Hornby Multicultural Centre Hall
Qualitative Engineering Evaluation

Reference: 227683

Prepared for:
Christchurch City Council

Functional Location ID: BU 2522 001 EQ2

Address: 151 Gilberthorpes Road, Hornby

Revision: 2

Date: 19 October 2012

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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 Hornby Multicultural Centre Hall 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**	Hornby Multicultural Centre Hall			
Building Location ID	BU 2522 001 EQ2			**Multiple Building Site**	Y
Building Address	151 Gilberthorpes Road, Hornby			**No. of residential units**	0
Soil Technical Category	TC1	**Importance Level**	2	**Approximate Year Built**	1961
Foot Print (m²)	200	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Timber rafter roof, timber sarking roof, steel portal frame, concrete masonry walls, timber floor, concrete perimeter foundation wall with internal concrete piles and a concrete slab on grade foundation.				

Qualitative L4 Report Results Summary

Building in Use	Y	The Hornby Multicultural Centre Hall is currently in use.
Suitable for Continued Use	Y	The Hornby Multicultural Centre Hall is suitable for continued use.
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 of report body.
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.
Levels Survey Results	Y	Floor levels were generally within tolerable limits with the exception of the of toilet area. Refer section 2.6 of report body for details.
Building %NBS From Analysis	Estimated 67%	Based on out checks for bracing adequacy. Building assessed as "low risk" category according to NZSEE guidelines.

Qualitative L4 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	Christopher Bong	**Name**	Lee Howard
Title	Structural Engineer	**Title**	Senior Structural Engineer

1 Introduction

1.1 General

On 10 June 2012 Aurecon engineers visited the Hornby Multicultural Centre Hall 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 Hornby Multicultural Centre Hall 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

Originally a Presbyterian church built in 1961, the Hornby Multicultural Centre Hall is a single storey hall building. The building has timber roof sarking, concrete masonry walls and steel portal frames.

The building consists of 3 different parts – the hall, the kitchen and toilets. The council records show that the kitchen area is an infill between the hall and toilet buildings. This is evidenced by the different roof systems, floor finishes and foundations. The timber floor of the main hall is founded on a concrete perimeter foundation with internal concrete piles, the kitchen is founded on a mat foundation with an edge thickening and the toilet is founded on a slab on grade foundation.

The footprint of the complex is approximately 200 square metres. The building is an Importance Level 2 Structure in accordance with NZS 1170 Part 0: 2002.

2.2 Building Structural Systems Vertical and Horizontal

The Hornby Multicultural Centre Hall is a simple hall structure of concrete masonry wall and steel portal frame construction.

The vertical loads above the hall and kitchen from the timber sarking roof are resisted by the steel portal frames. The steel portal frame legs are founded on concrete pads. On the other hand, the timber rafter roof above the toilets is supported on the concrete masonry walls and the concrete slab on grade foundation.

The primary load resisting mechanism in the across direction for the hall and kitchen are the steel portal frames. The timber sarking roof distributes the seismic forces via diaphragm action into the portal frames. The toilet area on the other hand utilises the concrete masonry walls to brace the structure in the across direction.

In the along direction the bracing capacity is provided primarily by the concrete masonry walls. The loads are distributed via the timber sarking roof into the concrete masonry walls in the hall and kitchen areas. Similarly, the seismic actions are distributed via the timber framed roof into the concrete masonry walls in the toilet area.

2.3 Reference Building Type

The Hornby Multicultural Centre Hall is a typical hall building of steel portal frame and concrete masonry construction. For the purposes of this report, we have assumed that the walls are partially filled. This is in line with the observations in the kitchen and toilet areas and is consistent with the lack of damage on the stack bond gable wall of the hall. Lightly reinforced and partially filled masonry buildings have generally shown low levels of damage. Expected damage for buildings of this nature typically consists of cracking in mortar joints and in brittle non-structural claddings.

2.4 Building Foundation System and Soil Conditions

Due to the alterations and additions over the years, the Hornby Multicultural Centre Hall is founded on several foundation systems:

- The hall area is founded on a concrete perimeter foundation wall with internal pile foundations.
- The kitchen area is founded on a concrete slab on grade foundation with edge thickenings.
- The toilet block is founded on a concrete slab on grade foundation.

The land beneath the building and adjacent properties, has been classified as “Technical Category 1” land according to the DBH Technical Classes dated 18 May 2012. Additionally, there were no signs of liquefaction bulges, boils any subsidence in the vicinity of the building.

2.5 Available Structural Documentation and Inspection Priorities

Unfortunately, there were no original architectural or structural drawings available for the Hornby Multicultural Centre Hall. The council files do contain however, some documentation for the kitchen infill area. The inspection priorities pertain to a review of potential damage to foundations and consideration of wall bracing adequacy.

2.6 Available Survey Information

A floor levels survey was undertaken to establish the level of unevenness. 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 will have introduced some margin of error.

The Department of Building and Housing (DBH) published “Revised guidance on repairing and rebuilding houses affected by the Canterbury earthquake sequence” in November 2011. This document recommends some form of re-levelling or rebuilding of the floor if the slope is greater than 0.5% for any two points more than 2m apart, or there is significant cracking of the floor or the variation in level over the floor plan is greater than 50mm.

These figures are recommendations only and are intended to be applied to residential buildings however they provide useful guidance in determining acceptable floor level variations.

The floor levels for the Hornby Multicultural Centre Hall were generally found to be within the recommended tolerances with the exception of the toilet block area. Both the levels survey and visual assessment concur that the toilet block has settled in the north western corner. Nevertheless, the lack of damage seen to the superstructure and the absence of liquefaction boils in the vicinity suggests that the observed settlement is due to long term soil consolidation rather than seismic actions.

3 Structural Investigation

3.1 Summary of Building Damage

The Hornby Multicultural Centre Hall was in use at the time of the damage assessment. The building has performed well and has only suffered minor damage. The observed damage can be summarised below:

- Step cracking in the concrete masonry wall mortar joints below the window sills on the south eastern side wall;
- Cracking in the concrete masonry blocks in the toilet/kitchen area inter-partition wall; and
- Cracking in mortar joints of the south eastern gable wall.

3.2 Record of Intrusive Investigation

The extent of damage was relatively minor and therefore, an intrusive investigation was neither warranted nor undertaken for Hornby Multicultural Centre Hall. Furthermore, the exposed structure of the building has allowed for most of the structure to be visually assessed for damage.

3.3 Damage Discussion

Only minor damage was observed to the Hornby Multicultural Centre Hall as a result of seismic actions. This is unsurprising as reinforced and filled concrete masonry walls are intrinsically robust. Cracking in the mortar joints are a relatively common occurrence in unfilled and partially filled concrete masonry wall buildings as the mortar is inherently weaker than the concrete masonry blocks.

4 Building Review Summary

4.1 Building Review Statement

As noted previously, no intrusive investigations were undertaken on the Hornby Multicultural Centre Hall. Furthermore, due to the generic nature of the building, a significant amount of information can be inferred from a thorough internal and external inspection.

4.2 Critical Structural Weaknesses

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

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

5.1 General

The Hornby Multicultural Centre Hall is a typical hall building of steel portal frame and concrete masonry construction. Buildings of this nature have shown good structural performance in the Canterbury earthquake sequence. With good detailing and adequate material strength, steel portal frame and concrete masonry wall buildings generally have ductile failure modes.

5.2 Initial %NBS Assessment

The Hornby Multicultural Centre Hall 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 Calculating the Bracing Demand

Seismic Parameter	Quantity	Comment/Reference
Site Soil Class	D	NZS 1170.5:2004, clause 3.1.3, Deep or Soft Soils.
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.
Ductility Factor in the Across Direction, μ	2.00	Steel portal frames.
Ductility Factor in the Along Direction, μ	1.25	Concrete masonry walls.

The bracing check in the across and along directions have shown that the building is capable of achieving approximately 67%NBS. This corresponds to a "low risk" building in accordance with the New Zealand Society for Earthquake Engineering (NZSEE) guidelines.

5.3 Results Discussion

The results of the bracing check on the Hornby Multicultural Centre Hall correspond well with the low levels of damage observed in the visual damage assessment. This is not surprising as lightly reinforced partially filled concrete masonry wall buildings which are regular in plane have relatively good seismic performance and torsional stability.

6 Conclusions and Recommendations

As noted within this report, only low levels of damage was observed and the levels survey has shown that the floor levels were within acceptable limits. This is further supported by the analytical bracing check that was undertaken. It is therefore considered that the Hornby Multicultural Centre Hall **is suitable for continued use.**

As there is no clear evidence of any liquefaction or ground movement in the vicinity of the Hornby Multicultural Centre Hall, **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.

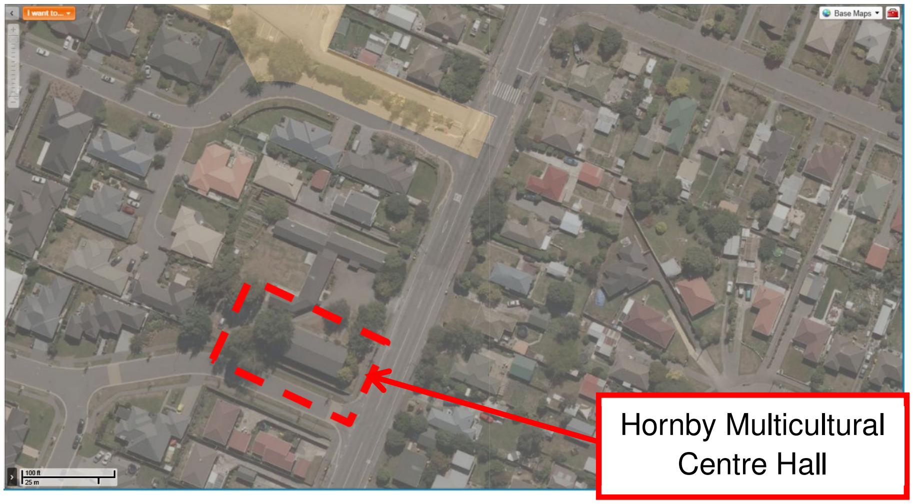
Without limiting any of the above, Aurecon's liability, whether under the law of contract, tort, statute, equity or otherwise, is limited as set out in the terms of the engagement with the client.

Appendices

Appendix A

Site Map, Photos and Levels Survey Results

Site Photographs (10 June 2012)



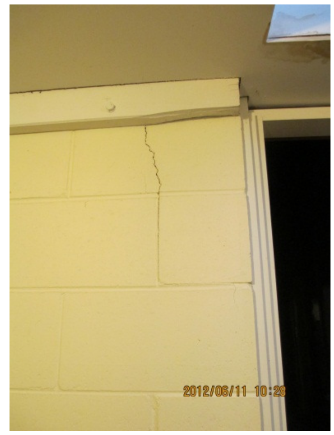
Western elevation of the Hornby Multicultural Centre Hall.

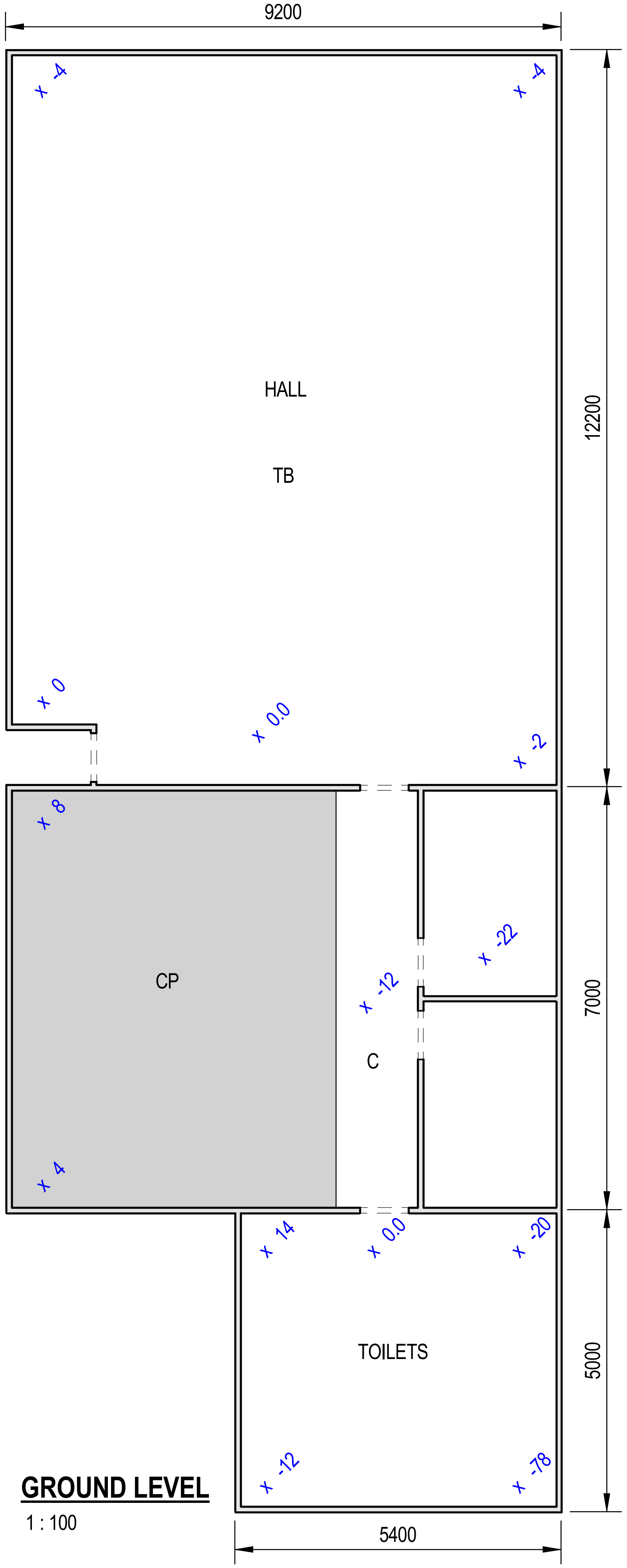
South western elevation of the Hornby Multicultural Centre Hall toilet block. The joint running through the centre of the toilet block highlights that the toilet block was constructed in two stages.

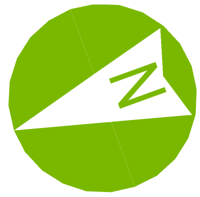
Close up of the crack in the toilet block, which increases in width up the wall indicating differential settlement.	
Difference in gap widths above the toilet door when viewed from the interiors indicating differential settlement.	
View from underneath the vents of the concrete perimeter foundation suggests that the concrete masonry walls are partially filled.	
View from underneath the vents of the concrete perimeter foundation showing the concrete pile foundations.	

Exterior south western elevation of the hall and kitchen area. The absence of vents beneath the kitchen area indicates that the hall and kitchen area have different foundations and were built at different times. The kitchen is founded on a concrete slab foundation (left) while the hall is founded on concrete perimeter wall foundation with internal piles (right).	
Step cracking in the mortar joints beneath the window sill in the south eastern side wall	
Interior view of the south eastern stack bonded concrete masonry gable wall.	
Cracking of the mortar joints in the south eastern gable wall.	

Cracking in the mortar joints of the south eastern side wall.	
Timber sarking roof and steel portal frames in the main hall area.	
Close up of the interface between the timber sarking roof, the steel portal frame and the concrete masonry side wall.	
Interface between the timber and concrete floors in the hall and kitchen areas respectively.	

Cracking in the kitchen/toilet concrete masonry partition wall viewed from the kitchen area.	
Cracking in the kitchen/toilet concrete masonry partition wall viewed from the toilet block.	
Top view of the toilet's concrete masonry partition walls.	





GROUND LEVEL

1 : 100

MAXIMUM VARIATIION ACROSS GROUND LEVEL = 78mm

LEGEND:

C= CONCRETE
CP= CARPET
TB= TIMBER FLOOR
0.0 = REFERENCE POINT

NOTES:

1. FLOOR PLANS AND DIMENSIONS ARE APPROXIMATE ONLY
2. FLOOR LEVEL SURVEY CARRIED OUT ON 21/09/2012

19/10/2012 1:13:40 p.m.

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CLIENT

REV	DATE	REVISION DETAILS	APPROVAL
A	11.10.12	ISSUED FOR INFORMATION	

DRAWN	DESIGNED
T.DOWN	C.BONG
CHECKED	
Checker	
APPROVED	DATE
Approver	

PROJECT
153 GIBERTHORPES RD, HEI HEI, CHRISTCHURCH
CCC HORNBY MULTICULTURAL CENTRE

TITLE
FLOOR LEVEL SURVEY

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.	
227683	
SCALE	SIZE
1 : 100	A4
DRAWING No.	REV
S-01-00	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 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 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).

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:	Hornby Multicultural Centre Hall			Reviewer:	Lee Howard
	Unit	No:	Street	CPEng No:	1008889
Building Address:		151	Gilberthorpes Road	Company:	Aurecon NZ Ltd
Legal Description:	Lot 1 DP 9514			Company project number:	227683
				Company phone number:	03 375 1328
	Degrees	Min	Sec		
GPS south:	43	31	49.98	Date of submission:	Jun-12
GPS east:	172	31	15.42	Inspection Date:	10-Jun-12
				Revision:	1
Building Unique Identifier (CCC):	BU 2522 001 EQ2			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):	27.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	27.30
Ground floor split?	no		Ground floor elevation above ground (m):	0.30
Storeys below ground	0			
Foundation type:	other (describe)		if Foundation type is other, describe:	concrete mat, concrete raft, concrete perimeter with infill p
Building height (m):	6.00		height from ground to level of uppermost seismic mass (for IEP only) (m):	6
Floor footprint area (approx):	200			
Age of Building (years):	50		Date of design:	1935-1965
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	other (specify)		Brief strengthening description:	
Use (upper floors):				
Use notes (if required):	community hall			
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	frame system		
Roof:	timber truss	truss depth, purlin type and cladding	timber sarking
Floors:	timber	joist depth and spacing (mm)	both timber and concrete floors present
Beams:	timber	type	
Columns:	load bearing walls	typical dimensions (mm x mm)	
Walls:	partially filled concrete masonry	thickness (mm)	

Lateral load resisting structure

Lateral system along:	partially filled CMU	**Note: Define along and across in**		
Ductility assumed, μ:	1.25	**detailed report!**	note total length of wall at ground (m):	
Period along:	0.40	##### enter height above at H31	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	welded and bolted steel moment frame			deflection governed

Ductility assumed, μ:	2.00		note typical bay length (m)	
Period across:	1.20	0.00	estimate or calculation?	calculated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	

Separations:

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

Non-structural elements

Stairs:			
Wall cladding:			painted
Roof Cladding:	Metal	describe	corrugated iron
Glazing:	timber frames		
Ceilings:			timber sarking
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
Settlement:	25-100m	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:	minor non-structural	Describe:	mortar joint crack repairs
	Building Consent required:	no	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	67%	0% %NBS from IEP below	If IEP not used, please detail assessment methodology: from bracing check calculations
	Assessed %NBS after e'quakes:	67%		
Across	Assessed %NBS before e'quakes:	84%	0% %NBS from IEP below	
	Assessed %NBS after e'quakes:	84%		

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: 6m

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	1.2
(%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

Near Fault scaling factor, from NZS1170.5, cl 3.1.6: 1.00

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

2.3 Hazard Scaling Factor

Hazard factor Z for site from AS1170.5, Table 3.3:	0.30
Z_{1992}, from NZS4203:1992	
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)	1.25	2.00
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:	1.14	2.00
Ductiity Scaling Factor, **Factor D**:	1.14	2.00

2.6 Structural Performance Scaling Factor:

	along	across
Sp:	0.925	0.700
Structural Performance Scaling Factor **Factor E**:	1.081081081	1.428571429

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

	along	across
%NBS$_b$:	**0%**	**0%**

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

3.1. Plan Irregularity, factor A: 1

3.2. Vertical irregularity, Factor B: 1

3.3. Short columns, Factor C: 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 1

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

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

3.6. 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

	Along	Across
3.7. Overall Performance Achievement ratio (PAR)	**1.00**	**1.00**
4.3 PAR x (%NBS)b: PAR x Baselline %NBS:	**0%**	**0%**
4.4 Percentage New Building Standard (%NBS), (before)		**0%**

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