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Toilets – Hollis Reserve
PRK_1769_BLDG_001

Detailed Engineering Evaluation

Qualitative Report

Version Final

8 Landsdowne Terrace, Cashmere

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

Toilets – Hollis Reserve
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Detailed Engineering Evaluation
Qualitative Report
Version Final

8 Landsdowne Terrace, Cashmere

Christchurch City Council

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Date
24-05-13

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Toilets – Hollis Reserve

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Detailed Engineering Evaluation

Qualitative Report - SUMMARY

Version Final

8 Lansdowne Terrace, Cashmere

Background

This is a summary of the Qualitative 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 and visual inspections on 23 July 2012.

Building Description

The toilet block at the Hollis Reserve is part of the structure to the Lansdowne Terrace Play Centre and is located at 8 Lansdowne Terrace, Cashmere and was constructed in 1976. The entire structure has been assessed for the purpose of this report. A steel portal frame forms the main hall structure with a combination of timber framed and masonry blockwork walls. The roof to the structure is lightweight metal cladding.

Internal linings consist of plasterboard to the timber framed walls with plywood to the hall ceiling. In the ancillary structures the masonry is exposed with the ceiling linings consisting of fibreboard. There is a large amount of openings and access doors to the east side of the portal frame, concrete columns (200mm x 200mm) and beams support these openings in between blockwork masonry.

The kitchen and toilet block ancillary to the east of the hall appears to be an extension and consists of masonry blockwork. Similarly the toilets/storage block to the west of the structure appears to be an extension and also consists of blockwork masonry.

Concrete slab on grade forms the floor with perimeter strip footings to the perimeter.

Key Damage Observed

Key damage observed includes:-

Minor separation between concrete masonry and timber framed walls.

Critical Structural Weaknesses

No critical structural weaknesses exist to 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 63% NBS and post-earthquake capacity also in the order of 63% NBS. The buildings post-earthquake capacity excluding critical structural weaknesses is in the order of 63% NBS.

The building has been assessed to have a seismic capacity in the order of 63% NBS and is therefore potentially an Earthquake Risk building.

Recommendations

It is recommended that:

- A quantitative assessment is deemed necessary as the building has been assessed to be an Earthquake Risk as the % NBS does not exceed 67% NBS.
- The current green placard status of the building is to remain.

1. Background

GHD has been engaged by the Christchurch City Council (CCC) to undertake a detailed engineering evaluation of the Toilet block at the Hollis Reserve.

This report is a Qualitative 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.

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. The building description is based on the visual inspection carried out on site and the building drawings made available.

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 toilet block at the Hollis Reserve is part of the structure to the Lansdowne Terrace play centre and is located at 8 Lansdowne Terrace, Cashmere and was constructed in 1976. The entire structure has been assessed for the purpose of this report. The structure consists of a steel portal frame hall area with a combination of timber framed and masonry walls, a concrete frame exists to the right side of the portal frames. An ancillary toilet block exists to the west side of the building and a toilet/kitchen area to the east. The site can be accessed from Lansdowne Terrace and is surrounded by residential dwellings and a green area to the south west of the building.

A steel portal frame forms the main hall structure with a combination of timber framed and masonry blockwork walls. The roof to the structure is lightweight metal cladding. Internal linings to the walls and ceiling consist of plasterboard with the structure being blockwork clad externally. To the east of the portal frame the openings and access doors are supported by concrete columns (200mm x 200mm) and beams as shown in Figure 2. The kitchen and toilet block structure to the east of the hall appears to be an extension and consists of masonry blockwork. Similarly the toilets/storage block to the west of the structure appears to be an extension and also consists of blockwork masonry.

A concrete slab on grade forms the floor with perimeter strip footings to the perimeter.

The site is predominantly flat with insignificant variations in ground levels throughout. No drawings were available for the structure.

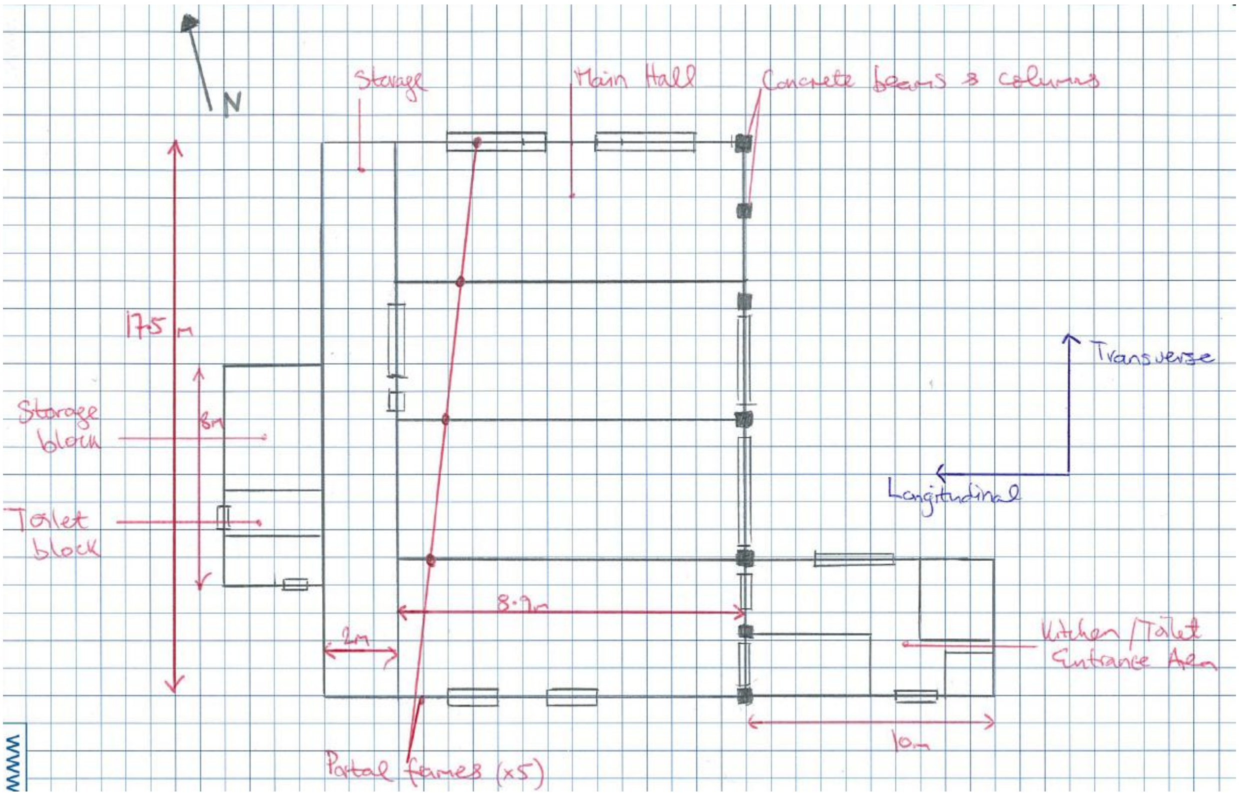


Figure 2 Plan drawing of key structural elements to the structure

4.2 Gravity Load Resisting System

The gravity loads in the structure are resisted by the steel portal frames and the blockwork masonry/timber framed walls. The gravity load is transferred from the lightweight metal cladding into the timber purlins to the steel portals. The steel portals then transfer the load to the ground via the concrete foundations.

For the ancillary structures to the east and west of the main hall, the gravity load is transferred from the timber framed roof to the masonry external walls. It is transferred down through the walls to the concrete foundations and into the ground.

4.3 Lateral Load Resisting System

The lateral load resisting system to the structure comprises of steel portal frames and timber framed/masonry block walls.

In the longitudinal direction the lateral loads are resisted by the steel portal frames to the hall. The lateral load is transferred from the lightweight roof cladding to the timber framed roof with the aid of the plywood lined diaphragm and into the steel portals. The portals then transfer the lateral load down to the ground via the concrete foundations.

In the transverse direction the hall lateral roof load is transferred through the timber framed roof and diaphragm ceiling to the masonry walls. The load is then transferred down through the walls to the concrete foundations.

For the ancillary structures to the hall, the masonry blockwork walls provide the lateral resistance in both the long and short directions to the structure. The lateral roof load is transferred from the lightweight metal cladding to the timber framed roof. From the timber framed roof the load is transferred out to the walls by diaphragm action of the fibreboard ceiling. The lateral load is then transferred down through the walls into the ground via the concrete foundations.

5. Assessment

A visual inspection of the building was undertaken on 23 July 2012. Both the interior and exterior of the building were inspected. The building was observed to have a green placard in place. The main structural components of the building were able to be viewed due to the exposed simple construction of the building.

The visual inspection consisted of observing the building to determine the structural systems and likely behaviour of the building during an earthquake. The site was assessed for damage, including observing the ground conditions, checking for damage in 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.

The %NBS score is determined using the IEP procedure described by the NZSEE which is based on the information obtained from visual observation of the building.

6. Damage Assessment

6.1 Surrounding Buildings

The Toilet Block at the Hollis Reserve is located in a residential area with properties surrounding the site with a green area to the south west of the structure. During the inspection there was no apparent damage to the surrounding buildings or adjoining properties.

6.2 Residual Displacements and General Observations

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

Minor separation was noted between the plasterboard walls and blockwork masonry to structure.

No damage was evident to the portal frames or the concrete beams and columns to the hall structure.

6.3 Ground Damage

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

7. Critical Structural Weakness

7.1 Short Columns

No short columns were observed during inspections of the building.

7.2 Lift Shaft

The building does not contain a lift shaft.

7.3 Roof

No critical structural weaknesses were observed in the roof structure. Roof bracing could not be observed to the hall due to a lack of access.

7.4 Plan Irregularity

No Plan Irregularity was identified to the structure.

7.5 Staircases

No staircases exist in the structure.

7.6 Liquefaction

No liquefaction was observed on site.

8. Geotechnical Consideration

8.1 Site Description

The site is situated within a recreational reserve in Cashmere, south Christchurch. It is relatively flat at approximately 10m above mean sea level. It is approximately 180m southwest of the Heathcote River, and 8.5km west of the coast (Pegasus Bay) at New Brighton.

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 soils; comprising valley fill and slope wash of loess-volcanic derived colluvium.

Anecdotal evidence suggests that previously displaced boulders and rock fall debris may be present in the loess-colluvium matrix.

8.2.2 Environment Canterbury Logs

Information from Environment Canterbury (ECan) indicates that eight boreholes are located within 200m of the site (see Table 2). Of these boreholes, four have an adequate lithographic log. The site geology described in these logs indicates the site to be underlain by wet clayey silt.

Table 2 ECan Borehole Summary

Bore Name	Log Depth	Groundwater	Distance & Direction from Site
M36/8763	4.6m	-	120m N
M36/8764	6.1m	1.7m bgl	70m NW
M36/8765	6.1m	1.7m bgl	60m W
M36/8793	4.27m	-	100m N

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 to a recognised geotechnical standard. In addition strength data is not recorded.

8.2.3 EQC Geotechnical Investigations

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 CERA Land Zoning

Canterbury Earthquake Recovery Authority (CERA) has indicated the site is situated within the Green Zone, indicating that repair and rebuild may take place.

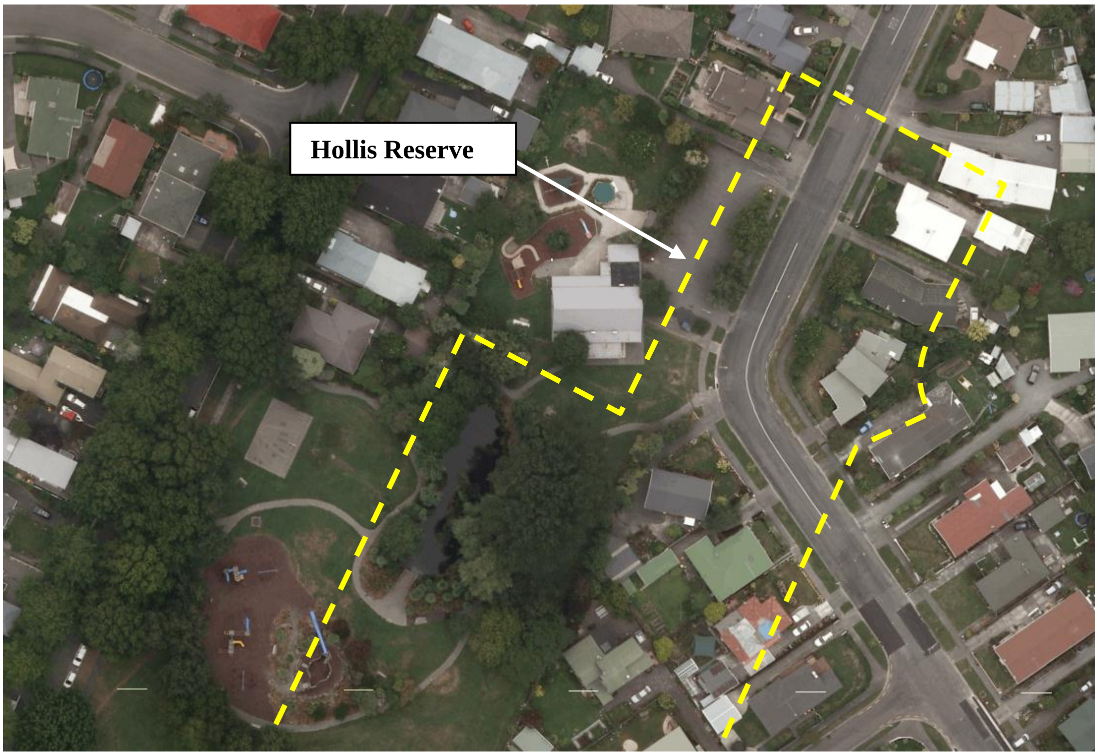
Land in the CERA green zone has been divided into three technical categories. These categories describe how the land in expected to perform in future earthquakes.

The subject site is surrounded by land categorised as Technical Category 2 (TC2, yellow)[2], which means that minor to moderate land damage from liquefaction is possible in future significant earthquakes.

8.2.5 Post February Aerial Photography

Aerial photography taken following the 22 February 2011 earthquake shows 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 [3]



8.2.6 Summary of Ground Conditions

From the information presented above, the ground conditions underlying the site are anticipated to comprise clayey silt, derived from loess colluvium. Anecdotal evidence suggests boulders may also be present in the loess-colluvium matrix.

[2] CERA Land check website, http://cera.govt.nz/my-property

[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 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	22 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	60 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.

8.3.2 Ground Shaking Hazard

The recent Canterbury seismic activity has produced earthquakes of Magnitude-6.3 with peak ground accelerations (PGA) up to twice the acceleration due to gravity (2g) in near-by 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.

In addition, anticipation of clayey silts, a 475-year PGA (peak ground acceleration) of ~0.4 (Stirling et al, 2002)[4], and bedrock anticipated to be 20 to 50m deep, ground shaking potential is likely to be moderate.

8.4 Slope Failure and/or Rockfall Potential

The topography surrounding the site suggests that the rockfall potential is very low. However, any retaining structures or embankments nearby should be further investigated to determine the site-specific local 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, http://maps.gns.cri.nz/website/af/viewer

8.5 Liquefaction Potential

Based on the discovered geological data and absence of liquefaction occurring during the 22 Feb 2011 earthquake, it is considered unlikely that liquefaction will occur at this site.

8.6 Recommendations

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

If a more detailed assessment is required, intrusive investigation should be undertaken.

8.7 Conclusions & Summary

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

The site appears to be situated on clayey silt originating from loess/colluvium. There is also potential for previously displaced boulders to be present in the underlying soils.

The site has a low liquefaction potential.

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

Should a more comprehensive ground condition assessment be required, it is recommended that an intrusive investigation be conducted at the site.

9. Survey

No level or verticality surveys have been undertaken for this building at this stage.

10. Initial Capacity Assessment

10.1 % NBS Assessment

The building has had its capacity assessed using the Initial Evaluation Procedure based on the information available. The buildings capacity excluding critical structural weaknesses and the capacity of any identified weaknesses are expressed as a percentage of new building standard (%NBS) and are in the order of that shown below in Table 4. These capacities are subject to confirmation by a more detailed quantitative analysis.

Item	%NBS	
Direction of building	Along	Across
Building	76	63

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 63% New Building Standard (NBS). Under the New Zealand Society for Earthquake Engineering (NZSEE) guidelines the building is considered to be a potentially Earthquake Risk building as it achieves below 67% NBS. This score has not been adjusted when considering damage to the structure as no significant damage was observed.

10.2 Seismic Parameters

The seismic design parameters based on current design requirements from NZS1170:2002 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.

Several key seismic parameters have influenced the %NBS score obtained from the IEP assessment. The building has been assessed as an Importance Level 2 building. An increased Z factor of 0.3 for Christchurch has been used in line with recommendations from the Department of Building and Housing recommendations. Due to the age of the structure and no apparent damage it is reasonable to expect the building to be regarded as a potentially Earthquake Risk structure.

10.3 Expected Structural Ductility Factor

A structural ductility factor of 2.0 has been assumed longitudinally due to the portal frames and a ductility of 1.5 transversely based on the blockwork masonry structure.

10.4 Discussion of Results

The results obtained from the initial IEP assessment are consistent with those expected for a building of this age, importance level and construction type founded on Class C soils. This building would have been designed to standards at the time (namely NZS 4203:1976) which would have used design loads less than those required by the current loading standard and lower detailing requirements for ductile seismic behaviour than those present in the current standards. This combined with the increase in the hazard factor for Christchurch to 0.3, it is reasonable to expect the building to be classified as an Earthquake Risk building. Further to this as no critical structural weaknesses exist, the building is not deemed to be Earthquake Prone.

10.5 Occupancy

The building does not pose an immediate risk to users and occupants as no collapse hazards or critical structural weaknesses have been identified. However as the building does not achieve the 67% NBS, it is still regarded as a potentially Earthquake Risk building. Occupancy is permitted.

11. Initial Conclusions

The building has been assessed to have a seismic capacity in the order of 63% NBS and is therefore regarded as a potentially Earthquake Risk building. Occupancy is allowed.

12. Recommendations

The damage to the building during recent seismic activity in Christchurch has only caused minor damage to the building, with minor separation between the blockwork masonry walls and plasterboard ceiling linings the only damage noted.

As the building suffered insignificant damage that would not compromise the load resisting capacity of the existing structural systems, has no collapse hazards or significant critical structural weakness and has achieved over 33% NBS following an initial IEP assessment of the building, no further assessment is required. In addition occupancy of the structure is permitted. However, as the building has achieved less than 67% NBS we recommend a quantitative assessment of the building is undertaken to determine the seismic capacity and to develop potential strengthening concepts if required.

The current green placard status is to remain as is.

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 report.

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: Western and southern facing elevations showing hall and toilet block

Photograph 2: Toilet block to west of the structure

Photograph 3: Steel portal frame to hall structure

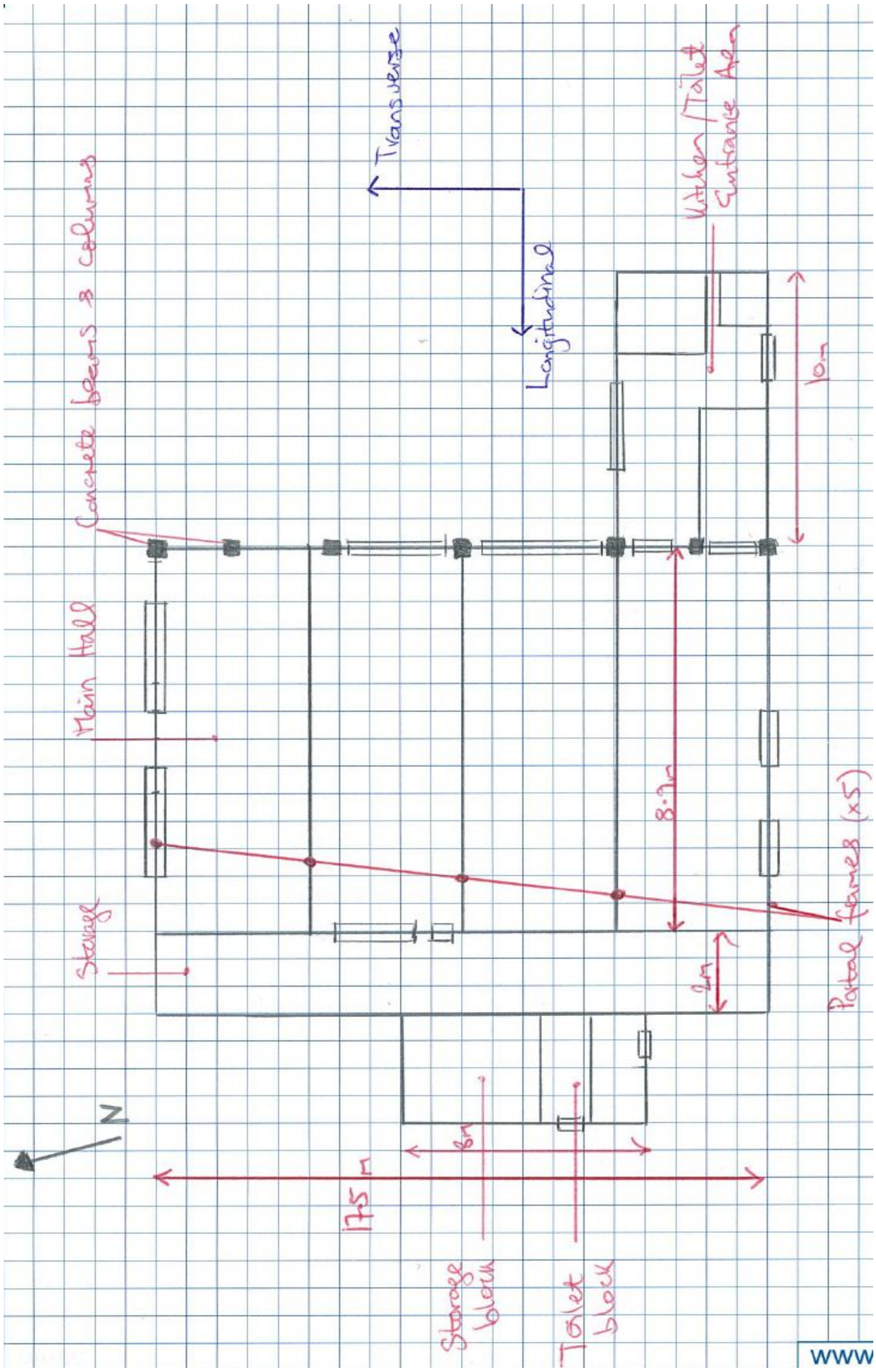
Photograph 4: Concrete columns and beams to right of portal frame to offer support for openings

Photograph 5: Minor separation between plasterboard ceiling and blockwork masonry

Photograph 6: Fibreboard ceiling to kitchen/toilet block to eastern side of the structure

Appendix B
Existing Drawings/Sketches

No drawings have been made available for this building. Shown below is a plan of the overall site with sketches of each building showing key structural elements.



Appendix C

CERA Building Evaluation Form

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Toilets - Hollis Reserve			Reviewer:	Derek Chinn
	Unit	No:	Street	CPEng No:	177243
Building Address:	Lansdowne Terrace Playcentre		8 Lansdowne Terrace, Cashmere	Company:	GHD Limited
Legal Description:	LOT 6 DP 28383			Company project number:	51-30902-08
				Company phone number:	03 378 0900
	Degrees	Min	Sec		
GPS south:	43	34	16.51	Date of submission:	24/05/13
GPS east:	172	38	22.21	Inspection Date:	23/7/2012
				Revision:	Final
Building Unique Identifier (CCC):	PRK_1769_BLDG_001			Is there a full report with this summary?	yes

Site

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

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	
Ground floor split?	no		Ground floor elevation above ground (m):	0.00
Storeys below ground	0			
Foundation type:	strip footings		if Foundation type is other, describe:	slab on grade with perimeter strip footing
Building height (m):	5.20		height from ground to level of uppermost seismic mass (for IEP only) (m):	4
Floor footprint area (approx):	240			
Age of Building (years):	36		Date of design:	1976-1992
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	other (specify)		Brief strengthening description:	
Use (upper floors):				
Use notes (if required):				
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	frame system		
Roof:	timber framed	rafter type, purlin type and cladding	
Floors:	concrete flat slab	slab thickness (mm)	concrete slab on grade
Beams:	precast concrete	overall depth (mm)	
Columns:	cast-insitu concrete	typical dimensions (mm x mm)	
Walls:	partially filled concrete masonry	thickness (mm)	200

Lateral load resisting structure

Lateral system along:	steel frame with infill		**Note: Define along and across in detailed report!**	note typical frame sizes and bay length (m)	256 UB, Bay length = 3.475m
Ductility assumed, μ:	2.00				
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:	partially filled CMU				
Ductility assumed, μ:	1.50			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:	other light	describe	Internal-lightweight plaster/masonry External-masonry
Roof Cladding:	Metal	describe	lightweight metal cladding
Glazing:	aluminium frames		
Ceilings:	fibrous plaster, fixed		
Services(list):			

Available documentation

Architectural	none	original designer name/date	
Structural	none	original designer name/date	
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	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):		
Across	Damage ratio:	0%	
	Describe (summary):		
Diaphragms	Damage?:	no	Describe:
CSWs:	Damage?:	no	Describe:
Pounding:	Damage?:	no	Describe:
Non-structural:	Damage?:	yes	Describe: minor separation between plasterboard lining & blockwor

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

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:	76%	76% %NBS from IEP below	If IEP not used, please detail assessment methodology:
	Assessed %NBS after e'quakes:	76%		
Across	Assessed %NBS before e'quakes:	63%	63% %NBS from IEP below	
	Assessed %NBS after e'quakes:	63%		

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

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

h_n from above: 4m

Seismic Zone, if designed between 1965 and 1992: B

not required for this age of building

not required for this age of building

	along	across
Period (from above):	0.1	0.1
(%NBS)nom from Fig 3.3:	16.0%	16.0%

Note:1 for specifically design public buildings, to the code of the day: pre-1965 = 1.25; 1965-1976, Zone A =1.33; 1965-1976, Zone B = 1.2; all else 1.0	1.00
Note 2: for RC buildings designed between 1976-1984, use 1.2	1.0
Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (1.0)	1.0

	along	across
Final $(\%NBS)_{nom}$:	**16%**	**16%**

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:**	3.333333333

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)	2.00	1.50
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:	1.57	1.29
Ductiity Scaling Factor, **Factor D**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

Sp:	0.700	0.850
Structural Performance Scaling Factor **Factor E**:	1.428571429	1.176470588

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

$\%NBS_b$:	**76%**	**63%**

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

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

3.4. Pounding potential

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

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

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

3.5. Site Characteristics	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)	**1.00**	**1.00**

4.3 PAR x (%NBS)b:

PAR x Baselline %NBS:	**76%**	**63%**

4.4 Percentage New Building Standard (%NBS), (before) **63%**

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
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