Christchurch City Council

Akaroa Court House PRO 3635-005

Detailed Engineering Evaluation

Quantitative Assessment Report

Christchurch City Council

Akaroa Court House

Quantitative Assessment Report

71 Rue Lavaud, Akaroa

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Akaroa Court House
PRO 3635-005

Detailed Engineering Evaluation
Quantitative Report – SUMMARY
Final V2

71 Rue Lavaud, Akaroa

Background

This is a summary of the quantitative assessment report for the Akaroa Court House located at 71 Rue Lavaud, Akaroa, and is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011, visual inspection on 12 April 2012, intrusive investigation on 24 September 2012 and available drawings.

Key Damage Observed

- Sagging timber bearer below where the former central fireplace / chimney was located.
- Degrading weatherboard adjacent to the south east entrance.
- Degrading internal timber match lining below the east elevation window.

Critical Structural Weaknesses

Although there are no significant CSW's for this building, the poor condition and the lack of lateral bracing to the substructure may result in a partial failure of the foundation in the event of a significant earthquake shaking causing significant lean to the building.

Indicative Building Strength (from quantitative assessment)

Based on the information available, and from undertaking a quantitative assessment, the buildings seismic capacity has been assessed to be 73 %NBS.
Although the substructure has a capacity of less than 33%NBS, the building is not considered to be an earthquake risk or earthquake prone in accordance to the Building Act 2004 because the building structure is expected to remain intact in the event the substructure fails.

Recommendation

a. As a matter of priority, replace or upgrade existing substructure with a foundation system of sufficient lateral resistance.

b. Repair sagging bearer below the former fireplace; and investigate and repair as necessary the adjacent structural members.

Contents

1 Introduction

Opus International Consultants Limited (Opus) has been engaged by Christchurch City Council (CCC) to undertake a detailed seismic assessment of the Akaroa Court House located at 71 Rue Lavaud, Akaroa following the M6.3 Christchurch earthquake on 22 February 2011.

This report is a Stage Two quantitative assessment of the building structure, and is based on the qualitative and quantitative procedures detailed in the Detailed Engineering Evaluation Procedure (DEEP) document (draft) issued by the Structural Engineering Society (SESOC) on 19 July 2011 [3].

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 2006. This policy was amended immediately following the Darfield Earthquake on 4 September 2010.

The 2010 amendment 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
Low Risk Building	A or B	Low	Above 67	Acceptable (improvement may be desirable)
Moderate Risk Building	B or C	Moderate	34 to 66	Acceptable legally. Improvement recommended
High Risk Building	D or E	High	33 or lower	Unacceptable (Improvement required under Act)

Improvement of Structural Performance	
Legal Requirement	NZSEE Recommendation
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
	Not recommended. Acceptable only in exceptional circumstances
Unacceptable	Unacceptable

Figure 1: NZSEE Risk Classifications Extracted from Table 2.2 of the NZSEE 2006 AISPBE Guidelines

Table 1 below compares the percentage NBS to the relative risk of the building failing in a seismic event with a 10% risk of exceedance in 50 years (i.e. 0.2% in the next year).

Table 1: %NBS compared to relative risk of failure

Percentage of New Building Standard (%NBS)	Relative Risk (Approximate)
>100	<1 time
80-100	1-2 times
67-80	2-5 times
33-67	5-10 times
20-33	10-25 times
<20	>25 times

3.1 Minimum and Recommended Standards

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

3.1.1 Occupancy

The Canterbury Earthquake Order[1] in Council 16 September 2010, modified the meaning of "dangerous building" to include buildings that were identified as being EPB's. As a result of this, we would expect such a building would be issued with a Section 124 notice, by the Territorial Authority, or CERA acting on their behalf, once they are made aware of our assessment. Based on

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

information received from CERA to date and from the DBH guidance document dated 12 June 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.

4 Background Information

4.1 Building Description

The Akaroa Court House, located within the Akaroa Museum complex at 71 Rue Lavaud, Akaroa, was completed in 1880 and was used as a court house until 1979. The building is Protected under the Banks Peninsula District Plan and registered as a Category II historic place, under the provisions of the Historic Places Act, 1993.

The building is a single storey timber structure which consists of a courtroom with an annex attached to the south elevation. The courtroom is presently an exhibition gallery, while the annex is being used as a storage area.

The courtroom building has corrugated steel gable roof while the annex has a hip roof, also of corrugated steel. The external finish is timber weatherboard and the interior walls and ceilings have timber match lining finish. The overall building is approximately 11m wide by 13m long, and the height of the courtroom roof apex is 7.2m while the annex roof is 5.3m high.

A major alteration was undertaken in 1984 where the building's original timber piles were replaced with in-situ concrete piles. At the same time, fireplaces and chimneys were also removed.

The Court House fronts Rue Lavaud and is predominantly west facing. For the purpose of this report, we refer to the direction parallel to Rue Lavaud as north-south (or transverse) and the direction parallel to Rue Balguerie as east-west (or longitudinal).

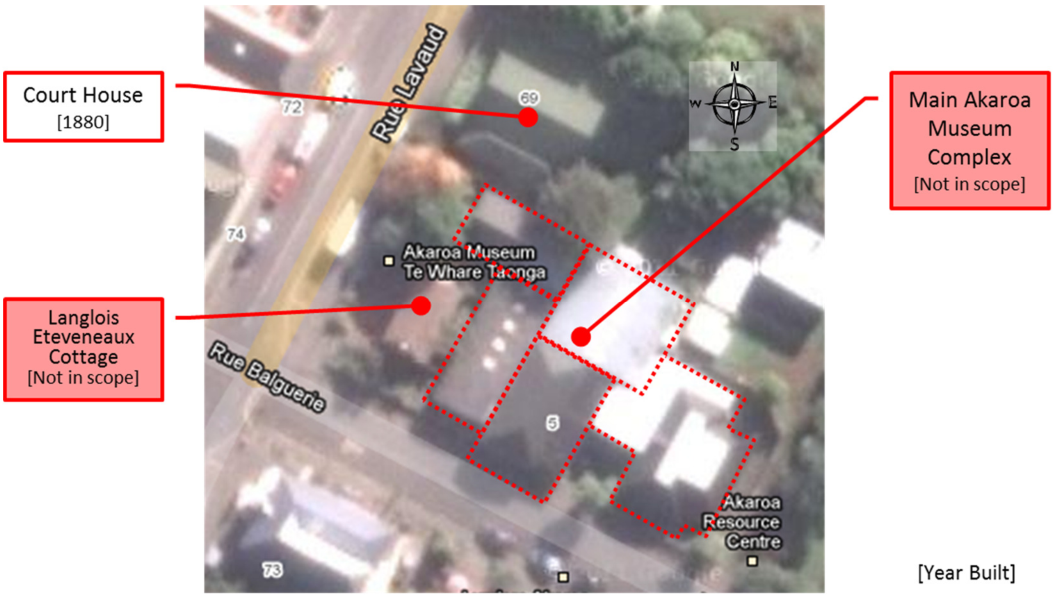


Figure 2: Akaroa Museum Site Layout

4.2 Gravity Load Resisting System

The courtroom roof gravity loads are resisted by transverse 115x50mm timber rafters at 450mm centres supported on a perimeter timber framed walls. There are also 100x25mm collar ties to the rafters at approximately mid-height; and 140x25 hangers supporting the 130x50mm ceiling joists at midspan. The annex roof gravity loads are resisted by transverse 120x45mm timber rafters tied at the base with 130x50mm timber ceiling joists, and supported on perimeter timber framed walls.

4.3 Lateral Load Resisting System

The lateral load resisting system in both principal directions are the perimeter and internal timber framed walls acting as bracing walls. The walls are assumed to be constructed with continuous let-in diagonal timber braces, which was a typical timber construction practice at the time. An overview of the key lateral resisting elements is as shown is Figure 3 below.

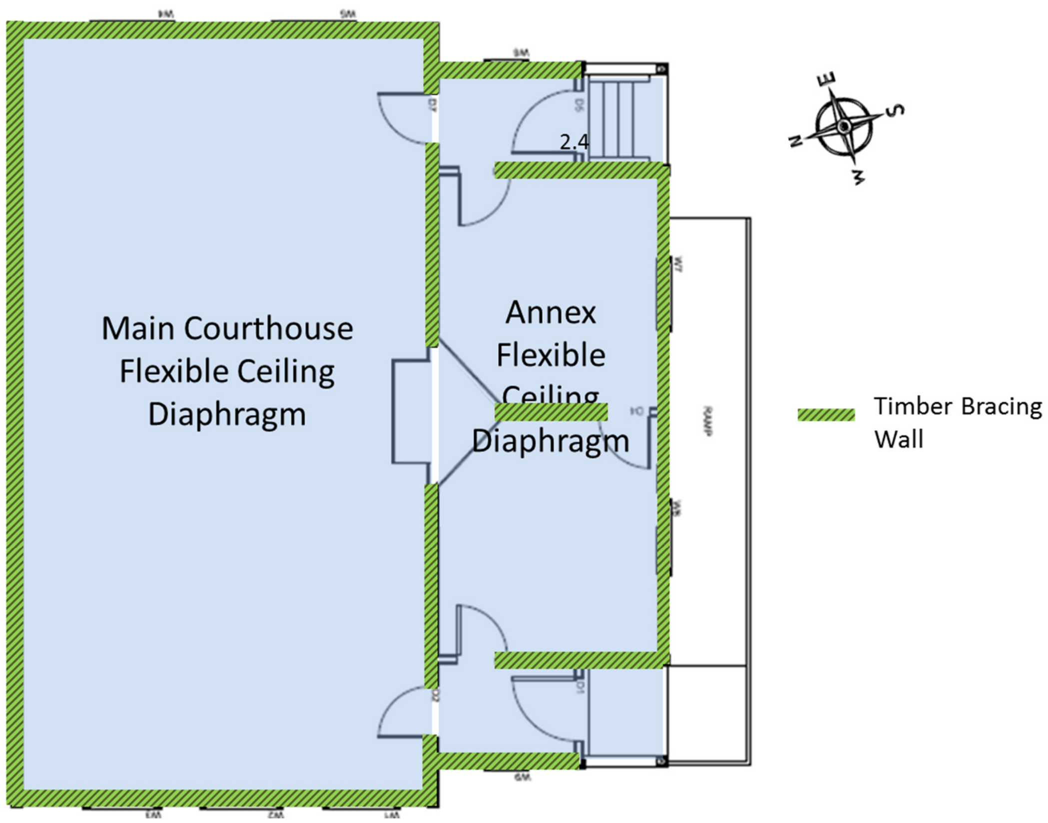


Figure 3: Building Layout and Location of Timber Bracing Wall

4.4 Foundation

The timber floor joists and external walls are supported on timber bearers that span between 200mm square in-situ concrete piles. The bearers sit on damp proof membrane on top of the concrete piles and do not appear to be fixed to the piles. The lightly reinforced piles (two 12mm diameter reinforcing bars) are embedded in approximately 400mm square shallow postholes (with maximum depth of approximately 300mm).

There is no evidence of lateral bracing in the substructure.

4.5 Original Documentation

Akaroa Court House Building basic layout plan and elevation drawings (reference no. CP501638) was provided by CCC. The drawing shows some basic plan dimensions and elevation views of the building. See Appendix 2 - Drawing.

5 Survey

5.1 Post 22 February 2011 Rapid Assessment

An engineer from Structex undertook a Level 2 assessment of the building on 21 June 2011.

5.2 Further Inspections

A further detailed inspection was undertaken by an Opus engineer on 12 April 2012 for the purpose of this detailed engineering evaluation. An intrusive site investigation was subsequently requested and carried out on 24 September 2012.

6 Damage Assessment

The following damage has been noted:

6.1 Roofing

No observed earthquake related damage. A minor crack to a courtroom roof timber collar was noted. See Photo 2 in Appendix 1.

6.2 Load Bearing Wall

No observed earthquake related damage. A minor crack to the corner of door jamb in the annex was noted. See Photo 3 in Appendix 1.

6.3 Flooring

No observed earthquake related damage to the timber flooring. However, there was a timber bearer sagging significantly below where the former central fireplace/chimney was located. See Photo 4 in Appendix 1. The bearer at this location appeared to be spanning longer than average spacing of the piles. This appears to be the likely cause of the sagging. Furthermore, there is an existing air conditioning unit located directly above this location. The vertical acceleration due to the recent earthquake may have worsened the condition.

Due to constrained access at the time of investigation, it could not be determined if there was any cracking to the bearer or surrounding joists. Further investigation is recommended, prior to re-occupying the building to establish the extent of the damage.

6.4 Foundation

Most of the piles were wrapped in cardboard formwork used in the construction of the in-situ concrete piles. For those concrete piles that could be visually inspected, no major earthquake related damage was observed. However, they showed signs of serious honeycombing due to the concrete not being well vibrated when formed. Some of the reinforcement has no concrete cover and are subject to continuous corrosion. See Photo 5 in Appendix 1.

Due to the poor condition of the existing piles and the lack of lateral bracing capacity (as described further in Section 8), it is recommended that the entire foundation to be upgraded or replaced to a foundation system that has a capacity sufficient for the design loads as a matter of priority .

6.5 Non Structural

- Degrading weatherboard adjacent to the south east entrance. See Photo 6 in Appendix 1.
- Signs of degrading internal timber match lining below the east elevation window. See Photo 7 in Appendix 1.

7 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.

7.1 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.

Although there are no significant CSW's for this building, the poor condition and the lack of lateral bracing to the substructure may result in a partial failure of the foundation in the event of a significant earthquake shaking, causing significant lean to the building. This is especially true at the west section where the pile height is 400mm, compared with 150mm to the east.

7.2 Quantitative Assessment Methodology

The equivalent static load method was used to analyse the forces in the key components of the building's lateral load resisting system. The parameters used for the detailed analyses are as follows:

7.2.1 Seismic coefficient parameters

The seismic design parameters based on current design requirements from NZS1170.5:2004 [1] and the NZBC clause B1 for this building complex are:

- Site soil class C, clause 3.1.3 NZS 1170:2002
- Site hazard factor, Z=0.3, B1/VM1 clause 2.2.14B
- Return period factor R_{u} = 1.0 (from table 3.5, NZS 1170.5:2004 [1] with a 50 year design life and based on an Importance Level 2).

7.2.2 Expected ductility factor

Based on our assessment of the structural drawings and using guidance from the timber structures standard NZS3603:1993, our estimate for the expected maximum structural ductility factor for the structure in both orthogonal directions is 1.25.

7.3 Limitations and Assumptions in Results

Our analysis and assessment is based on an assessment of the building in its undamaged state. 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.

7.4 Quantitative Analysis Methodology

The seismic force arising from the roof mass is assumed to be distributed to the perimeter and internal timber wall frame based on their respective tributary area. This is a reasonable assumption considering the flexible horizontal diaphragm created by the timber match lining ceiling within the courtroom and the annex.

7.5 Quantitative Assessment Results

Based on the criteria as listed above, the estimated structural performance of the respective primary structural load resisting elements is as follows.

Table 2: Summary of Structural Performance

Structural Element / System	Failure mode or description of limiting criteria based on elastic capacity of critical element	% NBS (based on calculated capacity)
North-South Direction		
Perimeter timber bracing wall along the east & west elevations	Timber bracing wall resisting lateral load in north-south direction. The failure mode is likely to be ductile failure of the nail connection.	73%
Foundation concrete piles, especially along the west elevation	Lack of bracing capacity to resist lateral load in east-west direction. The failure mode is likely to be partial failure of some piles, causing differential settlement to the building structure.	<33%
East - West Direction		
Internal timber bracing wall between the courtroom and the annex	Timber bracing wall resisting lateral load in east-west direction. The failure mode is likely to be ductile failure of the nail connection.	85 %

8 Discussion of Results

Based on the analysis, the building has a minimum seismic capacity of approximately 73% NBS. This is limited by the seismic capacity of the perimeter timber bracing walls along the west elevation resisting lateral loads in the north-south direction.

The existing concrete foundation appears to be designed to resist gravity load only and has little or no lateral resisting capacity. This is further exacerbated by the poor construction and the lack of structural fixing between the timber bearers and the piles. Therefore, the seismic capacity of the substructure is assessed to be less than 33%. In the event of a significant earthquake shaking, some of the concrete piles near the west elevation might fail, causing the building to lean significantly. However, the building is expected to remain intact. Therefore, this building is not considered to be earthquake risk or earthquake prone in accordance with the Building Act 2004.

9 Summary of Geotechnical Appraisal

9.1 Regional Geology

The published geological map of the area, (Geology of the Christchurch Area 1:250,000, Forsyth, Barrell and Jongens, 2008) indicates the site is located on grey river alluvium beneath plains or low-level terraces.

9.2 Peak Ground Acceleration

Interpolation of United States Geological Survey (USGS) Shakemap: South Island of New Zealand (22 Feb, 2011) indicates that this location has likely experienced a Horizontal Peak Ground Acceleration (PGA) of approximately 0.05g to 0.1 g during the 22nd February 2011 Earthquake. Estimated PGA's have been cross checked with Geonets' Modified Mercalli intensity scale observations.

9.3 Expected Ground Conditions

Two ECan borehole logs are located within 120m north of the Akaroa Museum which indicates well graded, tightly packed Gravel with some silt to a depth of 4.90m. Refer to ECan borehole log's attached. The ground conditions at the site are expected to be of a similar alluvium deposit.

9.4 Site Observation

The building was inspected by an Opus Structural Engineer on the 12th April 2012. The following observations were made from photographs taken during the site visit.

- This building is located on a gently sloping grassed site.
- A small creek is located 70m north east of the building.
- The concrete footpath to the south east of the building appears to have heaved by up to 20mm at two locations (See Photo 8 of Appendix 1).

- There does not appear to have been any liquefaction in the vicinity of the building.
- The Akaroa Court House building appears to be founded on square concrete piles at regular grid (See Photo 9 of Appendix 1). Structex report dated 19th May 2011 identified deterioration of the pile condition under exterior walls. Opus Structural Engineer has undertaken invasive investigation to assess pile condition and pile footing type and depth. The results of the investigation are presented in Section 6.4 of this report.

9.5 Conclusions and Discussion

The existing foundations of the Akaroa Court House building appear to have performed satisfactorily in the recent seismic events. No liquefaction has been observed on site. The heave that appears to have occurred to the concrete footpath on the south east corner of the building is most likely to have occurred during construction. Due to the likely presence of silty gravels at shallow depths, the risk of lateral spreading and liquefaction induced settlement is considered low. No further geotechnical testing is recommended at this location.

10 Conclusions

a. The building superstructure has seismic capacity of 73% NBS.

b. Although the substructure has a seismic capacity of less than 33%, the building is not considered to be an earthquake risk or earthquake prone in accordance to the Building Act 2004 because the building structure is expected to remain intact in the event the substructure fails.

11 Recommendations

a. As a matter of priority, replace or upgrade existing substructure with a foundation system of sufficient lateral resistance.

b. Repair sagging bearer below the former fireplace; and investigate and repair as necessary the adjacent structural members.

12 Limitations

- This report is based on an inspection of the structure of the building and focuses on the structural damage resulting from the Canterbury Earthquakes and aftershocks only. Some non-structural damage is described but this is not intended to be a complete list of damage to non-structural items.
- Apart from the intrusive investigations as mentioned in this report, our inspections have been visual and non-intrusive, and no linings or finishes were removed to expose structural elements. Calculations have been limited to comparisons of seismic coefficients. No other analyses have been performed. 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 CCC to assist with assessing the remedial works required for their buildings and facilities. It is not intended for any other party or purpose.

13 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.

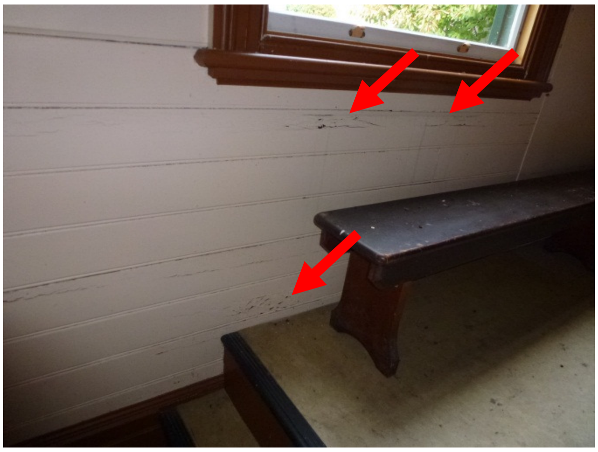
[6] DBH (2012), *Guidance for engineers assessing the seismic performance of non-residential and multi-unit residential buildings in greater Christchurch*, Department of Building and Housing, June 2012

Appendix 1 - Photographs

No.	Item description	Photo
1.	General building elevations North West elevation South elevation East elevation	  

2.	Minor crack to timber collar at courtroom roof framing.	
3.	Minor split at corner of door jamb in annex	
4.	Sagging bearer below former internal fireplace / chimney	

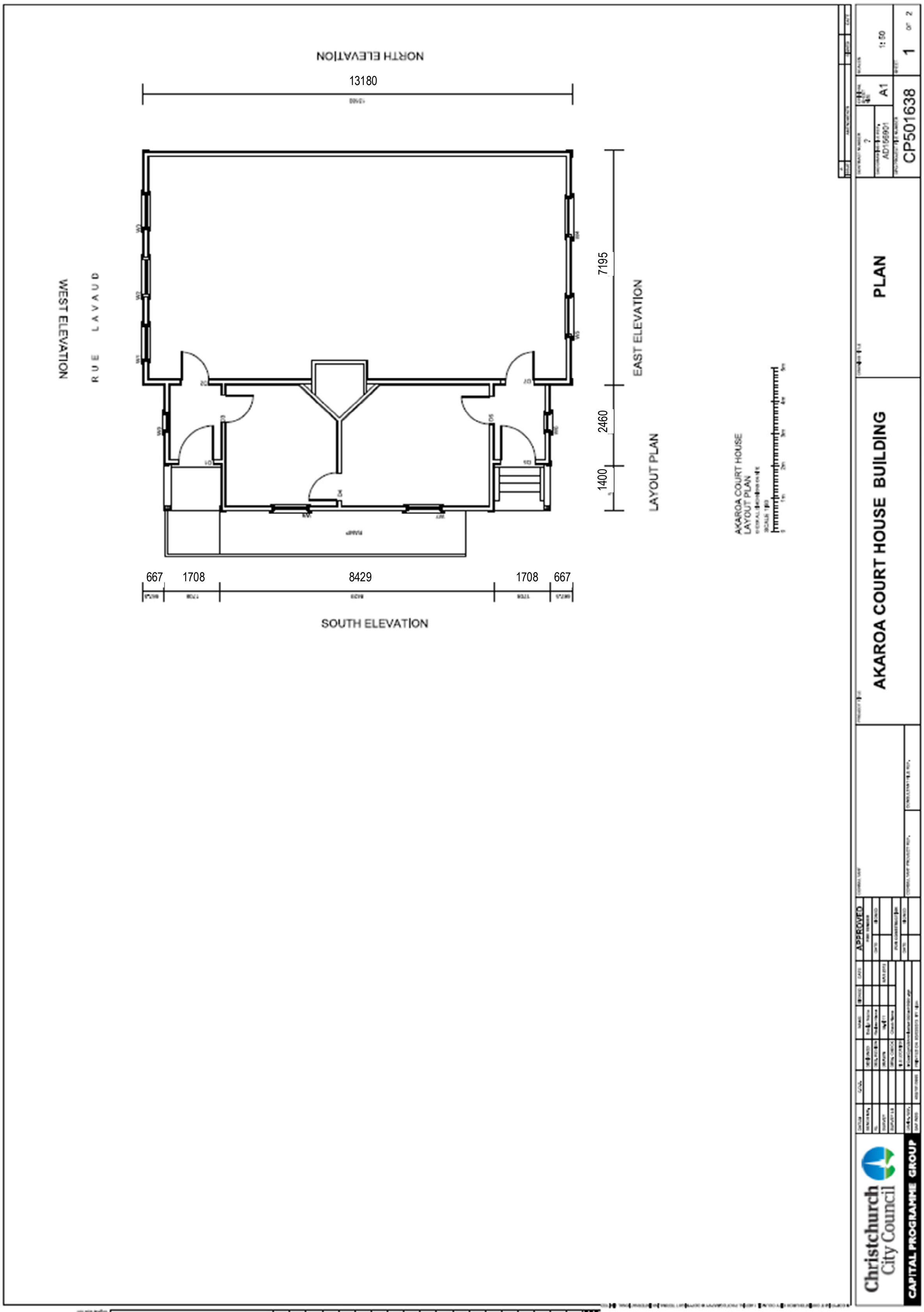
5.	Exposed reinforcing bar and honeycombing to concrete piles	  

6.	Rotting weatherboard adjacent to south east corner entrance	
7.	Decaying timber matchlining below the east elevation window	
8.	Up to 20mm of apparent ground heave on the concrete footpath	

9.	Concrete piles below timber flooring	

Appendix 2 - Drawings


EAST ELEVATION
NORTH ELEVATION
SOUTH ELEVATION
WEST ELEVATION
AKAROA COURT HOUSE
LAYOUT ELEVATIONS
AKAROA COURT HOUSE BUILDING
ELEVATIONS
A1
1:50
CP501638
2 of 2
APPROVED
Christchurch City Council
CAPITAL PROGRAMME GROUP


NORTH ELEVATION
13180
WEST ELEVATION
RUE LAVAUD
7195
2460
1400
EAST ELEVATION
LAYOUT PLAN
667
1708
8429
1708
667
SOUTH ELEVATION
AKAROA COURT HOUSE BUILDING
PLAN
APPROVED
A1
1:50
CP501638
1
Christchurch City Council
CAPITAL PROGRAMME GROUP

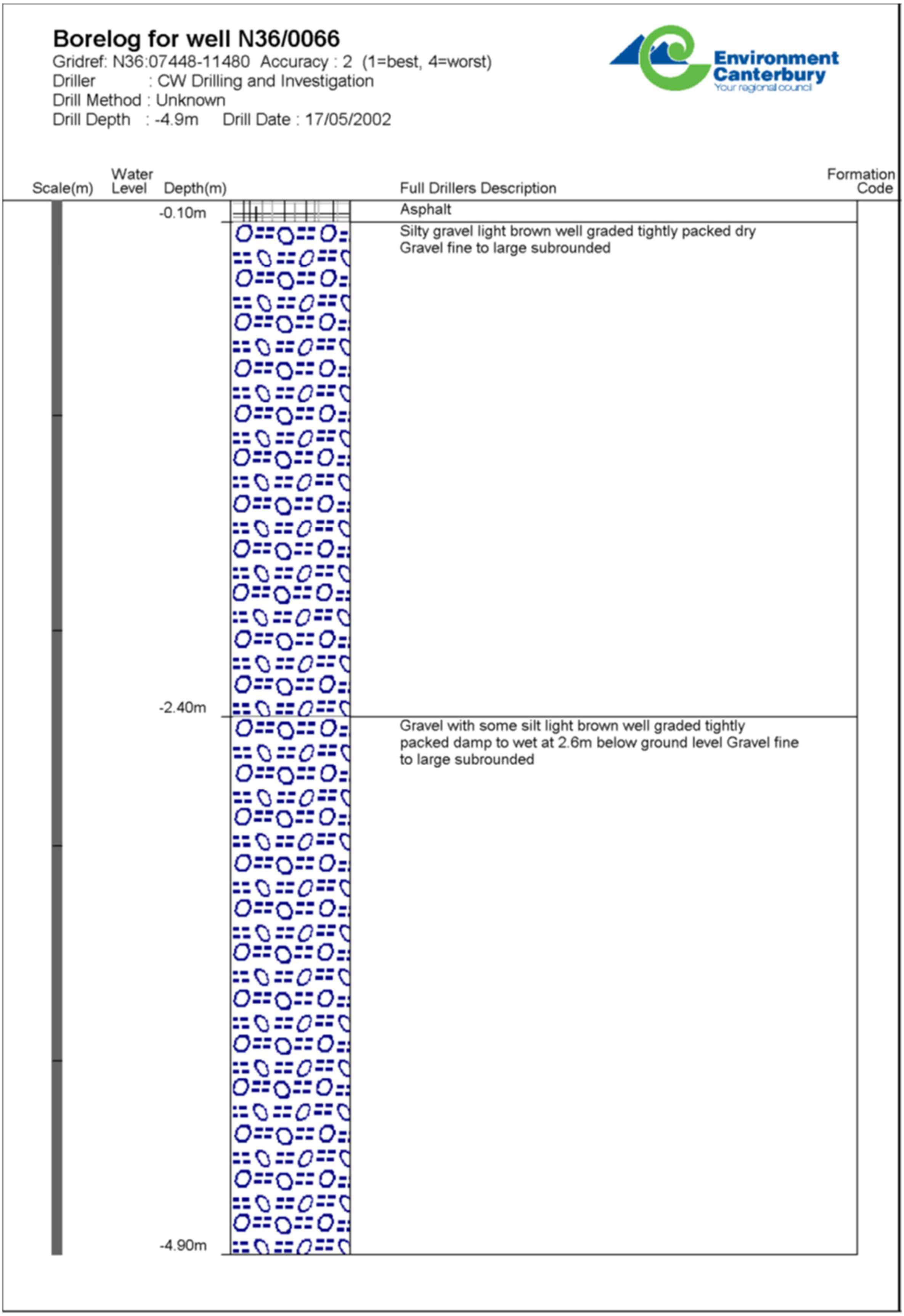
Appendix 3 - Environment Canterbury Borehole Logs

Borelog for well N36/0065

Gridref: N36:07450-11490 Accuracy : 3 (1=best, 4=worst)
Driller : CW Drilling and Investigation
Drill Method : Unknown
Drill Depth : -4.8m Drill Date : 16/05/2002

Environment Canterbury
Your regional council

Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
		-0.10m	Asphalt	
		-2.20m	Silty gravel light brown well graded tightly packed dry Gravel fine to large subrounded	
		-4.80m	Gravel with some silt light brown well graded tightly packed damp to wet at 2.4m below ground level Gravel fine to large subrounded	



Borelog for well N36/0066

Gridref: N36:07448-11480 Accuracy : 2 (1=best, 4=worst)
Driller : CW Drilling and Investigation
Drill Method : Unknown
Drill Depth : -4.9m Drill Date : 17/05/2002

Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
		-0.10m	Asphalt	
		-2.40m	Silty gravel light brown well graded tightly packed dry Gravel fine to large subrounded	
		-4.90m	Gravel with some silt light brown well graded tightly packed damp to wet at 2.6m below ground level Gravel fine to large subrounded	

Appendix 4 – CERA DEE Data Sheet

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Akaroa Museum - Old Court House	Reviewer:	Jan Stanway
Building Address:	Unit: / No: 71 / Street: Rue Lavaud, Akaroa	CPEng No:	222291
Legal Description:		Company:	Opus International Consultants Ltd
		Company project number:	6-QUCCC.78
		Company phone number:	03-3635400
GPS south: (Degrees / Min / Sec)		Date of submission:	Mar-14
GPS east:		Inspection Date:	12-Apr-12
		Revision:	Final V2
Building Unique Identifier (CCC):	PRO 3635-005	Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:	gravel	Soil Profile (if available):	
Site Class (to NZS1170.5):	C		
Proximity to waterway (m, if <100m):	70	If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	0.00

Building

No. of storeys above ground:	1 (single storey = 1)	Ground floor elevation (Absolute) (m):	7.20
Ground floor split?	no	Ground floor elevation above ground (m):	0.40
Storeys below ground	0		
Foundation type:	other (describe)	if Foundation type is other, describe:	cast insitu piles on shallow postholes
Building height (m):	7.20	height from ground to level of uppermost seismic mass (for IEP only) (m):	5
Floor footprint area (approx):	140		
Age of Building (years):	132	Date of design:	Pre 1935
Strengthening present?	no	If so, when (year)?	
		And what load level (%g)?	
Use (ground floor):	public	Brief strengthening description:	
Use (upper floors):			
Use notes (if required):	museum gallery		
Importance level (to NZS1170.5):	IL2		

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	corrugate steel on 20mm timber sarking on timber rafters
Floors:	timber	joist depth and spacing (mm)	200x50 @ 450 crs
Beams:	timber	type	
Columns:			
Walls:			

Lateral load resisting structure

Note: Define along and across in detailed report!

Lateral system along:	lightweight timber framed walls		note typical wall length (m)	13
Ductility assumed, μ:	1.25			
Period along:	0.20	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	lightweight timber framed walls		note typical wall length (m)	1.5
Ductility assumed, μ:	1.25			
Period across:	0.16	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	

Separations:

leave blank if not relevant

north (mm):	
east (mm):	0
south (mm):	0
west (mm):	

Non-structural elements

Stairs:			
Wall cladding:	other light	describe	weatherboard
Roof Cladding:	Metal	describe	corrugated steel
Glazing:	timber frames		
Ceilings:	strapped or direct fixed		timber match lining
Services(list):			

Available documentation

Architectural	partial	original designer name/date	CCC / Mar 2012
Structural	none	original designer name/date	
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	partial	original designer name/date	Opus / Oct 12

Damage

Site: (refer DEE Table 4-2)

Site performance:		Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	none apparent	notes (if applicable):	
Lateral Spread:	none apparent	notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

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

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

Recommendations

Level of repair/strengthening required:	minor structural	Describe:	
Building Consent required:		Describe:	
Interim occupancy recommendations:	full occupancy	Describe:	

Along	Assessed %NBS before:	85%	##### %NBS from IEP below
	Assessed %NBS after:	85%	
Across	Assessed %NBS before:	73%	##### %NBS from IEP below
	Assessed %NBS after:	73%	