Le Bons Bay Community Hall

BU 3597-001 EQ2

Detailed Engineering Evaluation

Quantitative Report

Christchurch City Council

Christchurch City Council

Le Bons Bay Community Hall

Detailed Engineering Evaluation Quantitative Report

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Status: Final

Le Bons Bay Community Hall Building
BU 3597-001 EQ2

Detailed Engineering Evaluation
Quantitative Report - SUMMARY
Final

Le Bons Bay, Banks Peninsula

Background
This is a summary of the quantitative report for the building structure, and is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011, visual inspections on 18 January 2012, available drawings and calculations.

Key Damage Observed
There is no evidence of any seismic damage having occurred to the building.

Critical Structural Weaknesses
No critical structural weaknesses have been identified for this building.

Indicative Building Strength
Based on the information available, and from undertaking a quantitative assessment, the buildings original capacity has been assessed to be in the order of 46% NBS across the building and 63% NBS along the building and a post-earthquake capacity in the order of 46% NBS across the building and 63% NBS along the building.

The building has been assessed to have a seismic capacity in the order of 46% NBS and is therefore not classed as earthquake prone.

Recommendations
It is recommended that:

a) A strengthening scheme be developed to increase the overall capacity of the building to at least 67% NBS

Contents

1 Introduction

Opus International Consultants Limited has been engaged by Christchurch City Council (CCC) to undertake a detailed seismic assessment of the Le Bons Bay Community Hall building, located at Le Bons Bay, Banks Peninsula, following the M6.3 Christchurch earthquake on 22 February 2011.

The purpose of the assessment is to determine if the building is 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) on 19 July 2011.

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.

Any building with a capacity of less than 34% of new building standard (including consideration of critical structural weaknesses) will need to be strengthened to a target of 67% as required by 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).

Section 115 – Change of Use

This section requires that the territorial authority (in this case Christchurch City Council (CCC)) 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 CCC as being 67% of the strength of an equivalent new building. 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.

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:

- 36% increase in the basic seismic design load for Christchurch (Z factor increased from 0.22 to 0.3);
- Increased serviceability requirements.

2.5 Institution of Professional Engineers New Zealand (IPENZ) Code of Ethics

One of the core ethical values of professional engineers in New Zealand is the protection of life and safeguarding of people. The IPENZ Code of Ethics requires that:

Members shall recognise the need to protect life and to safeguard people, and in their engineering activities shall act to address this need.

1.1 Giving Priority to the safety and well-being of the community and having regard to this principle in assessing obligations to clients, employers and colleagues.

1.2 Ensuring that responsible steps are taken to minimise the risk of loss of life, injury or suffering which may result from your engineering activities, either directly or indirectly.

All recommendations on building occupancy and access must be made with these fundamental obligations in mind.

3 Earthquake Resistance Standards

For this assessment, the building's earthquake resistance is compared with the current New Zealand Building Code requirements for a new building constructed on the site. This is expressed as a percentage of new building standard (%NBS). The loadings are in accordance with the current earthquake loading standard NZS1170.5 [1].

A generally accepted classification of earthquake risk for existing buildings in terms of %NBS that has been proposed by the NZSEE 2006 [2] is presented in Figure 1 below.

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

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

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). It is noted that the current seismic risk in Christchurch results in a 6% risk of exceedance 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

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

they are made aware of our assessment. Based on information received from CERA to date, 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/Christchurch City Council 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 Building Description

4.1 General

The Le Bons Bay Community Hall building is a single storey timber framed structure with a timber weatherboard cladding and lightweight corrugated iron roof. The building sits on a concrete perimeter foundation and circular concrete tapered piles.

The building is situated on a flat sandy section. The building is approximately 16.1m long in the north-south direction and approximately 9.8m wide in the east-west direction. The building consists of bathrooms at the south end, an office and kitchen on the east side, and a main hall on the west side of the building. The building has a 1.8m concrete veranda extending around the east and north sides of the building. The apex of the building is approximately 5.2m off the ground and the building has wall stud heights of 2.4m to 3.4m.

The building age is unknown, but is expected to have been constructed approximately 35 to 40 years ago.

4.2 Gravity Load Resisting System

The roof consists of two timber framed monoslope roofs at different levels, with exposed rafters at 1.2m centres.

The walls are timber framed with stud heights varying between 2.4-3.4m and a stud size of 100mm x 50mm. The stud spacing is unknown, but is assumed to be 600mm.

The building sits on a concrete perimeter beam and tapered concrete pile foundations.

The subfloor consists of a suspended timber floor with tongue in groove flooring.

4.3 Seismic Load Resisting System

The main lateral support for the building is provided by the GIB lining to the walls.

The sub floor bracing is provided by the concrete perimeter beam under the exterior walls.

5 Survey

The building currently has a green placard (not issued as part of this inspection and authorised by an engineer working for a company other than Opus International Consultants).

Copies of the following drawings were referred to as part of the assessment:

- One architectural sketch of the building completed by Opus Architecture, dated 22 February 2012.

No copies of the design calculations or structural drawings have been obtained for this building.

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

6 Damage Assessment

The building does not appear to have suffered any damage as a result of the recent earthquake events. A crack was observed in the concrete step on the veranda, however this appears to be historic damage.

7 General Observations

Overall the building has performed well under seismic conditions which would be expected for a timber framed single storey structure. The building has sustained little damage and continues to be fully operational.

Due to the non-intrusive nature of the original survey, many connection details could not be ascertained.

8 Detailed Seismic Assessment

8.1 Critical Structural Weaknesses

As outlined in the Critical Structural Weakness and Collapse Hazards draft briefing document, issued by the Structural Engineering Society (SESOC) on 7 May 2011, 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 the building.

We have identified no critical structural weaknesses in the building.

8.2 Seismic Coefficient Parameters

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

- Site soil class D, clause 3.1.3 NZS 1170.5:2004
- 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, for an Importance Level 2 structure with a 50 year design life.
- μ_{max} = 2 for the gib lined, timber-framed building.

8.3 Detailed Seismic Assessment Results

A summary of the structural performance of the building is shown in the following tables. Note that the values given represent the worst performing elements in the building, as these effectively define the building's capacity. Other elements within the building may have significantly greater capacity when compared with the governing element.

Table 2: Summary of Seismic Performance

Structural Element/System	Failure mode and description of limiting criteria	Critical Structural Weakness and Collapse Hazard	% NBS based on calculated capacity
Walls in the east west direction i.e. across the building	Bracing capacity of wall linings along the building	No	45%
Walls in the north south direction i.e. along the building	Bracing capacity of wall linings across the building	No	63%
Roof diaphragm	Bracing capacity of the roof plane diaphragm in the hall area	No	61%
Perimeter foundation	Bracing capacity of the concrete perimeter foundation	No	>100%

8.4 Discussion of Results

The building has a calculated capacity of 46% NBS, as limited by the GIB capacity in the wall between the kitchen and office rooms.

The capacity of the ceiling diaphragm is based on values published in the NZSEE 2006 document [2], and site verification of the diaphragm fixings will be required in order to confirm the actual capacity.

8.5 Limitations and Assumptions in Results

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

9 Geotechnical Assessment

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 beach gravel and sand along the active shoreline.

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 0.1g to 0.2g 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

No relevant site investigation data is available from Environment Canterbury database in the vicinity of this building.

9.4 Site Observations

The building was inspected by Opus structural engineers on the 19th January 2012. The following observations were made from site notes and photographs.

- The building is located on a flat site, 220m west of the beach and 250m north of the river.
- The building is founded on a perimeter strip footing of unknown dimensions and interior concrete cone piles. All concrete piles appear to be tied to the timber bearers.
- There does not appear to have been any ground movement in the vicinity of the building.
- The foundations appear to have been undermined at the south west corner of the building. A 5mm crack is present in this location. Settlement is not attributed to the recent seismic events. Refer to Photo 7.
- The building does not appear to have differentially settled.
- A 5mm crack has continued up a step on the east side, which connects to a concrete shrinkage cut line. Refer to Photo 8.

9.5 Discussion and Conclusions

The existing foundations appear to have performed satisfactorily in the recent seismic events. No ground deformation or liquefaction has been observed at the site. The undermining of the foundations on the south west corner of the building is unlikely to have been caused by the recent seismic events. The 5mm crack that is also evident in this area is due to the extension of the building and not the recent seismic events. Due to the adequate performance of the existing foundations, no further geotechnical testing is recommended.

10 Remedial Options

We recommend a strengthening scheme is developed to increase the overall building capacity to at least 67% NBS.

The capacity of the ceiling diaphragm fixings would also need to be assessed.

11 Conclusions

(a) The building has a seismic capacity of 46% NBS and is therefore classed as a moderate risk building.

(b) Strengthening work is required to increase the overall building capacity to at least 67% NBS.

(c) The existing foundations have performed satisfactorily, and no further geotechnical testing is required.

12 Recommendations

(a) Strengthening options be developed for increasing the seismic capacity of the building to at least 67% NBS.

13 Limitations

(a) This report is based on an inspection of the structure with a focus on the damage sustained from the 22 February 2011 Canterbury Earthquake and aftershocks only. Some non-structural damage is mentioned but this is not intended to be a comprehensive list of non-structural items.

(b) 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 the time.

(c) This report is prepared for the CCC to assist with assessing remedial works required for council buildings and facilities. It is not intended for any other party or purpose.

14 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.

Appendix A – Photographs

Photo 1 – The north perimeter wall

Photo 2 – The east perimeter wall

Photo 3 – The south perimeter wall

Photo 4 – View of the main hall room

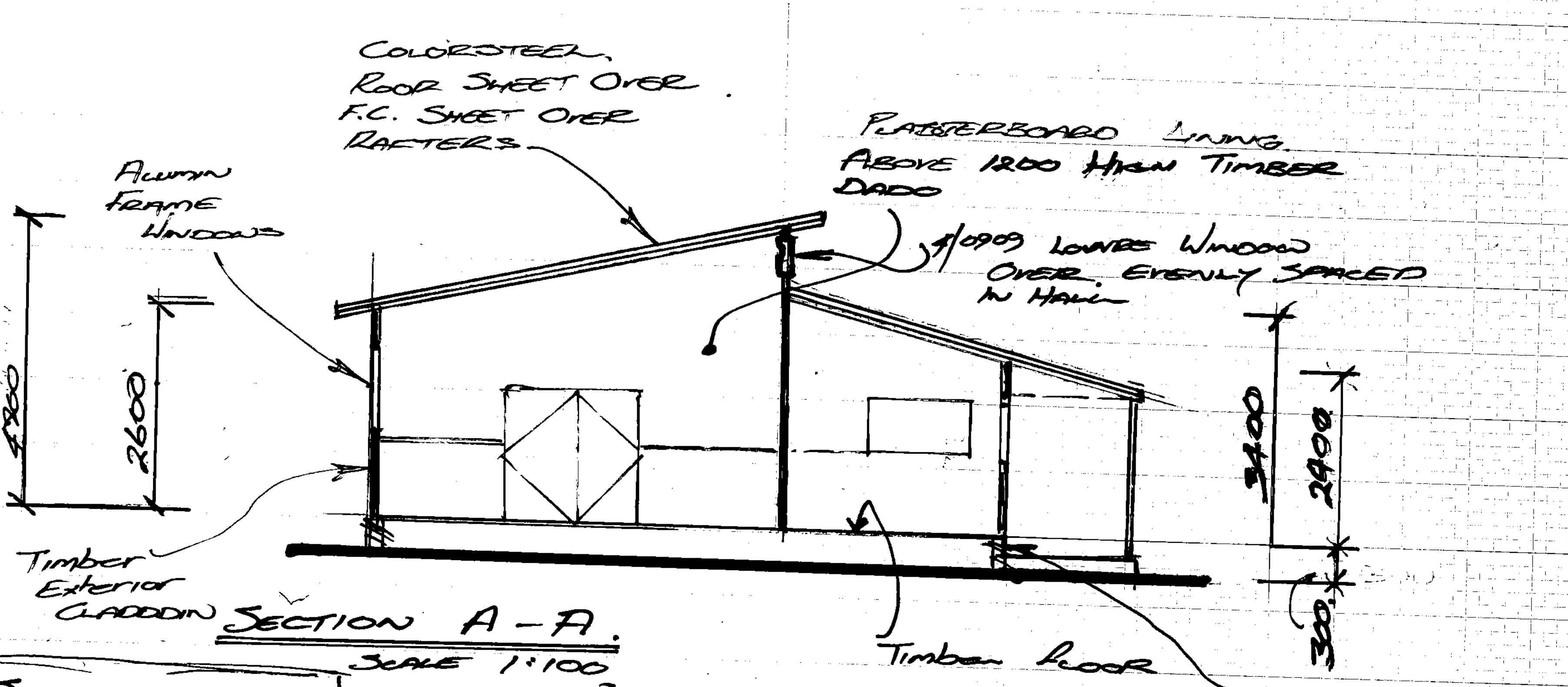
Photo 5 – View of the exposed rafters in the main hall room

Photo 6 – View of the pile foundations and subfloor framing

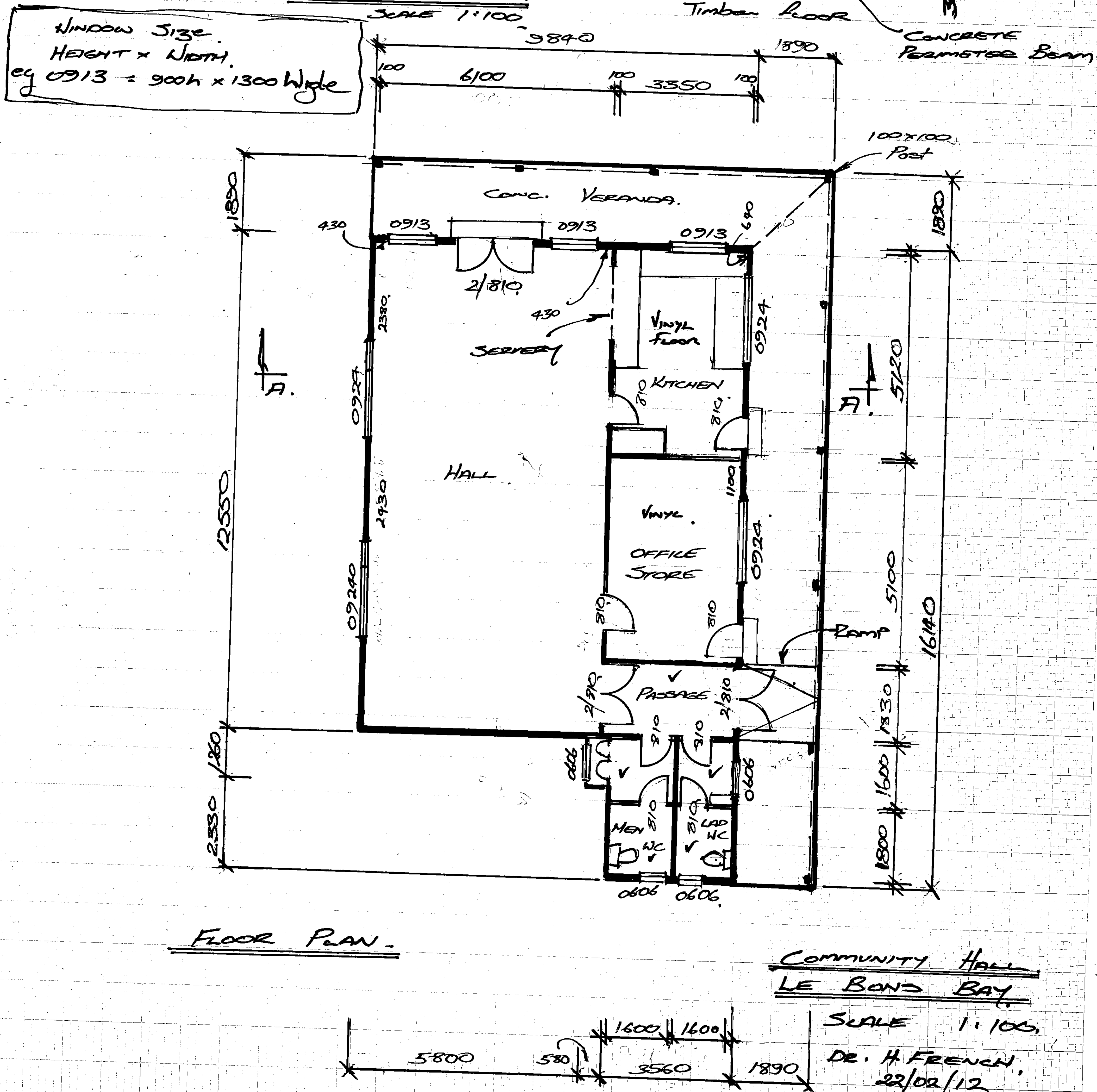
Photo 7: Undermined footing and cracks

Photo 8: 5mm crack on step

Appendix B – Floor Plan



SECTION A-A.
SCALE 1:100



FLOOR PLAN.

COMMUNITY HALL
LE BONS BAY

SCALE 1:100.

DR. H FRENCH.
22/02/12

Appendix C – DEE Spreadsheet

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name: Le Bons Bay Community Hall
Unit / No: / Street
Building Address: Le Bons Bay
Legal Description:
Degrees / Min / Sec
GPS south:
GPS east:
Building Unique Identifier (CCC): BU 3597-001 EQ2

Reviewer: Alistair Boyce
CPEng No: 209860
Company: Opus International Consultants
Company project number: 6-QUCCC.73
Company phone number: 03 363 5400
Date of submission: 16-Oct-12
Inspection Date: 18-Jan-12
Revision: Final
Is there a full report with this summary? yes

Site

Site slope: flat
Soil type:
Site Class (to NZS1170.5): D
Proximity to waterway (m, if <100m):
Proximity to clifftop (m, if < 100m):
Proximity to cliff base (m,if <100m):

Max retaining height (m):
Soil Profile (if available):
If Ground improvement on site, describe:
Approx site elevation (m): 20.00

Building

No. of storeys above ground: 1 — single storey = 1
Ground floor split? no
Storeys below ground: 0
Foundation type:
Building height (m): 5.20
Floor footprint area (approx): 160
Age of Building (years): 35

Ground floor elevation (Absolute) (m):
Ground floor elevation above ground (m):
if Foundation type is other, describe: Perimeter footing, concrete piles to timber subfloor
height from ground to level of uppermost seismic mass (for IEP only) (m):
Date of design: 1976-1992

Strengthening present? no
Use (ground floor): public
Use (upper floors):
Use notes (if required):
Importance level (to NZS1170.5): IL2

If so, when (year)?
And what load level (%g)?
Brief strengthening description:

Gravity Structure

Gravity System: load bearing walls
Roof: timber framed
Floors: timber
Beams: none
Columns:
Walls:

rafter type, purlin type and cladding: timber rafters, profiled steel roof
joist depth and spacing (mm)
overall depth x width (mm x mm)

Lateral load resisting structure

Lateral system along: lightweight timber framed walls
Ductility assumed, μ: 2.00
Period along: 0.20 0.00
Total deflection (ULS) (mm):
maximum interstorey deflection (ULS) (mm):

Note: Define along and across in detailed report!

note typical wall length (m): 3
estimate or calculation? calculated
estimate or calculation?
estimate or calculation?

Lateral system across: lightweight timber framed walls
Ductility assumed, μ: 2.00
Period across: 0.20 0.00
Total deflection (ULS) (mm):
maximum interstorey deflection (ULS) (mm):

note typical wall length (m): 3
estimate or calculation? calculated
estimate or calculation?
estimate or calculation?

Separations:

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

leave blank if not relevant

Non-structural elements

Stairs:
Wall cladding: other light — describe
Roof Cladding: Metal — describe
Glazing: aluminium frames
Ceilings: fibrous plaster, fixed
Services(list):

Available documentation

Architectural — original designer name/date
Structural — original designer name/date
Mechanical — original designer name/date
Electrical — original designer name/date
Geotech report — original designer name/date

Damage

Site:
(refer DEE Table 4-2)

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

Building:

Current Placard Status: green

Along — Damage ratio:
Describe (summary):
Describe how damage ratio arrived at:

Across — Damage ratio: #DIV/0!
Describe (summary):

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

Diaphragms — Damage?: no — Describe:
CSWs: — Damage?: no — Describe:
Pounding: — Damage?: no — Describe:
Non-structural: — Damage?: no — Describe:

Recommendations

Level of repair/strengthening required: significant structural and strengthening — Describe: Strengthening works recommended
Building Consent required: yes — Describe:
Interim occupancy recommendations: full occupancy — Describe:

Along — Assessed %NBS before: ##### %NBS from IEP below
Assessed %NBS after: 63%

If IEP not used, please detail assessment methodology: Quantitative seismic assessment

Across — Assessed %NBS before: ##### %NBS from IEP below
Assessed %NBS after: 46%

IEP

Use of this method is not mandatory - more detailed analysis may give a different answer, which would take precedence. Do not fill in fields if not using IEP.

Period of design of building (from above): 1976-1992
h_n from above: m

Seismic Zone, if designed between 1965 and 1992:
not required for this age of building
not required for this age of building

	along	across
Period (from above):	0.2	0.2
(%NBS)nom from Fig 3.3:		

Note:1 for specifically design public buildings, to the code of the day: pre-1965 = 1.25; 1965-1976, Zone A =1.33; 1965-1976, Zone B = 1.2; all else 1.0: 1.00
Note 2: for RC buildings designed between 1976-1984, use 1.2: 1.0
Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (1.0): 1.0

	along	across
Final $(\%NBS)_{nom}$:	**0%**	**0%**

2.2 Near Fault Scaling Factor

Near Fault scaling factor, from NZS1170.5, cl 3.1.6: 1.00

	along	across
Near Fault scaling factor (1/N(T,D), **Factor A**:	1	1

2.3 Hazard Scaling Factor

Hazard factor Z for site from AS1170.5, Table 3.3:
Z_{1992}, from NZS4203:1992
Hazard scaling factor, **Factor B:** #DIV/0!

2.4 Return Period Scaling Factor

Building Importance level (from above): 2
Return Period Scaling factor from Table 3.1, **Factor C**:

2.5 Ductility Scaling Factor

	along	across
Assessed ductility (less than max in Table 3.2)	1.00	1.00
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:		
Ductiity Scaling Factor, **Factor D**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

	along	across
Sp:	1.000	1.000
Structural Performance Scaling Factor **Factor E**:	1	1

2.7 Baseline %NBS, $(NBS\%)_b = (\%NBS)_{nom} \times A \times B \times C \times D \times E$

	along	across
$\%NBS_b$:	#DIV/0!	#DIV/0!

Global Critical Structural Weaknesses: (refer to NZSEE IEP Table 3.4)

3.1. Plan Irregularity, factor A: 1
3.2. Vertical irregularity, Factor B: 1
3.3. Short columns, Factor C: 1
3.4. Pounding potential
Pounding effect D1, from Table to right: 1.0
Height Difference effect D2, from Table to right: 1.0
Therefore, Factor D: 1
3.5. Site Characteristics 1

Table for selection of D1	Severe	Significant	Insignificant/none
Separation	0<sep<.005H	.005<sep<.01H	Sep>.01H
Alignment of floors within 20% of H	**0.7**	**0.8**	**1**
Alignment of floors not within 20% of H	**0.4**	**0.7**	**0.8**

Table for Selection of D2	Severe	Significant	Insignificant/none
Separation	0<sep<.005H	.005<sep<.01H	Sep>.01H
Height difference > 4 storeys	0.4	0.7	1
Height difference 2 to 4 storeys	0.7	0.9	1
Height difference < 2 storeys	1	1	1

3.6. Other factors, Factor F

	Along	Across
For ≤ 3 storeys, max value =2.5, otherwise max valule =1.5, no minimum		
Rationale for choice of F factor, if not 1		

Detail Critical Structural Weaknesses: (refer to DEE Procedure section 6)
List any: — Refer also section 6.3.1 of DEE for discussion of F factor modification for other critical structural weaknesses

	Along	Across
3.7. Overall Performance Achievement ratio (PAR)	**0.00**	**0.00**
4.3 PAR x (%NBS)b: PAR x Baseline %NBS:	**#DIV/0!**	**#DIV/0!**
4.4 Percentage New Building Standard (%NBS), (before)		**#DIV/0!**

OPUS