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Styx Mill Reserve Equipment Shed
PRK 0340-BLDG-004 EQ2

Detailed Engineering Evaluation

Qualitative Report

Version FINAL

130 Hussey Road, Harewood

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

Styx Mill Reserve Equipment Shed
PRK 0340-BLDG-004 EQ2

Detailed Engineering Evaluation
Qualitative Report
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130 Hussey Road, Harewood

Christchurch City Council

Prepared By
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Reviewed By
Stephen Lee

Date
31/10/12

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Styx Mill Reserve Equipment Shed

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Detailed Engineering Evaluation

Qualitative Report - SUMMARY

Version FINAL

130 Hussey Road, Harewood

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 17 April 2012.

Building Description

The Equipment Shed is located at 130 Hussey Road within Styx Mill Reserve in Harewood, Christchurch. The building is situated close to a few residential buildings to the north and east.

The building is approximately 10m long, 9.7m wide and 4m in height. The overall footprint of the building is approximately $97m^2$. The building was constructed on 1999. No alterations have been made to the building since construction.

The structure is made of steel UB portal frames with timber roof purlins clad with corrugated metal roofing. Two diagonal steel angle roof bracings are located in the northeast and southwest roof quadrants. The walls have steel posts with timber purlins and are clad with corrugated metal sheeting.

A timber framed office has been constructed within the Equipment Shed. The timber walls of the office are not load bearing.

The building's foundation consists of concrete strip footings to the external perimeter connected to the concrete floor slab founded on hardfill.

Key Damage Observed

No apparent damage was observed.

Critical Structural Weaknesses

No potential critical structural weakness has been identified.

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 85% NBS and post-earthquake capacity in the order of 85% NBS.

The building has been assessed to have a seismic capacity in the order of 85% NBS and is therefore not a potential Earthquake Risk.

Recommendations

It is recommended that:

a) As the building does not have any apparent damage and has achieved greater than 67% NBS following an initial IEP assessment, the building can remain occupied as per Christchurch City Council's policy.

b) No detailed quantitative assessment is required.

1. Background

GHD Limited has been engaged by the Christchurch City Council (CCC) to undertake a detailed engineering evaluation of the Equipment Shed located at Styx Mill Reserve.

This report is a Qualitative Assessment of the building structure, and is based generally 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. A planning drawing was made available. The building description below is based on our visual inspections and the planning drawing available.

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 3.1 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 3.1 NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE

Table 3.1 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 3.1 %NBS compared to relative risk of failure

4. Building Description

4.1 General

The Equipment Shed is located at 130 Hussey Road within Styx Mill Reserve in Harewood, Christchurch. The building is situated close to a few residential buildings to the north and east.

The building is approximately 10m long, 9.7m wide and 4m in height. The overall footprint of the building is approximately 97m^2. The building was constructed in 1999. No alterations have been made to the building since construction. Plan and cross section details are shown in Figures 4.1 to 4.2.

The structure is made of steel UB portal frames with timber roof purlins clad with corrugated metal roofing. Two diagonal steel angle roof bracings are located in the northeast and southwest roof quadrants. The walls have steel posts with timber purlins and are clad with corrugated metal sheeting.

A timber framed office has been constructed within the Equipment Shed. The timber walls of the office are not load bearing.

The building's foundation consists of concrete strip footings to the external perimeter connected to the concrete floor slab founded on hardfill.

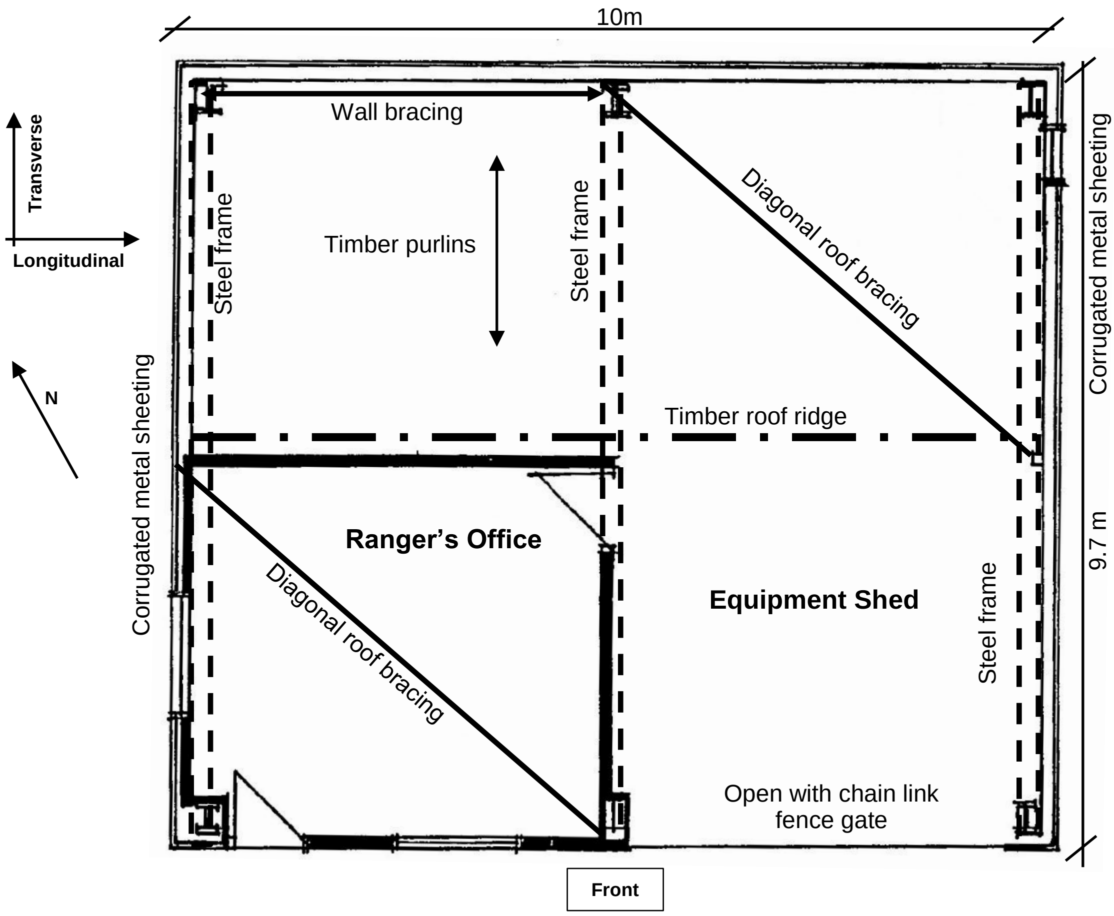

Figure 4.1 Plan View

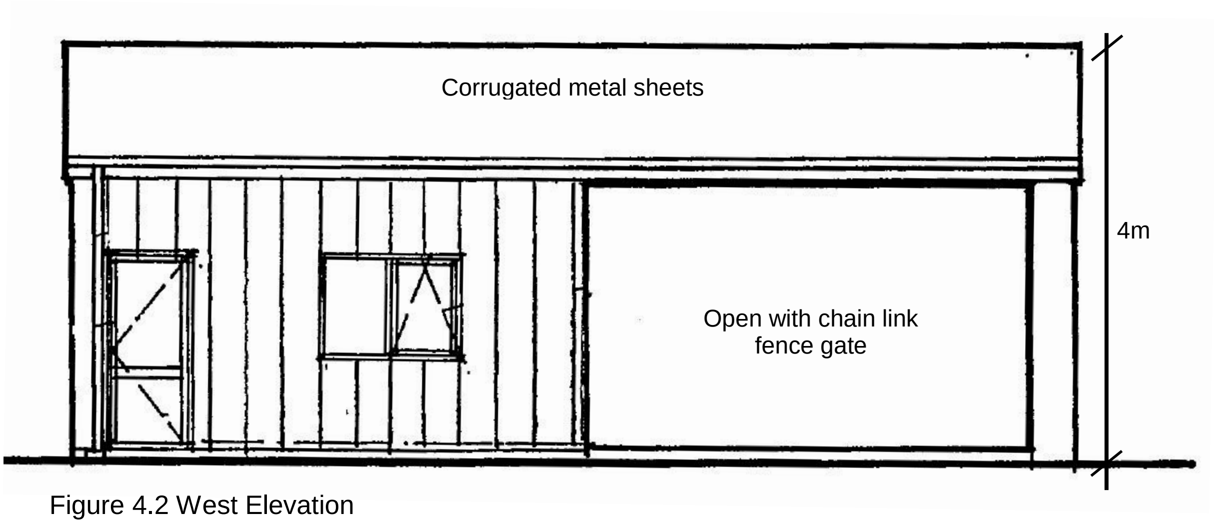

Figure 4.2 West Elevation

4.2 Gravity Load Resisting System

Roof loads are carried by the corrugated metal roof sheeting to timber purlins spanning in the longitudinal direction, and transferred to the steel frames which span the building in the transverse direction. Loads from the steel frames are transferred to the isolated concrete foundations and into the ground. All floor gravity loads are transferred through the concrete slab and compacted hardfill and into the ground.

4.3 Lateral Load Resisting System

Lateral loads acting on the building are primarily resisted by steel portal frames in the transverse direction. In the longitudinal direction, lateral loads are transferred through the timber roof purlins into the steel angle diagonal roof bracing. These loads are then transferred to wall bracing in the northwest quadrant of the building.

Lateral loads are transferred through the steel frame columns into the concrete foundations and into the ground.

5. Assessment

An inspection of the building was undertaken on the 17th of April 2012. Both the interior and exterior of the building were inspected. No placard was observed. The main structural components of the building including the roof structure were all able to be viewed. No inspection of the foundations of the structure was able to be undertaken.

An inspection of the building was undertaken on the 17th of April 2012. Both the interior and exterior of the building were inspected. No placard was observed. The main structural components of the building including the roof structure were all able to be viewed. No inspection of the foundations of the structure was able to be undertaken.

The inspection consisted of observing the building to determine the structural systems and likely behaviour of the building during earthquake. The site was assessed for damage, including observing the ground conditions, checking for damage in 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.

The %NBS score is determined using the IEP procedure described by the NZSEE which is based on the information obtained from visual observation of the building and available drawings.

6. Damage Assessment

6.1 Surrounding Buildings

The closest buildings, comprising the Ranger's house and few residential buildings are located approximately 30m from the shed.

No damage to these buildings was observed during the site inspection.

6.2 Residual Displacements and General Observations

No apparent damage was noted throughout the building.

6.3 Ground Damage

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

7. Critical Structural Weakness

7.1 Short Columns

The building does not contain any significant short column.

7.2 Lift Shaft

The building does not contain a lift shaft.

7.3 Roof

No Critical Structural Weakness was observed on the roof structure. The roof is braced by the two diagonal steel angles located in the northeast and southwest roof quadrants. These work in conjunction with the timber purlins which act as struts between the portal frames.

7.4 Plan Irregularity

In the longitudinal direction, the only wall bracing is in the northwest quadrant. Therefore, there is a potential torsional effect to the bracing. However, adequate roof bracing in conjunction with portal frames in the transverse direction means that this plan irregularity can be considered insignificant.

7.5 Vertical Irregularity

The building does not qualify for vertical irregularity according to IEP standard.

7.6 Staircases

The building has no staircase.

8. Geotechnical Consideration

8.1 Site Description

The Styx Mill Conservation Reserve is situated in Harewood, Christchurch. The reserve is flat at 10m above mean sea level and it's approximately 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, only one had lithographic logs (see Table 3), which indicate the area is typically underlain by clay in the shallow part, followed by the gravel.

Table 2 ECan Borehole Summary

Bore Name	Log Depth	Groundwater	Distance & Direction from Site
M35/5525	8.8m	1.1m bgl	100m N of the site

It should be noted that the purpose of the boreholes the well logs are associated with, 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.

8.2.4 Land Zoning

Canterbury Earthquake Recovery Authority (CERA) has not published any information for this 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.

8.2.5 Post February Aerial Photography

Aerial photography taken following the 22 February 2011 earthquake doesn't show the 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. However, limited information on particle sizes or density was readily available.

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.

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

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	130 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 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

This 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.

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.

In addition, anticipation of marine and/or estuarine sands of varying density, a 475-year PGA (peak ground acceleration) of ~0.4 (Stirling et al, 2002[3]), and bedrock anticipated to be in excess of 500m deep, and hence ground shaking is likely to be relatively high.

8.3.3 Slope Failure and/or Rockfall Potential

Given the site's location, a flat suburb in northeast Christchurch, global slope instability is considered negligible. However, any localised retaining structures or embankments should be further investigated to determine the site-specific slope instability potential.

8.3.4 Liquefaction Potential

It is not clear from the post-earthquake aerial photography (Figure 3) whether liquefaction has occurred at the site.

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

[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

8.4 Recommendations

A soil class of **D/E** (in accordance with NZS 1170.5:2004) should be adopted for the site. The soil class can be confirmed following assessment of adequate intrusive ground investigation information.

It is recommended that one machine-drilled borehole and two piezocone CPT investigations be conducted to target depth of 20m. This will allow a liquefaction assessment to be undertaken.

8.5 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.

It is recommended that intrusive investigation comprising one machine-drilled borehole and two piezocone CPTs should be conducted to target depth of 20m.

9. Survey

No level or verticality survey has been undertaken for this building at this stage in accordance with Christchurch City Council guidelines.

10. Initial Capacity Assessment

10.1 % NBS Assessment

The building's capacity was assessed using the Initial Evaluation Procedure based on the information available. The building's capacity is expressed as a percentage of new building standard (%NBS) and is in the order of that shown below. This capacity is subject to confirmation by a more detailed quantitative analysis which is more detailed.

Item	%NBS
Building's seismic capacity (No CSW observed)	85

Following an IEP assessment, the building has been assessed as achieving 85% 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 greater than 67% NBS.

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

Several key seismic parameters that have influenced the %NBS score obtained from the IEP assessment. An increased Z factor of 0.3 for Christchurch has been used in line with recommendations from the Department of Building and Housing recommendations resulting in a reduced % NBS score.

10.3 Expected Structural Ductility Factor

A structural ductility factor of 3.0 has been assumed. This is based on the steel portal frame system observed in both directions.

10.4 Discussion of Results

The original building was constructed in 1999 and was likely designed to the loading standard current at the time, NZS 4203:1992. The design loads used in this standard 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 and soil class E for very soft site, it would be expected that the building would not achieve 100% NBS.

10.5 Occupancy

The building does not pose an immediate risk to users and occupants as no collapse hazards have been identified.

11. Initial Conclusions

The building has been assessed to have a seismic capacity in the order of 85% NBS and is therefore not a potentially Earthquake Risk.

12. Recommendations

It is recommended that:

a) As the building does not have any apparent damage and has achieved over 67% NBS following an initial IEP assessment, the building can remain occupied as per Christchurch City Council's policy.

b) No detailed quantitative assessment and strengthening option is required.

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.
- No level or verticality surveys have been undertaken.
- No material testing has been undertaken.
- No calculations have been performed, other than those included as part of the IEP in the CERA Building Evaluation 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.

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.

13.2 Geotechnical Limitations

This report presents the results of a geotechnical appraisal prepared for the purpose of this commission, and prepared solely for the use of Christchurch City Council and their advisors. The data and advice provided herein related 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

Photo 1 Aerial photograph showing location of Styx Mill Reserve Equipment Shed.

Photo 2 Equipment Shed (Northeast elevation).

Photo 3 Equipment Shed (Northwest elevation).

Photo 4 Equipment Shed (Southeast elevation).

Photo 5 Equipment Shed (South elevation).

Photo 6 Equipment Shed (West elevation).

Photo 7 View of the roof structure.

Photo 8 View of the diagonal roof bracing.

Photo 9 View of corrugated metal walls.

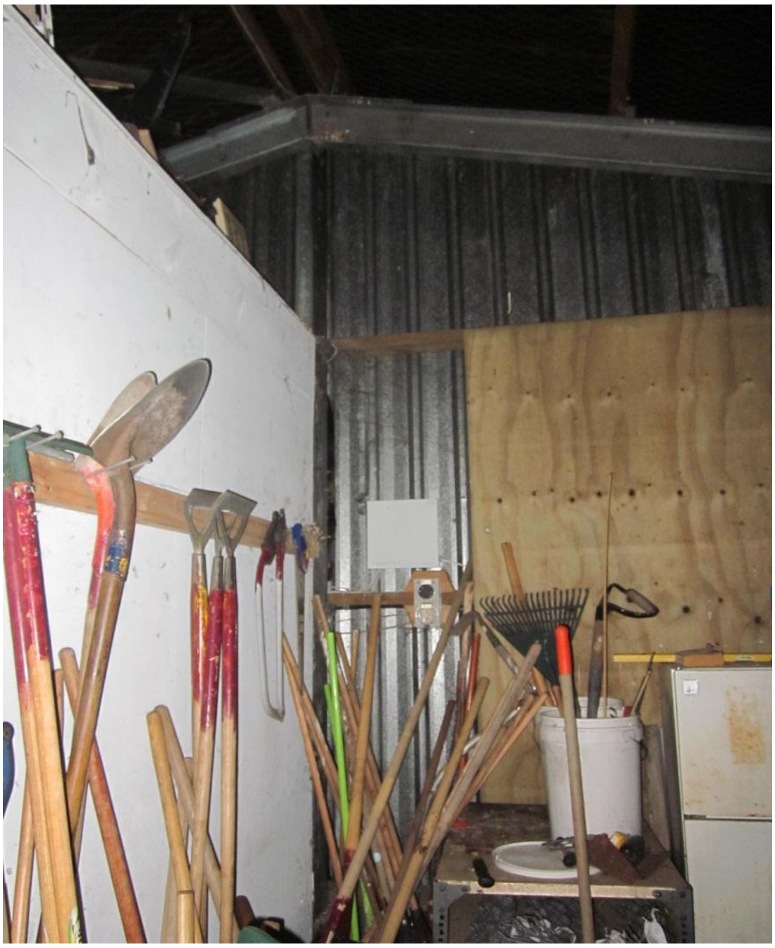

Photo 10 View of partition between Equipment Room and Ranger’s Office.

Appendix B

Existing Drawings

Appendix C

CERA Building Evaluation Form

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Equipment Shed			Reviewer:	Stephen Lee
	Unit	No:	Street	CPEng No:	1006840
Building Address:	Styx Mill Reserve	130	Hussey Road, Harewood	Company:	GHD
Legal Description:	Lot 6 DP 29040			Company project number:	513059667
				Company phone number:	(03) 3780900
	Degrees	Min	Sec		
GPS south:				Date of submission:	05/10/2012
GPS east:				Inspection Date:	17/04/2012
				Revision:	
Building Unique Identifier (CCC):	PRK 0340_BLDG_004 EQ2			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):	E		
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):	
Ground floor split?	no		Ground floor elevation above ground (m):	
Storeys below ground	0			
Foundation type:	Strip footing		if Foundation type is other, describe:	
Building height (m):	4.0		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	97			
Age of Building (years):	13		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):				
Use notes (if required):				
Importance level (to NZS1170.5):	IL2			

<u>Gravity Structure</u>

Gravity System:	frame system		
Roof:	steel framed	rafter type, purlin type and cladding	Timber purlins with corrugated steel sheets
Floors:	concrete flat slab	slab thickness (mm)	approximately 100mm
Beams:	steel non-composite	beam and connector type	I-sections
Columns:	steel non-composite	typical dimensions (mm x mm)	I-sections
Walls:	Timber girts with steel cladding & diagonal bracing		Clad with corrugated steel sheets

Lateral load resisting structure

Lateral system along:	Steel braced frame	**Note: Define along and across in detailed report!**	note total length of wall at ground (m):	5
Ductility assumed, μ:	3.0		wall thickness (m):	
Period along:	0.17		estimate or calculation?	
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	Steel moment frame		note typical frame sizes and bay length (m)	4.5
Ductility assumed, μ:	3.0			
Period across:	0.40		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:	Corrugated steel sheets	describe (note cavity if exists)	
Roof Cladding:	Corrugated steel sheets		
Glazing:			
Ceilings:			
Services(list):			

Available documentation

Architectural	partial	original designer name/date	
Structural	partial	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:	Good	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:	No placard in place	
Along	Damage ratio:	0%	Describe how damage ratio arrived at:
	Describe (summary):	No apparent damage observed	
Across	Damage ratio:	0%	
	Describe (summary):	No apparent damage observed	
Diaphragms	Damage?:	no	Describe:
CSWs:	Damage?:	no	Describe:
Pounding:	Damage?:	no	Describe:
Non-structural:	Damage?:	no	Describe:

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

Recommendations

	Level of repair/strengthening required:	none		Describe:
	Building Consent required:	no		Describe:
	Interim occupancy recommendations:	full occupancy		Describe:
Along	Assessed %NBS before:	85%	85% %NBS from IEP below	If IEP not used, please detail assessment methodology:
	Assessed %NBS after:	85%		
Across	Assessed %NBS before:	85%	85% %NBS from IEP below	
	Assessed %NBS after:	85%		

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

Design Soil type from NZS4203:1992, cl 4.6.2.2: b) Intermediate

	along	across
Period (from above):	0.17	0.4
(%NBS)nom from Fig 3.3:	22.3%	22.3%

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	1.0
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 $(\%NBS)_{nom}$:	**22.3%**	**22.3%**

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	0.8
Hazard scaling factor, **Factor B:**	2.67

2.4 Return Period Scaling Factor

Building Importance level (from above):	2
Return Period Scaling factor from Table 3.1, **Factor C**:	1.0

2.5 Ductility Scaling Factor

	along	across
Assessed ductility (less than max in Table 3.2)	3.0	3.0
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:	1	1
Ductiity Scaling Factor, **Factor D**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

	along	across
Sp:	0.70	0.70
Structural Performance Scaling Factor **Factor E**:	1.43	1.43

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

	along	across
$\%NBS_b$:	**85%**	**85%**

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 Baselline %NBS:	**85%**	**85%**
4.4 Percentage New Building Standard (%NBS), (before)		**85%**

Official Use only:

Accepted By

Date:

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