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Spreydon Library
Qualitative Engineering Evaluation

Reference: 227256

Prepared for:

Christchurch City Council

Functional Location ID: PRO 2120 B001

Address: 266 Barrington Street

Revision: 3

Date: 14 October 2013

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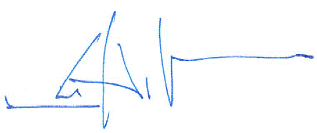
Author Signature		Approver Signature	
Name	Luis Castillo	Name	Lee Howard
Title	Senior Structural Engineer	Title	Senior Structural Engineer

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Appendices

Executive Summary

This is a summary of the Qualitative Engineering Evaluation for the Spreydon Library 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**	Spreydon Library			
Building Location ID	PRO 2120 B001			**Multiple Building Site**	N
Building Address	266 Barrington Street			**No. of residential units**	0
Soil Technical Category	TC2	**Importance Level**	2	**Approximate Year Built**	1970
Foot Print (m^2)	260	**Storeys above ground**	2	**Storeys below ground**	0
Type of Construction	Timber and steel Structure on concrete slab on grade				

Qualitative L4 Report Results Summary		
Building Occupied	Y	The Spreydon Library is currently in use.
Suitable for Continued Occupancy	Y	The Spreydon Library is suitable for continued use.
Key Damage Summary	Y	Refer to summary of building damage Section 4.1 of report.
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.
Levels Survey Results	Y	Variations in floor levels were within the DBH's Guidelines, with falls of less than 1:200 or 0.5%
Building %NBS From Analysis	51%	Based on an analysis of bracing capacity and demand.

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	Luis Castillo	Name	Lee Howard
Title	Senior Structural Engineer	Title	Senior Structural Engineer

1 Introduction

1.1 General

On 12 January 2012 before the earthquakes, Aurecon engineers visited the Spreydon Library at 266 Barrington Street Spreydon 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 additional investigation work 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 Spreydon Library 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

Spreydon Library is a two storey light weight structure designed in 1970 and refurbished in 2007. The 2007 refurbishment included the addition of a new 50 square metre mezzanine floor within the existing double height library space and the installation of a raised circular roof and clerestory windows above. The overall building footprint area is 260 square metres. Available building documentation included the original 1970's Architectural and Structural drawings and the Architectural drawings for the 2007 refurbishment. Spreydon Library is considered an importance level 2 building.

The original building, prior to the 2007 addition, was two storey only at the southern end of the building. In this area the upper level provided a separate reading area for "young adults". With the addition of the mezzanine in 2007 this 90 square metre space is now used for administration. The existing upper floor consists of particle board flooring on joists spanning between steel beams. The steel beams are supported by the same posts that support the roof beams.

The new mezzanine floor added in 2007 has a timber floor supported by a grid of steel beams. The new floor is connected to the existing upper level by a small ramp. The mezzanine is independently supported vertically and horizontally in the east-west direction.

2.2 Building Structural Systems Vertical and Horizontal

The building roof structure consists of lightweight roofing iron on sarking on timber purlins that span between long steel beams. The steel beams run longitudinally and are cranked to suit the profile of the roof. The steel beams are supported by square hollow section steel posts that carry loads down to a concrete slab on grade foundation.

Spreydon Library can be considered somewhat irregular due to the fact that it has two stories at the southern end, has a large open plan library space with liberal glazing to the east and to the west and relies on somewhat unevenly distributed timber framed walls to resist lateral loads.

Apart from loads transferred by the access ramp, the mezzanine can be considered as a separate structure within the body of the library. East-west lateral loads are resisted by the four hot rolled steel universal columns rigidly welded at the top to the beams supporting the mezzanine creating a pair of steel frames. In the North-south direction loads are transferred into the existing upper floor level at the south end of the library.

2.3 Building Foundation System and Soil Conditions

The library ground floor consists of a concrete slab on grade with internal pads for the new mezzanine and perimeter footing. The library is located within Spreydon Park and the surrounding land is zoned TC2 yellow meaning that it may be subject to liquefaction and may require special measures for foundations. No geotechnical investigation has been carried out.

2.4 Available Structural Documentation and Inspection Priorities

As noted above, original drawings for Spreydon Library were available and also for the 2007 refurbishment. Prior to visiting the library a review of the drawings was carried out. As a consequence of the review a priority for inspections became possible excessive lateral movement to the 2007 mezzanine as this appeared to be very flexible in the east-west direction.

3 Structural Investigation

3.1 Summary of Building Damage

The Spreydon Library is currently in use and was occupied at the time the damage assessment was carried out. Library manager Lindsey Moore was available and helped by providing access and related to us structural changes observed by Spreydon Library staff.

The architectural style of Spreydon Library is such that much of the primary steel support structure is exposed. As a consequence of this it was relatively easy to observe that the structure, as built, closely matches structural drawings from the original building consent and the 2007 refurbishment.

Damage noted included the following;

- Minor cracking at the intersection of the stucco clad wall and the soffit above main entry.
- Some relative movement at the point where canopy support beam intersects the stucco clad wall.
- Some joint stress to entry canopy framing above outermost support post.
- Minor cracks to stucco cladding on south elevation.
- Evidence of minor stress where steel mezzanine access ramp beams land on supporting beam.
- Evidence of minor lateral movement at each end of mezzanine support beam.
- Evidence of minor damage at ceiling-wall intersection of northern most transverse wall to alcove on west side of building near entrance.
- Evidence of liquefaction and ground movement in the surrounding land

Library staff mentioned that subsequent to the earthquake the access door to the lift up to the mezzanine floor scuffs the surface of the carpet in front of the lift door something it did not do before.

3.2 Record of Intrusive Investigation

As noted above the Architectural style of Spreydon Library is such that much of the primary steel support structure is exposed. However the ceiling has fixed linings and there were no accessible cavities to allow further inspection. No intrusive inspections were carried out.

3.3 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 may have introduced some margin of error.

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

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

3. If there is significant cracking of the floor.

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

The floor levels for the Spreydon Library were found to be within the recommended tolerances excluding the north-west corner of the building which has a slope of near 1%. No damage to the slab or wall was observed, nor any slant in the window frames. It is our belief that this slope is a defect from construction and not earthquake related.

3.4 Damage Discussion

The overall level of observed damage to Spreydon Library was minor. The method of construction being light weight and ductile is resilient. Although somewhat irregular in plan and elevation this building has suffered damage that is unlikely to have significantly reduced its lateral load capacity.

3.5 Reference Building Type

The Spreydon Library is primarily a timber framed, timber shear wall structure of a contemporary style. As such it belongs to a category of buildings that includes a wide variety of types and occupancies. As it relies primarily on lined timber shear walls to resist lateral loads a close inspection of wall intersections with other walls and wall intersections with ceiling diaphragms was required as these are the areas where any damage is likely to concentrate.

4 Building Review Summary

The building review covered all parts of the structure and all structural components. All parts of the building interior were visible however the condition of hidden structural elements in roof and suspended floor spaces was inferred from what was visible from above and below. In general there was no evidence of excessive displacement or damage that would indicate significant damage or displacements to the hidden supporting elements.

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

The refurbishment carried out in 2007 significantly altered the internal configuration at the southern end of the library. Existing walls were removed and new walls added. No structural drawings or calculations were available but a comparison of floor plans indicated that roughly similar lengths of walls were present before and after the alterations. Given similar strength values for new and existing walls the structure should have a similar strength before and after the alterations. It does not appear that the building was upgraded for lateral loads in 2007.

If it is assumed that the building has a similar capacity after the 2007 alterations as it did before and a ductility factor of 2 is adopted for the timber framed walls, a comparison between the loadings code in use in 1970 and the current code gives an approximate percentage new building standard of 75%NBS. This value relies on the assumption that wall bracing was subject to specific engineering design at that time.

A more detailed quantitative evaluation of the lateral load capacity of the structure was carried out as part of the detailed engineering evaluation. From this it was found that the longitudinal direction was the critical direction for lateral loads. In this direction the demand on each wall was determined to be 164 bracing units per meter. This level of demand is approximately double the maximum capacity allowable for estimating strengths of existing walls however it is not outside the range of possibilities for actual wall capacity.

The allowable level of estimated wall capacity for timber framed walls lined on both sides is 84 bracing units per meter. Using this value and calculating capacity over demand gives a percentage capacity of new building standard of 51%NBS. This is greater than 33%NBS but less than 67%NBS and places the building in the category of moderate risk building. However given the minor nature of the observed damage and the high level of shaking the building was likely to be subject to actual capacity may exceed this value.

6 Recommendations

The land below the Spreydon Library is zoned TC2 and has been identified as somewhat prone to liquefaction and settlement. There is local evidence of liquefaction in the surrounding land and in the adjacent Barrington Mall car park and some signs of possible movement internally. A levels survey was carried out to determine the extent of any differential settlement.

The building is currently occupied and in use as a library and in our opinion it is considered **suitable for continued occupation.**

7 Explanatory Statement

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

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

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

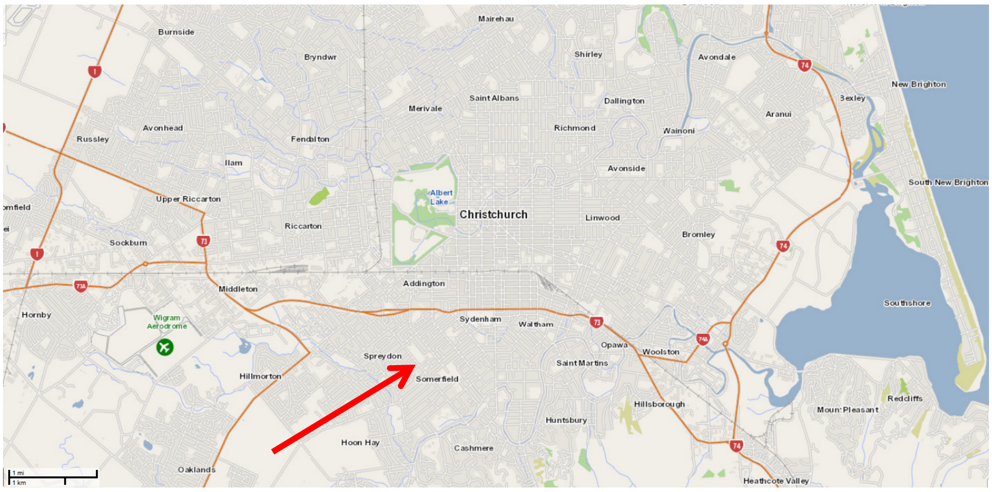
While this report may assist the client in assessing whether the building should be repaired, strengthened, or replaced that decision is the sole responsibility of the client.

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

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

Appendices

Appendix A
Site Map, Photos and Levels Survey



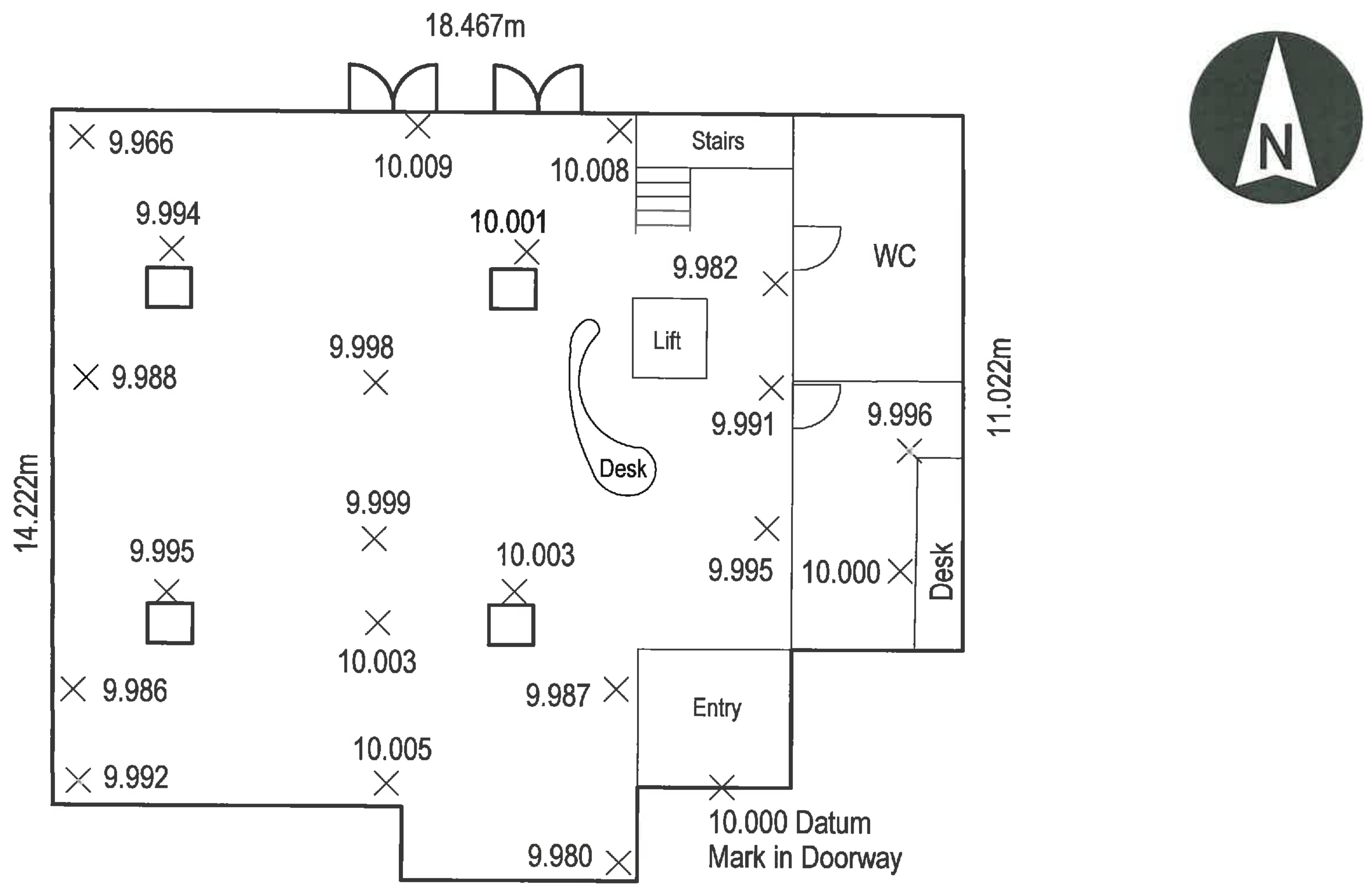
Location of Spreydon

Aerial Photo of the Spreydon Library.

Library east elevation and entry.	
Cracking between soffit and wall at entry.	
Cracking at intersection of wall and mezzanine ramp beam.	

Gap between steel frame support post and adjacent wall framing.	
Minor damage to alcove wall.	
Carpet scuff in front of lift door possibly due to local movement.	

Lifting of local underground service chamber possibly due to liquefaction.	
Repair work in adjacent car park due to liquefaction damage.	



Barrington Street

Notes:
Levels are in terms of an arbitary site datum and are not related between floors.
All levels were taken on carpet.
Relative level accuracy ±2mm.
Date of Survey: 16/05/2012

Key:
Internal Walls
External Walls
Columns
Level location

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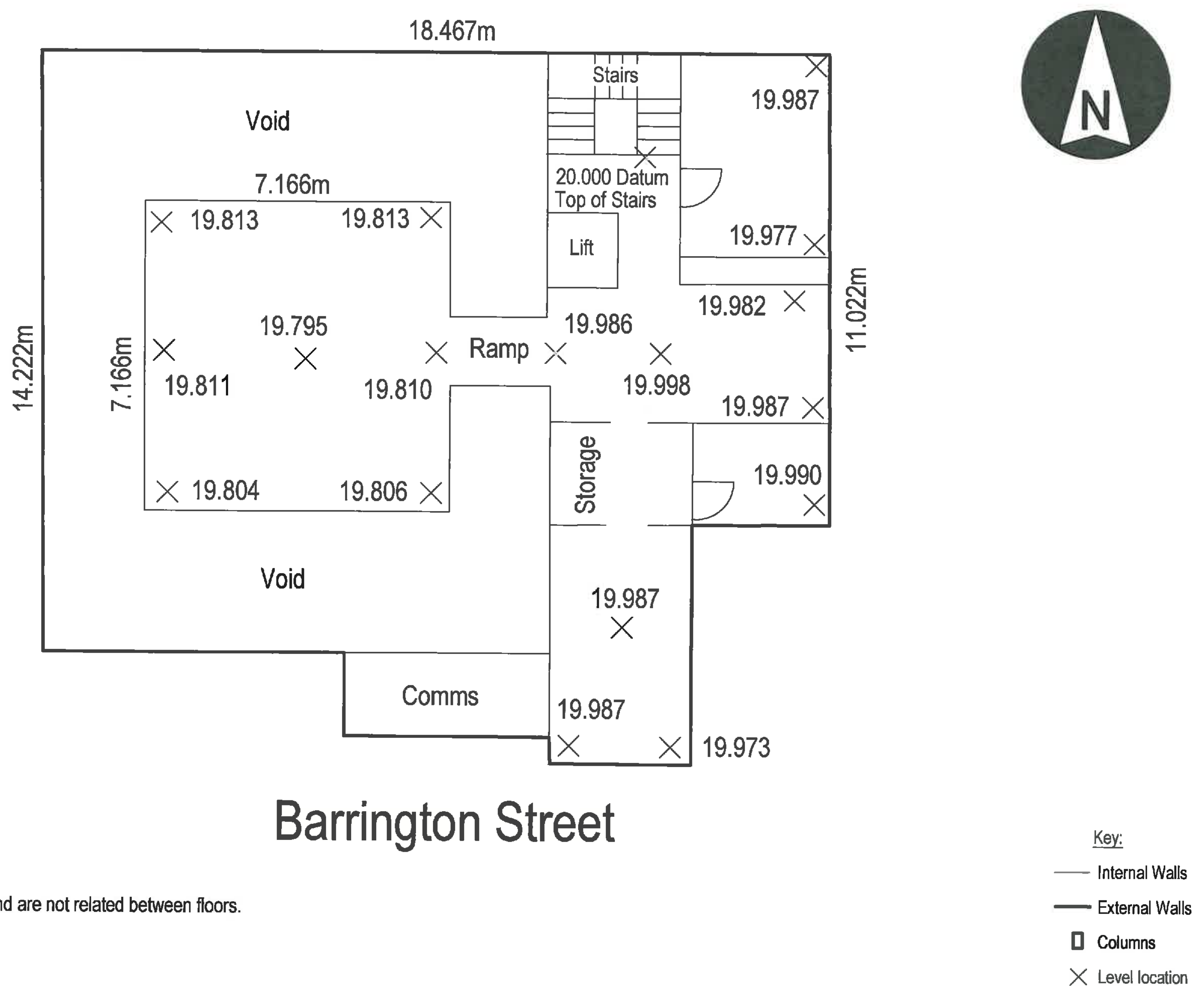
CLIENT	PROJECT	
CCC	Spreydon Library Barrington Street	NOT FOR CONSTRUCTION
DRAWN: TMurray	SURVEYED: TMurray	PROJECT No: 227256
CHECKED: RHope	TITLE: Ground Floor Floor Level Survey	SCALE: N.T.S. SIZE: A4
APPROVED: RHope DATE		DRAWING No: SI/01 REV: A



Notes:
Levels are in terms of an arbitary site datum and are not related between floors.
All levels were taken on carpet.
Relative level accuracy ±2mm.
Date of Survey: 16/05/2012

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CLIENT	DRAWN	SURVEYED	PROJECT	
CCC	TMurray	TMurray	Spreydon Library Barrington Street	NOT FOR CONSTRUCTION
	CHECKED: RHope		TITLE: First Floor Floor Level Survey	PROJECT No. 227256
	APPROVED: RHope	DATE		SCALE N.T.S. / SIZE A4
				DRAWING No. SI101 / REV A

Appendix B
References

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

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

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

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

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

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

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

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

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

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

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

Appendix C
Strength Assessment Explanation

New building standard (NBS)

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

Earthquake Prone Buildings

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

Christchurch City Council Earthquake Prone Building Policy 2010

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

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

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

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

Christchurch Seismicity

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

For this assessment, the building's earthquake resistance is compared with the current New Zealand Building Code requirements for a new building constructed on the site. This is expressed as a percentage of new building standard (%NBS). The new building standard load requirements have been determined in accordance with the current earthquake loading standard (NZS 1170.5:2004 Structural design actions - Earthquake actions - New Zealand).

The likely capacity of this building has been derived in accordance with the New Zealand Society for Earthquake Engineering (NZSEE) guidelines 'Assessment and Improvement of the Structural Performance of Buildings in Earthquakes' (AISPBE), 2006. These guidelines provide an Initial Evaluation Procedure that assesses a buildings capacity based on a comparison of loading codes from when the building was designed and currently. It is a quick high-level procedure that can be used when undertaking a Qualitative analysis of a building. The guidelines also provide guidance on calculating a modified Ultimate Limit State capacity of the building which is much more accurate and can be used when undertaking a Quantitative analysis.

The New Zealand Society for Earthquake Engineering has proposed a way for classifying earthquake risk for existing buildings in terms of %NBS and this is shown in Figure C1 below.

Description	Grade	Risk	%NBS	Existing Building Structural Performance	Improvement of Structural Performance	
					Legal Requirement	NZSEE Recommendation
Low Risk Building	A or B	Low	Above 67	Acceptable (improvement may be desirable)	The Building Act sets no required level of structural improvement (unless change in use) This is for each TA to decide. Improvement is not limited to 34%NBS.	100%NBS desirable. Improvement should achieve at least 67%NBS
Moderate Risk Building	B or C	Moderate	34 to 66	Acceptable legally. Improvement recommended		Not recommended. Acceptable only in exceptional circumstances
High Risk Building	D or E	High	33 or lower	Unacceptable (Improvement	Unacceptable	Unacceptable

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

Table C1 below compares the percentage NBS to the relative risk of the building failing in a seismic event with a 10% probability of exceedance in 50 years (i.e. 0.2% in the next year). It is noted that the current seismic risk in Christchurch results in a 6% probability of exceedance in the next year.

Table C1: Relative Risk of Building Failure In A

Percentage of New Building Standard (%NBS)	Relative Risk (Approximate)
>100	<1 time
80-100	1-2 times
67-80	2-5 times
33-67	5-10 times
20-33	10-25 times
<20	>25 times

Appendix D
Background and Legal Framework

Background

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

This report is a Qualitative Assessment of the building structure, and is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011.

A qualitative assessment involves inspections of the building and a desktop review of existing structural and geotechnical information, including existing drawings and calculations, if available.

The purpose of the assessment is to determine the likely building performance and damage patterns, to identify any potential critical structural weaknesses or collapse hazards, and to make an initial assessment of the likely building strength in terms of percentage of new building standard (%NBS).

Compliance

This section contains a brief summary of the requirements of the various statutes and authorities that control activities in relation to buildings in Christchurch at present.

Canterbury Earthquake Recovery Authority (CERA)

CERA was established on 28 March 2011 to take control of the recovery of Christchurch using powers established by the Canterbury Earthquake Recovery Act enacted on 18 April 2011. This act gives the Chief Executive Officer of CERA wide powers in relation to building safety, demolition and repair. Two relevant sections are:

Section 38 – Works

This section outlines a process in which the chief executive can give notice that a building is to be demolished and if the owner does not carry out the demolition, the chief executive can commission the demolition and recover the costs from the owner or by placing a charge on the owners' land.

Section 51 – Requiring Structural Survey

This section enables the chief executive to require a building owner, insurer or mortgagee carry out a full structural survey before the building is re-occupied.

We understand that CERA will require a detailed engineering evaluation to be carried out for all buildings (other than those exempt from the Earthquake Prone Building definition in the Building Act). It is anticipated that CERA will adopt the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011. This document sets out a methodology for both qualitative and quantitative assessments.

The qualitative assessment is a desk-top and site inspection assessment. It is based on a thorough visual inspection of the building coupled with a review of available documentation such as drawings and specifications. The quantitative assessment involves analytical calculation of the buildings strength and may require non-destructive or destructive material testing, geotechnical testing and intrusive investigation.

It is anticipated that factors determining the extent of evaluation and strengthening level required will include:

- The importance level and occupancy of the building
- The placard status and amount of damage
- The age and structural type of the building
- Consideration of any critical structural weaknesses
- The extent of any earthquake damage

Building Act

Several sections of the Building Act are relevant when considering structural requirements:

Section 112 – Alterations

This section requires that an existing building complies with the relevant sections of the Building Code to at least the extent that it did prior to any alteration. This effectively means that a building cannot be weakened as a result of an alteration (including partial demolition).

Section 115 – Change of Use

This section requires that the territorial authority (in this case Christchurch City Council (CCC)) be satisfied that the building with a new use complies with the relevant sections of the Building Code 'as near as is reasonably practicable'. Regarding seismic capacity 'as near as reasonably practicable' has previously been interpreted by CCC as achieving a minimum of 67%NBS however where practical achieving 100%NBS is desirable. The New Zealand Society for Earthquake Engineering (NZSEE) recommend a minimum of 67%NBS.

Section 121 – Dangerous Buildings

The definition of dangerous building in the Act was extended by the Canterbury Earthquake (Building Act) Order 2010, and it now defines a building as dangerous if:

- in the ordinary course of events (excluding the occurrence of an earthquake), the building is likely to cause injury or death or damage to other property; or
- in the event of fire, injury or death to any persons in the building or on other property is likely because of fire hazard or the occupancy of the building; or
- there is a risk that the building could collapse or otherwise cause injury or death as a result of earthquake shaking that is less than a 'moderate earthquake' (refer to Section 122 below); or
- there is a risk that that other property could collapse or otherwise cause injury or death; or
- a territorial authority has not been able to undertake an inspection to determine whether the building is dangerous.

Section 122 – Earthquake Prone Buildings

This section defines a building as earthquake prone if its ultimate capacity would be exceeded in a 'moderate earthquake' and it would be likely to collapse causing injury or death, or damage to other property. A moderate earthquake is defined by the building regulations as one that would generate ground shaking 33% of the shaking used to design an equivalent new building.

Section 124 – Powers of Territorial Authorities

This section gives the territorial authority the power to require strengthening work within specified timeframes or to close and prevent occupancy to any building defined as dangerous or earthquake prone.

Section 131 – Earthquake Prone Building Policy

This section requires the territorial authority to adopt a specific policy for earthquake prone, dangerous and insanitary buildings.

Christchurch City Council Policy

Christchurch City Council adopted their Earthquake Prone, Dangerous and Insanitary Building Policy in 2006. This policy was amended immediately following the Darfield Earthquake of the 4th September 2010.

The 2010 amendment includes the following:

- A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;
- A strengthening target level of 67% of a new building for buildings that are Earthquake Prone;
- A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,
- Repair works for buildings damaged by earthquakes will be required to comply with the above.

The council has stated their willingness to consider retrofit proposals on a case by case basis, considering the economic impact of such a retrofit.

We anticipate that any building with a capacity of less than 33%NBS (including consideration of critical structural weaknesses) will need to be strengthened to a target of 67%NBS of new building standard as recommended by the Policy.

If strengthening works are undertaken, a building consent will be required. A requirement of the consent will require upgrade of the building to comply 'as near as is reasonably practicable' with:

- The accessibility requirements of the Building Code.
- The fire requirements of the Building Code. This is likely to require a fire report to be submitted with the building consent application.

Building Code

The building code outlines performance standards for buildings and the Building Act requires that all new buildings comply with this code. Compliance Documents published by The Department of Building and Housing can be used to demonstrate compliance with the Building Code.

After the February Earthquake, on 19 May 2011, Compliance Document B1: Structure was amended to include increased seismic design requirements for Canterbury as follows:

- Hazard Factor increased from 0.22 to 0.3 (36% increase in the basic seismic design load)
- Serviceability Return Period Factor increased from 0.25 to 0.33 (80% increase in the serviceability design loads when combined with the Hazard Factor increase)

The increase in the above factors has resulted in a reduction in the level of compliance of an existing building relative to a new building despite the capacity of the existing building not changing.

Appendix E
Standard Reporting Spread Sheet

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Spreydon Library	Reviewer:	Simon Manning
	Unit / No: 266 / Street: Barrington St	CPEng No:	132053
Building Address:		Company:	Aurecon
Legal Description:		Company project number:	227257
		Company phone number:	(03) 3660821
	Degrees / Min / Sec		
GPS south:	43 / 33 / 23.22	Date of submission:	14/10/2013
GPS east:	172 / 37 / 5.85	Inspection Date:	1/12/2011
		Revision:	3
Building Unique Identifier (CCC):	PRO 2120 B001	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):	100	If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	3.00

Building

No. of storeys above ground:	1 (single storey = 1)	Ground floor elevation (Absolute) (m):	3.30
Ground floor split?	yes	Ground floor elevation above ground (m):	0.30
Storeys below ground			
Foundation type:	other (describe)	if Foundation type is other, describe:	Concrete Pad
Building height (m):	4.00	height from ground to level of uppermost seismic mass (for IEP only) (m):	2
Floor footprint area (approx):	260		
Age of Building (years):	40	Date of design:	1965-1976
Strengthening present?	no	If so, when (year)?	
		And what load level (%g)?	
Use (ground floor):	public	Brief strengthening description:	
Use (upper floors):	public		
Use notes (if required):	Suburban Public Library		
Importance level (to NZS1170.5):	IL2		

Gravity Structure

Gravity System:	load bearing walls		
Roof:	steel framed	rafter type, purlin type and cladding	sawn timber, sawn timber, iron
Floors:	timber	joist depth and spacing (mm)	200x50's - 450c/c
Beams:	steel non-composite	beam and connector type	Bolted
Columns:	structural steel	typical dimensions (mm x mm)	90x90
Walls:			

Lateral load resisting structure

Note: Define along and across in detailed report!

Lateral system along:	lightweight timber framed walls	note typical wall length (m)	
Ductility assumed, μ:	3.00		
Period along:	0.40 (0.00)	estimate or calculation?	estimated
Total deflection (ULS) (mm):	50	estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):	25	estimate or calculation?	estimated
Lateral system across:	lightweight timber framed walls	note typical wall length (m)	
Ductility assumed, μ:	3.00		
Period across:	0.40 (0.00)	estimate or calculation?	estimated
Total deflection (ULS) (mm):	50	estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):	25	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 light	describe	Timber weather boards
Roof Cladding:	Metal	describe	Corrugated iron
Glazing:	timber frames		
Ceilings:	fibrous plaster, fixed		
Services(list):			

Available documentation

Architectural	full	original designer name/date	Lucking and Vial 1970
Structural	partial	original designer name/date	Holmes and Wood 1970
Mechanical		original designer name/date	
Electrical		original designer name/date	
Geotech report		original designer name/date	

Damage

Site: (refer DEE Table 4-2)

Site performance:		Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	0-1:350	notes (if applicable):	Some local settlement but not internal
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:	slight	notes (if applicable):	Some local settlement and bulging

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:	minor repairs
Building Consent required:	no	Describe:	
Interim occupancy recommendations:	full occupancy	Describe:	

Along	Assessed %NBS before:	51%	##### %NBS from IEP below	If IEP not used, please detail assessment methodology: Estimated capacity using exist material strenghts
	Assessed %NBS after:	51%		
Across	Assessed %NBS before:	96%	##### %NBS from IEP below	
	Assessed %NBS after:	96%		

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): 1965-1976

h_n from above: 2m

Seismic Zone, if designed between 1965 and 1992:

not required for this age of building

not required for this age of building

	along	across
Period (from above):	0.4	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
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):	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: 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

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

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

3.7. Overall Performance Achievement ratio (PAR)

	0.00	**0.00**

4.3 PAR x (%NBS)b:

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

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

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