Spencer Park Surf Club Toilets

Quantitative Engineering Evaluation

Functional Location ID: PRK 2971 BLDG 002

Address: 100 Heyders Road, Bottle Lake

Reference: 232748

Prepared for:

Christchurch City Council

Revision: 2

Date: 1 July 2013

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Current Revision		**2**				

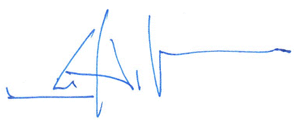
Approval			
Author Signature		Approver Signature	
Name	Guillaume Lefebvre	Name	Luis Castillo
Title	Structural Engineer	Title	Senior Structural Engineer

Contents

Appendices

Executive Summary

This is a summary of the Quantitative Engineering Evaluation for the Spencer Park Surf Club Toilets building and is based on the Detailed Engineering Evaluation Procedure document issued by the Engineering Advisory Group on 19 July 2011, visual inspections, available structural documentation and summary calculations as appropriate.

Building Details	**Name**	Spencer Park Surf Club Toilets			
Building Location ID	PRK 2971 BLDG 002			**Multiple Building Site**	N
Building Address	100 Heyders Road, Bottle Lake, Christchurch			**No. of residential units**	0
Soil Technical Category	NA	**Importance Level**	2	**Approximate Year Built**	1990
Foot Print (m²)	80	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Light weight roof, timber purlins and rafters, concrete masonry walls, strip footings beneath the concrete masonry walls and slab on grade foundations.				
Quantitative L5 Report Results Summary					
Building Occupied	Y	The Spencer Park Surf Club Toilets is currently in service.			
Suitable for Continued Occupancy	Y	The Spencer Park Surf Club Toilets is suitable for continued use.			
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 report body.			
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.			
Levels Survey Results	Y	A level survey was undertaken.			
Building %NBS From Analysis	>100%	Based on an analysis of bracing capacity and demand.			
Quantitative L5 Report Recommendations					
Geotechnical Survey Required	N	Geotechnical survey is not required			
Approval					
Author Signature			Approver Signature		
Name	Guillaume Lefebvre		Name	Luis Castillo	
Title	Structural Engineer		Title	Senior Structural Engineer	

1 Introduction

1.1 General

On 25 October 2012 Aurecon engineers visited the Spencer Park Surf Club Toilets to undertake a quantitative building damage assessment on behalf of Christchurch City Council. Detailed visual inspections were carried out to assess the damage caused by the earthquakes on 4 September 2010, 22 February 2011, 13 June 2011, 23 December 2011 and related aftershocks.

The scope of work included:

- Assessment of the nature and extent of the building damage.
- Visual assessment of the building strength particularly with respect to safety of occupants if the building is currently occupied.
- Assessment of requirements for detailed engineering evaluation including geotechnical investigation if necessary and level survey.

This report outlines the results of our Quantitative Assessment of damage to the Spencer Park Surf Club Toilets and is based on the Detailed Engineering Evaluation Procedure document issued by the Structural Advisory Group on 19 July 2011, visual inspections, available structural documentation and summary calculations as appropriate.

2 Description of the Building

2.1 Building Age and Configuration

The Spencer Park Surf Club Toilets is a single storey toilet block constructed in the 1990s. The building is of concrete masonry wall construction. It has a light weight timber roof on top of the centre part, a concrete floor and assumed concrete strip footings below the concrete masonry walls.

The building has an approximate floor area of 80 square metres. It is considered as an importance level 2 structure in accordance with AS/NZS 1170 Part 0:2002.

2.2 Building Structural Systems Vertical and Horizontal

The Spencer Park Surf Club Toilets are of concrete masonry construction. The gravity loads from the timber framed roof are transferred into the ground via the concrete masonry walls and strip footings. The loads from the ground floor are resisted by the concrete slab on grade.

The lateral load resisting is identical to the gravity system in which the lateral loads in both principal directions are resisted by the concrete masonry walls.

2.3 Reference Building Type

The Spencer Park Surf Club Toilets is of concrete masonry construction typical of the 1980s and 1990s. A metal detector was used to confirm if the masonry walls are reinforced. Reinforcing bars were detected every 650 mm (one every three cells). Consequently, the walls are considered as lightly reinforced and partially filled. A general overview of the reference building type, construction era and likely earthquake risk is presented in the figure below. The Spencer Park Surf Club Toilets was constructed around 1990 and according to the figure below may possibly be earthquake prone.

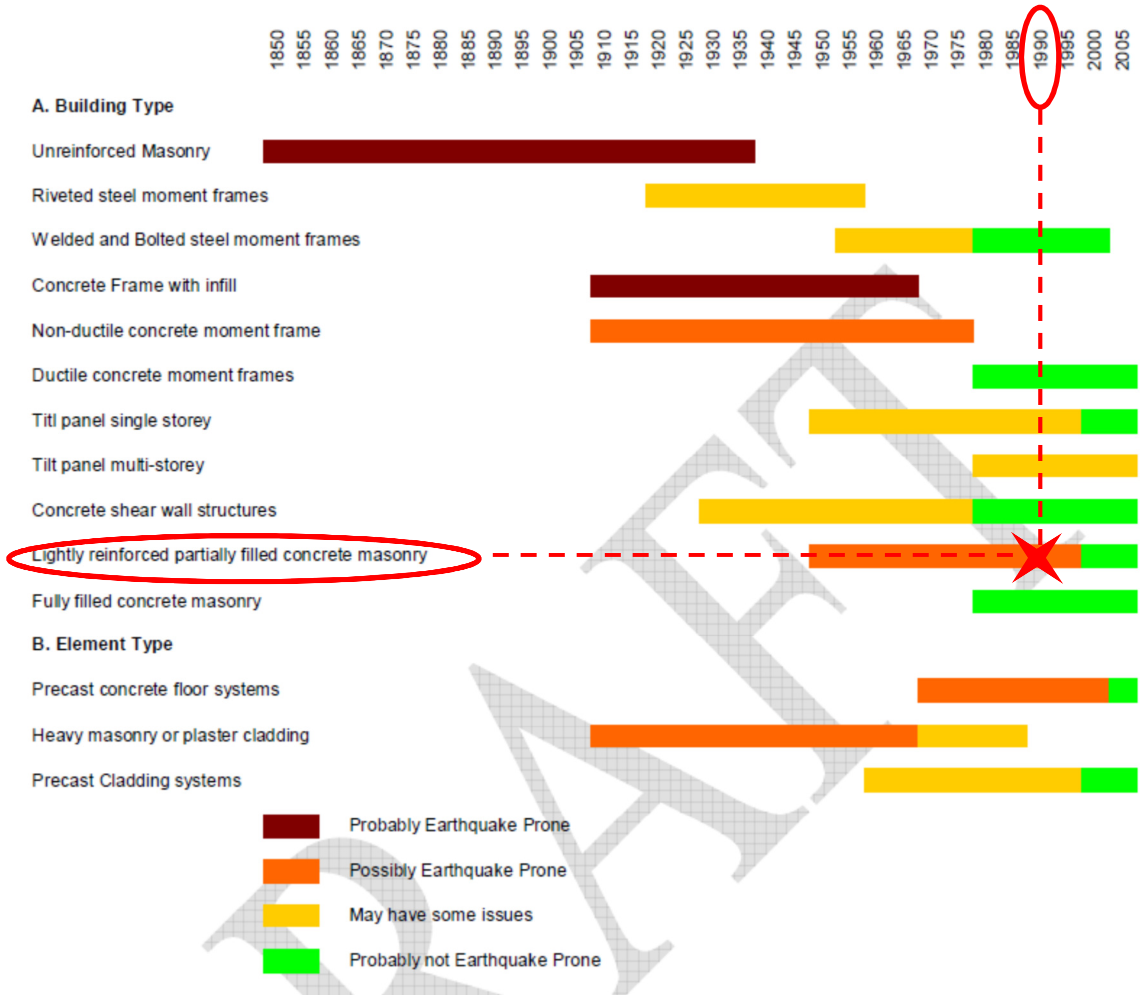


Figure 1: Timeline showing the building types, approximate time of construction and likely earthquake risk. (From the Draft Guidance on DEEs of non-residential buildings by the Engineering Advisory Group)

Given the stiff nature of concrete masonry walls, buildings of this nature are particularly prone to plan irregularities. Plan irregularities introduce localised areas of high seismic demand and torsional instabilities, causing local and global failure of the structure. However, as toilet blocks typically lack significant door, window or service openings, the Spencer Park Surf Club Toilets is precluded from the aforementioned issues.

2.4 Building Foundation System and Soil Conditions

The Spencer Park is used for non-residential recreational purposes, the Department of Housing and Building (DBH) do not currently have a technical classification for the land in the immediate vicinity of the Spencer Park Surf Club Toilets. It is of note however, that the closest suburb of Spencerville 1 kilometre to the west consists primarily of Technical Category 3 (TC 3) land. According to CERA, TC3 land considers that “Moderate to significant land damage from liquefaction is possible in future significant earthquakes”.

2.5 Available Structural Documentation and Inspection Priorities

No drawings were available for the Spencer Park Surf Club Toilets.

The inspection priorities for the building were the review of damage to the mortar joints which are inherently weaker than the concrete masonry blocks. Additionally, the damage assessment focused on the building geometry and other forms of potential damage such as cracking in the concrete masonry block and concrete floor.

2.6 Available Survey Information

A floor level survey was undertaken to establish the level of unevenness across the floors. The results of the survey are presented on the attached sketch in Appendix A.

The Department of Building and Housing (DBH) published the “Revised Guidance on Repairing and Rebuilding Houses Affected by the Canterbury Earthquake Sequence” in November 2011, which recommends some form of re-levelling or rebuilding of the floor

1. If the slope is greater than 0.5% for any two points more than 2m apart, or
2. If the variation in level over the floor plan is greater than 50mm, or
3. If there is significant cracking of the floor.

It is important to note that these figures are recommendations and are only intended to be applied to residential buildings. However, they provide useful guidance in determining acceptable floor level variations.

The floor levels for the Spencer Park Surf Club Toilets are considered to be acceptable despite the fact that some cracks were observed on the slab on grade. Furthermore, the toilet floors have an in-built fall for drainage. The slope from the shower is obviously over tolerances of standard floors, but it has been neglected during the overall evaluation because of its utility.

3 Structural Investigation

3.1 Summary of Building Damage

Minor cracking in the slab-on-grade was the only damage observed during the assessment.

3.2 Record of Intrusive Investigation

Since no significant damage was noted, an intrusive investigation was neither warranted nor undertaken for Spencer Park Surf Club Toilets. However, rebar scanning tests were carried out in order to measure the reinforcing bar spacing in the blockwork walls.

3.3 Damage Discussion

The cracks in the slab on grade do not seem to be related to seismic loads. The widest one (+/- 5mm) starts at the shower drain and ends at the drinking fountain (see photographs ref.6 in Appendix A). It separates the northern and outside slab on grade portion in two halves. These openings are the weakest points of the slab on grade. If concrete shrinkage or slight movement occurs, this weakest link will act as an expansion joint between the two halves of the building. Furthermore, the slab on grade is quite large and most likely lightly reinforced between these two parts (a mesh is assumed). From good practice, control joints in new buildings are recommended every 40 m^2, which is half of the actual slab on grade area. Nevertheless, this type of damage is not a critical issue and is very unlikely to create further damage.

Other smaller cracks were observed and are most likely also the result of shrinkage. Considering the proximity of TC3 lands, liquefaction and differential settlement might be other possible causes. Since the level of damage is very low and the results from the level survey are within the acceptable tolerances, no geotechnical survey is recommended.

4 Building Review Summary

4.1 Building Review Statement

As noted above no intrusive investigations were carried out for the Spencer Park Surf Club Toilets. Because of the generic nature of the building a significant amount of information can be inferred from an external and internal inspection.

4.2 Critical Structural Weaknesses

No specific critical structural weaknesses were identified as part of the building quantitative assessment.

5 Building Strength (Refer to Appendix C for background information)

5.1 General

The Spencer Park Surf Club Toilets is of lightly reinforced partially filled concrete masonry construction. With distributed walls and good detailing, the building has performed well in the Canterbury earthquake sequence as evidenced by the low quantity of noted damage in section 3 above.

5.2 Initial %NBS Assessment

The Spencer Park Surf Club Toilets has not been subject to specific engineering design and the initial evaluation procedure or IEP is not an appropriate method of assessment for this building. Nevertheless an estimate of lateral load capacity can be made by adopting assumed values for strengths of existing materials and calculating the capacity of existing walls.

Selected assessment seismic parameters are tabulated in the tables below.

Table 1: Parameters used in the Seismic Assessment

Seismic Parameter	Quantity	Comment/Reference
Site Soil Class	D	NZS 1170.5:2004, Clause 3.1.3, Deep or Soft Soil
Site Hazard Factor, Z	0.30	DBH Info Sheet on Seismicity Changes (Effective 19 May 2011)
Return period Factor, R_u	1.00	NZS 1170.5:2004, Table 3.5, Importance Level 2 Structure with a Design Life of 50 years
Ductility Factor in the Along Direction, μ	1.5	Lightly reinforced masonry
Ductility Factor in the Across Direction, μ	1.5	Lightly reinforced masonry

The seismic demand for the Spencer Park Surf Club Toilets has been calculated based on the current code requirements. The capacity of the existing walls in the building was calculated from assumed strengths of existing materials and the number and length of walls. Using geometric principles, the capacity of the walls was calculated in the main orthogonal directions. The seismic demand was then compared with the building capacity in these directions. The building was found to have a sufficient number and length of walls in both directions to achieve a capacity in excess of 100% NBS.

Table 5.2.1: Summary of Performance

Structural Element/System	Comments	%NBS Based of Detailed Assessment
LONGITUDINAL DIRECTION (X direction)		
Lightly reinforced partially filled concrete masonry walls		**>100%**
Overall bracing capacity of the building.	Calculation of the bracing demand according to the global area of the building. All the walls have been considered for the overall capacity of the building.	>100%
Bracing capacity of the small freestanding wall (northern portion of the building).	The capacity of this freestanding wall has been compared to the earthquake loads resulting from its own weight.	>100%
Bracing capacity of the eastern and western walls not connected to the roof.	They are considered as freestanding walls. The capacity of these freestanding walls has been compared to the earthquake loads resulting from their own weight.	>100%
TRANSVERSAL DIRECTION (Y direction)		
Lightly reinforced partially filled concrete masonry walls		**>100%**
Overall bracing capacity of the building.	Calculation of the bracing demand according to the global area of the building. All the walls have been considered for the overall capacity of the building.	>100%
Bracing capacity of the small free standing wall (northern portion of the building).	The capacity of this freestanding wall has been compared to the earthquake loads resulting from its own weight.	>100%
Bracing capacity of the eastern and western walls not connected to the roof.	They are considered as freestanding walls. The capacity of these freestanding walls has been compared to the earthquake loads resulting from their own weight.	>100%

5.3 Results Discussion

The bracing check is in agreement with the observations of the damage assessment. This is not surprising given that the building has an even distribution of walls that allow the seismic shear forces to be spread over a large wall area; giving the building good seismic performance and torsional stability.

6 Conclusions and Recommendations

Given the good performance of the Spencer Park Surf Club Toilets in the Canterbury earthquake sequence, the lack of foundation damage and the floor levels considered to be within acceptable limits, **a geotechnical investigation is currently not considered necessary**.

The slab on grade cracking can be repaired with epoxy grout injection in order to increase its longevity and prevent water infiltration.

Additionally, the building has suffered no loss of functionality and in our opinion the Spencer Park Surf Club Toilets **is considered suitable for continued occupation**.

7 Explanatory Statement

The inspections of the building discussed in this report have been undertaken to assess structural earthquake damage. No analysis has been undertaken to assess the strength of the building or to determine whether or not it complies with the relevant building codes, except to the extent that Aurecon expressly indicates otherwise in the report. Aurecon has not made any assessment of structural stability or building safety in connection with future aftershocks or earthquakes – which have the potential to damage the building and to jeopardise the safety of those either inside or adjacent to the building, except to the extent that Aurecon expressly indicates otherwise in the report.

This report is necessarily limited by the restricted ability to carry out inspections due to potential structural instabilities/safety considerations, and the time available to carry out such inspections. The report does not address defects that are not reasonably discoverable on visual inspection, including defects in inaccessible places and latent defects. Where site inspections were made, they were restricted to external inspections and, where practicable, limited internal visual inspections.

To carry out the structural review, existing building drawings were obtained (where available) from the Christchurch City Council records. We have assumed that the building has been constructed in accordance with the drawings.

While this report may assist the client in assessing whether the building should be repaired, strengthened, or replaced that decision is the sole responsibility of the client.

This review has been prepared by Aurecon at the request of its client and is exclusively for the client's use. It is not possible to make a proper assessment of this review without a clear understanding of the terms of engagement under which it has been prepared, including the scope of the instructions and directions given to and the assumptions made by Aurecon. The report will not address issues which would need to be considered for another party if that party's particular circumstances, requirements and experience were known and, further, may make assumptions about matters of which a third party is not aware. No responsibility or liability to any third party is accepted for any loss or damage whatsoever arising out of the use of or reliance on this report by any third party.

Without limiting any of the above, Aurecon's liability, whether under the law of contract, tort, statute, equity or otherwise, is limited as set out in the terms of the engagement with the client.

Appendices

Appendix A
Photos and Level Survey

25 October 2012 – Spencer Park Surf Club Toilets Site Photographs

REF.	PHOTOGRAPHS	
1		
2	Northern elevation of the Spencer Park Surf Club Toilets.	
3	Southern elevation of the Spencer Park Surf Club Toilets.	

4	Eastern elevation of the Spencer Park Surf Club Toilets.	
5	Oblique view the Spencer Park Surf Club Toilets.	
6	Oblique view of the Spencer Park Surf Club Toilets and slab on grade cracking.	
7	Internal view of the timber framed roof consisting of a ridge beam and rafters.	

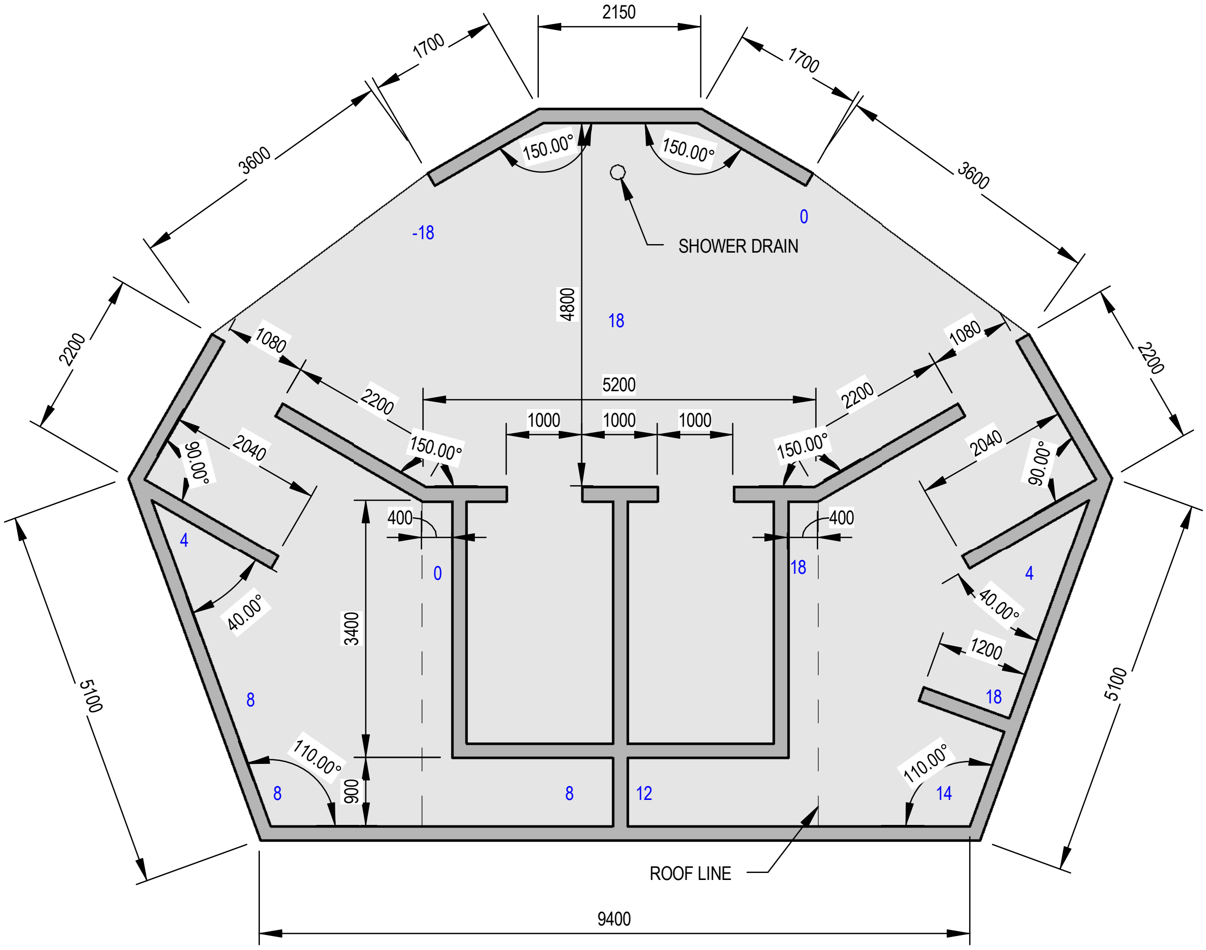
8	Interior view of the Spencer Park Surf Club Toilets.	
9	Interior view of the Spencer Park Surf Club Toilets.	
10	Interior view of the Spencer Park Surf Club Toilets.	
11	Interior view of the Spencer Park Surf Club Toilets.	

12	Interior view of the Spencer Park Surf Club Toilets.	

NOTES:

1. FLOOR PLANS AND DIMENSIONS ARE APPROXIMATE ONLY.

2. FLOOR LEVEL SURVEY CARRIED OUT ON 25/10/12.



NOTE: HEIGHT OF WALLS IS 2300mm.

FLOOR LEVEL SURVEY

1 : 100

26/11/2012 4:02:52 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-11-2012	DEE REPORT	L.HOWARD

DRAWN	D.LAKE
DESIGNED	G.LEFEBVRE
CHECKED	L.CASTILLO
APPROVED	L.HOWARD
DATE	
PROJECT	100 HEYDERS RD SPENCER PARK
TITLE	PLAN VIEW
	PRELIMINARY NOT FOR CONSTRUCTION
PROJECT No.	232748
SCALE	1 : 100
SIZE	A4
DRAWING No.	S-01-01
REV	A

Appendix B
References

1. Department of Building and Housing (DBH), “Revised Guidance on Repairing and Rebuilding Houses Affected by the Canterbury Earthquake Sequence”, November 2011

2. New Zealand Society for Earthquake Engineering (NZSEE), “Assessment and Improvement of the Structural Performance of Buildings in Earthquakes”, April 2012

3. Standards New Zealand, “AS/NZS 1170 Part 0, Structural Design Actions: General Principles”, 2002

4. Standards New Zealand, “AS/NZS 1170 Part 1, Structural Design Actions: Permanent, imposed and other actions”, 2002

5. Standards New Zealand, “NZS 1170 Part 5, Structural Design Actions: Earthquake Actions – New Zealand”, 2004

6. Standards New Zealand, “NZS 3101 Part 1, The Design of Concrete Structures”, 2006

7. Standards New Zealand, “NZS 3404 Part 1, Steel Structures Standard”, 1997

8. Standards New Zealand, “NZS 3603, Timber Structures Standard”, 1993

9. Standards New Zealand, “NZS 3604, Timber Framed Structures”, 2011

10. Standards New Zealand, “NZS 4229, Concrete Masonry Buildings Not Requiring Specific Engineering Design”, 1999

11. Standards New Zealand, “NZS 4230, Design of Reinforced Concrete Masonry Structures”, 2004

Appendix C
Strength Assessment Explanation

New building standard (NBS)

New building standard (NBS) is the term used with reference to the earthquake standard that would apply to a new building of similar type and use if the building was designed to meet the latest design Codes of Practice. If the strength of a building is less than this level, then its strength is expressed as a percentage of NBS.

Earthquake Prone Buildings

A building can be considered to be earthquake prone if its strength is less than one third of the strength to which an equivalent new building would be designed, that is, less than 33%NBS (as defined by the New Zealand Building Act). If the building strength exceeds 33%NBS but is less than 67%NBS the building is considered at risk.

Christchurch City Council Earthquake Prone Building Policy 2010

The Christchurch City Council (CCC) already had in place an Earthquake Prone Building Policy (EPB Policy) requiring all earthquake-prone buildings to be strengthened within a timeframe varying from 15 to 30 years. The level to which the buildings were required to be strengthened was 33%NBS.

As a result of the 4 September 2010 Canterbury earthquake the CCC raised the level that a building was required to be strengthened to from 33% to 67% NBS but qualified this as a target level and noted that the actual strengthening level for each building will be determined in conjunction with the owners on a building-by-building basis. Factors that will be taken into account by the Council in determining the strengthening level include the cost of strengthening, the use to which the building is put, the level of danger posed by the building, and the extent of damage and repair involved.

Irrespective of strengthening level, the threshold level that triggers a requirement to strengthen is 33%NBS.

As part of any building consent application fire and disabled access provisions will need to be assessed.

Christchurch Seismicity

The level of seismicity within the current New Zealand loading code (AS/NZS 1170) is related to the seismic zone factor. The zone factor varies depending on the location of the building within NZ. Prior to the 22nd February 2011 earthquake the zone factor for Christchurch was 0.22. Following the earthquake the seismic zone factor (level of seismicity) in the Christchurch and surrounding areas has been increased to 0.3. This is a 36% increase.

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 C1 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 C1: NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE Guidelines

Table C1 below compares the percentage NBS to the relative risk of the building failing in a seismic event with a 10% probability 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% probability of exceedance in the next year.

Table C1: Relative Risk of Building Failure In A

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

Appendix D
Background and Legal Framework

Background

Aurecon has been engaged by the Christchurch City Council (CCC) to undertake a detailed engineering evaluation of the building

This report is a Qualitative Assessment of the building structure, and is based 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).

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.

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

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.

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.

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.

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.

Appendix E
Standard Reporting Spread Sheet

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Spencer Surf Club Toilets	Reviewer:	Lee Howard
Building Address:	Unit: No: 100 Street: Heyders Road	CPEng No:	1008889
Legal Description:		Company:	Aurecon
		Company project number:	232748
		Company phone number:	03 375 0761
GPS south:	Degrees 43, Min 25, Sec 56.33	Date of submission:	1/07/2013
GPS east:	Degrees 172, Min 42, Sec 45.00	Inspection Date:	25/10/2012
		Revision:	2
Building Unique Identifier (CCC):	PRK 2971 BLDG 002	Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:	mixed	Soil Profile (if available):	
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	1.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	1.00
Ground floor split?	no		Ground floor elevation above ground (m):	1.00
Storeys below ground				
Foundation type:	strip footings		if Foundation type is other, describe:	(assumed)
Building height (m):	2.50		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	80			
Age of Building (years):	20		Date of design:	1976-1992
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	public		Brief strengthening description:	
Use (upper floors):	public			
Use notes (if required):				
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	timber	type	
Columns:			
Walls:	partially filled concrete masonry	thickness (mm)	

Lateral load resisting structure

Lateral system along:	partially filled CMU	**Note: Define along and across in detailed report!**	note total length of wall at ground (m):	54
Ductility assumed, μ:	1.50		wall thickness (m):	0.19
Period along:	0.35	##### enter height above at H31	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	estimated
Lateral system across:	partially filled CMU		note total length of wall at ground (m):	6
Ductility assumed, μ:	1.50		wall thickness (m):	
Period across:	0.35	##### enter height above at H31	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	estimated

Separations:

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

Non-structural elements

Stairs:	
Wall cladding:	
Roof Cladding:	
Glazing:	
Ceilings:	
Services(list):	

Available documentation

Architectural	none	original designer name/date	
Structural	none	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:	0-1:350	notes (if applicable):	
Liquefaction:	2-5 m²/100m²	notes (if applicable):	
Lateral Spread:	none apparent	notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	20-100mm/20m	notes (if applicable):	
Damage to area:	slight	notes (if applicable):	slab on grade cracking

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:	slab on grade cracking

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

Recommendations

	Level of repair/strengthening required:	none	Describe:	
	Building Consent required:	no	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before:	100%	0% %NBS from IEP below	If IEP not used, please detail assessment methodology: Quantitative
	Assessed %NBS after:	100%		
Across	Assessed %NBS before:	100%	0% %NBS from IEP below	
	Assessed %NBS after:	100%		

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

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

h_n from above: m

Seismic Zone, if designed between 1965 and 1992:

not required for this age of building
not required for this age of building

	along	across
Period (from above):	0.35	0.35
(%NBS)nom from Fig 3.3:	0.0%	0.0%

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

2.2 Near Fault Scaling Factor

	along	across
Near Fault scaling factor, from NZS1170.5, cl 3.1.6:		1.00
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)	1.50	3.00
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:	1.00	1.00
Ductiity Scaling Factor, **Factor D**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

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

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

$\%NBS_b$:	**0%**	**0%**

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	significant	0.7

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	1	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:	**0%**	**0%**
4.4 Percentage New Building Standard (%NBS), (before)		**0%**

Official Use only:

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