Christchurch City Council

Vincent Courts Housing Complex PRO 1012

Detailed Engineering Evaluation

Quantitative Assessment Report

Christchurch City Council

Vincent Courts Housing Complex

Quantitative Assessment Report

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Summary

Vincent Courts Housing Complex
PRO 1012

Detailed Engineering Evaluation
Quantitative Report - Summary
Final

Background
This is a summary of the quantitative report for the Vincent Courts 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 18 residential units on the site.

Key Damage Observed
The residential units have suffered minor to moderate damage to non-structural elements. This included cracking of the brick veneer cladding. There is also cracking to the concrete pad foundation and second floor concrete slab in Block C. Minor plasterboard cracking was observed in all units.

Level Survey
All floor slopes were assessed in a laser level survey. Units 6, 8, 9, 15 and 16 exceeded the 5mm/m limitation set out in the MBIE guidelines [6], as shown below.

Internal Lining Nail Spacings
The internal lining nail spacings were measured on site to vary between 150-350mm.

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

Indicative Building Strength

Table A: Summary of Seismic Performance by Blocks

Block	NBS%	Indicative Floor Levels	Nail Spacings
PRO 1012 B001 (Block A)	53%	Fail	Pass
PRO 1012 B004 (Block B)	53%	Fail	Pass
PRO 1012 B005 (Block C - Single Storey Section)	35%	Pass	Pass
PRO 1012 B005 (Block C - Two Storey Section)	36%	Fail	Pass
PRO 1012 B002 (Residents Lounge)	100%	Pass	Pass
PRO 1012 B003 (Garage)	100%	-	N/R

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

Blocks A and B have capacities of 53% NBS as limited by the in-plane shear capacity of the timber-framed shear walls in the longitudinal direction.

Block C single storey units have capacities of 35% NBS as limited by the in-plane shear capacity of the timber-framed shear walls in the longitudinal direction.

Block C two storey units have capacities of 36% NBS as limited by the in-plane shear capacity of the pre-cast panels in the longitudinal direction.

The Residents Lounge has a capacity of 100% NBS.

The Garages have a capacity of 100% NBS.

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

Recommendations

It is recommended that;

- Veneer at height (gable ends) have the veneer ties checked (Residents Lounge).
- Cracking of the concrete pad be repaired where significant cracking has occurred.
- Strengthening schemes be developed to increase seismic capacity of Blocks A - C to at least 67%NBS.
- 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 Vincent Courts Housing Complex, located at 60 Vincent Place, Opawa, following the Canterbury earthquake sequence since September 2010. The site was visited by Opus International Consultants on 18 November 2013.

The purpose of the assessment is to determine if the buildings in the complex 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	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 18 residential units numbered 1 to 18. The units are grouped together to form three blocks of four, six or eight units. Block A and Block B (Units 1-10) were constructed in 1977. Block C (units 11-18) and the Residents Lounge were constructed in 1993. The Garages appear to have been constructed at the same time. A site plan showing the location of the units is shown in Figure 2. Figure 3 shows the location of the site in Christchurch City.

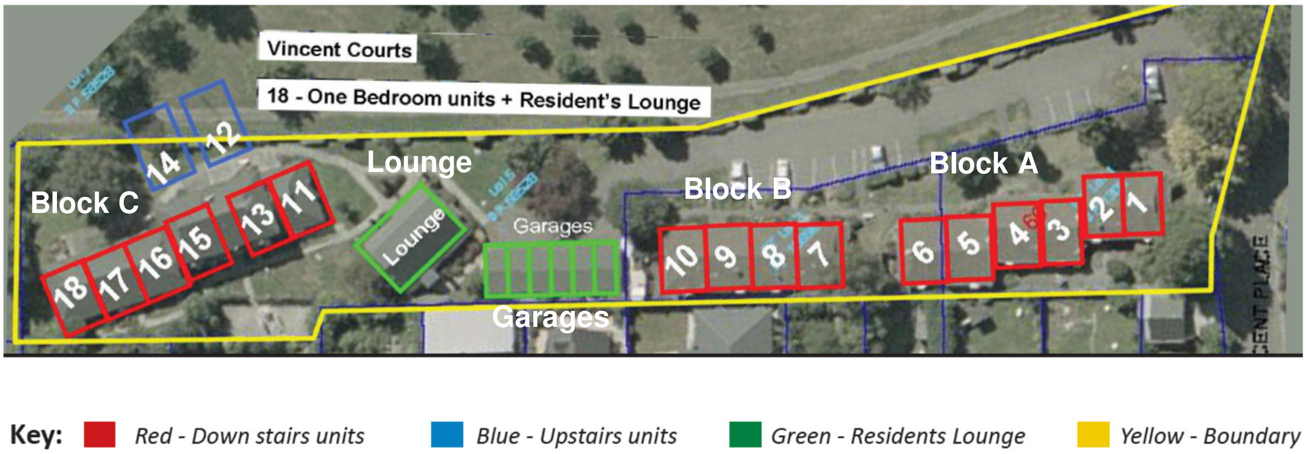


Figure 2: Site plan of Vincent Courts Housing Complex.

Figure 3: Location of Vincent Courts (circled) relative to Christchurch City CBD (Source: Google Earth).

Blocks A and B (Units 1-10) are timber-framed buildings with diagonal timber braces. The roof structure comprises of timber roof trusses supporting light-weight Decramastic tile roofs. The walls and ceilings are lined with plasterboard. External walls are clad with brick veneer. Foundations are strip footings under fire walls and around the perimeter of reinforced concrete slabs. The units are separated by 200mm block masonry fire walls which are reinforced with 12mm diameter bars at 600mm centres and to its perimeter.

Block C (Units 11-18) is a two storey precast concrete structure with internal walls which are timber-framed with diagonal braces. The roof structure comprises of timber roof trusses and steel strap braces supporting a light-weight metal roof. The walls and ceilings are lined with plasterboard. External walls are clad with concrete block and light weight metal cladding. Foundations are strip footings under fire walls and around the perimeter of reinforced concrete slabs. The units are separated by precast concrete fire walls. There is a single storey section of the block which is an extended layout of Blocks A and B.

The Residents Lounge is a timber framed building with diagonal timber braces. The roof structure comprises of timber roof trusses supporting a light weight metal roof and timber sarking. External walls are clad with a concrete block veneer. Foundations are strip footings around the perimeter of reinforced concrete slabs.

The Garages are a timber-framed building clad with light-weight steel. Studs are at 600mm centres and nailed at 200mm vertically with diagonal steel strap bracing. The roof structure comprises of timber trusses at 2400mm centres and steel strap braces supporting a light-weight metal roof. Foundations are shallow strip footings around perimeter walls and asphalt on grade. It is an open plan building measuring 5.6m by 18m, as measured by Opus. The walls are 2.2m high and the roof apex is 3m above the ground. There are 6 tilt-opening garage doors in the north side.

All of the units have the same floor layout however units in Block C have slightly larger dimensions.

Figure 4, Figure 5, and Figure 6 shows typical floor plans for Blocks A/B, Block C, and the Residents Lounge respectively. Figure 7 and Figure 8 show the cross sections used in calculations for Blocks A/B and Block C respectively.

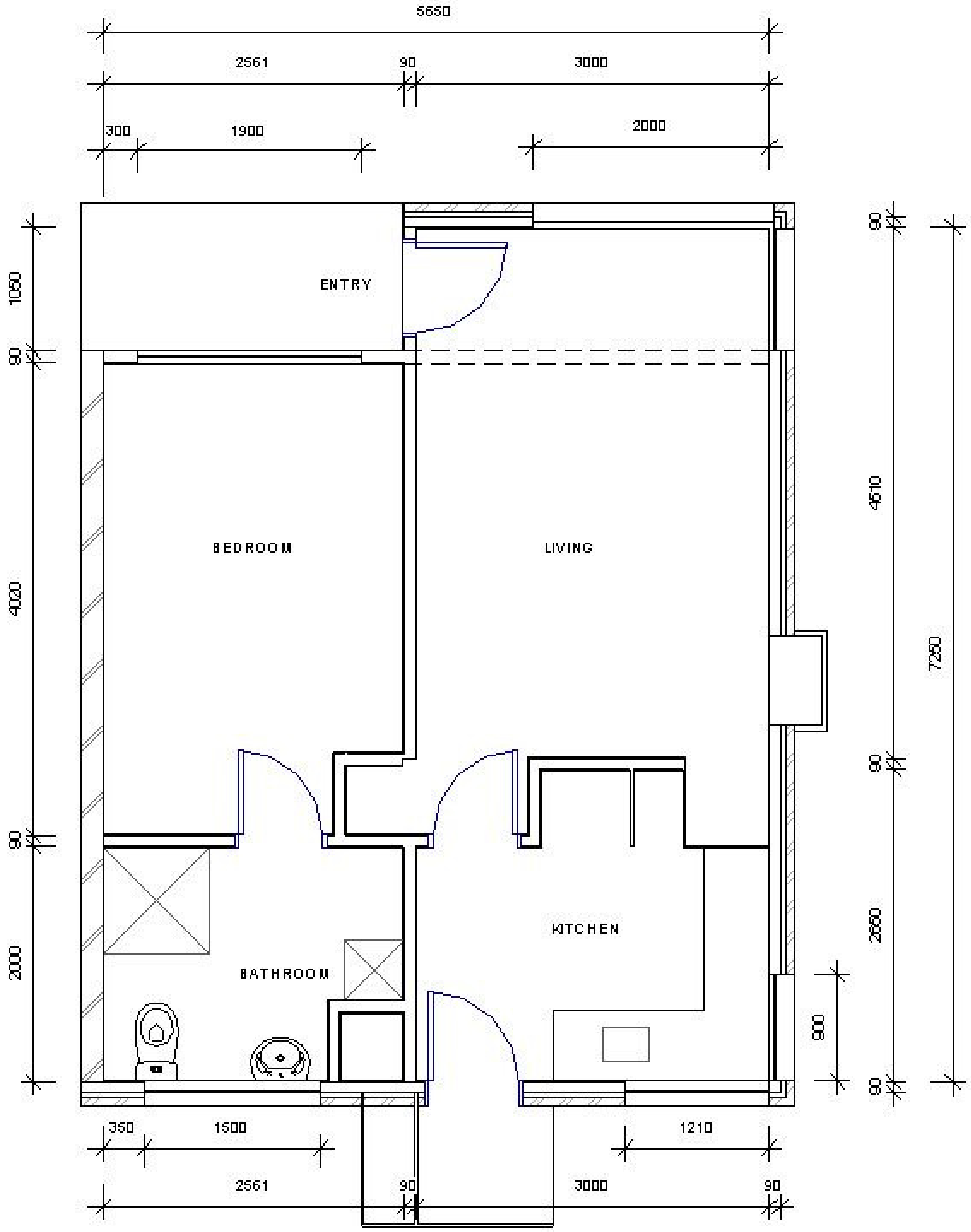


Figure 4: Typical partial floor plan Blocks A and B.

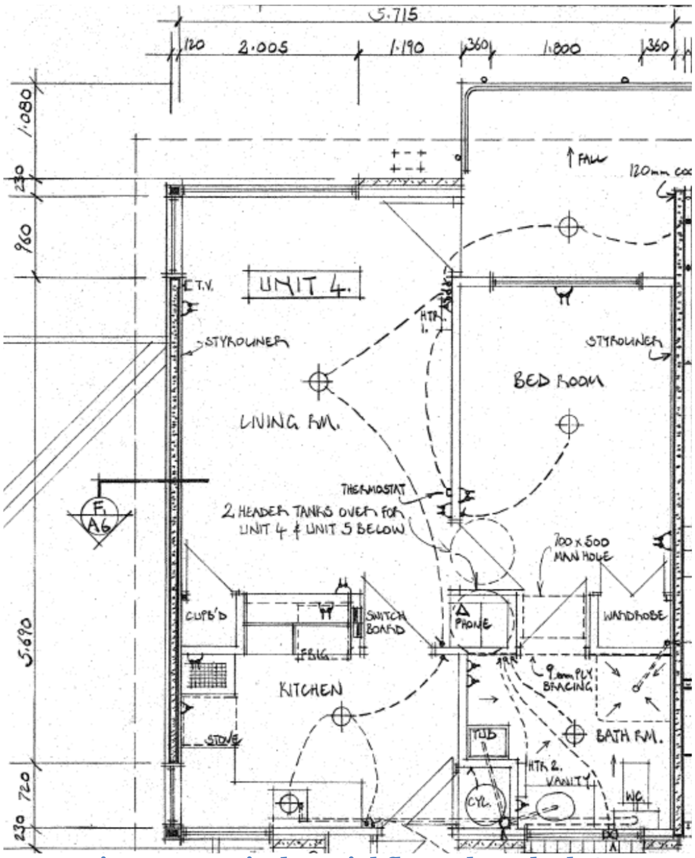


Figure 5: Typical partial floor plan Block C.

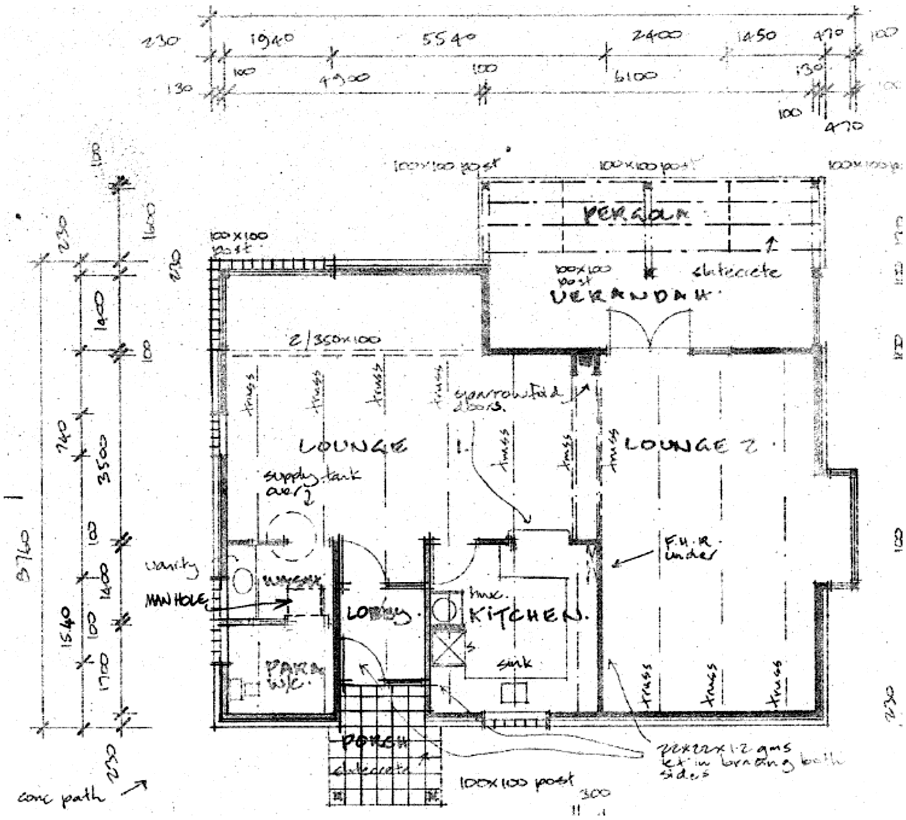


Figure 6: Floor plan of Residents Lounge.

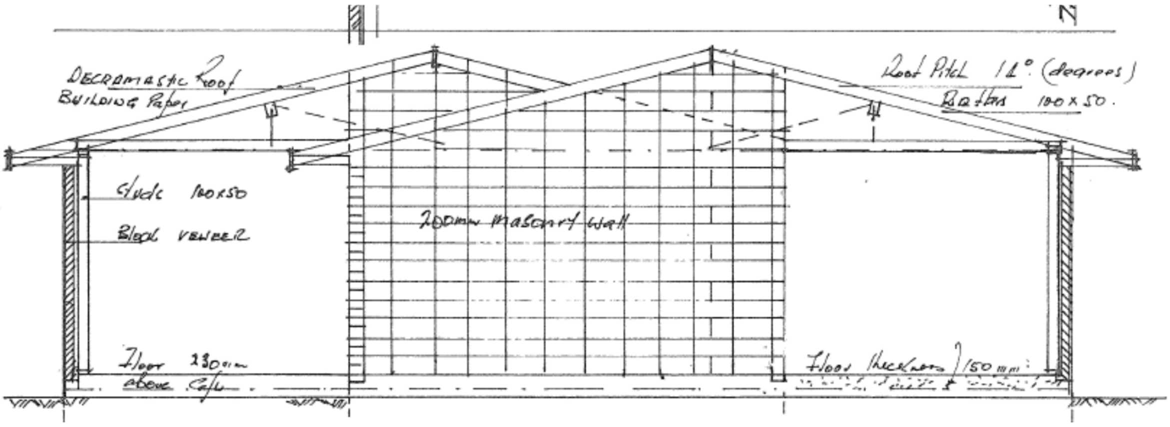


Figure 7: Cross section of Blocks A and B.

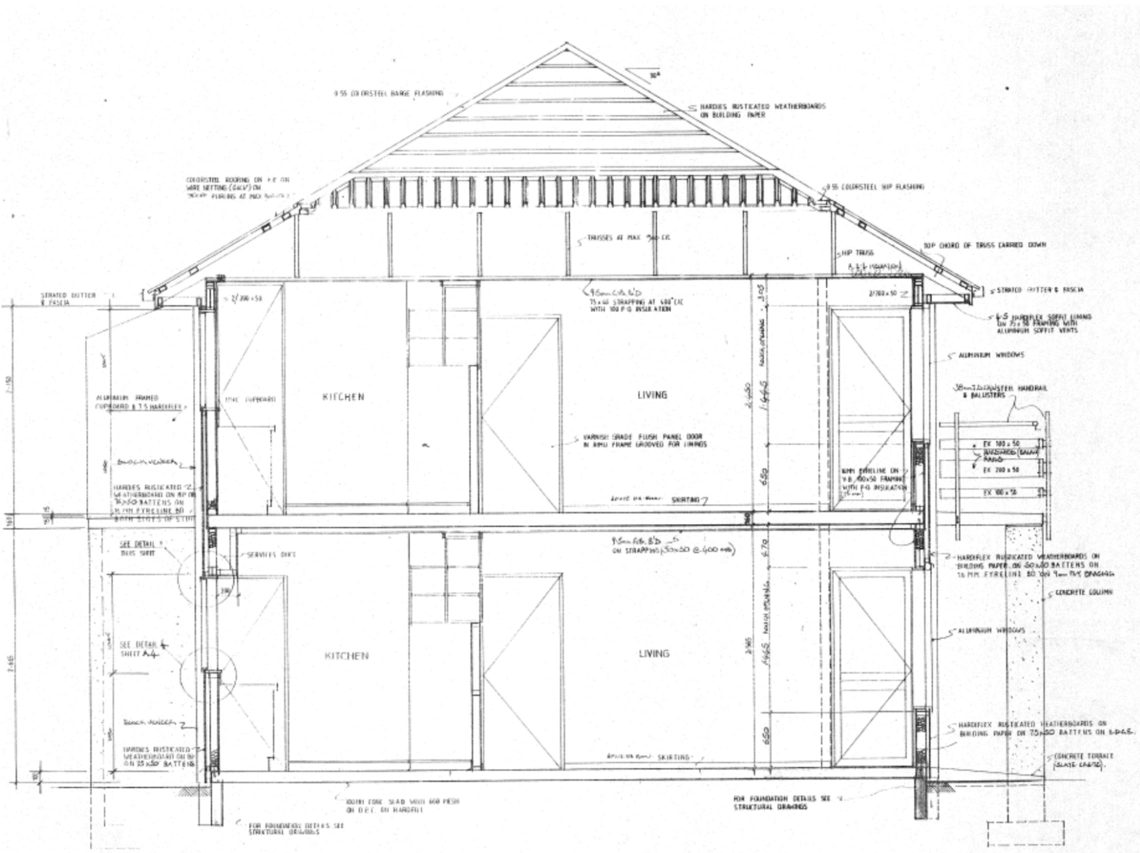


Figure 8: Cross section Block C.

4.2 Survey

4.2.1 Post 22 February 2011 Rapid Assessment

A structural (Level 2) assessment of the buildings/property was undertaken on 7 March 2011 by Opus International Consultants.

4.2.2 Level Survey

A full level survey was not deemed to be necessary at Vincent Courts as it is located in a TC2 zone. Properties in TC2 zones suffered minimal to moderate damage due to liquefaction and/or settlement. The site was visited by Opus International Consultants on 18 November 2013, and 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, the maximum slope in a unit was 7mm/m which exceeds the 5mm/m limitation imposed by MBIE guidelines. The general slope across all units was less than 5mm/m.

Table 2: Summary of the Level Survey

Block	Unit No.	Comment	Maximum Fall*
A	1	Pass	-
	2	Pass	-
	3	Pass	-
	4	Pass	-
	5	Fail	6mm/m
	6	Pass	
B	7	Pass	-
	8	Fail	8mm/m
	9	Fail	9mm/m
	10	Pass	-
C	11	Pass	-
	12	Pass	-
	13	Pass	-
	14	Pass	-
	15	Fail	7mm/m
	16	Fail	5mm/m
	17	Pass	-
	18	Pass	-
Residents Lounge		Pass	-

*Values are only recorded if greater than 5mm/m

Orange results represent floor levels which fall outside the MBIE guidelines when using the laser level but may comply when surveyed using more accurate equipment.

4.2.3 Nail Spacings

The internal lining nail spacings were measured on site to vary between 150-300mm.

4.3 Original Documentation

The following documentation was provided by the Christchurch City Council:

- D 1915 – Christchurch City Council – Vincent Place E.P.H – p. 1/1 – Site plan, floor plan, elevations, and sections – 1976
- D4350. – Christchurch City Council – Elderly Persons Housing Vincent Courts – p. 1-5/5 – Foundation, ground & first floor plans; Foundation, ground & first floor details; Pre-cast panel details; Details of stairs & landings; Sewer Details – 1992.
- 507.14 – Christchurch City Council – Vincent Courts Elderly Persons Housing – p. 1-12/12 – Site & services plan; Ground & first floor plans; Roof plan and elevations; Sections thru single storey units, details; Typical section thru two storey units; Typical cross sections at junctions; Typical sections thru stairwell between two storey units; Interior elevations & joinery details; Residents lounge plans, elevations, section; residents lounge cross sections, details; Residents lounge section, kitchen elevations; Residents lounge details – 1992.

In addition, a typical floor plan has been produced by Opus to help confirm as-built measurements. These were used to help investigate potential critical structural weaknesses (CSWs) and identify details which required particular attention.

Copies of the design calculations were not provided.

5 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.

It is noticeable that some residential unit blocks, and individual units, have suffered more damage than others. Overall, Units 8 and 9 appear to have suffered the highest levels of damage.

Minimal damage was observed in the Residents Lounge and Garages.

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

5.1 Residual Displacements

Residual displacements were observed to exceed MBIE guidelines in Units 6, 8, 9, 15 and 16. Displacements in Units 8 and 9 were more severe than other residual displacements observed and both occurred in the kitchen-living room-firewall corner.

5.2 Foundations

Minor foundation cracks were observed on Blocks A and B. Cracking was observed in the concrete slab under the stairs in Block C (photo 37). Cracking was also observed in the second storey precast floor slab originating from the firewall toward the balcony free edge (photos 38-40).

5.3 Primary Gravity Structure

No damage was observed in the timber framing or roof structure in any buildings on site.

5.4 Primary Lateral-Resistance Structure

Minor plasterboard cracking was observed in all units, typically observed above doorways, windows and at the roofline (photos 29-31). Minor cracking was observed in the ceiling diaphragms in most units. This damage is deemed minor and not to affect the lateral resistance structure.

5.5 Non Structural Elements

Stepped cracking in the brick veneer was observed in Blocks A and B, where a crack was observed between the brick veneers of Units 5 and 4 (photo 32). Cracking was observed through the brick under windows down to the foundations at the back of Blocks A and B (photo 34). Slight separation of the veneer from the firewall was observed in Block A. Cracking between the entrance ramp and patio was observed in Block A.

5.6 General Observations

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

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.

No CSWs 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. Figure 9 and Figure 10 show the walls used for bracing in their respective directions in Blocks A and B. Block C, the Residents Lounge and the Garages were analysed separately.

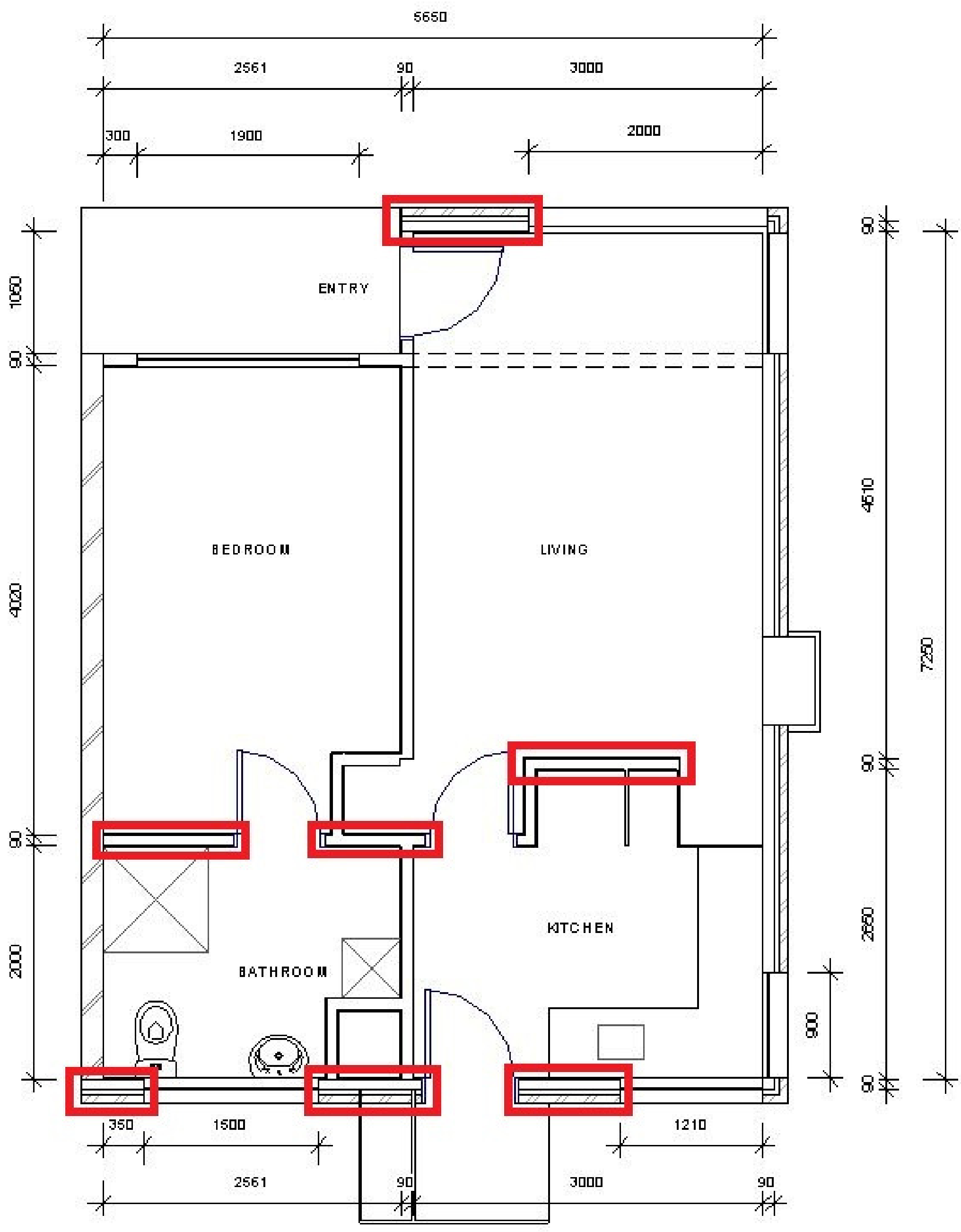


Figure 9: Walls used for bracing in the longitudinal direction in Blocks A and B.

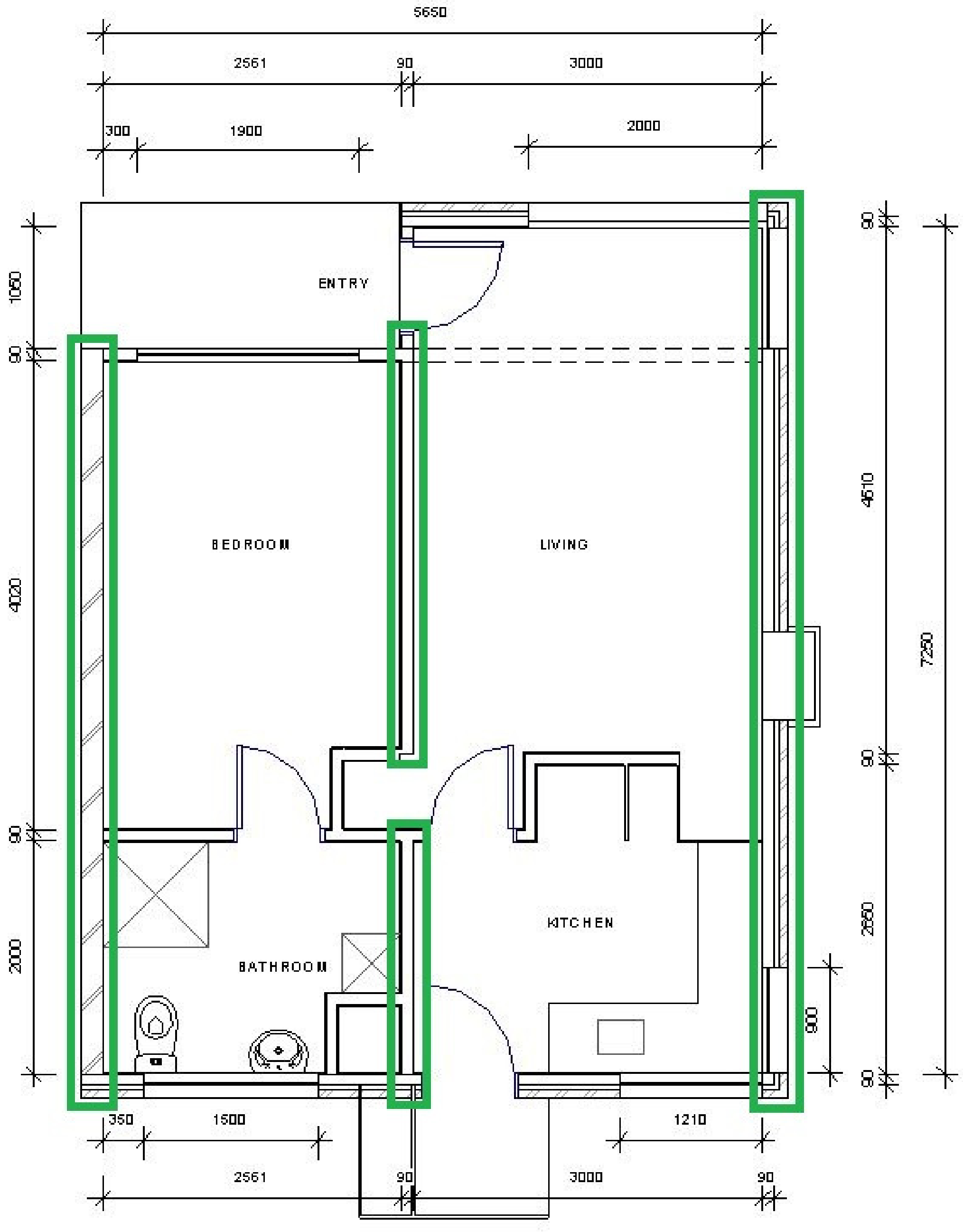


Figure 10: Walls used for bracing in the transverse direction in Blocks A and B.

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.
- 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 3. 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 3: Summary of Seismic Performance

Building Description	Critical element	% NBS based on calculated capacity in longitudinal direction	% NBS based on calculated capacity in transverse direction.
Block A and B	In-plane timber framed walls	53%	100%
Block C (Single Storey)	In-plane timber framed walls	35%	100%
Block C (Two Storey)	Pre-cast panels in plane	100%	100%
	Pre-cast panels out of plane	36%	-
	Panels to slab connection	40%	-
Residential Lounge	In-plane timber framed walls	100%	100%
Garage	In plane timber walls with steel strap bracing	100%	100%

7 Geotechnical Summary

CERA indicates that Vincent Courts is located in a TC2 zone (as shown in Figure 11). This classification suggests future significant earthquakes will cause minor to moderate land damage due to liquefaction and settlement.

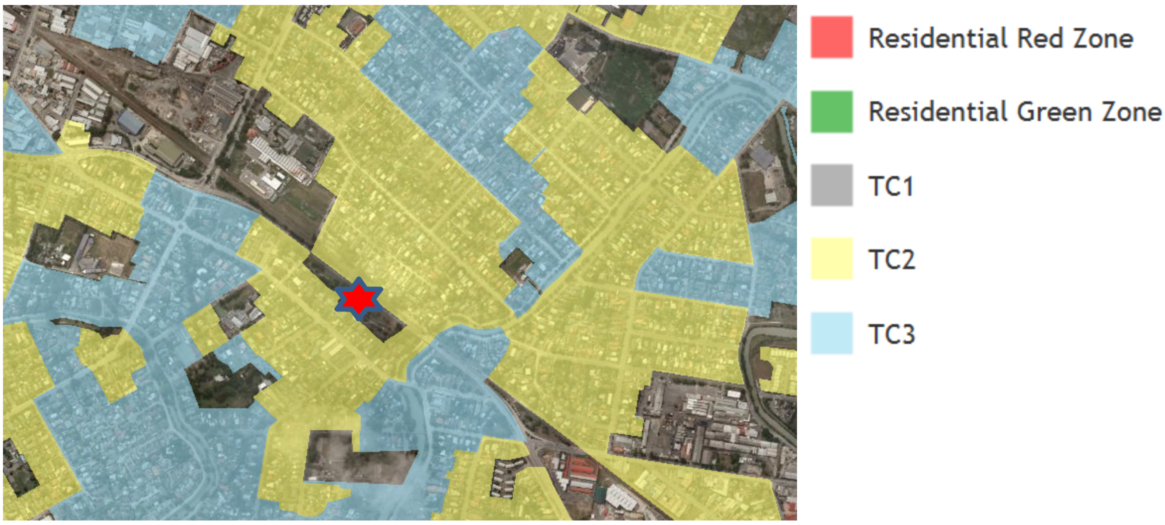


Figure 11: CERA Technical Categories map (loc. starred).

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.
- Blocks A and B have capacities of 53% NBS, as limited by the in-plane capacity of the bracing walls. 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).
- Block C single storey units have capacities of 35% NBS, as limited by the in-plane capacity of the bracing walls in the single storey units. 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).
- Block C two storey units have capacities of 36% NBS, as limited by the out of plane capacity of the precast concrete walls. 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 Residents Lounge has a capacity of 100% NBS, as limited by the in-plane capacity of the bracing walls. It is deemed to be a 'low risk' in a design seismic event according to NZSEE guidelines.
- The Garages have a capacity of 100% NBS, as limited by the in-plane capacity of the bracing walls. They are deemed to be a 'low risk' in a design seismic event according to NZSEE guidelines.
- Based on the geotechnical appraisal, differential settlement as a result of liquefaction could result in further damage, similar in nature to that which has occurred in the recent earthquake sequence. However, based on the nature of construction, this is unlikely to result in the collapse of concrete ground beams beneath the masonry walls.

9 Recommendations

It is recommended that;

- Veneer at height (gable ends) have the veneer ties checked (Residents Lounge).
- Cracking of the concrete pad be repaired where significant cracking has occurred.
- Strengthening schemes be developed to increase seismic capacity of Blocks A - C to at least 67%NBS.
- 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 Vincent Courts 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

Vincent Courts Housing Complex		
Blocks A and B Layout		
1.	Blocks A and B typical front view	
2.	Blocks A and B typical exterior end elevation	

3.	Blocks A and B typical rear view	
4.	Typical living room (Unit 1)	
5.	Typical bedroom (Unit 1)	

6.	Blocks A and B typical roof space showing fire wall (Unit 1)	
7.	Blocks A and B typical roof space (Unit 1)	
Block C Layout		
8.	Block C end units view	

9.	Block C exterior central structure view	
10.	Block C central structure, end units connection	
11.	Block C end units front elevation	

12.	Block C front view	
13.	Rear balcony (Unit 14)	

14.	Bedroom through bathroom view (Unit 14)	
15.	Typical kitchen view (Unit 14)	
16.	Internal nail spacings (Unit 14)	

17.	Typical roof space (Unit 14)	
18.	Typical roof space (Unit 14)	
Garages		
19.	Garage view	

20.	Garage interior view	
21.	Garage roof structure	
Residents Lounge Layout		
22.	Residents Lounge end elevation	

23.	Residents Lounge exterior	
24.	Residents Lounge interior view	
25.	Residents Lounge interior view	

26.	Residents Lounge kitchen view	
27.	Residents Lounge roof space	

28.	Residents Lounge roof space	
Damage		
29.	Typical plasterboard cracking above doorways	

30.	Typical plasterboard cracking above windows	
31.	Typical plasterboard cracking at the roofline	
32.	Cracking between the veneers of Units 5 and 4	

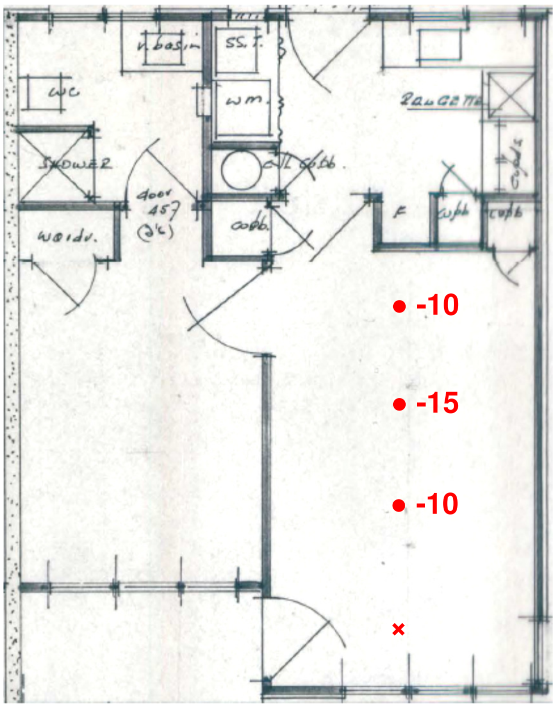
33.	Splitting between the veneer and firewall	
34.	Cracking through the brick at rear of Block A	

35.	Cracking in veneer around windows	
36.	Cracking of the rear entrance step	
37.	Cracking in the floor slab between stairwells in Block C	

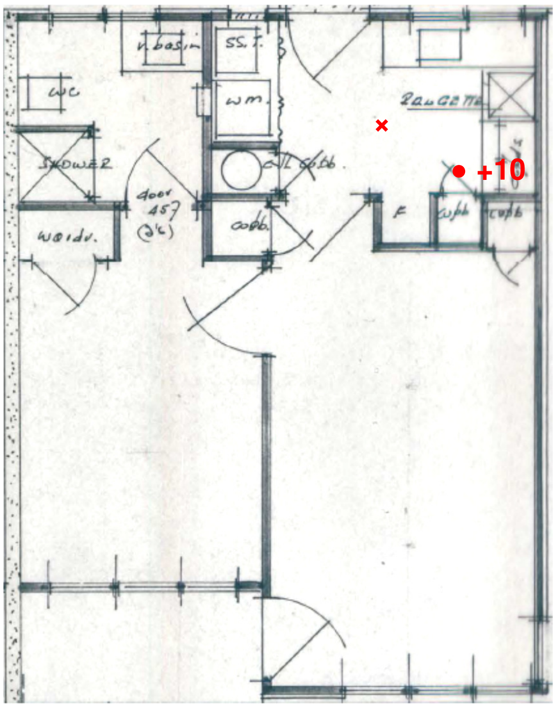
38.	Cracking under entrance balcony in Block C	
39.	Cracking of the second floor slab by the stairwell	
40.	Cracking of the second floor slab around firewall	

Appendix B – Level Survey

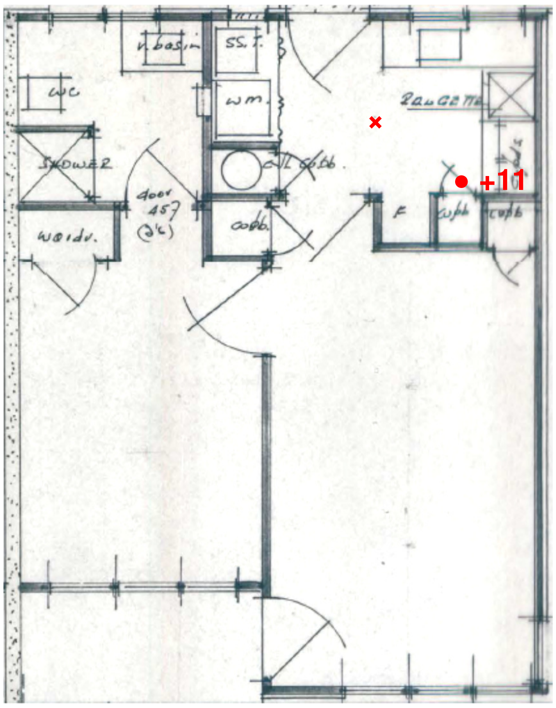
Unit 5


v. basin
SS.T.
wc
wm.
SHOWER
door
457
w.e.idr.
F
-10
-15
-10

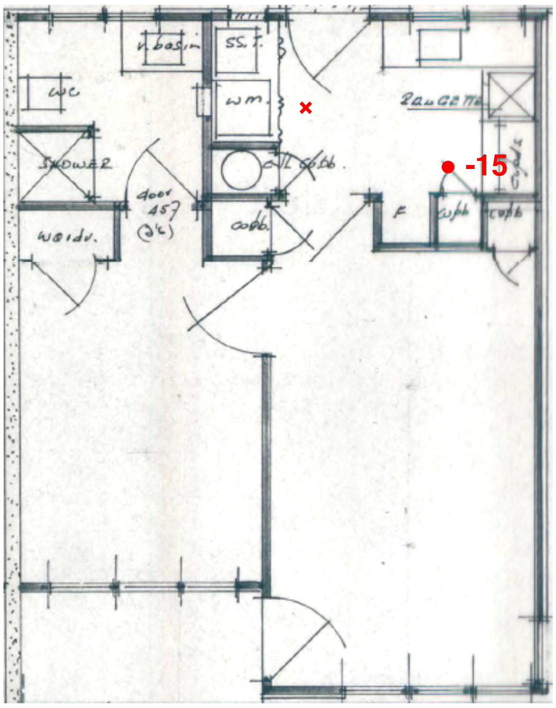
Unit 8


v. basin
SS.T.
wc
wm.
SHOWER
door
457
w.e.idr.
F
+10

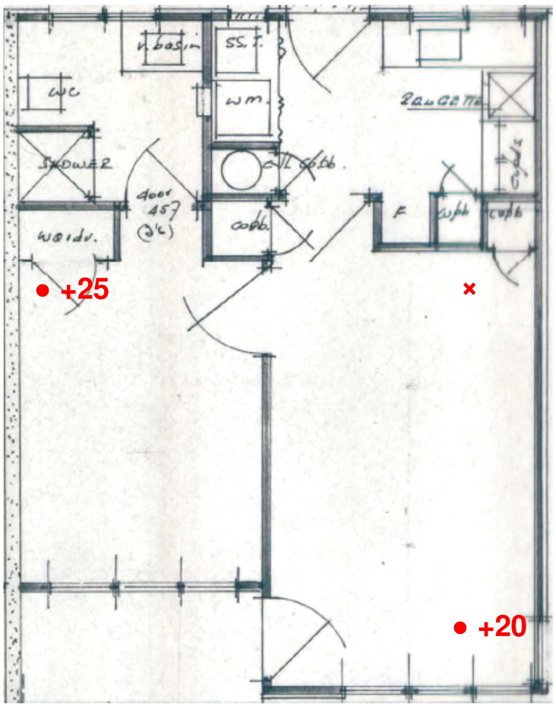
Unit 9



Unit 15



Unit 16



Appendix C – 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 timber walls of the units and 1.25 for the concrete tilt panels.

Analysis Procedure

Two storey units

Storey forces where calculated using equivalent static method.

The two storey block was analysed in each orthogonal direction based on a global area method. Transversely, the ceiling level diaphragms distribute force to the pre-cast panels and timber framed walls. Longitudinally, the ceiling level diaphragms distribute force to timber stud plasterboard lined perimeter walls.

At first floor level pre-cast floor units with a structural topping providing a rigid diaphragm to distribute storey shears to the pre-cast concrete tilt panels contained within. Between first floor level and the roof, in the longitudinal direction, the pre-cast tilt panels cantilever out-of-plane in turn supporting their self-weight, roof weight and in-plane weight of the perpendicular timber walls. Between first floor level and the roof, in the transverse direction, the ceiling level diaphragms distribute force to the pre-cast tilt panels acting in shear.

Single Storey Units

As the single storey 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.

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 D – CERA DEE Spreadsheet

Detailed Engineering Evaluation Summary Data V1.14

Location

Building Name:	Vincent Courts Housing Complex (Block A)	Reviewer:	Mary Ann Halliday
	Unit / No: 60 / Street: Vincent Place	CPEng No:	67073
Building Address:	60 Vincent Place	Company:	Opus International Consultants
Legal Description:		Company project number:	6-QC412.00
		Company phone number:	(03) 363 5400
	Degrees / Min / Sec		
GPS south:	43 / 33 / 10.08	Date of submission:	26-Feb-14
GPS east:	172 / 39 / 56.63	Inspection Date:	18/11/2013
		Revision:	1
Building Unique Identifier (CCC):	PRO1012	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):	7.00

Building

No. of storeys above ground:	1 (single storey = 1)	Ground floor elevation (Absolute) (m):	7.00
Ground floor split?	no	Ground floor elevation above ground (m):	0.00
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):	253		
Age of Building (years):	36	Date of design:	1965-1976
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:	frame system		
Roof:	timber truss	truss depth, purlin type and cladding	timber purlins, decromastic tile cladding
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	none	overall depth x width (mm x mm)	
Columns:	timber	typical dimensions (mm x mm)	
Walls:	non-load bearing		0

Lateral load resisting structure

Note: Define along and across in detailed report!

Lateral system along:	lightweight timber framed walls	note typical wall length (m)	1.1
Ductility assumed, μ:	2.00		
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	note typical wall length (m)	7.6
Ductility assumed, μ:	2.00		
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:

leave blank if not relevant

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

Non-structural elements

Stairs:			
Wall cladding:	brick or tile	describe (note cavity if exists)	Concrete block
Roof Cladding:	Other (specify)	describe	Decromastic Tiles
Glazing:	aluminium frames		
Ceilings:	light tiles		
Services(list):			

Available documentation

Architectural	partial	original designer name/date	Christchurch City Council 1976
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:	Good	Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	1:250-1:150	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:	slight	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 non-structural	Describe:	
Building Consent required:	no	Describe:	
Interim occupancy recommendations:	full occupancy	Describe:	
Along — Assessed %NBS before e'quakes:	53% (##### %NBS from IEP below)	If IEP not used, please detail assessment methodology:	Equivalent Static
Assessed %NBS after e'quakes:	53%		
Across — Assessed %NBS before e'quakes:	100% (##### %NBS from IEP below)		
Assessed %NBS after e'quakes:	100%		

Detailed Engineering Evaluation Summary Data V1.14

Location

Building Name:	Vincent Courts Housing Complex (Block B)	Reviewer:	Mary Ann Halliday
	Unit / No: / Street	CPEng No:	67073
Building Address:	60 / Vincent Place	Company:	Opus International Consultants
Legal Description:		Company project number:	6-QC412.00
		Company phone number:	(03) 363 5400
	Degrees / Min / Sec		
GPS south:	43 / 33 / 10.08	Date of submission:	26-Feb-14
GPS east:	172 / 39 / 56.63	Inspection Date:	18/11/2013
		Revision:	1
Building Unique Identifier (CCC):	PRO1012	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):	7.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	7.00
Ground floor split?	no		Ground floor elevation above ground (m):	0.00
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):	167			
Age of Building (years):	36		Date of design:	1965-1976
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:	frame system		
Roof:	timber truss	truss depth, purlin type and cladding	timber purlin, Democrastic tiles
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	none	overall depth x width (mm x mm)	
Columns:	timber	typical dimensions (mm x mm)	
Walls:	non-load bearing	0	

Lateral load resisting structure

Note: Define along and across in detailed report!

Lateral system along:	lightweight timber framed walls		note typical wall length (m)	1.1
Ductility assumed, μ:	2.00			
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		note typical wall length (m)	7.6
Ductility assumed, μ:	2.00			
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):	
east (mm):	
south (mm):	
west (mm):	

leave blank if not relevant

Non-structural elements

Stairs:			
Wall cladding:	brick or tile	describe (note cavity if exists)	
Roof Cladding:	Other (specify)	describe	Decromastic Tiles
Glazing:	aluminium frames		
Ceilings:	light tiles		
Services(list):			

Available documentation

Architectural	partial	original designer name/date	Christchurch City Council 1976
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:	Good	Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	1:250-1:150	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:	slight	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 non-structural		Describe:	
	Building Consent required:	no		Describe:	
	Interim occupancy recommendations:	full occupancy		Describe:	
Along	Assessed %NBS before e'quakes:	53%	##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	Equivalent Static
	Assessed %NBS after e'quakes:	53%			
Across	Assessed %NBS before e'quakes:	100%	##### %NBS from IEP below		
	Assessed %NBS after e'quakes:	100%			

Detailed Engineering Evaluation Summary Data V1.14

Location

Building Name:	Vincent Courts Housing Complex (Block C)	Reviewer:	Mary Ann Halliday
	Unit / No: 60 / Street: Vincent Place	CPEng No:	67073
Building Address:	60 Vincent Place	Company:	Opus International Consultants
Legal Description:		Company project number:	6-QC412.00
		Company phone number:	(03) 363 5400
	Degrees / Min / Sec		
GPS south:	43 / 33 / 7.80	Date of submission:	26-Feb-14
GPS east:	172 / 39 / 53.28	Inspection Date:	18/11/2013
		Revision:	1
Building Unique Identifier (CCC):	PRO1012	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):	7.00

Building

No. of storeys above ground:	1	single storey = 1 / Ground floor elevation (Absolute) (m):	7.00
Ground floor split?	no	Ground floor elevation above ground (m):	0.00
Storeys below ground	0		
Foundation type:	strip footings	if Foundation type is other, describe:	
Building height (m):	7.80	height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	295		
Age of Building (years):	20	Date of design:	1992-2004
Strengthening present?	no	If so, when (year)?	
		And what load level (%g)?	
Use (ground floor):	multi-unit residential	Brief strengthening description:	
Use (upper floors):	multi-unit residential		
Use notes (if required):			
Importance level (to NZS1170.5):	IL2		

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber truss	truss depth, 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:	load bearing concrete	#N/A	

Lateral load resisting structure

Lateral system along:	concrete shear wall	**Note: Define along and across in detailed report!** enter wall data in "IEP period calcs" worksheet for period calculation	1.1
Ductility assumed, μ:	1.25		
Period along:	0.10	##### enter height above at H31 / 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	note typical wall length (m)	7.8
Ductility assumed, μ:	2.00		
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:	precast, half height	describe supports	
Wall cladding:	other heavy	describe	Concrete Block and Metal
Roof Cladding:	Metal	describe	
Glazing:	aluminium frames		
Ceilings:	strapped or direct fixed		
Services(list):			

Available documentation

Architectural	partial	original designer name/date	Christchurch City Council 1992
Structural	partial	original designer name/date	Christchurch City Council 1992
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:	1:250-1:150	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:	slight	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 non-structural	Describe:	
	Building Consent required:	no	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	35%	##### %NBS from IEP below / If IEP not used, please detail assessment methodology:	Equivalent Static
	Assessed %NBS after e'quakes:	35%		
Across	Assessed %NBS before e'quakes:	100%	##### %NBS from IEP below	
	Assessed %NBS after e'quakes:	100%		

Detailed Engineering Evaluation Summary Data V1.14

Location

Building Name:	Vincent Courts Housing Complex (Garages)	Reviewer:	Mary Ann Halliday
	Unit / No: / Street	CPEng No:	67073
Building Address:	60 / Vincent Place	Company:	Opus International Consultants
Legal Description:		Company project number:	6-QC412.00
		Company phone number:	(03) 363 5400
	Degrees / Min / Sec		
GPS south:	43 / 33 / 8.93	Date of submission:	26-Feb-14
GPS east:	172 / 39 / 54.41	Inspection Date:	18/11/2013
		Revision:	1
Building Unique Identifier (CCC):	PRO1012	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):	7.00

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:	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):	101		
Age of Building (years):	20		Date of design: 1992-2004
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):			
Importance level (to NZS1170.5):	IL2		

Gravity Structure

Gravity System:	frame system		
Roof:	timber truss	truss depth, purlin type and cladding	
Floors:	other (note)	describe sytem	Asphalt on grade
Beams:	none	overall depth x width (mm x mm)	
Columns:	timber	typical dimensions (mm x mm)	
Walls:	non-load bearing		0

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	**Note: Define along and across in detailed report!**	note typical wall length (m)	
Ductility assumed, μ:	2.00			
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		note typical wall length (m)	
Ductility assumed, μ:	2.00			
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:	other light	describe	Metal
Roof Cladding:	Metal	describe	
Glazing:			
Ceilings:	none		
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:	Good	Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	1:250-1:150	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:	slight	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 non-structural	Describe:	
	Building Consent required:	no	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	100% ##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	Equivalent Static
	Assessed %NBS after e'quakes:	100%		
Across	Assessed %NBS before e'quakes:	100% ##### %NBS from IEP below		
	Assessed %NBS after e'quakes:	100%		

Detailed Engineering Evaluation Summary Data V1.14

Location

Building Name:	Vincent Courts Housing Complex (Residents Lounge)	Reviewer:	Mary Ann Halliday
	Unit / No: 60 / Street: Vincent Place	CPEng No:	67073
Building Address:	60 Vincent Place	Company:	Opus International Consultants
Legal Description:		Company project number:	6-QC412.00
		Company phone number:	(03) 363 5400
GPS south:	Degrees 43, Min 33, Sec 8.44	Date of submission:	26-Feb-14
GPS east:	Degrees 172, Min 39, Sec 53.98	Inspection Date:	18/11/2013
		Revision:	1
Building Unique Identifier (CCC):	PRO1012	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):	7.00

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:	strip footings		if Foundation type is other, describe:
Building height (m):	6.00		height from ground to level of uppermost seismic mass (for IEP only) (m):
Floor footprint area (approx):	94		
Age of Building (years):	20		Date of design: 1992-2004
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:	frame system		
Roof:	timber truss	truss depth, purlin type and cladding	
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	timber	type	
Columns:	timber	typical dimensions (mm x mm)	
Walls:	non-load bearing	0	

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	**Note: Define along and across in detailed report!**	note typical wall length (m):
Ductility assumed, μ:	2.00		
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		note typical wall length (m):
Ductility assumed, μ:	2.00		
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:	other heavy	describe	Concrete Block
Roof Cladding:	Metal	describe	
Glazing:	aluminium 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:	1:250-1:150	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:	slight	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 non-structural	Describe:
	Building Consent required:	no	Describe:
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Across	Assessed %NBS before e'quakes:	100% ##### %NBS from IEP below	
	Assessed %NBS after e'quakes:	100%	

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