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Styx Mill Ranger House
PRK 0340 BLDG 003
Detailed Engineering Evaluation
Qualitative Report
Version FINAL

130 Hussey Rd, Northwood

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

Styx Mill Ranger House
PRK 0340 BLDG 003

Detailed Engineering Evaluation
Qualitative Report
Version FINAL

130 Hussey Rd, Northwood

Christchurch City Council

Prepared By
Paul Clarke

Reviewed By
Rob Collins

Date
23 May 2013

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Ranger House

PRK 0340 BLDG 003

Detailed Engineering Evaluation

Qualitative Report - SUMMARY

Version FINAL

130 Hussey Rd, Northwood

Background

This is a summary of the Qualitative 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 19 July 2011 and visual inspections on 4 April 2012.

Building Description

The building is a single level timber framed structure, with a roof consisting of lightweight metal cladding on timber trusses and purlins, with a pitch of approximately twenty degrees. External wall construction consists of brick cladding on timber stud, lined internally with plasterboard. Internal walls also consist of timber stud and plasterboard. The floor consists of a concrete slab on grade floor with the external walls supported by perimeter strip footings. Internal walls are also supported by strip footings.

Key Damage Observed

No structural damage was observed.

Critical Structural Weaknesses

No critical structural weaknesses were observed to the structure.

Indicative Building Strength (from IEP and CSW assessment)

Based on the information available, and using the NZSEE Initial Evaluation Procedure, the building's original capacity has been assessed to be in the order of 86% NBS. The building's post-earthquake capacity, irrespective of critical structural weaknesses as none were present, is also in the order of 86% NBS. The building has been assessed to have a seismic capacity in the order of 86% NBS and is therefore neither Earthquake Prone nor an Earthquake Risk.

Recommendations

It is recommended that:

The building has been assessed as not being Earthquake Prone. As a result, the dwelling can remain occupied.

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 Styx Mill Ranger House, 130 Hussey Road.

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	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 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

Styx Mill Ranger House is located at 130 Hussey Road, Northwood, Christchurch. The site consists of the structure, paved driveway and a lawn area. The front boundary mainly consists of trees/large bushes. The building was constructed in 1995 according to resident estimate.

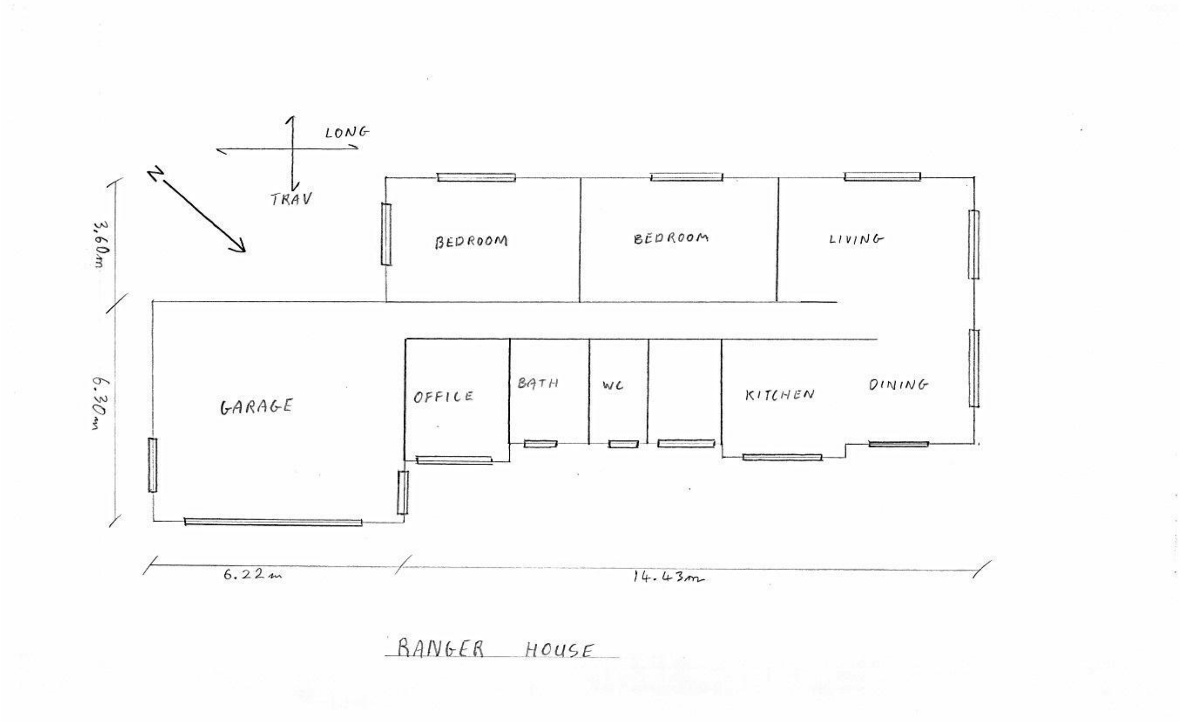

Figure 2 Plan Sketch Showing Structural Layout

The building is a single level timber framed structure, with a roof consisting of lightweight metal cladding on timber trusses and purlins, with a pitch of approximately twenty degrees. External wall construction consists of brick cladding on timber stud, lined internally with plasterboard. Internal walls also consist of timber stud and plasterboard. The floor consists of a concrete slab on grade floor with the external walls supported by perimeter strip footings. Strip footings also support internal walls.

The building is approximately 20m in length by 10m wide and is 4.5m high at the ridge. The overall footprint is 180m^2 approximately. The nearest building is over 45m away. Styx Mill ponds are located 300m away and Styx River approximately 20m to the south of the structure. The site is predominantly flat with insignificant variations in ground levels throughout.

Plans or drawings were not available for this building.

4.2 Gravity Load Resisting System

The gravity loads in the structure are resisted by a timber frame external wall system. Roof loads are transferred through timber trusses to the external walls. Loads are then carried through the external walls to the perimeter strip foundation.

Internal floor loads are transferred through the concrete slab to the underlying grade.

4.3 Lateral Load Resisting System

Lateral loads acting on the structure are resisted by the composite panel action of plasterboard lining and timber framing. Lateral roof loads and wall loads out of plane are transferred by the diaphragm action provided by ceiling plasterboard on timber framing, to walls which provide in-plane bracing. These walls in turn carry the load to the edge strip footing by bracing panel action of the plasterboard and timber stud. Roof stability is improved by diagonal bracing attached to the underside of roof plane timber.

5. Assessment

An inspection of the building was undertaken on the 23rd of 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 through the roof space access panel.

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 inspection of the building and available drawings.

6. Damage Assessment

6.1 Surrounding Buildings

No apparent damage was noted to the surrounding buildings or the adjoining properties.

6.2 Residual Displacements and General Observations

Cracking was noted to the internal plasterboard lining in several locations throughout the building, These were above doors/windows, in a ceiling at a re-entrant corner and along a wall/ceiling connection. See photographs 3 and 4. These cracks are not considered to be structurally significant.

A single crack was noted in the strip foundation of the building, this being at the corner external to a bedroom. See photograph 5. The cracking appears to be cosmetic and affects only the render finish.

No damage was evident to the roof structure.

No residual displacements of the structure were noted.

6.3 Ground Damage

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

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. Metal cladding and ceiling plasterboard combining with the roof trusses to provide a diaphragm action for roof stability. This was further increased by diagonal bracing attached to the underside of roof plane timber.

7.4 Staircases

The building does not contain a staircase.

7.5 Site Characteristics

The Geotechnical report indicates that no liquefaction has occurred, further investigation should be undertaken to better understand the liquefaction potential of the site. Given the nature of the structure (timber framed, single storey and on reinforced perimeter footings) it has been assessed as an 'insignificant' site characteristic in accordance with the NZSEE guidelines.

The Geotechnical report also indicates a potential for lateral spread due to the proximity to Styx River. Similarly, given the nature of the structure it has been assessed as an 'insignificant' site characteristic in accordance with the NZSEE guidelines.

8. Geotechnical Consideration

8.1 Site Description

The Rangers Hut is located between the north bank of Styx River and Hussey Road, in Casebrook, north Christchurch. It is 10m above mean sea level, 20m north of the Styx River, 4km south of the Waimakariri River, and 7km west of the coast.

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:

- Grey river alluvium beneath plains or low-level terraces (Q1a), Holocene in age.

8.2.2 Environment Canterbury Logs

Information from Environment Canterbury (ECan) indicates that a number of boreholes are located within a 200m radius of the site. Of these boreholes, none had lithographic logs.

However, three wells were located within 300m have lithographic logs, as outlined in Table 2. These indicate the area is typically underlain by sand and silt to 5 to 7m, underlain by interbedded thick layers of sandy gravel, and silt.

Table 2 ECan Borehole Summary

Bore Name	Log Depth	Groundwater (bgl)	Distance & Direction from Site
M35/6001	23m	1.8m	240m NE
M35/6814	23.7m	3.1m	280m N
M35/15675	3.4m	2.7m	280m E

It should be noted that the boreholes were sunk for groundwater extraction and not for geotechnical purposes. Therefore, the amount of material recovered and available for interpretation and recording will have been variable at best and may not be representative. 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 Investigations

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

[1] Forsyth P.J., Barrell D.J.A., & Jongens R. 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.

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.

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 is indicated as being technical category “N/A – Urban Non-residential”.

It is surrounded by land categorised as Technical Category 2 (TC2, yellow) , which means that minor to moderate land damage from liquefaction is possible in future significant earthquakes and Technical Category 3 (TC3 – blue) which means that moderate to significant land damage from liquefaction is possible in future significant earthquakes.

8.2.5 Post February Aerial Photography

Aerial photography taken following the 22 February 2011 earthquake doesn’t show any clear signs of liquefaction, 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, it is anticipated that ground conditions at the subject site comprise alluvial deposits.

[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

From the information presented above, it is anticipated that ground conditions at the subject site comprise sand and silt, underlain by sandy gravel from 4 to 7m bgl.

Table 3 Summary of Known Active Faults[3,4]

Known Active Fault	Distance from Site	Direction from Site	Max Likely Magnitude	Avg Recurrence Interval
Alpine Fault	120 km	NW	~8.3	~300 years
Greendale (2010) Fault	30 km	SW	7.1	~15,000 years
Hope Fault	100 km	N	7.2~7.5	120~200 years
Kelly Fault	110 km	NW	7.2	150 years
Porters Pass Fault	60 km	NW	7.0	1100 years

Recent earthquakes since 4 September 2010 have identified the presence of a previously unmapped active fault system underneath the Canterbury Plains, including 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.

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.

8.4 Slope Failure and/or Rockfall Potential

The topography surrounding the site suggests that rockfall is not a potential hazard. However, given its close proximity to the Styx River, the site may be susceptible to lateral spreading.

In addition, any retaining structures or embankments nearby should be further investigated to determine the site-specific local 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

8.5 Liquefaction Potential

It is not clear from the post-earthquake aerial photography (Figure 3)whether liquefaction occurred at the site. The gound conditions suggest that the soils may be prone to liquefaction.

Ground investigation should be undertaken to better understand the liquefaction potential of the site and allow a liquefaction assessment to be undertaken.

8.6 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. However, limited ground information was available for the subject site.

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

Due to its proximity to the Styx River, the site is considered potentially susceptible to lateral spreading. Further investigation is recommended to better determine this risk.

9. Survey

No level or verticality surveys have been undertaken for this building at this stage.

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 not considered a potential Earthquake Risk as it achieves above 67% NBS. This score has not been adjusted when considering CSWs or serious damage to the structure as neither were observed.

10.2 Seismic Parameters

The seismic design parameters based on current design requirements from NZS1170:2002 and the NZBC clause B1 for this building are:

- Site soil class: D/E, NZS 1170.5:2004, Clause 3.1.3, Soft/ Very 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 structure 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 D/E soils.

The building was constructed in 1995 and was likely designed to the loading standard current at the time, NZS 4203:1992. The design loads used in this code are likely to have been less than those required by the current loading standard. When combined with the increase in the hazard factor for Christchurch to 0.3, it would be expected that the building would not achieve 100% NBS. Due to the lack of any Critical Structural Weaknesses the structure achieved a %NBS of 86%, classifying the building as neither Earthquake Prone nor an 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 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 only caused minor damage to the building, with minor cracking in plasterboard linings and external render being the only damage noted. As the building suffered insignificant damage that would not compromise the load resisting capacity of the existing structural systems and 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 not carried out due to lack of access to the manhole.
- Visual inspections of the roof space were not carried out due to lack of access to the access hatch.
- 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 North elevation.

Photograph 2 View of the south side of structure.

Photograph 3 Minor cracking above window.

Photograph 4 Cracking in ceiling.

Photograph 5 Cracking in strip footing render.

Photograph 6 View of roof trusses and diagonal bracing.

Appendix B

CERA Building Evaluation Form

Detailed Engineering Evaluation Summary Data

V1.11

Location

Building Name:	Ranger House	Reviewer:	Derek Chinn
Building Address:	Unit: / No: 130 / Street: Hussey Road, Northwood	CPEng No:	177243
Legal Description:	Lot 6 DP 29040	Company:	GHD
		Company project number:	5130596/62
		Company phone number:	04 472 0799
GPS south:	Degrees 43, Min 27, Sec 42.60	Date of submission:	23/05/2013
GPS east:	Degrees 172, Min 36, Sec 14.41	Inspection Date:	23-May-12
		Revision:	FINAL
Building Unique Identifier (CCC):	PRK_0340_BLDG_003	Is there a full report with this summary?	yes

Site

Site slope:	flat	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):	

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	10.00
Ground floor split?	no		Ground floor elevation above ground (m):	0.25
Storeys below ground	0			
Foundation type:	strip footings		if Foundation type is other, describe:	
Building height (m):	4.30		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	200			
Age of Building (years):	17		Date of design:	1992-2004
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	other (specify)		Brief strengthening description:	
Use (upper floors):	other (specify)			
Use notes (if required):	Residential			
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber truss	truss depth, purlin type and cladding	
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	none	overall depth x width (mm x mm)	
Columns:			
Walls:			

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	**Note: Define along and across in detailed report!**	note typical wall length (m)	3
Ductility assumed, μ:	3.00			0.2
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)	3
Ductility assumed, μ:	3.00			0.2
Period across:	0.40	0.00	estimate or calculation?	estimated
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:			none
Wall cladding:			none
Roof Cladding:	Metal	describe	
Glazing:	aluminium frames		
Ceilings:	plaster, fixed		
Services(list):			

Available documentation

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

Damage

Site:
(refer DEE Table 4-2)

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

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):			
Across	Damage ratio:	0%		
	Describe (summary):			
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	yes	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%	86% %NBS from IEP below	If IEP not used, please detail assessment methodology:
	Assessed %NBS after:	86%		
Across	Assessed %NBS before:	86%	86% %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): 1992-2004

h_n from above: m

Seismic Zone, if designed between 1965 and 1992:

not required for this age of building: D soft soil

Design Soil type from NZS4203:1992, cl 4.6.2.2:

	along	across
Period (from above):	0.4	0.4
(%NBS)nom from Fig 3.3:	22.5%	22.5%

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 $(\%NBS)_{nom}$:	**23%**	**23%**

2.2 Near Fault Scaling Factor

	along	across
Near Fault scaling factor, from NZS1170.5, cl 3.1.6:		1.00
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	0.8
Hazard scaling factor, **Factor B**:	2.666666667

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

	along	across
$\%NBS_b$:	**86%**	**86%**

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	insignificant	1

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)	1.00	1.00
4.3 PAR x (%NBS)b: PAR x Baseline %NBS:	86%	86%
4.4 Percentage New Building Standard (%NBS), (before)		86%

Official Use only:

Accepted By:

Date:

GHD

Level 11, Guardian Trust House
15 Willeston street, Wellington 6011
T: 64 4 472 0799 F: 64 4 472 0833 E: wgtnmail@ghd.com

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		Name	Signature	Name	Signature	Date
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