Christchurch City Council
BE 1119 EQ2
Andrews Crescent

QUANTITATIVE ASSESSMENT REPORT

FINAL

- Rev B
- 04 June 2013

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Contents

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1. Executive Summary

1.1. Background

A Quantitative Assessment was carried out on the housing complex located at Andrews Crescent. The site comprises of nine buildings, with each building housing 4 separate living units, in total there are 36 livings units. An aerial photograph illustrating these areas is shown below in Figure 1. Detailed descriptions outlining the buildings age and construction type is given in Section 5 of this report.

- **Figure 1 Aerial Photograph of Andrews Crescent**

This Quantitative report for the building structure is based on the Engineering Advisory Group's "Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings" (draft) July 2011, visual inspections on 16/10/12, cover meter survey 29/11/12 and an intrusive investigation on 20/12/12. Limited drawings of Andrews Crescent show proposed additional cottages dated 1970 which were not constructed.

1.2. Key Damage Observed

Key damage observed includes:

- Cracks in the perimeter foundations
- Cracks in the internal wall and ceiling lining
- Cracks in concrete steps
- Settlement of the foundations

Refer to section 5 for further details of the damage discovered and section 6 for survey results.

1.3. Critical Structural Weaknesses

No potential critical structural weaknesses have been identified for these buildings.

1.4. Indicative Building Strength

As described in the Engineering Advisory Group's "Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings" (draft) July 2011, we have assessed the capacity of the buildings as a percentage new building standard seismic resistance using the quantitative method. Our assessment included consideration of geotechnical conditions, existing earthquake damage to the buildings and structural engineering calculations to assess both strength and ductility/resilience.

The assessments were based on the following:

- On-site investigation to assess the extent of existing earthquake damage including limited intrusive investigation.
- Qualitative assessment of critical structural weaknesses (CSWs) based on review of available structural drawings and inspection where drawings were not available.
- An intrusive geotechnical investigation has been undertaken. We have based this report on the information contained within this report knowledge of the site.
- Assessment of the strength of the existing structures taking account of the current condition.

Any building that is found to have a seismic capacity less than 33% of the new building standard (NBS) is required to be strengthened up to a target capacity of 67%NBS but at least 34%.

Based on the information available, and using the Quantitative Assessment Procedure, the buildings original and post earthquake capacity has been assessed to be in the order of 86%NBS for Block D and 67% NBS for the other 8 buildings. The buildings are therefore not potentially earthquake prone.

1.5. Recommendations

Based on the findings of this assessment indicating the buildings are in the order of 86% for Block D and 67% for the other 8 buildings, no strengthening is required in order to comply with Christchurch City Council (CCC) policy – Earthquake-prone dangerous & insanitary buildings policy 2010.

It is recommended that:

a) There is no damage to any of the buildings that would cause the buildings to be unsafe to occupy.
b) We consider that barriers around the buildings are not necessary.
c) The floors were found to be out of level and it is recommended the foundations be re-levelled or rebuilt, however the levelness of the foundation does not affect the %NBS of the buildings.

2. Introduction

Sinclair Knight Merz were engaged by Christchurch City Council to carry out a Quantitative Assessment of the seismic performance of Andrews Crescent.

The scope of this quantitative analysis includes the following:

- Analysis of the seismic load carrying capacity of the buildings compared with current seismic loading requirements or New Buildings Standard (NBS). It should be noted that this analysis considers the buildings in its damaged state where appropriate.
- Identify any critical structural weaknesses which may exist in the buildings and include these in the assessed %NBS of the structure.
- Preparation of a summary report outlining the areas of concern in the buildings.

The recommendations from the Engineering Advisory Group[1] were followed to assess the likely performance of the structures in a seismic event relative to the New Building Standard (NBS). 100% NBS is equivalent to the strength of a building that fully complies with current codes. This includes a recent increase of the Christchurch seismic hazard factor from 0.22 to 0.3[2].

At the time of this report, an intrusive site investigation had been carried out, looking inside the roof space and the sub floor. Construction drawings were not made available. The building description below is based on a review of our inspections.

[1] EAG 2011, *Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury - Draft*, p 10
[2] http://www.dbh.govt.nz/seismicity-info

3. Compliance

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

3.1. Canterbury Earthquake Recovery Authority (CERA)

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

Section 38 – Works

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

Section 51 – Requiring Structural Survey

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

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

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

It is anticipated that factors determining the extent of evaluation and strengthening level required will include:

- The importance level and occupancy of the building
- The placard status and amount of damage
- The age and structural type of the building
- Consideration of any critical structural weaknesses
- The extent of any earthquake damage

3.2. Building Act

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

3.2.1. Section 112 – Alterations

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

3.2.2. Section 115 – Change of Use

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

3.2.3. Section 121 – Dangerous Buildings

The definition of dangerous building in the Act was extended by the Canterbury Earthquake (Building Act) Order 2010, and it now defines a building as dangerous if:

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

3.2.4. Section 122 – Earthquake Prone Buildings

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

3.2.5. 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.

3.2.6. Section 131 – Earthquake Prone Building Policy

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

3.3. Christchurch City Council Policy

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

The 2010 amendment includes the following:

- A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;
- A strengthening target level of 67% of a new building for buildings that are Earthquake Prone. Council recognises that it may not be practicable for some repairs to meet that target. The council will work closely with building owners to achieve sensible, safe outcomes;
- A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,
- Repair works for buildings damaged by earthquakes will be required to comply with the above.

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

We anticipate that any building with a capacity of less than 34%NBS (including consideration of critical structural weaknesses) will need to be strengthened to a target of 67%NBS of new building standard as recommended by the Policy.

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

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

3.4. 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 Ministry of Business, Innovation and Employment can be used to demonstrate compliance with the Building Code.

After the February Earthquake, on 19 May 2011, Compliance Document B1: Structure was amended to include increased seismic design requirements for Canterbury as follows:

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

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

4. 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 new building standard load requirements have been determined in accordance with the current earthquake loading standard (NZS 1170.5:2004 Structural design actions - Earthquake actions - New Zealand).

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

The New Zealand Society for Earthquake Engineering has proposed a way for classifying earthquake risk for existing buildings in terms of %NBS and this is shown in Figure 2 below.

Description	Grade	Risk	%NBS	Existing Building Structural Performance	Improvement of Structural Performance	
					Legal Requirement	NZSEE Recommendation
Low Risk Building	A or B	Low	Above 67	Acceptable (improvement may be desirable)	The Building Act sets no required level of structural improvement (unless change in use) This is for each TA to decide. Improvement is not limited to 34%NBS.	100%NBS desirable. Improvement should achieve at least 67%NBS
Moderate Risk Building	B or C	Moderate	34 to 66	Acceptable legally. Improvement recommended		Not recommended. Acceptable only in exceptional circumstances
High Risk Building	D or E	High	33 or lower	Unacceptable (Improvement	Unacceptable	Unacceptable

- **Figure 2: NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE Guidelines**

Table 1 below provides an indication of the risk of failure for an existing building with a given percentage NBS, relative to the risk of failure for a new building that has been designed to meet current Building Code criteria (the annual probability of exceedance specified by current earthquake design standards for a building of 'normal' importance is 1/500, or 0.2% in the next year, which is equivalent to 10% probability of exceedance in the next 50 years).

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- **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

5. Building Details

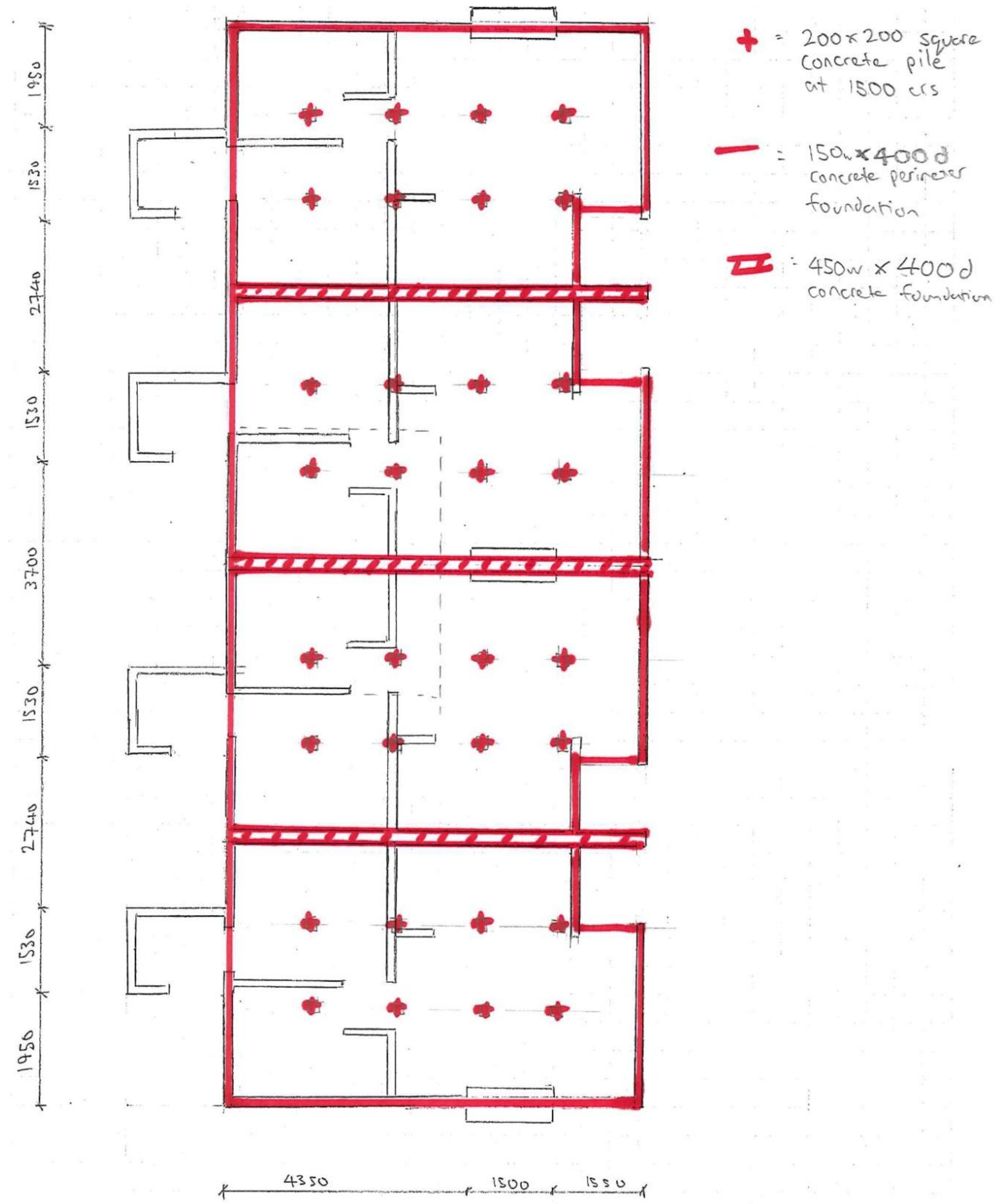
5.1. Building description

The Andrews Crescent Housing Complex (BE 1119) is located on Andrews Crescent, Spreydon, it is made up of 9 buildings, with 4 self-contained 1 bedroom residential units in each building. For the ease of identification, the buildings have been named Blocks A-I. Refer to figure 1 for an aerial photograph showing these allocations.

- Block A: Units 1, 3, 5, 7
- Block I: Units 2, 4, 6, 8
- Block B: Units 9, 11, 13, 15
- Block H: Units 10, 12, 14, 16
- Block C: Units 17, 19, 21, 23
- Block B: Units 18, 20, 22, 24
- Block D: Units 25, 27, 29, 31
- Block E: Units 33, 35, 37, 39
- Block F: Units 41, 43, 45, 47

The design and construction of each of the buildings are nearly identical. All the buildings are clad with a timber weatherboard exterior. Roofs are clad with heavy tile cladding except for building 7 on the north end of the complex which is clad with corrugated metal. A timber disabled access ramp is provided for Block B for units 9 and 11, and also building 1 for unit 7. Sketches of the typical building have been prepared based on site measurements and visual inspections. See figure 3 and figure 4 for a sketch of the foundation plan and ground floor plan respectively.

Drawings provided by the Christchurch City Council indicated proposed additional buildings dated 1970, which have not been constructed. We estimate the existing buildings were constructed pre 1965.



- **Figure 3 Sketch of foundation plan for typical building in Andrews Crescent**

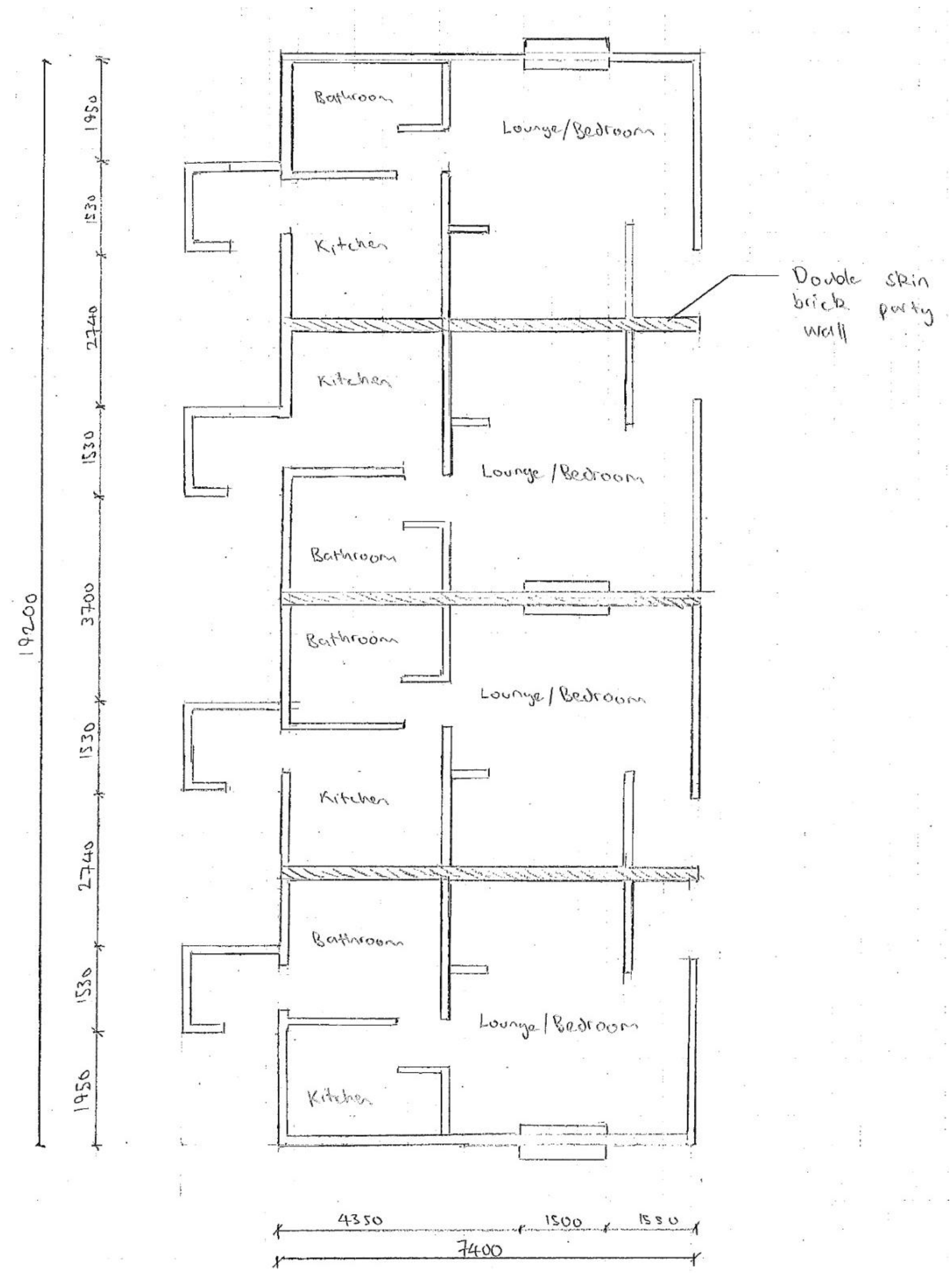


Figure 4 Sketch of ground floor plan for typical building in Andrews Crescent

5.2. Gravity Load Resisting system

The gravity load resisting structure of the buildings is made up of a timber framed roof, supported by timber framed walls and double skin brick party walls. These walls are then supported by concrete pile and concrete perimeter beam foundations.

5.3. Seismic Load Resisting system

For the purposes of this report the longitudinal direction of the buildings are defined as being in the direction parallel to the longest sides of the building and transverse direction is defined as being parallel to the shortest sides of the building.

Lateral load on the building is resisted by the lathe and plaster lined timber framed walls in the longitudinal direction and by the double skin brick party walls in the transverse direction. These loads are then resisted by the concrete pile and perimeter beam foundations. The loads are able to be distributed to the foundation elements by the timber floor diaphragm.

5.4. Building Damage

5.5. Block A - PRO 1119 B001

Internal damage

- Unit 5 has cracks in the bathroom ceiling (see photo 20)
- Unit 5 has cracks in the kitchen party wall (see photo 21)

External damage

- Cracks were found around the entire perimeter foundation these were found to have a maximum crack width of 3mm and were found at the perimeter foundation openings (see photos 9, 11, 12, 15, 16, 17, 19, 25, 27)

5.6. Block I - PRO 1119 B009

Internal damage

- Unit 4 has ceiling cracks beside the roof manhole in the hallway and also in the bathroom (see photos 36, 37, 38)

External damage

- Cracks were found around the entire perimeter foundation. (see photo 30, 33, 40, 41, 43, 46, 47, 49) A maximum crack width of 5mm was found at the rear of unit 2.

5.7. Block B - PRO 1119 B002

Internal damage

- Unit 9 has 1mm crack at corner of doorway in the lounge area (see photo 59)
- Unit 9 has diagonal cracks in the bathroom lining (see photo 60, 61)

- Unit 9 has vertical cracks between the door frame junctions (see photo 62, 63)
- Unit 9 has diagonal crack beside the manhole in the hallway (see photo 65)
- Unit 11 has cracks in the lounge area above the doorway and also in the ceiling (see photo 67, 68)
- Unit 11 has a crack above the electrical meter box in the kitchen (see photo 70)
- Unit 11 has a crack above the back entrance doorway in the kitchen (see photo 71)
- Unit 15 has a crack above the doorway in the lounge area (see photo 76)
- Unit 15 has a diagonal crack beside the manhole in the hallway crack (see photo 78)

External damage

- Cracks were found around the entire perimeter foundation. (see photo 53, 55, 59, 75) These were found to have a maximum size of 2.5mm.

5.8. Block H - PRO 1119 B008

- **Internal damage**
- No internal damage was found during the inspection. The floor was seen to be severely out of level from initial inspections (see photo 97, 109). Refer to Section 6.2 Survey.

External damage

- Cracks were found around the entire perimeter foundation. (see photo 85, 86, 87, 88, 90, 92, 94, 100, 101, 104, 106, 112, 113, 115) A maximum crack width of over 5mm was found at the rear of unit 12.

5.9. Block C - PRO 1119 B003

- **Internal damage**
- Unit 23 has a vertical crack between the lounge and kitchen door frames. (photo 117)

External damage

- Cracks were found around the perimeter foundation. (see photo 124, 127, 129, 132, 136)
- Concrete has spalled from the concrete perimeter foundation, exposing rusted reinforcing at the rear entrance of unit 23 (see photo 124). This damage does not appear to have come as a direct result of the earthquakes
- Concrete render has been displaced from the concrete perimeter foundation at the rear corner of unit 23 (see photo 119)
- Concrete steps leading up to the entrances of units 19 and 17 have cracked 2.5mm and 1mm respectively (see photo 121, 134)

5.10. Block G - PRO 1119 B007

Internal damage

- Unit 22 has cracks in the interior lining in the kitchen and bathroom areas. (see photo 154, 155)

External damage

- Cracks were found around the perimeter foundation. (see photo 138, 141, 142, 145, 148, 150, 152, 153, 154, 155). A maximum crack width was measured to be 11mm located outside the front entrance to unit 20.

5.11. Block D - PRO 1119 B004

Internal damage

- Unit 31 has cracks in the wall and ceiling junction in the kitchen area. (photo 159)
- Unit 27 has cracks between the cupboard and party wall. (see photo 167

External damage

- Front entrance steps to unit 31 has cracks
- Cracks were found around the perimeter foundation. (see photo 161, 162, 164). A maximum crack width was measured to be 0.8mm.

5.12. Block E - PRO 1119 B005

Internal damage

- No internal damage was found on this building

External damage

- Front entrance steps to unit 39 has 0.8mm cracks
- Cracks were found around the perimeter foundation. (see photo 173, 176, 180, 182, 184).

5.13. Block F - PRO 1119 B006

Internal damage

- No internal damage was found on this building

External damage

- Cracks were found on the exterior of unit 41 on the east end of the building at the perimeter foundation. (see photo 188, 189, 190) These were found to have a maximum crack width of 5mm.
- Concrete perimeter foundation reinforcing was exposed near the rear entrance of unit 41 (see photo 192)

6. Available Information and Assumptions

6.1. Available Information

SKM carried out a seismic review on the structure. This review was undertaken using the available information which was as follows:

- SKM visual inspections findings from 16th October 2012
- SKM cover meter survey results carried on the 29th November 2012
- Survey results by Woods dated 7th December 2012
- SKM intrusive inspection findings from 20th December 2012
- Geotechnical Report by Tonkin and Taylor dated April 2013

6.2. Survey

The buildings were surveyed on 26th and 27th November 2012 by Woods. Block H had an internal floor level survey and a wall verticality survey completed. Blocks A, B, C, D, E, F, G and I, were surveyed on the exterior of the building using the concrete perimeter foundation; therefore there may be inaccuracies in the level results. The difference in floor level of the buildings using these results ranged between 21mm to 203mm. A summary of the results is shown below in Table 2, along with the corresponding indicator criteria found in Table 2.3 of the Ministry of Business, Innovation and Employment, “Revised guidance on rebuilding houses affected by the Canterbury earthquake sequence”.

- **Table 2: Survey Results Summary**

Block	Change in Floor Level	Indicator criteria
A	51	Foundation re-level
B	115	Foundation re-build
C	77	Foundation re-level
D	65	Foundation re-level
E	76	Foundation re-level
F	21	No Foundation re-level
G	174	Foundation re-build
H	203	Foundation re-build
I	64	Foundation re-level

If the indicator criteria for the variation in floor level as stated in Ministry of Business, Innovation and Employment, "Revised guidance on rebuilding houses affected by the Canterbury earthquake sequence" is the basis that is used to determine if the foundations require either re-level or rebuild. Blocks A, C, D, F and I require a foundation re-level, and blocks B, G and H require a foundation rebuild.

6.3. Design Criteria and Assumptions

The following design criteria and assumptions made in undertaking the assessment include:

- We have reviewed the building and from our visual inspection the structure appears to be built in accordance with good practice at the time.
- The soil on site is class [D] as described in AS/NZS1170.5:2004, Clause 3.1.3, Soft Soil, this is on the basis of the readily available geotechnical data. The ultimate bearing capacity for the perimeter foundation is 200kPa for area A and 120kPa for area B.
- Standard design criteria for residential buildings as described in AS/NZS1170.0:2002:
  - 50 year design life, which is the default NZ Building Code design life.
  - Structure Importance Level 2. This level of importance is described as 'normal' with medium or considerable consequence for loss of human life, or considerable economic, social or environmental consequence of failure.
- The building has a short period less than 0.4 seconds.
- Site hazard factor, Z = 0.3, NZBC, Clause B1 Structure, Amendment 11 effective from 1 August 2011
- The seismic demand of the building was calculated using NZS1170.5 using a ductility of 2 in the along direction and a ductility of 1.25 in the across direction. The ductility of 2 was used due to the inherent ductility of the timber framed walls in the along direction and a ductility of 1.25 was used in the across direction due to the brick walls providing nominal ductility.

- The following material properties were used in the analyses:
- **Table 3: Material Properties**

Material	Material Property	Reference
Average mortar compressive strength for medium hardness (f'_j)	5.5 MPa	Assessment and Improvement of unreinforced masonry buildings for earthquake resistance, Faculty of Engineering, the University of Auckland
Masonry bed joint shear strength under zero axial compression (f'_{ms})	0.25 MPa	Assessment and Improvement of unreinforced masonry buildings for earthquake resistance, Faculty of Engineering, the University of Auckland
Ultimate bearing capacity of soil	200 kPa for area A and 120kPa for area B	Tonkin and Taylor memo dated 22nd April 2013
Gypsum wall lining	Shear capacity = 3.0 kN/m (φ=0.7)	Table 11.1, NZSEE Assessment and Improvement of the Structural Performance of Buildings in Earthquakes, June 2006

The detailed engineering analysis is a post construction evaluation therefore it has the following limitations:

- It is not likely to pick up on any concealed construction errors (if they exist)
- Other possible issues that could affect the performance of the building such as corrosion and modifications to the structure will not be identified unless they are visible and have been specifically mentioned in this report.
- The detailed engineering evaluation deals only with the structural aspects of the structure. Other aspects such as building services are not covered.

6.4. The Detailed Engineering Evaluation (DEE) process

The DEE is a procedure written by the Ministry of Business, Innovation and Employment's Engineering Advisory Group and grades buildings according to their likely performance in a seismic event. The procedure is not yet recognised by the NZ Building Code but is widely used and recognised by the Christchurch City Council as the preferred method for preliminary seismic investigations of buildings[3].

The procedure of the DEE is as follows:

[3] http://resources.ccc.govt.nz/files/EarthquakeProneDangerousAndInsanitaryBuildingsPolicy2010.pdf

1) Qualitative assessment procedure
    a. Determine the building's status following any rapid assessment that have been done
    b. Review any existing documentation that is available. This will give the engineer an understanding of how the building is expected to behave. If no documentation is available, site measurements may be required
    c. Review the foundations and any geotechnical information available. This will include determining the zoning of the land and the likely soil behaviour, a site investigation may be required
    d. Investigate possible Critical Structural Weaknesses (CSW) or collapse hazards
    e. Assess the original and post earthquake strength of the building (this assessment is subsequently superseded by the quantitative assessment)
2) Quantitative procedure
    a. Carry out a geotechnical investigation if required by the qualitative assessment
    b. Analyse the building according to current building codes and standards. Analysis accounts for damage to the building.

The DEE assessment ranks buildings according to how well they are likely to perform relative to a new building designed to current earthquake standards, as shown in Table 4. The building rank is indicated by the percent of the required New Building Standard (%NBS) strength that the building is considered to have. Earthquake prone buildings are defined as having less than 34 %NBS strength which correlates to an increased risk of approximately 20 times that of 100% NBS[4]. Buildings that are identified to be earthquake prone are required by law to be strengthened within 30 years of the owner being notified that the building is potentially earthquake prone[5].

[4] NZSEE 2006, *Assessment and Improvement of the Structural Performance of Buildings in Earthquakes,* p 2-2
[5] http://resources.ccc.govt.nz/files/EarthquakeProneDangerousAndInsanitaryBuildingsPolicy2010.pdf

- **Table 4: DEE Risk classifications**[6]

Description	Grade	Risk	%NBS	Structural performance
Low risk building	A+	Low	> 100	Acceptable. Improvement may be desirable.
	A		100 to 80	
	B		80 to 67	
Moderate risk building	C	Moderate	67 to 33	Acceptable legally. Improvement recommended.
High risk building[7]	D	High	33 to 20	Unacceptable. Improvement required.
	E		< 20	

The DEE method rates buildings based on the plans (if available) and other information known about the building and some more subjective parameters associated with how the building is detailed and so it is possible that %NBS derived from different engineers may differ.

This assessment describes only the likely seismic Ultimate Limit State (ULS) performance of the building. The ULS is the level of earthquake that can be resisted by the building without catastrophic failure. The DEE does also consider Serviceability Limit State (SLS) performance of the building and or the level of earthquake that would start to cause damage to the building but this result is secondary to the ULS performance.

The NZ Building Code describes that the relevant codes for determining %NBS are primarily:

- AS/NZS 1170 Structural Design Actions
- NZS 3101:2006 Concrete Structures Standard
- NZS 3404:1997 Steel Structures Standard
- NZS4230:2004 Design of Reinforced Concrete Masonry Structures
- NZS 3603:1993 Timber Structures Standard
- NZS 3604:2011 Timber Framed Buildings

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[6] NZSEE 2006, *Assessment and Improvement of the Structural Performance of Buildings in Earthquakes*, §2 pp.13-14

[7] Although the NZSEE guidelines describe a building with a seismic capacity which is assessed as less than 34%NBS as a "High Risk Building", with the structural performance described as "Unacceptable"; note that, in accordance with the local authority *Earthquake-Prone, Dangerous And Insanitary Buildings Policy*, the building can continue to be occupied provided there is no structural damage that would cause all of parts of the building to be unsafe. Note also that it will need to be strengthened to at least 34%NBS in the future.

7. Results and Discussions

7.1. Critical Structural Weaknesses

No potential critical structural weaknesses have been identified for these buildings.

7.2. Analysis Results

The equivalent static force method was used to analyse the seismic capacity of the building. The results of the analysis are reported in the following table as %NBS. The results below are calculated for the building in its damaged state. The building results have been broken down into their seismic resisting elements.

(%NBS = probable strength / new building standards)

- **Table 5: DEE Results**

Block	Seismic Resisting Element	Action	Seismic Rating %NBS
Block D	Gib lined walls	Along	86%
	Gib lined walls and brick party walls	Across	100%
	Foundation	Both directions	100%
Blocks A, B, C	Gib lined walls	Along	67%
	Foundation	Along	92%
	Foundation	Across	100%
	Gib lined walls and brick party walls	Across	100%
Blocks E, F, G, H, I	Gib lined walls	Along	67%
	Foundation	Both directions	100%
	Gib lined walls and brick party walls	Across	100%

The buildings are found to have a seismic capacity of 86% for Block D and 67% for all other buildings. All the buildings are governed by the gib lined walls in the along direction.

7.3. Recommendations

Based on the findings of this assessment indicating the buildings are in the order of 86% NBS for Block D and 67% for all other buildings and are therefore classed as being in the category of 'Low Risk Buildings" no strengthening is required in order to comply with Christchurch City Council (CCC) policy – Earthquake-prone dangerous & insanitary buildings policy 2010.

8. Conclusion

SKM carried out a quantitative assessment on BE 1119, Andrews Crescent. This assessment concluded that the building is classified as not Earthquake Prone. No strengthening is required in order to comply with Christchurch City Council (CCC) policy – Earthquake-prone dangerous & insanitary buildings policy 2010.

Table 6: Quantitative assessment summary

Description	Grade	Risk	%NBS	Structural Performance
Block A, B, C, E, F, G, H, I	A	Low	67	Acceptable. Improvement may be desirable
Block D	B	Low	86	Acceptable. Improvement may be desirable

It is recommended that:

a) There is no damage to any of the buildings that would cause it to be unsafe to occupy.
b) We consider that barriers around the buildings are not necessary.
c) The floors were found to be out of level and it is recommended the foundations be re-levelled or rebuild, however the levelness of the foundation does not affect the %NBS of the buildings.

9. Limitation Statement

This report has been prepared on behalf of, and for the exclusive use of, SKM's client, and is subject to, and issued in accordance with, the provisions of the contract between SKM and the Client. It is not possible to make a proper assessment of this report without a clear understanding of the terms of engagement under which it has been prepared, including the scope of the instructions and directions given to, and the assumptions made by, SKM. The report may not address issues which would need to be considered for another party if that party's particular circumstances, requirements and experience were known and, further, may make assumptions about matters of which a third party is not aware. No responsibility or liability to any third party is accepted for any loss or damage whatsoever arising out of the use of or reliance on this report by any third party.

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

It is not within SKM's scope or responsibility to identify the presence of asbestos, nor the responsibility of SKM to identify possible sources of asbestos. Therefore for any property pre-dating 1989, the presence of asbestos materials should be considered when costing remedial measures or possible demolition.

Should there be any further significant earthquake event, of a magnitude 5 or greater, it will be necessary to conduct a follow-up investigation, as the observations, conclusions and recommendations of this report may no longer apply Earthquake of a lower magnitude may also cause damage, and SKM should be advised immediately if further damage is visible or suspected.

10. Appendix 1 – Photos

Photo 1: Block H southwest elevation elevation (typical side elvation for all the buildings)

Photo 2: Block H northwest elevation (typical front elevation for all the buildings)

Photo 3: Block H northeast elevation (typical side elevation for all the buildings)

Photo 4: Block H southeast elevation (typical rear elevation for all the buildings)

Photo 5: View beneath Block B (typical view of subfloor for all the buildings)

Photo 6: View beneath Block B (typical view of subfloor for all the buildings)

Photo 7: Front elevation of Block A showing entrances to Units 1,3,5,7 respectively

Photo 8: Front view of unit 1, with crack in foundation circled

Photo 9: Close view from photo 8 showing 3mm crack at foundation

Photo 10: View of rear entrance of Unit 1 with cracks in foundation circled.

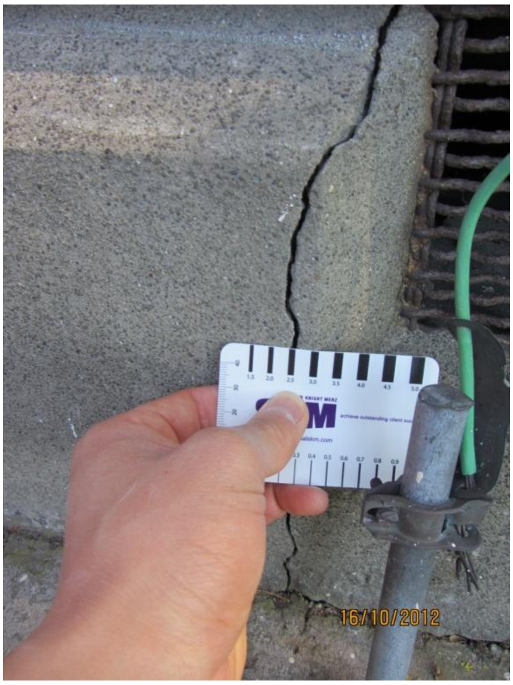


Photo 11: Close up view of 2.5mm crack in photo 10

Photo 12: Close up view of 1mm crack in photo 10

	
Photo 13: View along the side of the building close to the rear entrance of unit 1	Photo 14: Close up view from photo 13
	
Photo 15: Close up view from photo 13 showing 1.5mm crack around the foundation opening	Photo 16: Close up view from photo 13 showing crack around the foundation opening

	
Photo 17: Close up view from photo 13 showing crack around the foundation opening	Photo 18: Entrance to unit 5 and 7
	
Photo 19: Close up view of photo 18 showing 1.5mm crack beside the foundation opening	Photo 20: View of bathroom ceiling crack in unit 5

Photo 21: View of cracks in kitchen party wall in unit 5

Photo 22: Close up view from photo 21

Photo 23: Entrance to unit 7

Photo 24: Disabled access ramp leading to unit 7 showing location of crack in foundation

Photo 25: Close up view from photo 24

Photo 26: Disabled access ramp leading to unit 7 showing location of crack in foundation

Photo 27: Close up view from photo 26

Photo 28: Entrance to unit 4 and 2 respectively

Photo 29: Entrance to unit 2

	
Photo 30: Close up view from photo 29	Photo 31: Rear of unit 2
	
Photo 32: Rear of unit 2 at foundation level, showing foundation cracks at two locations	Photo 33: Close up view from photo 32 crack was measured to be 5mm

Photo 34: Entrance to unit 4

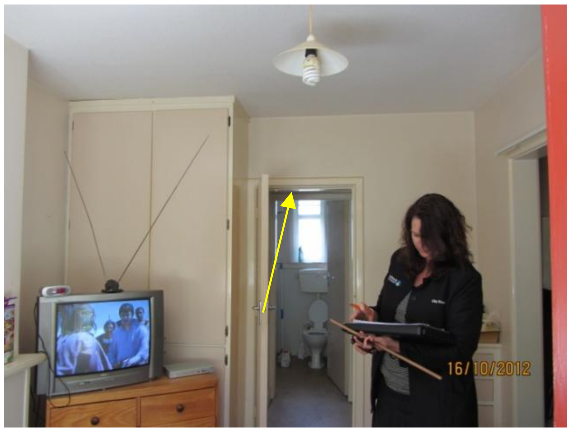


Photo 35: Interior view of unit 4, arrow indicates the ceiling in the hallway in photo 36

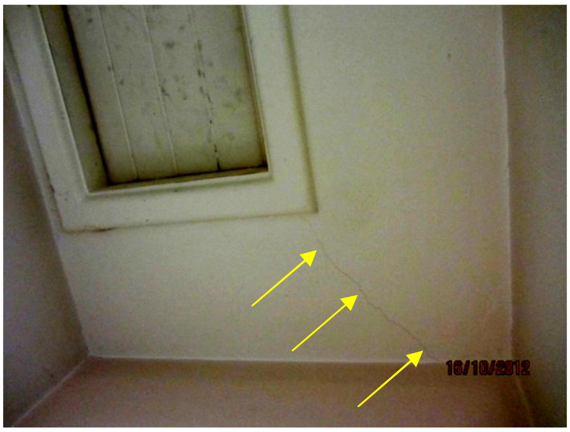


Photo 36: roof space mainhole showing diagonal cracking

Photo 37: Ceiling cracks in the bathroom ceiling in unit 4

 	
Photo 38: Another view of ceiling cracks in the bathroom ceiling in unit 4	Photo 39: Rear entrance of unit 4
 	
Photo 40: Close up view from photo 39 showing vertical crack in the concrete foundation	Photo 41: Close up view from photo 39 showing diagonal cracks beside the steps

Photo 42: Rear entrance of unit 6

Photo 43: Close up view of photo 42, showing cracks between the foundation opening and drain pipe. This was measured to be 2.5mm

Photo 44: End of Block I, with unit 8 in the immediate foreground.

Photo 45: Close up view of perimeter concrete foundation from photo 44

Photo 46: Close up view from photo 45 showing 2mm cracks

Photo 47: Close up view from photo 45 showing 3.5mm cracks

Photo 48: Rear entrance to unit 8

Photo 49: Close up view from photo 48 showing cracks around the steps

Photo 50: Block B with the entrance to unit 9 and 11 respectively

Photo 51: Block B with the entrance to unit 13 and 15 respectively

Photo 52: Entrance to Unit 13

Photo 53: Close up view from photo 52 showing crack in concrete perimeter foundation

	
Photo 54: Rear entrance to Block B	Photo 55: Close up view from photo 54 showing 2.5mm crack in perimeter foundation
	
Photo 56: Entrance to unit 9 and 11 respectively	Photo 57: Close up view from photo 56 showing roof hogging of the roof ceiling

	
Photo 58: Interior view of unit 9	Photo 59: Close up view from photo 58 showing diagonal 1mm crack in lining abve doorway

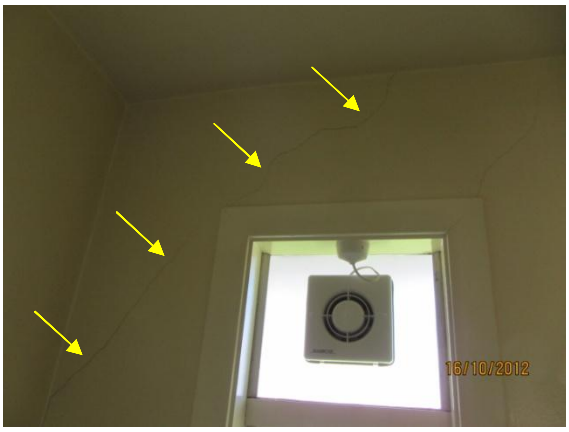



Photo 60: Interior view of the bathroom in unit 9 showing cracks in lining (1)	Photo 61: Interior view of the bathroom in unit 9 showing cracks in lining (2)

Photo 62: Kitchen and lounge doorway junction showing crack

Photo 63: Bathroom and kitchen doorway junction showing crack

Photo 64: View of manhole above the hallway in unit 9

Photo 65: Close up view of crack in manhole fro photo 64

	
Photo 66: Interior view of unit 11	Photo 67: Close up view from photo 66 showing cracks above doorway
	
Photo 68: Close up view from photo 66 showing crack in ceiling	Photo 69: Interior view of kitchen in unit 11

	
Photo 70: Crack in ceiling beside the electrical meter box in the kitchen	Photo 71: View of diagonal crack in interior lining above back entrance doorway in unit 11
	
Photo 72: Exterior view of unit 15 along the end of the building	Photo 73: Close up view of photo 72 showing crack in photo 73

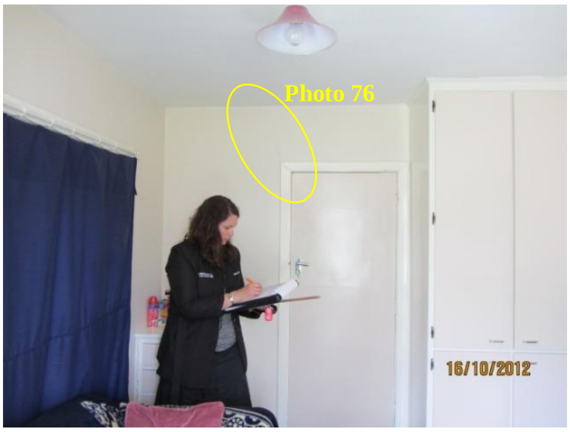
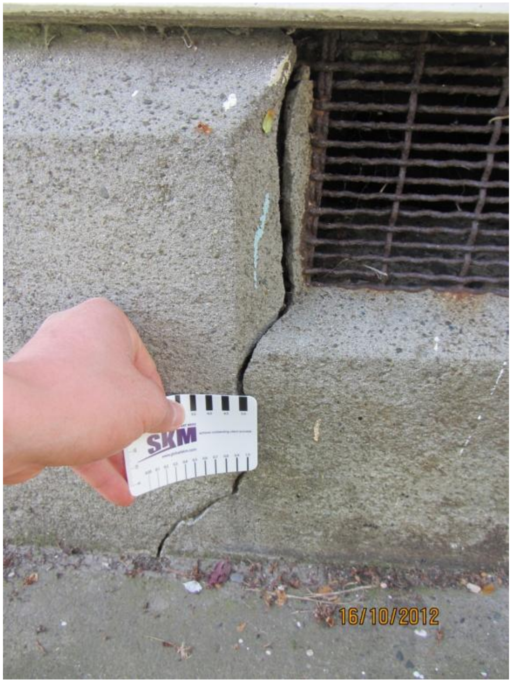
	
Photo 74: Close up view from photo 73 showing 0.6mm crack in foundation on the exterior unit 15	Photo 75: Interior view of lounge area in unit 15
	
Photo 76: Close up view from photo 75 showing diagonal crack above doorway	Photo 77: View of roof manhole in unit 15

	
Photo 78: Close up view from photo 77 showing crack around roof manhole	
	
Photo 79: View of Block H	Photo 80: Southwest side elevation
	
Photo 81: Front elevation	Photo 82: Northeast side elevation

	
Photo 83: Rear elevation	Photo 84: Exterior of unit 10, with locations of cracks in foundation shown.
	
Photo 85: Close up view from photo 84 showing 2mm crack in perimeter foundation	Photo 86: Close up view from photo 84 showing 0.8mm crack in perimeter foundation

	
Photo 87: Close up view from photo 84 showing 3mm crack in perimeter foundation	Photo 88: Close up view from photo 84 showing 5mm crack in perimeter foundation
	
Photo 89: Rear exterior of unit 10	Photo 90: Close up view from photo 89 showing 0.5mm cracks around drain area

<table>
<tr><td>
</td><td>
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<tr><td>Photo 91: Rear entrance of unit 10</td><td>Photo 92: Close up view from photo 91 showing 2mm cracks around the foundation opening</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Photo 93: Close up view from photo 91 showing cracks around the foundation opening</td><td>Photo 94: Crack measured to be 1mm</td></tr>
</table>

	
Photo 95: Interior view of unit 12 bathroom, arrow indicates direction of slope in floor	Photo 96: Slope of floor from photo 95
	
Photo 97: Slope of floor in unit 12 kitchen area	Photo 98: Rear entrance of unit 12

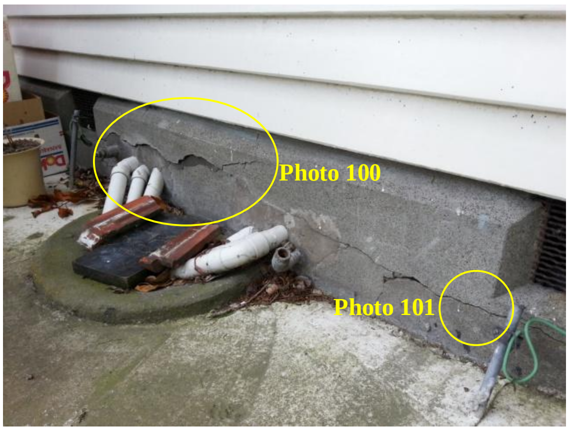


Photo 99: Close up view of rear perimeter foundation in unit 12

Photo 100: Crack in perimeter foundation from photo 99

Photo 101: 1.5mm crack in perimeter foundation from photo 99

Photo 102: Rear entrance of unit 12

Photo 103: Close up view from photo 102 showing evidence of floor slope

Photo 104: Close up view from photo 102 showing large >5mm crack around the steps

Photo 105: Rear entrance to unit 14

Photo 106: Close up view from photo 105, showing cracks at perimeter foundation

<table>
<tr><td></td><td></td></tr>
<tr><td>Photo 107: Entrance to unit 16</td><td>Photo 108: Lounge area of unit 16 with arrow indicating the direction of floor slope</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Photo 109: floor slope in unit 16</td><td>Photo 110: Exterior view of unit 16, with arrow indicating location of crack in perimeter foundation</td></tr>
</table>

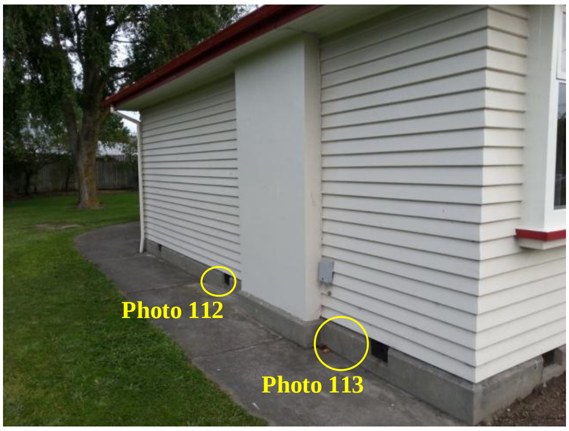


Photo 111: Side exterior view of unit 16	Photo 112: Close up view from photo 111 showing 0.8mm crack
	
Photo 113: Close up view from photo 111 showing 0.5mm crack	Photo 114: Rear entrance of unit 16

	
Photo 115: Close up view from photo 114 showing 3.5mm crack around the foundation opening	
	
Photo 116: Entrance to unit 23	Photo 117: 0.8mm Crack in door frame between lounge and kitchen.

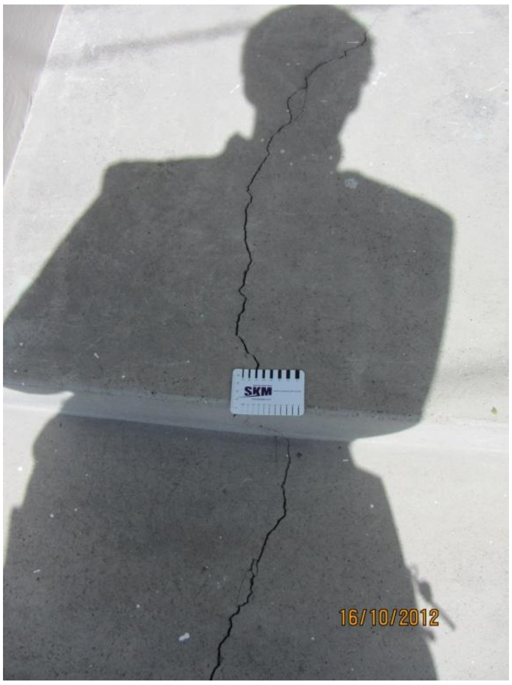
	
Photo 118: Side exterior view of unit 23	Photo 119: Close up view from photo 118 showing damage to concrete render
	
Photo 120: Entrance to unit 19	Photo 121: Close up view from photo 120 showing 2.5mm crack in entrance steps

	
Photo 122: Rear entrance of unit 23	Photo 123: Perimeter foundation of unit 23 at rear entrance
	
Photo 124: Close up view from photo 123, damage does not appear to be due to the earthquake	Photo 125: Rear entrances of units 23 and 21 respectively

	
Photo 126: Rear entrance of unit 21	Photo 127: Close up view from photo 126 showing cracks on the perimeter foundation
	
Photo 128: Rear of unit 21	Photo 129: Close up view from photo 128 showing cracks around the perimeter foundation

	
Photo 130: Rear entrance to unit 19 and 17 respectively	Photo 131: View of rear entrance to unit 19
	
Photo 132: Close up view form photo 131 showing cracks in the perimeter foundation	Photo 133: Entrance to unit 17

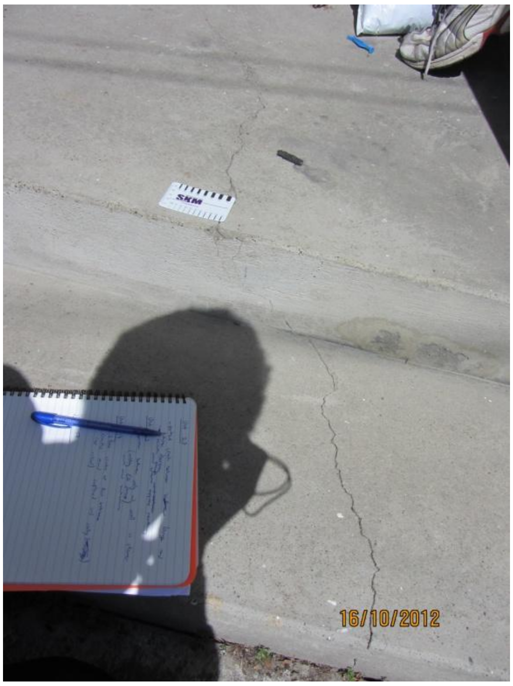


Photo 134: Close up view from photo 133 showing 1mm cracks in the entrance steps	Photo 135: Exterior view of unit 17
	
Photo 136: Close up view from photo 135 showing 1mm cracks around the foundation opening	

	
Photo 137: Entrance to unit 18	Photo 138: Close up view from photo 137 showing 1mm crack beside the entrance
	
Photo 139: Rear entrance of unit 18	Photo 140: Rear entrance of unit 18 showing perimeter foundation

	
Photo 141: Close up view from photo 140 showing cracks in perimeter foundation (1)	Photo 142: Close up view from photo 140 showing cracks in perimeter foundation (2)
	
Photo 143: Front elevation of Block G, showing entrances to units 24, 22, 20, 18 respectively	Photo 144: Entrance to unit 20, showing location of crack

	
Photo 145: close up view from photo 144 showing 11mm crack	Photo 146: Rear entrance for unit 20 (1)
	
Photo 147: Rear entrance for unit 20 (2)	Photo 148: Close up view from photo 147 showing 0.7mm crack

	
Photo 149: Entrance to unit 22	Photo 150: Close up view from photo 149 showing 3 mm crack
	
Photo 151: Rear entrance for unit 22	Photo 152: Close up view from photo 151 showing 1mm crack

	
Photo 153: Close up view from photo 151 showing 1.5mm crack	Photo 154: Interior view of bathroom area in unit 22, showing cracks in the interior lining.

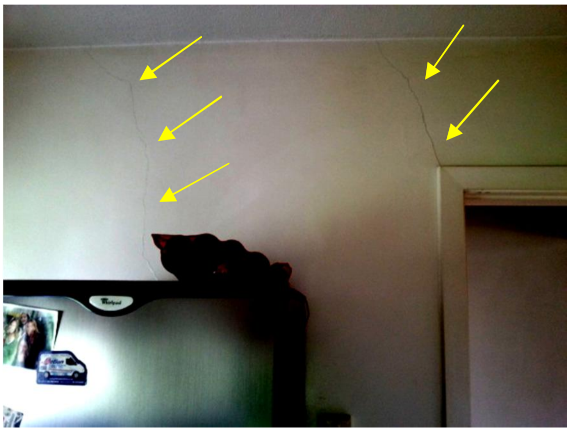



Photo 155: Interior view of the kitchen wall in unit 22 showing cracks in the interior lining	

Photo 156: Entrance to unit 31

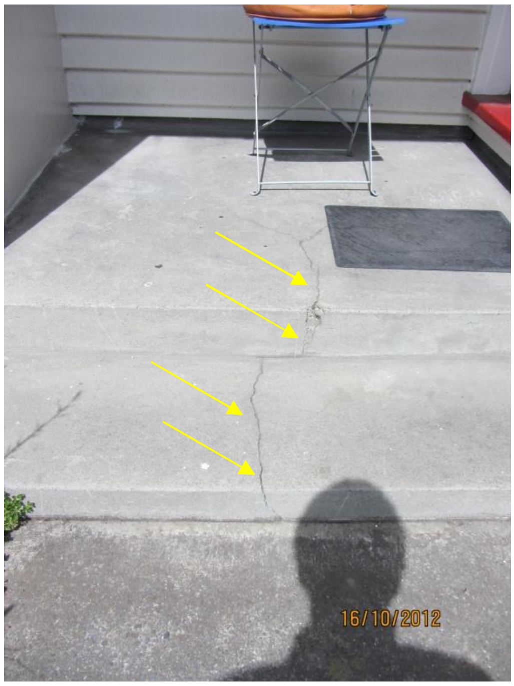


Photo 157: Front entrance steps to unit 31 showing cracks

Photo 158: Interior view of unit 31 showing cracks in kitchen wall and ceiling interface

Photo 159: Close up view of photo 158

	
Photo 160: Rear view of unit 31	Photo 161: Close up view of photo 161 showing cracks in concrete render
	
Photo 162: Entrance to unit 25 showing crack in perimeter foundation	Photo 163: Close up view from photo 162 showing 0.5mm crack

	
Photo 164: Side exterior view of unit 25	Photo 165: Close up view from photo 164 showing 0.8mm crack
	
Photo 166: Interior view of unit 27 in lounge area	Photo 167: Close up view from photo 166 showing cracks between cupboard and wall

	
Photo 168: Front elevation of Block E	Photo 169: Rear elevation of Block E

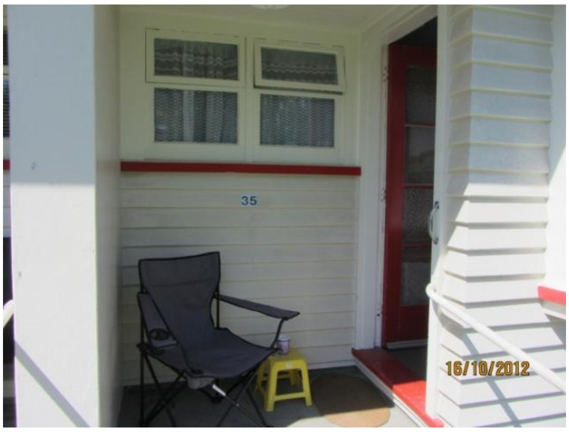



Photo 170: Front entrance to unit 35	Photo 171: Front entrance to unit 33
	
Photo 172: Rear of unit 33	Photo 173: Close up view from photo 172

Photo 174: Front entrance to unit 35

Photo 175: Front entrance to unit 37, with arrow indicating the location of crack in perimeter foundation

Photo 176: Crack in perimeter foundation

Photo 177: Front entrance to unit 39

	
Photo 178: Close up view from photo 177 showing 0.8mm cracks	Photo 179: Exterior side view of unit 39
	
Photo 180: Close up view from photo 179 showing 0.5mm crack in perimeter foundation	Photo 181: Rear of unit 39

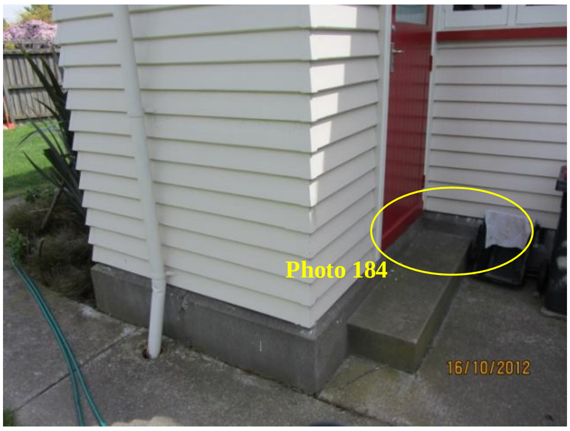
	
Photo 182: Close up view from photo 181	Photo 183: Rear entrance to unit 39
	
Photo 184: Close up view of photo 183 showing cracks around rear entrance steps	

	
Photo 185: Block F, entrances to units 41, 43, 45, 47 respectively	Photo 186: Block F, entrances to units 45, 47 respectively
	
Photo 187: Exterior of unit 41 at front corner	Photo 188: Close up view from photo 187 showing cracks

	
Photo 189: Close up view from photo 187 showing 5mm cracks	Photo 190: One of the openings on the end of the building
	
Photo 191: Rear entrance to unit 41	Photo 192: Close up view from photo 192, showing exposed reinforcing and cracks

11. Appendix 2 – CERA Standardised Report Form

Detailed Engineering Evaluation Summary Data V1.14

Location

Building Name:	Andrews Court (BE 1119) Block A (units 1,3,5,7), Block B (units 9,11,13,15), Block C (units 17,19,21,23), Block E (units 33,35,37,39), Block F (units 41,43,45,47), Block G (units 18,20,22,24), Block H (units 10,12,14,16), Block I (units 2,4,6,8),	Reviewer:	N Calvert
	Unit / No: / Street	CPEng No:	242062
Building Address:	Andrews Crescent	Company:	Sinclair Knight Merz
Legal Description:		Company project number:	ZB01276.215
		Company phone number:	03 940 4919
	Degrees / Min / Sec		
GPS south:		Date of submission:	4/06/2013
GPS east:		Inspection Date:	16/10/2012
		Revision:	B
Building Unique Identifier (CCC):	PRO 1119 B001; PRO 1119 B002; PRO 1119 B003; PRO 1119 B005; PRO 1119 B006; PRO 1119 B007; PRO 1119 B008; PRO 1119 B009;	Is there a full report with this summary?	yes

Site

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

Building

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

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	100x50 rafters @ 450, purlins @ 300, tiled cladding for all buildings except corrugated metal cladding for Block D
Floors:	timber	joist depth and spacing (mm)	bearings @ 1500
Beams:	timber	type	
Columns:			
Walls:	load bearing brick	#N/A	

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	Note: Define along and across in detailed report!	note typical wall length (m)	2
Ductility assumed, μ:	2.00			
Period along:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):	5		estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	unreinforced masonry bearing wall - brick		note wall thickness and cavity	230mm thick wall, with 26mm cavity
Ductility assumed, μ:	1.25			
Period across:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):	5		estimate or calculation?	estimated
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:	plaster system	describe	gypsum plasterboard
Roof Cladding:	Heavy tiles	describe	heavy tiles for all buildings except for corrugated metal for Block D
Glazing:	timber frames		
Ceilings:	plaster, 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	full	original designer name/date	Tonkin and Taylor, April 2013

Damage

Site: (refer DEE Table 4-2)

Site performance:		Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	1:150 or more	notes (if applicable):	Assuming the buildings were level pre earthquake. The difference in floor levels varied between the buildings
Liquefaction:	none apparent	notes (if applicable):	
Lateral Spread:	none apparent	notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):	small cracks in gypsum plaster, and in perimeter foundation		
Across	Damage ratio:	0%		
	Describe (summary):	small cracks in gypsum plaster, and in perimeter foundation		
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	yes	Describe:	cracks in concrete entrance steps

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

Recommendations

	Level of repair/strengthening required:	significant structural	Describe:	rebuild and relevelling of foundation
	Building Consent required:	yes	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	67% ##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	SKM calculations
	Assessed %NBS after e'quakes:	67%		
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:	Andrews Court (BE 1119) Block D (units 25,27,29,31)	Reviewer:	N Calvert
	Unit / No: / Street	CPEng No:	242062
Building Address:	Andrews Crescent	Company:	Sinclair Knight Merz
Legal Description:		Company project number:	ZB01276.215
		Company phone number:	03 940 4919
	Degrees / Min / Sec		
GPS south:		Date of submission:	4/06/2013
GPS east:		Inspection Date:	16/10/2012
		Revision:	B
Building Unique Identifier (CCC):	PRO 1119 B004	Is there a full report with this summary?	yes

Site

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

Building

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

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	100x50 rafters @ 450, purlins @ 300, tiled cladding for all buildings except corrugated metal cladding for Block D
Floors:	timber	joist depth and spacing (mm)	bearings @ 1500
Beams:	timber	type	
Columns:			
Walls:	load bearing brick	#N/A	

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	**Note: Define along and across in detailed report!**	note typical wall length (m)	2
Ductility assumed, μ:	2.00			
Period along:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):	5		estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	unreinforced masonry bearing wall - brick		note wall thickness and cavity	230mm thick wall, with 26mm cavity
Ductility assumed, μ:	1.25			
Period across:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):	5		estimate or calculation?	estimated
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:	plaster system	describe	gypsum plasterboard
Roof Cladding:	Heavy tiles	describe	heavy tiles for all buildings except for corrugated metal for Block D
Glazing:	timber frames		
Ceilings:	plaster, 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	full	original designer name/date	Tonkin and Taylor, April 2013

Damage

Site: (refer DEE Table 4-2)

Site performance:		Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	1:150 or more	notes (if applicable):	Assuming the buildings were level pre earthquake. The difference in floor levels varied between the buildings
Liquefaction:	none apparent	notes (if applicable):	
Lateral Spread:	none apparent	notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):	small cracks in gypsum plaster, and in perimeter foundation		
Across	Damage ratio:	0%		
	Describe (summary):	small cracks in gypsum plaster, and in perimeter foundation		
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	yes	Describe:	cracks in concrete entrance steps

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

Recommendations

	Level of repair/strengthening required:	significant structural	Describe:	rebuild and relevelling of foundation
	Building Consent required:	yes	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	86% ##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	SKM calculations
	Assessed %NBS after e'quakes:	86%		
Across	Assessed %NBS before e'quakes:	100% ##### %NBS from IEP below		
	Assessed %NBS after e'quakes:	100%		