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Pavilion/Toilet – Le Bons Bay Domain
PRK 3596 BLDG 003 EQ2

Detailed Engineering Evaluation
Quantitative Report
Version FINAL

16B Rue de la Mer, Le Bons Bay

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Pavilion/Toilet – Le Bons Bay Domain

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Detailed Engineering Evaluation

Quantitative Report

Version FINAL

16B Rue de la Mer, Le Bons Bay

Christchurch City Council

Prepared By

Paul Clarke

Reviewed By

Stephen Lee

Date

17 September 2013

Contents

Table Index

Figure Index

Appendices

Quantitative Report Summary

Pavilion/Toilet – Le Bons Bay Domain

PRK 3596 BLDG 003 EQ2

Detailed Engineering Evaluation

Quantitative Report - SUMMARY

Version FINAL

16B Rue de la Mer, Le Bons Bay

Background

This is a summary of the Quantitative report for the building structure, and is based in general on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 15 July 2011, visual inspections on 15 February 2013 and available drawings itemised in 5.2.

Building Description

The single storey timber frame building consists of a mono-pitch and lean-to portion, with a veranda on the northern and eastern elevations. The structure's timber frame roof is clad with corrugated lightweight metal sheeting, while the walls are clad with weather boards externally. The interior lining varies between either hardboard or plasterboard above timber boards, with all ceilings having a hardboard lining. The floors are primarily formed with timber floor boards. Foundations consist of concrete perimeter footing with piles internally.

Key Damage Observed

No damage was observed in the structure.

Building Capacity Assessment

Based on the results of the quantitative assessment the building scored 49% NBS. Therefore the building is Earthquake Risk.

Recommendations

The building currently achieves a New Building Standard of 49%. No further action is required however given the low score achieved by the structure the development of strengthening schemes to a minimum of 67% NBS is recommended.

1. Background

GHD has been engaged by Christchurch City Council (CCC) to undertake a detailed engineering evaluation of Pavilion/Toilet – Le Bons Bay.

This report is a Quantitative Assessment of the building structure, and is based in general on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group 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 carry out a full structural survey before the building is re-occupied.

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

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

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

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

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

2.2.1 Section 121 – Dangerous Buildings

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

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

Section 122 – Earthquake Prone Buildings

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

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 of the 4th September 2010.

The 2010 amendment includes the following:

- A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;
- A strengthening target level of 67% of a new building for buildings that are Earthquake Prone;
- A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,
- Repair works for buildings damaged by earthquakes will be required to comply with the above.

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

We anticipate that any building with a capacity of less than 33% NBS (including consideration of critical structural weaknesses) will need to be strengthened to a target of 67% NBS of new building standard as recommended by the Policy.

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

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

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.

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

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

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

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

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

The New Zealand Society for Earthquake Engineering has proposed a way for classifying earthquake risk for existing buildings in terms of %NBS and this is shown in Figure 1 below.

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

Figure 3-1NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE

Table 1 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.

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

Figure 3-2 %NBS compared to relative risk of failure

4. Building Description

4.1 General

The building is located at 16B Rue de la Mer, Le Bons Bay. The building is estimated to have been constructed in the late 1970's. The building's use is a community hall with kitchen, meeting and toilet facilities.

The single storey timber frame building consists of a large mono-pitch hall with a lean-to section, and a veranda on the northern and eastern elevations. The structure's timber frame roof is clad with corrugated lightweight metal sheeting, while the walls are clad with weather boards externally. The interior lining varies between either hardboard or plasterboard above timber boards, with all ceilings having a hardboard lining. The floors are primarily formed with timber floor boards. Foundations consist of concrete perimeter footing with piles internally.

The building is approximately 16.8m in length by 9.8m in width and 4.95m in height. The overall footprint is approximately 145m^2. The building is relatively isolated with no other structures in the immediate vicinity. The flat site is approximately 250m from the Le Bons Bay coastline and is located at an elevation of 2m.

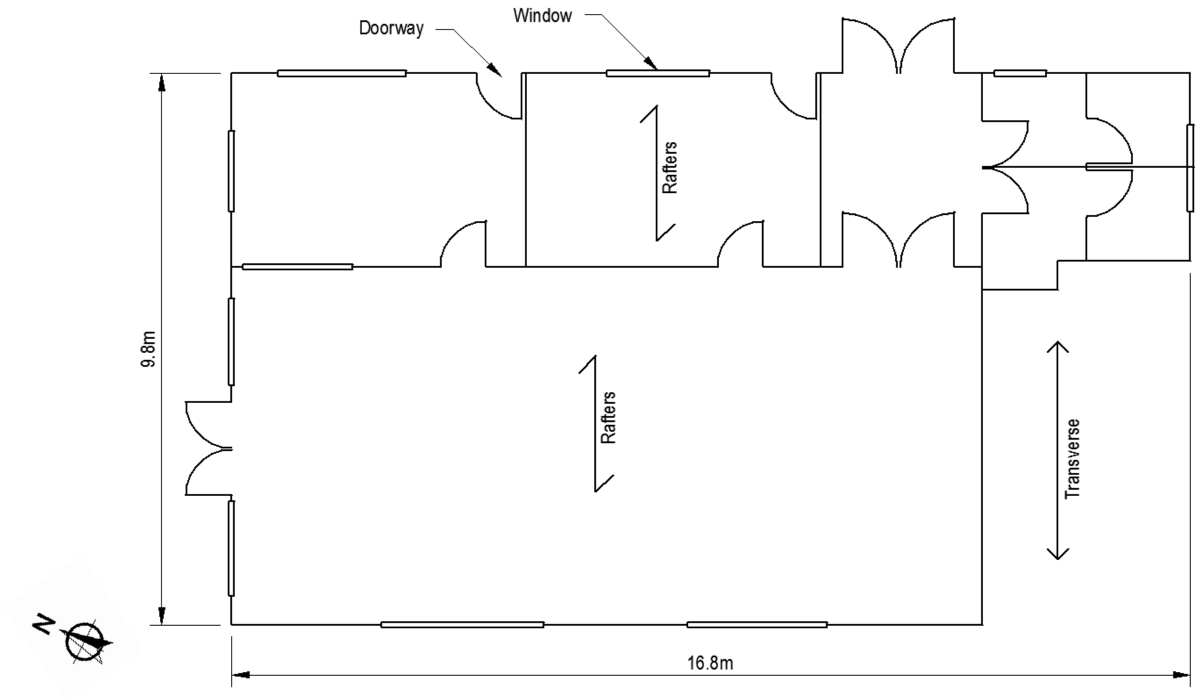


Figure 4-1 Plan Sketch of Original Structure

4.2 Gravity Load Resisting System

Gravity roof loads are supported by timber rafters. These timber rafters transfer the gravity roof loads to the load bearing timber frame walls which transfer the loads down to the foundations. The foundations transfer the gravity loads into the ground beneath. The internal gravity floor loads are supported by timber joists on timber bearers with piles beneath.

4.3 Lateral Load Resisting System

The lateral load resisting system is similar for both the longitudinal and transverse direction.

The lateral roof loads are transferred through the roof diaphragm to the walls in the plane of loading. These walls transfer the loads to the foundation level by the combined panel action of the timber framing and linings. The foundations distribute the lateral loads into the ground beneath. Walls subject to out of plane loading span vertically between the foundations and the restraint provided by the roof diaphragm.

Lateral floor loads are transferred to the foundations by the diaphragm action of the floor. The absence of significant walls requiring diaphragm restraint above the floor level result in low seismic demand on the diaphragm. The primary floor area is formed from tongue and groove timber floor boards which will provide adequate diaphragm capacity to deal with the seismic demand.

5. Assessment

5.1 Site Inspection

An inspection of the building was undertaken on the 15th of February 2013. Both the interior and exterior of the building were inspected. The main structural components of the building were all able to be viewed. It should be noted that inspection of the internal foundations of the structure was not possible due to the lack of sub-floor access.

The inspection consisted of observing the building to determine the structural systems and likely behaviours of the building during earthquake. The site was assessed for damage, including observing the ground condition, checking for damage areas where damage would be expected for the structure type observed and noting general damage observed throughout the building in both structural and non-structural elements.

5.2 Available Drawings

No drawings were made available.

Sketches are attached as Appendix B.

6. Damage Assessment

6.1 Surrounding Buildings

There were no buildings in the vicinity of the structure.

6.2 Residual Displacements and General Observations

There were no settlement or damage issues identified during the inspection of the structure.

6.3 Ground Damage

No ground damage was observed during our inspection of the site.

7. Structural Analysis

7.1 Seismic Parameters

Earthquake loads shall be calculated using New Zealand Code.

Site Classification	D
Seismic Zone factor (Z)	
(Table 3.3, NZS 1170.5:2004 and NZBC Clause B1 Structure)	0.30 (Akaroa)
Annual Probability of Exceedance	
(Table 3.3, NZS 1170.0:2002)	1/500 (ULS) Importance Level 2
Return Period Factor (Ru)	
(Table 3.5, NZS 1170.5:2004)	1.0 (ULS)
Ductility Factor (μ)	3.0
Ductility Scaling Factor (k_μ)	2.14
Performance Factor (Sp), based on NZS 3.1.0.1	0.7
Gravitational Constant (g)	9.81 m/s^2

An increased Z factor of 0.3 for Akaroa has been used in line with recommendations from the Department of Building and Housing recommendations resulting in a reduced % NBS score.

7.2 Equivalent Static Method

Equivalent Static forces were calculated in accordance with NZS 1170.5:2004. A ductility factor of 3.0 has been assumed given the age and the lightweight timber frame construction used.

The elastic site hazard spectrum for horizontal loading:

$C(T_1)=C_h \cdot Z \cdot R \cdot N(T,D)$

$C_h=3.0$ – Value from 3.1 table for the period (T=0.4s)

Z=0.3 – Hazard factor determined from the table 3.3 (NZS 1170.5:2004)

R=1.0 – Return period factor determined from the table 3.5 (NZS 1170.5:2004)

N (T,D) = 1.0 – Near fault factor- clause 3.1.6. (NZS 1170.5:2004)

$C(T_1)= 3.0 \cdot 0.3 \cdot 1.0 \cdot 1.0 = 0.9$

The horizontal design action coefficient:

$$C_d(T_1)=\frac{C(T_1) \cdot S_p}{k_\mu}=\frac{0.90 \cdot 0.7}{2.14}=0.3$$

The structure's seismic mass and associated bracing demand was calculated in accordance with NZS1170.5:2004.

7.3 Bracing Capacity

The building was assessed in accordance with NZS3604:2011. The bracing capacity of the structure for each orthogonal direction was assessed based on the wall lengths in each direction and the linings used. The bracing capacity for each orthogonal direction was calculated from the combined capacity of the individual wall lengths for each direction. These values were compared to the seismic demand to assess the structure's performance compared to a New Building Standard.

8. Geotechnical Consideration

8.1 Site Description

The site is situated in Le Bons Bay, in Banks Peninsula. It is relatively flat at approximately 2 m above mean sea level. It is approximately 12 km northeast of Akaroa, and is on the coast at Le Bons Bay.

8.2 Public Information on Ground Conditions

8.2.1 Published Geology

Brown & Weeber, 1992 describes the site geology as:

- Beach gravel and sand of post-glacial shorelines, including those of Lake Ellesmere (Q1b).

8.2.2 Environmental Canterbury Logs

No nearby boreholes comprised lithographic logs. However, wells slightly further away (800 m South) indicate the area to be underlain by sand and clay to 39 m bgl, overlying volcanic bedrock.

Groundwater was recorded at 2.6 m bgl in the borehole log.

Table 1 ECan Borehole Summary

Bore Name	Log Depth	Groundwater	From Site	Log Summary	
N36/0052	61.0 m	2.6 m	800 m S	0.0 – 11.8 m	SAND
				11.8 – 23.2 m	CLAY
				23.2 – 26.8 m	SAND
				26.8 – 39.5 m	CLAY
				39.5 – 61.0 m	Volcanic rock

It should be noted that the logs have been written by the well driller and not a geotechnical professional or to a standard. In addition strength data is not recorded.

8.2.3 EQC Geotechnical Investigation

The Earthquake Commission has not undertaken geotechnical testing in the area of the subject site.

8.2.4 CERA Land Zoning

Canterbury Earthquake Recovery Authority (CERA) has indicated the site is situated within the Green Zone, indicating that repair and rebuild may take place.

Land in the CERA green zone has been divided into three technical categories. These categories describe how the land in expected to perform in future earthquakes.

The site has been categorised as “N/A – Port Hills and Banks Peninsula”. These areas have not been given a technical category as their geology differs significantly from the Canterbury Plains.

8.2.5 Post-Earthquake Land Observations

The site is not in coverage of the aerial photography following the major earthquakes of the Canterbury earthquake sequence.

8.2.6 Summary of Ground Conditions

From the information presented above, the ground conditions underlying the site are anticipated to be sand and clay to 39 m bgl, overlying volcanic bedrock.

Groundwater is considered to be approximately 2.6 m bgl.

8.3 Seismicity

8.3.1 Nearby Faults

There are many faults in the Canterbury region, however only those considered most likely to have an adverse effect on the site are detailed below.

Table 2 Summary of Known Active Faults[1,2]

Known Active Fault	Distance from Site	Direction from Site	Max Likely Magnitude	Avg Recurrence Interval
Alpine Fault	160 km	NW	~8.3	~300 years
Greendale Fault (2010)	60 km	W	7.1	~15,000 years
Hope Fault	140 km	N	7.2~7.5	120~200 years
Kelly Fault	145 km	NW	7.2	~150 years
Porters Pass Fault	105 km	NW	7.0	~1100 years
Port Hills Fault (2011)	*38 km*	NW	6.3	Not Estimated

The recent earthquake sequence since 4 September 2010 has identified the presence of a previously unmapped active fault system underneath the Canterbury Plains; this includes the Greendale Fault and Port Hills Fault listed in Table 2 above. Research and published information on this system is in development and the average recurrence interval is yet to be established for the Port Hills Fault.

8.3.2 Ground Shaking Hazard

New Zealand Standard NZS 1170.5:2004 quantifies the Seismic Hazard factor for Christchurch as 0.30, being in a moderate to high earthquake zone. This value has been provisionally upgraded recently (from 0.22) to reflect the seismicity hazard observed in the earthquakes since 4 September 2010.

[1] Stirling, M.W. McVerry, G.H., and Berryman, K.R. (2002). A New Seismic Hazard Model for New Zealand, Bulletin of the Seismological Society of America, Vol. 92 No. 5, pp. 1878-1903, June 2002.

[2] GNS Active Faults Database

The recent seismic activity has produced earthquakes of Magnitude 6.3 with significant peak ground accelerations (PGA) across large parts of the city.

Conditional PGA's from the CGD are not available for Banks Peninsula.

8.3.3 Slope Failure and/or Rockfall Potential

The topography surrounding the site suggests that rockfall is not a potential hazard. In addition, any retaining structures or embankments nearby should be further investigated to determine the site-specific local slope instability potential.

8.3.4 Liquefaction Potential

The site is considered to have a low to moderate susceptibility to liquefaction, due to the following reason:

- Presence of saturated sands beneath the site.

8.3.5 Conclusions & Recommendations

This assessment is based on a review of the geology and existing ground investigation information, and observations from the Christchurch earthquakes since 4 September 2010.

The site appears to be situated on sand and clay to 39 m bgl, overlying volcanic bedrock. Associated with this the site also has a low to moderate liquefaction potential, in particular where sands are present.

A soil class of D (in accordance with NZS 1170.5:2004) should be adopted for the site.

Should a more comprehensive liquefaction and/or ground condition assessment be required, it is recommended that intrusive investigation be conducted.

9. Results of Analysis

The building was assessed in accordance with NZS3604:2011. The building's capacity in each direction was compared to the seismic demand to provide a comparison to a New Building Standard. The orthogonal directions in the building are as shown in Figure 9-1.

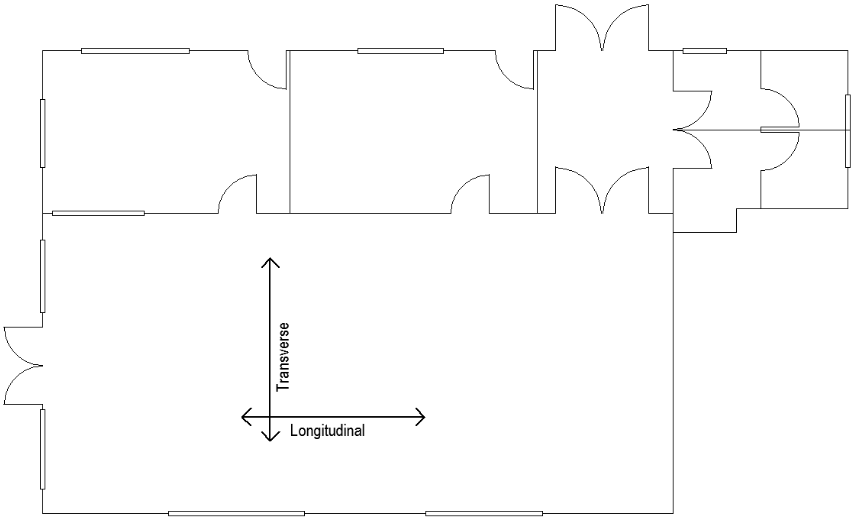


Figure 9-1 Plan showing orthogonal directions.

The performance of the structure for each orthogonal direction is given in Table 3 below.

Table 3 %NBS of Orthogonal Directions

Direction	**% NBS**
Longitudinal Direction	54%
Transverse Direction	55%

In addition to the bracing capacity check, other NZS3604:2011 requirements were checked. In accordance with NZS3604:2011, bracing lines shall be at no greater than 6m centres. As show in Figure 9-2 there is a distance of 12.2m between bracing lines for the mono-pitch hall portion of the structure. This large distance between bracing lines results in higher demand on the roof diaphragm. The building has been assessed as having a New Building Standard of 49% in this regard.

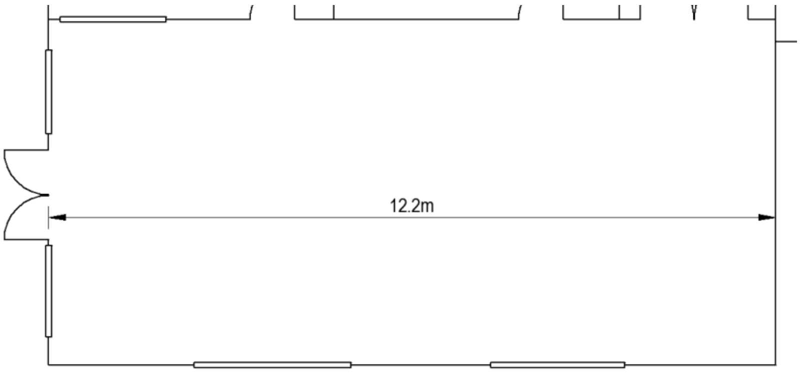


Figure 9-2 Bracing Line Spacing

9.1 Discussion of Results

The results obtained from the analysis are generally consistent with those expected for a building of this size, age and construction type, founded on Class D soils.

The Pavilion/Toilets – Le Bons Bay Domain was built in the late 1970's approximately and was likely designed in accordance with the loading standard current at the time, NZS4203:1976. The design loads used are likely to have been less than those required by the current loading standard. In addition, the structure's internal linings have been identified as achieving lower bracing capacities compared to modern equivalents. Wall bracing capacities are reduced further by significant wall heights and numbers of openings. These features combine to achieve 54% NBS in regard of lateral bracing.

However the critical %NBS score is controlled by the large hall area where no internal bracing lines exist. The absence of internal bracing lines require the roof diaphragm to span 12.2m between external walls resulting in a New Building Standard of 49%.

10. Conclusions and Recommendations

The building overall has been assessed as having a seismic capacity of 49% NBS and is therefore classified as being ‘Earthquake Risk’.

No further action is required, however given the low score achieved, the development of strengthening schemes to a minimum of 67% NBS is recommended.

11. Limitations

11.1 General

This report has been prepared subject to the following limitations:

- Available drawings itemised in 5.2 was used in the assessment.
- The foundations of the building were unable to be inspected beyond those exposed above ground level externally.
- No level or verticality surveys have been undertaken.
- No material testing has been undertaken.

It is noted that this report has been prepared at the request of Christchurch City Council and is intended to be used for their purposes only. GHD accepts no responsibility for any other party or person who relies on the information contained in this report.

11.2 Geotechnical Limitations

The data and advice provided herein relate only to the project and structures described herein and must be reviewed by a competent geotechnical professional before being used for any other purpose. GHD Limited (GHD) accepts no responsibility for other use of the data by third parties.

Where drill hole or test pit logs, cone tests, laboratory tests, geophysical tests and similar work have been performed and recorded by others under a separate commission, the data is included and used in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

The advice tendered in this report is based on information obtained from the desk study investigation location test points and sample points. It is not warranted in respect to the conditions that may be encountered across the site other than at these locations. It is emphasised that the actual characteristics of the subsurface materials may vary significantly between adjacent test points, sample intervals and at locations other than where observations, explorations and investigations have been made. Subsurface conditions, including groundwater levels and contaminant concentrations can change in a limited time. This should be borne in mind when assessing the data.

It should be noted that because of the inherent uncertainties in subsurface evaluations, changed or unanticipated subsurface conditions may occur that could affect total project cost and/or execution. GHD does not accept responsibility for the consequences of significant variances in the conditions and the requirements for execution of the work.

The subsurface and surface earthworks, excavations and foundations should be examined by a suitably qualified and experienced Engineer who shall judge whether the revealed conditions accord with both the assumptions in this report and/or the design of the works. If they do not accord, the Engineer shall modify advice in this report and/or design of the works to accord with the circumstances that are revealed.

An understanding of the geotechnical site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experienced based. Hence this report should not be altered, amended or abbreviated, issued in part and issued incomplete in any way without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances which arise from the issue of the report which have been modified in any way as outlined above.

Appendix A

Photographs

Photo 1. View of the building from the North.

Photo 2. View of the building from the South.

Photo 3. Veranda on the Eastern Elevation.

Photo 4. Concrete perimeter strip footing with weather boards above.

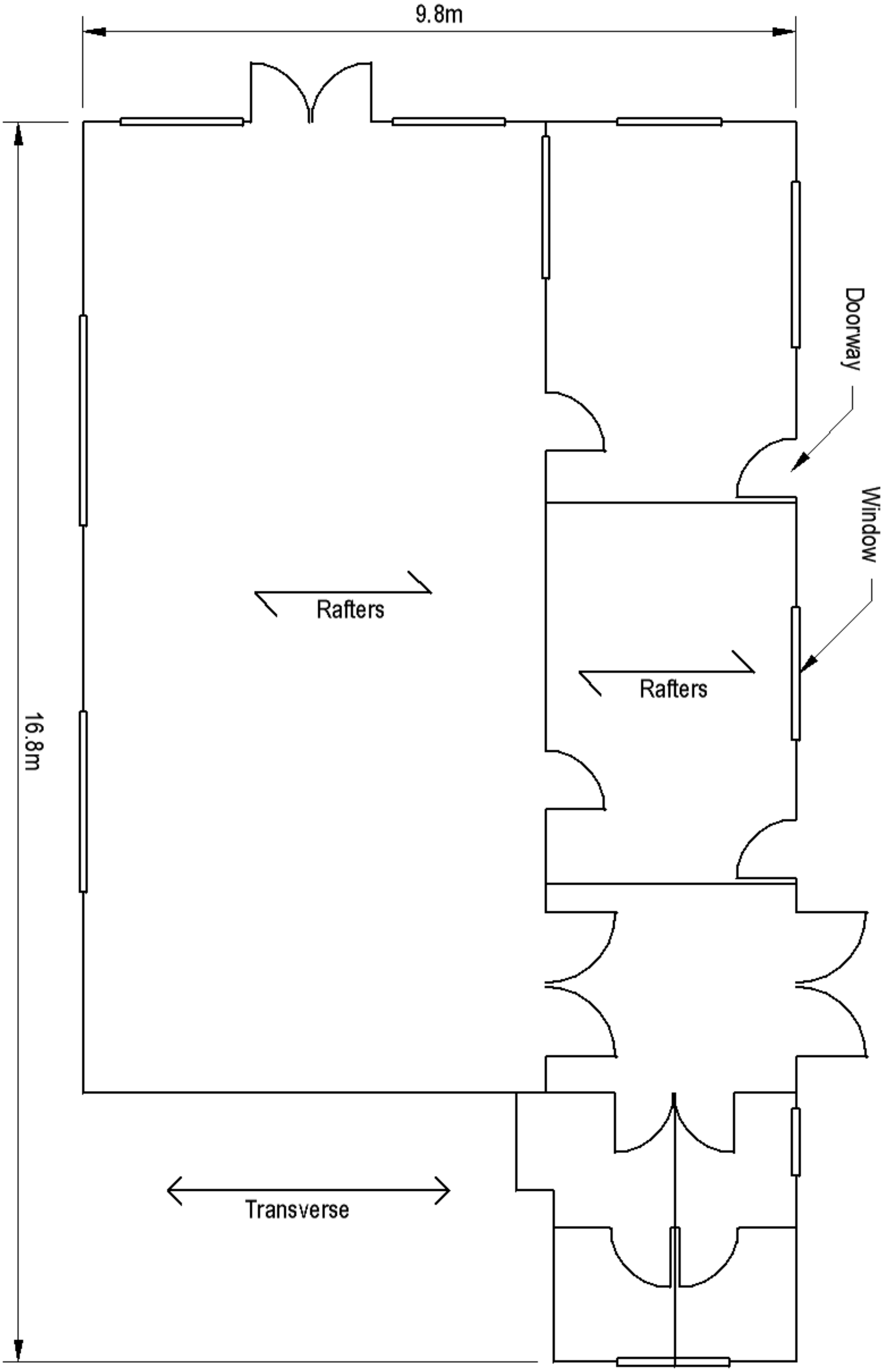
Photo 5. Internal view of the hall portion.

Photo 6. Timber rafters supporting roof structure.

Photo 7. Timber board lining with plasterboard above.

Appendix B

Sketches


9.8m
16.8m
Doorway
Window
Rafters
Rafters
Transverse

Appendix C

CERA Form

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Pavilion/Toilet - Le Bons Bay			Reviewer:	Stephen Lee
	Unit	No:	Street	CPEng No:	1006840
Building Address:	16B		Rue de la Mer	Company:	GHD
Legal Description:				Company project number:	
				Company phone number:	04 472 0799
	Degrees	Min	Sec		
GPS south:				Date of submission:	04-08-13
GPS east:				Inspection Date:	15/02/13
				Revision:	Final
Building Unique Identifier (CCC):	PRK 3596 BLDG 003 EQ2			Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:	sandy 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):	2.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	
Ground floor split?	yes		Ground floor elevation above ground (m):	
Storeys below ground	0			
Foundation type:	other (describe)		if Foundation type is other, describe:	Perimeter strip with piles internally
Building height (m):	5.00		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	145			
Age of Building (years):	35		Date of design:	1976-1992
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	other (specify)		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	
Floors:	other (note)	describe sytem	Timber boards on bearers
Beams:			
Columns:			
Walls:			

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	**Note: Define along and across in detailed report!**		
Ductility assumed, μ:	3.00		note typical wall length (m)	
Period along:	0.40	0.00	estimate or calculation?	
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	lightweight timber framed walls			
Ductility assumed, μ:	3.00		note typical wall length (m)	

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	Board
Roof Cladding:	Metal	describe	Corrugated Metal Sheeting
Glazing:			
Ceilings:			
Services(list):			

Available documentation

Architectural	none	original designer name/date	
Structural	none	original designer name/date	
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	none	original designer name/date	

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:			
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):			
Across	Damage ratio:	0%		
	Describe (summary):			
Diaphragms	Damage?:		Describe:	
CSWs:	Damage?:		Describe:	
Pounding:	Damage?:		Describe:	
Non-structural:	Damage?:		Describe:	

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

Recommendations

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

Along

Assessed %NBS before e'quakes:	54%	##### %NBS from IEP below	If IEP not used, please detail assessment methodology: Detailed Calculation
Assessed %NBS after e'quakes:	54%		

Across

Assessed %NBS before e'quakes:	49%	##### %NBS from IEP below
Assessed %NBS after e'quakes:	49%	

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):	0.4	0.4
(%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 $=k_\mu$, 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

		Along	Across
3.6. Other factors, Factor F	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 Baselline %NBS:	**#DIV/0!**	**#DIV/0!**
4.4 Percentage New Building Standard (%NBS), (before)			**#DIV/0!**

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