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Rawhiti Domain (East) Toilets
PRK 2004 BLDG 003 EQ2

Detailed Engineering Evaluation

Qualitative Report

Version FINAL

136 Shaw Avenue, New Brighton, Christchurch

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

Rawhiti Domain (East) Toilets
PRK 2004 BLDG 003 EQ2

Detailed Engineering Evaluation
Qualitative Report
Version FINAL

136 Shaw Avenue, New Brighton

Christchurch City Council

Prepared By
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Reviewed By
David Lee

Date
7th September 2012

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Qualitative Report Summary

Rawhiti Domain (East) Toilets

PRK 2004 BLDG 003 EQ2

Detailed Engineering Evaluation

Qualitative Report - SUMMARY

Version FINAL

136 Shaw Avenue, New Brighton, Christchurch

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, visual inspections on 27th August 2012 and available architectural drawings.

Building Description

The building is located at 136 Shaw Avenue, New Brighton. The building was designed in 2002 with the building's sole use being a public toilet. There have been no alterations to the building since construction.

The roof consists of lightweight, corrugated metal fixed to horizontal timber sarking. The sarking is fixed to timber rafters with timber purlins cut between the rafters. The rafters are supported on a timber wall plate bolted to the top of the wall and connected to a steel lintel above the doors. Walls consist of fully grouted, reinforced, concrete masonry units. A timber framed internal wall is present between the two toilets. Foundations of the building consist of a reinforced concrete strip footing to the perimeter walls and a reinforced on-grade floor slab.

Key Damage Observed

No damage to the building was observed.

Critical Structural Weaknesses

No critical structural weaknesses have been identified for this building.

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 64% NBS and post-earthquake capacity also in the order of 64% NBS.

The building has been assessed to have a seismic capacity in the order of 64% NBS and is therefore considered potentially Earthquake Risk.

Recommendations

It is recommended that the current placard status of the building of green remains as is.

The recent seismic activity in Christchurch has caused no apparent damage to the building. As the building suffered no apparent damage that would compromise the load resisting capacity of the existing structural systems and has achieved between 33% and 67% NBS following an initial IEP assessment of the building, no further assessment is required by Christchurch City Council to comply with the building act.

As the building has not been classified as being potentially Earthquake Prone and there are no immediate collapse hazards or critical structural weakness, general access to the building is permitted.

1. Background

GHD has been engaged by the Christchurch City Council (CCC) to undertake a detailed engineering evaluation of the toilet block at Rawhiti Domain (East).

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. Architectural drawings were made available, and these have been considered in our evaluation of the building. The building description presented 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
Low Risk Building	A or B	Low	Above 67	Acceptable (improvement may be desirable)
Moderate Risk Building	B or C	Moderate	34 to 66	Acceptable legally. Improvement recommended
High Risk Building	D or E	High	33 or lower	Unacceptable (Improvement

Improvement of Structural Performance	
Legal Requirement	NZSEE Recommendation
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
	Not recommended. Acceptable only in exceptional circumstances
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 building is located at 136 Shaw Avenue, New Brighton. The building was designed in 2002 with the buildings sole use is a public toilet. There have been no alterations to the building since construction.

The general construction of the toilet block is fully grouted, reinforced concrete masonry units. The roof consists of lightweight, 0.4mm thick, corrugated zincalum fixed to horizontal timber sarking. The sarking is fixed to timber 100 x 50mm rafters inclined at approximately 45 degrees with 100 x 50mm timber purlins cut between the rafters. The rafters are supported on a 100 x 50mm timber plate bolted to the top of the wall and connected to a rectangular hollow section lintel above the doors. Walls consist of 140mm fully grouted, reinforced, concrete masonry units. Reinforcing is provided by 12mm diameter steel bars at 600mm centres. A timber framed internal wall is present between the two toilets. Foundations of the building consist of a reinforced concrete strip footings to the perimeter walls and a reinforced on-grade concrete floor slab.

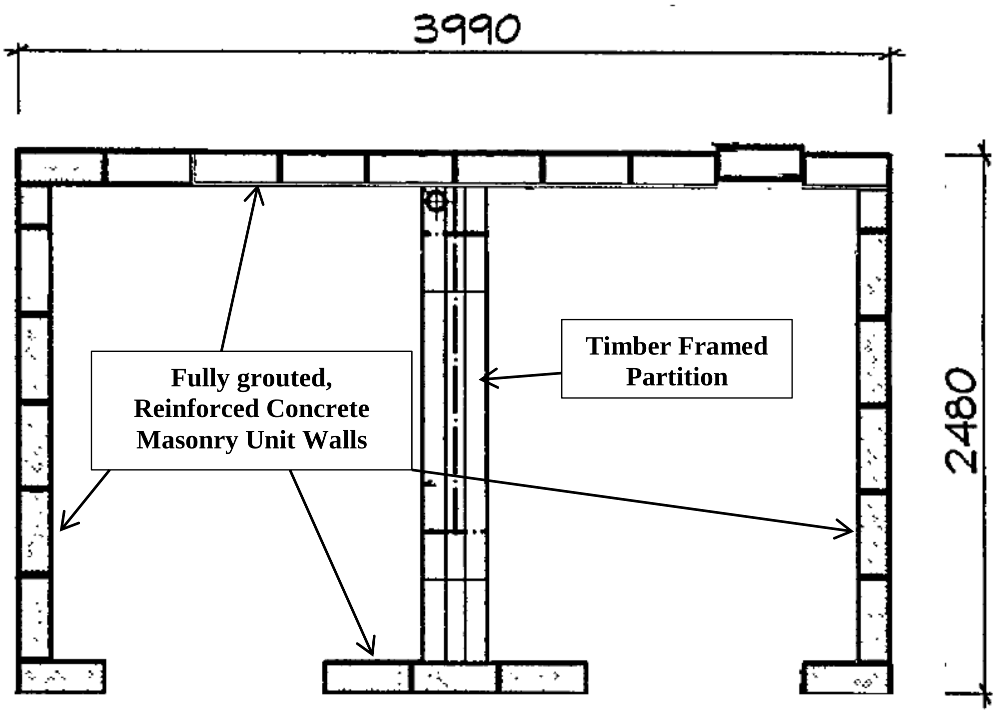

Figure 2 Plan Sketch Showing Key Structural Elements

The building is approximately 4m in length and 2.5m wide. The floor plan area of the building is approximately 10m^2. The nearest building to the toilet block is approximately 10m south of the building. The nearest waterway to the building is Pegasus Bay approximately 300m to the East. There is no slope on the site.

Architectural drawings for the building with some structural details were made available.

4.2 Gravity Load Resisting System

Gravity roof loads are transferred from the metal cladding, through its fixings to the timber roof sarking. Loads from the sarking are transferred through to the supporting timber rafters and down to the wall plate connection. Loads are then transferred down through the external concrete masonry walls to the supporting strip foundations and through to the ground below. Internal loads are transferred directly down through the on-grade floor slab to the ground below.

4.3 Lateral Load Resisting System

In both the longitudinal and transverse directions, primary lateral load resistance is provided by the fully grouted reinforced concrete masonry units. Secondary lateral load resistance is provided within the roof structure by the timber sarking, rafters and purlins.

Loads are transferred down through the building as for the gravity loads above.

5. Assessment

An inspection of the building was undertaken on the 27th August 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.

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

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

6. Damage Assessment

6.1 Surrounding Buildings

The toilet is located in Rawhiti Domain. All surrounding buildings are used for sports and recreational purposes. No significant damage was noted to any of the buildings in close proximity to the toilet block.

6.2 Residual Displacements and General Observations

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

No damage was noted to the building.

6.3 Ground Damage

There was no evidence of ground damage on the property or surrounding neighbours land. Post-earthquake aerial photography of the site revealed no signs of liquefaction on the site.

7. Critical Structural Weakness

7.1 Short Columns

No short columns are present in the structure.

7.2 Lift Shaft

The building does not contain a lift shaft.

7.3 Roof

Roof cross bracing was not seen from inside the building. Roof elements such as timber sarking, purlins and rafters were clearly visible and are expected to provide bracing to the roof structure.

7.4 Staircases

The building does not contain a staircase.

7.5 Site Characteristics

Due to the presence of marine and alluvial deposits, liquefaction is considered possible where sands and silts are present. However, evidence from the post-earthquake aerial photography shows no signs of 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.

8. Geotechnical Consideration

8.1 Site Description

The three individual sites are situated within a recreational domain, within the suburb of New Brighton in eastern Christchurch. It is relatively flat at approximately 3m above mean sea level. It is situated 500 m from the coast line (Pegasus Bay), approximately 800 m north of the Avon River.

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 Holocene marine/estuarine soils of the Christchurch Formation, comprising dominantly of sand of fixed and semi-fixed dunes and beaches

8.2.2 Environment Canterbury Logs

Information from Environment Canterbury (ECan) indicates that ten boreholes are located within a 200m radius of the site (see Table 2). Of these boreholes, two of them had lithographic logs that indicate the area is typically clays and sand with some peat layers between 30 and 40m bgl. Varying amounts of gravel is also indicated to be present. Groundwater was encountered between 1.65 and 5.2 m bgl.

Table 2 ECan Borehole Summary

Bore Name	Log Depth	Groundwater	Distance from Site
M35/2388	84.7m	5.2m bgl	200 m
M35/2443	104.2m	3.66m bgl	200m

It should be noted that the boreholes were sunk for groundwater extraction and not for geotechnical purposes' therefore, the amount of material recovered and available for interpretation and recording will have been variable at best and may not be representative. The logs have been written by the well driller and not a geotechnical professional or to a standard. In addition strength data is not recorded.

8.2.3 EQC Geotechnical Investigations

The Earthquake Commission has not undertaken geotechnical testing within 500m of the subject site.

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 TC1 (grey), TC2 (yellow) and TC3 (blue). These categories describe how the land in expected to perform in future earthquakes.

[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.

The site is classified as NA - Urban Nonresidential however, residential properties surrounding the site have been categorised TC2 (Yellow).

8.2.5 Post February Aerial Photography

Aerial photography taken following the 22 February 2011 earthquake shows no signs of liquefaction outside the building footprint or adjacent to the site, as shown in Figure 3**.**

Figure 3 Post February 2011 Earthquake Aerial Photography [2]

8.2.6 Summary of Ground Conditions

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

8.3 Seismicity

8.3.1 Nearby Faults

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

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

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

Known Active Fault	Distance from Site	Direction from Site	Max Likely Magnitude	Avg Recurrence Interval
Alpine Fault	130 km	NW	~8.3	~300 years
Greendale (2010) Fault	29 km	W	7.1	~15,000 years
Hope Fault	110 km	N	7.2~7.5	120~200 years
Kelly Fault	110 km	NW	7.2	~150 years
Porters Pass Fault	70 km	NW	7.0	~1100 years

Recent earthquakes since 04 September 2010 have identified the presence of a previously unmapped active fault system underneath the Canterbury Plains, extending beneath 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.

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 New Brighton, a flat suburb in eastern Christchurch, global slope instability is considered negligible. However, any localised retaining structures or embankments should be further investigated to determine the site-specific slope instability potential.

8.5 Liquefaction Potential

Due to the presence of marine and alluvial deposits, liquefaction is considered possible where sands and silts are present. However, evidence from the post-earthquake aerial photography shows no signs of liquefaction.

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.

[3] Stirling, M.W, McVerry, G.H, and Berryman K.R. (2002) A New Seismic Hazard Model for New Zealand, Bulletin of the Seismological Society of America, Vol. 92 No. 5, pp 1878-1903, June 2002.

[4] GNS Active Faults Database

The site appears to be situated on stratified marine and alluvial deposits, comprising clay, sand and gravel. Associated with this, the site also has a low to moderate liquefaction potential, in particular where sands are present.

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. Specfic testing details can be provided upon commission of the quantitative assessment phase.

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 is expressed as a percentage of new building standard (%NBS) and is in the order of that shown below in Table 4. The capacity is subject to confirmation by a more detailed quantitative analysis.

Item	%NBS
Building capacity	64

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 64% New Building Standard (NBS). Under the New Zealand Society for Earthquake Engineering (NZSEE) guidelines the building is considered potentially Earthquake Risk as it achieves greater than 33% but less than 67% NBS. This score has not been adjusted when considering damage to the structure as no damage was observed.

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

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

10.3 Expected Structural Ductility Factor

A structural ductility factor of 1.25 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. The building was designed in 2002 and was likely designed to the loading standard current at the time, NZS 4203: 1992. The design loads used in this standard are likely to have been less than those required by the current loading standard. When combined with the increase in the hazard factor for Christchurch to 0.3, it would be expected that the building would not achieve 100% NBS. As a result of this it is reasonable to expect the building to be classified as potentially Earthquake Risk.

10.5 Occupancy

The building does not pose an immediate risk to users and occupants as no critical structural weaknesses have been identified. The building has not been assessed as being Earthquake Prone. As the building has not been classified as being potentially Earthquake Prone and there are no immediate collapse hazards or critical structural weakness, general access to the building is permitted.

11. Initial Conclusions

The building has been assessed by the IEP to have a seismic capacity in the order of 64% NBS and is therefore potentially Earthquake Risk.

The building is not considered to pose an immediate risk to occupants as no critical structural weaknesses have been identified. As the building has not been classified as being potentially Earthquake Prone and there are no immediate collapse hazards or critical structural weakness, general access to the building is permitted.

The NZSEE guidelines recommend quantitative analysis and potential strengthening for structures assessed to be less than 67% NBS, however, we consider the assessed seismic capacity of 64% NBS is near enough to be classified as a low risk building. GHD consider further assessment and strengthening design not necessary for this building.

12. Recommendations

It is recommended that the current placard status of the building of green remains as is.

The recent seismic activity in Christchurch has caused no apparent damage to the building. As the building suffered no apparent damage that would compromise the load resisting capacity of the existing structural systems and has achieved between 33% and 67% NBS following an initial IEP assessment of the building, no further assessment is required by Christchurch City Council to comply with the building act.

As the building has not been classified as being potentially Earthquake Prone and there are no immediate collapse hazards or critical structural weakness, general access to the building is permitted.

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 North elevation.

Photograph 2 View of the toilet from the East.

Photograph 3 Roof structure showing timber sarking, rafters and purlins.

Photograph 4 Rectangular hollow section lintel above door, embedded into the concrete masonry unit wall.

Photograph 5 Timber wall plate fixed to fully grouted concrete masonry wall with 12mm diameter bolts.

Appendix B

Existing Drawings

Appendix C

CERA Building Evaluation Form

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Rawhiti Domain Toilets (East)	Reviewer:	David Lee
	Unit / No: / Street	CPEng No:	112052
Building Address:	136 Shaw Avenue	Company:	GHD Ltd
Legal Description:	Pt RES 1616	Company project number:	513090229
		Company phone number:	03 378 0900
	Degrees / Min / Sec		
GPS south:	43 / 30 / 13.58	Date of submission:	7/09/2012
GPS east:	172 / 43 / 30.89	Inspection Date:	27/08/2012
		Revision:	Draft
Building Unique Identifier (CCC):	PRK 2004 BLDG 003 EQ2	Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	0
Soil type:	silty sand	Soil Profile (if available):	
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	2.00

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):	0.10
Storeys below ground	0		
Foundation type:	mat slab	if Foundation type is other, describe:	
Building height (m):	3.50	height from ground to level of uppermost seismic mass (for IEP only) (m):	2.7
Floor footprint area (approx):	10		
Age of Building (years):	10	Date of design:	1992-2004
Strengthening present?	no	If so, when (year)?	
		And what load level (%g)?	
Use (ground floor):	public	Brief strengthening description:	
Use (upper floors):			
Use notes (if required):	Public Toilet		
Importance level (to NZS1170.5):	IL2		

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	100 x 50mm rafter @ 600mm c/c, 100 x 50m purlin cut between rafters, coloursteel Zincalum Cladding
Floors:	concrete flat slab	slab thickness (mm)	100
Beams:			
Columns:			
Walls:	fully filled concrete masonry	#N/A	

Lateral load resisting structure

Lateral system along:	fully filled CMU	**Note: Define along and across in detailed report!**		3.99
Ductility assumed, μ:	1.25		note total length of wall at ground (m):	
Period along:	0.10	##### enter height above at H31	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	fully filled CMU			2.48
Ductility assumed, μ:	1.25		note total length of wall at ground (m):	
Period across:	0.10	##### enter height above at H31	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:			
Roof Cladding:	Metal	describe	0.4mm Coloursteel Zincalum
Glazing:			
Ceilings:	none		
Services(list):			

Available documentation

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

Damage

Site: (refer DEE Table 4-2) Site performance:		Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	none apparent	notes (if applicable):	
Lateral Spread:	none apparent	notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

Current Placard Status: green

Along	Damage ratio:	0%	Describe how damage ratio arrived at:
	Describe (summary):	No Damage	
Across	Damage ratio:	0%	
	Describe (summary):	No Damage	
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 e'quakes:	64%	64% %NBS from IEP below	If IEP not used, please detail assessment methodology:
	Assessed %NBS after e'quakes:	64%		
Across	Assessed %NBS before e'quakes:	64%	64% %NBS from IEP below	
	Assessed %NBS after e'quakes:	64%		

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: 2.7m

Seismic Zone, if designed between 1965 and 1992:

not required for this age of building

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

	along	across
Period (from above):	0.1	0.1
(%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)	1.25	1.25
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:	0.925	0.925
Structural Performance Scaling Factor **Factor E**:	1.081081081	1.081081081

2.7 Baseline %NBS, $(NBS\%)_b = (\%NBS)_{nom}$ x A x B x C x D x E — **$\%NBS_b$:**	**64%**	**64%**

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:	**64%**	**64%**
4.4 Percentage New Building Standard (%NBS), (before)		**64%**

GHD

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Document Status

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