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AVIARY, WOODHAM PARK
PRK 0697 BLDG 003 EQ2

Detailed Engineering Evaluation

Qualitative Report

Version DRAFT

157 Woodham Road, Linwood

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

AVIARY, WOODHAM PARK
PRK 0697 BLDG 003 EQ2

Detailed Engineering Evaluation
Qualitative Report
Version Final

157 Woodham Road, Linwood

Christchurch City Council

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Date
4th October 2012

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Qualitative Report Summary

Aviary, Woodham Park

PRK 0697 BLDG 003 EQ2

Detailed Engineering Evaluation

Qualitative Report - SUMMARY

Version Final

157 Woodham Road, Linwood

Background

This is a summary of the Qualitative report for the 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 19 July 2012.

Structure Description

The structure is located within Woodham Park at 157 Woodham Road, Linwood in Christchurch. The structure is owned by the Christchurch City Council and currently used as an aviary. The nearest structure to the Aviary is a park toilet which is approximate 15m to the west.

It appears that the structure was constructed in 1980 and no alterations have been made since construction.

The roof of the building is corrugated plastic sheeting on timber purlins spanning longitudinally between timber beams. The timber beams rest on the timber framed walls to the front and rear of the building. Intermediate supports are provided by the internal timber frames spanning in the transverse direction with spacing of approximately 2m centres. The front face of the building is clad with steel mesh attached to the timber frames while the back and side face of the building are clad with timber board attached to the timber frames.

Floors are concrete slab on grade. Foundations are concrete strip footings to the perimeter of the building.

Key Damage Observed

No major damage observed to the structure.

Critical Structural Weaknesses

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

- Site Characteristics (Significant Liquefaction, 30% Reduction) (110% NBS)

Indicative Building Strength (from IEP and CSW assessment)

Based on the information available, and using the NZSEE Initial Evaluation Procedure, the original capacity of the structure has been assessed to be in the order of 110% NBS and post-earthquake capacity also in the order of 110% NBS. The building's post-earthquake capacity excluding critical structural weaknesses is in the order of 157% NBS.

The structure has been assessed to have a seismic capacity in the order of 110% NBS and is therefore not an Earthquake Risk structure.

Recommendations

It is recommended that:

- As the structure achieved greater than 67% NBS following an initial IEP assessment, the structure can remain occupied as per Christchurch City Council's policy, and
- No detailed quantitative assessment is required.

1. Background

GHD has been engaged by the Christchurch City Council (CCC) to undertake a detailed engineering evaluation of the Aviary in Woodham Park, Linwood.

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 structure 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 structure performance and damage patterns, to identify any potential critical structural weaknesses or collapse hazards, and to make an initial assessment of the likely structure 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 structure had been carried out. As there are no available drawings, the structure's evaluation is based on the visual inspection carried out on site. The date of construction of the structure is unknown and therefore estimated for the purpose of this assessment. The results of the evaluation may change should the exact construction date is made known.

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 structure is located within Woodham Park at 157 Woodham Road, Linwood in Christchurch. The structure is owned by the Christchurch City Council and currently used as an Aviary. The nearest structure to the Aviary is a park toilet which is approximate 15m to the west.

It appears that the structure was constructed in 1980 and no alterations have been made since construction.

The roof of the building is corrugated plastic sheeting on timber purlins spanning longitudinally between timber beams. The timber beamss rest on the timber framed walls to the front and rear of the building. Intermediate supports are provided by the internal timber frames spanning in the transverse direction with spacing of approximately 2m centres. The front face of the building is clad with steel mesh attached to the timber frames while the back and side face of the building are clad with timber board attached to the timber frames.

Floors are concrete slab on grade. Foundations are concrete strip footings to the perimeter of the building.

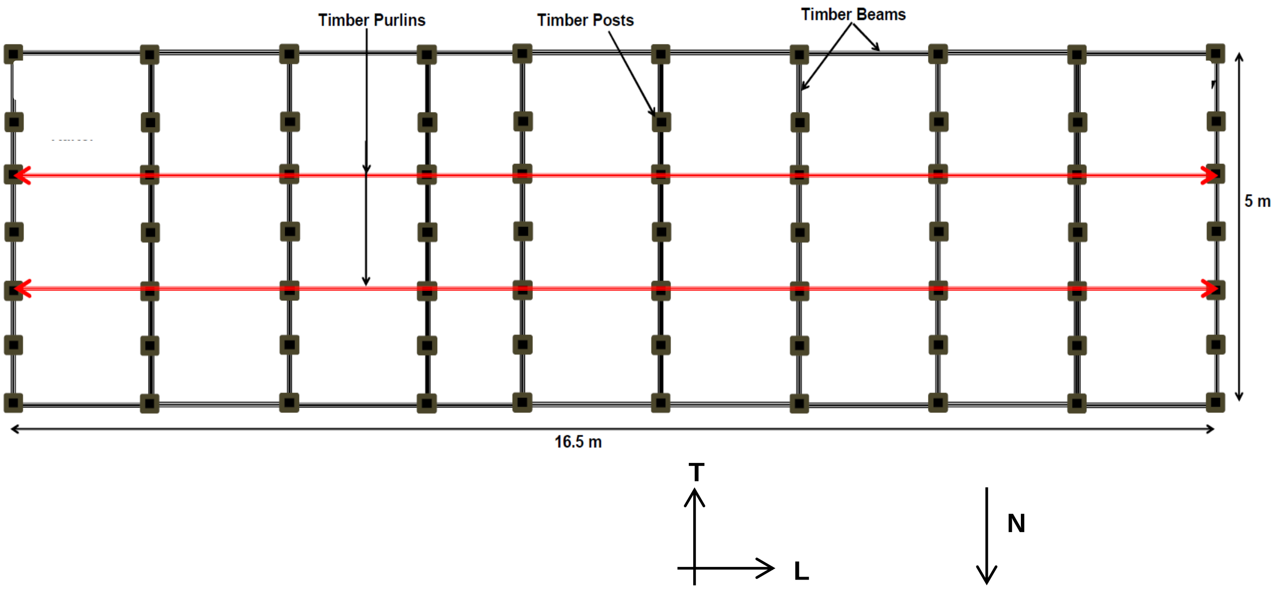


Figure 2 Plan Sketch Showing Key Structural Elements

The building is approximately 5m in width, 16m in length and 2.6m in height. The plan area of the building is approximately 80m^2.

4.2 Gravity Load Resisting System

The roof gravity loads are carried by the timber purlins supported on timber beams. These loads are then transferred to the timber moment frames and into the ground.

4.3 Lateral Load Resisting System

In both the transverse and longitudinal direction, seismic demand is resisted by the timber purlins and beams in the roof and then transferred to the timber moment frames located at the perimeter and internally. These seismic forces are then transferred to the ground.

5. Assessment

An inspection of the structure was undertaken on the 19th of July 2012. Both the interior and exterior of the structure were inspected. The main structural components of the roof of the building were all able to be viewed. However, the foundations were not able to be viewed.

The inspection consisted of scrutinising the structure 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.

6. Damage Assessment

6.1 Surrounding Buildings

A Park Toilet can be found approximately 15m to the west of the Aviary and no apparent damage was observed to this toilet.

6.2 Residual Displacements and General Observations

No residual displacements of the structure were noticed during our inspection of the building.

6.3 Ground Damage

There was no evidence of ground damage on the property or surrounding neighbour’s 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 bracing was not observed in the structure however, close spacing of timber purlins supported on timber frames are visible and expected to provide sufficient bracing to the roof.

7.4 Staircases

The building does not contain a staircase.

7.5 Site Characteristics

Following the geotechnical appraisal, it was found out that the site appears to have a moderate to significant liquefaction potential. Associated with this, the site is also susceptible to lateral spreading and sand boil, in particular where saturated sand and/or silts are present.

For the purpose of the IEP assessment and determination of the % NBS score of the structure, the effects of soil liquefaction on the performance of the structure has been assessed as a ‘significant’ site characteristic in accordance with the NZSEE guidelines.

7.6 Plan Irregularity

No plan irregularity observed.

7.7 Vertical irregularity

No vertical irregularity observed.

7.8 Pounding effect

Pound effect is not a concern since the nearest structure is 15m away.

8. Geotechnical Consideration

8.1 Site Description

The site is situated in the suburb of Linwood, in eastern Christchurch. It is relatively flat at approximately 4m above mean sea level. It is approximately 850km east of Avon River at Lynwood Avenue and Avonside Drive intersection, 330m south of the Avon River at the northern end of Gloucester St, and 5.3km west of the coast (Pegasus Bay).

8.2 Published Information on Ground Conditions

8.2.1 Published Geology

The geological map of the area[1] indicates that the site is underlain by the following unit:

- Dominantly sand and silt overbank deposits, being alluvial soils of the Yaldhurst Member, sub-group of the Springston Formation, Holocene in age.

Figure 72 from Brown & Weeber indicates that groundwater is likely 1.0m from ground level.

8.2.2 Environment Canterbury Logs

Information from Environment Canterbury (ECan) indicates that fourteen boreholes with lithographic logs are located within 200m of the site (see Table 2).

These indicate the area is underlain by silts and sands with horizons of clay present. As the boreholes within 200m of the site only had a maximum depth of 3.91m bgl an addition search was undertaken to locate deep drilled borehole to assess the underlying ground conditions. These wells slightly further away indicate the area to be underlain by alternating horizons of sands and gravels underlie the area.

Groundwater has been indicated typically between 2.44m bgl and 4.90m bgl.

Table 2 ECan Borehole Summary

Bore Name	Log Depth	Groundwater	Distance & Direction from Site
M35-2297*	85.0m	4.9m bgl	~300m S
M35/2408*	82.90m	3.66m bgl	~340m SW
M35/12216	3.66m	2.44m bgl	~100m E
M35/12217	3.35m	2.52m bgl	~180m SE
M35/12326	3.91m	3.05m bgl	~126m NE
M35/13924	1.83m	N/A	~132m NE
M35/13925	1.83m	N/A	~97m E
M35/13927	3.05m	N/A	~130m SE

[1] Brown, L. J. & Weeber, J.H. (1992): *Geology of the Christchurch Urban Area*. Institute of Geological and Nuclear Sciences

Bore Name	Log Depth	Groundwater	Distance & Direction from Site
M35/13936	3.35m	N/A	~177m SE
M35/13937	3.35m	N/A	~129m SE
M35/13938	2.28m	N/A	~87 m S
M35/13939	2.13m	N/A	~138m SW
M35/14163	1.98m	N/A	~150m N
M35/14164	1.83m	N/A	~160m NNW
M35/16902	3.25m	1.4m bgl	~182m S
M35/16903	2.95m	1.7m bgl	~185m S

*Additional search for borehole up to 400m from site.

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 undertaken geotechnical testing in the area of the site. Information pertaining to this investigation is included in the Tonkin & Taylor Report for Linwood[2] Tonkin & Taylor Report for Avonside[3]. Two investigation points were undertaken within 200m of the site, as summarised below in Table 3.

Table 3 EQC Geotechnical Investigation Summary Table

Bore Name	Orientation from Site	Depth (m bgl)	Log Summary
CPT-AVD-43	10m SE	0 – 1.0	Pre-drilled
		1.0 – 32	SILT and SAND mixtures occasional clay horizons
			(WT at 2.25m bgl)
CPT-LWD-09	200m SE	0 – 3.0	SILT and stiff CLAY
			(WT at 2.0 m bgl)

Initial observations of the CPT results indicate the soils are fine/medium, loose to medium dense with soft to firm silt and sand interbedded horizons.

Groundwater was intersected between 2.25m bgl and 2.00m bgl respectively. Groundwater levels may be subjected to seasonal and climatic variation.

[2] Tonkin & Taylor Ltd., 2011: Christchurch Earthquake Recovery, *Geotechnical Factual Report, Linwood.*

[3] Tonkin & Taylor Ltd., 2011: Christchurch Earthquake Recovery, *Geotechnical Factual Report, Avonside.*

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.

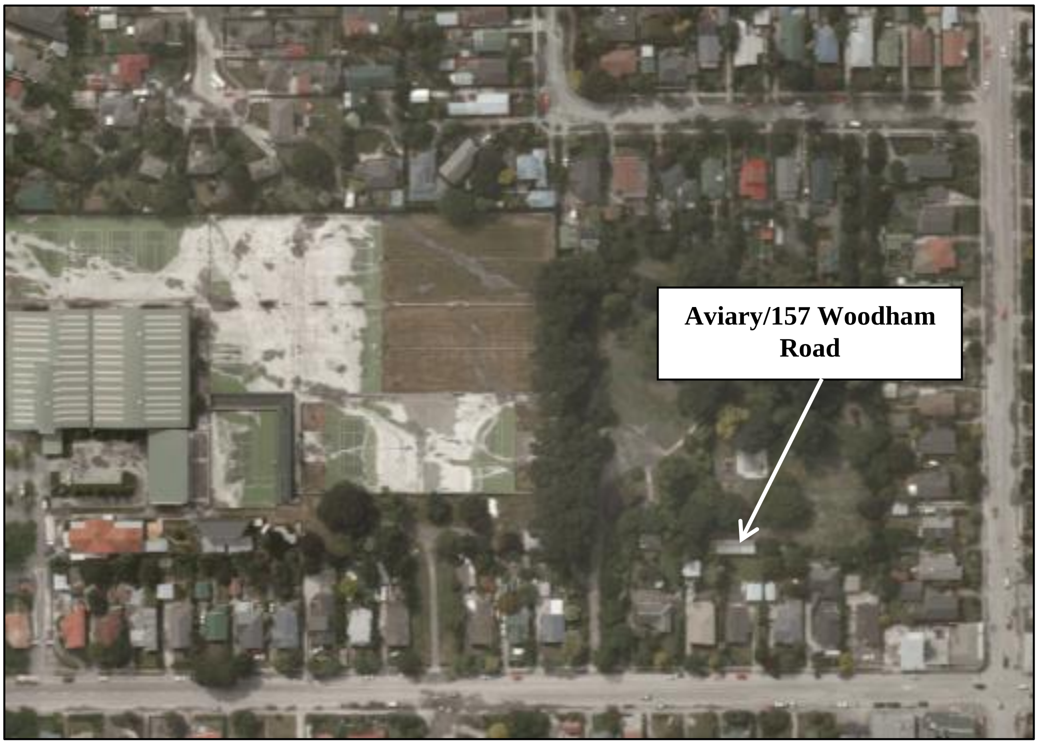
Land in the CERA green zone has been divided into three technical categories. These categories describe how the land in expected to perform in future earthquakes.

The site has been categorised as "N/A – Urban no residential", however is indicated as being surrounded by properties within the TC3 (blue) zone[4]. This 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 shows evidence of liquefaction outside the building footprint aswell as significant liquefaction and lateral spreading in adjacent sites, as shown in Figure 3.

Figure 3 Post February 2011 Earthquake Aerial Photography [5]



8.2.6 Summary of Ground Conditions

From the information presented above, the ground conditions underlying the site are anticipated to comprise multiple strata of sand and silts, with varying amounts of clay.

[4] CERA Landcheck website, http://cera.govt.nz/my-property

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

Based on the geology map, high groundwater levels of approximately 1.0m bgl are anticipated for the area. Nearby ECan and EQC intrusive investigations have confirmed high groundwater levels typically between 4.9m bgl and 2.0m bgl. The groundwater levels may be subjected to seasonal and climatic variation.

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 4 Summary of Known Active Faults[6][7]

Known Active Fault	Distance from Site	Direction from Site	Max Likely Magnitude	Avg Recurrence Interval
Alpine Fault	130	NW	~8.3	~300 years
Ashley Fault	30	N	7.2	~2000 years
Greendale (2010) Fault	23	W	7.1	~15,000 years
Hope Fault	110	N	7.2~7.5	120~200 years
Kelly Fault	110	NW	7.2	~150 years
Porters Pass Fault	65	NW	7.0	~1100 years
Esk Fault	80	NW	7.0	7500 years
Lees Valley Fault	60	NW	6.7	7000 years
Cust Fault	45	NW	-	>2000 years
Pouter Fault	100	NW	-	3500-5000 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.

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.

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[6] 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.

[7] GNS Active Faults Database

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

The topography surrounding the site suggests that rockfall is not a potential hazard. However, given its proximity to the Avon River, and evidence of lateral spreading nearby resulting from the recent earthquakes, 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.

8.5 Liquefaction Potential

The site is considered to be at risk from moderate to significant liquefaction, due to the following reasons:

- Aerial photography shows significant sand boils and distinct NW/SE linear trends in adjoining properties;
- The site is indicated as being surrounded by properties within the TC3 (blue) zone;
- The geology map indicates a high susceptibility of liquefaction in this area;
- The author has undertaken previous site inspections on nearby adjoining streets where significant sand boils and lateral spreading was noted; and,
- Saturated soils are anticipated beneath the site.

8.6 Conclusion & Recommendations

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

The site appears to be situated on stratified alluvial deposits, comprising sand and silt. Associated with this the site also has a moderately to significant liquefaction potential, in particular where saturated sands and/or silts are present.

Evidence of lateral spreading and sand boil lineations can be seen in the aerial photograph. The author also has previous experience along adjoining sites where lateral spreading was observed.

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

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

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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 building's 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 Table 5. These capacities are subject to confirmation by a more detailed quantitative analysis.

Item	%NBS
Building excluding CSW's	157
Site Characteristics (Significant liquefaction, 30% Reduction)	110

Table 5 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 110% New Building Standard (NBS). Under the New Zealand Society for Earthquake Engineering (NZSEE) guidelines the building is not considered Earthquake Risk as it achieves greater than 67% NBS. This score has not been adjusted when considering damage to the structure as all damage observed was relatively minor and considered unlikely to adversely 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: D, NZS 1170.5:2004, Clause 3.1.3, Soft Soil
- Site hazard factor, Z = 0.3, NZBC, Clause B1 Structure, Amendment 11 effective from 1 August 2011
- Return period factor R_u = 0.5, NZS 1170.5:2004, Table 3.5, Importance level 1 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 2.0 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 and construction type. With the estimated construction date of the building of 1980, the structure is likely to have been designed to the loading standard current at the time, NZS 4203:1976. With the combined effect of the increase in the hazard factor for Christchurch to 0.3 and significant liquefaction potential (30% reduction), it is reasonable to expect that the building would not achieve 100% NBS.

10.5 Occupancy

The structure does not pose an immediate risk to users as the building has not been assessed as being Earthquake Risk building. As a result, the building can remain occupied, as per CCC's policy.

11. Initial Conclusions

The structure has been assessed to have a seismic capacity in the order of 110% NBS and is therefore not considered a potentially Earthquake Risk structure.

12. Recommendations

It is recommended that:

- As the structure achieved greater than 67% NBS following an initial IEP assessment, the structure can remain occupied as per Christchurch City Council's policy, and
- No detailed quantitative assessment 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, 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 Front view of the Aviary.

Photograph 2 Back view of the Aviary.

Photograph 3 Outside view of the roof.

Photograph 4 Interior view of the Aviary.

Photograph 5 Interior view of the Aviary.

Appendix B

CERA Building Evaluation Form

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Aviary			Reviewer:	Stephen Lee
	Unit	No:	Street	CPEng No:	1006840
Building Address:	Woodham Park	157	Woodham Road	Company:	GHD Ltd.
Legal Description:				Company project number:	51-30902-44
				Company phone number:	04 472 0799
	Degrees	Min	Sec		
GPS south:				Date of submission:	17-08-2012
GPS east:				Inspection Date:	19-07-2012
				Revision:	
Building Unique Identifier (CCC):	PRK_0697_BLDG_003 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):			
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:	mat slab		if Foundation type is other, describe:	
Building height (m):	2.60		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	80			
Age of Building (years):	32		Date of design:	1976-1992
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	other (specify)		Brief strengthening description:	Bird cage - Aviary
Use (upper floors):				
Use notes (if required):				
Importance level (to NZS1170.5):	IL1			

Gravity Structure

Gravity System:	frame system		
Roof:	timber framed	rafter type, purlin type and cladding	Timber rafters and purlins, with light roofing
Floors:			slab on grade
Beams:	timber	type	
Columns:	timber	typical dimensions (mm x mm)	
Walls:	timber framed	thickness (mm)	

Lateral load resisting structure

Lateral system along:	timber moment frame	**Note: Define along and across in detailed report!**	note typical bay length (m)	
Ductility assumed, μ:	2.00			estimated
Period along:	0.20	0.00	estimate or calculation?	
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	timber moment frame		note typical bay length (m)	
Ductility assumed, μ:	2.00			estimated
Period across:	0.20	0.00	estimate or calculation?	
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	

Separations:

north (mm):		leave blank if not relevant
east (mm):		
south (mm):		
west (mm):		

Non-structural elements

Stairs:			
Wall cladding:	other light	describe	timber boards (across) & steel mesh (along)
Roof Cladding:	Other (specify)	describe	light roofing
Glazing:	other (specify)		
Ceilings:			
Services(list):			

Available documentation

Architectural		original designer name/date	
Structural		original designer name/date	
Mechanical		original designer name/date	
Electrical		original designer name/date	
Geotech report		original designer name/date	

Damage

Site:
(refer DEE Table 4-2)

Site performance:		Describe damage:	
Settlement:	none apparent	notes (if applicable):	
Differential settlement:	none apparent	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:	no		Describe:	
	Interim occupancy recommendations:	full occupancy		Describe:	
Along	Assessed %NBS before:	100%	110% %NBS from IEP below	If IEP not used, please detail assessment methodology:	
	Assessed %NBS after:	100%			
Across	Assessed %NBS before:	100%	110% %NBS from IEP below		
	Assessed %NBS after:	100%			

IEP **Use of this method is not mandatory - more detailed analysis may give a different answer, which would take precedence. Do not fill in fields if not using IEP.**

Period of design of building (from above): 1976-1992

h_n from above: m

Seismic Zone, if designed between 1965 and 1992: B

not required for this age of building

not required for this age of building

	along	across
Period (from above):	0.2	0.2
(%NBS)nom from Fig 3.3:	16.5%	16.5%

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 $(\%NBS)_{nom}$:	**17%**	**17%**

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)	2.00	2.00
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, $(NBS\%)_b$ = $(\%NBS)_{nom}$ x A x B x C x D x E

	along	across
$\%NBS_b$:	**157%**	**157%**

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

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

3.4. Pounding potential

Pounding effect D1, from Table to right	1.0
Height Difference effect D2, from Table to right	1.0
Therefore, Factor D:	1

Table for selection of D1	Severe	Significant	Insignificant/none
Separation	0<sep<.005H	.005<sep<.01H	Sep>.01H
Alignment of floors within 20% of H	**0.7**	**0.8**	**1**
Alignment of floors not within 20% of H	**0.4**	**0.7**	**0.8**

Table for Selection of D2	Severe	Significant	Insignificant/none
Separation	0<sep<.005H	.005<sep<.01H	Sep>.01H
Height difference > 4 storeys	0.4	0.7	1
Height difference 2 to 4 storeys	0.7	0.9	1
Height difference < 2 storeys	1	1	1

3.5. Site Characteristics	significant	0.7

3.6. Other factors, Factor F

	Along	Across
For ≤ 3 storeys, max value =2.5, otherwise max valule =1.5, no minimum	1.0	1.0
Rationale for choice of F factor, if not 1		

Detail Critical Structural Weaknesses: (refer to DEE Procedure section 6)

List any: Refer also section 6.3.1 of DEE for discussion of F factor modification for other critical structural weaknesses

	along	across
3.7. Overall Performance Achievement ratio (PAR)	**0.70**	**0.70**
4.3 PAR x (%NBS)b: PAR x Baselline %NBS:	**110%**	**110%**
4.4 Percentage New Building Standard (%NBS), (before)		**110%**

GHD

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