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Toilets Upper Riccarton Domain
PRK 0236 BLDG 005 EQ2

Detailed Engineering Evaluation

Quantitative Report

Version FINAL

92 Yaldhurst Road, Upper Riccarton

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

Toilets Upper Riccarton Domain
PRK 0236 BLDG 005 EQ2

Detailed Engineering Evaluation
Quantitative Report
Version FINAL

92 Yaldhurst Road, Upper Riccarton

Christchurch City Council

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Date
15 March 2013

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Quantitative Report Summary

Toilets Riccarton Domain

PRK 0236 BLDG 005 EQ2

Detailed Engineering Evaluation

Quantitative Report - SUMMARY

Version FINAL

92 Yaldhurst Road, Upper Riccarton

Background

This is a summary of the Quantitative report for the building structure, and is based in general on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011, visual inspections on 21 September 2012 and available drawings itemised in 5.2.

Building Description

The curved metal clad roof is supported upon a steel tube frame with steel tube posts extending down to either isolated pad foundations at ground level or the top of load bearing timber frame walls. The four load bearing lightweight timber frame walls, consisting of a plywood cladding over an internal Hardie's villaboard, form a ceiling-less enclosure beneath the roof. The timber frame walls are supported on a reinforced concrete strip footing with the floor consisting of a reinforced concrete ground slab on grade.

Key Damage Observed

No damage was observed in the structure.

Building Capacity Assessment

Based on the results of the quantitative assessment the building scored >100% NBS. Therefore the building is neither Earthquake Prone nor Earthquake Risk.

Recommendations

No further action is required.

1. Background

GHD has been engaged by Christchurch City Council (CCC) to undertake a detailed engineering evaluation of Toilets Upper Riccarton Domain.

This report is a Quantitative Assessment of the building structure, and is based in general on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011.

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 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

Figure 2 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

Figure 2 %NBS compared to relative risk of failure

4. Building Description

4.1 General

The building is located at 92 Yaldhurst Road, Upper Riccarton. The building was constructed in 2007 according to construction drawings provided. The sole purpose of the building is a public toilet.

The curved metal clad roof is supported upon a ø50mm steel tube frame with similar steel tube posts extending down to either isolated pad foundations at ground level or to the top of load bearing timber frame walls. The four load bearing lightweight timber frame walls, consisting of a plywood cladding over an internal Hardie’s villaboard, form a ceiling-less enclosure beneath the roof. The timber frame walls are supported on a reinforced concrete strip footing with the floor consisting of a reinforced concrete ground slab on grade.

The building is approximately 4.0m in length by 3.2m in width and 2.8m in height. The overall footprint of the building is approximately 13m^2. The nearest structure is sports rooms, situated 5m to the east. The flat site, located 600m south of Avon River, contains a large playing field, clubhouses, tennis and basketball courts, paved carpark and a small playground.

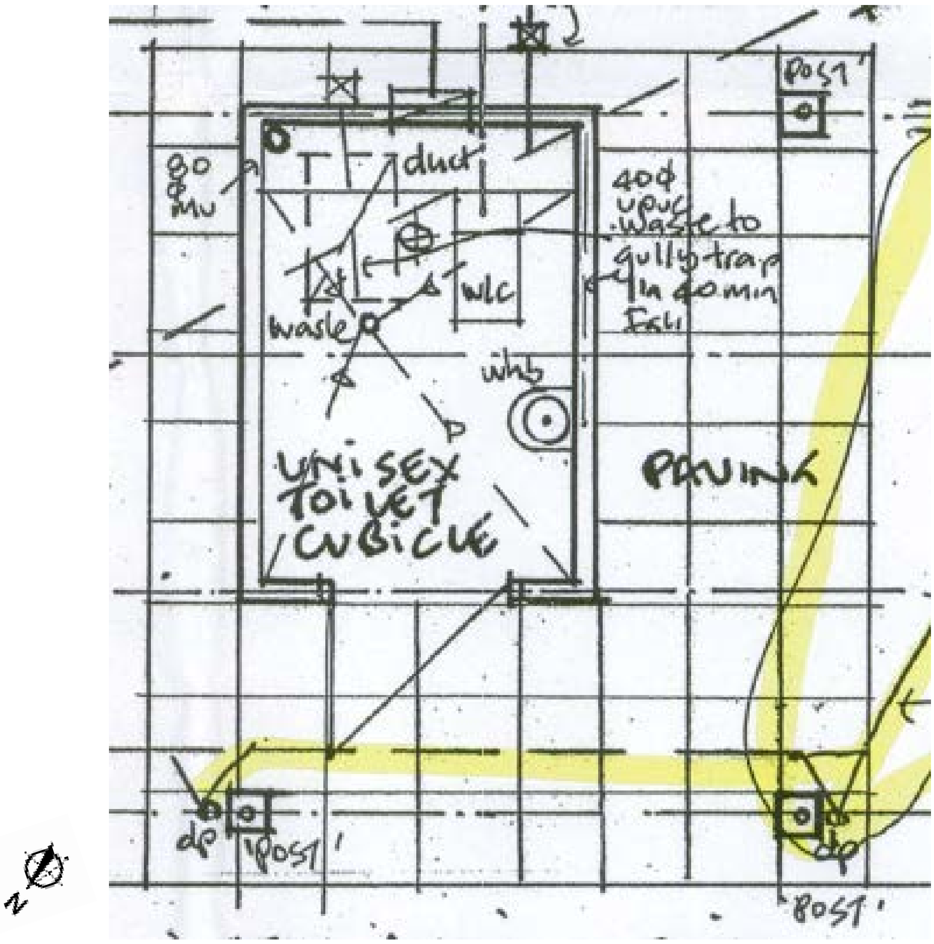


Figure 3 Plan of Original Structure

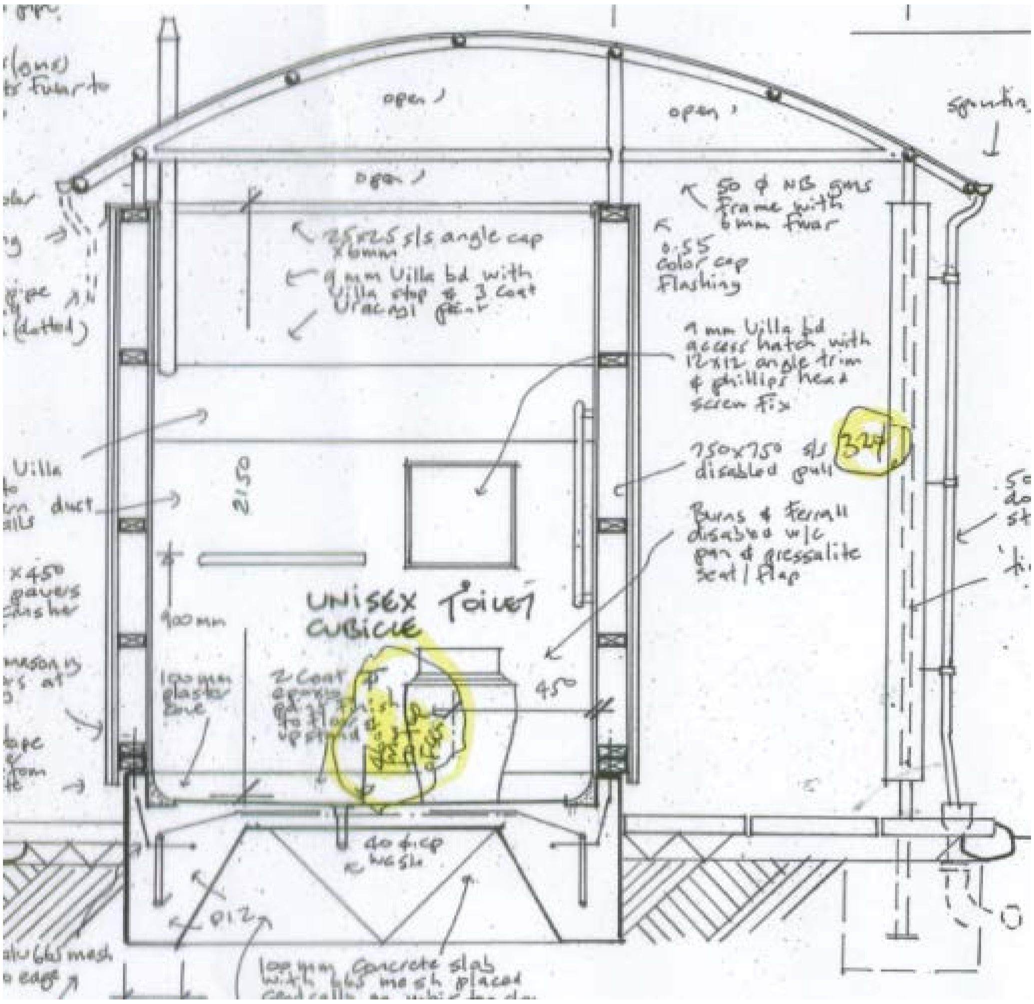


Figure 4 Section of Original Structure

4.2 Gravity Load Resisting System

The gravity roof loads are transferred through the rigid steel tube roof frame to the steel tube posts. These steel tube posts transfer the gravity loads downwards to isolated concrete pad footings or to the top of load bearing timber frame walls. The load bearing timber frame walls transfer the gravity loads down to a reinforced concrete strip footing. Both the concrete pad footings and the reinforced concrete strip footing transfer the gravity load into the ground beneath. The floor slab supports gravity loads by bearing directly on grade.

4.3 Lateral Load Resisting System

In both the longitudinal and transverse directions, lateral loads are resisted by the actions of both the timber frame walls and the portal action of the steel tube frame. The lateral load resistance of the timber frame walls is supplied by the panel action of the timber stud and the board linings. The rigid connections of the steel tube posts and roof frame forms a portal which resists lateral loads by the bending action of the steel tube posts. The lateral roof loads are transferred through the rigid steel tube roof frame to both the timber frame wall and the steel tube posts, which transfers the lateral loads to the foundations in their respective system. The foundations transfer the lateral loads into the ground beneath. Walls subject to out-of–plane loading span vertically between the foundations and the restraint provided by the roof structure.

5. Assessment

5.1 Site Inspection

An inspection of the building was undertaken on the 21st of September 2012. Both the interior and exterior of the building were inspected. The main structural components of the building were all able to be viewed. It should be noted that inspection of the foundations of the structure was limited to the top of the external strips exposed above ground level.

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

5.2 Available Drawings

The construction drawings of the structure were made available.

Drawings are attached as Appendix B.

6. Damage Assessment

6.1 Surrounding Buildings

There was no damage noted to surrounding buildings.

6.2 Residual Displacements and General Observations

There were no settlement or damage issues identified during the inspection of the structure.

6.3 Ground Damage

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

7. Structural Analysis

7.1 Seismic Parameters

Earthquake loads shall be calculated using New Zealand Code.

◗ Site Classification	D
◗ Seismic Zone factor (Z)	
(Table 3.3, NZS 1170.5:2004 and NZBC Clause B1 Structure)	0.30 (Christchurch)
◗ Annual Probability of Exceedance	
(Table 3.3, NZS 1170.0:2002)	1/500 (ULS) Importance Level 2
◗ Return Period Factor (Ru)	
(Table 3.5, NZS 1170.5:2004)	1.0 (ULS)
◗ Ductility Factor (μ)	2.0
◗ Ductility Scaling Factor (k_μ)	1.57
◗ Performance Factor (Sp), based on NZS 3.1.0.1	0.7
◗ Gravitational Constant (g)	9.81 m/s^2

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

7.2 Equivalent Static Method

Equivalent Static forces were calculated in accordance with NZS 1170.5:2004. A ductility factor of 2.0 has been assumed given the age and combined construction type of lightweight timber frame and rigid steel tube frame. The structure is expected to have ductile behavior given the two construction types utilized, with the steel tube frame being the limiting Ductility Factor.

The elastic site hazard spectrum for horizontal loading:

$C(T_1)=C_h \cdot Z \cdot R \cdot N(T,D)$

$C_h=3.0$ – Value from 3.1 table for the period (T=0.4s)

Z=0.3 – Hazard factor determined from the table 3.3 (NZS 1170.5:2004)

R=1.0 – Return period factor determined from the table 3.5 (NZS 1170.5:2004)

N (T,D) = 1.0 – Near fault factor- clause 3.1.6. (NZS 1170.5:2004)

$C(T_1)= 3.0 \cdot 0.3 \cdot 1.0 \cdot 1.0 = 0.9$

The horizontal design action coefficient:

$$C_d(T_1)=\frac{C(T_1)\cdot S_p}{k_\mu}=\frac{0.90\cdot 0.7}{1.57}=0.40$$

7.3 Dependable Capacity

7.3.1 Steel Tube Frame Bracing Capacity

The steel tube roof frame and two posts aligned in the plane of loading were analysed as a portal frame for both orthogonal directions. The capacity of the steel tube portal was calculated to determine the lateral load capacity of the portal frames. The equivalent Bracing Units for the portal frames were found from these lateral load capacities.

7.3.2 Bracing Schedule

As detailed in NZS 3604:2011, a bracing schedule was prepared using the Bracing Units for the timber framed walls and the equivalent Bracing Units from the steel tube portal frames. Seismic demand, as calculated form the equivalent static method, was compared to these values.

8. Geotechnical Consideration

8.1 Site Description

The site is situated within a recreational reserve, within the suburb of Upper Riccarton in Christchurch. It is relatively flat at approximately 18m above mean sea level. It is approximately 600m south of the Avon River, and 15km west of the coast at New Brighton.

8.2 Public Information on Ground Conditions

8.2.1 Published Geology

The geological map of the area[1] indicates that the site is underlain by Holocene alluvial soils of the Yaldhurst Member, sub-group of the Springston Formation, comprising alluvial sand and silt overbank deposits.

Brown & Weeber[1] (Figure 72) also indicates that groundwater is ~5m below ground level (bgl).

8.2.2 Environmental Canterbury Logs

Information from Environment Canterbury (ECan) indicates that nine boreholes are located within a 200m radius of the site (see Table 1). Of these boreholes, four contain an adequate lithographic log. These logs indicate the area typically comprises ~3m of sands and silts, underlain by gravel. Groundwater was not recorded in any of the borehole logs.

Table 1 ECan Borehole Summary

Bore Name	Log Depth	Groundwater	Distance & Direction from Site
M35/14079	3.05m	-	100m E
M35/14830	3.05m	-	100m SE
M35/16002	2.7m	-	100m SW
M35/16173	1.8m	-	150m W

It should be noted 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 Investigation

The Earthquake Commission has not undertaken geotechnical testing in the area of the subject site.

[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.

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 technical categories. These categories describe how the land is expected to perform in future earthquakes. The site is within an area classified as Technical Category 1 (TC1, grey)[2], which means that future land damage from liquefaction is unlikely.

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 5

Figure 5 Post February 2011 Earthquake Aerial Photography3

8.2.6 Summary of Ground Conditions

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] CERA Land Check, http://cera.govt.nz/residential-green-zone-technical-categories

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

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 2 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	15 km	SW	7.1	~15,000 years
Hope Fault	105 km	NW	7.2~7.5	120~200 years
Kelly Fault	105 km	NW	7.2	150 years
Porters Pass Fault	60 km	NW	7.0	1100 years

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.

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.

8.3.3 Slope Failure and/or Rockfall Potential

Given the site's location in Upper Riccarton, a flat suburb in western 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.

[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

8.3.4 Liquefaction Potential

The site is not considered susceptible to liquefaction, due to the following reasons:

- No evidence of liquefaction is visible in the post-February aerial photography;
- Sand and silt deposits underlying the site are not anticipated to be saturated; and,
- During the structural inspection, no evidence of liquefaction was observed.

8.3.5 Conclusions & Recommendations

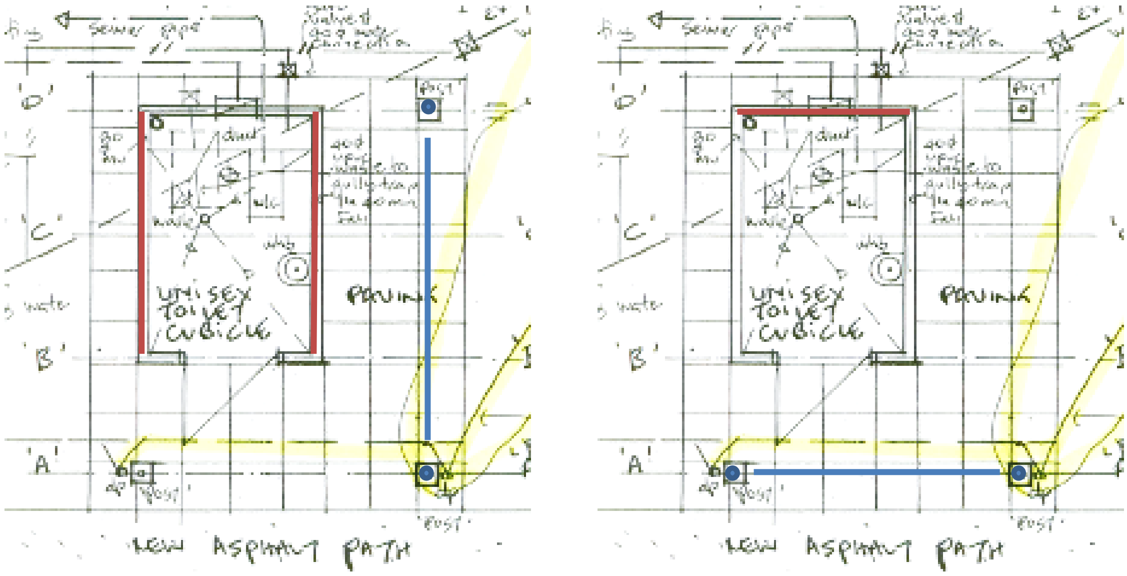
This assessment is based on a review of the geology and existing ground investigation information, and observations from the Christchurch earthquakes since 4 September 2010.

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

Due to the anticipation of gravel at 2 to 3m bgl, no further geotechnical assessment is considered necessary. However, if any repairs be undertaken to the subject structure's foundations, testing should be conducted to confirm the depth to dense gravel. Specific geotechnical advice regarding this can be provided upon request.

9. Results of Analysis

The longitudinal and transverse directions were considered separately. The Bracing Elements providing lateral restraint in each direction are shown below in Figure 6. The timber frame wall panels are shown in red, and the steel tube portal frames are shown in blue.



Longitudinal Direction **Transverse Direction**

Figure 6 Bracing Elements as considered for both directions

The %New Building Standard was derived by comparing the seismic demand to the lateral load resisting capacity in both orthogonal directions. The results are shown in Table 3 below.

Table 3 %NBS of Directions

Direction	% NBS
Longitudinal Direction	>100%
Transverse Direction	>100%

9.1 Discussion of Results

The results obtained from the analysis are generally consistent with those expected for a building of this size, age and construction type, founded on Class D soils.

The Toilet Riccarton Domain was built in 2007 and was likely designed in accordance with the current loading standard, NZS 1170:2004. The design loads used in accordance with this standard should inherently achieve a minimum %NBS of 100%, hence it is reasonable to expect that this structure would be classed as neither Earthquake Prone or Earthquake Risk. The building achieves a %NBS of >100% NBS, as anticipated for a recent construction correctly designed and detailed.

10. Conclusions and Recommendations

The building overall has been assessed as having a seismic capacity of >100% NBS and is therefore classified as being neither ‘Earthquake Prone’ nor ‘Earthquake Risk’.

No further action is required.

11. Limitations

11.1 General

This report has been prepared subject to the following limitations:

- Available drawings itemised in 5.2 was used in the assessment.
- The foundations of the building were unable to be inspected.
- No level or verticality surveys have been undertaken.
- No material testing has been undertaken.

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

11.2 Geotechnical Limitations

The data and advice provided herein relate only to the project and structures described herein and must be reviewed by a competent geotechnical professional before being used for any other purpose. GHD Limited (GHD) accepts no responsibility for other use of the data by third parties.

Where drill hole or test pit logs, cone tests, laboratory tests, geophysical tests and similar work have been performed and recorded by others under a separate commission, the data is included and used in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

The advice tendered in this report is based on information obtained from the desk study investigation location test points and sample points. It is not warranted in respect to the conditions that may be encountered across the site other than at these locations. It is emphasised that the actual characteristics of the subsurface materials may vary significantly between adjacent test points, sample intervals and at locations other than where observations, explorations and investigations have been made. Subsurface conditions, including groundwater levels and contaminant concentrations can change in a limited time. This should be borne in mind when assessing the data.

It should be noted that because of the inherent uncertainties in subsurface evaluations, changed or unanticipated subsurface conditions may occur that could affect total project cost and/or execution. GHD does not accept responsibility for the consequences of significant variances in the conditions and the requirements for execution of the work.

The subsurface and surface earthworks, excavations and foundations should be examined by a suitably qualified and experienced Engineer who shall judge whether the revealed conditions accord with both the assumptions in this report and/or the design of the works. If they do not accord, the Engineer shall modify advice in this report and/or design of the works to accord with the circumstances that are revealed.

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

Appendix A

Photographs

Photo 1.   View of toilets from the northwest.

Photo 2.   View of toilets form the southwest.

Photo 3. Rigid frame formed from fixed connections of steel tubes.

Photo 4. Steel tube post supported on load bearing timber frame wall.

Photo 5. Toilet interior.

Appendix B

Existing Drawings

CITYSOLUTIONS

			NAME	SIGNED	DATE
DATUM		DESIGNED			16/8/07
BENCH MK.		DES. REVIEW			
SURVEY FB		DRAWN			
SURVEY LB		DRW. CHECK	L. Leonard		21.8.07
CONSTN.EB					
CONSTN.LB					
SDR FILE					

APPROVED
DATE 20/8/07

CLIENT
CHRISTCHURCH CITY COUNCIL · YOUR PEOPLE · YOUR CITY

PROJECT TITLE
NEW PUBLIC TOILET AT UPPER RICCARTON DOMAIN for TRAFFIC & GREENSPACE UNIT. (2007.)

DRAWING TITLE
WORKING DRAWINGS.

FILE NUMBER 562/001785/01/02
CONTRACT NUMBER 07/08-47
ORIGINAL SHEET SIZE A1
SCALES as shown
DRAWING & PROJECT NUMBER
SHEET A1. of 1.

Appendix C

CERA Form

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name: Toilet Riccarton Domain
Building Address: Unit: | No: 92 | Street: Yaldhurst Road
Legal Description:
GPS south: Degrees | Min | Sec
GPS east:
Building Unique Identifier (CCC): PRK_0236_BLDG_005 EQ2

Reviewer: Stephen Lee
CPEng No: 1006840
Company: GHD
Company project number: 513090216
Company phone number: 04 472 0799
Date of submission:
Inspection Date: 21-Sep-12
Revision:
Is there a full report with this summary? yes

Site

Site slope: flat
Soil type: mixed
Site Class (to NZS1170.5): D
Proximity to waterway (m, if <100m):
Proximity to clifftop (m, if < 100m):
Proximity to cliff base (m,if <100m):

Max retaining height (m):
Soil Profile (if available):
If Ground improvement on site, describe:
Approx site elevation (m): 18.00

Building

No. of storeys above ground: 1 (single storey = 1)
Ground floor split? no
Storeys below ground: 0
Foundation type: isolated pads, no tie beams
Building height (m): 2.80
Floor footprint area (approx): 8
Age of Building (years): 5

Ground floor elevation (Absolute) (m): 18.00
Ground floor elevation above ground (m): 18.00
if Foundation type is other, describe:
height from ground to level of uppermost seismic mass (for IEP only) (m): 2.8
Date of design: 2004-

Strengthening present? no
If so, when (year)?
And what load level (%g)?
Brief strengthening description:

Use (ground floor): public
Use (upper floors):
Use notes (if required):
Importance level (to NZS1170.5): IL2

Gravity Structure

Gravity System: frame system
Roof: other (note) — describe system: Steel tube truss frame
Floors: other (note) — describe sytem: slab on grade
Beams:
Columns: structural steel — typical dimensions (mm x mm):
Walls:

Lateral load resisting structure

Lateral system along: lightweight timber framed walls — and steel tube portal
Note: Define along and across in detailed report!
Ductility assumed, μ: 2.00 — note typical wall length (m): 2.5
Period along: 0.40 | 0.00 — estimate or calculation?
Total deflection (ULS) (mm): — estimate or calculation?
maximum interstorey deflection (ULS) (mm): — estimate or calculation?

Lateral system across: lightweight timber framed walls — and steel tube portal
Ductility assumed, μ: 2.00 — note typical wall length (m): 1.4
Period across: 0.40 | 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: Ply cladding, cement board internal
Roof Cladding: Metal — describe: Corrugate steel
Glazing:
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 observed — notes (if applicable):
Differential settlement: none observed — notes (if applicable):
Liquefaction: none apparent — notes (if applicable):
Lateral Spread: none apparent — notes (if applicable):
Differential lateral spread: none apparent — notes (if applicable):
Ground cracks: none apparent — notes (if applicable):
Damage to area: none apparent — notes (if applicable):

Building:

Current Placard Status:

Along — Damage ratio: 0% — Describe how damage ratio arrived at:
Describe (summary):

Across — Damage ratio: 0%
Describe (summary):

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

Diaphragms — Damage?: no — Describe:
CSWs: — Damage?: no — Describe:
Pounding: — Damage?: no — Describe:
Non-structural: — Damage?: no — Describe:

Recommendations

Level of repair/strengthening required: — Describe:
Building Consent required: — Describe:
Interim occupancy recommendations: — Describe:

Along — Assessed %NBS before e'quakes: 100% | #### %NBS from IEP below
Assessed %NBS after e'quakes: 100%
If IEP not used, please detail assessment methodology: Detailed calculation

Across — Assessed %NBS before e'quakes: 100% | #### %NBS from IEP below
Assessed %NBS after e'quakes: 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): 2004-

h_n from above: 2.8m

Seismic Zone, if designed between 1965 and 1992: B

Design Soil type from NZS1170.5:2004, cl 3.1.3:
not required for this age of building: b) Intermediate

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

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
Note 2: for RC buildings designed between 1976-1984, use 1.2
Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (1.0)

	along	across
Final $(\%NBS)_{nom}$:	**0%**	**0%**

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)		
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:		
Ductiity Scaling Factor, **Factor D**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

	along	across
Sp:		
Structural Performance Scaling Factor **Factor E**:	#DIV/0!	#DIV/0!

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

	along	across
$\%NBS_b$:	**#DIV/0!**	**#DIV/0!**

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

3.1. Plan Irregularity, factor A:	significant	0.7
3.2. Vertical irregularity, Factor B:	insignificant	1
3.3. Short columns, Factor C:	insignificant	1

3.4. Pounding potential

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

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

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

3.5. Site Characteristics: insignificant | 1

3.6. Other factors, Factor F

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

Detail Critical Structural Weaknesses: (refer to DEE Procedure section 6)
List any:
Refer also section 6.3.1 of DEE for discussion of F factor modification for other critical structural weaknesses

3.7. Overall Performance Achievement ratio (PAR)	**0.70**	**0.70**
4.3 PAR x (%NBS)b: PAR x Baselline %NBS:	**#DIV/0!**	**#DIV/0!**
4.4 Percentage New Building Standard (%NBS), (before)		**#DIV/0!**

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