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Toilet – Donnell Sports Ground
PRK_2225_BLDG_001 EQ2

Detailed Engineering Evaluation

Qualitative Report

Version FINAL

Brooker Ave/Rebecca Ave

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

Toilet – Donnell Sports Ground
PRK_2225_BLDG_001 EQ2

Detailed Engineering Evaluation
Qualitative Report
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Brooker Ave/Rebecca Ave

Christchurch City Council

Prepared By
Simon Barker

Reviewed By
Stephen Lee

Date
5 April 2013

Contents

Table Index

Figure Index

Appendices

Qualitative Report Summary

Toilet – Donnell Sports Ground

PRK_2225_BLDG_001 EQ2

Detailed Engineering Evaluation

Qualitative Report - SUMMARY

Version FINAL

Brooker Ave/Rebecca Ave

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 21st September 2012.

Building Description

The toilet is located in Donnell Sports Ground, which is outlined by Kingsbridge Drive and, Brooker and Rebecca Avenues. The toilet sits on level ground; it is isolated from neighbouring buildings and lies approximately 15m from a creek. The toilet is thought to be constructed in the early 2000's and is for public use, no alterations have been made to the building since its original construction. The toilet is a single story timber-framed structure and has a roof clad with profiled steel sheeting. The building consists of a cubicle with a small services duct sitting to its rear. Internally, the timber framed walls are clad with hardie flex board, while externally the upper half of the walls is clad with timber boards, with a stone veneer beneath. The timber-framed walls support a roof consisting of timber trusses spaced at approximately 750mm centres, timber boards and profiled steel cladding.
The building is likely founded on concrete strip footings with the floor a concrete slab.

Key Damage Observed

No key damage was observed during the inspection.

Critical Structural Weaknesses

No critical structural weaknesses have been identified in the structure.

Indicative Building Strength (from IEP and CSW assessment)

Based on the information available, and using the NZSEE Initial Evaluation Procedure, the original capacity of the building has been assessed to be in the order of 85% NBS and post-earthquake capacity also in the order of 85% NBS. The buildings post-earthquake capacity excluding critical structural weaknesses is also 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 should not be considered Earthquake Risk nor Earthquake Prone.

Recommendations

No further action is required.

1. Background

GHD has been engaged by the Christchurch City Council (CCC) to undertake a detailed engineering evaluation of the Toilet at Donnell Sports Ground.

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 toilet is located in Donnell Sports Ground, which is outlined by Kingsbridge Drive and, Brooker and Rebecca Avenues. The toilet sits on level ground; it is isolated from neighbouring buildings and lies approximately 15m from a creek.
The toilet is thought to be constructed in early 2000's and is for public use, no alterations have been made to the building since its original construction. The toilet is a single story timber-framed structure and has a roof clad with profiled steel sheeting. The building consists of a cubicle with a small services duct sitting to its rear. Internally, the timber framed walls are clad with hardie flex board, while externally the upper half of the walls is clad with timber boards, with a stone veneer beneath. The timber-framed walls support a roof consisting of timber trusses spaced at approximately 750mm centres, timber boards and profiled steel cladding.

The building is likely founded on concrete strip footings with the floor a concrete slab.

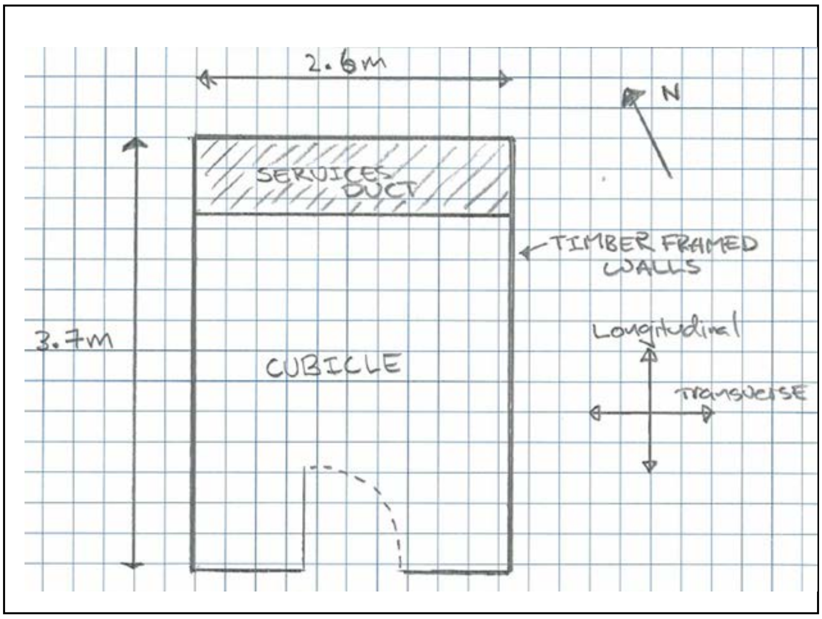

Figure 2 Plan Sketch Showing Key Structural Elements

Construction plans were not made available.

4.2 Gravity Load Resisting System

Gravity roof loads are carried by timber boards spanning in the longitudinal direction between timber roof trusses which span in the transverse direction. Gravity loads are then transferred by the timber roof trusses, which span the building in the transverse direction, to the timber-framed walls. The timber-framed walls transfer the gravity loads downward to the strip foundations beneath.

Gravity floor loads are transferred through the concrete slab to the strip foundations and finally into the ground beneath.

4.3 Lateral Load Resisting System

In the transverse direction the lateral roof loads are transferred by the diaphragm action of the timber roof boards to the walls in the plane of loading. The panel action of the timber-framed walls then passes the lateral loads to the foundation and finally into the ground.

In the longitudinal direction the lateral roof loads are transferred by the diaphragm action of the timber roof boards to the walls in the plane of loading. The panel action of the timber studs and lining transfer these lateral loads to the strip footings and are then distributed to the ground beneath.

Walls perpendicular to the lateral loading span between the diaphragm action of the roof and the foundations below.

5. Assessment

An inspection of the building was undertaken on the 21st September 2012. Both the interior and exterior of the building were inspected. The main structural components of the roof of the building were/were not all able to be viewed. The foundations were unable to be viewed as these were below ground level.

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

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

5.1 Damage Assessment

5.1.1 Surrounding Buildings

No damage was noted to the surrounding buildings.

5.1.2 Residual Displacements and General Observations

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

5.1.3 Floor Level Survey

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

5.1.4 Ground Damage

The site contained numerous areas of uplifted sand which suggests liquefaction in previous seismic events.

6. Critical Structural Weakness

6.1 Short Columns

No short columns are present in the structure.

6.2 Lift Shaft

The building does not contain a lift shaft.

6.3 Roof

Roof elements such as boards and trusses were clearly visible and are expected to provide bracing to the roof structure.

6.4 Staircases

The building does not contain a staircase.

6.5 Site Characteristics

Following the geotechnical appraisal it was found that the site has a high 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. The lightweight single story structure is unlikely to suffer premature collapse due to differential settlements.

6.6 Plan Irregularity

There is a stiffness offset when considering lateral loads in the transverse direction. The north eastern wall spans the full width of the building, while the south western wall has an opening. This stiffness offset has the potential to cause torsional effects; however, given the size and nature of the structure, these effects have not been considered a critical structural weakness.

6.7 Vertical irregularity

There is no vertical irregularity in this structure.

7. Geotechnical Consideration

7.1 Site Description

The site is situated within a recreational reserve, within the suburb of Burwood in northeast Christchurch. It is relatively flat at approximately 5m above mean sea level. It is approximately 500m north of the Avon River, and 2.5km west of the coast (Pegasus Bay) at New Brighton.

7.2 Published Information on Ground Conditions

7.2.1 Published Geology

The geological map of the area[1] indicates that the site is underlain by Holocene soils of the Christchurch Formation, comprising dominantly of sand, silt and peat of drained lagoons and estuaries.

A deposit of Holocene alluvial soils of the Yaldhurst Member, sub-group of the Springston Formation, comprising alluvial sand and silt overbank deposits is located 100m to the south of the site along the banks of the Avon River.

7.2.2 Environment Canterbury Logs

Information from Environment Canterbury (ECan) indicates that no boreholes are located within a 200m radius of the site.

7.2.3 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 Burwood[2]. Four investigation points were undertaken within 200m of the property, as summarised below in Table 2.

Table 2 EQC Geotechnical Investigation Summary Table

Bore Name	Grid Reference	Depth (m bgl)	Log Summary
CPT – BUR 81	2485588 mE	0 – 1.2	0 – 1.2 Pre-drilled
	5745610 mN	1.2 – 2.0	1.2 – 2.0 Sand/Silt mixtures
		2.0 – 3.0	2.0 – 3.0 Silt/Clay mixtures
		3.0 – 14.0	3.0 – 14.0 Sand/Silt mixtures
		14.0 – 14.5	14.0 – 14.5 Silt/Clay mixtures
		14.5 – 22.48	14.5 – 22.48 Sand/Silt mixtures
			(WT assumed at 9.5m bgl)

[1] Brown, L. J. and Weeber, J.H. 1992: *Geology of the Christchurch Urban Area*. Institute of Geological and Nuclear Sciences 1:25,000 Geological Map 1. Lower Hutt. Institute of Geological and Nuclear Sciences Limited.

[2] Tonkin and Taylor . September 2011: Christchurch Earthquake Recovery, Geotechnical Factual Report, Burwood.

Bore Name	Grid Reference	Depth (m bgl)	Log Summary
CPT – BUR 89	2485595 mE	0 – 1.2	0 - 1.2 Pre-drilled
	5745671 mN	1.2 – 1.5	1.2 - 1.5 m Sand
		1.5 – 2.0	1.5 – 2.0 m Clay
		2.0 – 12.42	2.0 – 12.42 m Sand/Silt mixtures
			(WT assumed at 9.5m bgl)
BH – BUR 21	2485395 mE	0 – 1.5	0 – 1.5 m Fill
	5745581 mN	1.5 – 19.95	1.2 – 19.95 m Sand/Silt mixtures
			(WT assumed at 4.5m bgl)
BH – BUR 22	2485627 mE	0 – 1.5	0 – 1.5 m Fill
	5745586 mN	1.5 – 20.435	1.5 – 20.435 m Sand with some silt and gravel
			(WT not defined in CPT log)

Initial observations of the CPT results indicate the soils are fine to coarse grained, and vary from soft/loose to dense/stiff with the varying soil strata at depth. This would infer that liquefaction is probable in a significant seismic event.

7.2.4 CERA Land Zoning

Canterbury Earthquake Recovery Authority (CERA) has indicated the site is situated within the Red Zone, indicating that repair and rebuild is unlikely.

7.2.5 Post February Aerial Photography

Aerial photography taken following the 22 February 2011 earthquake shows signs of extensive liquefaction outside the building footprint and adjacent to the site, as shown in Figure 3.

Figure 3 Post February 2011 Earthquake Aerial Photography [3]

During the site inspection, it was noted that lateral spreading had not occurred at the site, despite the proximity to the adjacent swale.

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

7.2.6 Summary of Ground Conditions

From the information presented above, the ground conditions underlying the site are anticipated to comprise sand and silt, with occasional strata of gravel and clay.

Anecdotal evidence suggests that that the area was filled by 1 to 2m during land development for subdivision (circa 2000).

7.3 Seismicity

7.3.1 Nearby Faults 7.3.2

There are many faults in the Canterbury region, however only those considered most likely to have an adverse effect on the site are detailed in Table 3.

Table 3 Summary of Known Active Faults[4,5]

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	27 km	SW	7.1	~15,000 years
Hope Fault	100 km	NNW	7.2~7.5	120~200 years
Kelly Fault	110 km	NW	7.2	~150 years
Porters Pass Fault	65 km	NW	7.0	~1100 years

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

7.3.2 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.

[4] 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.

[5] GNS Active Faults Database, http://maps.gns.cri.nz/website/af/viewer/

7.4 Slope Failure and/or Rockfall Potential

Given the site's location in Burwood, 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.

7.5 Liquefaction Potential

The liquefaction susceptibility is considered high, due to the following reasons:

- the presence of extensive liquefaction observed in the site visit; and,
- evidence from the post-earthquake aerial photography (see Figure 3).

7.6 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.

The site is anticipated to be underlain by 1~2m of fill material, overlying marine and estuarine sand and silt deposits. The site has a high liquefaction potential, as observed in the aerial photography (Figure 3).

Due to the anticipated presence of fill material overlying loose sands, and without an engineered fill certificate, it is recommended that should this structure require further detailed engineering an intrusive investigation be conducted. Further detail on testing methods can be provided following commission of the quantitative phase of assessment.

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

Given that the land is zoned red, the fate of this building is unclear.

8. Initial Capacity Assessment

8.1 % 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 Table 4. These capacities are subject to confirmation by a more detailed quantitative analysis.

Item	%NBS
Building excluding CSW's	85
Builing including CSW's	85

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 85% New Building Standard (NBS). Under the New Zealand Society for Earthquake Engineering (NZSEE) guidelines the building is neither considered Earthquake Risk nor Earthquake Prone as it achieves greater than 67% NBS. This score has not been adjusted when considering damage to the structure as none was observed.

8.2 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 = 1.0, NZS 1170.5:2004, Table 3.5, Importance level 2 structure with a 50 year design life.

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

8.3 Expected Structural Ductility Factor

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

8.4 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, the building was likely constructed in the early 2000's and designed to the loading standard current at the time, NZS 4203:1992. The design loads used in accordance with this standard are likely 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. However, given the lack of any Critical Structural Weaknesses and the type of structure, it is reasonable to expect the building to be classified as neither potentially Earthquake Prone nor Earthquake Risk.

9. Conclusions & Recommendations

The building has been assessed to have a seismic capacity in the order of 85% NBS and is therefore not considered potentially Earthquake Prone nor Earthquake Risk.

The recent seismic activity in Christchurch has caused no identifiable damage to the building. As it is believed the building suffered no damage that would not compromise the load resisting capacity of the existing structural systems and has achieved greater than 67% NBS following an initial IEP assessment, no further assessment is required by Christchurch City Council to comply with the building act.

10. Limitations

10.1 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 could not be inspected.
- No level or verticality surveys have been undertaken.
- No material testing has been undertaken.
- No calculations, other than those included as part of the IEP in the CERA Building Evaluation Report, have been undertaken. No modelling of the building for structural analysis purposes has been performed.

It is noted that this report has been prepared at the request of Christchurch City Council and is intended to be used for their purposes only. GHD accepts no responsibility for any other party or person who relies on the information contained in this reportrite a specific limitations section.

10.2 Geotechnical Limitations

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

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

An understanding of the geotechnical site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experienced based. Hence this report should not be altered, amended or abbreviated, issued in part and issued incomplete in any way without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances, which arise from the issue of the report, which have been modified in any way as outlined above.

Appendix A

Photographs

Photograph 1 View of building from the West Southwest.

Photograph 2 View of building from the Northeast.

Photograph 3 Timber Truss roof structure

Photograph 4 Adjacent waterway with possible sand boils in foreground.

Photograph 5 Tiled concrete floor slab.

Appendix B

CERA Building Evaluation Form

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Toilet - Donnells Sports Ground	Reviewer:	Stephen Lee
Building Address: (Unit / No: / Street)	Brooker Ave	CPEng No:	1006840
Legal Description:		Company:	GHD
		Company project number:	513090239
		Company phone number:	04 472 0799
GPS south: (Degrees / Min / Sec)		Date of submission:	10/9/2012
GPS east:		Inspection Date:	9/21/2012
		Revision:	
Building Unique Identifier (CCC):	PRK_2225_BLDG_001 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):	D		
Proximity to waterway (m, if <100m):	20	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 footings	if Foundation type is other, describe:	
Building height (m):	3.30	height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	10		
Age of Building (years):	12	Date of design:	1992-2004
Strengthening present?	no	If so, when (year)?	
		And what load level (%g)?	
Use (ground floor):		Brief strengthening description:	
Use (upper floors):			
Use notes (if required):			
Importance level (to NZS1170.5):	IL2		

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber truss	truss depth, purlin type and cladding	
Floors:	other (note)	describe sytem	Slab on grade
Beams:	timber	type	
Columns:			
Walls:			

Lateral load resisting structure

Note: Define along and across in detailed report!

Lateral system along:	lightweight timber framed walls			
Ductility assumed, μ:	3.00		note typical wall length (m)	
Period along:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	lightweight timber framed walls			
Ductility assumed, μ:	3.00		note typical wall length (m)	
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:	other light	describe	Timber Boards
Roof Cladding:	Metal	describe	Profilled Sheeting
Glazing:			
Ceilings:	none		
Services(list):	Water Electricity Sewage		

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	GHD - Samantha Webb

Damage

Site: (refer DEE Table 4-2)

Site performance:	Okay	Describe damage:	Evidence of liquifaction
Settlement:	none observed	notes (if applicable):	
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	2-5 m³/100m²	notes (if applicable):	Estimate
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:		Describe:	
	Building Consent required:		Describe:	
	Interim occupancy recommendations:		Describe:	
Along	Assessed %NBS before e'quakes:	85%	85% %NBS from IEP below	If IEP not used, please detail assessment methodology:
	Assessed %NBS after e'quakes:	85%		
Across	Assessed %NBS before e'quakes:	85%	85% %NBS from IEP below	
	Assessed %NBS after e'quakes:	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: B

not required for this age of building: D soft soil
Design Soil type from NZS4203:1992, cl 4.6.2.2:

	along	across
Period (from above):	0.4	0.4
(%NBS)nom from Fig 3.3:	22.3%	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	1.00
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:	**22%**	**22%**

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:**	2.666666667

2.4 Return Period Scaling Factor

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

2.5 Ductility Scaling Factor

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

2.6 Structural Performance Scaling Factor:

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

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

$\%NBS_b$:	**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
3.5. Site Characteristics	insignificant	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

3.6. 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

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%**

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