

Christchurch City Council

**Division Street
Housing Complex
PRO 0547**

**Detailed Engineering Evaluation
Quantitative Assessment Report**






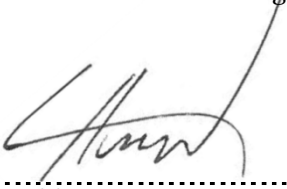
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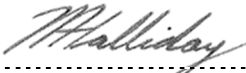
Division Street Housing Complex

Quantitative Assessment Report

**38 Division Street, Riccarton,
Christchurch 8041**

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Date: February 2014
Reference: 6-QC336.00
Status: Final

Summary

Division Street Housing Complex
PRO 0547

Detailed Engineering Evaluation
Quantitative Report - Summary
Final

Background

This is a summary of the quantitative report for the Division Street Housing Complex, and is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011. This assessment covers the 24 residential units on the site.

Key Damage Observed

The residential units have suffered minor damage to non-structural elements. This included slight separation of the block veneer and the firewall. There is also slight lateral cracking of the render on the concrete pad. Settlement was observed of the concrete path surrounding the units. This damage was not deemed significant enough to affect the capacities of the buildings.

Level Survey

All floor slopes were assessed in a laser level survey. Floor slopes were greater than the 5mm/m limitation set out in the MBIE guidelines [6], in Units 2, 3, 7 and 17 as shown below.

Internal Lining Nail Spacings

The internal lining nail spacings were measured on site averaged at 300mm for Blocks A-C and 450mm for Blocks D-F.

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 0547 B001 (Block A)	63%	Fail	Pass
PRO 0547 B002 (Block B)	63%	Fail	Pass
PRO 0547 B003 (Block C)	63%	Pass	Pass
PRO 0547 B004 (Block D)	63%	Pass	Fail
PRO 0547 B005 (Block E)	63%	Fail	Fail
PRO 0547 B006 (Block F)	63%	Pass	Fail

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

The residential units have a capacity of 63% NBS as limited by the in-plane shear capacity of the timber-framed shear walls in the longitudinal direction. They are deemed to be a ‘moderate risk’ in a design seismic event according to NZSEE guidelines.

The %NBS has been calculated using the strength of the braces within the wall. The nail spacing does not comply with the minimum fixing requirements for plasterboard in some units. An increase in the number of fixings would enhance the performance of these structures.

Recommendations

It is recommended that;

- Veneer at height (gable ends) have the veneer ties checked.
- Cosmetic repairs be undertaken as required.
- Strengthening schemes be developed to increase seismic capacity of all blocks to 67%NBS.
- Unrestrained header tanks in the ceiling spaces be secured or removed.

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1 Introduction

Opus International Consultants Limited has been engaged by Christchurch City Council to undertake a detailed seismic assessment of the Division Street Housing Complex, located at 38 Division Street, Riccarton, Christchurch 8041, following the Canterbury earthquake sequence since September 2010. The site was visited by Opus International Consultants on 22 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 Order¹ in Council 16 September 2010, modified the meaning of “dangerous building” to include buildings that were identified as being EPB’s. As a result of this, we would expect such a building would be issued with a Section 124 notice, by the Territorial Authority, or CERA acting on their behalf, once they are made aware of our assessment. Based on information received from CERA to date and from the MBIE guidance document dated December 2012 [6], this notice is likely to prohibit occupancy of the building (or parts thereof), until its seismic capacity is improved to the point that it is no longer considered an EPB.

3.1.2 Cordoning

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

3.1.3 Strengthening

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

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

3.1.4 Our Ethical Obligation

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

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

4 Background Information

4.1 Building Descriptions

The site contains 24 residential units where Blocks A, B and C were constructed in 1970, and Blocks D, E and F were constructed in 1985. A site plan showing the location of the units, numbered 1 to 25 (there is no Unit 13), is shown in Figure 2. Units 14, 17 and 21 are larger (double bedroom size) than the other units. Figure 3 shows the location of the site in Christchurch City. The units are grouped together to form six blocks of three, four or five units.



Figure 2: Site plan of Division Street Housing Complex.

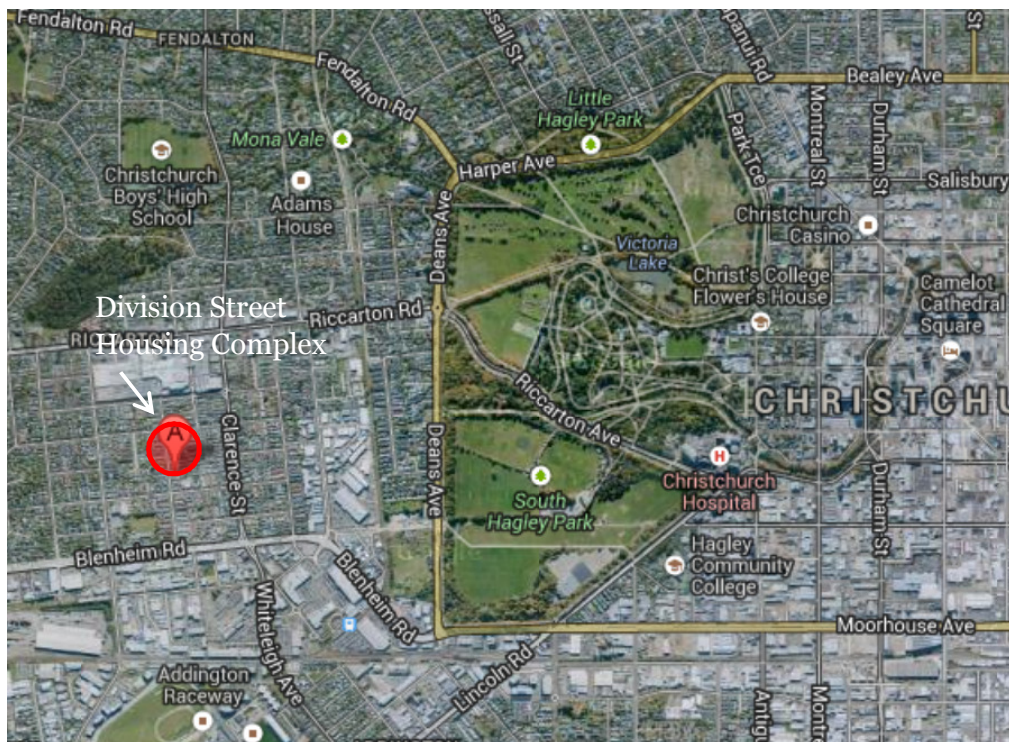


Figure 3: Location of Division Street (circled) relative to Christchurch City CBD (Source: Google Earth).

The residential units are timber-framed buildings with diagonal braces. The roof structure comprises of timber roof trusses supporting light-weight metal roofs. The walls and ceilings

are lined with plasterboard. External walls are clad with brick veneer on Blocks A to C, concrete block on Blocks D to F. Foundations are strip footings under fire walls and around the perimeter of reinforced concrete slabs.

The units are separated by 150mm block masonry fire walls which are filled with 12mm diameter reinforcement at 600mm centres to the perimeter.

Figure 4 and 5 show typical floor plans for a single residential unit and a double residential unit respectively. These plans were produced from site measurements by Opus. Figure 6 shows the cross section used in calculations. It was noted onsite that Blocks D, E and F had cavity sliding doors in the bedroom/lounge wall. This prevents this wall being used as bracing in calculations but does not affect the %NBS.

During the inspections it was noted that unsecured copper header tanks are in place in the ceiling spaces of the units.

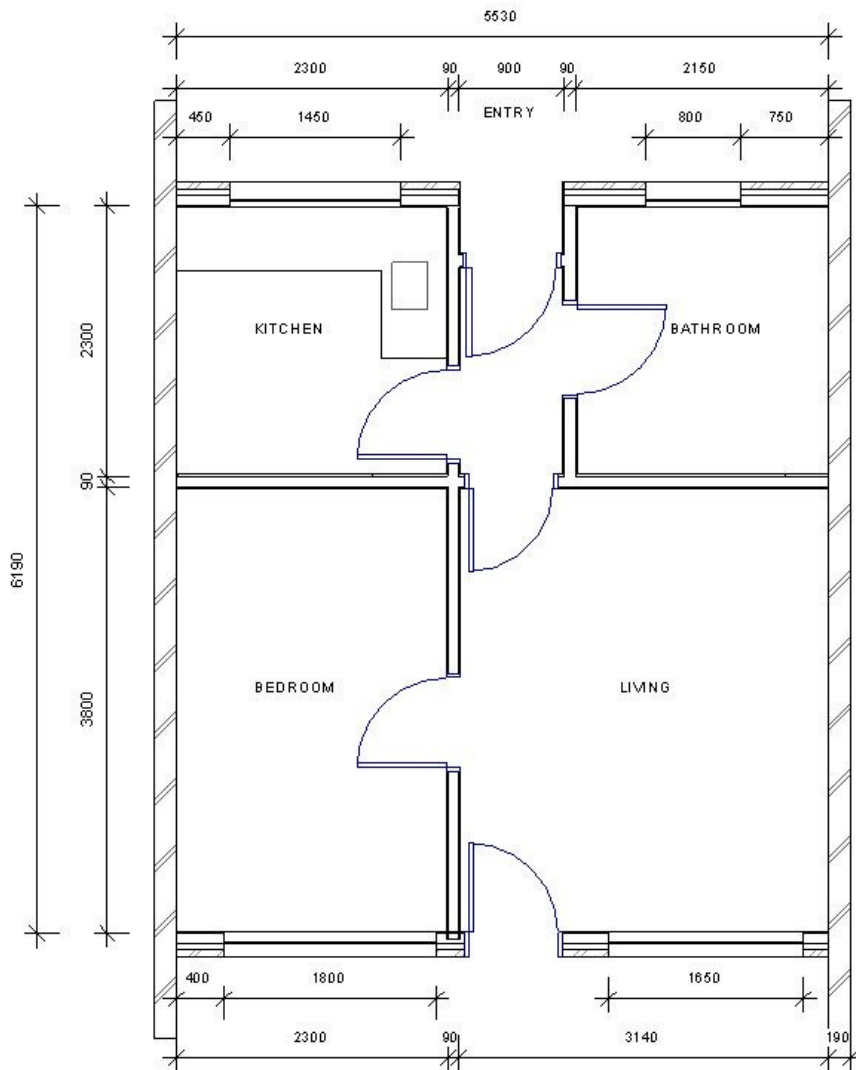


Figure 4: Typical partial floor plan of residential unit blocks.

4.2 Survey

4.2.1 Post 22 February 2011 Rapid Assessment

A structural (Level 2) assessment of the buildings/property was undertaken on 9 March 2011 by Opus International Consultants.

4.2.2 Level Survey

A full level survey was not deemed to be necessary at Division Street as it is located in a TC2 zone. Properties in TC2 zones suffered minor to moderate damage due to liquefaction and/or settlement. In lieu of a full level survey, a laser level was placed in each unit so that differentials in vertical levels could be measured at the extreme ends of the unit. These values could then be used to determine the floor slope of the entire unit. For this site, the maximum slope in a unit was 10mm/m (which exceeds the 5mm/m limitation imposed by MBIE guidelines), the general slopes across all units was less than this guideline.

Table 2: Summary of the level survey

Block	Unit No.	Comment	Maximum Fall*
A	1	Pass	-
	2	Fail	5 mm/m
	3	Fail	6 mm/m
	4	Pass	-
B	5	Pass	-
	6	Pass	-
	7	Fail	10 mm/m
	8	Pass	-
C	9	Pass	-
	10	Pass	-
	11	Pass	-
	12	No Access	-
D	14	Pass	-
	15	Pass	-
	16	Pass	-
E	17	Fail	7 mm/m
	18	Pass	-
	19	Pass	-
	20	Pass	-
	21	Pass	-
F	22	Pass	-
	23	Pass	-
	24	Pass	-
	25	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 averaged at 300mm for Blocks A-C and 450mm for Blocks D-F.

The %NBS has been calculated using the strength of the braces within the wall. The nail spacing does not comply with the minimum fixing requirements for plasterboard in some blocks. An increase in the number of fixings would enhance the performance of these structures.

4.3 Original Documentation

The following documentation was provided by the Christchurch City Council:

- 1460 – Canterbury Draughting and Design Services ltd– Pensioner Flats at 38 Division Street – Sheets 1-5/5 - Site plan, floor plans, elevations and sections – 1971.

In addition a typical floor plan of the residential units has been produced by Opus from site measurements 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 noted that damage was minor in all units with the exception for Units 7 and 17, where the most significant residual displacement was observed.

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

5.1 Residual Displacements

Residual displacement was observed in Units 2, 3, 7 and 17. Displacements in units 2 and 3 only exceeded MBIE guidelines by small amounts which could be attributed to the accuracy margin of the equipment used.

The displacements in Units 7 and 17 were more significant. A local residual displacement was observed in the bedroom corner of Unit 7 which exceeds MBIE guidelines. Unit 17 experienced settlement across the lounge.

5.2 Foundations

Cracking were observed in the render of the concrete foundation in Block C (photo 17) and settlement of the render on Block F (photo 15).

5.3 Primary Gravity Structure

No damage was observed in the framing roof structure.

5.4 Primary Lateral-Resistance Structure

Minor to moderate plasterboard cracking was observed in all units, typically above doorways, windows and in the ceiling line (photo 12). Cracking was also observed in the ceiling diaphragms (photo 11). This damage is considered minor and does not affect the lateral resistance of the structure.

5.5 Non Structural Elements

Slight splitting was observed between the veneer and the firewall in Block F (photo 14). Settlement was observed in the footpaths and foundation veneers.

5.6 General Observations

The buildings appeared to have performed reasonably well, as would be expected for buildings of this type, during the earthquakes. They have suffered distributed amounts of minor damage which is typical of the 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 C. A brief summary follows:

Hand calculations were performed to determine seismic forces from the current building codes. These forces were applied globally to the structure and the capacities of the walls were calculated and used to estimate the %NBS. The walls, highlighted in Figure 7 to Figure 11, were used for bracing in their respective directions.

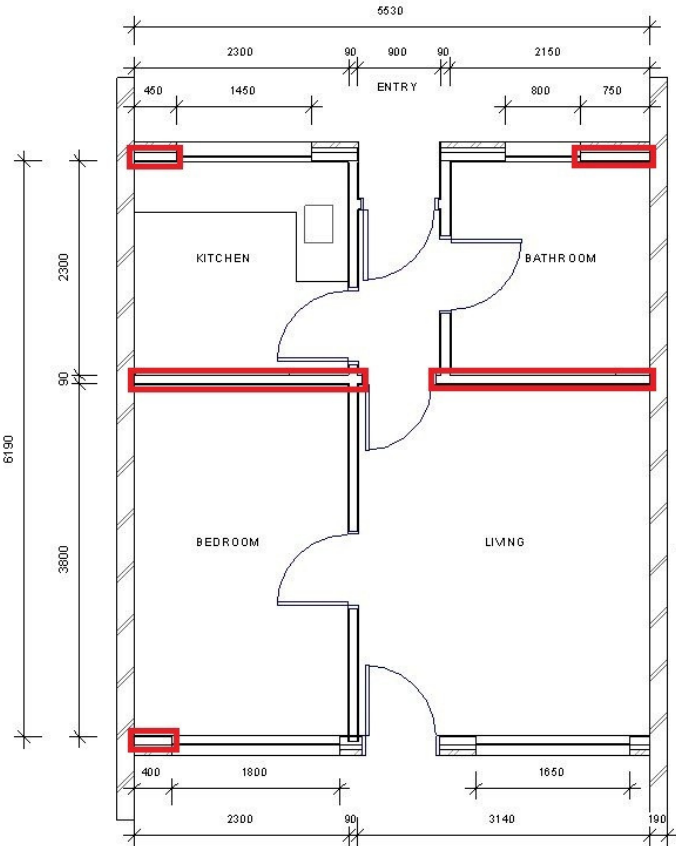


Figure 7: Walls used for bracing in the longitudinal direction single unit.

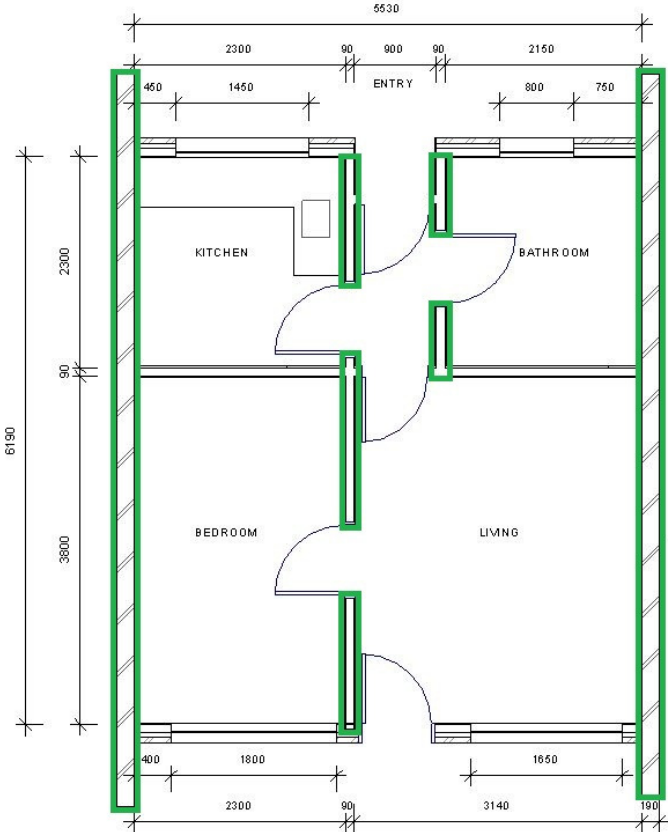


Figure 8: Walls used for bracing in the transverse direction single unit.

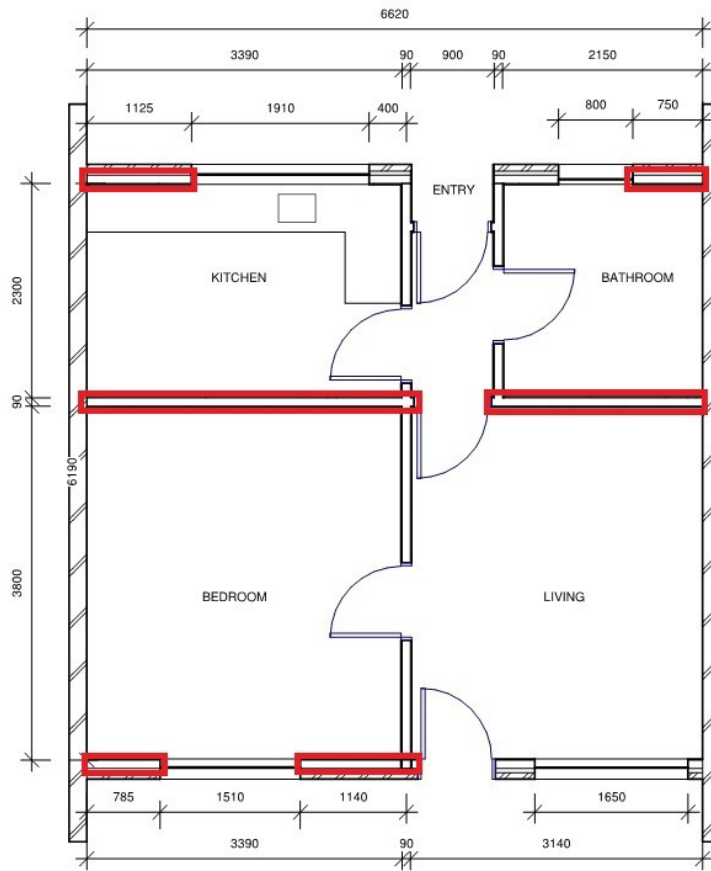


Figure 9: Walls used for bracing in the longitudinal direction double unit.

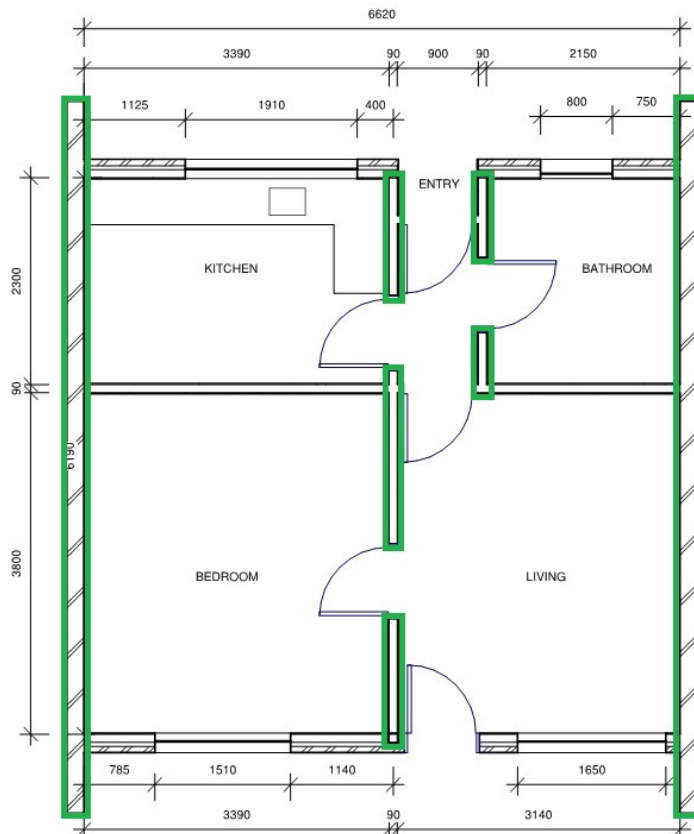


Figure 10: Walls used for bracing in the transverse direction double unit.

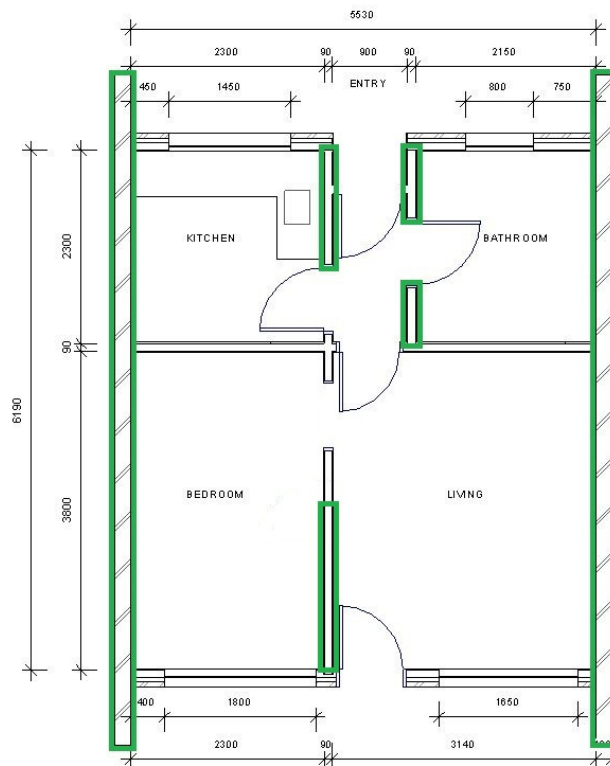


Figure 11: Walls used for bracing in the transverse direction for a unit with a sliding door in the bathroom.

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.
Blocks A-F	Timber bracing walls	63%	100%

7 Geotechnical Summary

CERA indicates that Division Street is located in a TC2 zone (as shown in figure 12). This classification suggests future significant earthquakes will cause minor to moderate land damage due to liquefaction and settlement.



Figure 12: 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.
- The residential units have a capacity of 63% 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).
- 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.
- Cosmetic repairs be undertaken as required.
- Strengthening schemes be developed to increase seismic capacity of all blocks to 67%NBS.
- Unrestrained header tanks in the ceiling spaces be secured or removed.

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 Division Street 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

Division Street Housing Complex – Detailed Engineering Evaluation




Division Street Housing Complex		
Residential Units Layout		
1.	Typical exterior elevation (back) Block A	
2.	Typical exterior elevation (front) Block A	

Division Street Housing Complex – Detailed Engineering Evaluation



<p>3.</p>	<p>Typical exterior elevation (front) Block E</p>	
<p>4.</p>	<p>Typical exterior elevation (end) Block E</p>	



<p>5.</p>	<p>Typical lounge view</p>	 A photograph of a typical lounge area. The room features a red and gold patterned carpet, a brown armchair, a small table with a white tablecloth, and a wooden shelving unit. A person is visible near a window with yellow curtains. A framed picture hangs on the wall.
<p>6.</p>	<p>Typical kitchen view</p>	 A photograph of a typical kitchen area. The kitchen has white cabinetry, a white countertop, a white sink, a white stove, and a white refrigerator with a microwave on top. A window is visible on the left side.

<p>7.</p>	<p>Typical bathroom view</p>	
<p>8.</p>	<p>Typical bedroom view</p>	



<p>9.</p>	<p>Typical roof space showing gable end walls and timber trusses</p>	 A photograph showing the interior of a roof space. It features a complex arrangement of wooden timber trusses and rafters. The walls are constructed from brick, and the floor is covered with a layer of yellow insulation. A white pipe runs vertically through the space.
<p>10.</p>	<p>Typical roof space showing concrete block fire wall and timber trusses</p>	 A photograph of a roof space with a prominent concrete block fire wall. The timber trusses are clearly visible, and the floor is insulated with yellow material. The lighting is somewhat dim, highlighting the structural elements.
<p>11.</p>	<p>Typical cracking of ceiling diaphragm</p>	 A photograph of a plain white ceiling. A distinct, horizontal crack runs across the middle of the frame, indicating a failure in the ceiling diaphragm. A light fixture is visible in the lower-left corner.

Division Street Housing Complex – Detailed Engineering Evaluation

<p>12.</p>	<p>Typical gib cracking above windows</p>	 A photograph showing a wall with floral wallpaper. A window with white curtains is visible. Above the window frame, there is a vertical crack in the white plaster or gypsum board, which is the 'gib' mentioned in the text.
<p>13.</p>	<p>Typical nail spacings Approx. 300mm</p>	 A photograph showing a white wall next to a door. A yellow measuring tape is held vertically against the wall. The tape is positioned to measure the distance between two nails, which is approximately 300mm.

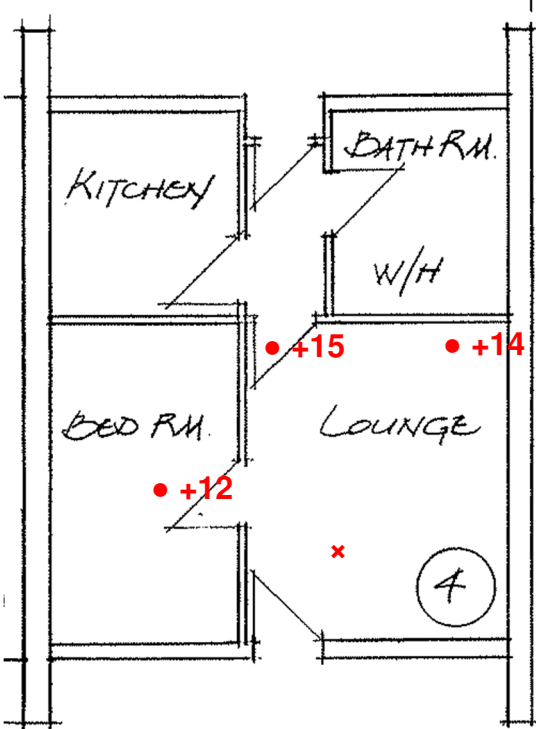
<p>14.</p>	<p>Cracking between veneer and firewall</p>	
<p>15.</p>	<p>Displacement of foundation render</p>	

Division Street Housing Complex – Detailed Engineering Evaluation

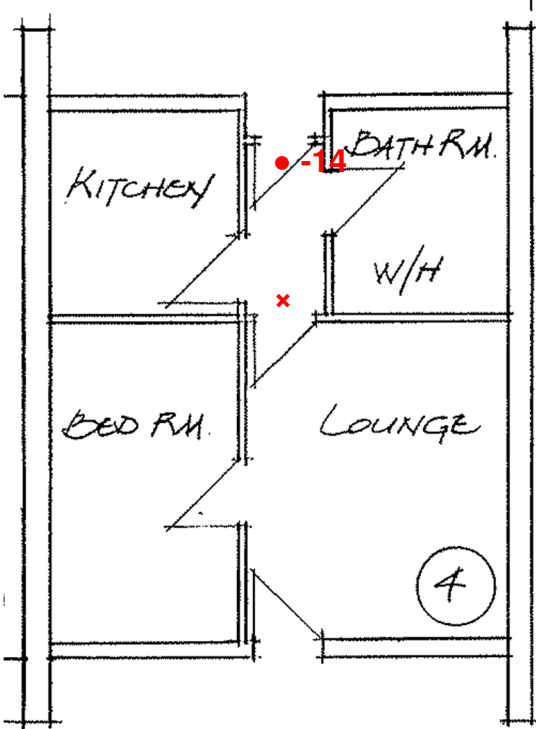
<p>16.</p>	<p>Settlement of pathways</p>	 A photograph showing a concrete pathway with a distinct horizontal crack and some surface cracking. The concrete is light grey and appears to be in an outdoor setting with some debris and a white wall visible in the background.
<p>17.</p>	<p>Lateral cracking of render on foundation of Block C</p>	 A photograph showing a brick wall with a render finish. There is a significant vertical crack in the render at the base of the wall, where it meets the foundation. The bricks are reddish-brown, and the render is a light grey color. There is some debris and a green object at the bottom of the image.

Appendix B – Level Survey

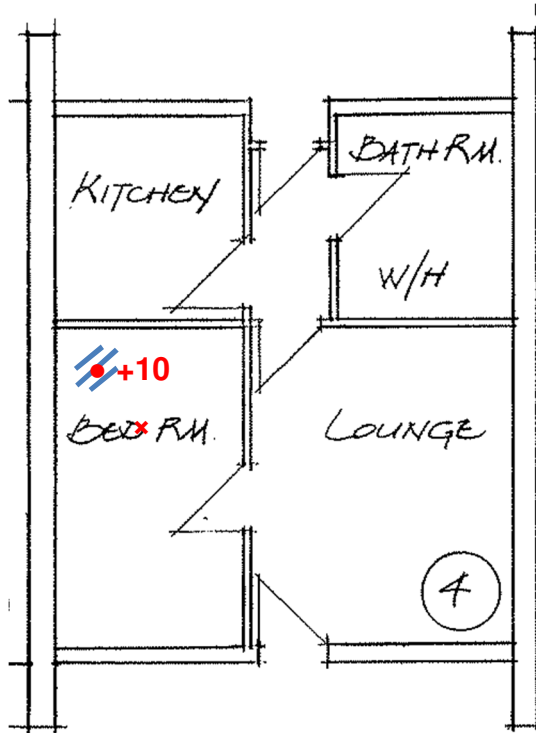
Unit 2



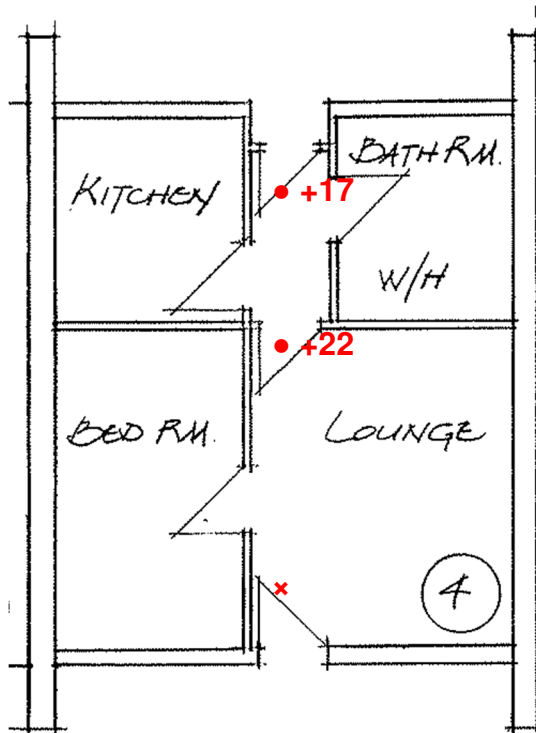
Unit 3



Unit 7



Unit 17



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 residential units.

Analysis Procedure

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

Location		Building Name: <input type="text" value="Division Street Housing Complex"/>	Unit No: <input type="text" value="38"/>	Street: <input type="text" value="Division Street"/>	Reviewer: <input type="text" value="Mary Ann Halliday"/>
Building Address: <input type="text"/>	Legal Description: <input type="text"/>				CPEng No: <input type="text" value="67073"/>
					Company: <input type="text" value="Opus International Consultants"/>
					Company project number: <input type="text" value="6-OC336.00"/>
					Company phone number: <input type="text" value="(03) 363 5400"/>
					Date of submission: <input type="text" value="5-Feb-14"/>
					Inspection Date: <input type="text" value="22/11/2013"/>
					Revision: <input type="text" value="1"/>
Building Unique Identifier (CCC): <input type="text" value="PRO 0547"/>					Is there a full report with this summary? <input type="text" value="yes"/>

Site		Site slope: <input type="text" value="flat"/>	Max retaining height (m): <input type="text"/>
		Soil type: <input type="text"/>	Soil Profile (if available): <input type="text"/>
		Site Class (to NZS1170.5): <input type="text" value="D"/>	If Ground improvement on site, describe: <input type="text"/>
		Proximity to waterway (m, if <100m): <input type="text"/>	Approx site elevation (m): <input type="text"/>
		Proximity to cliff top (m, if < 100m): <input type="text"/>	
		Proximity to cliff base (m, if <100m): <input type="text"/>	

Building		No. of storeys above ground: <input type="text" value="1"/>	single storey = 1	Ground floor elevation (Absolute) (m): <input type="text"/>
		Ground floor split?: <input type="text" value="no"/>		Ground floor elevation above ground (m): <input type="text"/>
		Storeys below ground: <input type="text" value="0"/>		if Foundation type is other, describe: <input type="text"/>
		Foundation type: <input type="text" value="strip footings"/>	height from ground to level of uppermost seismic mass (for IEP only) (m): <input type="text"/>	Date of design: <input type="text" value="1965-1976"/>
		Building height (m): <input type="text" value="3.00"/>		
		Floor footprint area (approx): <input type="text" value="155"/>		
		Age of Building (years): <input type="text" value="43"/>		
		Strengthening present?: <input type="text" value="no"/>		If so, when (year)? <input type="text"/>
		Use (ground floor): <input type="text" value="multi-unit residential"/>		And what load level (%g)? <input type="text"/>
		Use (upper floors): <input type="text"/>		Brief strengthening description: <input type="text"/>
		Use notes (if required): <input type="text"/>		
		Importance level (to NZS1170.5): <input type="text" value="IL2"/>		

Gravity Structure		Gravity System: <input type="text" value="frame system"/>	truss depth, purlin type and cladding: <input type="text"/>
		Roof: <input type="text" value="timber truss"/>	slab thickness (mm): <input type="text"/>
		Floors: <input type="text" value="concrete flat slab"/>	overall depth x width (mm x mm): <input type="text"/>
		Beams: <input type="text" value="none"/>	typical dimensions (mm x mm): <input type="text"/>
		Columns: <input type="text" value="timber"/>	0
		Walls: <input type="text" value="non-load bearing"/>	

Lateral load resisting structure		Lateral system along: <input type="text" value="lightweight timber framed walls"/>	Note: Define along and across in detailed report!	note typical wall length (m): <input type="text"/>
		Ductility assumed, μ: <input type="text" value="2.00"/>		estimate or calculation? <input type="text" value="estimated"/>
		Period along: <input type="text" value="0.10"/>		estimate or calculation? <input type="text"/>
		Total deflection (ULS) (mm): <input type="text"/>		estimate or calculation? <input type="text"/>
		maximum interstorey deflection (ULS) (mm): <input type="text"/>		
		Lateral system across: <input type="text" value="lightweight timber framed walls"/>		note typical wall length (m): <input type="text"/>
		Ductility assumed, μ: <input type="text" value="2.00"/>		estimate or calculation? <input type="text" value="estimated"/>
		Period across: <input type="text" value="0.10"/>		estimate or calculation? <input type="text"/>
		Total deflection (ULS) (mm): <input type="text"/>		estimate or calculation? <input type="text"/>
		maximum interstorey deflection (ULS) (mm): <input type="text"/>		estimate or calculation? <input type="text"/>

Separations:		north (mm): <input type="text"/>	leave blank if not relevant
		east (mm): <input type="text"/>	
		south (mm): <input type="text"/>	
		west (mm): <input type="text"/>	

Non-structural elements		Stairs: <input type="text"/>	describe (note cavity if exists) <input type="text"/>	
		Wall cladding: <input type="text" value="brick or tile"/>		describe <input type="text"/>
		Roof Cladding: <input type="text" value="Metal"/>		
		Glazing: <input type="text" value="aluminium frames"/>		
		Ceilings: <input type="text" value="strapped or direct fixed"/>		
		Services(list): <input type="text"/>		

Available documentation		Architectural: <input type="text" value="partial"/>	original designer name/date: <input type="text"/>
		Structural: <input type="text" value="partial"/>	original designer name/date: <input type="text"/>
		Mechanical: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
		Electrical: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
		Geotech report: <input type="text" value="none"/>	original designer name/date: <input type="text"/>

Damage		Site performance: <input type="text" value="Good"/>	Describe damage: <input type="text"/>
Site: (refer DEE Table 4-2)		Settlement: <input type="text" value="none observed"/>	notes (if applicable): <input type="text"/>
		Differential settlement: <input type="text" value="none observed"/>	notes (if applicable): <input type="text"/>
		Liquefaction: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
		Lateral Spread: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
		Differential lateral spread: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
		Ground cracks: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
		Damage to area: <input type="text" value="slight"/>	notes (if applicable): <input type="text"/>

Building:		Current Placard Status: <input type="text" value="green"/>	
Along	Damage ratio: <input type="text" value="0%"/>	Describe how damage ratio arrived at: <input type="text"/>	
	Describe (summary): <input type="text"/>		
Across	Damage ratio: <input type="text" value="0%"/>	Describe (summary): <input type="text"/>	
	Describe (summary): <input type="text"/>		
		$Damage_Ratio = \frac{(\%NBS\ (before) - \%NBS\ (after))}{\%NBS\ (before)}$	
Diaphragms	Damage?: <input type="text" value="yes"/>	Describe: <input type="text"/>	
CSWs:	Damage?: <input type="text" value="no"/>	Describe: <input type="text"/>	
Pounding:	Damage?: <input type="text" value="no"/>	Describe: <input type="text"/>	
Non-structural:	Damage?: <input type="text" value="yes"/>	Describe: <input type="text"/>	

Recommendations		Level of repair/strengthening required: <input type="text" value="minor non-structural"/>	Describe: <input type="text"/>
		Building Consent required: <input type="text" value="no"/>	Describe: <input type="text"/>
		Interim occupancy recommendations: <input type="text" value="full occupancy"/>	Describe: <input type="text"/>
Along	Assessed %NBS before e'quakes: <input type="text" value="63%"/>	#### %NBS from IEP below	If IEP not used, please detail Equivalent Static assessment methodology: <input type="text" value="Equivalent Static"/>
	Assessed %NBS after e'quakes: <input type="text" value="63%"/>		
Across	Assessed %NBS before e'quakes: <input type="text" value="100%"/>	#### %NBS from IEP below	
	Assessed %NBS after e'quakes: <input type="text" value="100%"/>		

Location		Building Name: <input type="text" value="Division Street Housing Complex"/>	Unit No: <input type="text" value="38"/>	Street: <input type="text" value="Division"/>	Reviewer: <input type="text" value="Mary Ann Halliday"/>
Building Address: <input type="text"/>	Legal Description: <input type="text"/>				CPEng No: <input type="text" value="67073"/>
			Company: <input type="text" value="Opus International Consultants"/>		
			Company project number: <input type="text" value="6-OC336.00"/>		
			Company phone number: <input type="text"/>		
			Date of submission: <input type="text" value="5-Feb-14"/>		
			Inspection Date: <input type="text" value="22/11/2013"/>		
			Revision: <input type="text" value="1"/>		
GPS south: <input type="text" value="43"/> Degrees <input type="text" value="32"/> Min <input type="text" value="4.23"/> Sec					
GPS east: <input type="text" value="172"/> Degrees <input type="text" value="35"/> Min <input type="text" value="58.92"/> Sec					
Building Unique Identifier (CCC): <input type="text" value="PRO0547"/>			Is there a full report with this summary? <input type="text" value="yes"/>		

Site	Site slope: <input type="text" value="flat"/>	Max retaining height (m): <input type="text"/>
	Soil type: <input type="text"/>	Soil Profile (if available): <input type="text"/>
	Site Class (to NZS1170.5): <input type="text" value="D"/>	
	Proximity to waterway (m, if <100m): <input type="text"/>	If Ground improvement on site, describe: <input type="text"/>
	Proximity to cliff top (m, if < 100m): <input type="text"/>	
	Proximity to cliff base (m,if <100m): <input type="text"/>	Approx site elevation (m): <input type="text"/>

Building	No. of storeys above ground: <input type="text" value="1"/>	single storey = 1	Ground floor elevation (Absolute) (m): <input type="text"/>
	Ground floor split?: <input type="text" value="no"/>		Ground floor elevation above ground (m): <input type="text"/>
	Storeys below ground: <input type="text" value="0"/>		
	Foundation type: <input type="text" value="strip footings"/>		if Foundation type is other, describe: <input type="text"/>
	Building height (m): <input type="text" value="3.00"/>	height from ground to level of uppermost seismic mass (for IEP only) (m): <input type="text"/>	
	Floor footprint area (approx): <input type="text" value="110"/>		Date of design: <input type="text" value="1976-1992"/>
	Age of Building (years): <input type="text" value="28"/>		
	Strengthening present?: <input type="text" value="no"/>		If so, when (year)? <input type="text"/>
	Use (ground floor): <input type="text" value="multi-unit residential"/>		And what load level (%g)? <input type="text"/>
	Use (upper floors): <input type="text"/>		Brief strengthening description: <input type="text"/>
	Use notes (if required): <input type="text"/>		
	Importance level (to NZS1170.5): <input type="text" value="IL2"/>		

Gravity Structure	Gravity System: <input type="text" value="frame system"/>	
	Roof: <input type="text" value="timber truss"/>	truss depth, purlin type and cladding <input type="text"/>
	Floors: <input type="text" value="concrete flat slab"/>	slab thickness (mm) <input type="text"/>
	Beams: <input type="text" value="none"/>	overall depth x width (mm x mm) <input type="text"/>
	Columns: <input type="text" value="timber"/>	typical dimensions (mm x mm) <input type="text"/>
	Walls: <input type="text" value="non-load bearing"/>	0 <input type="text"/>

Lateral load resisting structure	Lateral system along: <input type="text" value="lightweight timber framed walls"/>	Note: Define along and across in detailed report!	note typical wall length (m) <input type="text"/>
	Ductility assumed, μ: <input type="text" value="2.00"/>		estimate or calculation? <input type="text" value="estimated"/>
	Period along: <input type="text" value="0.10"/>		estimate or calculation? <input type="text"/>
	Total deflection (ULS) (mm): <input type="text"/>	0.00	estimate or calculation? <input type="text"/>
	maximum interstorey deflection (ULS) (mm): <input type="text"/>		
	Lateral system across: <input type="text" value="lightweight timber framed walls"/>		note typical wall length (m) <input type="text"/>
	Ductility assumed, μ: <input type="text" value="2.00"/>		estimate or calculation? <input type="text" value="estimated"/>
	Period across: <input type="text" value="0.10"/>		estimate or calculation? <input type="text"/>
	Total deflection (ULS) (mm): <input type="text"/>	0.00	estimate or calculation? <input type="text"/>
	maximum interstorey deflection (ULS) (mm): <input type="text"/>		estimate or calculation? <input type="text"/>

Separations:	north (mm): <input type="text"/>	leave blank if not relevant
	east (mm): <input type="text"/>	
	south (mm): <input type="text"/>	
	west (mm): <input type="text"/>	

Non-structural elements	Stairs: <input type="text"/>	
	Wall cladding: <input type="text" value="other heavy"/>	describe <input type="text" value="Concrete Block"/>
	Roof Cladding: <input type="text" value="Metal"/>	describe <input type="text"/>
	Glazing: <input type="text" value="aluminium frames"/>	
	Ceilings: <input type="text" value="strapped or direct fixed"/>	
	Services(list): <input type="text"/>	

Available documentation	Architectural: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
	Structural: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
	Mechanical: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
	Electrical: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
	Geotech report: <input type="text" value="none"/>	original designer name/date: <input type="text"/>

Damage Site:	Site performance: <input type="text" value="Good"/>	Describe damage: <input type="text"/>
(refer DEE Table 4-2)	Settlement: <input type="text" value="none observed"/>	notes (if applicable): <input type="text"/>
	Differential settlement: <input type="text" value="none observed"/>	notes (if applicable): <input type="text"/>
	Liquefaction: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
	Lateral Spread: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
	Differential lateral spread: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
	Ground cracks: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
	Damage to area: <input type="text" value="slight"/>	notes (if applicable): <input type="text"/>

Building:	Current Placard Status: <input type="text" value="green"/>	
Along	Damage ratio: <input type="text" value="0%"/>	Describe how damage ratio arrived at: <input type="text"/>
	Describe (summary): <input type="text"/>	
Across	Damage ratio: <input type="text" value="0%"/>	$Damage_Ratio = \frac{(\%NBS\ (before) - \%NBS\ (after))}{\%NBS\ (before)}$
	Describe (summary): <input type="text"/>	
Diaphragms	Damage?: <input type="text" value="yes"/>	Describe: <input type="text"/>
CSWs:	Damage?: <input type="text" value="no"/>	Describe: <input type="text"/>
Pounding:	Damage?: <input type="text" value="no"/>	Describe: <input type="text"/>
Non-structural:	Damage?: <input type="text" value="yes"/>	Describe: <input type="text"/>

Recommendations	Level of repair/strengthening required: <input type="text" value="minor non-structural"/>	Describe: <input type="text"/>
	Building Consent required: <input type="text" value="no"/>	Describe: <input type="text"/>
	Interim occupancy recommendations: <input type="text" value="full occupancy"/>	Describe: <input type="text"/>
Along	Assessed %NBS before e'quakes: <input type="text" value="63%"/>	#### %NBS from IEP below
	Assessed %NBS after e'quakes: <input type="text" value="63%"/>	
Across	Assessed %NBS before e'quakes: <input type="text" value="100%"/>	#### %NBS from IEP below
	Assessed %NBS after e'quakes: <input type="text" value="100%"/>	

If IEP not used, please detail assessment methodology:

Location		Building Name: <input type="text" value="Division Street Housing Complex"/>	Unit No: <input type="text" value="38"/>	Street: <input type="text" value="Division"/>	Reviewer: <input type="text" value="Mary Ann Halliday"/>
Building Address: <input type="text"/>	Legal Description: <input type="text"/>				CPEng No: <input type="text" value="67073"/>
			Company: <input type="text" value="Opus International Consultants"/>		
			Company project number: <input type="text" value="6-OC336.00"/>		
			Company phone number: <input type="text"/>		
			Date of submission: <input type="text" value="5-Feb-14"/>		
			Inspection Date: <input type="text" value="22/11/2013"/>		
			Revision: <input type="text" value="1"/>		
GPS south: <input type="text" value="43"/> Degrees <input type="text" value="32"/> Min <input type="text" value="4.23"/> Sec					
GPS east: <input type="text" value="172"/> Degrees <input type="text" value="35"/> Min <input type="text" value="58.92"/> Sec					
Building Unique Identifier (CCC): <input type="text" value="PRO0547"/>			Is there a full report with this summary? <input type="text" value="yes"/>		

Site	Site slope: <input type="text" value="flat"/>	Max retaining height (m): <input type="text"/>
	Soil type: <input type="text"/>	Soil Profile (if available): <input type="text"/>
	Site Class (to NZS1170.5): <input type="text" value="D"/>	
	Proximity to waterway (m, if <100m): <input type="text"/>	If Ground improvement on site, describe: <input type="text"/>
	Proximity to cliff top (m, if < 100m): <input type="text"/>	
	Proximity to cliff base (m,if <100m): <input type="text"/>	Approx site elevation (m): <input type="text"/>

Building	No. of storeys above ground: <input type="text" value="1"/>	single storey = 1	Ground floor elevation (Absolute) (m): <input type="text"/>
	Ground floor split?: <input type="text" value="no"/>		Ground floor elevation above ground (m): <input type="text"/>
	Storeys below ground: <input type="text" value="0"/>		
	Foundation type: <input type="text" value="strip footings"/>		if Foundation type is other, describe: <input type="text"/>
	Building height (m): <input type="text" value="3.00"/>	height from ground to level of uppermost seismic mass (for IEP only) (m): <input type="text"/>	
	Floor footprint area (approx): <input type="text" value="188"/>		Date of design: <input type="text" value="1976-1992"/>
	Age of Building (years): <input type="text" value="28"/>		
	Strengthening present?: <input type="text" value="no"/>		If so, when (year)? <input type="text"/>
	Use (ground floor): <input type="text" value="multi-unit residential"/>		And what load level (%g)? <input type="text"/>
	Use (upper floors): <input type="text"/>		Brief strengthening description: <input type="text"/>
	Use notes (if required): <input type="text"/>		
	Importance level (to NZS1170.5): <input type="text" value="IL2"/>		

Gravity Structure	Gravity System: <input type="text" value="frame system"/>	
	Roof: <input type="text" value="timber truss"/>	truss depth, purlin type and cladding
	Floors: <input type="text" value="concrete flat slab"/>	slab thickness (mm)
	Beams: <input type="text" value="none"/>	overall depth x width (mm x mm)
	Columns: <input type="text" value="timber"/>	typical dimensions (mm x mm)
	Walls: <input type="text" value="non-load bearing"/>	<input type="text" value="0"/>

Lateral load resisting structure	Lateral system along: <input type="text" value="lightweight timber framed walls"/>	Note: Define along and across in detailed report!	note typical wall length (m) <input type="text"/>
	Ductility assumed, μ: <input type="text" value="2.00"/>		estimate or calculation? <input type="text" value="estimated"/>
	Period along: <input type="text" value="0.10"/>		estimate or calculation? <input type="text"/>
	Total deflection (ULS) (mm): <input type="text"/>		estimate or calculation? <input type="text"/>
	maximum interstorey deflection (ULS) (mm): <input type="text"/>		
	Lateral system across: <input type="text" value="lightweight timber framed walls"/>		note typical wall length (m) <input type="text"/>
	Ductility assumed, μ: <input type="text" value="2.00"/>		estimate or calculation? <input type="text" value="estimated"/>
	Period across: <input type="text" value="0.10"/>		estimate or calculation? <input type="text"/>
	Total deflection (ULS) (mm): <input type="text"/>		estimate or calculation? <input type="text"/>
	maximum interstorey deflection (ULS) (mm): <input type="text"/>		estimate or calculation? <input type="text"/>

Separations:	north (mm): <input type="text"/>	leave blank if not relevant
	east (mm): <input type="text"/>	
	south (mm): <input type="text"/>	
	west (mm): <input type="text"/>	

Non-structural elements	Stairs: <input type="text"/>	describe: <input type="text"/>
	Wall cladding: <input type="text" value="other heavy"/>	describe: <input type="text" value="Concrete Block"/>
	Roof Cladding: <input type="text" value="Metal"/>	
	Glazing: <input type="text" value="aluminium frames"/>	
	Ceilings: <input type="text" value="strapped or direct fixed"/>	
	Services(list): <input type="text"/>	

Available documentation	Architectural: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
	Structural: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
	Mechanical: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
	Electrical: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
	Geotech report: <input type="text" value="none"/>	original designer name/date: <input type="text"/>

Damage Site:	Site performance: <input type="text" value="Good"/>	Describe damage: <input type="text"/>
(refer DEE Table 4-2)	Settlement: <input type="text" value="none observed"/>	notes (if applicable): <input type="text"/>
	Differential settlement: <input type="text" value="none observed"/>	notes (if applicable): <input type="text"/>
	Liquefaction: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
	Lateral Spread: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
	Differential lateral spread: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
	Ground cracks: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
	Damage to area: <input type="text" value="slight"/>	notes (if applicable): <input type="text"/>

Building:	Current Placard Status: <input type="text" value="green"/>	
Along	Damage ratio: <input type="text" value="0%"/>	Describe how damage ratio arrived at: <input type="text"/>
	Describe (summary): <input type="text"/>	
Across	Damage ratio: <input type="text" value="0%"/>	$Damage_Ratio = \frac{(\%NBS\ (before) - \%NBS\ (after))}{\%NBS\ (before)}$
	Describe (summary): <input type="text"/>	
Diaphragms	Damage?: <input type="text" value="yes"/>	Describe: <input type="text"/>
CSWs:	Damage?: <input type="text" value="no"/>	Describe: <input type="text"/>
Pounding:	Damage?: <input type="text" value="no"/>	Describe: <input type="text"/>
Non-structural:	Damage?: <input type="text" value="yes"/>	Describe: <input type="text"/>

Recommendations	Level of repair/strengthening required: <input type="text" value="minor non-structural"/>	Describe: <input type="text"/>
	Building Consent required: <input type="text" value="no"/>	Describe: <input type="text"/>
	Interim occupancy recommendations: <input type="text" value="full occupancy"/>	Describe: <input type="text"/>
Along	Assessed %NBS before e'quakes: <input type="text" value="63%"/>	#### %NBS from IEP below
	Assessed %NBS after e'quakes: <input type="text" value="63%"/>	
Across	Assessed %NBS before e'quakes: <input type="text" value="100%"/>	#### %NBS from IEP below
	Assessed %NBS after e'quakes: <input type="text" value="100%"/>	

If IEP not used, please detail assessment methodology:

Location		Building Name: <input type="text" value="Division Street Housing Complex"/>	Unit No: <input type="text" value="38"/>	Street: <input type="text" value="Division"/>	Reviewer: <input type="text" value="Mary Ann Halliday"/>
Building Address: <input type="text"/>	Legal Description: <input type="text"/>				CPEng No: <input type="text" value="67073"/>
			Company: <input type="text" value="Opus International Consultants"/>		
			Company project number: <input type="text" value="6-OC336.00"/>		
			Company phone number: <input type="text"/>		
			Date of submission: <input type="text" value="5-Feb-14"/>		
			Inspection Date: <input type="text" value="22/11/2013"/>		
			Revision: <input type="text" value="1"/>		
GPS south: <input type="text" value="43"/> Degrees <input type="text" value="32"/> Min <input type="text" value="4.23"/> Sec					
GPS east: <input type="text" value="172"/> Degrees <input type="text" value="35"/> Min <input type="text" value="58.92"/> Sec					
Building Unique Identifier (CCC): <input type="text" value="PRO0547"/>			Is there a full report with this summary? <input type="text" value="yes"/>		

Site	Site slope: <input type="text" value="flat"/>	Max retaining height (m): <input type="text"/>
	Soil type: <input type="text"/>	Soil Profile (if available): <input type="text"/>
	Site Class (to NZS1170.5): <input type="text" value="D"/>	
	Proximity to waterway (m, if <100m): <input type="text"/>	If Ground improvement on site, describe: <input type="text"/>
	Proximity to cliff top (m, if < 100m): <input type="text"/>	
	Proximity to cliff base (m,if <100m): <input type="text"/>	Approx site elevation (m): <input type="text"/>

Building	No. of storeys above ground: <input type="text" value="1"/>	single storey = 1	Ground floor elevation (Absolute) (m): <input type="text"/>
	Ground floor split?: <input type="text" value="no"/>		Ground floor elevation above ground (m): <input type="text"/>
	Storeys below ground: <input type="text" value="0"/>		
	Foundation type: <input type="text" value="strip footings"/>		if Foundation type is other, describe: <input type="text"/>
	Building height (m): <input type="text" value="3.00"/>	height from ground to level of uppermost seismic mass (for IEP only) (m): <input type="text"/>	
	Floor footprint area (approx): <input type="text" value="132"/>		Date of design: <input type="text" value="1976-1992"/>
	Age of Building (years): <input type="text" value="28"/>		
	Strengthening present?: <input type="text" value="no"/>		If so, when (year)? <input type="text"/>
	Use (ground floor): <input type="text" value="multi-unit residential"/>		And what load level (%g)? <input type="text"/>
	Use (upper floors): <input type="text"/>		Brief strengthening description: <input type="text"/>
	Use notes (if required): <input type="text"/>		
	Importance level (to NZS1170.5): <input type="text" value="IL2"/>		

Gravity Structure	Gravity System: <input type="text" value="frame system"/>	
	Roof: <input type="text" value="timber truss"/>	truss depth, purlin type and cladding: <input type="text"/>
	Floors: <input type="text" value="concrete flat slab"/>	slab thickness (mm): <input type="text"/>
	Beams: <input type="text" value="none"/>	overall depth x width (mm x mm): <input type="text"/>
	Columns: <input type="text" value="timber"/>	typical dimensions (mm x mm): <input type="text"/>
	Walls: <input type="text" value="non-load bearing"/>	0: <input type="text"/>

Lateral load resisting structure	Lateral system along: <input type="text" value="lightweight timber framed walls"/>	Note: Define along and across in detailed report!	note typical wall length (m): <input type="text"/>
	Ductility assumed, μ: <input type="text" value="2.00"/>		estimate or calculation? <input type="text" value="estimated"/>
	Period along: <input type="text" value="0.10"/>		estimate or calculation? <input type="text"/>
	Total deflection (ULS) (mm): <input type="text"/>	0.00	estimate or calculation? <input type="text"/>
	maximum interstorey deflection (ULS) (mm): <input type="text"/>		
	Lateral system across: <input type="text" value="lightweight timber framed walls"/>		note typical wall length (m): <input type="text"/>
	Ductility assumed, μ: <input type="text" value="2.00"/>		estimate or calculation? <input type="text" value="estimated"/>
	Period across: <input type="text" value="0.10"/>	0.00	estimate or calculation? <input type="text"/>
	Total deflection (ULS) (mm): <input type="text"/>		estimate or calculation? <input type="text"/>
	maximum interstorey deflection (ULS) (mm): <input type="text"/>		estimate or calculation? <input type="text"/>

Separations:	north (mm): <input type="text"/>	leave blank if not relevant
	east (mm): <input type="text"/>	
	south (mm): <input type="text"/>	
	west (mm): <input type="text"/>	

Non-structural elements	Stairs: <input type="text"/>	
	Wall cladding: <input type="text" value="other heavy"/>	describe: <input type="text" value="Concrete Block"/>
	Roof Cladding: <input type="text" value="Metal"/>	describe: <input type="text"/>
	Glazing: <input type="text" value="aluminium frames"/>	
	Ceilings: <input type="text" value="strapped or direct fixed"/>	
	Services(list): <input type="text"/>	

Available documentation	Architectural: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
	Structural: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
	Mechanical: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
	Electrical: <input type="text" value="none"/>	original designer name/date: <input type="text"/>
	Geotech report: <input type="text" value="none"/>	original designer name/date: <input type="text"/>

Damage	Site performance: <input type="text" value="Good"/>	Describe damage: <input type="text"/>
Site: (refer DEE Table 4-2)	Settlement: <input type="text" value="none observed"/>	notes (if applicable): <input type="text"/>
	Differential settlement: <input type="text" value="none observed"/>	notes (if applicable): <input type="text"/>
	Liquefaction: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
	Lateral Spread: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
	Differential lateral spread: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
	Ground cracks: <input type="text" value="none apparent"/>	notes (if applicable): <input type="text"/>
	Damage to area: <input type="text" value="slight"/>	notes (if applicable): <input type="text"/>

Building:	Current Placard Status: <input type="text" value="green"/>	
Along	Damage ratio: <input type="text" value="0%"/>	Describe how damage ratio arrived at: <input type="text"/>
	Describe (summary): <input type="text"/>	
Across	Damage ratio: <input type="text" value="0%"/>	$Damage_Ratio = \frac{(\%NBS\ (before) - \%NBS\ (after))}{\%NBS\ (before)}$
	Describe (summary): <input type="text"/>	
Diaphragms	Damage?: <input type="text" value="yes"/>	Describe: <input type="text"/>
CSWs:	Damage?: <input type="text" value="no"/>	Describe: <input type="text"/>
Pounding:	Damage?: <input type="text" value="no"/>	Describe: <input type="text"/>
Non-structural:	Damage?: <input type="text" value="yes"/>	Describe: <input type="text"/>

Recommendations	Level of repair/strengthening required: <input type="text" value="minor non-structural"/>	Describe: <input type="text"/>
	Building Consent required: <input type="text" value="no"/>	Describe: <input type="text"/>
	Interim occupancy recommendations: <input type="text" value="full occupancy"/>	Describe: <input type="text"/>
Along	Assessed %NBS before e'quakes: <input type="text" value="63%"/>	#### %NBS from IEP below
	Assessed %NBS after e'quakes: <input type="text" value="63%"/>	
Across	Assessed %NBS before e'quakes: <input type="text" value="100%"/>	#### %NBS from IEP below
	Assessed %NBS after e'quakes: <input type="text" value="100%"/>	

If IEP not used, please detail assessment methodology:



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