking was observed in the cladding under the eaves.

5.6 General Observations

The buildings appeared to have performed reasonably well, as would be expected for buildings of this type, during the earthquakes. They have suffered distributed amounts of minor damage which is consistent with the age of the buildings.

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 brick 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.

No CSW's were identified in the buildings.

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 6 and Figure 7, were used for bracing of the residential units in their respective directions.

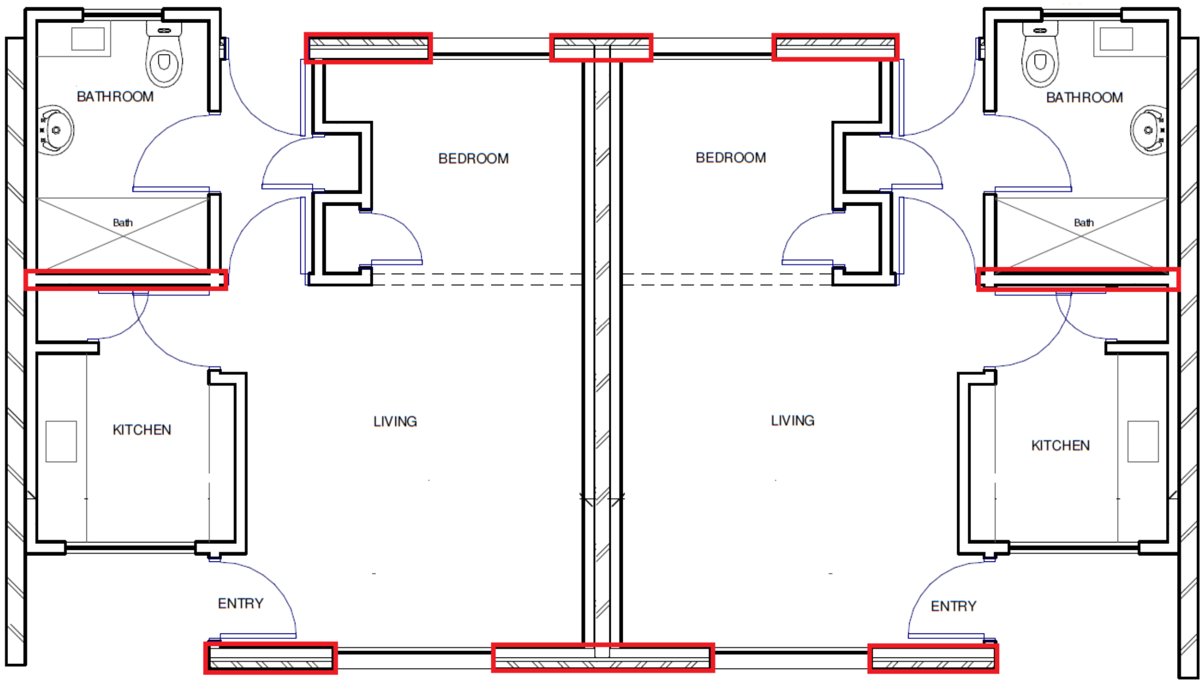

Figure 6: Walls used for bracing in the longitudinal direction.

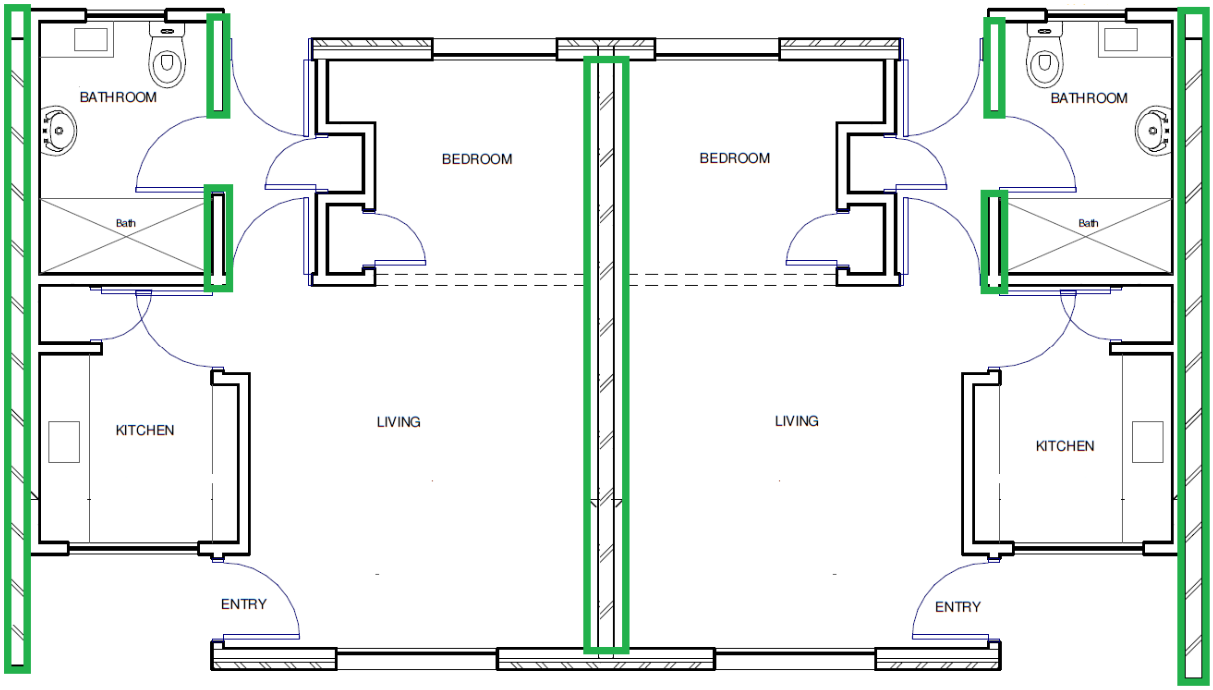

Figure 7: Walls used for bracing in the transverse direction.

6.3 Limitations and Assumptions in Results

The observed level of damage suffered by the buildings was deemed low enough to not affect their capacity. Therefore the analysis and assessment of the buildings was based on them being in an undamaged state. 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; 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.

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.

Unit considered	Failure Mode, or description of limiting criteria based on displacement capacity of critical element.	% NBS based on calculated capacity In longitudinal direction	% NBS based on calculated capacity in transverse direction.
All Multi-Unit Blocks	Bracing capacity of structural walls.	58%	100%
Garage	Bracing capacity of structural walls	39%	71%

7 Geotechnical Summary

CERA indicates that Alma Place Housing Complex is located in a TC2 zone (as shown in Figure 8). This classification suggests future significant earthquakes will cause minor to moderate land damage due to liquefaction and settlement.

Figure 8: TC2 zoning for Alma Place Housing Complex.

There is no evidence to suggest that further geotechnical investigation is warranted for this site.

8 Conclusions

- None of the buildings on site are considered to be Earthquake Prone.
- The storage garages have a capacity of 39% NBS, as limited by the in-plane capacity of the reinforced concrete panels of the building. They are deemed to be a 'moderate risk' in a design seismic event according to NZSEE guidelines. Their level of risk is 5-10 times that of a 100% NBS building (Figure 1).
- The residential units have a capacity of 58% NBS, as limited by the in-plane shear capacity of the lined shear walls. They are deemed to be a 'moderate risk' building in a design seismic event according to NZSEE guidelines. Its level of risk is 5-10 times that of a 100% NBS building (Figure 1).

9 Recommendations

It is recommended that;

- A strengthening works scheme be developed to increase the seismic capacity of all buildings to at least 67% NBS. This will need to consider compliance with accessibility and fire requirements.
- Cosmetic repairs be undertaken.
- Veneer at height (gable ends) have their veneer ties checked.

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 Alma Place 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.

Appendix A - Photographs

Alma Place Housing Complex		
Garage Block		
1	South wall	
2	East wall	

3	North wall	
4	Typical interior of a storage unit	
Residental Units		
5	Typical layout of front of units (north west facing side)	

6	Typical layout of the back of the units (south east facing side)	
7	Typical end walls for all blocks (both south west facing and north east facing)	
8	Typical roof space showing fire wall between units	

9	Typical foundations of the residential units	
10	Typical cracking around the vents in the perimeter foundations of the units	
11	Typical cracking in the soffit of the units	

12	Separation between steps and walkway	
13	Typical cracking in the GIB lined walls around the windows	
14	Typical cracking between the wall and ceiling lining	

15	Typical cracking where the GIB wall linings have been joined. Image showing spacing of GIB screws	

Appendix B - Methodology and Assumptions

Seismic Parameters

As per NZS 1170.5:

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

For the analyses, a μ of 2 was assumed for the residential units and 1.25 for the storage garages.

Analysis Procedure

Residential Units: 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. Due to the relatively unknown nature of the walls, the kN/m rating was taken as 3 kN/m for all timber walls with an aspect ratio (height: length) of less than 2:1. This was scaled down to zero kN/m at an aspect ratio of 3.5:1 as per NZSEE guidelines. %NBS values were then found through the ratio of bracing demand to bracing capacity for all walls in each direction.

Storage Garages: Multiple modes were analysed in order to determine the weakest element in the structure. This included the out-of-plane face loadings and the connection capacities of the structure as well as the in-plane capacities of the walls and columns. It was assumed that the modules which make up the front face (surrounding the garage doors) of the structure were not structurally connected. The weakest element was found to be bending in the support columns on the front face of the garages.

The following values were assumed in the analysis of the garages;

- A_s (Mesh) = 483 MPa
- A_s (H12 Bars) = 430 MPa
- f'_c = 30 MPa x 1.5 (as per NZSEE guidelines) = 45 MPa

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 Spreadsheets

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Alma Place Housing Complex	Reviewer:	Mary Ann Halliday
	Unit / No: / Street	CPEng No:	67073
Building Address:	Units 1-25 / Alma Place	Company:	OPUS International Consultants Ltd
Legal Description:	Residential Units	Company project number:	6-QC305.00
		Company phone number:	6433635400
	Degrees / Min / Sec		
GPS south:	43 / 30 / 17.82	Date of submission:	Nov-13
GPS east:	172 / 39 / 48.67	Inspection Date:	28-Jun-13
		Revision:	Final
Building Unique Identifier (CCC):	PRO 0715	Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:		Soil Profile (if available):	
Site Class (to NZS1170.5):			
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):	6.00

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:	isolated pads, no tie beams	if Foundation type is other, describe:	
Building height (m):		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):			
Age of Building (years):	50	Date of design:	1935-1965
Strengthening present?		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:	frame system		
Roof:	timber framed	rafter type, purlin type and cladding	
Floors:	timber	joist depth and spacing (mm)	
Beams:	timber	type	
Columns:			
Walls:			

Lateral load resisting structure

Note: Define along and across in detailed report!

Lateral system along:	lightweight timber framed walls			
Ductility assumed, μ:	2.00		note typical wall length (m)	
Period along:	0.10	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	lightweight timber framed walls			
Ductility assumed, μ:	2.00		note typical wall length (m)	
Period across:	0.10	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:	brick or tile	describe (note cavity if exists)	
Roof Cladding:	Metal	describe	Lightweight
Glazing:	aluminium frames		
Ceilings:	strapped or direct fixed		
Services(list):			

Available documentation

Architectural	none	original designer name/date	
Structural	none	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:		Describe damage:	
Settlement:		notes (if applicable):	
Differential settlement:		notes (if applicable):	
Liquefaction:		notes (if applicable):	
Lateral Spread:		notes (if applicable):	
Differential lateral spread:		notes (if applicable):	
Ground cracks:		notes (if applicable):	
Damage to area:		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:	minor GIB cracking

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

Recommendations

	Level of repair/strengthening required:		Describe:	
	Building Consent required:		Describe:	
	Interim occupancy recommendations:		Describe:	
Along	Assessed %NBS before e'quakes:	58%	##### %NBS from IEP below	If IEP not used, please detail assessment methodology: Equivalent Static
	Assessed %NBS after e'quakes:	58%		
Across	Assessed %NBS before e'quakes:	100%	##### %NBS from IEP below	
	Assessed %NBS after e'quakes:	100%		

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Alma Place Housing Complex		Reviewer:	Mary Ann Halliday
	Unit / No: / Street		CPEng No:	67073
Building Address:	Garages 1-6	Alma Place	Company:	OPUS International Consultants Ltd
Legal Description:	Parking and Storage Garages		Company project number:	6-QC305.00
			Company phone number:	6433635400
	Degrees / Min / Sec			
GPS south:	43 / 30 / 17.92		Date of submission:	Nov-13
GPS east:	172 / 39 / 48.67		Inspection Date:	28-Jun-13
			Revision:	Final
Building Unique Identifier (CCC):	PRO 0715		Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:		Soil Profile (if available):	
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	6.00

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:	mat slab		if Foundation type is other, describe:	
Building height (m):			height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):				
Age of Building (years):	50		Date of design:	1935-1965
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	parking		Brief strengthening description:	
Use (upper floors):				
Use notes (if required):	primarily storage units			
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:	precast concrete	overall depth (mm)	
Columns:			
Walls:	load bearing concrete	#N/A	

Lateral load resisting structure

Lateral system along:	concrete shear wall	**Note: Define along and across in**	enter wall data in "IEP period calcs"	
Ductility assumed, μ:	1.25	**detailed report!**	worksheet for period calculation	
Period along:	0.10	##### enter height above at H31	estimate or calculation?	
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	concrete shear wall		enter wall data in "IEP period calcs"	
Ductility assumed, μ:	1.25		worksheet for period calculation	
Period across:	0.10	##### enter height above at H31	estimate or calculation?	
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:	precast panels	thickness and fixing type	
Roof Cladding:	Metal	describe	Lightweight
Glazing:			
Ceilings:	none		
Services(list):			

Available documentation

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

Damage

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Site performance:	Good	Describe damage:	
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Differential settlement:		notes (if applicable):	
Liquefaction:		notes (if applicable):	
Lateral Spread:		notes (if applicable):	
Differential lateral spread:		notes (if applicable):	
Ground cracks:		notes (if applicable):	
Damage to area:		notes (if applicable):	

Building:

	Current Placard Status:	green		
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	Describe (summary):			
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	Describe (summary):			
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	no	Describe:	

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

Recommendations

	Level of repair/strengthening required:		Describe:	
	Building Consent required:		Describe:	
	Interim occupancy recommendations:		Describe:	
Along	Assessed %NBS before e'quakes:	39% ##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	Equivalent Static, Out of plane face loading
	Assessed %NBS after e'quakes:	39%		
Across	Assessed %NBS before e'quakes:	73% ##### %NBS from IEP below		
	Assessed %NBS after e'quakes:	73%		

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