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Sign of the Kiwi Rangers House
PRK 1823 BLDG 001 EQ2

Detailed Engineering Evaluation

Qualitative Report

Version FINAL

Corner of Summit and Dyers Pass Roads

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

Sign of the Kiwi Ranger House
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Detailed Engineering Evaluation
Qualitative Report
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Corner of Summit and Dyers Pass Roads

Christchurch City Council

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Reviewed By
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Date
6/11/ 2012

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Sign of the Kiwi Ranger House

PRK_1823_BLDG_001 EQ2

Detailed Engineering Evaluation

Qualitative Report - SUMMARY

Version FINAL

Corner of Summit and Dyers Pass Road

Background

This is a summary of the Qualitative report for the building structure, and is based in part on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011 and visual inspections on 25th May 2012.

Building Description

The building is a single level structure formed from laminate timber and was constructed from kitset manufactured by “Fraemohs”. Walls are formed by stacking members, seated by tongue and groove, into post tensioned panels which interlock at wall intersections. Wall construction is consistent throughout. The roof consists of metal cladding over an interlocking timber ceiling, supported by walls and beams. Ground floor is formed by tongue and groove on joists, supported by bearers and subsequently timber piles.

Key Damage Observed

No key damage was observed.

Critical Structural Weaknesses

The critical structural weakness of significant potential for landslide has been identified in the site characteristics, effecting a 30% reduction in NBS.

Indicative Building Strength (from IEP and CSW assessment)

Based on the information available, and using the NZSEE Initial Evaluation Procedure, the original capacity of the building has been assessed to be in the order of 86% NBS and post-earthquake capacity also in the order of 86% NBS. The buildings post-earthquake capacity excluding critical structural weaknesses is in the order of 124% NBS.

The building has been assessed to have a seismic capacity in the order of 86% NBS and is therefore neither Earthquake Risk nor Earthquake Prone.

Recommendations

It is recommended that:

- The current placard status of the building of green, remain as is.
- The building has been assessed as being not Earthquake Prone. As a result, the Sign of the Kiwi Ranger House can remain occupied, as per CCC's policy.
- There is also no requirement for quantitative analysis of this structure.

1. Background

GHD has been engaged by the Christchurch City Council (CCC) to undertake a detailed engineering evaluation of the Sign of the Kiwi Ranger House.

This report is a Qualitative Assessment of the building structure, and is based in part on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011.

A qualitative assessment involves inspections of the building and a desktop review of existing structural and geotechnical information, including existing drawings and calculations, if available.

The purpose of the assessment is to determine the likely building performance and damage patterns, to identify any potential critical structural weaknesses or collapse hazards, and to make an initial assessment of the likely building strength in terms of percentage of new building standard (%NBS).

At the time of this report, no intrusive site investigation, detailed analysis, or modelling of the building structure had been carried out. Construction drawings were made available, and these have been considered in our evaluation of the building. The building description below is based on a review of the drawings and our visual inspections.

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

Improvement of Structural Performance	
Legal Requirement	NZSEE Recommendation
The Building Act sets no required level of structural improvement (unless change in use) This is for each TA to decide. Improvement is not limited to 34%NBS.	100%NBS desirable. Improvement should achieve at least 67%NBS
	Not recommended. Acceptable only in exceptional circumstances
Unacceptable	Unacceptable

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

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

Table 1 %NBS compared to relative risk of failure

4. Building Description

4.1 General

Sign of the Kiwi Ranger House is located on the corner of Summit and Dyers Pass Road. The site consists of a driveway, various buildings and green areas with some bushes and trees. The site is terraced by cut and fill, with the uppermost terrace occupied by the Ranger House. Ground rises steeply behind the house, with a vertical cut face of 2m being in immediate proximity to the structure. Boulders rest on the slope immediately above this face. The building was constructed in 1986 according to resident estimate. Lower buildings are the Sign of the Kiwi Café, a toilet and a garage.

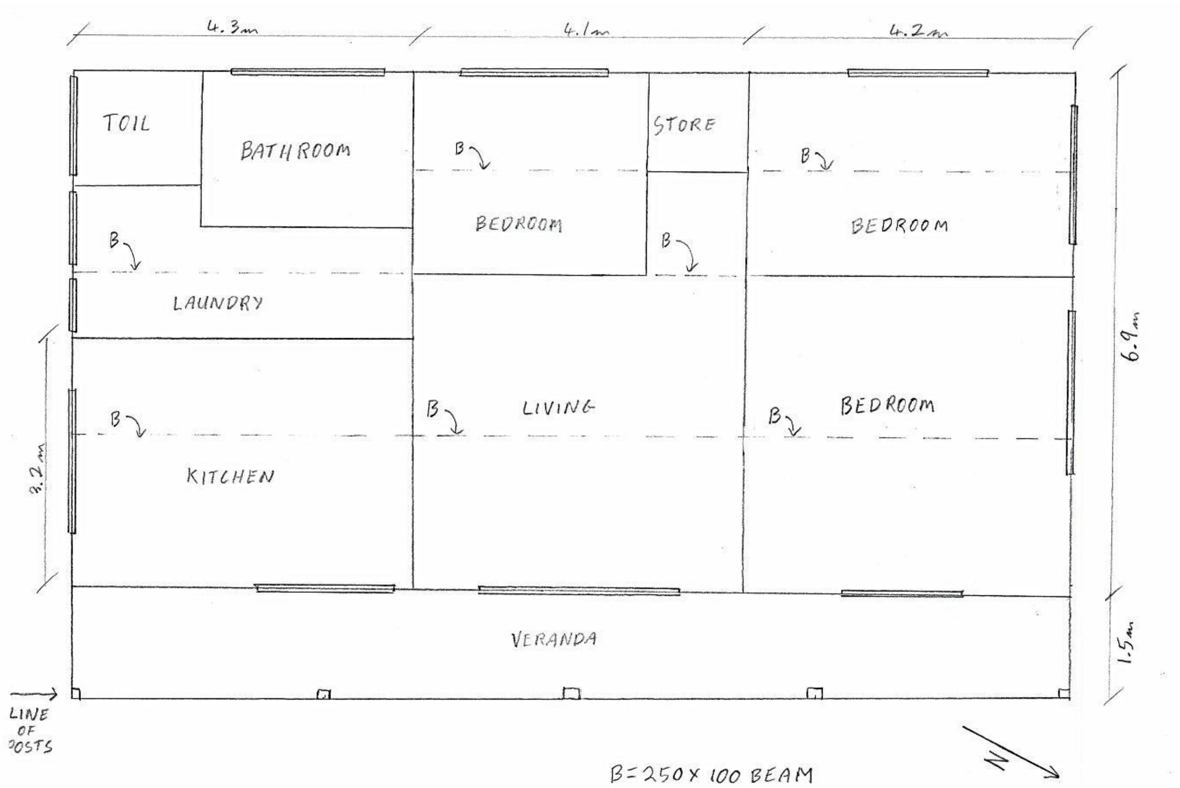

Figure 2 Plan Sketch Showing Structural Layout

The building is a single level structure formed from laminate timber and was constructed from kitset manufactured by "Fraemohs". Walls are formed by stacking members, seated by tongue and groove, into post tensioned panels which interlock at wall intersections. Wall construction is consistent throughout. The roof consists of metal cladding over an interlocking timber ceiling, supported by walls and beams. Ground floor is formed by tongue and groove on joists, supported by bearers and subsequently timber piles.

The building is approximately 12.6m in length by 6.9m in width, with an additional 1.5m of veranda along the front of the structure. The apex sits 3.5m above floor level, with a further 1m to ground level. The building, including veranda, has an approximate footprint of 105m^2. The nearest building is over 12m away. The site is terraced, formed by cut and fill.

Plans or drawings were not available for this building.

4.2 Gravity Load Resisting System

Gravity loads are supported by a load bearing wall system upon piled foundations. Lightweight metal cladding on battens, overlays a tongue and groove timber roof which rests on roof beams or directly on walls. Walls transfer roof loads to the floor level where tongue and groove is supported upon joists. Bearers transfer loads from floor and walls to the timber piles.

4.3 Lateral Load Resisting System

Lateral loads acting on the structure are resisted by the panel action of interlocking timber members. Lateral roof loads and wall loads out of plane are transferred by the diaphragm action provided by interlocking timber members to walls which provide in-plane bracing by panel action. Diaphragm action of tongue and groove floor boards distribute lateral loads from walls to timber piles in the subfloor via bearers. Piles resist lateral loads by bracing, though there is also a probable cantilever pile effect. Construction appears to likely adhere to the relevant timber standard of the time, NZS 3604 (1984).

5. Assessment

An inspection of the building was undertaken on the 25th May 2012. Both the interior and exterior of the building were inspected. The main structural components of the roof of the building were all able to be viewed as exposed internally. Similarly the piled foundations were able to be viewed from an opening beneath the veranda but visible structural elements were restricted to the vicinity of the opening.

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

The %NBS score determined for this building has been based on the IEP procedure described by the NZSEE and based on the information obtained from visual observation of the building

6. Damage Assessment

6.1 Surrounding Buildings

The Ranger House is located close to three other buildings situated within 30m of the house; the Sign of the Kiwi Café, the Sign of the Kiwi Toilet and an associated garage. There was no damage to the Sign of the Kiwi Toilet or garage. A few of the exterior stone walls of the Sign of the Kiwi Café were damaged but had been restrained by temporary timber works.

6.2 Residual Displacements and General Observations

There were no residual displacements noted.

6.3 Ground Damage

Minor slips were noted in the vicinity, reported by resident.

7. Critical Structural Weakness

7.1 Short Columns

No short columns are present in the structure.

7.2 Lift Shaft

The building does not contain a lift shaft.

7.3 Roof

No critical structural weaknesses were observed in the roof structure. The roof construction of metal cladding over interlocking timber members provided a diaphragm action for roof stability.

7.4 Staircases

The building does not contain a staircase.

7.5 Site Characteristics

Following the geotechnical appraisal it was found that the site has a moderate potential for slope instability, allowing potential for site instability and landslide from above. In addition the presence of discontinuous bluffs above add a potential rockfall hazard. For the purposes of the IEP assessment of the building and the determination of the %NBS score, these effects on the performance of the building has been assessed as a ‘significant’ site characteristic in accordance with the NZSEE guidelines.

8. Geotechnical Consideration

8.1 Site Description

The site is situated within a recreational reserve, on the Port Hills in southern Christchurch. It is located on a saddle (Dyers Pass) at approximately 300m above mean sea level, with steep slopes dipping to the northwest and southeast. It is approximately 6km west of Lyttleton, and 2km north of Governors Bay.

8.2 Published Information on Ground Conditions

8.2.1 Published Geology

The geological map of the area[1] indicates that the site is underlain by Miocene volcanic rock of the Lyttleton Volcanic Group, comprising basaltic to trachytic lava flows interbedded with breccia and tuff, numerous dikes and minor domes (Mvl).

8.2.2 Environment Canterbury Logs

Information from Environment Canterbury (ECan) indicates that four boreholes are located within a 400m radius of the site (see Table 2). All of these boreholes had lithographic logs, which indicate the area is typically underlain by 0.4 to 2m of loess colluvium, overlying volcanic rock.

Table 2 ECan Borehole Summary.

Bore Name	Log Depth	Groundwater	Distance & Direction from Site
M36/1026	~21.1m	~2.8m bgl	400m NE
M36/1027	~15.2m	~2.8m bgl	400m NE
M36/1028	~21.3m	~2.8m bgl	400m NE
M36/1029	~15.2m	~2.8m bgl	400m NE

8.2.3 EQC Geotechnical Investigations

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

8.2.4 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.

[1] Forsyth P.J., Barrell D.J.A., & Jongens R. (compilers) 2008: *Geology of the Christchurch Area*. Institute of Geological and Nuclear Sciences 1:250,000 Geological Map 16. Lower Hutt. Institute of Geological and Nuclear Sciences Limited.

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

The site has been classified as Technical Category N/A - Port Hills and Banks Peninsula. Properties in the Port Hills and Banks Peninsula have not been given a Technical Category due to their differing underlying geology.

8.2.5 Post February Aerial Photography

Aerial photography taken following the 22 February 2011 earthquake shows no signs of liquefaction outside the building footprint or adjacent to the site, as shown in Figure 3**.**

Figure 3 Post February 2011 Earthquake Aerial Photography [2]

8.2.6 Summary of Ground Conditions

From the information presented above, the ground conditions underlying the site are anticipated to comprise a thin superficial cover of loess / loess colluvium underlain by basalt.

[2] Aerial Photography Supplied by Koordinates sourced from http://koordinates.com/layer/3185-christchurch-post-earthquake-aerial-photos-24-feb-2011/

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 3 Summary of Known Active Faults[34]

Known Active Fault	Distance from Site	Direction from Site	Max Likely Magnitude	Avg Recurrence Interval
Alpine Fault	130 km	NW	~8.3	~300 years
Greendale (2010) Fault	23km	W	7.1	~15,000 years
Hope Fault	110 km	N	7.2~7.5	120~200 years
Kelly Fault	110 km	NW	7.2	~150 years
Porters Pass Fault	65 km	NW	7.0	~1100 years

Recent earthquakes since 22 February 2011 have identified the presence of a previously unmapped active fault system underneath Christchurch City and the Port Hills. Research and published information on this system is in development and not generally available. Average recurrence intervals are yet to be estimated.

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.

This recent seismic activity has produced earthquakes of Magnitude-6.3 with peak ground accelerations (PGA) up to twice the acceleration due to gravity (2g) in some parts of the city. This has resulted in widespread liquefaction throughout Christchurch.

In addition, anticipation of bedrock at or near the surface, and a 475-year PGA (peak ground acceleration) of ~0.4 (Stirling et al, 2002)[3], ground shaking potential is considered low.

However, due to the sites location atop a ridgeline, there is potential for topographical amplification effects in a seismic event.

8.4 Slope Failure and/or Rockfall Potential

Given the site's location in the Port Hills global slope instability potential is considered moderate. The site has also been cut into the slope creating local retaining structures which increase slope instability potential.

[3] 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.

[4] GNS Active Faults Database

The topography of the site and presence of discontinuous bluffs above create a potential rockfall hazard. Several fallen boulders have been mapped on the hillside above the site.

8.5 Liquefaction Potential

Due to the anticipated geology and groundwater not likely near the surface, subsoil liquefaction is not considered a potential hazard for this site. In addition no effects of liquefaction were reportedly observed at the ground surface on the Port Hills.

8.6 Recommendations

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

If a more detailed assessment is required, details can be provided upon approval of quantitative assessments phase

8.7 Conclusions & Summary

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 loess and/or loess colluvium underlain by basalt, therefore subsoil liquefaction is not considered a potential hazard for this site.

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

If a more detailed assessment is required, details can be provided upon approval of quantitative assessments phase

9. Survey

No level or verticality surveys have been undertaken for this building at this stage as indicated by Christchurch City Council guidelines.

10. Initial Capacity Assessment

10.1 % NBS Assessment

Following an IEP assessment, the building has been assessed as achieving 86% New Building Standard (NBS). Under the New Zealand Society for Earthquake Engineering (NZSEE) guidelines the building is considered neither Earthquake Prone nor Earthquake Risk as it achieves above 67% NBS. This score has been adjusted, as detailed in the NZSEE Initial Evaluation Procedure, to account for CWS's in the form of site characteristics. The building would have achieved a NBS of 124% had there been no CSW's.

10.2 Seismic Parameters

The seismic design parameters based on current design requirements from NZS 1170:2002 and the NZBC clause B1 for this building are:

- Site soil class: B NZS 1170.5:2004, Clause 3.1.3, Soft Soil
- Site hazard factor, Z = 0.3, NZBC, Clause B1 Structure, Amendment 11 effective from 1 August 2011
- Return period factor R_u = 1.0 NZS 1170.5:2004, Table 3.5, Importance level 2 with a 50 year design life.

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

10.3 Expected Structural Ductility Factor

A structural ductility factor of 3.0 has been assumed based on the structural system observed and the date of construction.

10.4 Discussion of Results

The results obtained from the initial IEP assessment are consistent with those expected for a building of this age, importance level and construction type founded on Class B soils.

The building was constructed in 1986 and was likely designed to the loading standard current at the time, NZS 4203:1984. The design loads used in this code are likely to have been less than those required by the current loading standard. When this is combined with the increase in the hazard factor for Christchurch to 0.3 and the existence of a Critical Structural Weakness, it would be expected that the building would not achieve 100% NBS. Due to the lack of any structural damage it is reasonable to expect a NBS of 86% and for the building to be classed as neither Earthquake Prone nor Earthquake Risk.

10.5 Occupancy

As the building has been assessed to have a % NBS exceeding 67%, it is not deemed a potential Earthquake Risk. As per the Christchurch City Council's (CCC) policy, occupancy of the structure may continue.

11. Initial Conclusions

The building has been assessed to have a seismic capacity in the order of 86% NBS and is therefore neither Earthquake Risk nor Earthquake Prone.

12. Recommendations

The recent seismic activity in Christchurch has caused no damage to the building, hence the building has achieved above 67% NBS following an initial IEP assessment of the building, no further assessment is required by Christchurch City Council to comply with the building act.

The building is currently occupied and the findings of this report mean that this is acceptable and occupancy may continue.

13. Limitations

13.1 General

This report has been prepared subject to the following limitations:

- No intrusive structural investigations have been undertaken.
- No intrusive geotechnical investigations have been undertaken.
- Visual inspections of the sub-floor space were limited to the vicinity of the opening beneath the veranda and as a result the entirety of the subfloor space could not be inspected.
- No level or verticality surveys have been undertaken.
- No material testing has been undertaken.
- No calculations, other than those included as part of the IEP in the CERA Building Evaluation Report, have been undertaken. No modelling of the building for structural analysis purposes has been performed.

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 reportrite a specific limitations section.

13.2 Geotechnical Limitations

This report presents the results of a geotechnical appraisal prepared for the purpose of this commission, and for prepared solely for the use of Christchurch City Council and their advisors. The data and advice provided herein relate only to the project and structures described herein and must be reviewed by a competent geotechnical engineer before being used for any other purpose. GHD Limited (GHD) accepts no responsibility for other use of the data.

The advice tendered in this report is based on a visual geotechnical appraisal. No subsurface investigations have been conducted. An assessment of the topographical land features have been made based on this information. It is emphasised that Geotechnical conditions may vary substantially across the site from where observations have been made. Subsurface conditions, including groundwater levels can change in a limited distance or time. In evaluation of this report cognisance should be taken of the limitations of this type of investigation.

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

Photograph 1 View from the North.

Photograph 2 View of Ranger House from the south.

Photograph 3 View from slope above(Potential rockfall hazard in foreground).

Photograph 4 View of cut face from interior.

Photograph 5 Braced pile to the rear.

Photograph 6 Laminate timber panels interlocking at corner / roof beam seen above.

Appendix B

CERA Building Evaluation Form

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Sign of the Kiwi Rangers House	Reviewer:	Derek Chinn
	Unit / No: / Street	CPEng No:	177243
Building Address:	Summit Rd	Company:	GHD
Legal Description:		Company project number:	513059692
		Company phone number:	(03) 3780900
	Degrees / Min / Sec		
GPS south:	43 / 36 / 22.87	Date of submission:	
GPS east:	172 / 38 / 43.61	Inspection Date:	25-May-12
		Revision:	0
Building Unique Identifier (CCC):	PRK_1823_BLDG_001 EQ2	Is there a full report with this summary?	yes

Site

Site slope:	slope < 1in 10	Max retaining height (m):	
Soil type:	mixed	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):	340.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	340.00
Ground floor split?	no		Ground floor elevation above ground (m):	1.00
Storeys below ground	0			
Foundation type:	timber piles		if Foundation type is other, describe:	
Building height (m):	4.50		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	85			
Age of Building (years):	26		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):	Residential			
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	Locked timber roof on timber beams
Floors:	timber	joist depth and spacing (mm)	T&G on joists then bearers
Beams:	timber	type	250 x 100
Columns:	timber	typical dimensions (mm x mm)	90 x 90 Veranda posts
Walls:			

Lateral load resisting structure

Lateral system along:	other (note)	**Note: Define along and across in detailed report!**	describe system	Solid locked timber walls
Ductility assumed, μ:	3.00			
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:	other (note)		describe system	Solid locked timber walls
Ductility assumed, μ:	3.00			
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:			none
Roof Cladding:	Metal	describe	CGI sheet
Glazing:	aluminium frames		
Ceilings:	strapped or direct 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:	none observed	notes (if applicable):	
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	none apparent	notes (if applicable):	
Lateral Spread:	none apparent	notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

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

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

Recommendations

	Level of repair/strengthening required:	None	Describe:	
	Building Consent required:	no	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before:	86%	87% %NBS from IEP below	If IEP not used, please detail assessment methodology:
	Assessed %NBS after:	86%		
Across	Assessed %NBS before:	86%	87% %NBS from IEP below	
	Assessed %NBS after:	86%		

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: B

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:	26.0%	26.0%

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:	**26%**	**26%**

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:	0.30
Z_{1992}, from NZS4203:1992	
Hazard scaling factor, **Factor B:**	3.333333333

2.4 Return Period Scaling Factor

Building Importance level (from above):	2
Return Period Scaling factor from Table 3.1, **Factor C**:	1.00

2.5 Ductility Scaling Factor

	along	across
Assessed ductility (less than max in Table 3.2)	3.00	3.00
Ductility scaling factor: =1 from 1976 onwards; or =k_μ, if pre-1976, fromTable 3.3:	1.00	1.00
Ductiity Scaling Factor, **Factor D**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

	along	across
Sp:	0.700	0.700
Structural Performance Scaling Factor **Factor E**:	1.428571429	1.428571429

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

	along	across
%NBS$_b$:	**124%**	**124%**

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

3.1. Plan Irregularity, factor A:	insignificant	1
3.2. Vertical irregularity, Factor B:	insignificant	1
3.3. Short columns, Factor C:	insignificant	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

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

3.5. Site Characteristics	significant	0.7

3.6. Other factors, Factor F

	Along	Across
For ≤ 3 storeys, max value =2.5, otherwise max valule =1.5, no minimum	1.0	1.0
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)	**0.70**	**0.70**
4.3 PAR x (%NBS)b: PAR x Baselline %NBS:	**87%**	**87%**

4.4 Percentage New Building Standard (%NBS), (before) **87%**

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