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North Hagley Park – Pavilion
Qualitative Engineering Evaluation

Reference: 229615
Prepared for:
Christchurch City Council

Functional Location ID: PRK_1190_BLDG_016

Address: 10 Riccarton Avenue

Revision: 2
Date: 14 October 2013

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Approval			
Author Signature		Approver Signature	
Name	Thomas Bolton	Name	Luis Castillo
Title	Senior Structural Engineer	Title	Senior Structural Engineer

Contents

Appendices

Executive Summary

This is a summary of the Qualitative Engineering Evaluation for the North Hagley Park – Pavilion 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**	North Hagley Park – Pavilion			
Building Address	10 Riccarton Avenue			**No. of residential units**	1
Soil Technical Category	N/A	**Importance Level**	1	**Approximate Year Built**	1940s
Foot Print (m²)	30	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Timber framed roof with lightweight corrugated metal roof, timber ceiling, unreinforced brick masonry walls and concrete floor slab on grade.				
Qualitative Results Summary					
Building Occupied	Y	The North Hagley Park – Pavilion is currently in use.			
Suitable for Continued Occupancy	Y	The North Hagley Park – Pavilion is suitable for continued occupation.			
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	Variations in floor levels were within the MBIE Guidelines, with falls of less than 1:200 or 0.5%			
Building %NBS From Analysis	40%	Based on an analysis of bracing capacity and demand.			
Qualitative Report Recommendations					
Geotechnical Survey Required	N	Geotechnical survey not required due to lack of observed ground damage on site.			
Proceed to L5 Quantitative DEE	N	A quantitative DEE is not required for this structure.			
Approval					
Author Signature		**Approver Signature**			
Name	Thomas Bolton	**Name**	Luis Castillo		
Title	Structural Engineer	**Title**	Senior Structural Engineer		

1 Introduction

1.1 General

On 23 August 2012 an Aurecon engineer visited the North Hagley Park – Pavilion to carry out 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:

- 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, 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 North Hagley Park – Pavilion 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 North Hagley Park – Pavilion is a single storey building and we assume it was built in about 1940. The building has a timber trussed roof with corrugated metal roof sheeting. The ceiling is lined with timber slats laid horizontally. The walls are two leaf unreinforced brick masonry with a concrete render. The north face of the building is open with timber columns supporting the roof. The building has a concrete floor slab on grade and we assumed strip footings under load bearing walls.

The approximate floor area of the building is 30 square metres. It is an importance level 1 structure in accordance with NZS 1170 Part 0:2002.

2.2 Building Structural Systems Vertical and Horizontal

The North Hagley Park – Pavilion is a simple structure. Its light corrugated metal roof is supported on timber trusses that transfer loads to the brick masonry walls on 3 sides and timber columns on the south face of the structure. The floor is concrete on grade and we assume concrete strip footings under the load bearing walls. Lateral loads are resisted by the unreinforced brick masonry walls in the across direction. Timber columns and unreinforced brick masonry walls resist the lateral loads in the along direction.

2.3 Reference Building Type

The North Hagley Park – Pavilion is a basic structure typical of its age and style. We assume it was not subjected to specific engineering design; rather it was constructed to a reliable formula known to achieve the performance and aesthetic objectives of the time it was built.

2.4 Building Foundation System and Soil Conditions

The North Hagley Park – Pavilion, as discussed above, has a concrete floor slab on grade and we assume concrete strip footings under load bearing walls.

The land and surrounds of North Hagley Park – Pavilion are zoned N/A which means that no mapping of the land with respect to technical categories has been done. The land across Hagley Avenue towards Selwyn Street is categorised as TC2 which means minor to moderate land damage from liquefaction is possible in future significant earthquakes. However, there are no signs in the vicinity of North Hagley Park – Pavilion of liquefaction bulges or boils and subsidence.

2.5 Available Structural Documentation and Inspection Priorities

No drawings were available for the North Hagley Park – Pavilion. Inspection priorities related to a review of potential damage to foundations and consideration of wall bracing adequacy. We assumed the generic building type for the North Hagley Park – Pavilion is of 1980's unreinforced brick masonry structure and this type of structure has performed poorly during the Canterbury Earthquakes.

2.6 Available Survey Information

A floor level survey was undertaken on 3 September 2012 to establish the level of unevenness across the floors. The results of the survey are presented on the attached sketch in Appendix A. All of the levels were taken on top of the existing floor coverings which may have introduced some margin of error.

The Ministry of Business, Innovation and Employment (MBIE) published the guideline "Repairing and rebuilding houses affected by the Canterbury earthquakes" in 2012, 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 North Hagley Park – Pavilion were found to be within the recommended tolerances, although the slopes approach 0.5% in several locations.

3 Structural Investigation

3.1 Summary of Building Damage

The North Hagley Park – Pavilion is currently in use and was occupied at the time the damage assessment was carried out. The North Hagley Park – Pavilion has performed well but has suffered damage to the floor and wall covering. There are minor cracks running through the concrete floor slab and wall. The cracks may have been pre-existing in the slab as it is unreinforced and likely over 70 years old.

3.2 Record of Intrusive Investigation

Intrusive investigations were limited to the scanning of the walls for reinforcement. While the scanner did appear to indicate horizontal reinforcement in places, it was not consistent enough to use this information in calculations of the buildings strength.

3.3 Damage Discussion

There was minor damage observed to the building during our inspection. However, this damage may be pre-existing and not as a result of the seismic actions as stated in Section 3.1 of this report.

4 Building Review Summary

4.1 Building Review Statement

As noted above, minor intrusive investigations were carried out for the North Hagley Park – Pavilion. However, 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 qualitative assessment.

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

5.1 General

The North Hagley Park – Pavilion is, as discussed above, a typical example of its generic style, 1940's structure built from unreinforced brick masonry. It is of a type of building that, due to its heavy weight and low bracing capacity, has typically performed poorly. However, the North Hagley Park – Pavilion is an exception to this. It has performed well and there is only minor damage to the building which may not be related to the recent earthquakes.

5.2 Initial %NBS Assessment

It is assumed the North Hagley Park – Pavilion 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 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, Z	0.30	DBH Info Sheet on Seismicity Changes (Effective 19 May 2011)
Return period Factor, R_u	0.50	NZS 1170.5:2004, Table 3.5, Importance Level 1 Structure with a Design Life of 50 years
Ductility Factor in across (north-south) Direction, μ	2.00	Unreinforced brick walls
Ductility Factor in along (east – west) Direction, μ	2.00	Unreinforced brick walls

5.2.1 Building Strength

5.2.1.1 Masonry Walls

Double skinned brick masonry walls form the exterior walls, there is a large opening in one wall in the along direction. The end stub walls either side of this opening are limited firstly by rocking, then toe crushing. These were found to have a strength of 21%NBS and 23%NBS respectively. A timber frame is present that will take in plane forces in this direction, thus the %NBS for this line is higher but it must be accepted that damage will occur. The out of plane capacity of these walls were found to have a strength of 76%NBS.

5.2.1.2 Timber frame

The timber frame in the opening is assumed to act as a portal and support take in plane loads along this line. The timber frame was found to have a strength of 55%NBS limited by flexure in the timber members.

5.2.1.3 Timber Diaphragm

The timber diaphragm transfers the out of plane forces on walls to lines of support. The timber diaphragm was found to have a strength of 40%NBS in the across direction, and 80%NBS in the along direction.

5.2.2 Summary

A summary of the strength of the various elements of the building is provided in Table 1 below

Table 2: Building Strength

Building Element	Failure Mode	%NBS
Masonry Walls	Out of Plane	76
	In Plane Rocking	21*
Timber Frame	Flexure	55
Timber Diaphragm	Across	40
	Along	80

*Timber frame takes load after onset of rocking and thus capacity in this line can be considered to be 55%NBS

The seismic demand for the North Hagley Park – Pavilion 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 present for both the along and across directions. The seismic demand was then compared with the building capacity in these directions. The calculated capacity is **40%NBS** (i.e. a 'moderate risk' building according to NZEE Guidelines).

5.3 Results Discussion

Our basic analysis shows that damage should have occurred to the shorter walls at the front of pavilion. The lack of damage suggests that the diaphragm may have transferred load to the stiffer stronger rear wall. The values found include assumptions about the North Hagley Park – Pavilion structure, these were typically conservative so the building may have strength of greater than 40%NBS. A more detailed quantitative assessment would account for this but we do not see this as a requirement due to the size and nature of the building. The limiting element in the structure is the timber diaphragm; this is likely to fail in a ductile manner. North Hagley Pavilion is at low risk of sudden collapse despite its low %NBS.

6 Conclusions and Recommendations

As there is no clear evidence of any liquefaction or ground movement in the vicinity of the North Hagley Park – Pavilion **a geotechnical investigation is currently not considered necessary**.

The building is currently occupied and in use and in our opinion the North Hagley Park – Pavilion **is suitable for continued occupation**.

A quantitative assessment for this building would be difficult due to the lack of drawings; full investigation of the structure would be required. If strengthening is to be undertaken a quantitative assessment may reduce the number elements required to be strengthened. At this stage we do not recommend a quantitative DEE due to size and nature of the building.

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, building drawings were requested from the Christchurch City Council records. However, no drawings were available to carry this structural review. Therefore, we were not able to confirm if 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
Site Location, Photos and Levels Survey

23 August 2012 – North Hagley Park – Pavilion Site Photographs

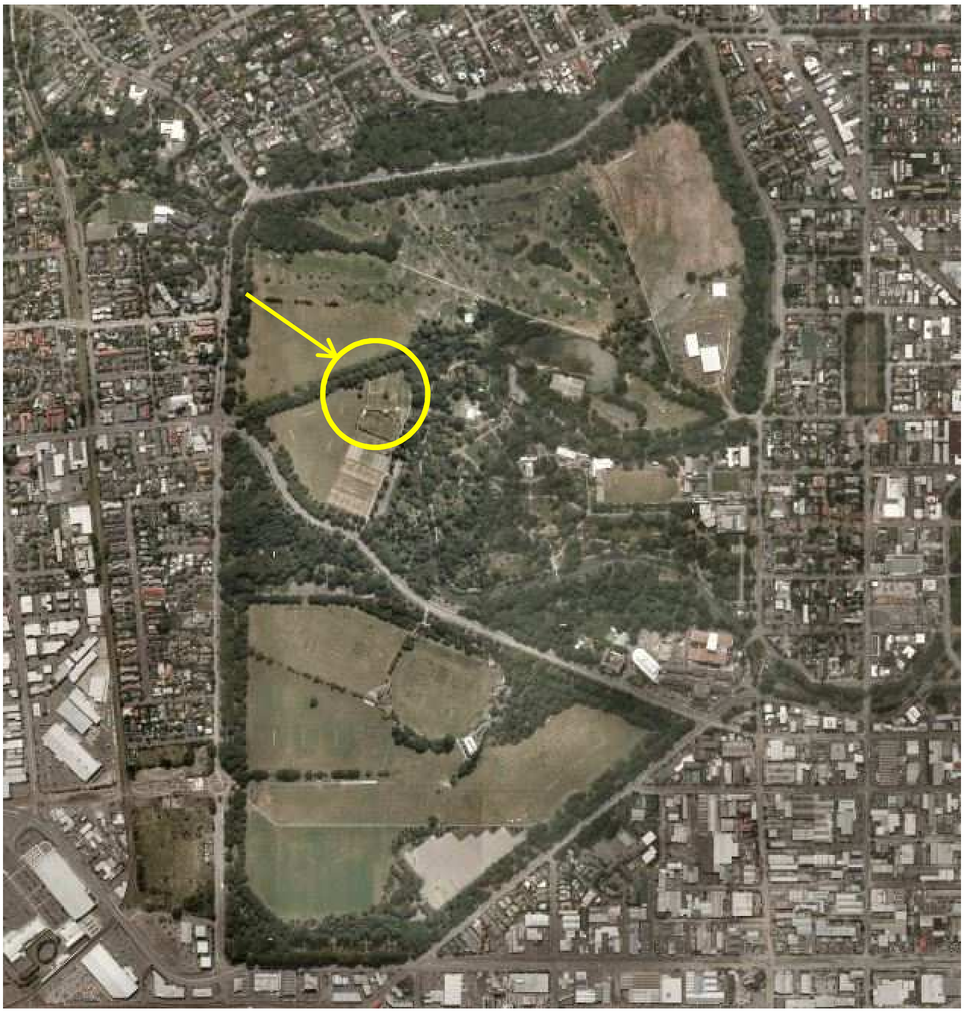
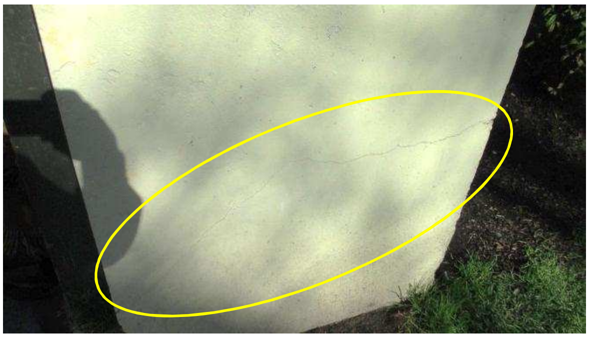
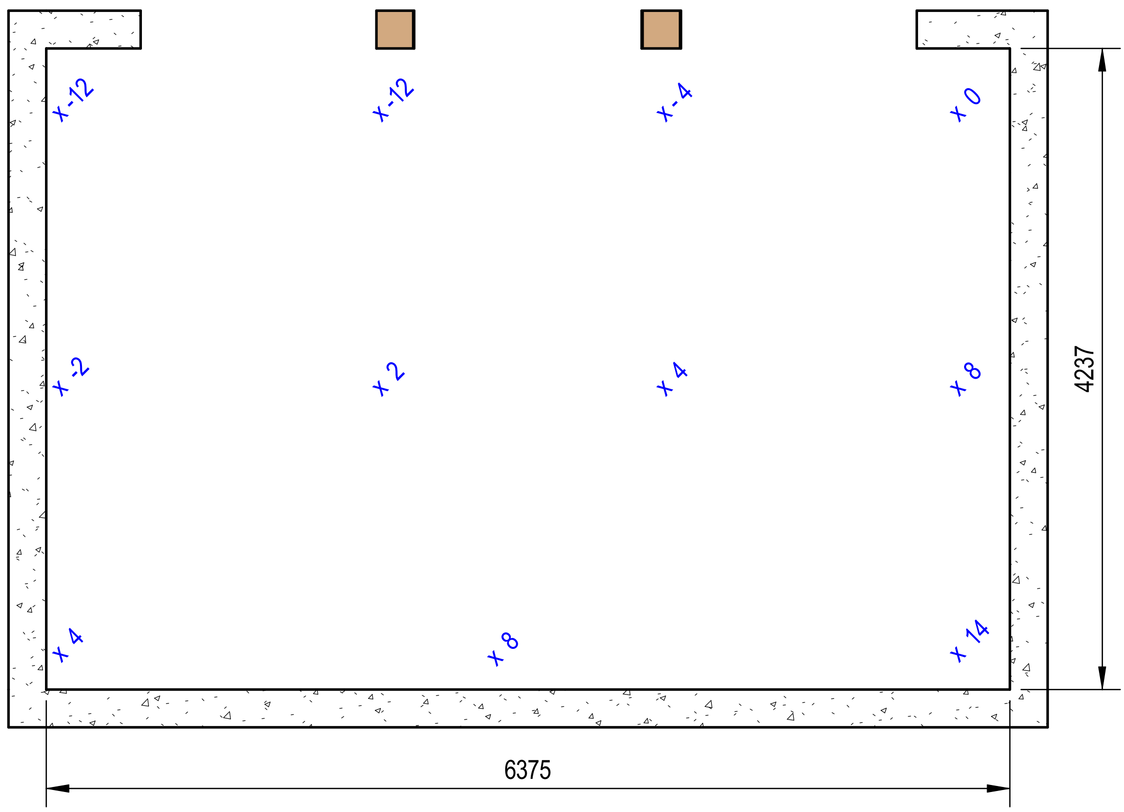


Image: Sourced from koordinates.con and LINZ. Crown Copyright Reserved

1. Aerial view of the building.

2. South elevation of the building.	
3. West elevation of the building.	
4. East elevation of the building.	
5. Crack in the concrete floor slab.	
6. Cracking to concrete covering.	

7. Exposed brick masonry.	



PLAN - LEVELS

1 : 50

3/09/2012 4:43:22 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	03.09.12	PRELIMINARY	APP

DRAWN	DESIGNED
N.Stanojevic	S.Edwards
CHECKED	
Checker	
APPROVED	
Approver	DATE

PROJECT
HAGLEY AVENUE
ADDRESS LINE 2

TITLE
PLAN - LEVELS

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.	
229615	
SCALE	SIZE
1 : 50	A4
DRAWING No.	REV
S-01-02	A

Appendix B
References

1. The Ministry of Business, Innovation and Employment (MBIE) “Repairing and rebuilding houses affected by the Canterbury earthquakes”, 2012

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 3606, 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 qualitative 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

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 qualitative 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:	North Hagley Park - Pavilion	Reviewer:	Lee Howard
	Unit / No: / Street	CPEng No:	1008889
Building Address:	10 Riccarton Avenue	Company:	Aurecon NZ Ltd
Legal Description:	Lot 4 DP 11013	Company project number:	229615
		Company phone number:	03 366 0821
	Degrees / Min / Sec		
GPS south:	43 / 31 / 41.29	Date of submission:	14/10/2013
GPS east:	172 / 36 / 58.71	Inspection Date:	23/08/2012
		Revision:	2
Building Unique Identifier (CCC):	PRK_1190_BLDG_016	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):	

Building

No. of storeys above ground:	1 (single storey = 1)	Ground floor elevation (Absolute) (m):	
Ground floor split?	no	Ground floor elevation above ground (m):	0.10
Storeys below ground	0		
Foundation type:	strip footings	if Foundation type is other, describe:	
Building height (m):	2.70	height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	30		
Age of Building (years):	27	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):	IL1		

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber truss	truss depth, purlin type and cladding	timber purlins and rafters, corrugated metal roof
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	none	overall depth x width (mm x mm)	
Columns:	load bearing walls	typical dimensions (mm x mm)	
Walls:	load bearing brick	#N/A	

Lateral load resisting structure

Lateral system along:	unreinforced masonry bearing wall - brick	**Note: Define along and across in detailed report!**	
Ductility assumed, μ:	2.00	note wall thickness and cavity	
Period along:	0.40 (0.40 from parameters in sheet)	estimate or calculation?	estimated
Total deflection (ULS) (mm):		estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):		estimate or calculation?	estimated
Lateral system across:	unreinforced masonry bearing wall - brick		
Ductility assumed, μ:	2.00	note wall thickness and cavity	
Period across:	0.40 (0.00)	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:	other heavy	describe	concrete
Roof Cladding:	Metal	describe	corrugated metal sheeting
Glazing:			
Ceilings:	strapped or direct 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:	good	Describe damage:	
Settlement:	0-25mm	notes (if applicable):	see Appendix A of main report
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:	minor non-structural	Describe:	
	Building Consent required:	no	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	55% ##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	calculation
	Assessed %NBS after e'quakes:	55%		
Across	Assessed %NBS before e'quakes:	40% ##### %NBS from IEP below		
	Assessed %NBS after e'quakes:	40%		

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:	m
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):	0.4	0.4
(%NBS)nom from Fig 3.3:		
Note:1 for specifically design public buildings, to the code of the day: pre-1965 = 1.25; 1965-1976, Zone A =1.33; 1965-1976, Zone B = 1.2; all else 1.0		
Note 2: for RC buildings designed between 1976-1984, use 1.2		
Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (1.0)		
	along	across

		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:		
	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): 1

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:

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

2.7 Baseline %NBS, (NBS%)b = (%NBS)nom x A x B x C x D x E

	along	across
%NBSb:	**#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

Height Difference effect D2, from Table to right

Therefore, Factor D: 0

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		
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

	along	across
3.7. Overall Performance Achievement ratio (PAR)	**0.00**	**0.00**

4.3 PAR x (%NBS)b:

	along	across
PAR x Baselline %NBS:	**#DIV/0!**	**#DIV/0!**

4.4 Percentage New Building Standard (%NBS), (before) **#DIV/0!**

Official Use only:

Accepted By

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