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Shed/Garage – Heritage Park
PRK 3659 BLDG 006

Detailed Engineering Evaluation

Qualitative Report

Version FINAL

12 Barclays Road, Little River

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

Shed/Garage - Heritage Park
Park 3659 BLDG 006

Detailed Engineering Evaluation
Qualitative Report
Version FINAL

12 Barclays Road

Christchurch City Council

Prepared By
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Reviewed By
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Date
19th December 2013

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Shed/Garage – Heritage Park

PRK 3659 BLDG 006

Detailed Engineering Evaluation

Qualitative Report - SUMMARY

Version FINAL

12 Barclays 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 28th of June 2012.

Key Damage Observed

No key damage was observed.

Critical Structural Weaknesses

The following potential critical structural weaknesses have been identified in the structure.

- Plan Irregularity (30% Reduction)

Indicative Building Strength (from IEP and CSW assessment)

Based on the information available, and using the NZSEE Initial Evaluation Procedure, the baseline capacity (excluding critical structural weaknesses and earthquake damage) of the building has been assessed to be in the order of 40% NBS.

This building has been considered plan irregular due to the combination of the buildings 'L-shape' and length. This has resulted in a 30% drop in the buildings baseline NBS to 28%.

There was no damage observed in our visual inspection and the baseline NBS has remained as it is.

The building has been assessed to have a seismic capacity in the order of 28% NBS and is therefore classified as Earthquake Prone.

Recommendations

The building has been assessed as being Earthquake Prone. As a result, the structure cannot remain occupied, as per CCC's policy. However, the building is in particularly poor condition as a result of decay and Council may wish to consider demolition rather than any additional work on the structure.

1. Background

GHD has been engaged by the Christchurch City Council (CCC) to undertake a detailed engineering evaluation of the Shed/Garage in Heritage Park, Little River.

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

The Shed/Garage is located in Heritage Park at 12 Barclays Road, Little River, Canterbury. The building is broken into four sections of similar size. The most southern section is both greater in width and height than the other three giving the building a slight L shape. Each section is currently used for storage purposes. The building is in particularly poor condition and has reached the end of its useful life.

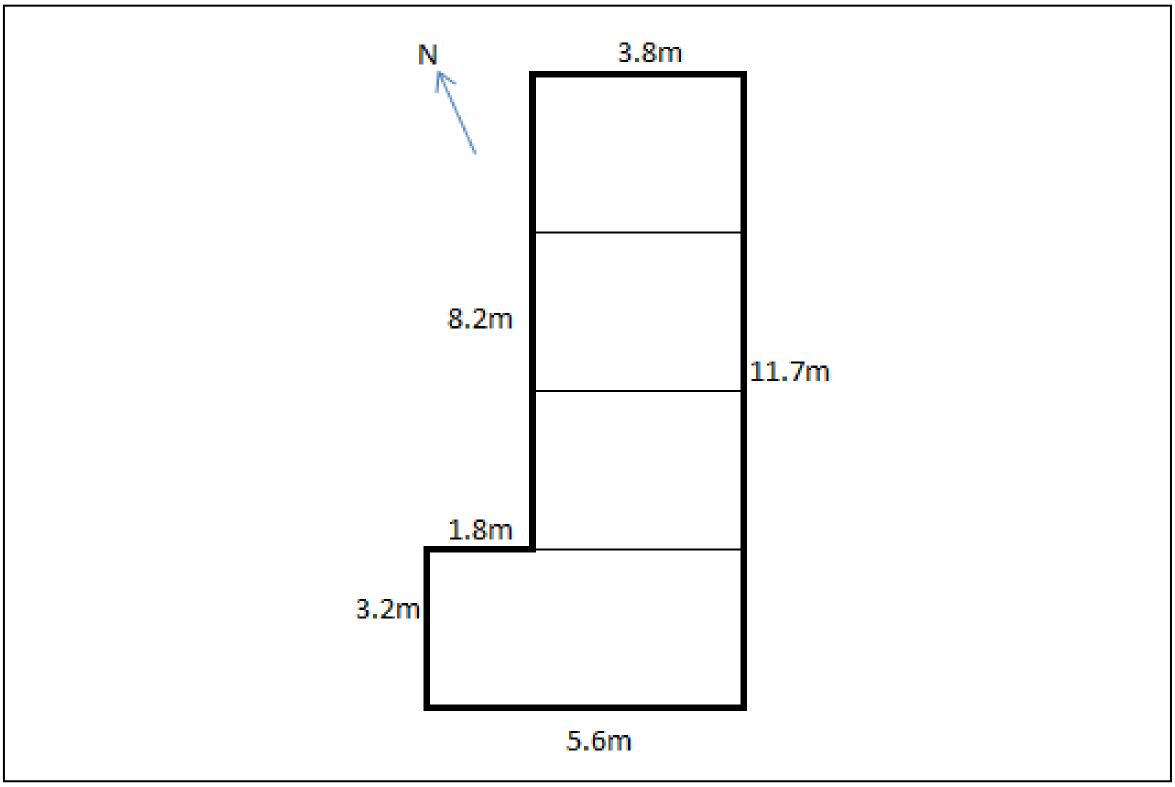
The date of construction is unknown and is assumed to be between 1935 and 1965.

The structure is constructed from timber framed walls and roof.

Externally, the walls are cladded with a mix of corrugated iron and timber weatherboards. Internally they are cladded with timber planks or have been left bare.

Essentially the roof can be thought of as two parts. The first sits on the southern section of the building and has timber trusses supporting the cladding. The second is a timber bracing sloping downward toward the west; this roof is slightly shorter than the first but runs over the three northern sections. Both roofs are cladded with corrugated iron.

Figure 2 Plan Sketch Showing Key Structural Elements



The dimensions of the building are approximately 11.7m in the longitudinal direction and 3.8m and 5.6m in the north and south facing elevations respectively. The plan area of the building is 50.22m^2. The height of the building is 2.7m on the southernmost section and 2.0m in the northern section. The building is relatively isolated with the nearest structure being approximately 40m to the east. There is a small stream approximately 25m south of the building feeding a river around 100m away. The site is flat.

No useful plans were available for this structure.

4.2 Gravity Load Resisting System

The external gravity loads are carried from the roof cladding to the roof framing and then to the timber frame walls. The external timber framed walls transfer the loads into the ground.

Internal gravity loads are passed directly into the ground.

4.3 Lateral Load Resisting System

The lateral load resisting systems in both the transverse and longitudinal directions are similar.

The primary lateral load resisting system is the moment frame action. This is supported by the timber roof which provides a nominal diaphragm and helps to redistribute lateral loads to the frame. The moment frame transfers the load into the foundations and finally into the ground.

5. Assessment

An inspection of the building was undertaken on the 28th of June 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 there was no ceiling. The foundations were not able to be viewed.

The inspection consisted of identifying and visually inspecting 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 structure is relatively isolated with the nearest structure being approximately 40m to the east. There is a structure 70m to the north and 80m to the south. No damage to these properties was noted upon observation.

6.2 Residual Displacements and General Observations

No residual displacements of the structure were noticed during our inspection of the building. There were loose sheets of corrugated iron; these were unlikely a result of seismic activity. However, the building is in particularly poor condition.

6.3 Ground Damage

There was no evidence of ground damage on the property or surrounding neighbours land.

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

Roof elements such as timber purlins and trusses were clearly visible and are expected to provide bracing to the roof structure. See photograph 8.

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 low to moderate potential for liquefaction. For the purposes of the IEP assessment of the building and the determination of the %NBS score, the effects of soil liquefaction on the performance of the building has been assessed as an insignificant site characteristic in accordance with the NZSEE guidelines.

7.6 Plan Irregularity

This building has been considered plan irregular due to the combination of the buildings 'L-shape' and length. This has resulted in a 30% drop in the buildings baseline NBS; from 40% to 28%.

7.7 Vertical irregularity

There was no significant vertical irregularity.

8. Geotechnical Consideration

8.1 Site Description

The site is situated in the township of Little River, towards the southwestern side of the Banks Peninsula. It is relatively flat at less than 20m above mean sea level. It is approximately 120m west and northwest of Okana Stream, 2.5km north of the Takinitawai River mouth/head of Lake Forsythe (Wairewa), and 15km west of Akaroa.

8.2 Published Information on Ground Conditions

8.2.1 Published Geology

The geological map of the area[1] indicates that the site is on or in close proximity to the boundary of the following units:

- Grey river alluvium beneath plains or low-level terraces, Holocene in age.
- Yellow-brown windblown silt on Banks Peninsula, greater than 3m thick and commonly in multiple layers, Holocene in age.

With the following unit underlying the site at depth:

- Akaroa Volcanic Group - Basaltic to trachytic lava flows with associated tuff and pyroclastic breccia, mid to late Miocene in age.

8.2.2 Environment Canterbury Logs

Information from Environment Canterbury (ECan) indicates that one borehole with a lithographic log is located within 750m of the site (see **Error! Reference source not found.**).

This indicates the area is underlain by yellow clay, which is further underlain by broken volcanic rock with sea shells. It is interpreted that that the yellow clay recorded within the drillers log may be wind-blown silt, also known as loess.

Table 2 ECan Borehole Summary

Bore Name	Log Depth	Groundwater	Distance & Direction from Site
N36/0133	23.0m	~0.2m bgl	750m

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

[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. IGNS Limited: Lower Hutt.

8.2.3 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.

The site has been categorised as "N/A – Port Hills and Banks Peninsula".

8.2.4 Post February Aerial Photography

The aerial photography taken following the 22 February 2011 earthquake does not cover this location, therefore it is not possible to determine whether or not there were signs of liquefaction on or adjacent to the site.

8.2.5 Summary of Ground Conditions

From the information presented above, the ground conditions underlying the site are anticipated to comprise multiple strata of clay/cohesive silt and possible alluvial deposits, overlying volcanic rock.

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[2][3]

Known Active Fault	Distance from Site	Direction from Site	Max Likely Magnitude	Avg Recurrence Interval
Alpine Fault	160km	NW	~8.3	~300 years
Greendale (2010) Fault	40km	W	7.1	~15,000 years
Hope Fault	130km	N	7.2~7.5	120~200 years
Kelly Fault	130km	NW	7.2	~150 years
Porters Pass Fault	90km	NW	7.0	~1100 years

The 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.

[2] 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.

[3] GNS Active Faults Database

8.3.2 Ground Shaking Hazard

New Zealand Standard NZS 1170.5:2004 quantifies the Seismic Hazard factor for Christchurch and Akaroa 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.

The 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

Given the site's location in a flat river valley, global slope instability is considered negligible. However, any localised retaining structures or embankments (none noted from the information provided) should be further investigated to determine the site-specific slope instability potential.

The topography surrounding the site suggests that rockfall is not a significant hazard. However, given its proximity to surrounding hillsides, this hazard cannot be fully discounted.

8.5 Liquefaction Potential

Due to the potential presence of alluvial deposits and/or wind-blown silt beneath the site, it is considered possible that liquefaction may occur at the site in layers where sands and silts are encountered.

However, if clay layers are present beneath the site (as noted in the ECan borelog 750m away) these will likely retard/negate the development of liquefaction, and its effects at the surface. However, due to the lack of site specific ground information, the liquefaction potential of the site cannot be fully appraised.

The site is located in close proximity to a drainage dyke/channel. If liquefaction were to affect the site, it is considered that minor lateral spreading towards that drainage channel may be possible.

Further investigation is recommended to better determine subsoil conditions. From this, a more comprehensive liquefaction assessment could be undertaken.

8.6 Conclusions & Recommendations

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

Given the lack of ground information beneath the site, it is not possible to accurately quantify the liquefaction potential of the site.

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

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

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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

The building has had its capacity assessed using the Initial Evaluation Procedure based on the information available. The buildings capacity excluding critical structural weaknesses and the capacity of any identified weaknesses are expressed as a percentage of new building standard (%NBS) and are in the order of that shown below in **Error! Reference source not found.**. These capacities are subject to onfirmation by a more detailed quantitative analysis.

Item	%NBS
Building excluding CSW's	40
Building including CSW's	28

Table 4 Indicative Building and Critical Structural Weaknesses Capacities based on the NZSEE Initial Evaluation Procedure

Following an IEP assessment, the building has been assessed as achieving 28% New Building Standard (NBS). Under the New Zealand Society for Earthquake Engineering (NZSEE) guidelines the building is considered Earthquake prone as it lessthan 33%. This score has not been adjusted when considering damage to the structure as all damage observed was relatively minor. It is unlikely any damage to the structure was due to seismic events nor will this damage affect the load carrying capacity of the structural systems.

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: C, NZS 1170.5:2004, Clause 3.1.3, Shallow Soil
- Site hazard factor, Z = 0.3, NZBC, Clause B1 Structure, Amendment 11 effective from 1 August 2011
- Return period factor R_u = 2, NZS 1170.5:2004, Table 3.5, Importance level 1 structure with a 100 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 1.5 has been assumed based on the structural system observed, the date of construction and overall building condition.

10.4 Discussion of Results

The results obtained from the initial IEP assessment are consistent with those expected for a building of this age and construction type. Although the original building construction date is unknown, it has been assumed it was designed between 1935 and 1965. The building was likely designed to the loading standard current at the time, NZSS 95:1935. The design loads used in this standard are 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 and the abundance of bracing it is reasonable to expect the building to be classified as Earthquake Prone.

10.5 Occupancy

The building has been assessed as being Earthquake Prone and cannot remain occupied, as per CCC's policy.

11. Initial Conclusions

The building has been assessed as being Earthquake Prone as achieved 28%. However, the building is in particularly poor condition as a result of decay and Council may wish to consider demolition rather than any additional work on the structure.

12. Recommendations

The recent seismic activity in Christchurch has caused no identifiable damage to the building, however the building is in particularly poor condition as a result of decay and Council may wish to consider demolition rather than any additional work on the structure.

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 foundation were non-existent due to the foundations being below ground level.
- 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 Southern and Eastern elevations.

Photograph 3 East Elevation

Photograph 4 West Elevation

Photograph 5 Loose Corrugated Iron cladding/sheeting.

Photograph 6 Stream to the south

Photograph 7 Southern Section - Interior 1

Photograph 8 Southern Section – Interior 2

Photograph 9 Northern Section – Storage

Photograph 10: Roof System - Northern Section

Photograph 11: Roof System - Northern Section

Photograph 12: Roof System – Northern Section

Appendix B

Existing Drawings

Appendix C

CERA Building Evaluation Form

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Barn			Reviewer:	Derek Chinn
	Unit	No:	Street	CPEng No:	177243
Building Address:	Heritage Park	12	Barclays Road	Company:	GHD
Legal Description:				Company project number:	513090221
				Company phone number:	04 472 0799
	Degrees	Min	Sec		
GPS south:				Date of submission:	07-09-12
GPS east:				Inspection Date:	28-06-12
				Revision:	FINAL
Building Unique Identifier (CCC):	PRK_3659_BLDG_006			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):	C		
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):	2.70
Ground floor split?	no		Ground floor elevation above ground (m):	2.70
Storeys below ground	0			
Foundation type:			if Foundation type is other, describe:	Unknown - Cannot see
Building height (m):	2.70		height from ground to level of uppermost seismic mass (for IEP only) (m):	2.7
Floor footprint area (approx):	50			
Age of Building (years):	55		Date of design:	1935-1965
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):	Storage			
Importance level (to NZS1170.5):	IL1			

Gravity Structure

Gravity System:	frame system		
Roof:	timber framed	rafter type, purlin type and cladding	Timber Purlins/Rafters, Corrgated Iron Cladding
Floors:	other (note)	describe sytem	Earth
Beams:	timber	type	
Columns:	timber	typical dimensions (mm x mm)	
Walls:	non-load bearing	0	

Lateral load resisting structure

Lateral system along:	timber moment frame		**Note: Define along and across in detailed report!**		
Ductility assumed, μ:	2.00			note typical bay length (m)	3.9
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:	timber moment frame				
Ductility assumed, μ:	2.00			note typical bay length (m)	4.25
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:			
Wall cladding:	profiled metal	describe	Also some wooden panels
Roof Cladding:	Metal	describe	Corregated iron
Glazing:	timber frames		No window panes
Ceilings:	none		
Services(list):			

Available documentation

Architectural	none	original designer name/date	
Structural	none	original designer name/date	
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	full	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:		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:
	Describe (summary):		
Across	Damage ratio:	0%	
	Describe (summary):		
Diaphragms	Damage?:	no	Describe:
CSWs:	Damage?:	no	Describe:
Pounding:	Damage?:	no	Describe:
Non-structural:	Damage?:	no	Describe:

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

Recommendations

	Level of repair/strengthening required:	none		Describe:
	Building Consent required:			Describe:
	Interim occupancy recommendations:			Describe:
Along	Assessed %NBS before e'quakes:	28%	28% %NBS from IEP below	If IEP not used, please detail assessment methodology:
	Assessed %NBS after e'quakes:	28%		
Across	Assessed %NBS before e'quakes:	28%	28% %NBS from IEP below	
	Assessed %NBS after e'quakes:	28%		

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): 1935-1965

h_n from above: 2.7m

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:	4.0%	4.0%

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)$_{nom}$:	**4%**	**4%**

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):	1
Return Period Scaling factor from Table 3.1, **Factor C**:	2.00

2.5 Ductility Scaling Factor

	along	across
Assessed ductility (less than max in Table 3.2)	1.50	1.50
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:	1.29	1.29
Ductiity Scaling Factor, **Factor D**:	1.29	1.29

2.6 Structural Performance Scaling Factor:

	along	across
Sp:	0.850	0.850
Structural Performance Scaling Factor **Factor E**:	1.176470588	1.176470588

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

	along	across
$\%NBS_b$:	**40%**	**40%**

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

3.1. Plan Irregularity, factor A:	significant	0.7
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)	**0.70**	**0.70**
4.3 PAR x (%NBS)b: PAR x Baselline %NBS:	**28%**	**28%**

4.4 Percentage New Building Standard (%NBS), (before) **28%**

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