Okains Bay Community Centre

BU 3696-001 EQ2

Detailed Engineering Evaluation

Quantitative Report

Christchurch City Council

Christchurch City Council

Okains Bay Community Centre

Detailed Engineering Evaluation Quantitative Report

Prepared by	John Newall Civil/Structural Engineer		Opus International Consultants Ltd Christchurch Office 20 Moorhouse Avenue PO Box 1482, Christchurch Mail Centre, Christchurch 8140 New Zealand	
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			Date: Reference: Status:	October 2012 6-QUCCC.63 Final V2

Okains Bay Community Centre Building
BU 3696-001 EQ2

Detailed Engineering Evaluation
Quantitative Report - SUMMARY
Final V2

Okains 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 29 December 2011, available drawings and calculations.

Key Damage Observed

Some minor damage to internal linings was observed. The water tower (now removed) was leaning towards the building.

Critical Structural Weaknesses

- The building is unlikely to have any hold down connections between the bearers and the piles, resulting in a lack of subfloor bracing capacity.

Indicative Building Strength

Based on the information available, and from undertaking a quantitative assessment, the building's original capacity had been assessed to be less than 34% NBS along the building, as limited by the wall lining on the eastern wall. Following interim strengthening work in January 2012, the bracing capacity of the wall linings has been assessed to be in the order of 40% NBS along the building and 57% NBS across the building.

The building has been assessed to have a current seismic capacity of less than 34% NBS, as limited by the lack of subfloor bracing, however as the building is less than 200mm above ground level the consequence of failure of the subfloor bracing is expected to be limited. The building is however officially 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 Okains Bay Community Centre building, located at Okains 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 Okains Bay Community Centre building is a single storey timber framed structure with pressed metal cladding and a lightweight corrugated iron roof. The structure consists of a main hall space in the centre of the building with lean-to type extensions to the front (toilets and storage) and the rear (kitchen). The building has a low ground clearance and is assumed to sit on shallow timber foundations.

The building is situated on a largely flat section which is adjacent to the Okains River. The apex of the roof is approximately 7m from the ground and the stud heights are 3.6m in the main hall, dropping down to approximately 2.4m in the lean-to sections. The walls and ceiling have tongue and groove lining with the floor also lined with timber boards.

Adjacent to the main building was a standalone water tower that has now been removed.

The building age is unknown, but the main hall is expected to have been built before 1940 with extensions made at a later date.

4.2 Gravity Load Resisting System

The roof structure is a timber framed truss system with timber purlins to support the roof and ceiling. The roof trusses are supported by timber frame walls with a timber beam over the large opening near the main entrance. The lean-to structures are also timber framed with roof rafters supported by the adjacent walls.

The subfloor consists of tongue and groove timber floor boards on suspended timber framing sitting on low timber piles.

4.3 Seismic Load Resisting System

Seismic loads in both principal directions are resisted by the shear walls braced with the tongue and groove wall linings which are in place behind a newer plaster board lining. The ceiling over the hall area is lined with tongue and groove timber boards and is assumed to provide a form of diaphragm action to distribute the lateral loads to the wall bracing elements. Some plywood linings were installed on the eastern wall in January 2012 to increase the bracing capacity along the building.

The building is positioned only 200-300mm above ground level and does not have a perimeter concrete foundation wall. It is unknown whether the bearers have any 6kN hold down connections at the pile locations.

5 Survey

The building was inspected initially on the 11th of March 2011 with the main identified hazard being the leaning water tower.

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

- One architectural sketch of the building showing general floor layout of the building.

No copies of the original construction drawings have been obtained for this building.

An intrusive survey was carried out in order to confirm the wall lining type. This survey found that tongue and groove wall linings is present behind a newer plaster board lining.

6 Damage Assessment

The building has suffered some damage to internal linings. A brick chimney at the rear of the building also collapsed and the water tower (now removed) had a noticeable lean.

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 isolated damage only.

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.

The following critical structural weakness has been identified:

a) The building is unlikely to have any hold down connections between the bearers and the piles, resulting in a lack of subfloor bracing capacity. Due to the low height of the building above ground level this is not considered to be a collapse hazard.

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} = 1.25 for the tongue and groove wall linings.

8.3 Detailed Seismic Assessment Results

A summary of the structural performance of the building is shown in the following table. 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	% NBS based on calculated capacity
Walls in the approximate east-west direction i.e. across the building	Bracing capacity of wall linings across the building	57%
Walls in the approximate north-south direction i.e. along the building	Bracing capacity of wall linings along the building	40%
Ceiling diaphragm	Capacity of the ceiling lining/diaphragm	>33%
Subfloor bracing	Bracing capacity of the subfloor structure	<34%

8.4 Discussion of Results

The building has a calculated capacity of approximately 40% NBS as limited by the wall lining in the north-south direction. This is governed by the eastern wall with the large opening.

It has been assumed that the tongue and groove ceiling lining acts as a diaphragm.

Due to the low height of the building above the ground level the lack of capacity of the bearer to pile connections, which is less than 34% NBS, is not considered to be critical or pose a collapse risk. The capacity of these elements should however be addressed during the design of any strengthening works.

As the building has a capacity less than 34% NBS it is defined as earthquake prone in accordance with the Building Act 2004.

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 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.

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 grey to brown alluvium, comprising of silty sub-angular gravel and sand forming alluvial fans.

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 0.15 g during the 22nd February 2011

Earthquake. Estimated PGA's have been 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 18th January 2012. The following observations were made from site notes and photographs.

- The Community Centre is located on flat low-lying land with Okains River running parallel 50m north of the building.
- A small stream is located 5m to the west of the Community Centre.
- Two chimneys on the north side have fallen.
- The elevated concrete water tank on the west side of the building appeared to have settled towards the drain. This has now been removed.

9.5 Conclusions and Discussion

The existing foundations appear to have performed satisfactorily in the recent seismic event. This building is located in close proximity to a small stream and is expected to have a high groundwater level. The building does not appear to have experienced any differential settlement but evidence of the water tank settling toward the west indicates that there has been ground movement or temporary loss of bearing capacity around the building. Due to high groundwater table, possible presence of loose sand deposits and close proximity a stream and river the risk of lateral spreading in future seismic events is considered to be moderate. Site investigations are recommended to identify the risk of liquefaction at this site.

10 Conclusions

(a) The current level of compliance of this building, excluding the capacity of the subfloor bracing, is greater than 33% NBS.

(b) The capacity of the subfloor bracing is less than 34% NBS, however due to the low height of the building above the ground level the lack of capacity of the bearer to pile connections is not considered to be critical or pose a collapse risk.

(c) The building overall, when also considering the capacity of the subfloor structure, has a seismic capacity of less than 34% NBS and is therefore classed as earthquake prone in accordance with the Building Act 2004.

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

(e) The existing foundations have performed satisfactorily, however site investigations are recommended to identify the risk of liquefaction at the site.

11 Recommendations

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

12 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.

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.

Appendix A – Photographs

Photo 1: View of the building from the south-east

Photo 2: View of the building from the north-west. This also shows the water tower (now removed)

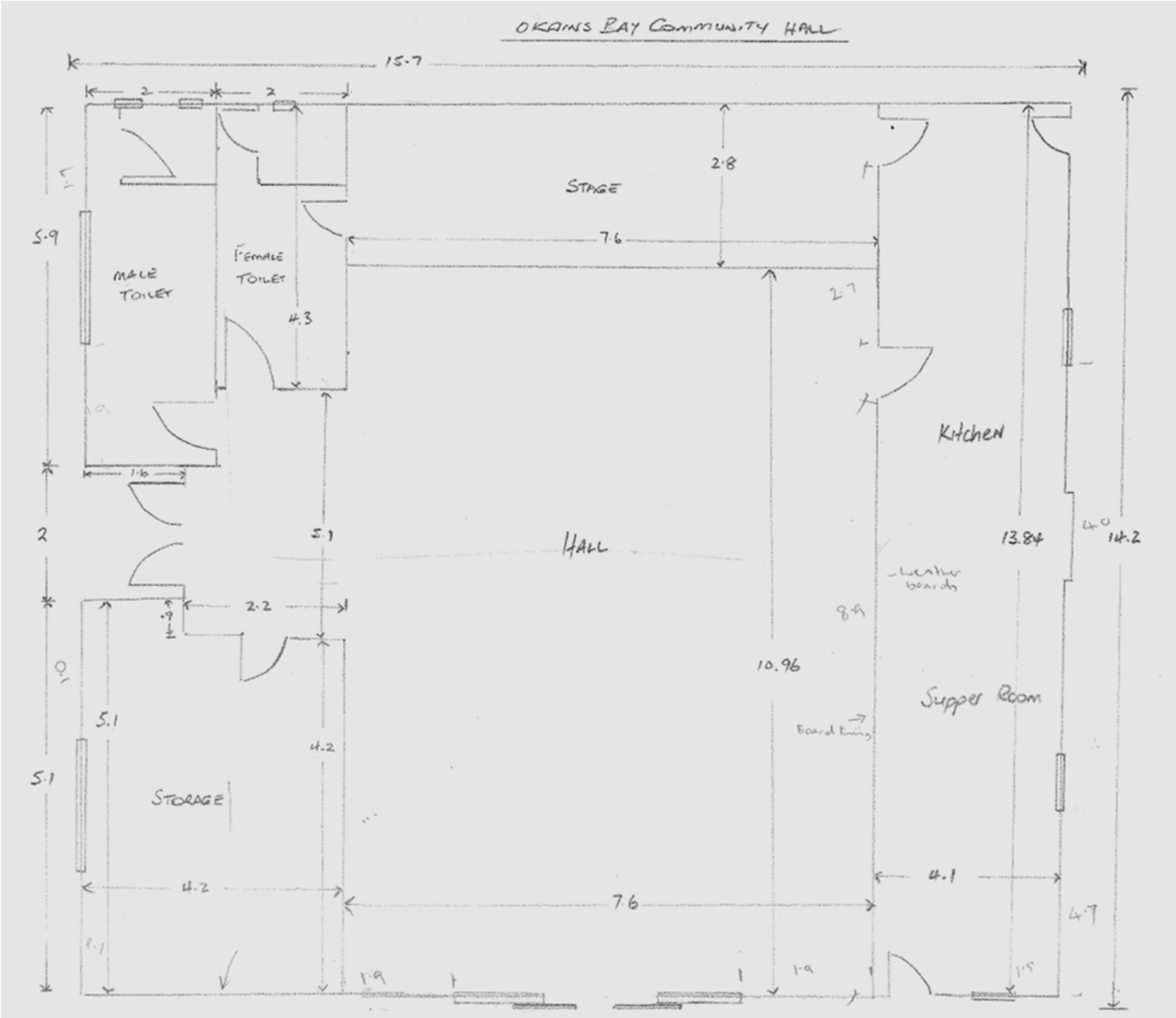
Photo 3: Showing the location of the brick chimney that collapsed

Photo 4: General internal location shot. Shows tongue and groove ceiling

Photo 5: Internal view of eastern wall with large opening (prior to strengthening. Shows bottom section of roof trusses

Photo 6: Water tank sitting on top of the braced steel frame (now removed)

Appendix B – Floor Plan


OKAINS BAY COMMUNITY HALL
15.7
STAGE
MALE TOILET
FEMALE TOILET
HALL
Kitchen
Supper Room
STORAGE
7.6
2.8
10.96
13.84
14.2
5.9
5.1
4.3
4.2
4.1
2.2

Appendix C – DEE Spreadsheet

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Okains Bay Community Centre		Reviewer:	Alistair Boyce
	Unit / No: / Street		CPEng No:	209860
Building Address:	Okains Bay Road		Company:	Opus International Consultants
Legal Description:			Company project number:	6-QUCCC.63
			Company phone number:	3635400
	Degrees / Min / Sec			
GPS south:			Date of submission:	17-Feb-14
GPS east:			Inspection Date:	20/01/2012
			Revision:	Final V2
Building Unique Identifier (CCC):	BU 3696-001 EQ2		Is there a full report with this summary?	yes

Site

Site slope:	slope < 1in 10	Max retaining height (m):	0
Soil type:	silt	Soil Profile (if available):	
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	5.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	5.00
Ground floor split?	no		Ground floor elevation above ground (m):	0.30
Storeys below ground	0			
Foundation type:	timber piles		if Foundation type is other, describe:	
Building height (m):	7.00		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	90			
Age of Building (years):	80		Date of design:	1935-1965
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):				
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	Corrugated iron cladding
Floors:	timber	joist depth and spacing (mm)	
Beams:	timber	type	
Columns:	timber	typical dimensions (mm x mm)	
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)	1.5m - 6m
Ductility assumed, μ:	1.25			
Period along:	0.40	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)	1.5-6m
Ductility assumed, μ:	1.25			
Period across:	0.40	0.00	estimate or calculation?	
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	

Separations:

north (mm):		leave blank if not relevant
east (mm):		
south (mm):		
west (mm):		

Non-structural elements

Stairs:			
Wall cladding:	other light	describe	Tongue and groove
Roof Cladding:	Metal	describe	Corrugated iron
Glazing:	timber frames		
Ceilings:	none		Tongue and groove ceiling
Services(list):			

Available documentation

Architectural	partial	original designer name/date	Basic floor layout only
Structural	none	original designer name/date	
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	none	original designer name/date	

Damage

Site: (refer DEE Table 4-2)

Site performance:	Generally good	Describe damage:	Limited
Settlement:	0-25mm	notes (if applicable):	
Differential settlement:	0-1:350	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:	yellow		
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:	yes	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	The subfloor bracing capacity is less than 34% NBS how
Along	Assessed %NBS before:	40%	##### %NBS from IEP below	If IEP not used, please detail assessment methodology: Quantitative assessment
	Assessed %NBS after:	40%		
Across	Assessed %NBS before:	57%	##### %NBS from IEP below	
	Assessed %NBS after:	57%		

OPUS