Spencer Park Camping Ground Tourist Flats

Qualitative Engineering Evaluation

Functional Location ID: BU 0157 008 EQ2

Address: 100 Heyders Road, Spencerville

Reference: 228610

Prepared for:

Christchurch City Council

Revision: 2

Date: 11 January 2013

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Document control						aurecon
Report Title		Qualitative Engineering Evaluation				
Functional Location ID		**BU 0157 008 EQ2**	**Project Number**		228610	
File Path		P:\ 228610 - Spencer Park Camping Ground Tourist Flats.docx				
Client		Christchurch City Council	**Client Contact**		Michael Sheffield	
Rev	**Date**	**Revision Details/Status**	**Prepared**	**Author**	**Verifier**	**Approver**
1	**25 May 2012**	Draft	C. Bong	C. Bong	L. Howard	L. Howard
2	**11 January 2013**	Final	C. Bong	C. Bong	L. Castillo	L. Castillo
Current Revision		**2**				

Approval			
Author Signature		Approver Signature	
Name	Christopher Bong	Name	Luis Castillo
Title	Structural Engineer	Title	Senior Structural Engineer

Contents

Appendices

Executive Summary

This is a summary of the Qualitative Engineering Evaluation for the Spencer Park Camping Ground Tourist Flats building and is based on the Detailed Engineering Evaluation Procedure document issued by the Engineering Advisory Group on 19 July 2011, visual inspections, available structural documentation and summary calculations as appropriate.

Building Details	**Name**	Spencer Park Camping Ground Tourist Flats			
Building Location ID	BU 0157 008 EQ2			**Multiple Building Site**	Y
Building Address	100 Heyders Road, Spencerville			**No. of residential units**	3
Soil Technical Category	N/A	**Importance Level**	2	**Approximate Year Built**	1980s
Foot Print (m²)	720	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Corrugated steel roof, lightweight timber roof with purlins and rafters, timber stud wall with vertical fibre cement sheathing, concrete pad foundation				

Qualitative L4 Report Results Summary		
Building Occupied	Y	The Spencer Park Camping Ground Tourist Flats are currently in use.
Suitable for Continued Occupancy	Y	The Spencer Park Camping Ground Tourist Flats are 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	The floor was within the DBH's Guidelines with falls of less than 1:200 or 0.5%.
Building %NBS From Analysis	Estimated 44%	Based on assumed approximate building material strength. Building falls within "medium risk" category according to NZSEE guidelines.

Qualitative L4 Report Recommendations		
Geotechnical Survey Required	N	A geotechnical survey is not required.
Proceed to L5 Quantitative DEE	N	A quantitative DEE is not required for this structure.

Approval			
Author Signature		Approver Signature	
Name	Christopher Bong	Name	Luis Castillo
Title	Structural Engineer	Title	Senior Structural Engineer

1 Introduction

1.1 General

On 14 March 2012 Aurecon engineers visited the Spencer Park Camping Ground Tourist Flats to undertake a qualitative building damage assessment on behalf of Christchurch City Council. Detailed visual inspections were carried out to assess the damage caused by the earthquakes on 4 September 2010, 22 February 2011, 13 June 2011, 23 December and related aftershocks.

The scope of work included:

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

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

2 Description of the Building

2.1 Building Age and Configuration

The Spencer Park Camping Ground Tourist Flats comprise of three discrete timber frame and concrete masonry wall buildings, these are:

1. Units 1-5 – which have yellow doors, 5 *chalets* and a store room at the Northern end
2. Units 6-10 - which have red doors and are identical in construction to Units 1-5
3. Units 11-16 - which have blue doors and with 6 *chalets* instead of 5

The tourist flats are founded on concrete slab on grade foundations. The walls of the building are of concrete masonry construction in the across direction and of timber frame construction in the along direction. The exterior timber frame walls are clad in vertical fibre cement board sheeting. The aluminium joinery suggests that the building was constructed in the 1980s.

The approximate total floor area of the three buildings is 720 square metres. The buildings are classified as Importance Level 2 Structures in accordance with NZS 1170 Part 0: 2002.

2.2 Building Structural Systems Vertical and Horizontal

The load path for the Spencer Park Camping Ground Tourist Flats to the concrete slab on grade foundation is simple; it comprises of three distinct systems in the vertical, along and across directions.

The vertical loads that originate from the lightweight timber roof are distributed onto what is assumed to be the lightly reinforced, partially filled concrete masonry walls via the timber rafters and beams. The veranda roof is held up by timber beams connected onto concrete masonry columns.

The horizontal loads in the across direction are taken by the evenly distributed concrete masonry inter-tenancy walls. In a similar fashion, the horizontal loads in the along direction are resisted primarily by the rear timber framed walls on the Eastern side of all three buildings. The torsional resistance is provided by the stiffer concrete masonry walls in the across direction.

2.3 Reference Building Type

The Spencer Park Camping Ground Tourist Flats comprise of three multi-tenancy wings of lightweight timber frame and concrete masonry construction. As a combination of two of the most common building types in New Zealand, they are characteristically robust and have been proven to sustain little damage in the Canterbury earthquakes.

Expected seismic damage for buildings of this nature typically consists of:

- Cracking in the mortar joints, a consequence of inadequate shear or flexural strength in concrete masonry wall buildings.
- Cracking in brittle claddings such as gypsum plasterboard, due to higher than tolerable displacements, in timber framed wall buildings,

These damages were specifically searched for in the damage assessment undertaken on 14 March 2012.

2.4 Building Foundation System and Soil Conditions

All three wings of the Spencer Park Camping Ground Tourist Flats are founded on a concrete pad foundation. The Department of Building and Housing's Guidance on Repairing and Rebuilding Houses Affected by the Canterbury Earthquake Sequence, classifies foundations of this nature as "Type C"

The land surrounding the Spencer Park Camping Ground Tourist Flats was classified as "rural and unmapped" according to the DHB Technical Classes dated 23 March 2012.

It is of note that the residential property to the immediate East has been classified as "Technical Category 3" or TC3 and according to CERA "may suffer moderate to significant liquefaction in future significant earthquakes".

2.5 Available Structural Documentation and Inspection Priorities

Unfortunately, no documentation was available for the Spencer Park Camping Ground Tourist Flats in the Christchurch City Council property files. However, the standard nature and exposed timber frame has allowed the structural performance to be deduced without the aid of these documentation.

The inspection priorities for this report pertain to the review of damage to the building and consideration of the building's bracing adequacy.

2.6 Available Survey Information

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

3 Structural Investigation

3.1 Summary of Building Damage

The Spencer Park Camping Ground Tourist Flats were in use at the time of the damage assessment. A thorough visual damage assessment has shown:

- Cracking in the vertical fibre cement boards;
- Cracking in the gypsum plasterboard linings; and
- Cracking in the concrete slab on grade foundations.

These were found in several locations in all three buildings. Refer to photographs of damage in Appendix A.

3.2 Record of Intrusive Investigation

The extent of damage was relatively minor and therefore, an intrusive investigation was considered unnecessary. Furthermore, the generic nature of the Spencer Park Camping Ground Tourist Flats has allowed a significant amount of structural information to be inferred from the building form and construction material.

3.3 Damage Discussion

The damage observed on the Spencer Park Camping Ground Tourist Flats was minor.

The cracking of the brittle sheeting such as the vertical fibre cement boards and gypsum plasterboard lining are the consequences of the differential movement between the roof and foundations of the building, a phenomenon known as racking.

The cracking in the concrete slab on grade could be partially attributed to shrinkage and creep due to the size of the slab. However, when viewed from the exposed side, the differential widths of the cracks seen are wider at the top; thus implying bowing/hogging in the slab due to comparatively greater levels of settlement on the ends of the concrete slab on grade. Nevertheless, the levels survey has shown that the floor levels are within acceptable limits and no further action in the form of re-levelling is considered necessary.

4 Building Review Summary

4.1 Building Review Statement

The internal cladding of the Spencer Park Camping Ground Tourist Flats prevented the viewing of the primary structural elements. Nevertheless, a non-intrusive damage assessment was undertaken assuming that the damage seen on the brittle sheathing would indicate a proportional level of displacement damage to the structure.

4.2 Critical Structural Weaknesses

No 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 Spencer Park Camping Ground Tourist Flats, being of lightweight timber frame and concrete masonry construction, are intrinsically robust and have stood up well in the recent seismic events. This is evidenced by the low level of displacement damage described in section 3.1 above.

5.2 Initial %NBS Assessment

The Spencer Park Camping Ground Tourist Flats has not been subject to specific engineering design and the Initial Evaluation Procedure (IEP) will not give a useful estimate of building capacity in terms of percentage of new building standard. Nevertheless, an estimate of lateral load capacity or bracing check can be made by adopting assumed values for strengths of existing materials and calculating the capacity of existing walls. Selected assessment seismic parameters are tabulated in 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	1.00	NZS 1170.5:2004, Table 3.5
Ductility Factor for the across direction of the building, μ	1.25	Partially filled, lightly reinforced concrete masonry walls
Ductility Factor for the along direction of the building, μ	2.00	Lightweight timber framed walls

The bracing check in both the longitudinal and transverse directions has shown that the building is capable of achieving approximately 44%NBS (i.e. a “moderate risk” building according to NZSEE guidelines).

5.3 Results Discussion

The findings of the bracing check are consistent with the observed damage in the visual damage assessment. The critical bracing element for the building was the lightweight timber framed walls.

The quantitative analysis was undertaken using the assumed approximate bracing capacity of the according to the New Zealand Society of Earthquake Engineering (NZSEE) guidelines for the Assessment and Improvement of The Structural Performance of Buildings in Earthquakes and the Standard New Zealand’s Design of Concrete Masonry Buildings (NZS 4230:2004).

6 Conclusions and Recommendations

As noted within the report, only low levels of visible damage was observed in the damage assessment and the levels survey has shown that the floor levels are within acceptable limits. This is further supported by the building strength analysis that was undertaken. It is therefore considered that the Spencer Park Camping Ground Tourist Flats is **suitable for continued use**.

As there is no clear evidence of any liquefaction or ground movement in the vicinity of the Spencer Park Camping Ground Tourist Flats **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 (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.

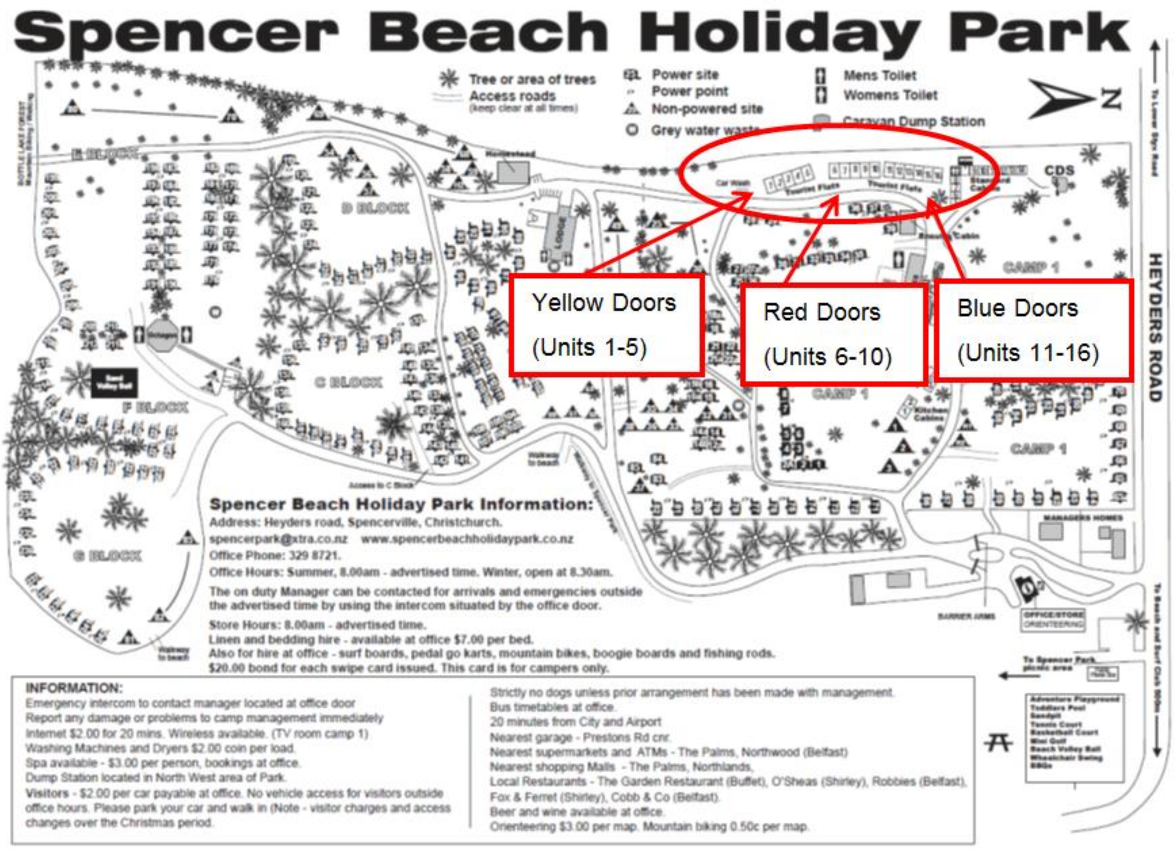
Without limiting any of the above, Aurecon's liability, whether under the law of contract, tort, statute, equity or otherwise, is limited as set out in the terms of the engagement with the client.

Appendices

Appendix A

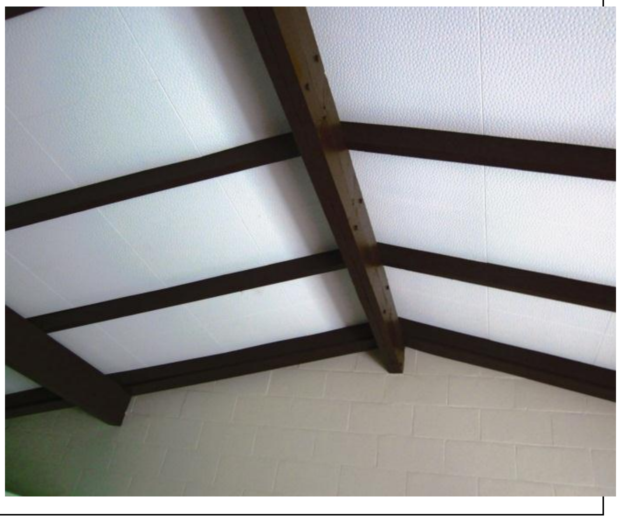
Site Map, Photos and Levels Survey

14 March 2012 – Spencer Park Camping Ground Tourist Flats Site Photographs

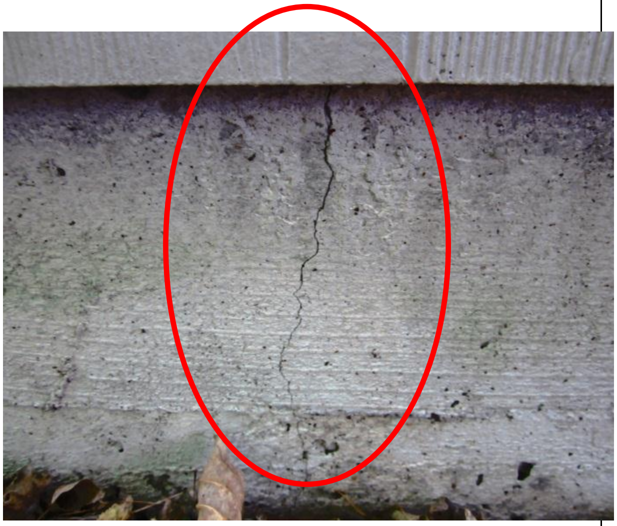


Side elevation of the Spencer Park Camping Ground Tourist Flats.	

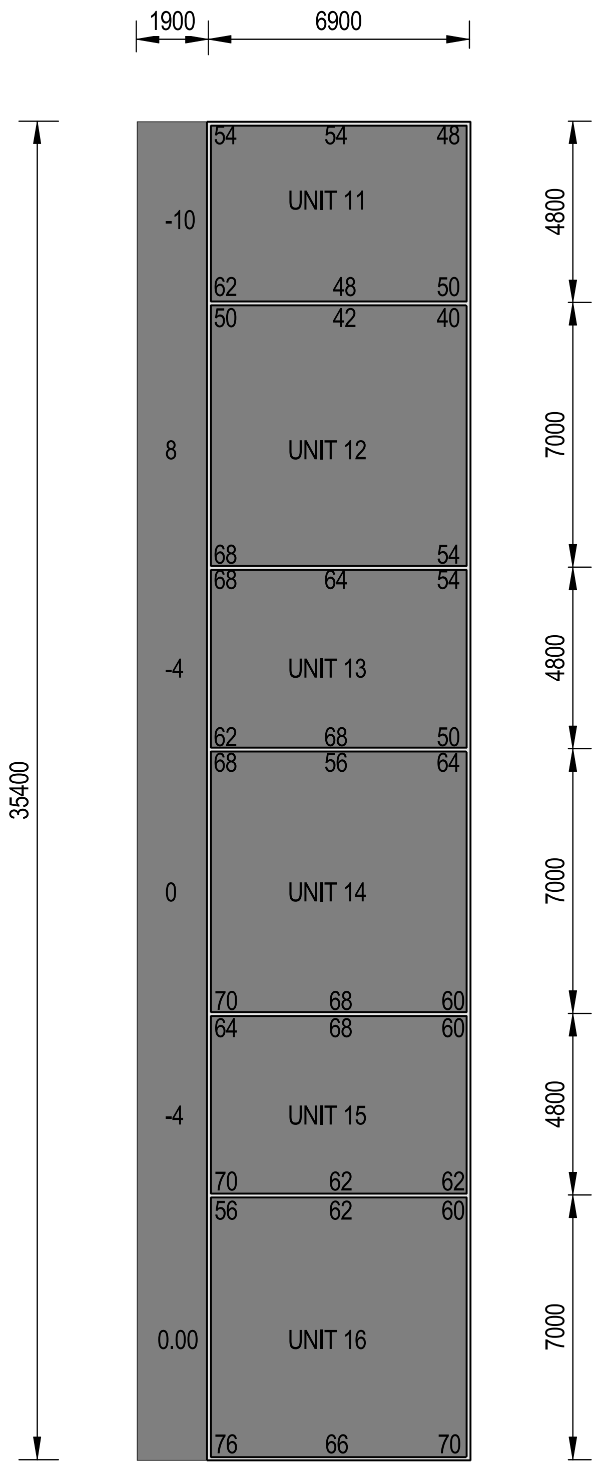
Typical end elevation of the Spencer Park Camping Ground Tourist Flats.	
Window opening in the end elevation of the Spencer Park Camping Ground Tourist Flats.	
Typical eastern elevation of the Spencer Park Camping Ground Tourist Flats	

Concrete masonry pillars and timber beams supporting the veranda roof.	
Timber rafters on roof ridge beam.	

Cracking on the exterior fibre cement cladding.	
View of cracking in the concrete foundation pad.	

Another instance of cracking in the concrete foundation pad.	
Plan view of surface cracking in concrete floor slab.	

TRUE NORTH



GROUND LEVEL FLOOR LEVELS PLAN

1 : 200

27/11/2012 2:52:33 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
1	24-05-12	LEVEL SURVEY	L.CASTILLO

DRAWN	DESIGNED
D.LAKE	C. BONG

CHECKED
D.ELLIOTT

APPROVED
DATE
L. CASTILLO

PROJECT
TOURIST FLATS F BLOCK (BLUE DOORS)
CHRISTCHURCH

TITLE
FLOOR LEVELS
PLAN

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.
228610

SCALE	SIZE
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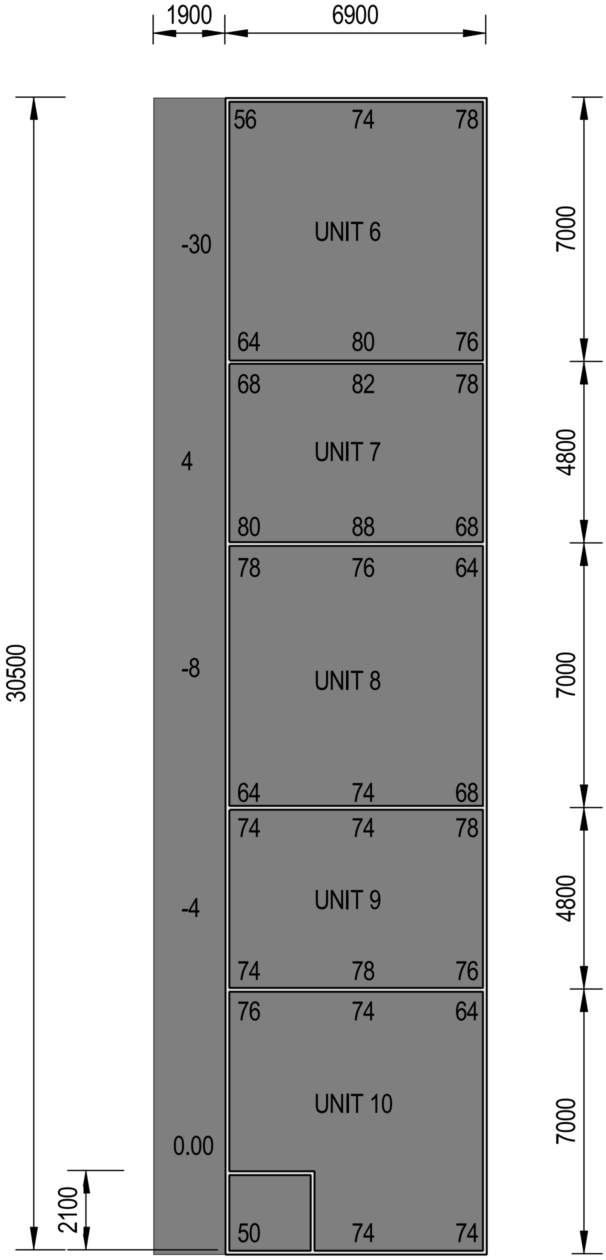
DRAWING No.	REV
S-01-00	1

TRUE NORTH



GROUND LEVEL FLOOR LEVELS PLAN

1 : 200

27/11/2012 2:48:01 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
1	24-05-12	LEVEL SURVEY	L.CASTILLO

DRAWN	DESIGNED
D.LAKE	C. BONG

CHECKED: D.ELLIOTT

APPROVED: L. CASTILLO DATE

PROJECT: TOURIST FLATS F BLOCK (RED DOORS) CHRISTCHURCH

TITLE: FLOOR LEVELS PLAN

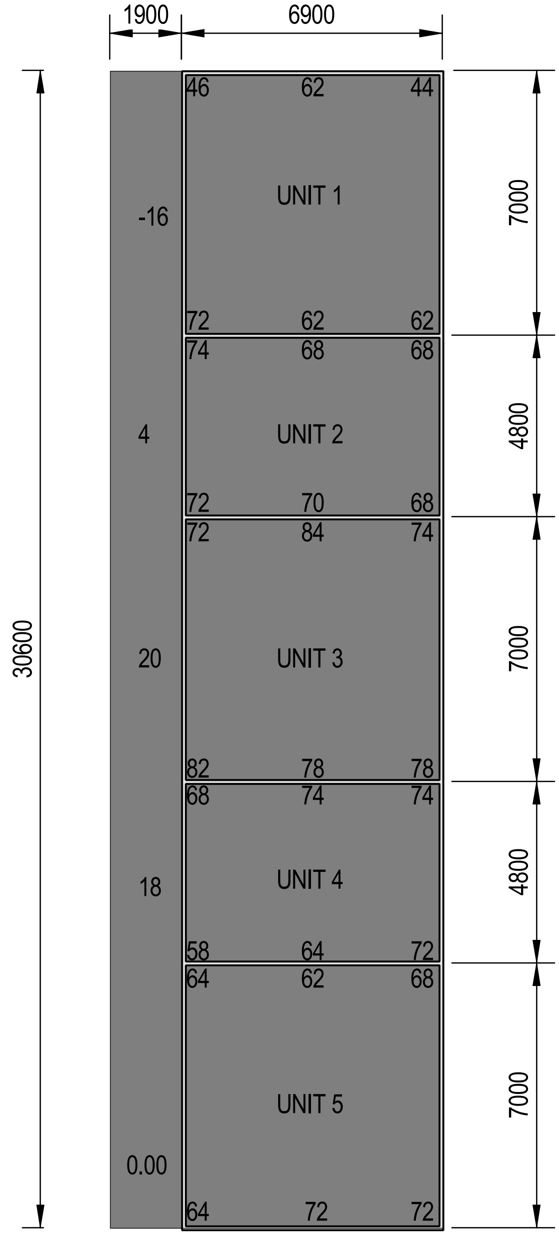
CONSENT

PROJECT No.: 228610

SCALE	SIZE
1 : 200	A4

DRAWING No.	REV
S-01-00	1

TRUE NORTH



GROUND LEVEL FLOOR LEVELS PLAN

1 : 200

27/11/2012 2:50:32 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
1	24-05-12	LEVEL SURVEY	L.CASTILLO

DRAWN	DESIGNED
D.LAKE	C. BONG
CHECKED	
D.ELLIOTT	
APPROVED	DATE
L. CASTILLO	

PROJECT
TOURIST FLATS F BLOCK (YELLOW DOORS)
CHRISTCHURCH

TITLE
FLOOR LEVELS
PLAN

CONSENT

PROJECT No.	
228610	
SCALE	SIZE
1 : 200	A4
DRAWING No.	REV
S-01-00	1

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:	Tourist Flats			Reviewer:	Lee Howard
	Unit	No:	Street	CPEng No:	1008889
Building Address:	Spencer Park Camping Ground	100 Heyders Road		Company:	Aurecon
Legal Description:	Lot 1 DP 44484			Company project number:	228610
				Company phone number:	03 375 1328
	Degrees	Min	Sec		
GPS south:	43	25	55.83	Date of submission:	May
GPS east:	172	42	10.15	Inspection Date:	March
				Revision:	
Building Unique Identifier (CCC):	BU 0157 008 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):	1.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	1.00
Ground floor split?			Ground floor elevation above ground (m):	0.00
Storeys below ground	0			
Foundation type:	raft slab		if Foundation type is other, describe:	
Building height (m):	4.00		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	720			
Age of Building (years):	30		Date of design:	1976-1992
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	multi-unit residential		Brief strengthening description:	
Use (upper floors):				
Use notes (if required):				
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	lightweight timber purlins and rafters
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	timber	type	lightweight timber for lintels
Columns:	timber	typical dimensions (mm x mm)	
Walls:	partially filled concrete masonry	thickness (mm)	

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	**Note: Define along and across in detailed report!**	note typical wall length (m)	
Ductility assumed, μ:	2.00			
Period along:		0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	estimated

Lateral system across:	partially filled CMU	note total length of wall at ground (m):	
Ductility assumed, μ:	1.25	wall thickness (m):	
Period across:	##### enter height above at H31	estimate or calculation?	estimated
Total deflection (ULS) (mm):		estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):		estimate or calculation?	estimated

Separations:

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

Non-structural elements

Stairs:			
Wall cladding:	plaster system	describe	exposed CMU, but plastered timber framed walls
Roof Cladding:	Metal	describe	corrugated iron
Glazing:	aluminium frames		
Ceilings:	plaster, fixed		
Services(list):			

Available documentation

Architectural	none	original designer name/date	
Structural	partial	original designer name/date	truss layout only
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	none	original designer name/date	

Damage

Site:
(refer DEE Table 4-2)

Site performance:		Describe damage:	
Settlement:	0-25mm	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?:	yes	Describe:	

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

Recommendations

	Level of repair/strengthening required:	none		Describe:	
	Building Consent required:	no		Describe:	
	Interim occupancy recommendations:	full occupancy		Describe:	
Along	Assessed %NBS before:	44%	0% %NBS from IEP below	If IEP not used, please detail assessment methodology:	Bracing Analysis
	Assessed %NBS after:	44%			
Across	Assessed %NBS before:	44%	0% %NBS from IEP below		
	Assessed %NBS after:	44%			

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

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

h_n from above: m

Seismic Zone, if designed between 1965 and 1992: B

not required for this age of building

not required for this age of building

	along	across
Period (from above):	0	0
(%NBS)nom from Fig 3.3:	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)	2.00	2.00
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:	2.00	1.25
Ductiity Scaling Factor, **Factor D**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

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

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

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

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

3.1. Plan Irregularity, factor A:	insignificant	1
3.2. Vertical irregularity, Factor B:	insignificant	1
3.3. Short columns, Factor C:	insignificant	1
3.4. Pounding potential	Pounding effect D1, from Table to right	1.0
	Height Difference effect D2, from Table to right	1.0
	Therefore, Factor D:	1
3.5. Site Characteristics	significant	0.7

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

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

		Along	Across
3.6. Other factors, Factor F	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)		**0.70**	**0.70**
4.3 PAR x (%NBS)b:	PAR x Baselline %NBS:	**0%**	**0%**
4.4 Percentage New Building Standard (%NBS), (before)			**0%**

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