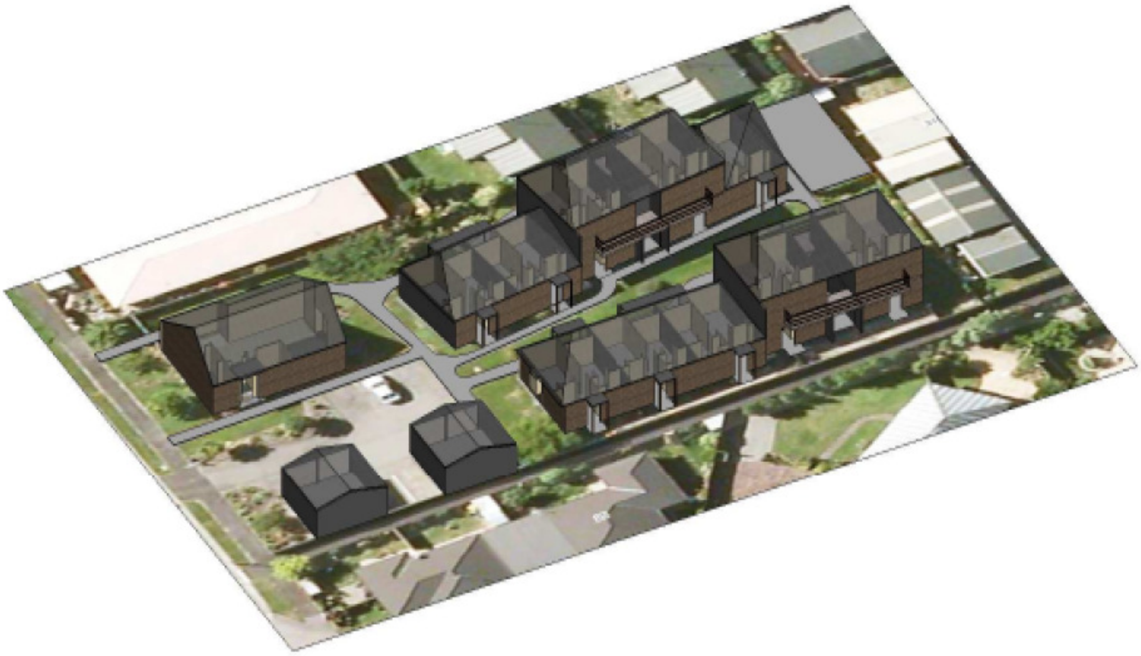


aurecon

19 Aberfoyle Place

Quantitative Engineering Evaluation

Functional Location ID: PRO 0118

Address: 19 Aberfoyle Place, Parklands

Reference: 232536

Prepared for:

Christchurch City Council

Revision: 2

Date: 16 October 2013

Leading. Vibrant. Global.
www.aurecongroup.com

Document Control Record

Document prepared by:

Aurecon New Zealand Limited
Level 2, 518 Colombo Street
Christchurch 8011

PO Box 1061
Christchurch 8140
New Zealand

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

A person using Aurecon documents or data accepts the risk of:

a) Using the documents or data in electronic form without requesting and checking them for accuracy against the original hard copy version.
b) Using the documents or data for any purpose not agreed to in writing by Aurecon.

Document control						aurecon
Report Title		Quantitative Engineering Evaluation				
Functional Location ID		**PRO 0118**		**Project Number**	232536	
File Path		P:\232536 - 19 Aberfoyle Place\8 - Report				
Client		Christchurch City Council	**Client Contact**		Michael Sheffield	
Rev	**Date**	**Revision Details/Status**	**Prepared**	**Author**	**Verifier**	**Approver**
1	**26 August 2013**	Draft	M. Ardalany	M. Ardalany	L. Howard	L. Howard
2	**16 October 2013**	Final	M. Ardalany	M. Ardalany	L. Howard	L. Howard
Current Revision		**2**				

Approval			
Author Signature		Approver Signature	
Name	Manoochehr Ardalany	Name	Lee Howard
Title	Structural Engineer	Title	Technical Director

Contents

Appendices

Executive Summary – Block A

This is a summary of the Quantitative Engineering Evaluation for 19 Aberfoyle Place Block A 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**	19 Aberfoyle Place – Block A			
Building Location ID	PRO 0118 B001			**Multiple Building Site**	Y
Building Address	19 Aberfoyle Place, Parklands			**No. of residential units**	7
Soil Technical Category	TC3	**Importance Level**	2	**Approximate Year Built**	1991
Foot Print (m²)	252	**Storeys above ground**	Mixed of 1 and 2	**Storeys below ground**	0
Type of Construction	Light weight roof, timber purlins and rafters, concrete tilt up panel, slab on grade, pad foundations.				

Quantitative L5 Report Results Summary		
Building Occupied	Y	The building is currently in service.
Suitable for Continued Occupancy	Y	The building is suitable for continued use.
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 report body.
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.
Levels Survey Results	Y	Refer to Appendix A.
Building %NBS From Analysis	31%	Based on an analysis of bracing capacity and demand.

Approval			
Author Signature		Approver Signature	
Name	Manoochehr Ardalany	Name	Lee Howard
Title	Structural Engineer	Title	Senior Structural Engineer

Executive Summary – Block B

This is a summary of the Quantitative Engineering Evaluation for 19 Aberfoyle Place Block B 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**	19 Aberfoyle Place – Block B			
Building Location ID	PRO 0118 B004			**Multiple Building Site**	Y
Building Address	19 Aberfoyle Place, Parklands			**No. of residential units**	7
Soil Technical Category	TC3	**Importance Level**	2	**Approximate Year Built**	1991
Foot Print (m²)	252	**Storeys above ground**	Mixed of 1 and 2	**Storeys below ground**	0
Type of Construction	Light weight roof, timber purlins and rafters, concrete tilt up panel.				

Quantitative L5 Report Results Summary		
Building Occupied	Y	The building is currently in service.
Suitable for Continued Occupancy	Y	The building is suitable for continued use.
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 report body.
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.
Levels Survey Results	Y	Refer to Appendix A.
Building %NBS From Analysis	31%	Based on an analysis of bracing capacity and demand.

Approval			
Author Signature		Approver Signature	
Name	Manoochehr Ardalany	Name	Lee Howard
Title	Structural Engineer	Title	Senior Structural Engineer

Executive Summary – Block C Lounge Room

This is a summary of the Quantitative Engineering Evaluation for 19 Aberfoyle Place Block C Lounge Room 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**	19 Aberfoyle Place – Block C Lounge Room			
Building Location ID	PRO 0118 B002			**Multiple Building Site**	Y
Building Address	19 Aberfoyle Place, Parklands			**No. of residential units**	1
Soil Technical Category	TC3	**Importance Level**	2	**Approximate Year Built**	1991
Foot Print (m²)	~ 91	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Light weight roof, timber purlins and rafters, timber walls and slab on grade foundations.				
Quantitative L5 Report Results Summary					
Building Occupied	Y	The buildings are currently in service.			
Suitable for Continued Occupancy	Y	The buildings are suitable for continued use.			
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 report body.			
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.			
Levels Survey Results	Y	Refer to Appendix A.			
Building %NBS From Analysis	44%	Based on an analysis of bracing capacity and demand.			
Approval					
Author Signature	M Ardalany	Approver Signature			
Name	Manoochehr Ardalany	Name	Lee Howard		
Title	Structural Engineer	Title	Senior Structural Engineer		

Executive Summary – Garages

This is a summary of the Quantitative Engineering Evaluation for 19 Aberfoyle Place Blocks D and E Garages 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**	19 Aberfoyle Place – Blocks D and E Garages			
Building Location ID	PRO 0118 B003 and PRO 0118 B005			**Multiple Building Site**	Y
Building Address	19 Aberfoyle Place, Parklands			**No. of residential units**	-
Soil Technical Category	TC3	**Importance Level**	2	**Approximate Year Built**	1991
Foot Print (m²)	66	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Light weight roof, concrete tilt up panel and slab on grade foundations.				

Quantitative L5 Report Results Summary		
Building Occupied	Y	The buildings are currently in service.
Suitable for Continued Occupancy	Y	The buildings are suitable for continued use.
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 report body.
Critical Structural Weaknesses (CSW)	Y	No critical structural weaknesses were identified.
Levels Survey Results	Y	Refer to Appendix A.
Building %NBS From Analysis	29%	Based on an analysis of bracing capacity and demand.

Approval			
Author Signature		Approver Signature	
Name	Manoochehr Ardalany	Name	Lee Howard
Title	Structural Engineer	Title	Senior Structural Engineer

1 Introduction

1.1 General

On 19 July 2013 Aurecon engineers visited 19 Aberfoyle Place to undertake a quantitative 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 the 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 a 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 Quantitative Assessment of damage to 19 Aberfoyle Place 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.

2 Description of the Buildings

2.1 Labelling of the buildings

There are a number of buildings in 19 Aberfoyle Place which are labelled in Figure 1. The labelling will be referred in the following sections of this report. The orientation of the buildings is referred by the “Along” and “Across” directions. The convention is shown in Figure 1.

Figure 1. Labelling of the buildings in 19 Aberfoyle Place with the definition of “Along” and “Across” of the buildings

2.2 Building Age and Configuration

The buildings in 19 Aberfoyle Place are a combination of single and two storey structures constructed in 1991. General information about these buildings is summarized in Table 1 .

Table 1. General information about buildings

Label	Roof	Floor	Walls	Foundation
Blocks A and B	Timber trusses with steel cladding	Ground floor: concrete slab on grade First storey: concrete slab	Combination of concrete tilt up panels, plywood and plasterboard walls	Pad foundation for tilt up panels and perimeter concrete foundation for the walls
Lounge Room	Timber trusses with steel cladding	Concrete slab on grade	Plasterboards walls	Perimeter concrete foundation
Garages	Corrugated steel on DHS purlins	Concrete slab on grade	Concrete tilt-up panels	Assumed local edge thickenings

The buildings have an approximate total floor area of 770 square metres excluding the garages. The total area of the site is about 2519 square meters (Data from QuickMap). The buildings are considered an importance level 2 structures in accordance with AS/NZS 1170.0:2002.

2.3 Building Structural Systems Vertical and Horizontal

In Blocks A and B the gravity loads are transferred into the ground via the concrete tilt up panels supported on pad foundations. In the Lounge Room, the gravity load of roof is transferred to the timber walls supported on a perimeter concrete foundation. In the garages, the gravity load of the roof is transferred into perimeter walls and then to the foundation. The lateral resisting systems of these buildings are summarized in Table 2.

Table 2. Lateral load resisting systems

Label	Lateral load resisting system "along" the buildings	Lateral load resisting system "across" the buildings
Blocks A and B	Combined concrete tilt up panels and plywood bracing	Concrete tilt up panels
Lounge Room	Plasterboard walls	Plasterboard walls
Garages	Concrete tilt up panels	Concrete tilt up panels

2.4 Reference Building Type

Since the buildings (especially Blocks A and B) have a combination of different lateral load resisting systems, it is difficult to make an accurate estimation of the structure behaviour based on Figure 2. However, assuming tilt up panels as load resisting systems for the along and across directions, an estimation of the behaviour was made which showed "May have some issues".

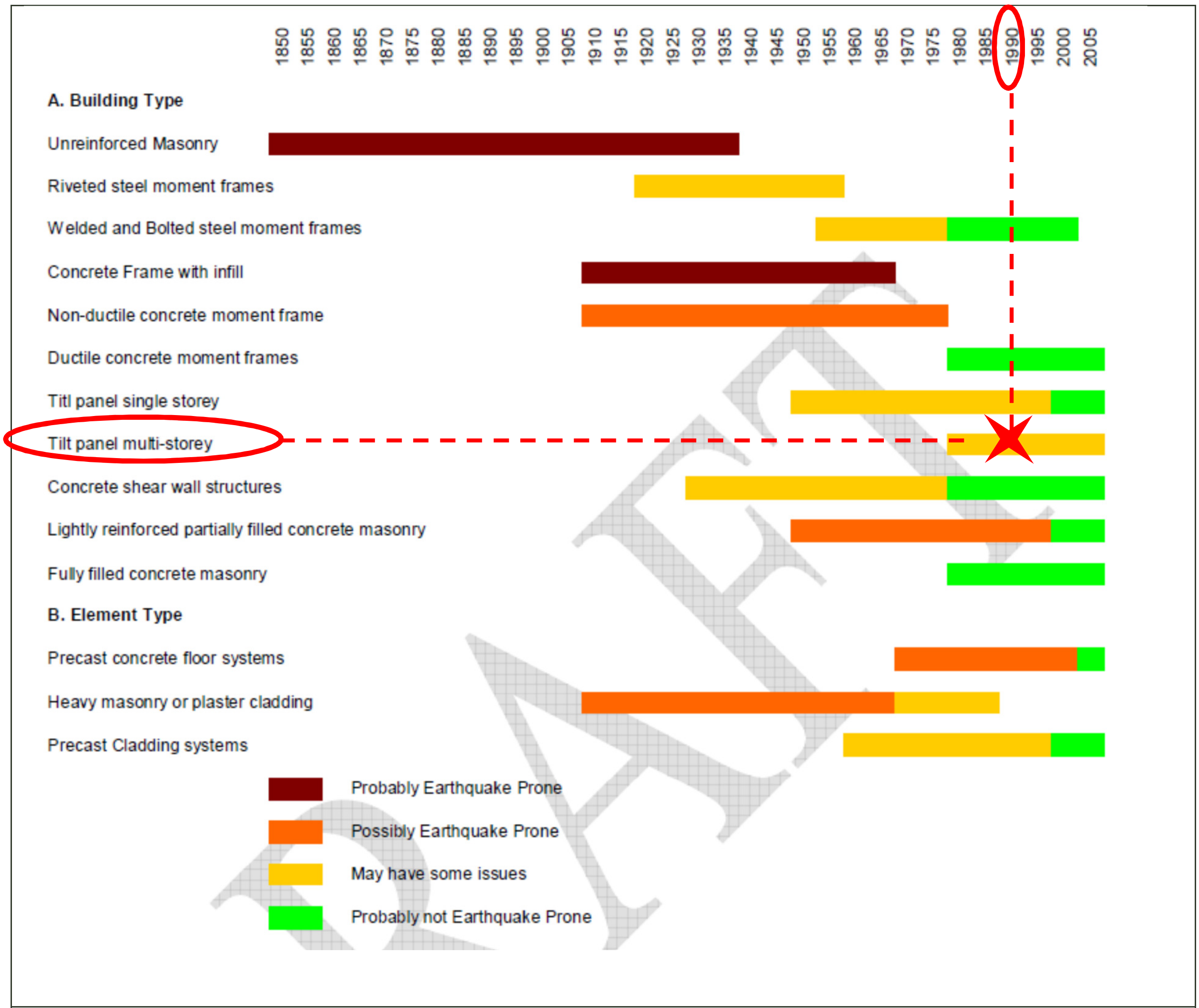


Figure 2. Reference building type

2.5 Building Foundation System and Soil Conditions

The land at 19 Aberfoyle Place based on Canterbury Geotechnical Database is classified as Technical Category 3 (TC3), which is characterized as "moderate to significant land damage from liquefaction is possible in future significant earthquakes".

2.6 Available Structural Documentation and Inspection priorities

Partial architectural drawings and partial structural drawings were available for Blocks A, B, garages and Lounge Room. The generic building type for 19 Aberfoyle Place is a reinforced precast concrete building constructed in the 1990s. This type of structure has performed reasonably well during the Canterbury Earthquakes.

2.7 Available Survey Information

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

The Ministry of Business, Innovation and Employment (MBIE) published the guideline "Repairing and rebuilding houses affected by the Canterbury earthquakes" in 2012, which recommends some form of re-levelling or rebuilding of the floor

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

It is important to note that these figures are recommendations and are only intended to be applied to residential buildings.

From the level survey carried out, the following points should be considered:

1. Unit 1: the bedroom and lounge room area has a maximum slope of 0.77 %.
2. Unit 2: the bedroom and lounge room area has a maximum slope of 0.70%.
3. Unit 7: the bedroom and Lounge room area has a slope of 0.80 %.
4. Unit 13: the kitchen area has a slope of 0.56 %.
5. Lounge room: the dining room area has a slope of 0.80 %.

3 Structural Investigation

3.1 Summary of Building Damage

A summary of the damage to Blocks A and B is presented below:

Block A and Block B

- Typical cracks in plasterboard walls at the corners of windows and doors
- Cracks in the mortar joints of the brick walls and in the bricks
- Minor cracks in corners of openings in plasterboard walls
- Cracks in the plasterboard walls
- Considerable cracks in the brick veneer.

Additional damage was observed in Unit 7 of Block A as summarized below:

- Separation of the plasterboard from the ceiling
- Separation of the door frame from the wall
- Major cracks in the plasterboard walls in the bedroom
- Deformation of door/window frames.

It is of note that most doors and windows in the along direction in unit 7 have been damaged and do not operate properly.

Lounge Room

- Minor cracks in the concrete slab
- Minor cracks in the perimeter concrete foundation.

Garages

- Damage to the connection between two walls
- Small separation of the concrete walls from surrounding panels
- Twist in the purlins of the roof
- Cracks in the gable wall at the entrance
- Out of plane rotation in the gable wall at the entrance.

Site

- Cracks in the pathways outside the units
- Major cracks of 20 mm width in the concrete slab surrounding the building
- Minor cracks in the pavements between units
- Settlement of the concrete pavement surrounding the buildings.

3.2 Record of Intrusive Investigation

A number of intrusive investigations were undertaken on 19 July 2011. The investigations were established to confirm some details with the available plans and to obtain more information. The intrusive investigation included:

1. Lifting up a portion of a carpet to check for cracks in the concrete slab on grade in the Lounge Room
2. Cutting a small hole into the plasterboard wall of Block A to check the wall behind
3. Check connection of the panel to panel for the garage.

Photos of the intrusive investigations are presented in Appendix A.

3.3 Damage Discussion

Moderate seismic related damage as addressed in section 3.1 was noted in the damage assessment for structure of these buildings.

4 Building Review Summary

4.1 Building Review Statement

The finishes of 19 Aberfoyle Place obstructed the viewing in some parts of the structure. Nevertheless, a damage assessment was undertaken assuming that the damage to the finishes of the building would indicate a commensurate level of displacement damage on the building's structure.

As no original calculations were available, assumptions had to be made in order to complete calculations using current NZ standards and NZSEE guidelines as referenced in Appendix B.

4.2 Critical Structural Weaknesses

No specific critical structural weaknesses were identified as a part of the building quantitative assessment for Blocks A, B, Lounge Room and garages.

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

5.1 General

In 19 Aberfoyle Place, the buildings having well distributed walls in the across direction have performed well in the Canterbury earthquake sequence despite the damage referenced in section 3.

5.2 Existing building strength

We consider that the damage to the buildings has not resulted in any measurable reduction in the strength of the buildings and so our strength assessment is based on the pre-earthquake condition of the buildings. Selected assessment seismic parameters are presented in Table 3.

Table 3. Parameters used in the seismic assessment

Seismic Parameter		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, Importance Level 2 Structure with a Design Life of 50 years
Ductility factor (μ)	2	Gib braced wall / Blocks A and B (along) / (As/NZS 1170.4, Table 6.5 (A))
	1.25	Tilt up panel / Blocks A and B (across)
	2	Gib braced walls / Lounge Room (along) / (As/NZS 1170.4, Table 6.5 (A))
	2	Gib braced walls / Lounge Room (across) / (As/NZS 1170.4, Table 6.5 (A))
	1.25	Tilt up panel / Garages (along)/ (SESOC recommendations Clause 4.1)
	1.25	Tilt up panel / Garages (across) /(SESOC recommendations Clause 4.1)

The seismic demand for 19 Aberfoyle Place has been calculated based on the current code requirements of NZS 1170.5 (Structural Design Actions 1170.5:2004). The capacity of the existing walls in the buildings was calculated from the assumed strengths of the existing materials and the number and length of walls present for both the along and across directions. These values were compared with the calculated seismic demand. The %NBS results are summarized in Table 4.

Table 4. Calculated % NBS

Label	Direction	NBS (%)	Comments
Block A	Along	31	Given by concrete tilt up panel out of plane moment capacity
	Across	69	Given by concrete tilt up panel in-plane capacity
Block B	Along	31	Given by GIB wall capacity
	Across	69	Given by concrete tilt up panel in-plane capacity
Lounge Room	Along	45	Given by plasterboard wall capacity
	Across	44	Given by plasterboard wall capacity
Garages	Along	29	Given by diaphragm capacity
	Across	39	Given by capacity of the connections

Note: Despite the architectural differences between Blocks A and B the lateral resisting systems are similar. No clear load paths were identified for the garages and roof sheeting was used for the calculations. The strength of 29% NBS is an estimation of the capacity.

For the garages following Intrusive investigations determined:

- Concrete panels are pined at top
- Walls are connected to each other at the corner by a single M12 bolt.

6 Results Discussion

Check of Blocks A and B is in agreement with the observations. The buildings have concrete walls evenly distributed in the across direction which provides the required capacity. However, the bracing capacity of the buildings in the along direction is provided through a combination of plywood walls and concrete walls which provides a capacity of 31% NBS.

The lounge room has well distributed timber walls in the along and across directions which provides a capacity of 44% NBS.

The garage has concrete walls in the along and across directions but it does not have an appropriate roof diaphragm to transfer earthquake induced forces to the back walls in the along direction. This provides a capacity about 29 % NBS.

7 Conclusions and Recommendations

Blocks A and B at 19 Aberfoyle Place have been assessed as having a capacity of 31%NBS and no critical structural weaknesses were found. Therefore, it is considered that the Blocks A and B at 19 Aberfoyle Place are **suitable for continued occupancy**.

For Blocks A and B, **strengthening of the buildings is recommended in the along direction**. We recommend strengthening to 67% NBS or 100% NBS if possible. Strengthening works would most likely involve design and installation of shear walls or portal frames for the building in the along direction.

In addition to the strengthening, repair works for Blocks A and B should include:

- Damage to the doors and windows by rehanging
- Repointing cracked brick veneer joints
- Replacement of the cracked brick veneers
- Cracking to internal wall and ceiling fibrous plaster linings should be repaired similar to that used for Gib linings in accordance with GIB 'Guidelines for repairing GIB plasterboard linings in wind and earthquake damaged properties'.

For Block A re-levelling is recommended for units 1, 2 and 7 which levels are out of the recommended level of 0.5%. This would likely involve low mobility grout injection in the affected area. For Block B and remaining units of block A, since the areas out of recommended level of 0.5% are limited and the levels are still within the tolerable limits, re-levelling is not recommended.

The Lounge room has been assessed as having a capacity of 44%NBS and no critical structural weaknesses were found. Therefore, it is considered that the Lounge room is **suitable for continued occupancy**.

For the Lounge room **Strengthening of the building is recommended** to a level of 67 % NBS and if possible to 100 %NBS. Strengthening will most likely involve installation of plasterboard bracings for some of the walls.

In addition to the strengthening, repair works for lounge room should include:

- Cracks in the perimeter concrete foundation should be filled by epoxy injection
- Cracks in the concrete floor should be filled by epoxy injection.

For the Lounge room, since the total variation in floor level is more than 50 mm and the floor has a slopes 0.8%, re-levelling is recommended. Re-levelling would likely involve low mobility grout injection below foundation.

The garages has been assessed as having a capacity of 29 % but no critical structural weaknesses were found. Therefore, it is considered that the garages are **suitable for continued occupation**.

The garages do not have appropriate diaphragm to transfer earthquake induced forces in the along direction. **Strengthening is recommended for the garages**. The strengthening will most likely involve installation of a cross-bracing in the roof and providing additional connections between the concrete panels.

In addition to the strengthening, repair works for the garages should include the followings:

- Repair cracks in the entrance gable wall by epoxy injection.

For the garages, since levels are within tolerable limits, no re-levelling is recommended.

Repair works for the site should include the followings:

- Replacement of the damaged concrete slabs around the buildings.

As a part of the strengthening and re-levelling works for buildings at 19 Aberfoyle Place, Parklands, **a geotechnical report** is recommended.

8 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.

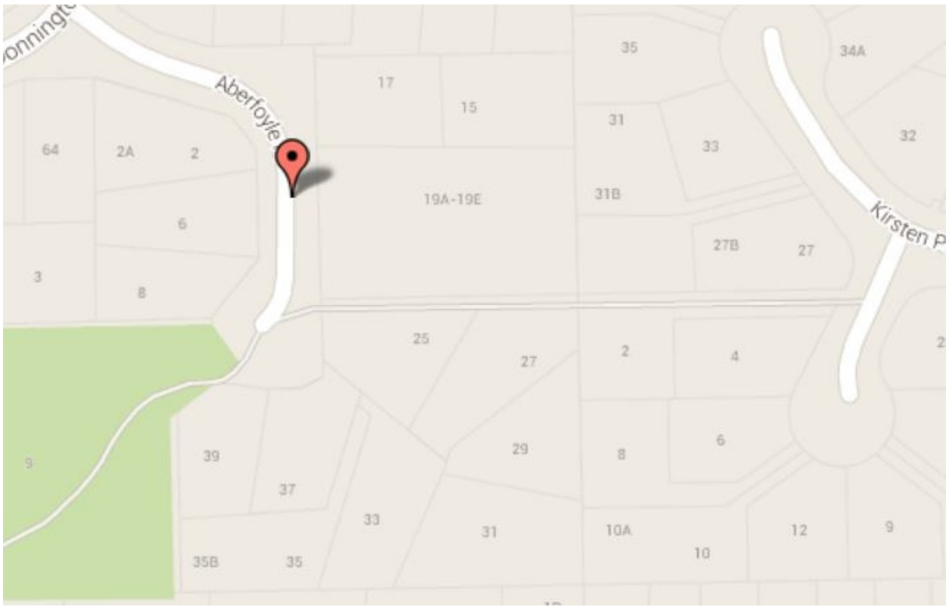
Without limiting any of the above, Aurecon's liability, whether under the law of contract, tort, statute, equity or otherwise, is limited as set out in the terms of the engagement with the client.

Appendices

Appendix A

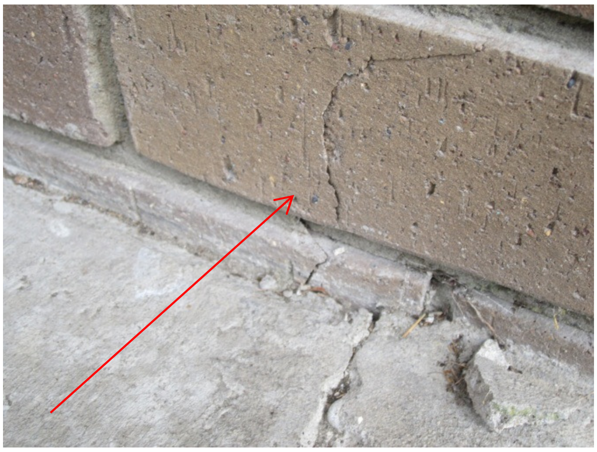
Site Map, Photos and Levels Survey

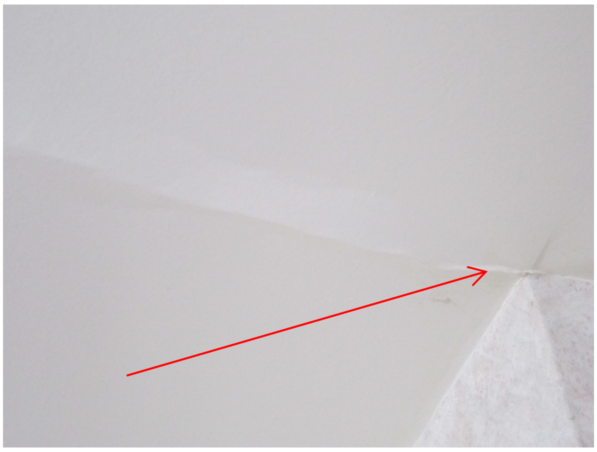
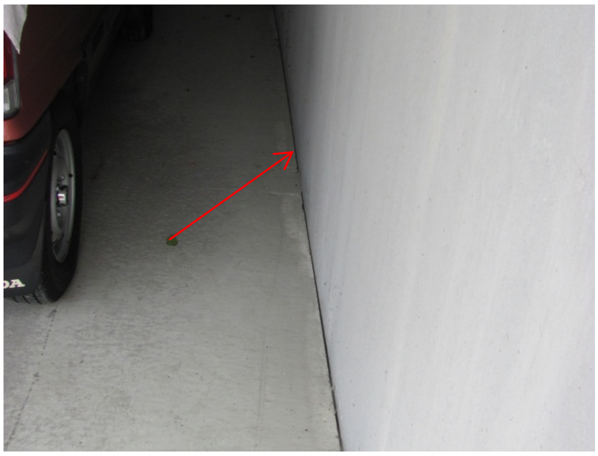
19 July 2013 –19 Aberfoyle Place Site Photographs

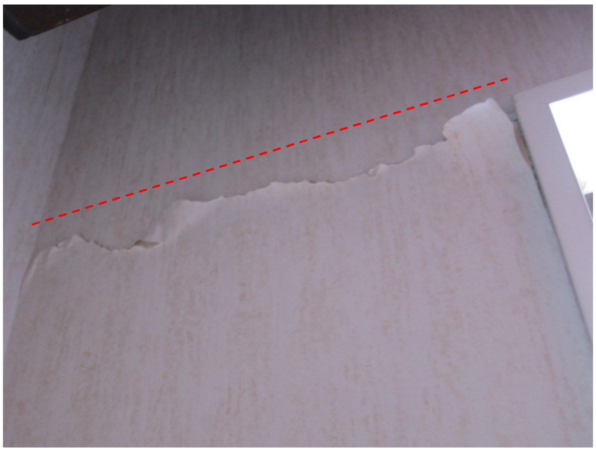
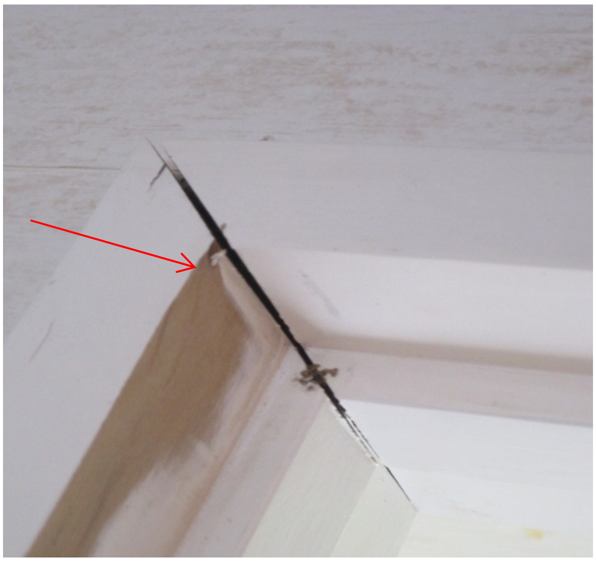


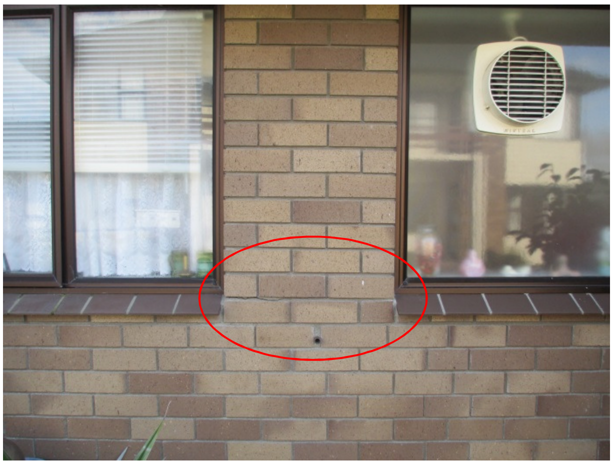
Damage	Site Photograph
Signs of possible liquefaction around the Lounge Room.	

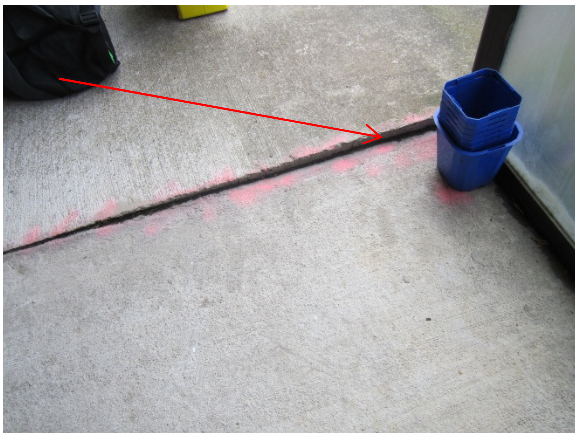
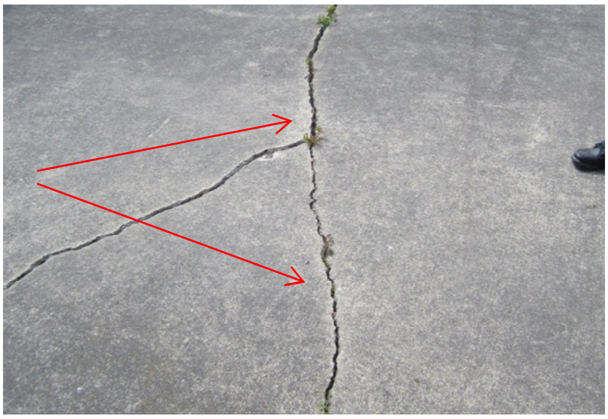
South Elevation of the lounge room.	
North elevation of Block A.	
South elevation of Block B.	

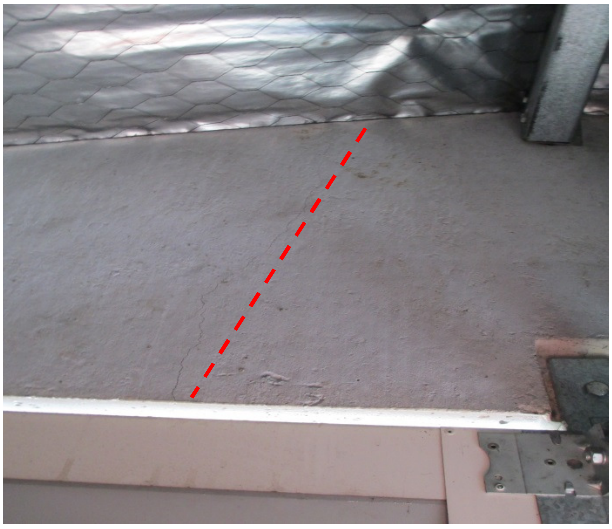
Typical cracks in the corners of the doors and windows.	
Cracks in the mortar of the brick walls.	
Cracks in brick veneer.	

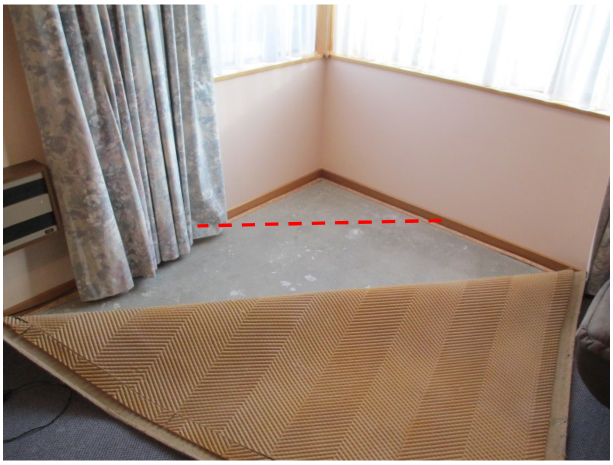
Minor cracks in the ceiling.	
Separation of the concrete wall from the surrounding concrete panel.	
Separation of the door frame from the plasterboard wall.	

Separation of the window from the wall.	
Cracks in the plaster board.	
Deformation of the door frame.	

Crack in the brick veneer.	
Cracks in the brick veneer.	
Cracks in the pavements between units.	

Settlement of the concrete slab around the units.	
Breaking of concrete on the east side of the site.	 
Garages	
Genral photo of the garage.	

Damage in the connection between two walls	
Cracks in the gable wall.	
Twist and movement of the gable wall.	

Twist of the DHS purlin.	
Intrusive investigations	
Intrusive investigation on the garage wall showing the M12 connection between the two walls.	
Intrusive investigation in the Lounge Room showing a minor crack in the concrete floor.	

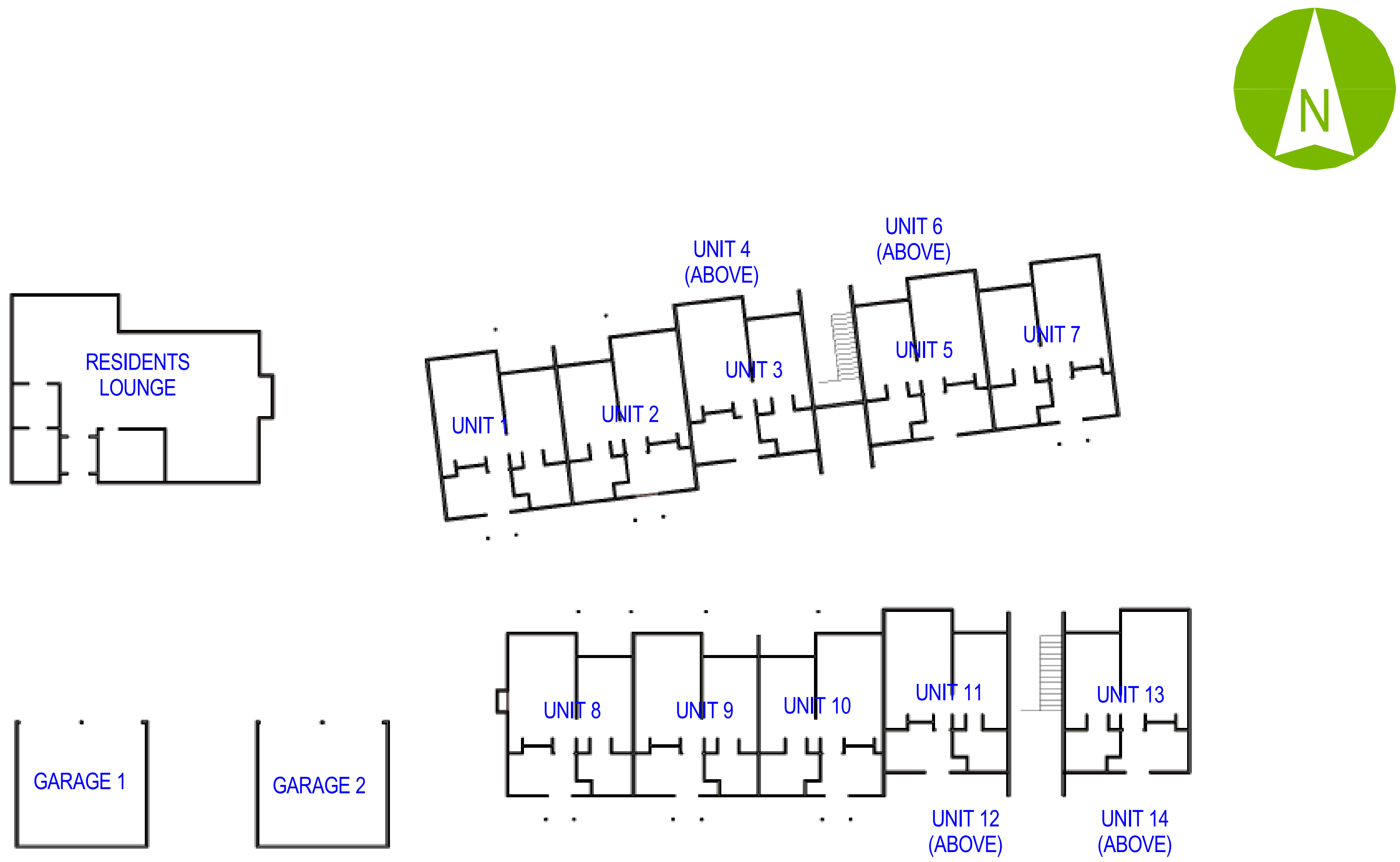
Intrusive investigation on the wall of unit 7 to check the wall behind. The investigation shows plywood behind the plasterboard wall.	

19 ABERFOYLE PLACE

CHRISTCHURCH

PRELIMINARY
NOT FOR CONSTRUCTION

SIZE	PROJECT No.	DATE	DRAWING No.	REV
A1	232536	DD-MM-YY	S-00-00	A



SITE PLAN

1 : 300

19/12/2012 5:29:50 p.m.

aurecon
www.aurecongroup.com

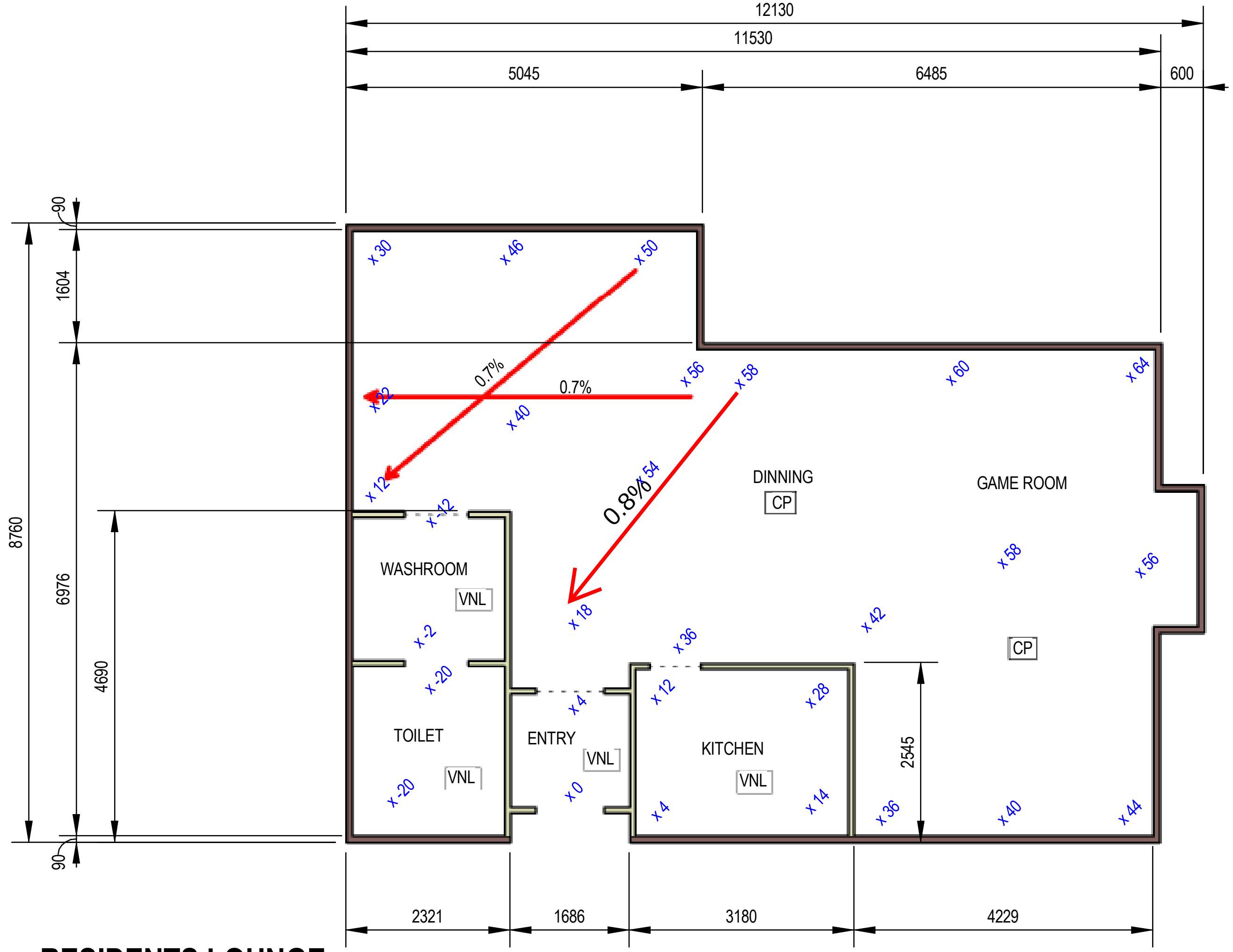
CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN: D.Lake
DESIGNED: Designer
CHECKED: M.Ardalany
APPROVED: Approver
DATE

PROJECT: CHRISTCHURCH
TITLE: SITE PLAN

PRELIMINARY
NOT FOR CONSTRUCTION
PROJECT No.: 232536
SCALE: 1 : 300
SIZE: A4
DRAWING No.: SK-000
REV: A



RESIDENTS LOUNGE

1 : 100

LEGEND

x ? = FLOOR LEVEL

CP = CARPET

VNL = VINYL

19/12/2012 5:29:51 p.m.

aurecon
www.aurecongroup.com

CLIENT	REV	DATE	REVISION DETAILS	APPROVAL
Christchurch City Council	A	12.12.12	LEVEL SURVEY	L. Howard

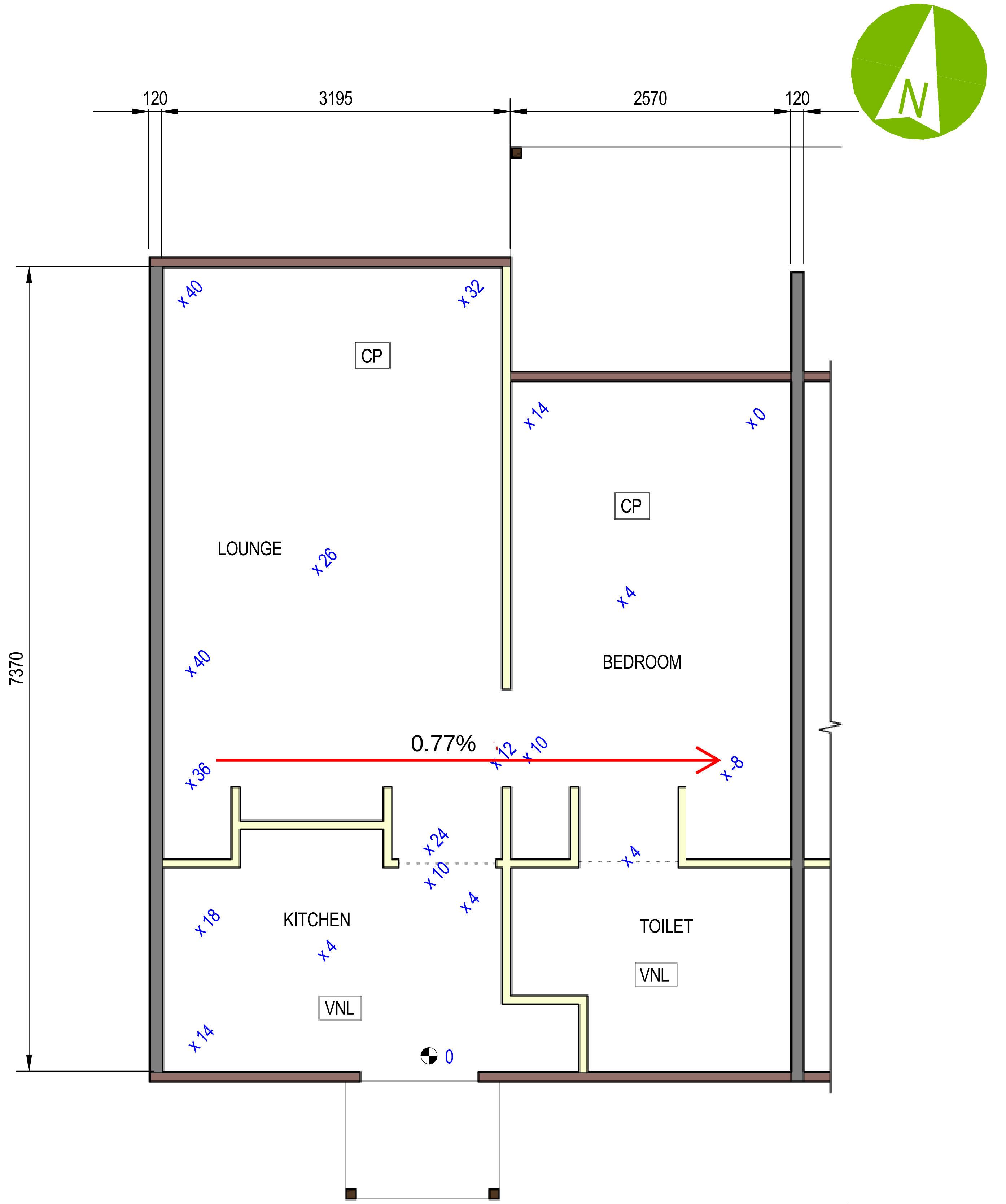
DRAWN	DESIGNED
D.Lake	Designer
CHECKED	
M.Ardalany	
APPROVED	DATE
Approver	

PROJECT: CHRISTCHURCH

TITLE: LEVEL SURVEY - RESIDENTS LOUNGE

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.	
232536	
SCALE	SIZE
As indicated	A4
DRAWING No.	REV
SK-015	A



LEGEND

x ? = FLOOR LEVEL

CP = CARPET

VNL = VINYL

FLAT 1

1 : 50

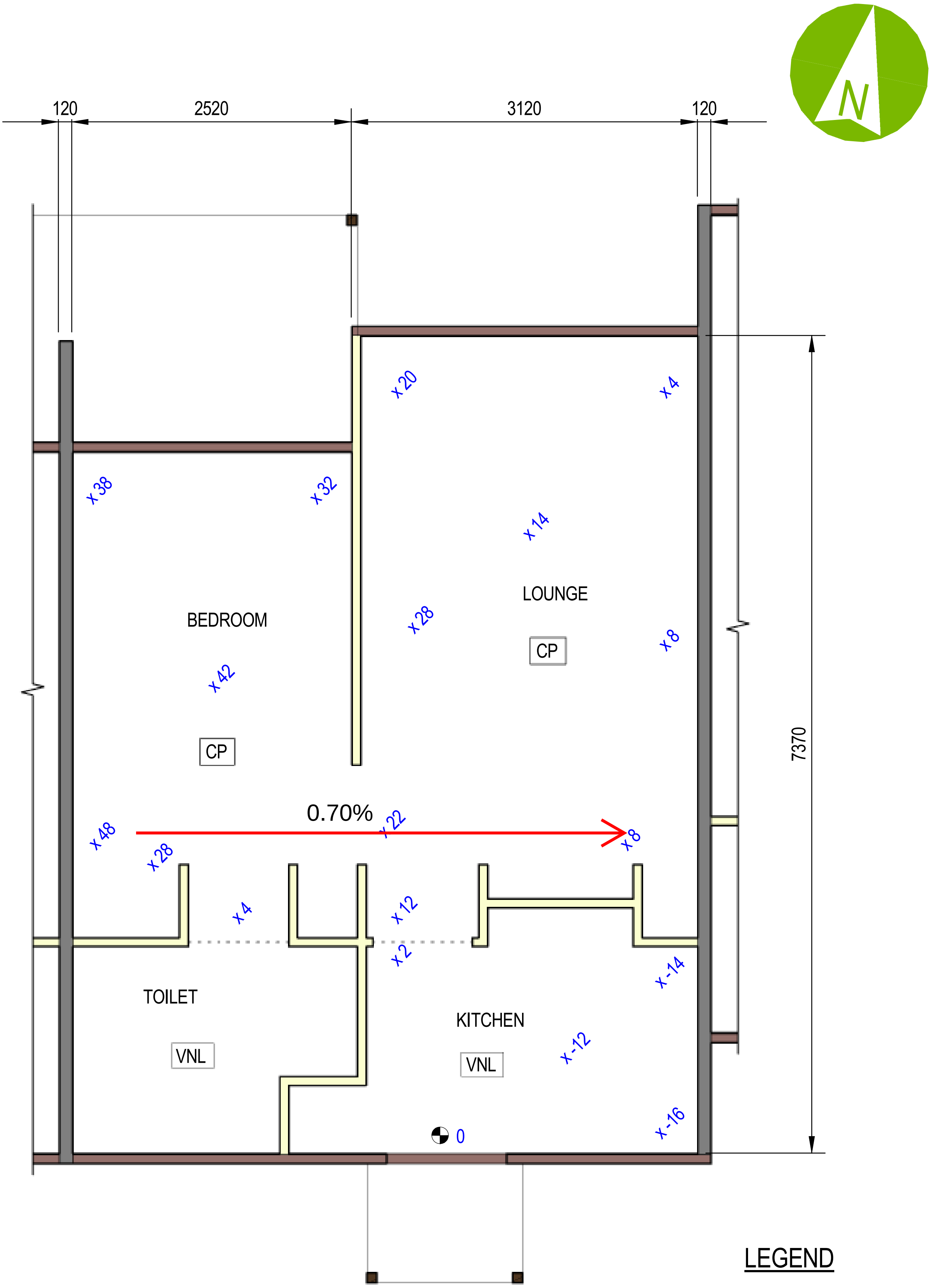
19/12/2012 5:28:48 p.m.

aurecon

CLIENT: Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN	D.Lake
DESIGNED	Designer
CHECKED	M.Ardalany
APPROVED	Approver
DATE	
PROJECT	CHRISTCHURCH
TITLE	LEVEL SURVEY - FLAT 1
	PRELIMINARY NOT FOR CONSTRUCTION
PROJECT No.	232536
SCALE	1 : 50
SIZE	A4
DRAWING No.	SK-001
REV	A



LEGEND

x ? = FLOOR LEVEL

CP = CARPET

VNL = VINYL

FLAT 2

1 : 50

19/12/2012 5:28:49 p.m.

aurecon

CLIENT: Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN	DESIGNED
D.Lake	Designer

CHECKED: M.Ardalany

APPROVED: Approver — DATE

PROJECT: CHRISTCHURCH

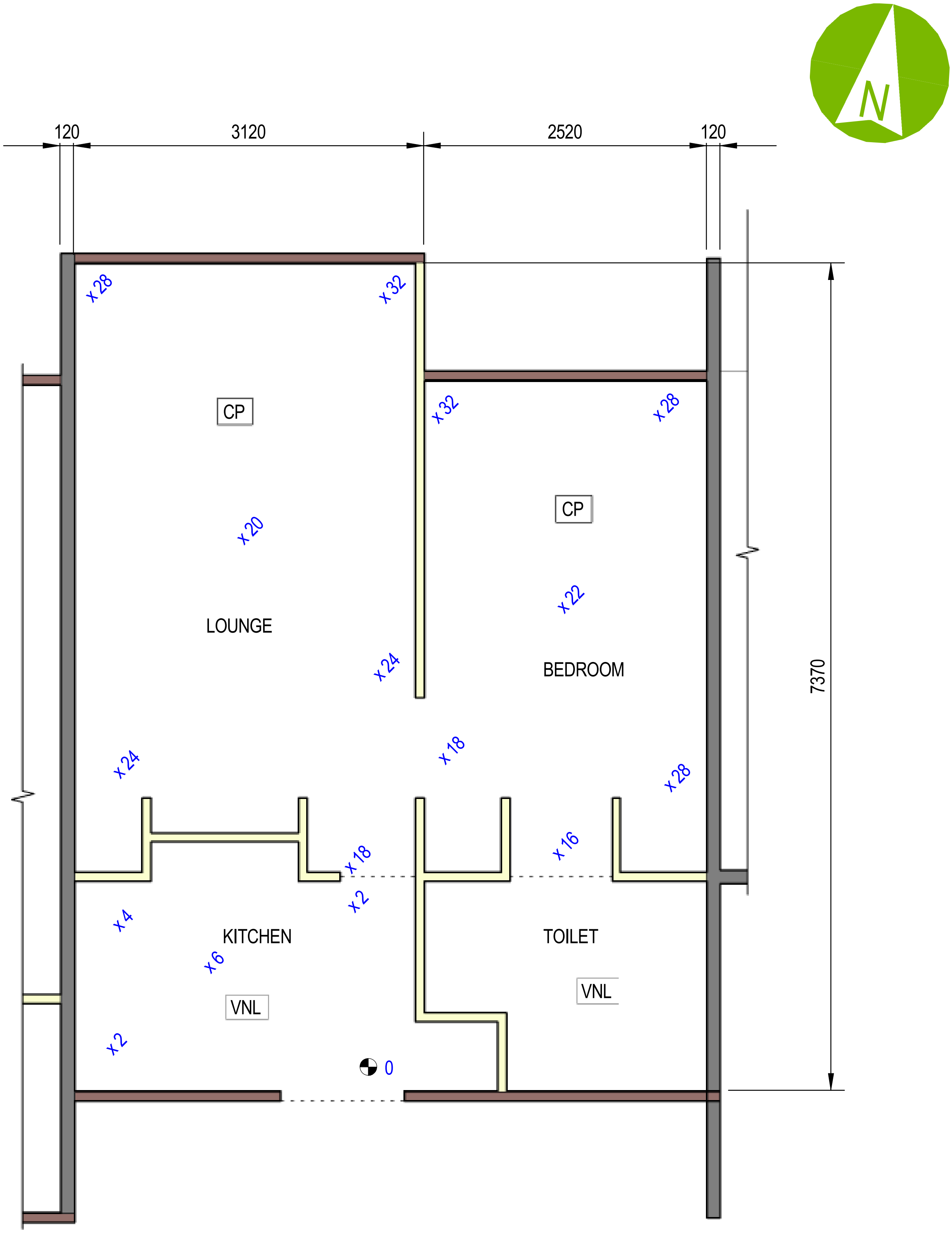
TITLE: LEVEL SURVEY - FLAT 2

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 232536

SCALE	SIZE
1 : 50	A4

DRAWING No.	REV
SK-002	A



LEGEND

x ? = FLOOR LEVEL

CP = CARPET

VNL = VINYL

FLAT 3

1 : 50

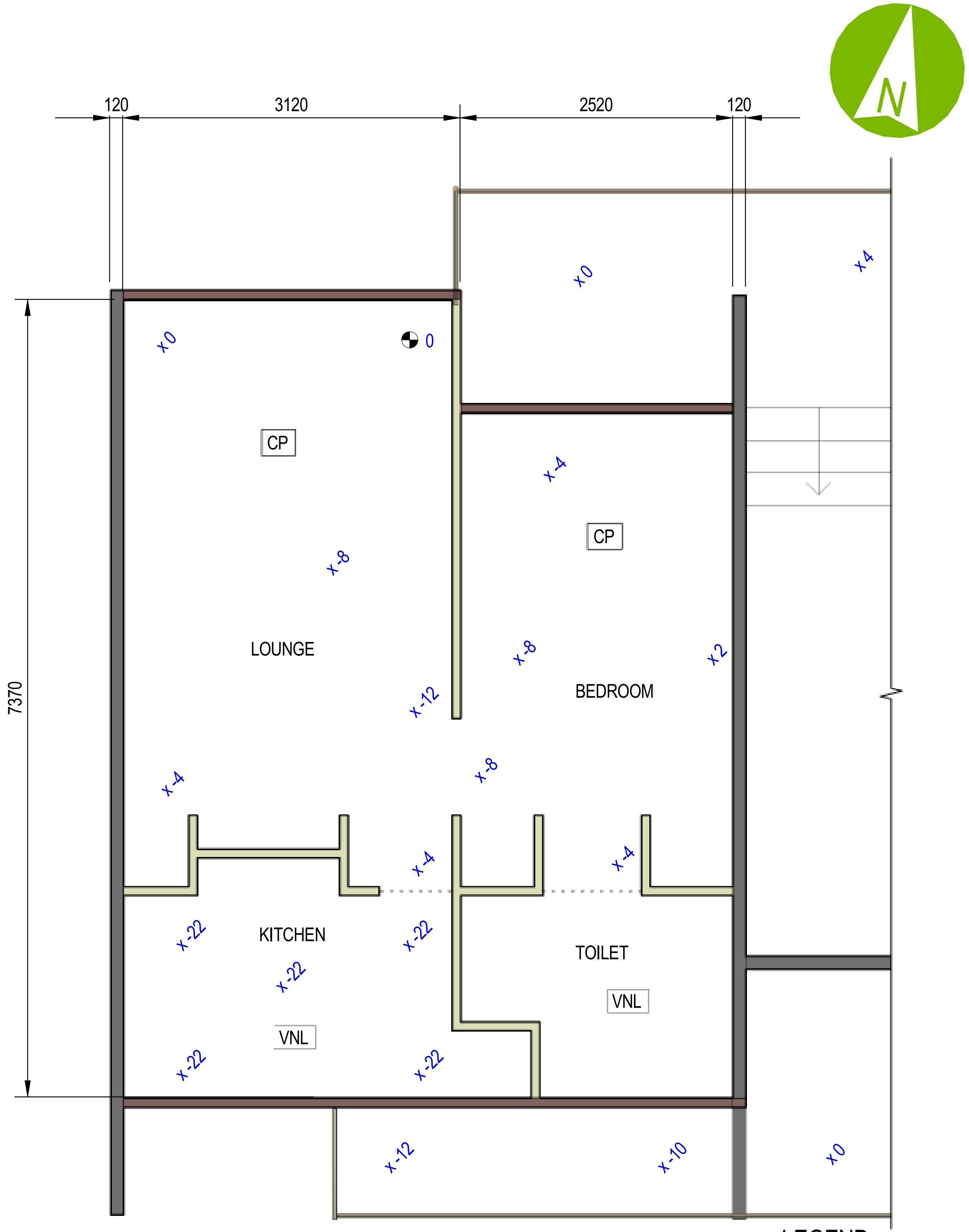
19/12/2012 5:28:49 p.m.

aurecon

CLIENT: Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN	D.Lake
DESIGNED	Designer
CHECKED	M.Ardalany
APPROVED	Approver
DATE	
PROJECT	CHRISTCHURCH
TITLE	LEVEL SURVEY - FLAT 3
PRELIMINARY	NOT FOR CONSTRUCTION
PROJECT No.	232536
SCALE	1 : 50
SIZE	A4
DRAWING No.	SK-003
REV	A



LEGEND

x ? = FLOOR LEVEL

CP = CARPET

VNL = VINYL

FLAT 4

1 : 50

19/12/2012 5:28:50 p.m.

aurecon

CLIENT

Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN	DESIGNED
D.Lake	Designer
CHECKED	
M.Ardalany	
APPROVED	DATE
Approver	

PROJECT: CHRISTCHURCH

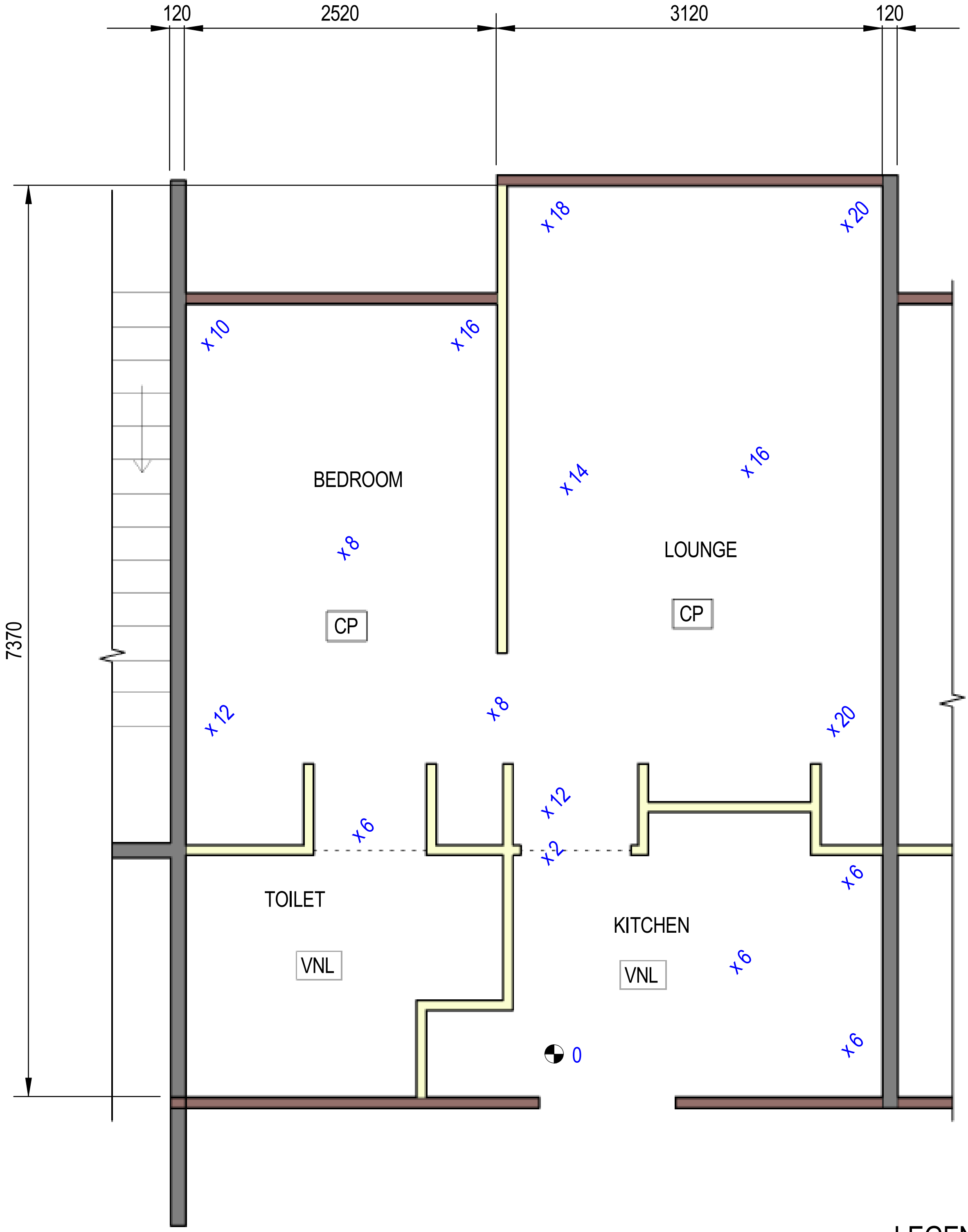
TITLE: LEVEL SURVEY - FLAT 4

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 232536

SCALE: 1 : 50 | SIZE: A4

DRAWING No.: SK-004 | REV: A



LEGEND

x ? = FLOOR LEVEL

CP = CARPET

VNL = VINYL

FLAT 5

1 : 50

19/12/2012 5:28:51 p.m.

aurecon

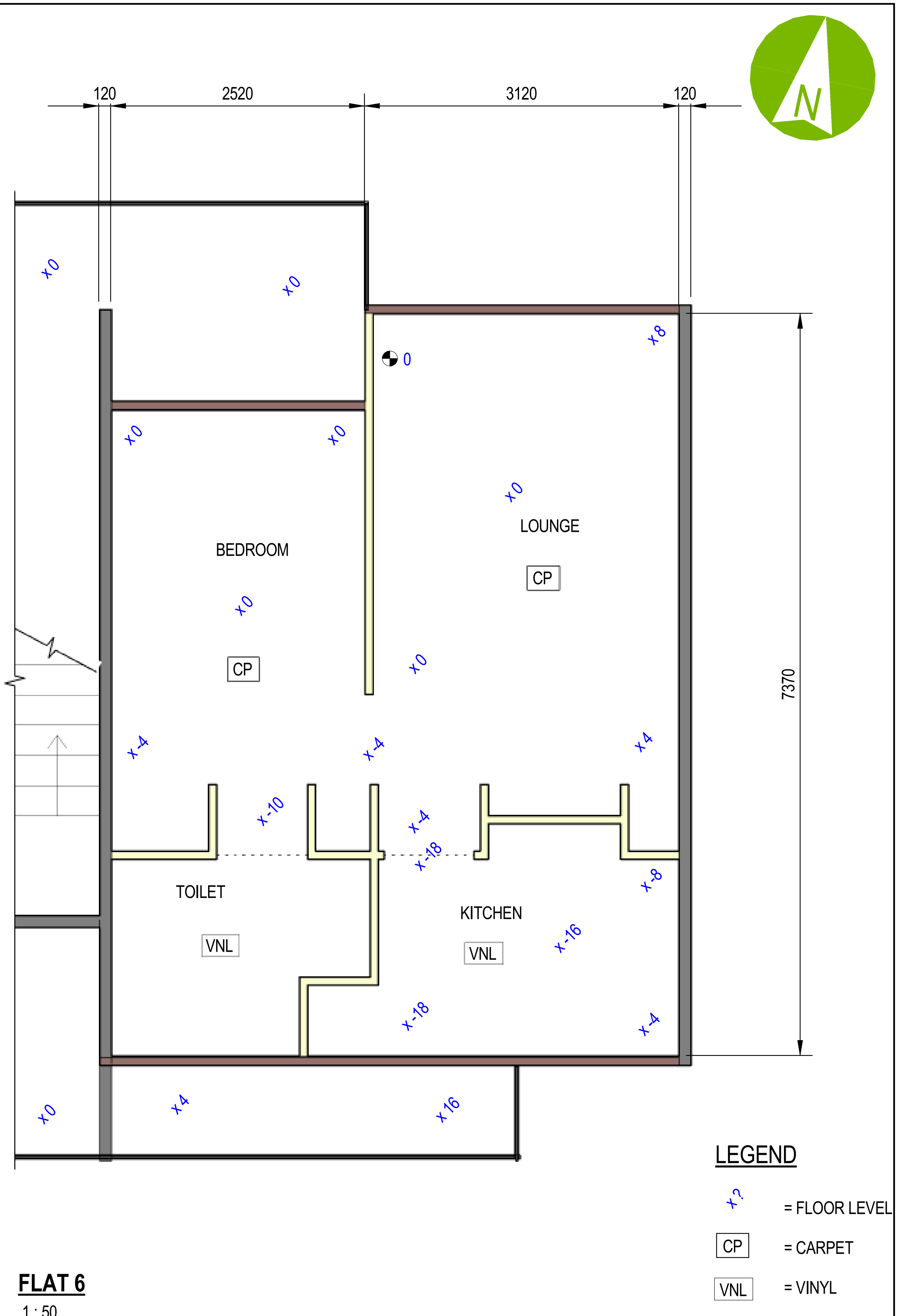
CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN: D.Lake | DESIGNED: Designer
CHECKED: M.Ardalany
APPROVED: Approver | DATE

PROJECT: CHRISTCHURCH
TITLE: LEVEL SURVEY - FLAT 5

PRELIMINARY
NOT FOR CONSTRUCTION
PROJECT No.: 232536
SCALE: 1 : 50 | SIZE: A4
DRAWING No.: SK-005 | REV: A



FLAT 6

1 : 50

19/12/2012 5:28:51 p.m.

aurecon

CLIENT: Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN	DESIGNED
D.Lake	Designer

CHECKED: M.Ardalany

APPROVED: Approver — DATE

PROJECT: CHRISTCHURCH

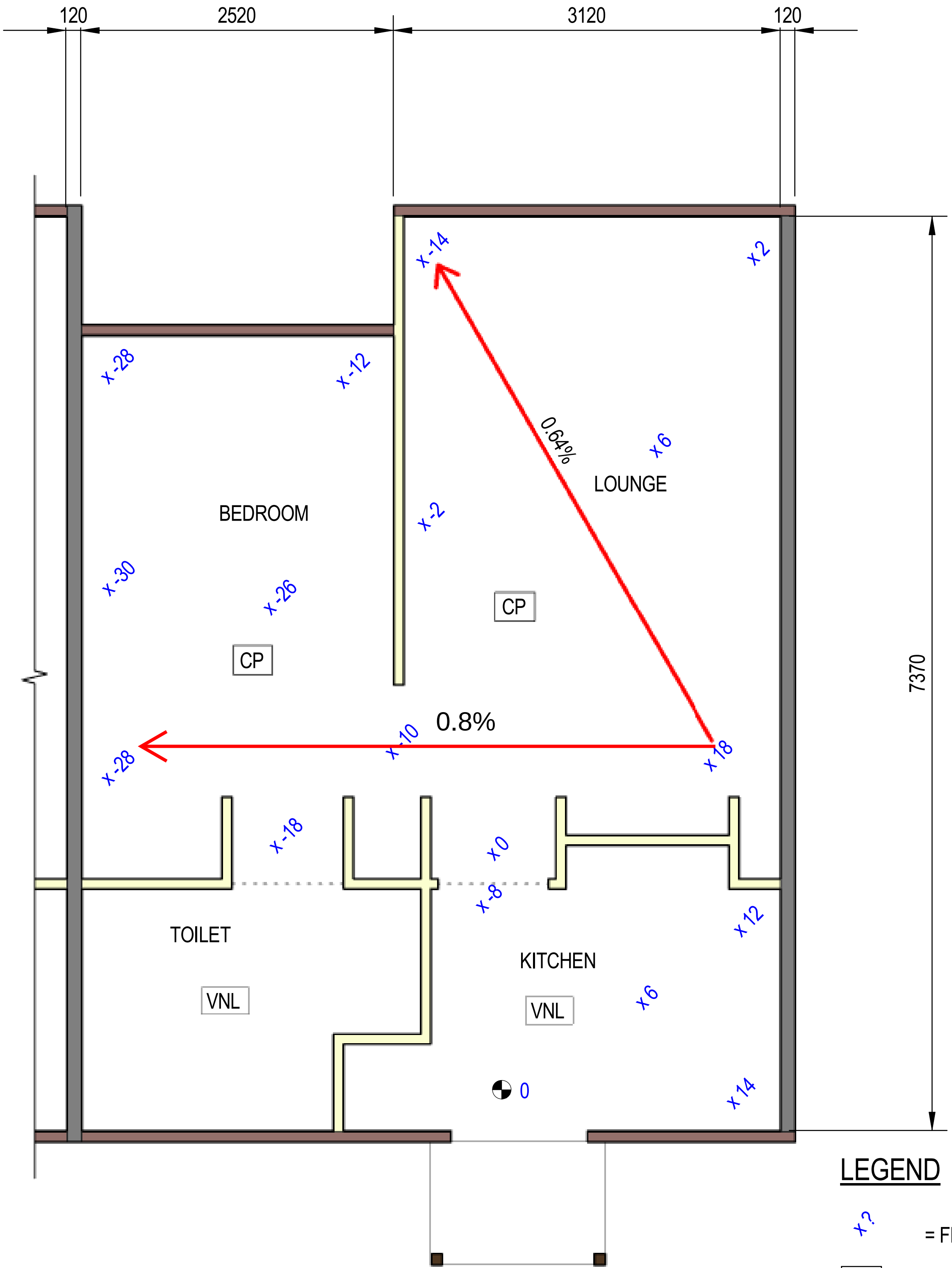
TITLE: LEVEL SURVEY - FLAT 6

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 232536

SCALE	SIZE
1 : 50	A4

DRAWING No.	REV
SK-006	A



LEGEND

x ?	= FLOOR LEVEL
CP	= CARPET
VNL	= VINYL

FLAT 7

1 : 50

19/12/2012 5:28:52 p.m.

aurecon

CLIENT: Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN: D.Lake | DESIGNED: Designer

CHECKED: M.Ardalany

APPROVED: Approver | DATE

PROJECT: CHRISTCHURCH

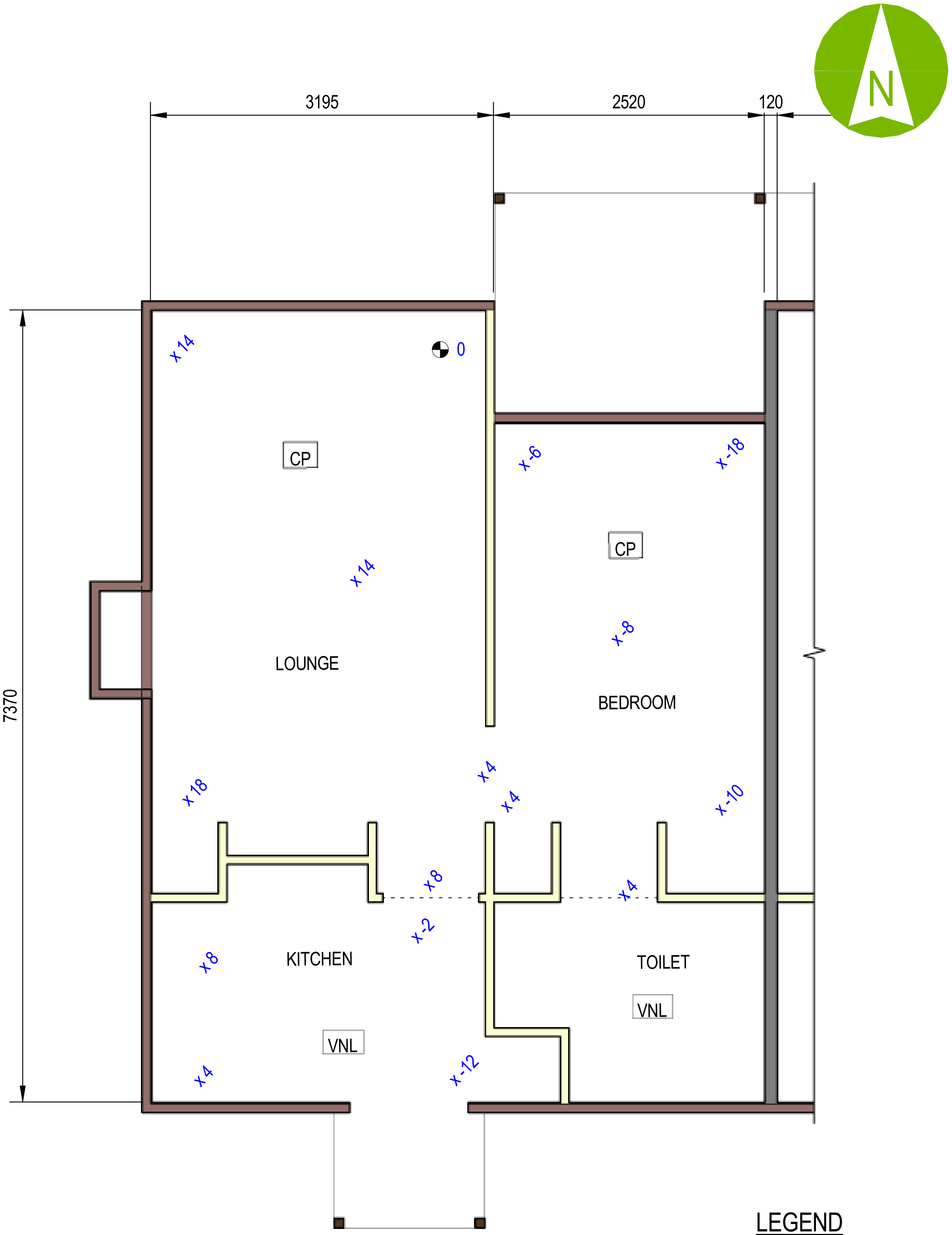
TITLE: LEVEL SURVEY - FLAT 7

PRELIMINARY NOT FOR CONSTRUCTION

PROJECT No.: 232536

SCALE: 1 : 50 | SIZE: A4

DRAWING No.: SK-007 | REV: A



LEGEND

x ? = FLOOR LEVEL

CP = CARPET

VNL = VINYL

FLAT 8

1 : 50

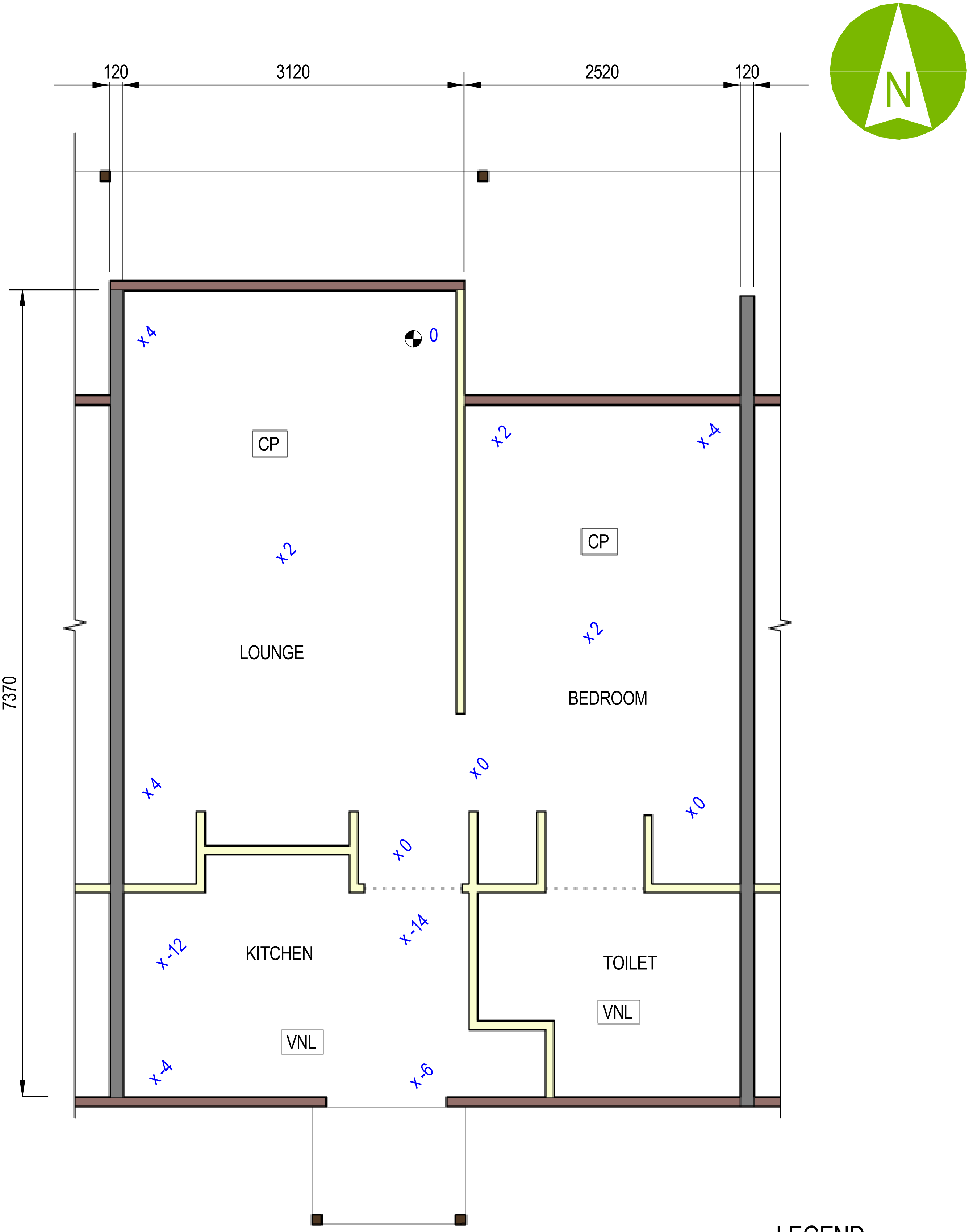
19/12/2012 5:28:52 p.m.

aurecon

CLIENT: Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN	D.Lake
DESIGNED	Designer
CHECKED	M.Ardalany
APPROVED	Approver
DATE	
PROJECT	CHRISTCHURCH
TITLE	LEVEL SURVEY - FLAT 8
PRELIMINARY	NOT FOR CONSTRUCTION
PROJECT No.	232536
SCALE	1 : 50
SIZE	A4
DRAWING No.	SK-008
REV	A



LEGEND

x ? = FLOOR LEVEL

CP = CARPET

VNL = VINYL

FLAT 9

1 : 50

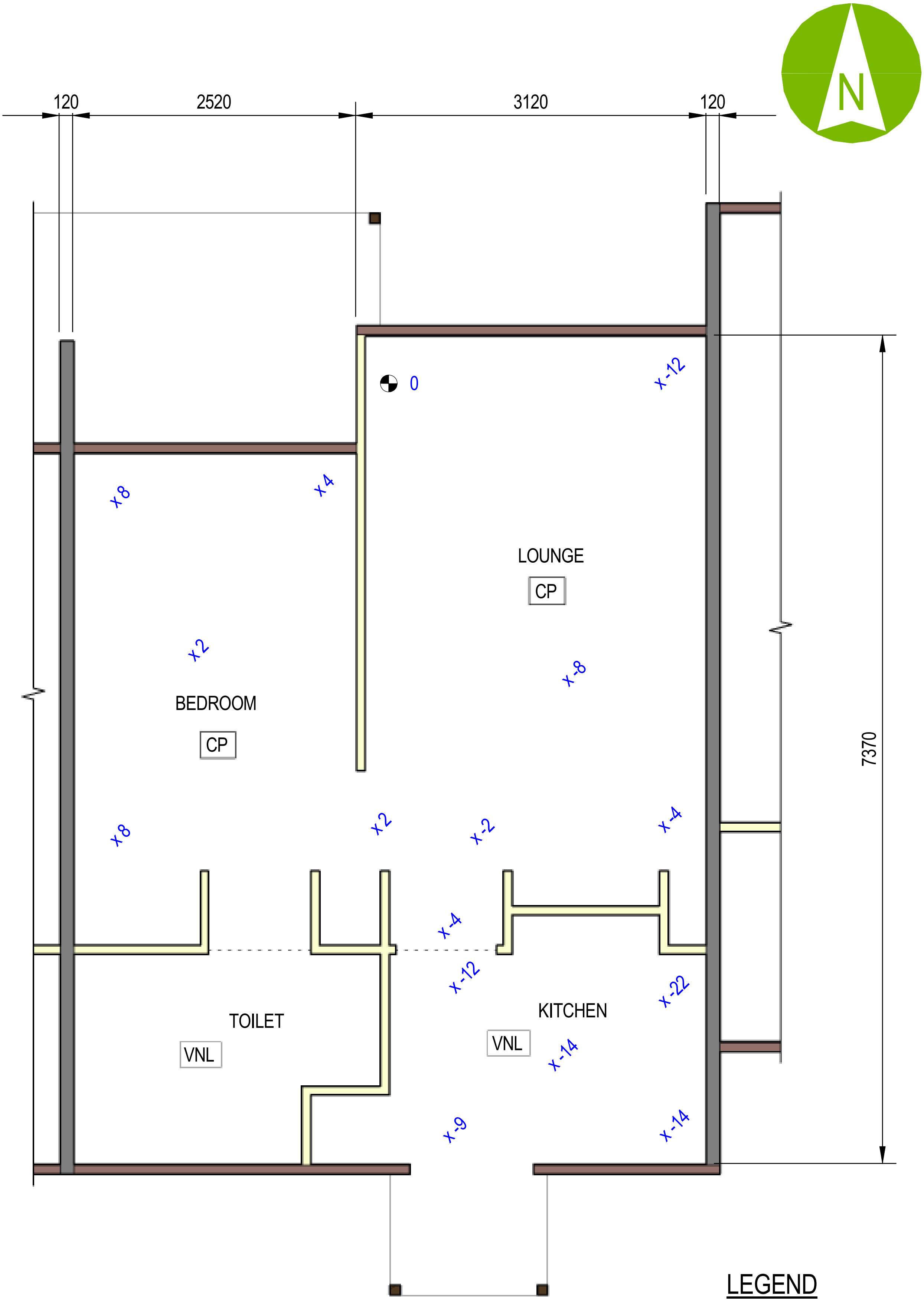
19/12/2012 5:28:53 p.m.

aurecon

CLIENT: Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN	D.Lake
DESIGNED	Designer
CHECKED	M.Ardalany
APPROVED	Approver
DATE	
PROJECT	CHRISTCHURCH
TITLE	LEVEL SURVEY - FLAT 9
	PRELIMINARY NOT FOR CONSTRUCTION
PROJECT No.	232536
SCALE	1 : 50
SIZE	A4
DRAWING No.	SK-009
REV	A



LEGEND

x ? = FLOOR LEVEL

CP = CARPET

VNL = VINYL

FLAT 10

1 : 50

19/12/2012 5:28:53 p.m.

aurecon

CLIENT: Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

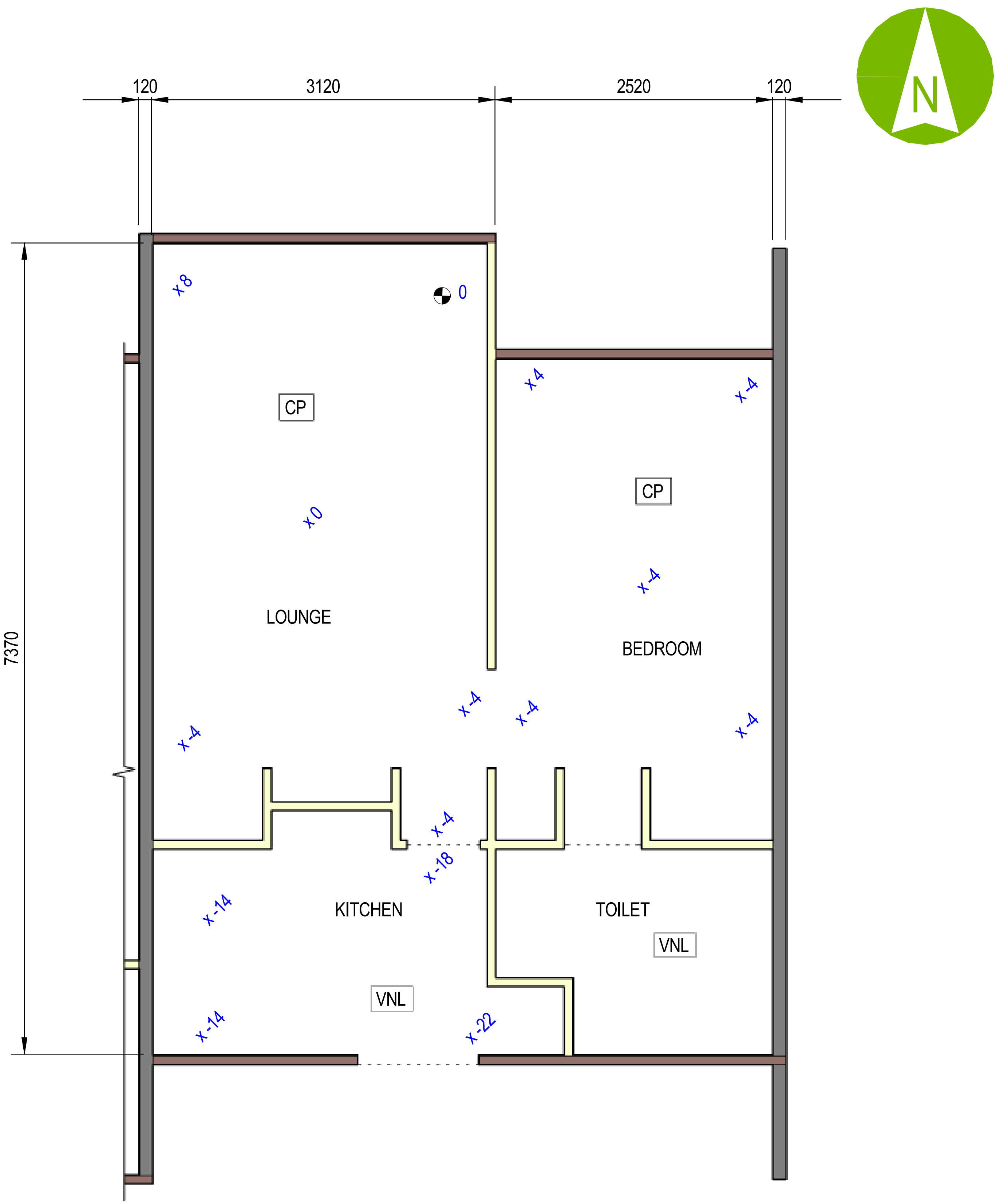
DRAWN	DESIGNED
D.Lake	Designer
CHECKED	
M.Ardalany	
APPROVED	DATE
Approver	

PROJECT: CHRISTCHURCH

TITLE: LEVEL SURVEY - FLAT 10

PRELIMINARY NOT FOR CONSTRUCTION

PROJECT No.	SCALE	SIZE	DRAWING No.	REV
232536	1 : 50	A4	SK-010	A



LEGEND

x ? = FLOOR LEVEL

CP = CARPET

VNL = VINYL

FLAT 11

1 : 50

19/12/2012 5:28:54 p.m.

aurecon

CLIENT

Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN: D.Lake
DESIGNED: Designer
CHECKED: M.Ardalany
APPROVED: Approver
DATE

PROJECT: CHRISTCHURCH

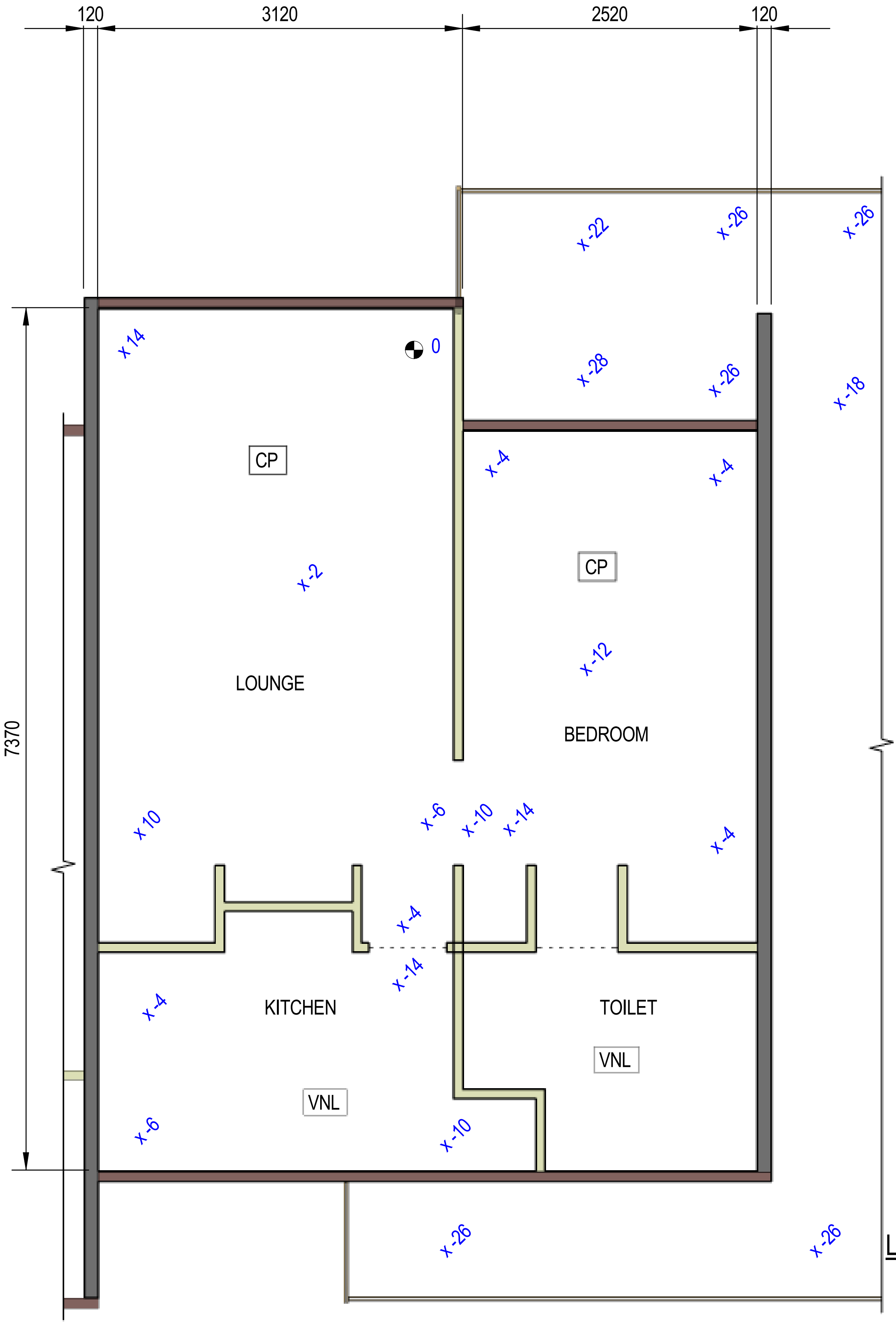
TITLE: LEVEL SURVEY - FLAT 11

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 232536

SCALE: 1 : 50
SIZE: A4

DRAWING No.: SK-011
REV: A



LEGEND

x ? = FLOOR LEVEL

CP = CARPET

VNL = VINYL

FLAT 12

1 : 50

19/12/2012 5:28:54 p.m.

aurecon
www.aurecongroup.com

CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

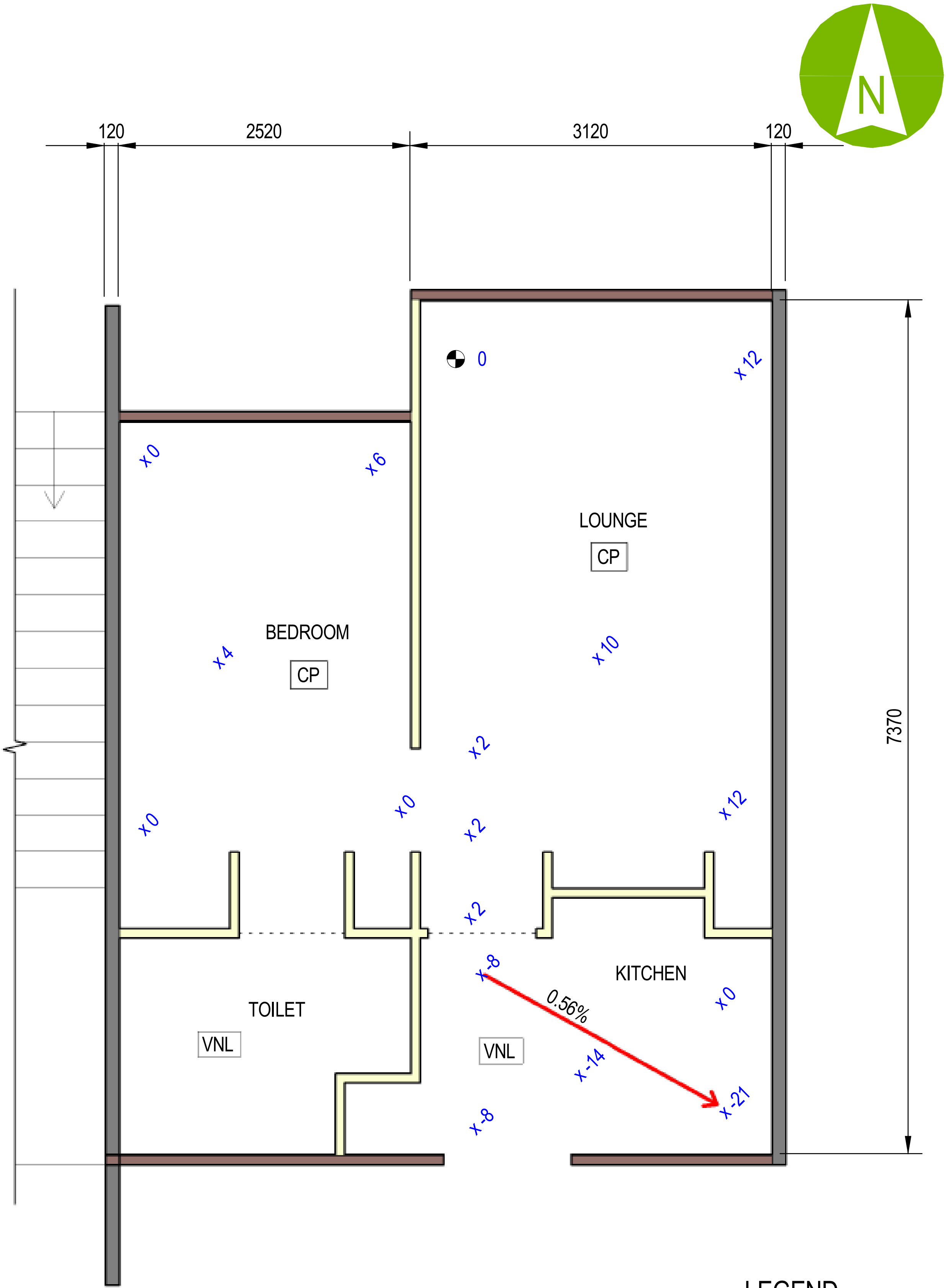
DRAWN	DESIGNED
D.Lake	Designer
CHECKED	
M.Ardalany	
APPROVED	DATE
Approver	

PROJECT
CHRISTCHURCH

TITLE
LEVEL SURVEY - FLAT 12

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.	
232536	
SCALE	SIZE
1 : 50	A4
DRAWING No.	REV
SK-012	A



LEGEND

x ? = FLOOR LEVEL

CP = CARPET

VNL = VINYL

FLAT 13

1 : 50

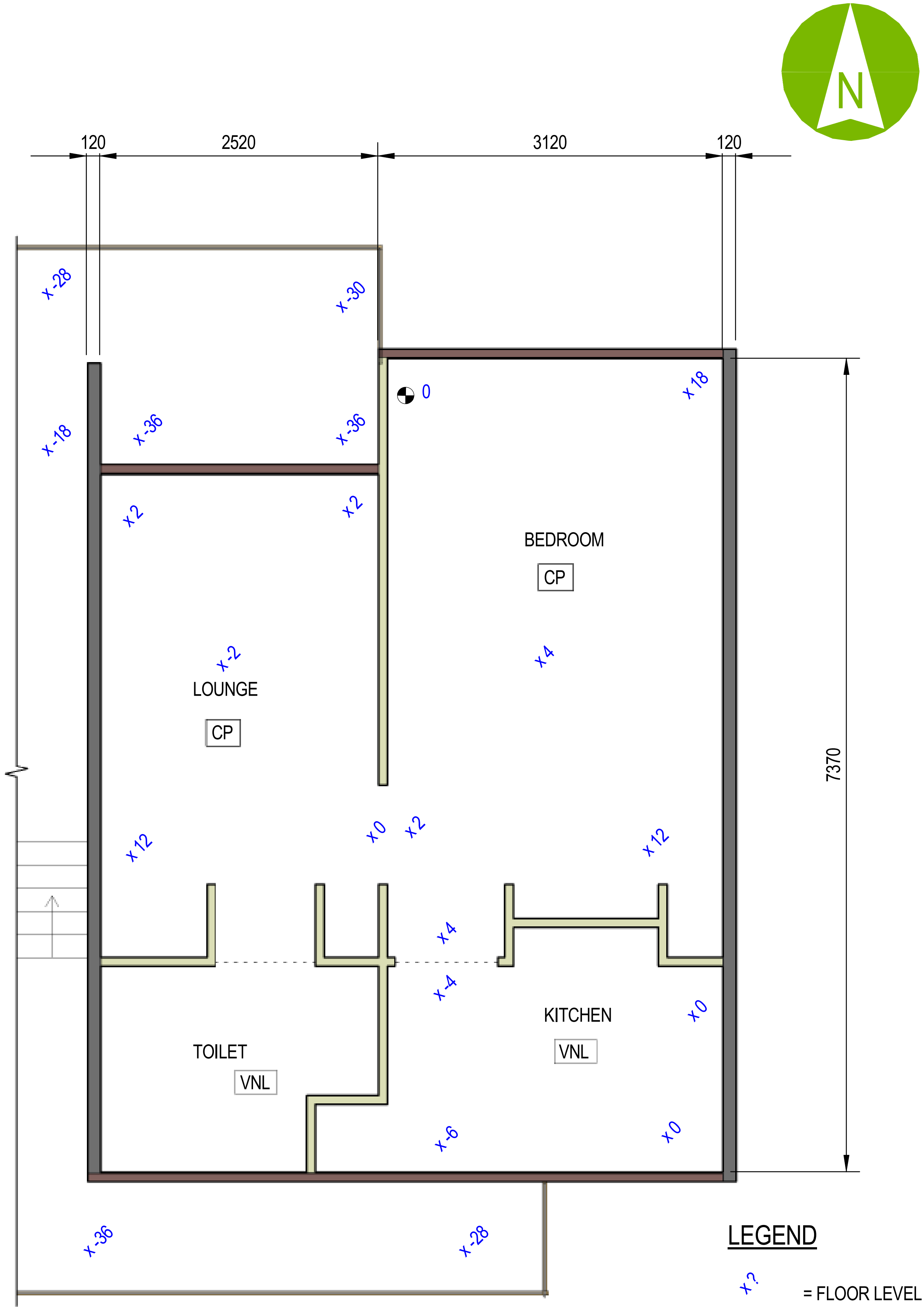
19/12/2012 5:28:55 p.m.

aurecon
www.aurecongroup.com

CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN	D.Lake
DESIGNED	Designer
CHECKED	M.Ardalany
APPROVED	Approver
DATE	
PROJECT	CHRISTCHURCH
TITLE	LEVEL SURVEY - FLAT 13
	PRELIMINARY NOT FOR CONSTRUCTION
PROJECT No.	232536
SCALE	1 : 50
SIZE	A4
DRAWING No.	SK-013
REV	A



LEGEND

x ? = FLOOR LEVEL

CP = CARPET

VNL = VINYL

FLAT 14

1 : 50

19/12/2012 5:28:55 p.m.

aurecon

CLIENT: Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN: D.Lake
DESIGNED: Designer
CHECKED: M.Ardalany
APPROVED: Approver
DATE

PROJECT: CHRISTCHURCH

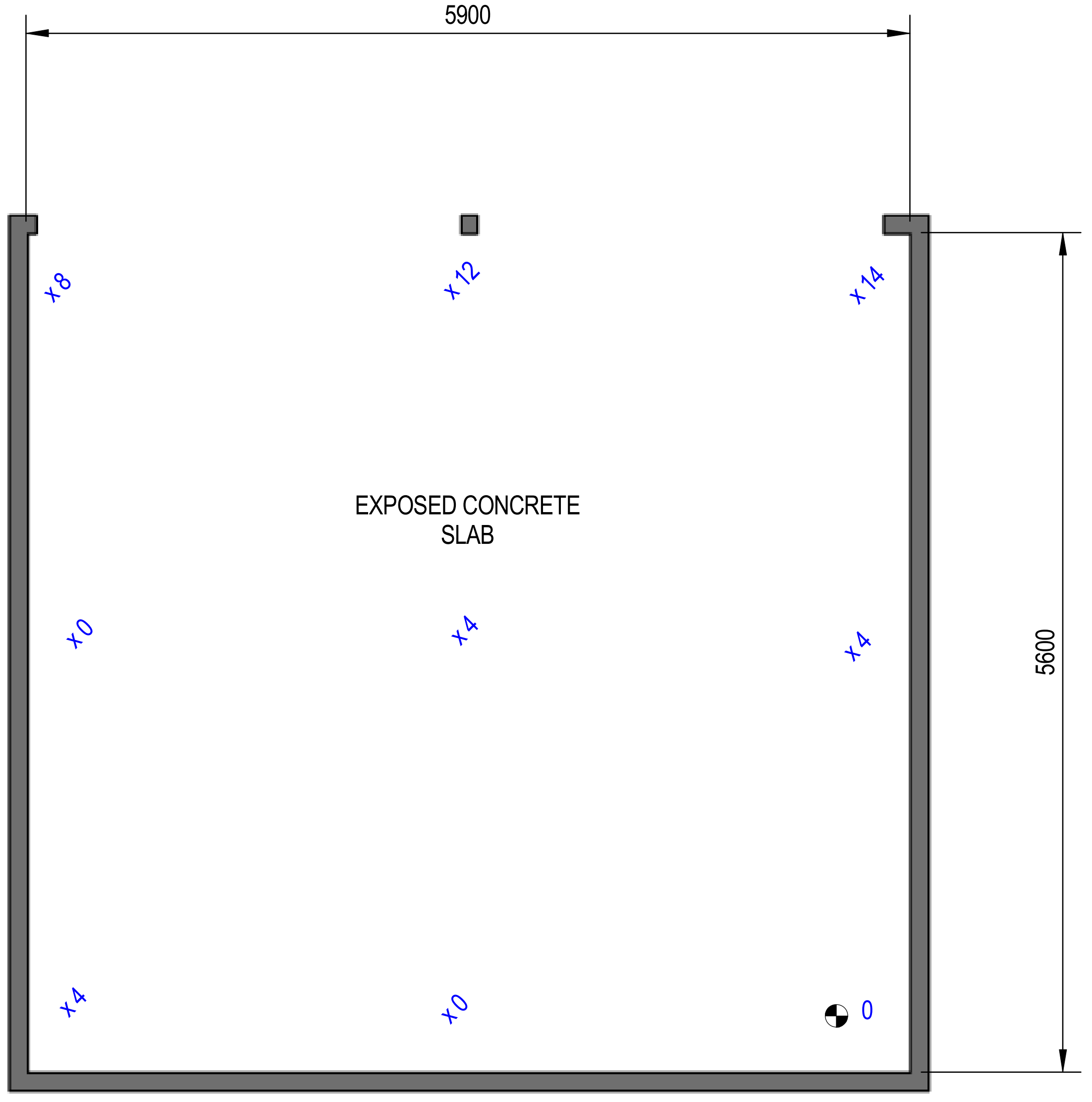
TITLE: LEVEL SURVEY - FLAT 14

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 232536

SCALE: 1 : 50
SIZE: A4

DRAWING No.: SK-014
REV: A



GARAGE 1

1 : 50

LEGEND

x ? = FLOOR LEVEL

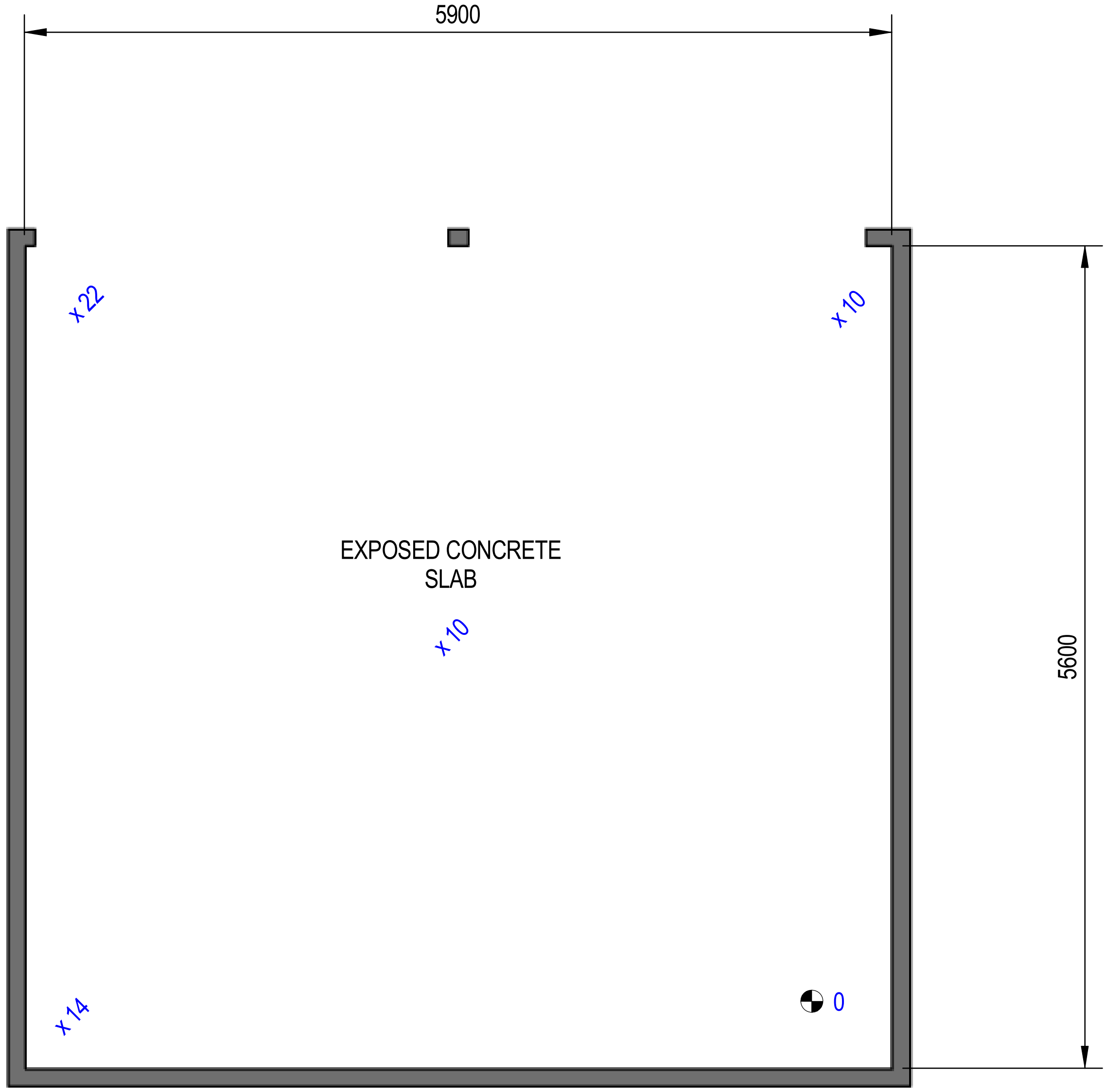
19/12/2012 5:28:56 p.m.

aurecon

CLIENT: Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN	D.Lake
DESIGNED	Designer
CHECKED	M.Ardalany
APPROVED	Approver
DATE	
PROJECT	CHRISTCHURCH
TITLE	LEVEL SURVEY - GARAGE 1
	PRELIMINARY NOT FOR CONSTRUCTION
PROJECT No.	232536
SCALE	1 : 50
SIZE	A4
DRAWING No.	SK-016
REV	A



GARAGE 2

1 : 50

LEGEND

x ? = FLOOR LEVEL

19/12/2012 5:28:57 p.m.

aurecon

CLIENT: Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	12.12.12	LEVEL SURVEY	L. Howard

DRAWN	DESIGNED
D.Lake	Designer

CHECKED: M.Ardalany

APPROVED: Approver — DATE

PROJECT: CHRISTCHURCH

TITLE: LEVEL SURVEY - GARAGE 2

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 232536

SCALE	SIZE
1 : 50	A4

DRAWING No.	REV
SK-017	A

Appendix B
References

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

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

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

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

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

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

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

8. Standards New Zealand, "NZS 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 Quantitative 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 quantitative 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 Spreadsheets

PRO 0118 B001 – Block A

PRO 0118 B004 – Block B

PRO 0118 B002 – Block C Lounge Room

PRO 0118 B003 – Block D Garage

PRO 0118 B005 – Block E Garage

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	19 Aberfoyle Place - Block A	Reviewer:	Lee Howard
	Unit / No: 19 / Street: Aberfoyle PL	CPEng No:	1008889
Building Address:	1, 2, 3, 4, 5, 6, 7	Company:	Aurecon
Legal Description:	LOT 16 DP 53592	Company project number:	232536
		Company phone number:	33660821
GPS south:	Degrees 43, Min 29, Sec 0.78	Date of submission:	16/10/2013
GPS east:	Degrees 172, Min 42, Sec 29.67	Inspection Date:	19/07/2013
		Revision:	2
Building Unique Identifier (CCC):	PRO 0118 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):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	

Building

No. of storeys above ground:	2	single storey = 1	Ground floor elevation (Absolute) (m):	0.00
Ground floor split?	no		Ground floor elevation above ground (m):	0.00
Storeys below ground	0			
Foundation type:	pads with tie beams		if Foundation type is other, describe:	
Building height (m):	6.00		height from ground to level of uppermost seismic mass (for IEP only) (m):	6
Floor footprint area (approx):	185			
Age of Building (years):	21		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):	multi-unit residential			
Use notes (if required):				
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber truss	truss depth, purlin type and cladding	2658 mm, timber, steel
Floors:	concrete flat slab	slab thickness (mm)	160
Beams:	none	overall depth x width (mm x mm)	
Columns:	precast concrete	typical dimensions (mm x mm)	
Walls:	load bearing concrete	#N/A	

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	**Note: Define along and across in detailed report!**		
Ductility assumed, μ:	2.00		note typical wall length (m)	
Period along:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	concrete shear wall		enter wall data in "IEP period calcs"	
Ductility assumed, μ:	1.25		worksheet for period calculation	
Period across:	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?	

Separations:

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

Non-structural elements

Stairs:	precast, full flight	describe supports	Precast stairs
Wall cladding:	brick or tile	describe (note cavity if exists)	Brick
Roof Cladding:	Metal	describe	Corrugated
Glazing:	aluminium frames		
Ceilings:	plaster, fixed		
Services(list):			

Available documentation

Architectural	partial	original designer name/date	CCC/1991
Structural	partial	original designer name/date	CCC/1991
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:	25-100m	notes (if applicable):	Some settlement exist
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	none apparent	notes (if applicable):	Some liquefaction may exist in the area
Lateral Spread:		notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	0-20mm/20m	notes (if applicable):	Some crack in the concrete slab on garde
Damage to area:	slight	notes (if applicable):	Concrete slab cracking

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):			
Across	Damage ratio:	0%		
	Describe (summary):			
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	no	Describe:	

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

Recommendations

	Level of repair/strengthening required:	significant structural	Describe:	Longitudinal direction strengthening to 67 %
	Building Consent required:	yes	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	31% ##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	Quantitative
	Assessed %NBS after e'quakes:	31%		
Across	Assessed %NBS before e'quakes:	69% ##### %NBS from IEP below		
	Assessed %NBS after e'quakes:	69%		

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: 6m

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**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

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

2.7 Baseline %NBS, $(NBS\%)_b = (\%NBS)_{nom}$ x A x B x C x D x E **$\%NBS_b$**: **#DIV/0!** **#DIV/0!**

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

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

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	19 Aberfoyle Place - Block B	Reviewer:	Lee Howard
Building Address:	8, 9 ,10, 11, 12, 13, 14, 15 — Unit No: 19 — Street: Aberfoyle PL	CPEng No:	1008889
Legal Description:	LOT 16 DP 53592	Company:	Aureon
		Company project number:	232536
		Company phone number:	33660821
GPS south:	Degrees 43, Min 29, Sec 0.81	Date of submission:	16/10/2013
GPS east:	Degrees 172, Min 42, Sec 30.01	Inspection Date:	19/07/2013
		Revision:	2
Building Unique Identifier (CCC):	PRO 0118 B004	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):	0.00

Building

No. of storeys above ground:	2 (single storey = 1)	Ground floor elevation (Absolute) (m):	0.00
Ground floor split?	no	Ground floor elevation above ground (m):	0.00
Storeys below ground	0		
Foundation type:	pads with tie beams	if Foundation type is other, describe:	
Building height (m):	6.00	height from ground to level of uppermost seismic mass (for IEP only) (m):	6
Floor footprint area (approx):	260		
Age of Building (years):	21	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):	multi-unit residential		
Use notes (if required):			
Importance level (to NZS1170.5):	IL2		

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber truss	truss depth, purlin type and cladding	2658mm, timber, steel
Floors:	concrete flat slab	slab thickness (mm)	160
Beams:	none	overall depth x width (mm x mm)	
Columns:	precast concrete	typical dimensions (mm x mm)	
Walls:	load bearing concrete	#N/A	

Lateral load resisting structure

Note: Define along and across in detailed report!

Lateral system along:	lightweight timber framed walls		note typical wall length (m)	Combination of timber walls & concrete
Ductility assumed, μ:	2.00			
Period along:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	concrete shear wall		enter wall data in "IEP period calcs" worksheet for period calculation	
Ductility assumed, μ:	1.25			
Period across:	0.40	0.19 from parameters in sheet	estimate or calculation?	estimated
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:	precast, full flight	describe supports	
Wall cladding:	brick or tile	describe (note cavity if exists)	Brick
Roof Cladding:	Metal	describe	Corrugated steel
Glazing:	steel frames		
Ceilings:	plaster, fixed		
Services(list):			

Available documentation

Architectural	partial	original designer name/date	CCC/1991
Structural	partial	original designer name/date	CCC/1991
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:	25-100m	notes (if applicable):	Values from levels of the building
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	none apparent	notes (if applicable):	Some liquefaction exist in the area
Lateral Spread:		notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	0-20mm/20m	notes (if applicable):	Some crack at concrete slab on grade
Damage to area:	slight	notes (if applicable):	Concrete slab cracking

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):			
Across	Damage ratio:	0%		
	Describe (summary):			
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	no	Describe:	

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

Recommendations

	Level of repair/strengthening required:	significant structural	Describe:	Longitudinal direction strengthening to 67 %
	Building Consent required:	yes	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	31% ##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	Quantitative
	Assessed %NBS after e'quakes:	31%		
Across	Assessed %NBS before e'quakes:	69% ##### %NBS from IEP below		
	Assessed %NBS after e'quakes:	69%		

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: 6m

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**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

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

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

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

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

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

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	19 Aberfoyle Place - Block C Lounge Room	Reviewer:	Lee Howard
	Unit / No: / Street	CPEng No:	1008889
Building Address:	8 / 19 / Aberfoyle PL	Company:	Aureon
Legal Description:	LOT 16 DP 53592	Company project number:	232536
		Company phone number:	33660821
	Degrees / Min / Sec		
GPS south:	43 / 29 / 0.81	Date of submission:	16/10/2013
GPS east:	172 / 42 / 30.01	Inspection Date:	19/07/2013
		Revision:	2
Building Unique Identifier (CCC):	PRO 0118 B002	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):	0.00

Building

No. of storeys above ground:	1 (single storey = 1)	Ground floor elevation (Absolute) (m):	0.00
Ground floor split?	no	Ground floor elevation above ground (m):	0.00
Storeys below ground	0		
Foundation type:	strip footings	if Foundation type is other, describe:	
Building height (m):	3.00	height from ground to level of uppermost seismic mass (for IEP only) (m):	6
Floor footprint area (approx):	120		
Age of Building (years):	21	Date of design:	1976-1992
Strengthening present?	no	If so, when (year)?	
		And what load level (%g)?	
Use (ground floor):	public	Brief strengthening description:	
Use (upper floors):			
Use notes (if required):			
Importance level (to NZS1170.5):	IL2		

Gravity Structure

Gravity System:	load bearing walls		
Roof:	concrete	slab thickness (mm)	about 2850, timber, steel
Floors:	concrete flat slab	slab thickness (mm)	100
Beams:	none	overall depth x width (mm x mm)	
Columns:			
Walls:	non-load bearing	0	

Lateral load resisting structure

Note: Define along and across in detailed report!

Lateral system along:	lightweight timber framed walls		
Ductility assumed, μ:	2.00	note typical wall length (m)	
Period along:	0.40 (0.00)	estimate or calculation?	estimated
Total deflection (ULS) (mm):		estimate or calculation?	
maximum interstorey deflection (ULS) (mm):		estimate or calculation?	
Lateral system across:	lightweight timber framed walls		
Ductility assumed, μ:	2.00	note typical wall length (m)	
Period across:	0.40 (0.00)	estimate or calculation?	estimated
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:			none
Wall cladding:	brick or tile	describe (note cavity if exists)	Brick
Roof Cladding:	Metal	describe	Corrugated
Glazing:	steel frames		
Ceilings:	plaster, fixed		
Services(list):			

Available documentation

Architectural	partial	original designer name/date	CCC/1991
Structural	partial	original designer name/date	CCC/1991
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:	25-100m	notes (if applicable):	Values from levels of the buildings
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	none apparent	notes (if applicable):	Some liquefaction in the area
Lateral Spread:		notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	0-20mm/20m	notes (if applicable):	Some crack at concrete slab on grade
Damage to area:	slight	notes (if applicable):	Concrete crack surrounding building

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 structural	Describe:	Repair of the cracks in the floor/ Strengtheing
	Building Consent required:	yes	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	45% ##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	Quantitative
	Assessed %NBS after e'quakes:	45%		
Across	Assessed %NBS before e'quakes:	44% ##### %NBS from IEP below		
	Assessed %NBS after e'quakes:	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: 6m

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

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

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

2.3 Hazard Scaling Factor

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

Z_{1992}, from NZS4203:1992

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

2.4 Return Period Scaling Factor

Building Importance level (from above): 2

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

2.5 Ductility Scaling Factor

	along	across
Assessed ductility (less than max in Table 3.2)		
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:		
Ductiity Scaling Factor, **Factor D**:	1.00	1.00

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

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		
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!**

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	19 Aberfoyle Place - Block D Garage	Reviewer:	Lee Howard
Building Address:	Unit: / No: 19 / Street: Aberfoyle PL	CPEng No:	1008889
Legal Description:	LOT 16 DP 53592	Company:	Aureon
		Company project number:	232536
		Company phone number:	33660821
GPS south:	Degrees 43, Min 29, Sec 0.92	Date of submission:	16/10/2013
GPS east:	Degrees 172, Min 42, Sec 29.98	Inspection Date:	19/07/2013
		Revision:	2
Building Unique Identifier (CCC):	PRO 0118 B003	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):	0.00

Building

No. of storeys above ground:	1	single storey = 1; Ground floor elevation (Absolute) (m):	0.00
Ground floor split?	no	Ground floor elevation above ground (m):	0.00
Storeys below ground	0		
Foundation type:	pads with tie beams	if Foundation type is other, describe:	Assumed as pad with tie beams
Building height (m):	2.50	height from ground to level of uppermost seismic mass (for IEP only) (m):	3
Floor footprint area (approx):	33		
Age of Building (years):	22	Date of design:	1976-1992
Strengthening present?	no	If so, when (year)?	
		And what load level (%g)?	
Use (ground floor):	parking	Brief strengthening description:	
Use (upper floors):	parking		
Use notes (if required):			
Importance level (to NZS1170.5):	IL2		

Gravity Structure

Gravity System:	load bearing walls		
Roof:	steel framed	rafter type, purlin type and cladding	
Floors:	concrete flat slab	slab thickness (mm)	
Beams:			None
Columns:			None
Walls:	load bearing concrete	#N/A	

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	**Note: Define along and across in detailed report!**	
Ductility assumed, μ:	1.25	note typical wall length (m)	
Period along:	0.40	0.00; estimate or calculation?	calculated
Total deflection (ULS) (mm):		estimate or calculation?	
maximum interstorey deflection (ULS) (mm):		estimate or calculation?	
Lateral system across:	concrete shear wall	enter wall data in "IEP period calcs" worksheet for period calculation	
Ductility assumed, μ:	1.25		
Period across:	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?	

Separations:

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

Non-structural elements

		describe
Stairs:		None
Wall cladding:		Tilt up panel
Roof Cladding:	Metal	None
Glazing:		None
Ceilings:		None
Services(list):		

Available documentation

Architectural	partial	original designer name/date	
Structural	partial	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:	25-100m	notes (if applicable):	Values from levels of the building
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:	slight	notes (if applicable):	Concrete crack surrounding the building

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):			
Across	Damage ratio:	0%		
	Describe (summary):			
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	no	Describe:	

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

Recommendations

	Level of repair/strengthening required:	significant structural	Describe:	Roof cross bracing, Installation of connection between wal
	Building Consent required:	yes	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	29%	##### %NBS from IEP below; If IEP not used, please detail assessment methodology:	Quantitative
	Assessed %NBS after e'quakes:	29%		
Across	Assessed %NBS before e'quakes:	39%	##### %NBS from IEP below	
	Assessed %NBS after e'quakes:	39%		

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: 3m

Seismic Zone, if designed between 1965 and 1992: B

not required for this age of building: D soft soil
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**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

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

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

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

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

3.1. Plan Irregularity, factor A: insignificant | 1

3.2. Vertical irregularity, Factor B: insignificant | 1

3.3. Short columns, Factor C: insignificant | 1

3.4. Pounding potential

Pounding effect D1, from Table to right: 1.0

Height Difference effect D2, from Table to right: 1.0

Therefore, Factor D: 1

3.5. Site Characteristics | 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		
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!**

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	19 Aberfoyle Place - Block E Garage		Reviewer:	Lee Howard
	Unit / No: / Street		CPEng No:	1008889
Building Address:	19 Aberfoyle PL		Company:	Aureon
Legal Description:	LOT 16 DP 53592		Company project number:	232536
			Company phone number:	33660821
	Degrees / Min / Sec			
GPS south:	43 / 29 / 0.92		Date of submission:	16/10/2013
GPS east:	172 / 42 / 29.98		Inspection Date:	19/07/2013
			Revision:	2
Building Unique Identifier (CCC):	PRO 0118 B005		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):	0.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	0.00
Ground floor split?	no		Ground floor elevation above ground (m):	0.00
Storeys below ground	0			
Foundation type:	pads with tie beams		if Foundation type is other, describe:	Assumed as pad with tie beams
Building height (m):	2.50		height from ground to level of uppermost seismic mass (for IEP only) (m):	3
Floor footprint area (approx):	33			
Age of Building (years):	22		Date of design:	1976-1992
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	parking		Brief strengthening description:	
Use (upper floors):	parking			
Use notes (if required):				
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	load bearing walls		
Roof:	steel framed	rafter type, purlin type and cladding	
Floors:	concrete flat slab	slab thickness (mm)	
Beams:			None
Columns:			None
Walls:	load bearing concrete	#N/A	

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	**Note: Define along and across in detailed report!**		
Ductility assumed, μ:	1.25		note typical wall length (m)	
Period along:	0.40	0.00	estimate or calculation?	calculated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	concrete shear wall		enter wall data in "IEP period calcs" worksheet for period calculation	
Ductility assumed, μ:	1.25			
Period across:	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?	

Separations:

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

Non-structural elements

Stairs:			None
Wall cladding:			Tilt up panel
Roof Cladding:	Metal	describe	None
Glazing:			None
Ceilings:			None
Services(list):			

Available documentation

Architectural	partial	original designer name/date	
Structural	partial	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:	25-100m	notes (if applicable):	Values from levels of the building
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:	slight	notes (if applicable):	Concrete crack surrounding the building

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):			
Across	Damage ratio:	0%		
	Describe (summary):			
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	no	Describe:	

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

Recommendations

	Level of repair/strengthening required:	significant structural	Describe:	Roof cross bracing, Installation of connection between wal
	Building Consent required:	yes	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	29%	##### %NBS from IEP below	If IEP not used, please detail assessment methodology: Quantitative
	Assessed %NBS after e'quakes:	29%		
Across	Assessed %NBS before e'quakes:	39%	##### %NBS from IEP below	
	Assessed %NBS after e'quakes:	39%		

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: 3m

Seismic Zone, if designed between 1965 and 1992: B

not required for this age of building: D soft soil

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**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

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

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

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

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

3.1. Plan Irregularity, factor A:	insignificant	1
3.2. Vertical irregularity, Factor B:	insignificant	1
3.3. Short columns, Factor C:	insignificant	1
3.4. Pounding potential Pounding effect D1, from Table to right		1.0
Height Difference effect D2, from Table to right		1.0
Therefore, Factor D:		1
3.5. Site Characteristics		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		
Rationale for choice of F factor, if not 1		

Detail Critical Structural Weaknesses: (refer to DEE Procedure section 6)

List any: Refer also section 6.3.1 of DEE for discussion of F factor modification for other critical structural weaknesses

	Along	Across
3.7. Overall Performance Achievement ratio (PAR)	**0.00**	**0.00**
4.3 PAR x (%NBS)b: PAR x Baselline %NBS:	**#DIV/0!**	**#DIV/0!**
4.4 Percentage New Building Standard (%NBS), (before)		**#DIV/0!**

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

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