aurecon

Spencer Park – Amenity Block/Laundry

Qualitative Engineering Evaluation

Functional Location ID: PRO_ 0157_B006

Address: 100 Heyders Road, Spencerville

Reference: 228603

Prepared for: Christchurch City Council

Revision: 2

Date: 16 October 2013

Document Control Record

Document prepared by:

Aurecon New Zealand Limited
Level 2, 518 Colombo Street
Christchurch 8011
PO Box 1061
Christchurch 8140
New Zealand

T +64 3 375 0761
F +64 3 379 6955
E christchurch@aurecongroup.com
W aurecongroup.com

Document control							aurecon
Report Title		Qualitative Engineering Evaluation					
Functional Location ID		**PRO_ 0157_B006**	**Project Number**		228603		
File Path		P:\ 228603 - Spencer Park – Amenity Block/Laundry.docx					
Client		Christchurch City Council	**Client Contact**		Michael Sheffield		
Rev	**Date**	**Revision Details/Status**	**Prepared**	**Author**	**Verifier**	**Approver**	
1	**8 June 2012**	Draft	C. Bong	C. Bong	L. Howard	L. Howard	
2	**16 October 2013**	Final	C. Bong	C. Bong	L. Howard	L. Howard	
Current Revision		2					

Approval			
Author Signature		**Approver Signature**	
Name	Christopher Bong	**Name**	Lee Howard
Title	Structural Engineer	**Title**	Senior Structural Engineer

Contents

Appendices

Executive Summary

This is a summary of the Qualitative Engineering Evaluation for the Spencer Park – Amenity Block/Laundry which 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 – Amenity Block/Laundry			
Building Location ID	PRO_ 0157_B006			**Multiple Building Site**	Y
Building Address	100 Heyders Road, Spencerville			**No. of residential units**	0
Soil Technical Category	N/A	**Importance Level**	2	**Year Built**	1960s
Foot Print (m²)	270	**Stories above ground**	1	**Stories below ground**	0
Type of Construction	Corrugated steel roof, lightweight timber roof with purlins and rafters, steel trusses, timber stud wall with plasterboard lining, concrete masonry walls, concrete pad foundation				
Qualitative L4 Report Results Summary					
Building Occupied	Y	The Spencer Park – Amenity Block/Laundry is currently in use			
Suitable for Continued Occupancy	Y	The Spencer Park – Amenity Block/Laundry is suitable for continued occupation.			
Key Damage Summary	Y	Refer to summary of building damage in Section 3.1 report body.			
Critical Structural Weaknesses (CSW)	Y	Unreinforced and unfilled concrete masonry.			
Levels Survey Results	Y	The floor slopes are within the DBH's Guidelines with falls of less than 1:200 or 0.5%.			
Building %NBS From Analysis	Approx. 36%	Based on out of plane unreinforced masonry performance. "Medium risk" category according to NZSEE guidelines refer Figure C1 in Appendix C.			
Qualitative L4 Report Recommendations					
Geotechnical Survey Required	N	A geotechnical survey is not required.			
Proceed to L5 Quantitative DEE	Y	Intrusive investigation and further analysis required to confirm the stability of the unreinforced concrete masonry walls.			
Approval					
Author Signature		**Approver Signature**			
Name	Christopher Bong	**Name**	Lee Howard		
Title	Structural Engineer	**Title**	Senior Structural Engineer		

1 Introduction

1.1 General

On 15 March 2012 Aurecon engineers visited the Spencer Park – Amenity Block/Laundry to undertake a qualitative 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:

1. Assessment of the nature and extent of the building damage;
2. Visual assessment of the building strength particularly with respect to safety of occupants if the building is currently occupied; and
3. Assessment of requirements for detailed engineering evaluation including geotechnical investigation, level survey and any areas where linings and floor coverings need removal to expose structural damage.

This report outlines the results of our Qualitative Assessment of damage to the Spencer Park – Amenity Block/Laundry and is based on the Detailed Engineering Evaluation Guidelines as issued by the Engineering Advisory Group on 19 July 2011, visual inspections, available structural documentation as appropriate are attached herein.

2 Description of the Building

2.1 Building Age and Configuration

The Spencer Park – Amenity Block/Laundry is primarily a concrete masonry block building with a timber framed amenities extension. The building has a lightweight corrugated iron roof and a concrete slab on grade foundation. The ceiling and timber framed walls are lined with hardboard.

Originally built in the 1960s, the building has undergone various additions over the years as evidenced by the different styles and finishes. The original structure appears to be the kitchen area. The concrete masonry toilets and laundry were post construction additions as evidenced by the steel trusses whereas the kitchen has timber rafters. The lounge is the most recent addition as indicated by the aluminium joinery.

The approximate total floor area is 270 square metres and is classified as an Importance Level 2 Structure in accordance with NZS 1170 Part 0: 2002.

2.2 Building Structural Systems Vertical and Horizontal

The Spencer Park – Amenity Block/Laundry can be thought of as two distinct buildings – the laundry block and the amenities block.

In the laundry block, the vertical loads from the lightweight roof are transferred via either the timber breams or steel trusses onto the concrete masonry wall. In a similar manner, the across and along lateral loads from the roof diaphragm are transferred into the concrete masonry walls.

In the amenities block, the vertical loads from the lightweight roof are transferred via the timber rafters onto either the concrete masonry walls at the top of the ridge or the Northern timber framed walls. The across and along lateral loads are transferred in shear via the concrete masonry and timber framed walls.

2.3 Reference Building Type

The Spencer Park – Amenity Block/Laundry is a multi-purpose, concrete masonry block building. Buildings of this nature have had a wide range of performances in the recent Canterbury earthquakes. The building performance can typically be attributed to the level of reinforcement and grout filled cells of the concrete masonry; which have increased over time as building codes have become more stringent.

Commonly observed seismic related damage for buildings of this nature, are:

- Inadequate shear or flexural strength of the masonry, evidenced by cracking in the mortar joints
- Cracking in the brittle claddings such as the gypsum plasterboard, due to higher than tolerable displacements sustained by the timber framed walls

These damages were specifically searched for in the damage assessment undertaken on 15 March 2012.

2.4 Building Foundation System and Soil Conditions

The Spencer Park – Amenity Block/Laundry has a concrete slab on grade foundation. The foundations of this nature have been classified as a "Type C" foundation in the Department of Building and Housing's Guidance on Repairing and Rebuilding Houses Affected by the Canterbury Earthquake Sequence.

The land surrounding the Spencer Park – Amenity Block/Laundry was classified as "rural and unmapped" according to the DHB Technical Classes dated 23 March 2012. It is of note that the residential property to the immediate East has been classified as "Technical Category 3" or TC3 and according to CERA, "may suffer moderate to significant liquefaction in future significant earthquakes".

2.5 Available Structural Documentation and Inspection Priorities

The only documentation available for the Spencer Park – Amenity Block/Laundry in the Christchurch City Council property files was the refurbishment of the toilets in 2002. However, the generic nature of the building has allowed the structural performance to be deduced without the aid of this documentation.

The inspection priorities for this report were the review of damage to the building and consideration of the building's bracing adequacy as well as the out of plane performance of the concrete masonry walls.

2.6 Available Survey Information

A levels survey was undertaken on the floor coverings of the building to quantify the level of any unevenness. The levels survey results were within the 1 in 200 or 0.5% slope threshold set by the Department of Building and Housing's November 2011 Guidelines. Therefore no further action in the form of re-levelling is considered necessary.

3 Structural Investigation

3.1 Summary of Building Damage

The Spencer Park – Amenity Block/Laundry was in use at the time of the damage assessment. A thorough visual damage assessment has shown:

- Severe step cracking in the mortar joints by the laundry room
- Separation of the concrete masonry wall from the concrete pilaster by the laundry room
- Cracking in the brittle hardboard cladding above the kitchen
- Cracking in the mortar joints around the kitchen windows

It is noted that some restraining work has been undertaken to prevent the concrete masonry wall in the laundry area from falling out of plane.

3.2 Record of Intrusive Investigation

An intrusive investigation has not been undertaken on the Spencer Park – Amenity Block/Laundry. However, the extent of damage around the laundry room was severe, and an intrusive investigation is strongly recommended to determine the appropriate remedial measures. This will involve drilling through the face shells of the concrete masonry wall to determine the level of reinforcement and grout filled cells, thus allowing for more accurate calculation of the strength of the concrete masonry walls.

3.3 Damage Discussion

The level of damage observed on the Spencer Park – Amenity Block/Laundry was wide ranging. The excessive step cracking in the mortar joints in the laundry room was a clear indication of the inadequate shear and flexural strength of the concrete masonry wall. The level of damage observed in this instant was very severe. On the other end of the spectrum, the cracking of the hardboard cladding above the kitchen was minor.

4 Building Review Summary

4.1 Building Review Statement

The level of finish of the Spencer Park – Amenity Block/Laundry obstructed the viewing of most of the primary structural elements. Nevertheless, a non-intrusive damage assessment was undertaken under the justification that the damage on the brittle claddings and finishes of the building would indicate a *pro rata* level of displacement damage on the structure.

4.2 Critical Structural Weaknesses

The critical structural weakness identified for this building was the potential for unreinforced and unfilled concrete masonry to fail in a sudden brittle manner.

5 Building Strength (refer Appendix C for background information)

5.1 General

The Spencer Park – Amenity Block/Laundry is, as discussed above, constructed in the 1960s. Unreinforced and unfilled buildings of this nature have suffered severe damage as a consequence of the Canterbury earthquake sequence.

5.2 Initial %NBS Assessment

The Spencer Park – Amenity Block/Laundry has not been subject to specific engineering design and the Initial Evaluation Procedure (IEP) will not give a useful estimate of building capacity in terms of percentage of new building strength. Nevertheless an estimate of lateral load capacity or bracing check 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 Table 1 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, $\boldsymbol{Z}$	0.30	DBH Info Sheet on Seismicity Changes (Effective 19 May 2011)
Return period Factor, $\boldsymbol{R_u}$	1.00	NZS 1170.5:2004, Table 3.5
Ductility Factor in the Across Direction, $\boldsymbol{\mu}$	1.25	Concrete masonry walls.
Ductility Factor in the Along Direction, $\boldsymbol{\mu}$	1.25	Concrete masonry walls.

The out of plane performance was found to be 39%NBS. This corresponds of a “moderate risk building” according to NZSEE guidelines.

5.3 Results Discussion

The analysis results were consistent with the level of the damage observed in the damage assessment. The lack of reinforcement and concrete filled cells has resulted in the wall forming an out of plane rocking mechanism. Rocking mechanisms are dangerous as excessive rocking displacements can cause sudden brittle failure. We recommend a quantitative analysis and intrusive investigation is undertaken for the Spencer Park – Amenity Block/Laundry.

6 Conclusions and Recommendations

As noted within the report, although the levels survey has shown that the floor levels of the Spencer Park – Amenity Block/Laundry are within tolerable limits. There have also been instances of high levels of damage seen, namely the step cracking in the concrete masonry walls which have had some remedial work. In light of the adequacy of these out of plane restraints, it is therefore considered that the Spencer Park – Amenity Block/Laundry is **suitable for continued occupation**.

However, there remains a degree of uncertainty surrounding the robustness of the concrete masonry walls. As such, it is strongly recommended that **an intrusive investigation and Level 5 Quantitative Detailed Engineering Investigation be undertaken.**

As there is no clear evidence of any liquefaction or ground movement in the vicinity of the Spencer Park – Amenity Block/Laundry **a geotechnical investigation is currently not considered necessary**.

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 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 strengthened, 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.

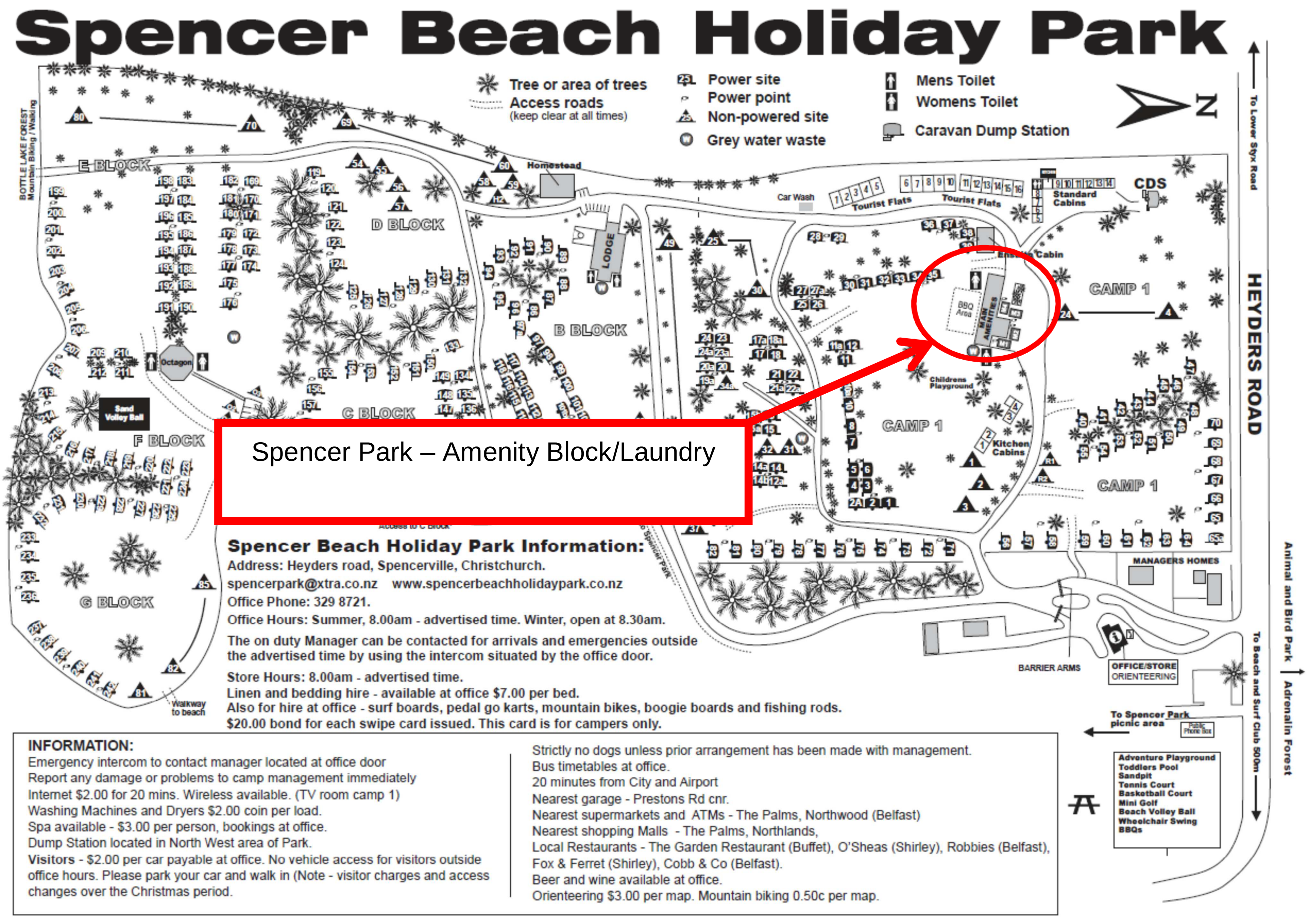
Without limiting any of the above, Aurecon's liability, whether under the law of contract, tort, statute, equity or otherwise, is limited as set out in the terms of the engagement with the client.

Appendices

Appendix A

Site Map, Photos and Levels Survey

Site photographs (15 March 2012)

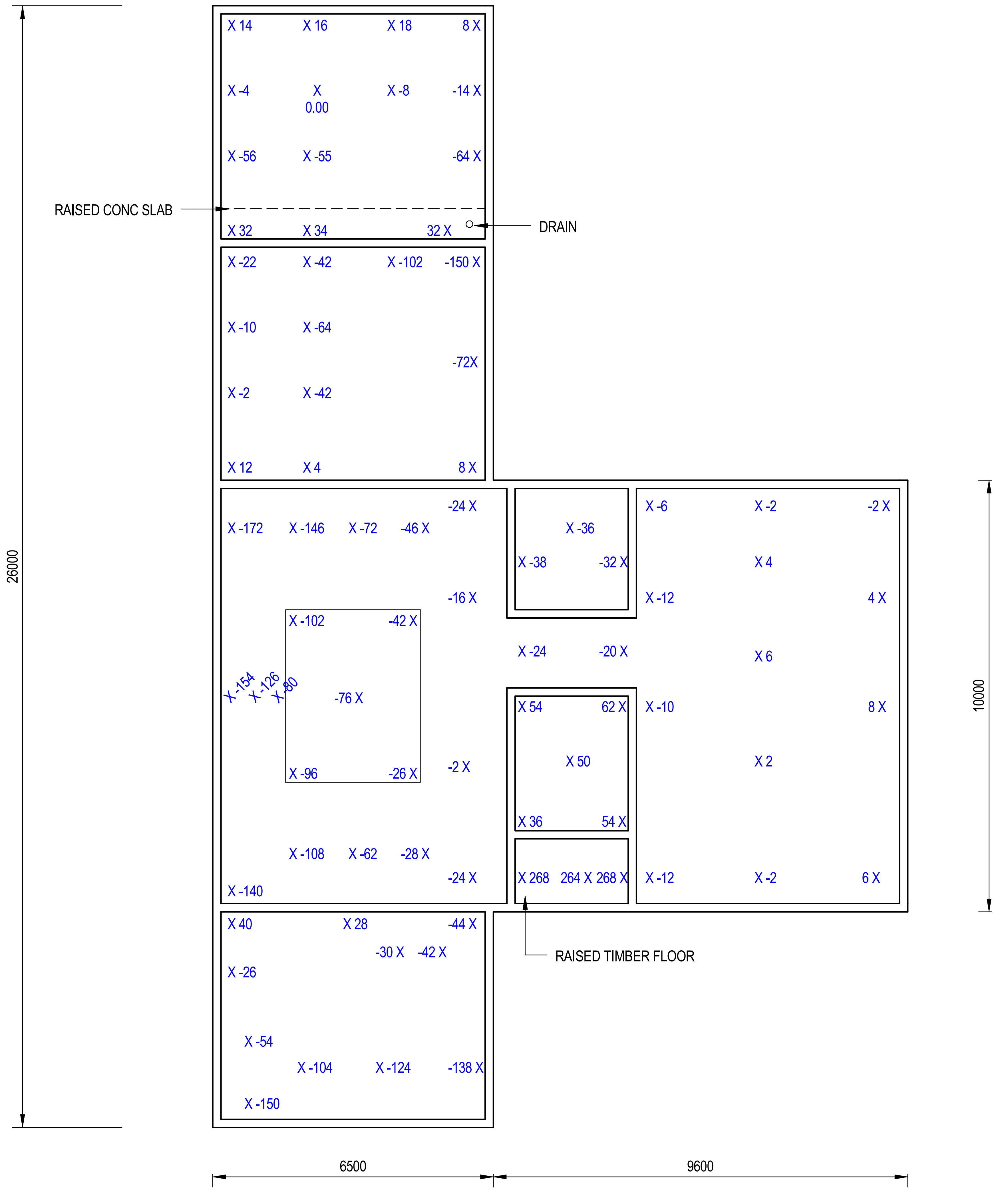


Eastern elevation of the Spencer Park – Amenity Block/Laundry.

Western elevation of the Spencer Park – Amenity Block/Laundry.	
Southern elevation of the Spencer Park – Amenity Block/Laundry.	
Roof overhang of the Spencer Park – Amenity Block/Laundry.	

Steel trusses within the toilet wings.	
Interior view of the lounge. Note aluminium joinery, evenly spaced timber rafters, hardboard lined walls.	
Step cracking and remedial work undertaken to restrain the wall from falling out of plane in the North Western corner of the building.	

Step cracking and remedial work undertaken to restrain the wall from falling out of plane in the North Western corner of the building.	
Cracking in the hardboard cladding above the kitchen.	
Cracking beneath the window sill on the exterior of the kitchen.	



aurecon
www.aurecongroup.com

CLIENT

Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL

PROJECT
SPENCER PARK CAMPING GROUND
AMENITIES/LAUNDRY BUILDING

TITLE
LEVEL SURVEY

DRAWN	DESIGNED	
D.HUNIA	C.BONG	PRELIMINARY NOT FOR CONSTRUCTION
CHECKED		PROJECT No.
Checker		228603
APPROVED		SCALE: 1 : 100 / SIZE: A3
DATE		DRAWING No.: S-01-00 / REV
L.HOWARD		

28/11/2012 3:13:03 p.m.

Appendix B
References

1. Standards New Zealand, "AS/NZS 1170 Part 0, Structural Design Actions: General Principles", 2002
2. Standards New Zealand, "AS/NZS 1170 Part 1, Structural Design Actions: Permanent, imposed and other actions", 2002
3. Standards New Zealand, "NZS 1170 Part 5, Structural Design Actions: Earthquake Actions – New Zealand", 2004
4. Standards New Zealand, "NZS 3101:2006, Concrete Structures Standard"
5. Standards New Zealand, "NZS 3404:1997, Steel Structures Standard"
6. Standards New Zealand, "NZS 3604:2011: Timber Framed Structures"
7. Standards New Zealand, "NZS 4229:1999, Concrete Masonry Buildings Not Requiring Specific Design"
8. Standards New Zealand, "NZS 4230:2004, Design of Reinforced Concrete Masonry Structures"
9. New Zealand Society for Earthquake Engineering (NZSEE), "Assessment and Improvement of the Structural Performance of Buildings in Earthquakes, June 2006"
10. Engineering Advisory Group, "Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-Residential Buildings in Canterbury. Part 2 Evaluation Procedure. Revision 5, 19 July 2011"

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	Improvement of Structural Performance: 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).

At the time of this report, no intrusive site investigation, detailed analysis, or modelling of the building structure had been carried out. Construction drawings were made available, and these have been considered in our evaluation of the building. The building description below is based on a review of the drawings and our visual inspections.

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 Park - Amenity Block / Laundry	Reviewer:	David Elliott
	Unit No: Street	CPEng No:	202002
Building Address:	Spencer Park Camping Ground 100 Heyders Road	Company:	Aurecon
Legal Description:	Lot 1 DP 44484	Company project number:	228604
		Company phone number:	03 375 0761
	Degrees Min Sec		
GPS south:	43 25 54.05	Date of submission:	16-Oct-13
GPS east:	172 42 12.89	Inspection Date:	15-Mar-12
		Revision:	2
Building Unique Identifier (CCC):	PRO_0157_B006	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?			Ground floor elevation above ground (m):	0.00
Storeys below ground	0			
Foundation type:	isolated pads, no tie beams		if Foundation type is other, describe:	
Building height (m):	4.50		height from ground to level of uppermost seismic mass (for IEP only) (m):	2.4
Floor footprint area (approx):	270			
Age of Building (years):	49		Date of design:	1935-1965
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	public		Brief strengthening description:	
Use (upper floors):				
Use notes (if required):				
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)	140

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):	
Ductility assumed, μ:	1.50		wall thickness (m):	
Period along:		##### 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):	
Ductility assumed, μ:	1.50		wall thickness (m):	
Period across:		##### 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:			none
Wall cladding:	exposed structure	describe	painted
Roof Cladding:	Metal	describe	corrugated iron
Glazing:			none
Ceilings:	none		
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?:	no	Describe:	

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

Recommendations

	Level of repair/strengthening required:	significant structural		Describe:	Strengthening of the walls, columns
	Building Consent required:	yes		Describe:	
	Interim occupancy recommendations:	full occupancy		Describe:	
Along	Assessed %NBS before:	34%	##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	Quantitative
	Assessed %NBS after:	34%			
Across	Assessed %NBS before:	36%	##### %NBS from IEP below		
	Assessed %NBS after:	36%			

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): 1935-1965 h_n from above: 2.4m

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	0
(%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:

	along	across
Near Fault scaling factor (1/N(T,D), **Factor A**:	#DIV/0!	#DIV/0!

2.3 Hazard Scaling Factor

Hazard factor Z for site from AS1170.5, Table 3.3:

Z_{1992}, from NZS4203:1992

Hazard scaling factor, **Factor B:** #DIV/0!

2.4 Return Period Scaling Factor

Building Importance level (from above): 2

Return Period Scaling factor from Table 3.1, **Factor C**:

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**:	0.00	0.00

2.6 Structural Performance Scaling Factor:

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

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!**

Official Use only:

Accepted By

Date:

aurecon

Aurecon New Zealand Limited
Level 2, 518 Colombo Street
Christchurch 8011
PO Box 1061
Christchurch 8140
New Zealand

T +64 3 375 0761
F +64 3 379 6955
E christchurch@aurecongroup.com
W aurecongroup.com