Regal Courts Housing Complex
Qualitative Engineering Evaluation

Functional Location ID: BE 1061 EQ2

Address: 146 King Street

Reference: 233415

Prepared for:
Christchurch City Council

Revision: 2

Date: 2 May 2013

Document Control Record

Document prepared by:

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Report Title		Qualitative Engineering Evaluation				
Functional Location ID		**BE 1061 EQ2**	**Project Number**		233415	
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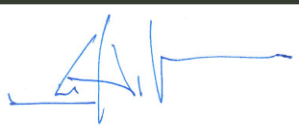
Approval			
Author Signature		Approver Signature	
Name	Eric Simeone	Name	Luis Castillo
Title	Senior Structural Engineer	Title	Senior Structural Engineer

Contents

Appendices

Executive Summary - Blocks A and D

This is a summary of the Qualitative Engineering Evaluation for the Regal Courts Housing Complex building and is based on the Detailed Engineering Evaluation Procedure document issued by the Engineering Advisory Group on 19 July 2011, visual inspections, available structural documentation and summary calculations as appropriate.

Building Details	**Name**	Regal Courts Housing Complex – Blocks A and D			
Building Location ID	BE 1061 EQ2			**Multiple Building Site**	Y
Building Address	146 King Street			**No. of residential units**	Block A (4) Block D (4)
Soil Technical Category	TC2	**Importance Level**	2	**Approximate Year Built**	1976
Foot Print (m²)	Blocks A and D (196 m²)	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Monier tile roofing supported by timber trusses, slab-on-grade for ground floor, and conventional shallow foundations.				
Qualitative L4 Report Results Summary					
Building Occupied	Y	Blocks A and D are currently occupied.			
Suitable for Continued Occupancy	Y	Blocks A and D are suitable for continued use.			
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 of the report body.			
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.			
Levels Survey Results	Y	Survey shows floor levels are within DBH guideline limits.			
Building %NBS From Analysis	75%	Longitudinal Direction - Limited by timber framed walls - Based on detailed calculations.			
Qualitative L4 Report Recommendations					
Geotechnical Survey Required	N	Geotechnical survey not required due to lack of observed ground damage on site.			
Proceed to L5 Quantitative DEE	N	A quantitative DEE is not required for this structure.			

Approval

Author Signature		Approver Signature	
Name	Eric Simeone	Name	Luis Castillo
Title	Senior Structural Engineer	Title	Senior Structural Engineer

Executive Summary - Block B

This is a summary of the Qualitative Engineering Evaluation for the Regal Courts Housing Complex building and is based on the Detailed Engineering Evaluation Procedure document issued by the Engineering Advisory Group on 19 July 2011, visual inspections, available structural documentation and summary calculations as appropriate.

Building Details	**Name**	Regal Courts Housing Complex – Block B			
Building Location ID	BE 1061 EQ2			**Multiple Building Site**	Y
Building Address	146 King Street			**No. of residential units**	Block B (2)
Soil Technical Category	TC2	**Importance Level**	2	**Approximate Year Built**	1976
Foot Print (m²)	Block B (98 m²)	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Monier tile roofing supported by timber trusses, slab-on-grade for ground floor, and conventional shallow foundations.				

Qualitative L4 Report Results Summary		
Building Occupied	Y	Block B is currently occupied.
Suitable for Continued Occupancy	Y	Blocks B is suitable for continued use.
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 of the report body.
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.
Levels Survey Results	Y	Survey shows floor levels are within DBH guideline limits.
Building %NBS From Analysis	41%	Longitudinal Direction- Limited by the timber framed walls - Based on detailed calculations.

Qualitative L4 Report Recommendations		
Geotechnical Survey Required	N	Geotechnical survey not required due to lack of observed ground damage on site.
Proceed to L5 Quantitative DEE	N	A quantitative DEE is not required for this structure.

Approval

Author Signature		Approver Signature	
Name	Eric Simeone	Name	Luis Castillo
Title	Senior Structural Engineer	Title	Senior Structural Engineer

Executive Summary - Block C

This is a summary of the Qualitative Engineering Evaluation for the Regal Courts Housing Complex building and is based on the Detailed Engineering Evaluation Procedure document issued by the Engineering Advisory Group on 19 July 2011, visual inspections, available structural documentation and summary calculations as appropriate.

Building Details	**Name**	Regal Courts Housing Complex – Block C			
Building Location ID	BE 1061 EQ2			**Multiple Building Site**	Y
Building Address	146 King Street			**No. of residential units**	10
Soil Technical Category	TC2	**Importance Level**	2	**Approximate Year Built**	1976
Foot Print (m²)	294 m²	**Storeys above ground**	2	**Storeys below ground**	0
Type of Construction	Monier tile roofing supported by timber trusses, reinforced concrete slab as first floor supported on reinforced masonry walls, slab-on-grade for ground floor and conventional shallow foundations.				

Qualitative L4 Report Results Summary		
Building Occupied	Y	Block C is currently occupied.
Suitable for Continued Occupancy	Y	Block C is suitable for continued use.
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 of the report body.
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.
Levels Survey Results	Y	Survey shows floor levels are within DBH guideline limits.
Building %NBS From Analysis	42%	Longitudinal Direction – Limited by the timber framed walls –Based on detailed calculations

Qualitative L4 Report Recommendations		
Geotechnical Survey Required	N	Geotechnical survey not required due to lack of observed ground damage on site.
Proceed to L5 Quantitative DEE	N	A quantitative DEE is not required for this structure.

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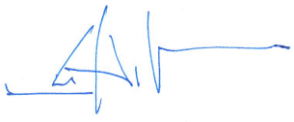
Author Signature		Approver Signature	
Name	Eric Simeone	Name	Luis Castillo
Title	Senior Structural Engineer	Title	Senior Structural Engineer

1 Introduction

1.1 General

On 6 December 2012 Aurecon engineers visited the Regal Courts Housing Complex to undertake a qualitative building damage assessment on behalf of the Christchurch City Council. Detailed visual inspections were carried out to assess the damage caused by the earthquakes on 4 September 2010, 22 February 2011, 13 June 2011, 23 December 2011 and related aftershocks.

The scope of work included:

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

This report outlines the results of our Qualitative Assessment of damage to the Regal Courts Housing Complex 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 Building Age and Configuration

The Regal Courts Housing Complex consists of four separate blocks totalling 20 one bedroom units. The four blocks have been identified from A to D (see image on following page) for purpose of identification in this report. It is assumed that the whole complex was constructed around 1976. All four blocks have an exterior brickwork cladding and a monier tile roof on a timber truss roof structure.

2.1.1 Blocks A and D

Blocks A and D are identical one storey buildings each comprising four units.

2.1.2 Block B

Block B has one storey and is of a similar construction as A and D but with only two units.

2.1.3 Block C

Block C has total of 10 units including four units on the second storey with balconies.

2.2 Building Structural Systems Vertical and Horizontal

2.2.1 Blocks A, B and D

Blocks A, B and D are of a similar construction. The roof structure consists of timber trusses bearing on timber framed walls with GIB lining. The ground floor consists of a 150mm reinforced slab-on-grade. The exterior cladding is brickwork while the roofing is made of monier tiles. The building foundations consist of a shallow reinforced concrete perimeter beam.

The horizontal loads are carried in the longitudinal direction by the timber framed walls and in the transverse direction by the reinforced masonry blockwork walls.

2.2.2 Block C

The roof structure for Block C consists of timber trusses bearing on timber framed walls with GIB lining. The first floor is made of stresscrete slabs. This system consists of precast slabs with a cast in place topping which are bearing on the reinforced masonry blockwork walls. The ground floor consists of a 150 mm reinforced slab on grade. The exterior cladding is brickwork while the roofing is made of monier tiles. The building foundation consists of a shallow reinforced concrete perimeter wall footing.

The horizontal loads at the top level are carried in the longitudinal direction by the timber framed walls and in the transverse direction by the reinforced masonry blockwork walls located in the service core area. At the ground level, the lateral loads are carried by the reinforced masonry blockwork walls for both directions on the two storey modules and for the transverse direction on the one story module.

2.3 Building Foundation System and Soil Conditions

The Regal Courts Housing Complex is used for residential purposes. The Ministry of Business, Innovation and Employment (formally the Department of Housing and Building or DHB) does not currently have a technical classification for the land in the immediate vicinity of the Regal Courts Housing Complex, however the area surrounding the building consists primarily of Technical Category 2 (TC2) land. According to Canterbury Earthquake Repair Authority (CERA), TC2 land is considered to “incur minor to moderate land damage from liquefaction”.

2.4 Available Structural Documentation and Inspection Priorities

Fully detailed architectural and structural drawings made by Entreprise Homes and dated 1976 were available for all four blocks.

The inspection priorities included the exterior walls, the timber structure of the roof, the structural slab of first floor, the slabs on grade, the brickwork, the interior linings and all the architectural elements in order to identify potential structural weaknesses.

2.5 Available Survey Information

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

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

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

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

The floor levels for the Regal Courts Housing Complex are considered to be acceptable. The tolerance was exceeded in some areas however this was due to floor coverings.

3 Structural Investigation

3.1 Summary of Building Damage

The buildings suffered very limited damage following the Canterbury earthquake sequence, with the overall building conditions remaining almost the same as before the earthquakes. The following observations were made during the site visit on 6 December 2012.

All photographs referenced have been included in Appendix A.

- Some cracks were found in the exterior brickwork of blocks A, B, C, D (photos 1, 2,3 and 6)
- There is cracking in the exterior patio slabs of Block C (photo 6).
- Few cracks were found in the interior GIB lining of block C (photos 7 and 8).
- A floor level survey using the zip level was carried out in each unit on the slab-on-grade and structural slab and has shown that the levels do not exceed DBH guidelines limits (see Appendix A).

3.2 Record of Intrusive Investigation

There was limited damage to the building and therefore, an intrusive investigation was neither warranted nor undertaken for Regal Courts Housing Complex. A metal detector was used on masonry walls to verify the reinforcement.

3.3 Damage Discussion

Minor seismic related damages were noted in the damage assessment. This is not surprising given that the building has concrete wall panels in both directions and there appears to be a good first floor diaphragm.

4 Building Review Summary

4.1 Building Review Statement

As noted above no intrusive investigations were carried out for the Regal Courts Housing Complex. Furthermore, as fully detailed architectural and structural drawings were available, it was not deemed necessary to do so.

4.2 Critical Structural Weaknesses

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

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

5.1 General

The Regal Courts Housing Complex consists of four blocks using reinforced concrete, timber and masonry type of construction. With sufficient walls and good detailing, all buildings have performed well in the Canterbury earthquake sequence as evidenced by the limited damage described in Section 3.

5.2 %NBS Assessment

5.2.1 Parameters used in the Seismic Assessment

Table 1: Parameters used in the Seismic Assessment

Seismic Parameter	Quantity	Comment/Reference
Site Soil Class	D	NZS 1170.5:2004, Clause 3.1.3, Deep or Soft Soil
Site Hazard Factor, Z	0.30	DBH Info Sheet on Seismicity Changes (Effective 19 May 2011)
Return period Factor, R_u	1.00	NZS 1170.5:2004, Table 3.5, Importance Level 2 Structure with a Design Life of 50 years
Ductility Factor , μ	2.0	Timber shear walls (AS 1170.4 – 2007 Table 6.5A).
	2.0	Unreinforced masonry walls (assessment and improvement of unreinforced masonry buildings for earthquake resistance – clause 4.3.2.4)
	2.0	Wide spaced reinforced masonry (AS 1170.4 – 2007 Table 6.5A).

5.2.2 Lateral load resistance system description

For Blocks A, B, C and D the strength assessment has been based on the lateral load carrying capacity of the GIB lined timber framed walls and the lateral load carrying capacity of the concrete masonry walls for both the principal directions of the buildings. The respective capacities have been compared to the seismic demand to produce a %NBS for buildings in each respective direction.

5.3 Assessment Results

Block	Direction	%NBS	Comments
A/D	Longitudinal	75%	Limited by the GIB Lined timber framed walls
	Transverse	100%	Based on detailed calculations
B	Longitudinal	41%	Limited by the GIB Lined timber framed walls
	Transverse	72%	Limited by the GIB Lined timber framed walls
C	Longitudinal	42%	Limited by the GIB Lined timber framed walls
	Transverse	100%	Based on detailed calculations

5.3.1 Assessment Discussion

The assessment of block A/D is limited by the GIB Lined timber framed walls in the longitudinal direction of the buildings. The lack of available timber lined wall length in the longitudinal direction is due to the presence of windows and doors.

The assessment of block B is limited by the capacity of the GIB Lined timber framed walls in the transverse and longitudinal directions of the buildings. The limited transverse direction capacity is governed by the lack of available timber lined wall length due to the presence of windows and doors

The assessment of block C is limited by the capacity of the GIB Lined timber framed walls in the longitudinal direction of the buildings. The limited longitudinal direction capacity is governed by the lack of available timber lined wall length at the second storey exterior wall locations.

6 Conclusions and Recommendations

Given the good performance of the buildings of Regal Courts Housing Complex in the Canterbury earthquake sequence, the limited foundation damage and the floor levels considered to be within acceptable limits, **a geotechnical investigation is currently not considered necessary**.

Additionally, the building has suffered no loss of functionality and in our opinion the Regal Courts Housing Complex buildings **are considered suitable for continued occupation on the following basis**:

- The strength of the building exceeds the minimum of 33% earthquake prone limit.
- There are no critical structural weaknesses.
- There is minimal damage.

7 Explanatory Statement

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

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

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

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

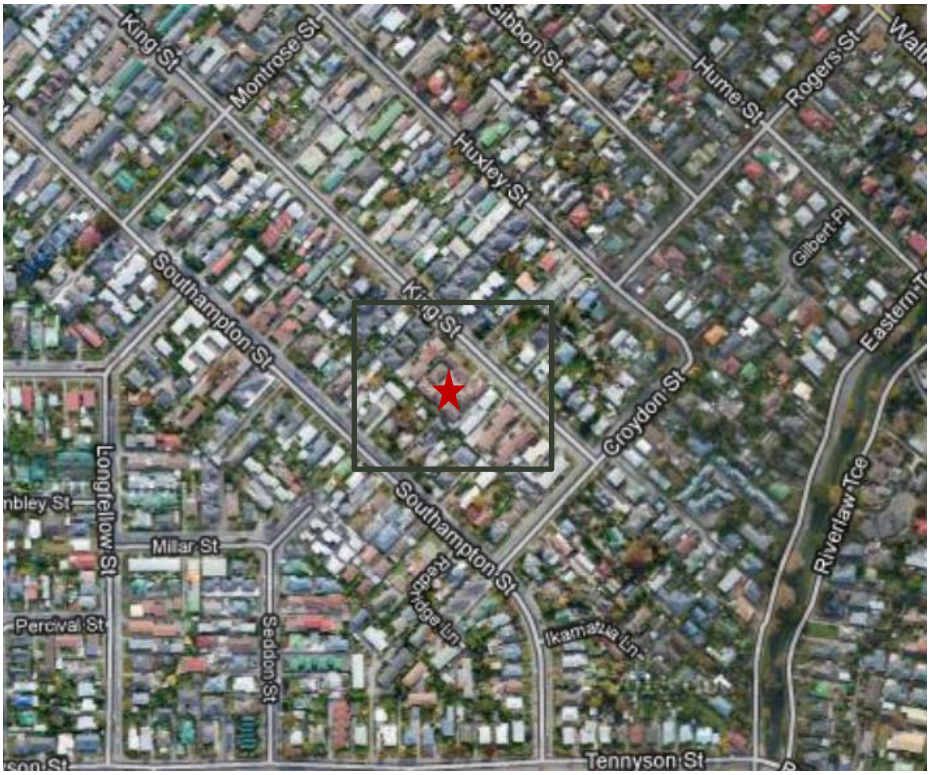
This review has been prepared by Aurecon at the request of its client and is exclusively for the client's use. It is not possible to make a proper assessment of this review without a clear understanding of the terms of engagement under which it has been prepared, including the scope of the instructions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

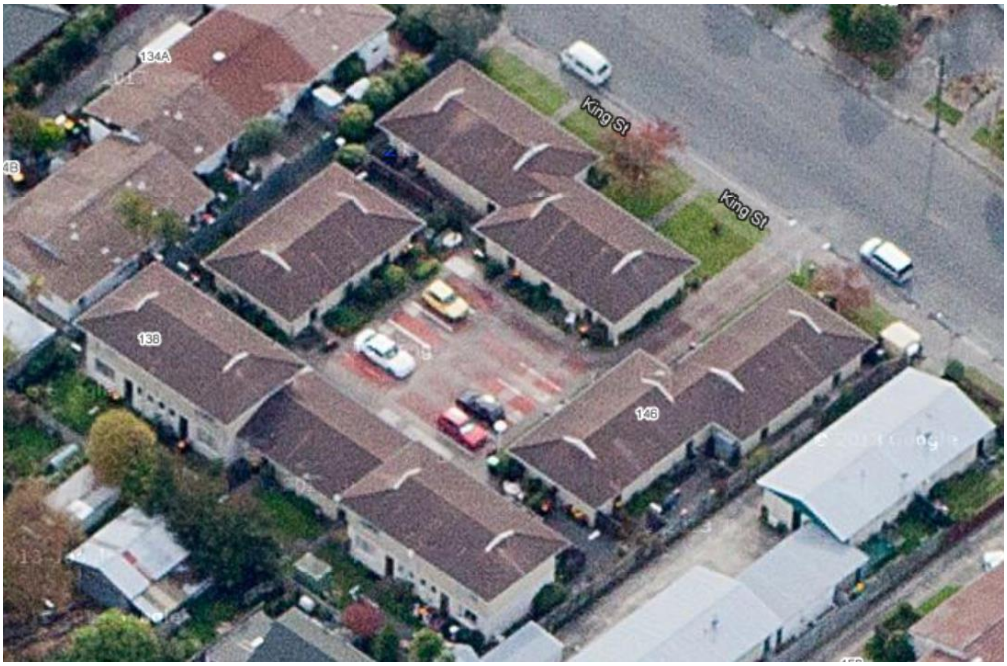
Without limiting any of the above, Aurecon's liability, whether under the law of contract, tort, statute, equity or otherwise, is limited as set out in the terms of the engagement with the client.

Appendices

Appendix A
Site Map, Photos and Levels survey

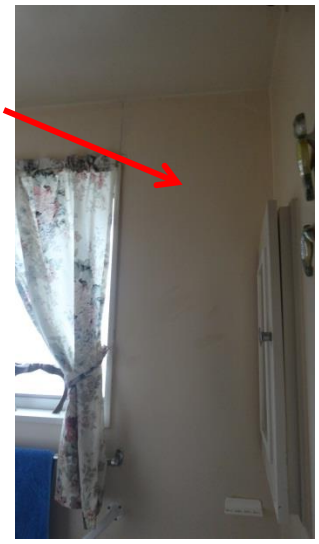
6 December 2012 – Regal Courts Housing Complex Site Photographs

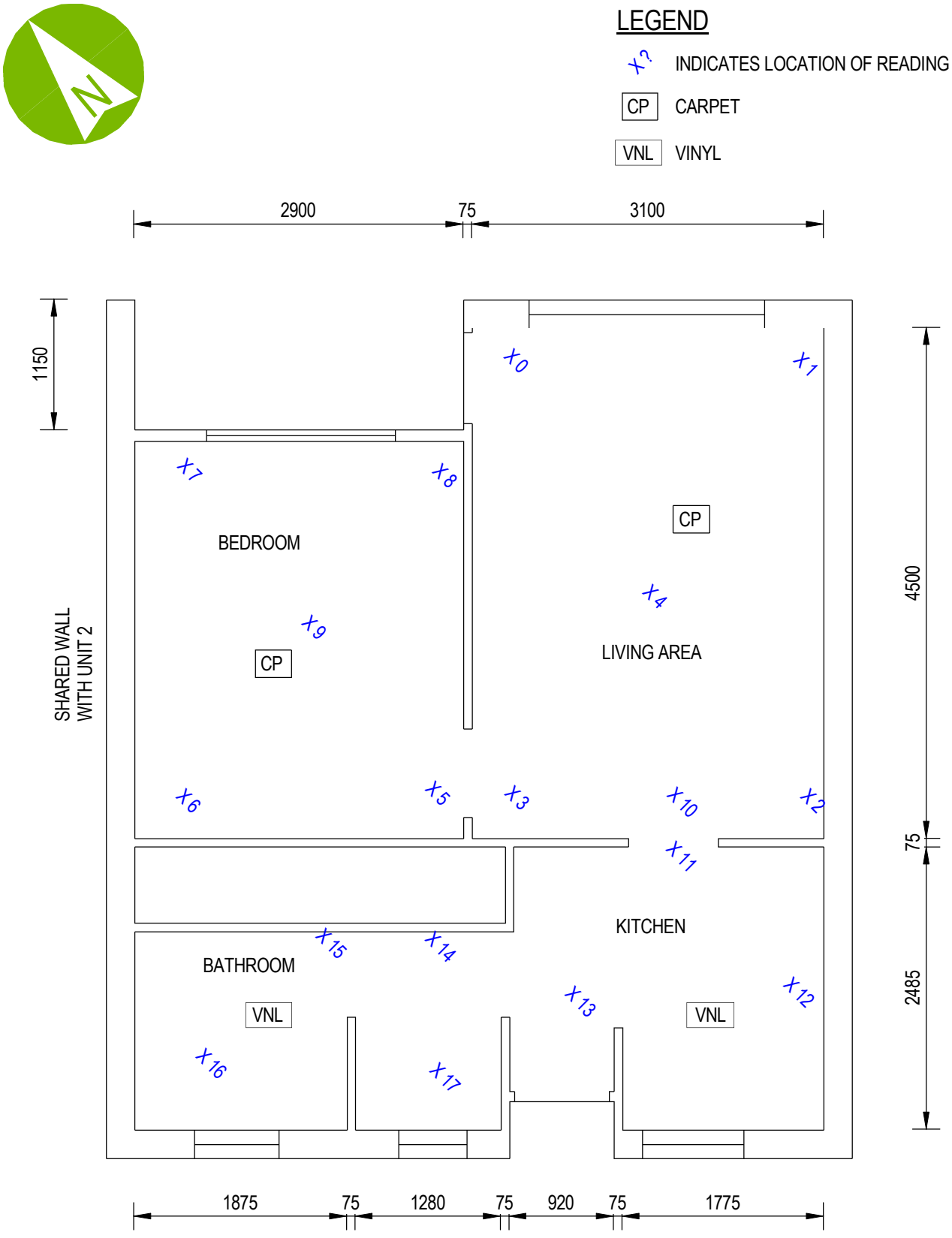




Aerial view showing Regal Courts Housing Complex

#1.	Cracking in the exterior brickwork of unit 4, Block A at Regal Courts Housing Complex.	
#2.	Cracking in the exterior brickwork of unit 6, Block B at Regal Courts Housing Complex.	
#3.	Cracking in the exterior brickwork of unit 11, Block C at Regal Courts Housing Complex.	
#4.	Cracking in the interior lining inside unit12, Block C.	
#5.	Crack in the exterior patio slab close to unit 13, Block C.	

#6.	Cracking in the exterior brickwork of unit 15, Block C at Regal Courts Housing Complex.	
#7.	Cracking in the interior lining inside unit 18, Block C.	
#8.	Cracking in the ceiling lining inside unit 20, Block C.	



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APPROVED	DATE
L.CASTILLO	

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KING STREET

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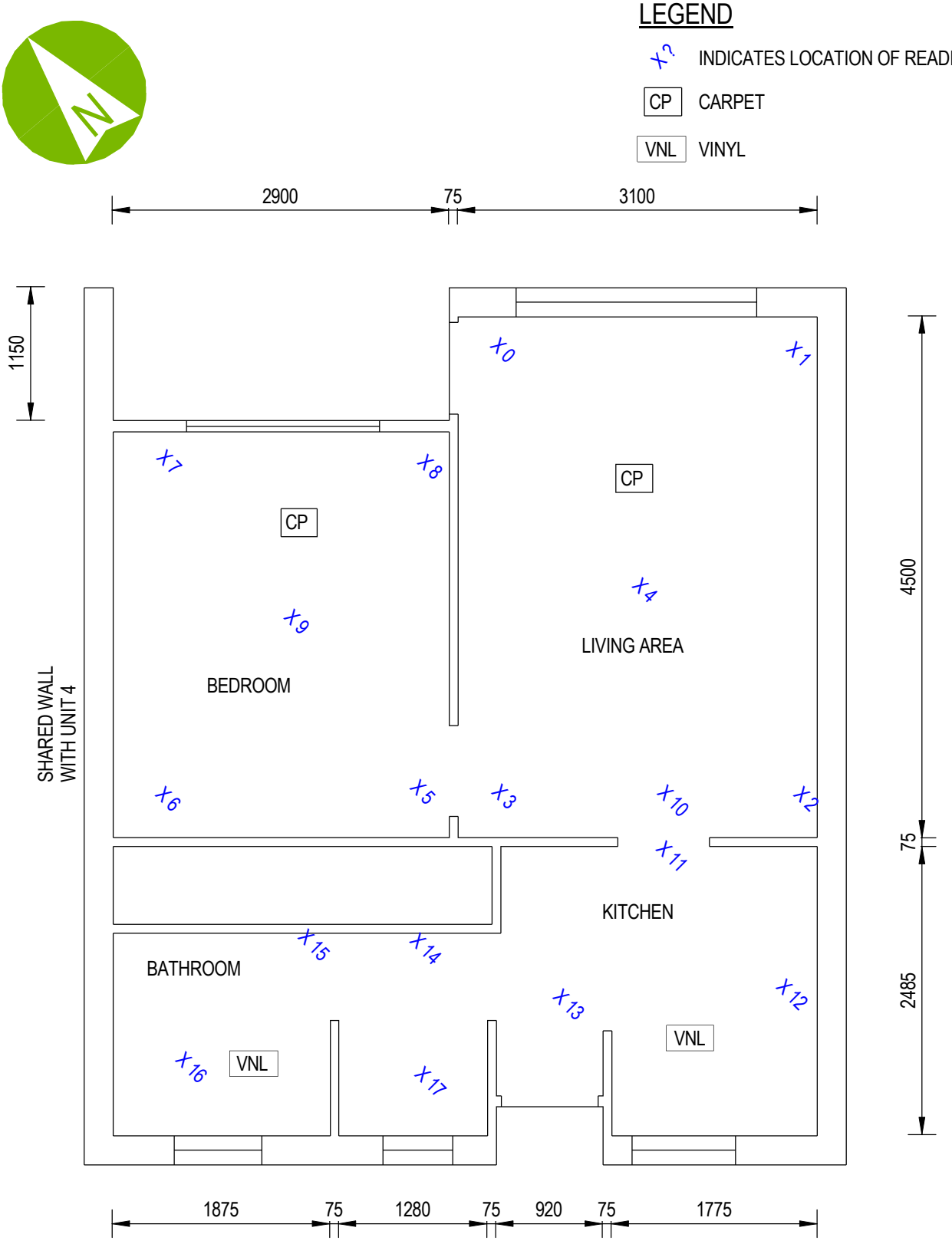

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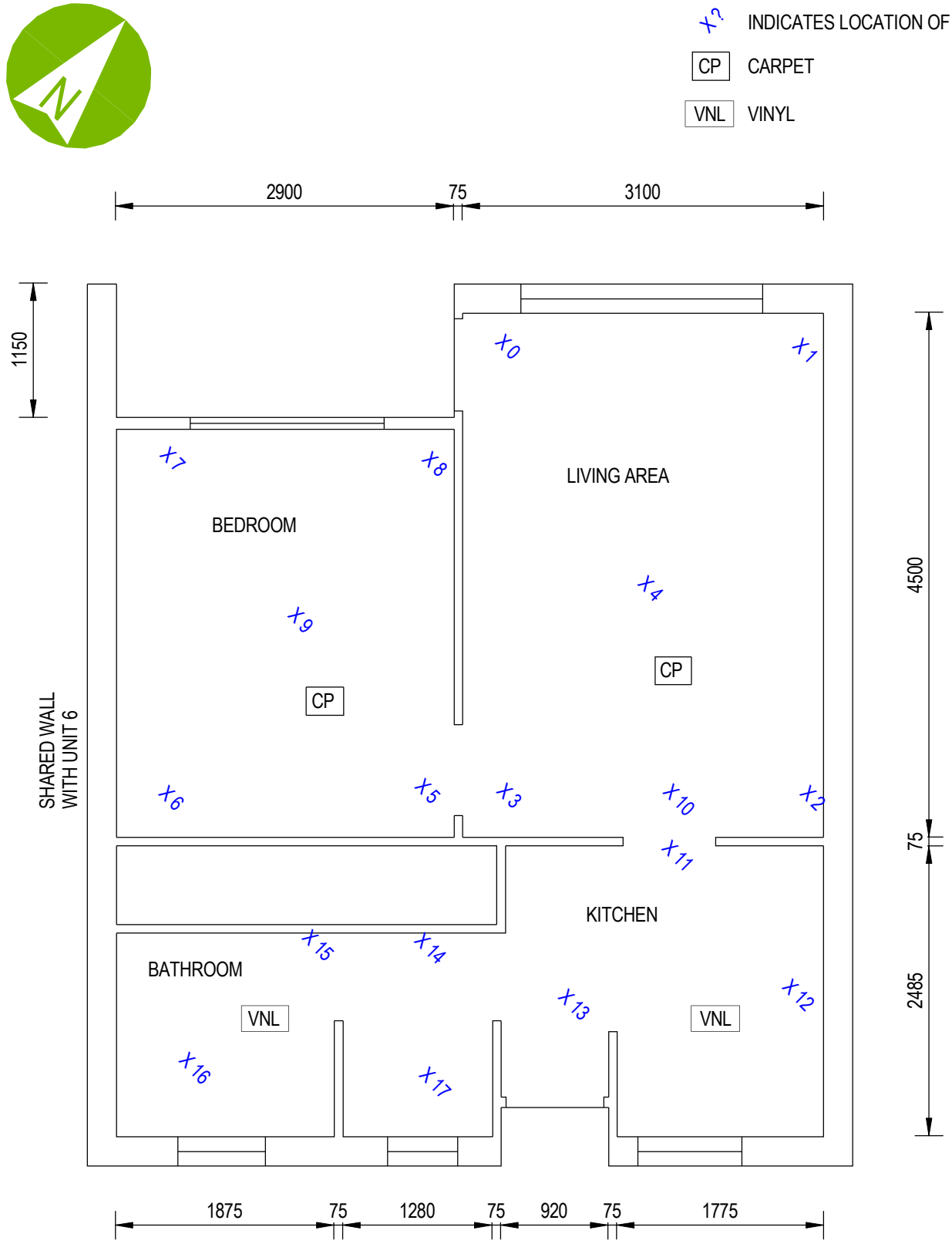

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KING STREET

TITLE
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UNIT 5

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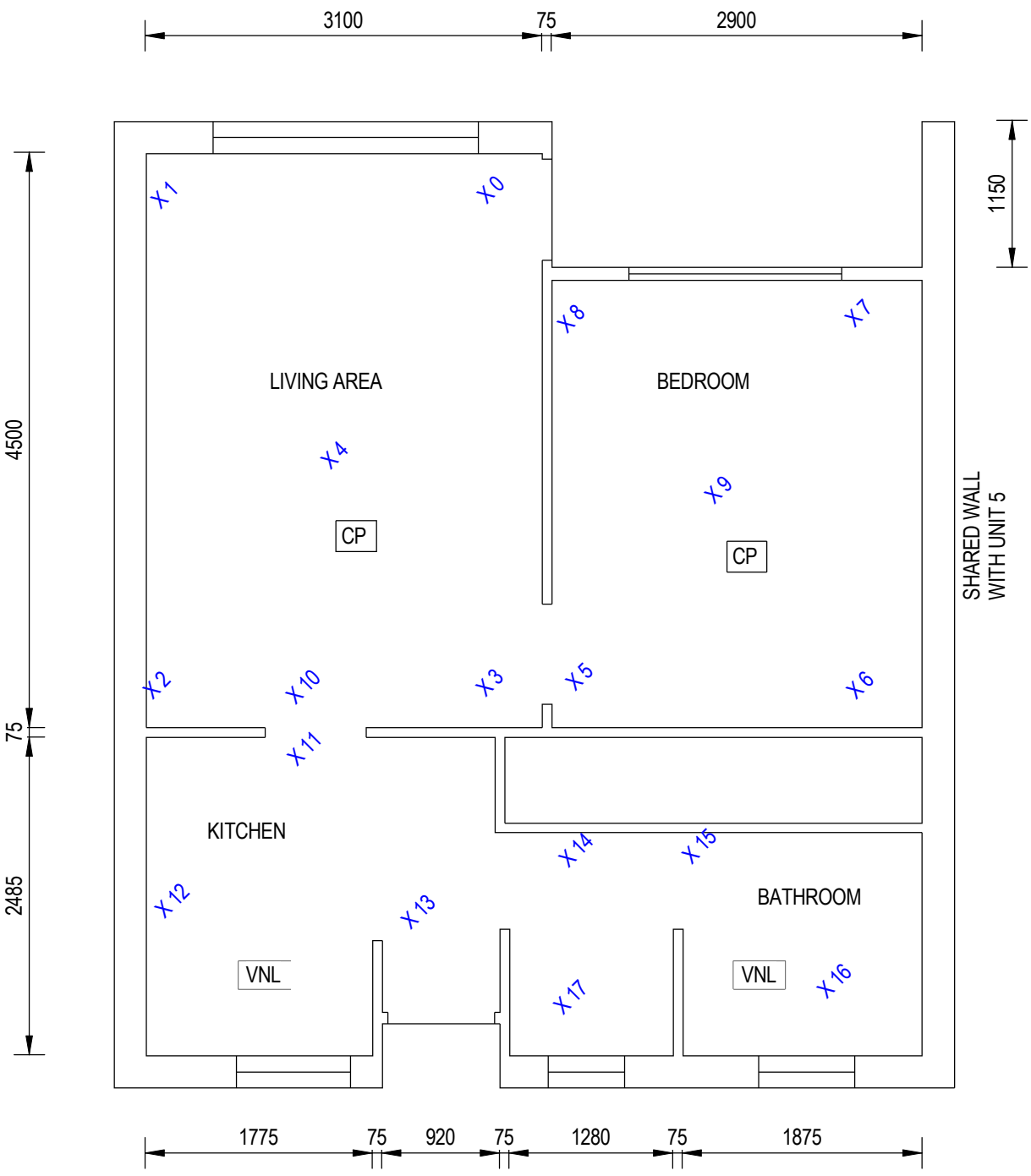

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PROJECT No.
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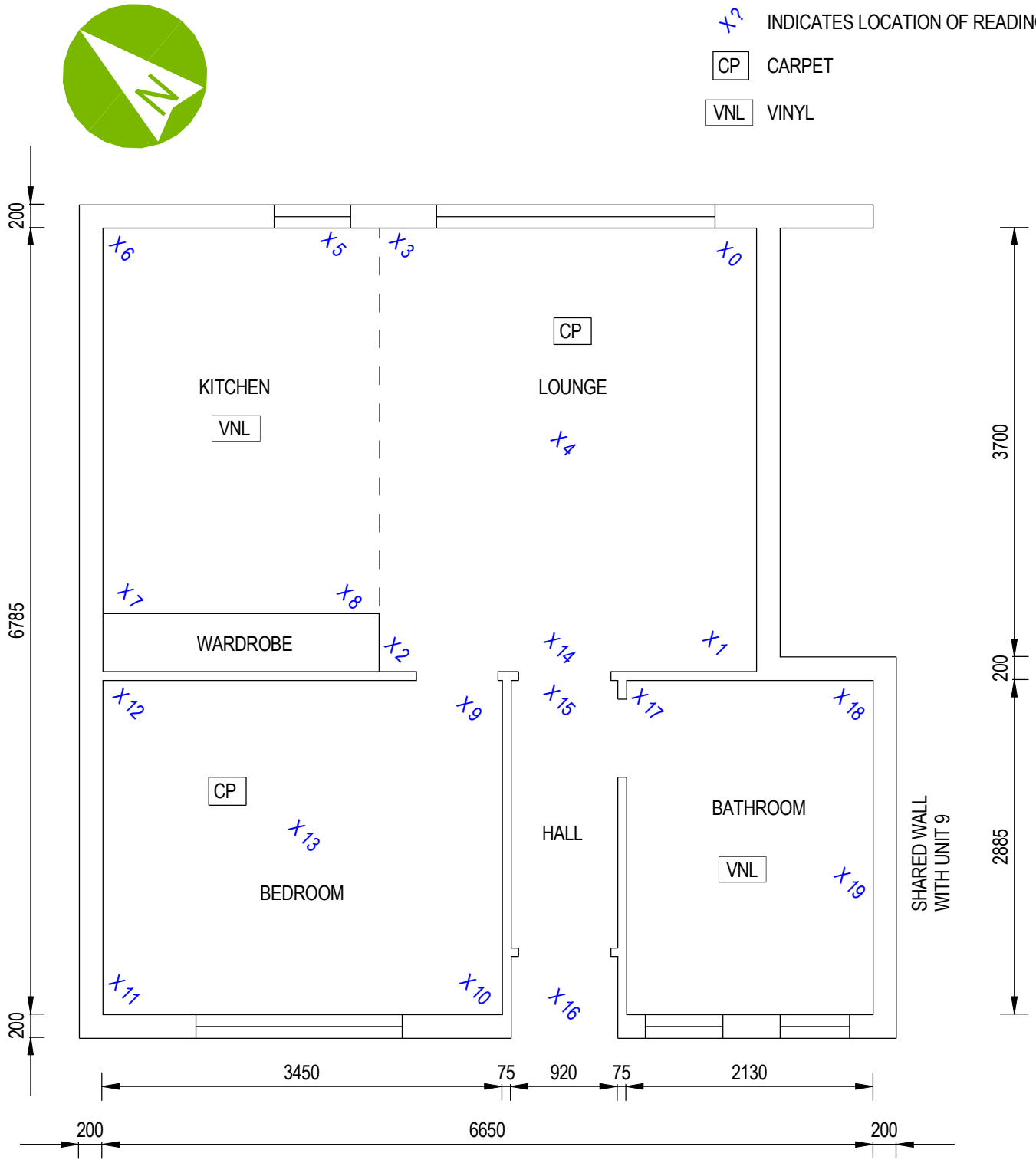

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PROJECT
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TITLE
FLOOR LEVEL SUVEY
UNIT 7

PRELIMINARY
NOT FOR CONSTRUCTION

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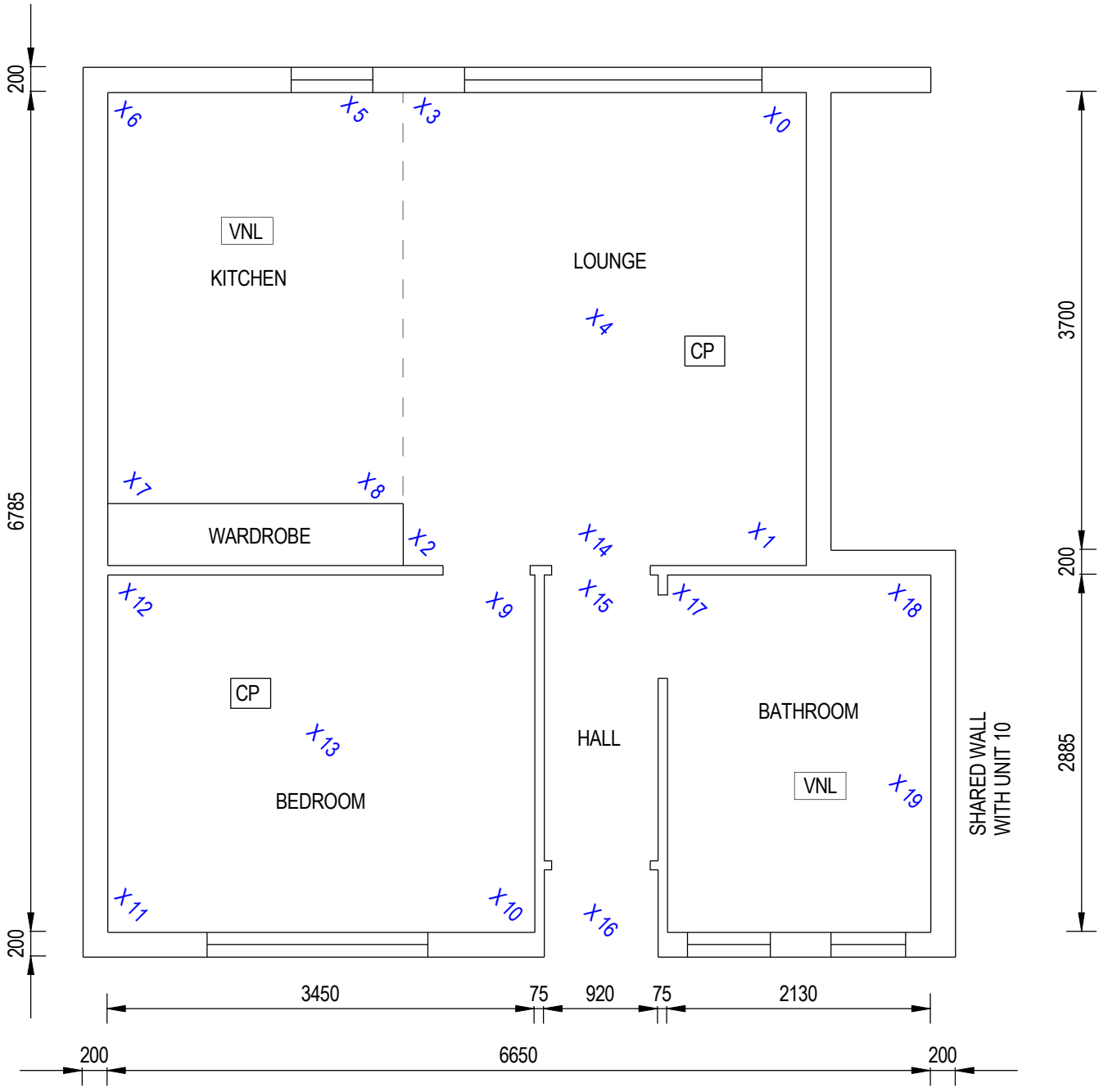

UNIT 8

1 : 50

2/04/2013 4:37:54 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-04-13	FLOOR LEVEL SURVEYS	L.CASTILLO

DRAWN	DESIGNED
D.HUNIA	N/A
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
CHRISTCHURCH
KING STREET

TITLE
FLOOR LEVEL SUVEY
UNIT 8

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.
233415

SCALE	SIZE
1 : 50	A4

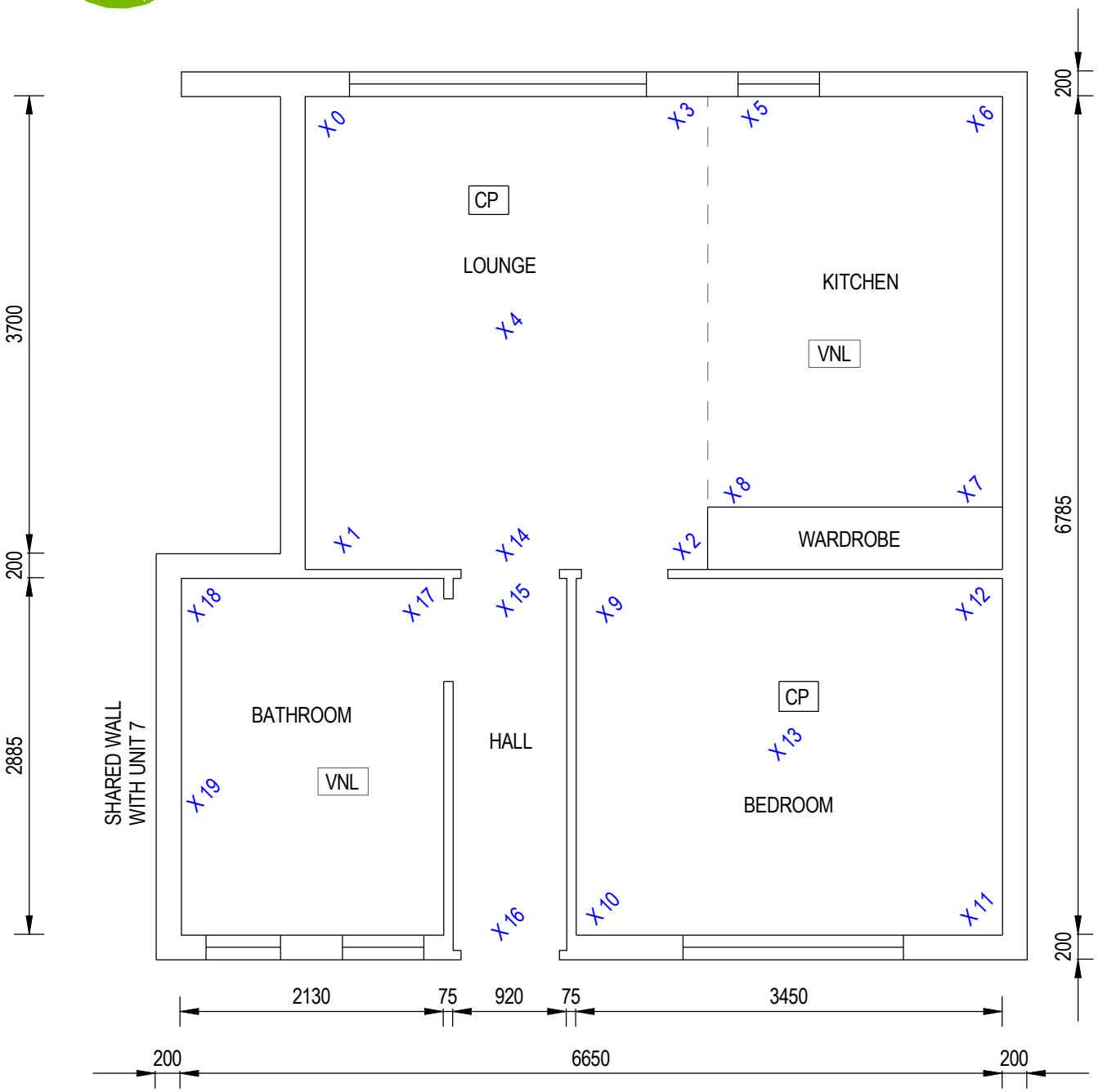
DRAWING No.	REV
S-01-07	A

LEGEND

X? INDICATES LOCATION OF READING

CP CARPET

VNL VINYL



UNIT 9

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2/04/2013 4:37:55 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-04-13	FLOOR LEVEL SURVEYS	L.CASTILLO

DRAWN	DESIGNED
D.HUNIA	N/A
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
CHRISTCHURCH
KING STREET

TITLE
FLOOR LEVEL SUVEY
UNIT 9

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.
233415

SCALE	SIZE
1 : 50	A4

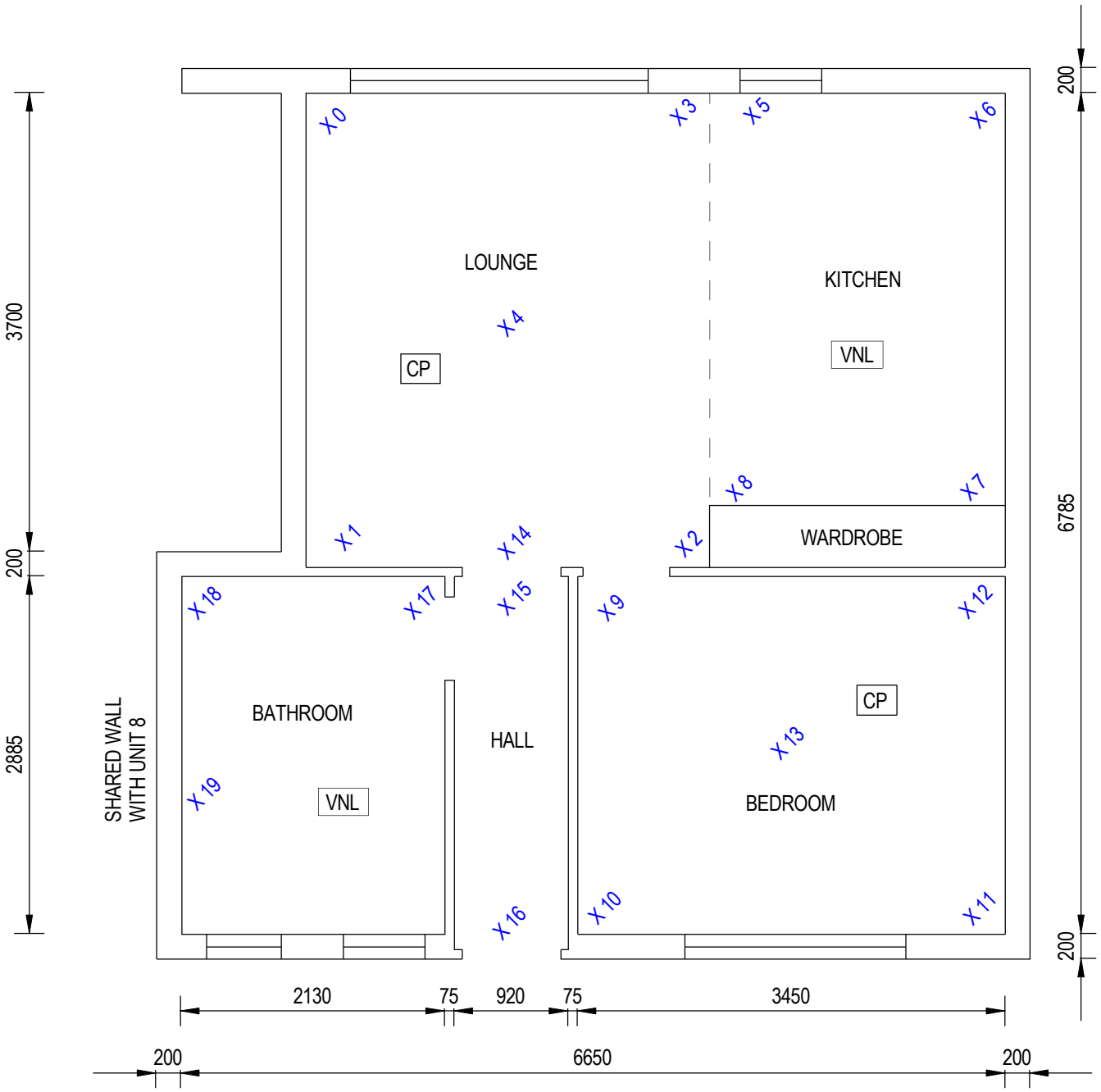
DRAWING No.	REV
S-01-08	A

LEGEND

X? INDICATES LOCATION OF READING

CP CARPET

VNL VINYL



UNIT 10

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2/04/2013 4:37:56 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-04-13	FLOOR LEVEL SURVEYS	L.CASTILLO

DRAWN	DESIGNED
D.HUNIA	N/A
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
CHRISTCHURCH
KING STREET

TITLE
FLOOR LEVEL SUVEY
UNIT 10

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.
233415

SCALE 1 : 50 | SIZE A4

DRAWING No. S-01-09 | REV A

LEGEND

X? INDICATES LOCATION OF READING

CP CARPET

VNL VINYL

UNIT 11

1 : 50

2/04/2013 4:37:57 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-04-13	FLOOR LEVEL SURVEYS	L.CASTILLO

DRAWN	DESIGNED
D.HUNIA	N/A
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
CHRISTCHURCH
KING STREET

TITLE
FLOOR LEVEL SUVEY
UNIT 11

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.
233415

SCALE	SIZE
1 : 50	A4

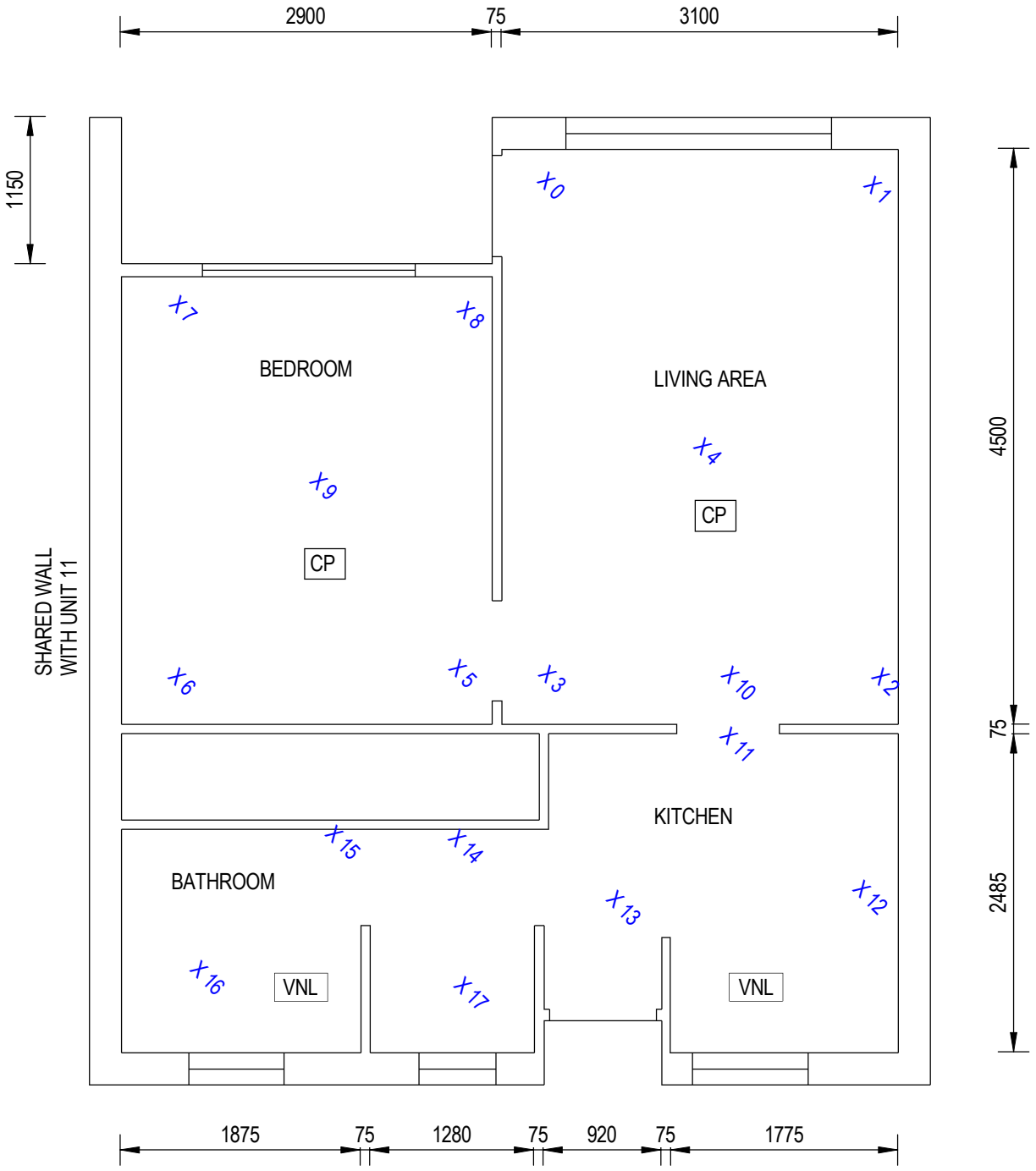
DRAWING No.	REV
S-01-10	A

LEGEND

x? INDICATES LOCATION OF READING

CP CARPET

VNL VINYL



UNIT 12

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2/04/2013 4:37:58 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-04-13	FLOOR LEVEL SURVEYS	L.CASTILLO

DRAWN	DESIGNED
D.HUNIA	N/A
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
CHRISTCHURCH
KING STREET

TITLE
FLOOR LEVEL SUVEY
UNIT 12

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.
233415

SCALE	SIZE
1 : 50	A4

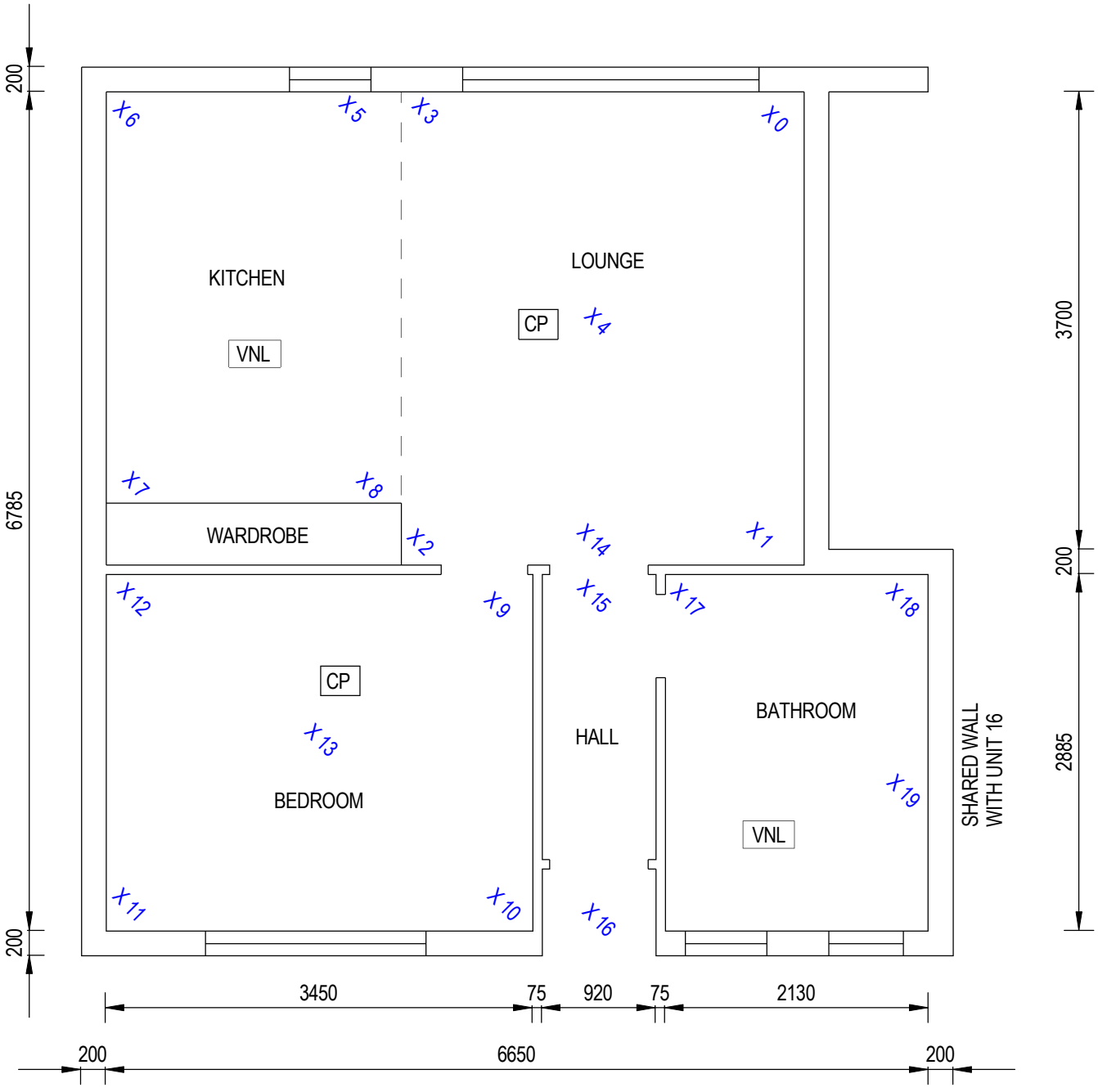
DRAWING No.	REV
S-01-11	A

LEGEND

x2 INDICATES LOCATION OF READING

CP CARPET

VNL VINYL



UNIT 13

1 : 50

2/04/2013 4:37:59 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-04-13	FLOOR LEVEL SURVEYS	L.CASTILLO

DRAWN	DESIGNED
D.HUNIA	N/A
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
CHRISTCHURCH
KING STREET

TITLE
FLOOR LEVEL SUVEY
UNIT 13

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.
233415

SCALE	SIZE
1 : 50	A4

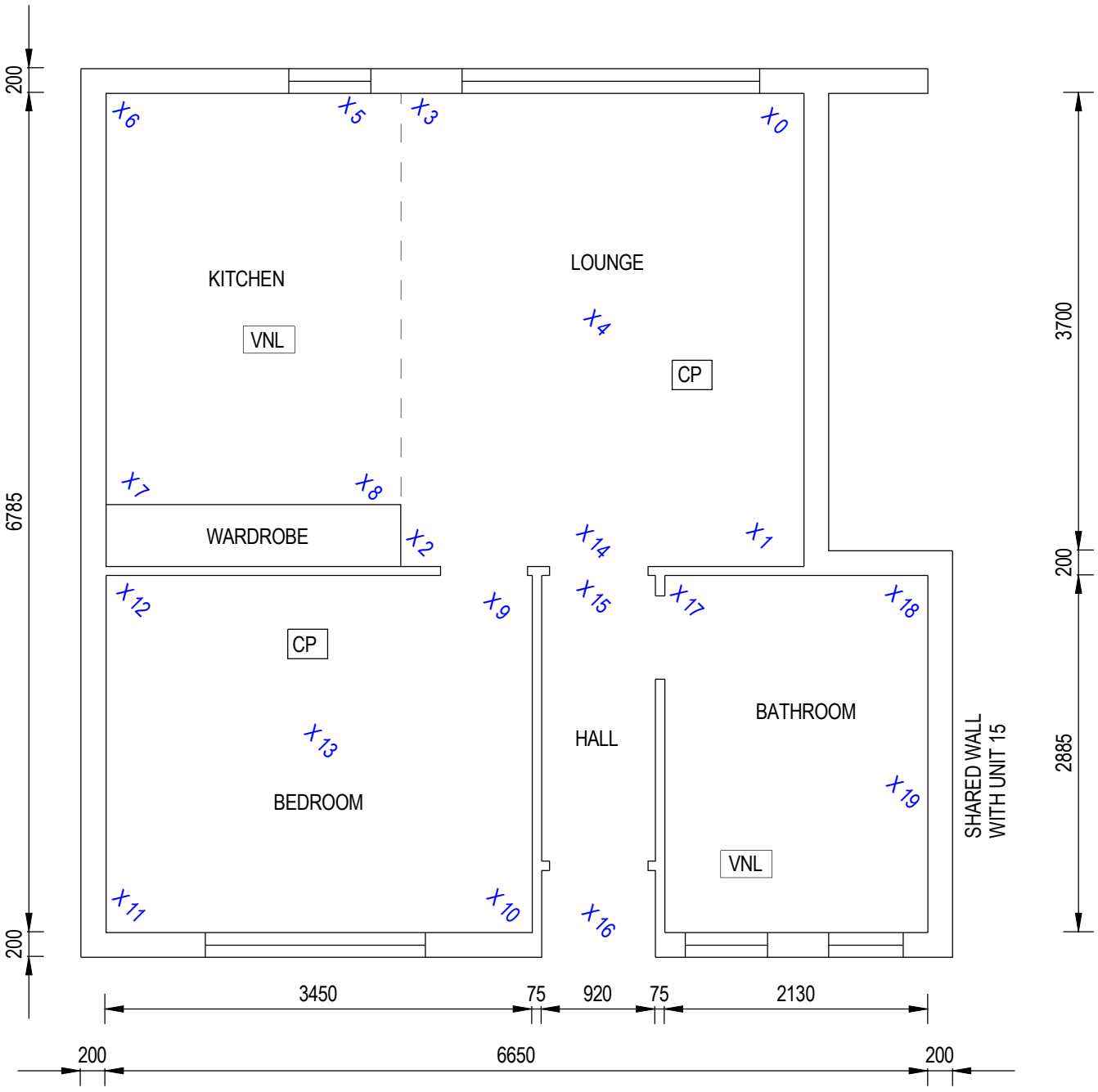
DRAWING No.	REV
S-01-12	A

LEGEND

x? INDICATES LOCATION OF READING

CP CARPET

VNL VINYL



UNIT 14

1 : 50

20/4/2013 4:38:00 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-04-13	FLOOR LEVEL SURVEYS	L.CASTILLO

DRAWN	DESIGNED
D.HUNIA	N/A
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
CHRISTCHURCH
KING STREET

TITLE
FLOOR LEVEL SUVEY
UNIT 14

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.
233415

SCALE	SIZE
1 : 50	A4

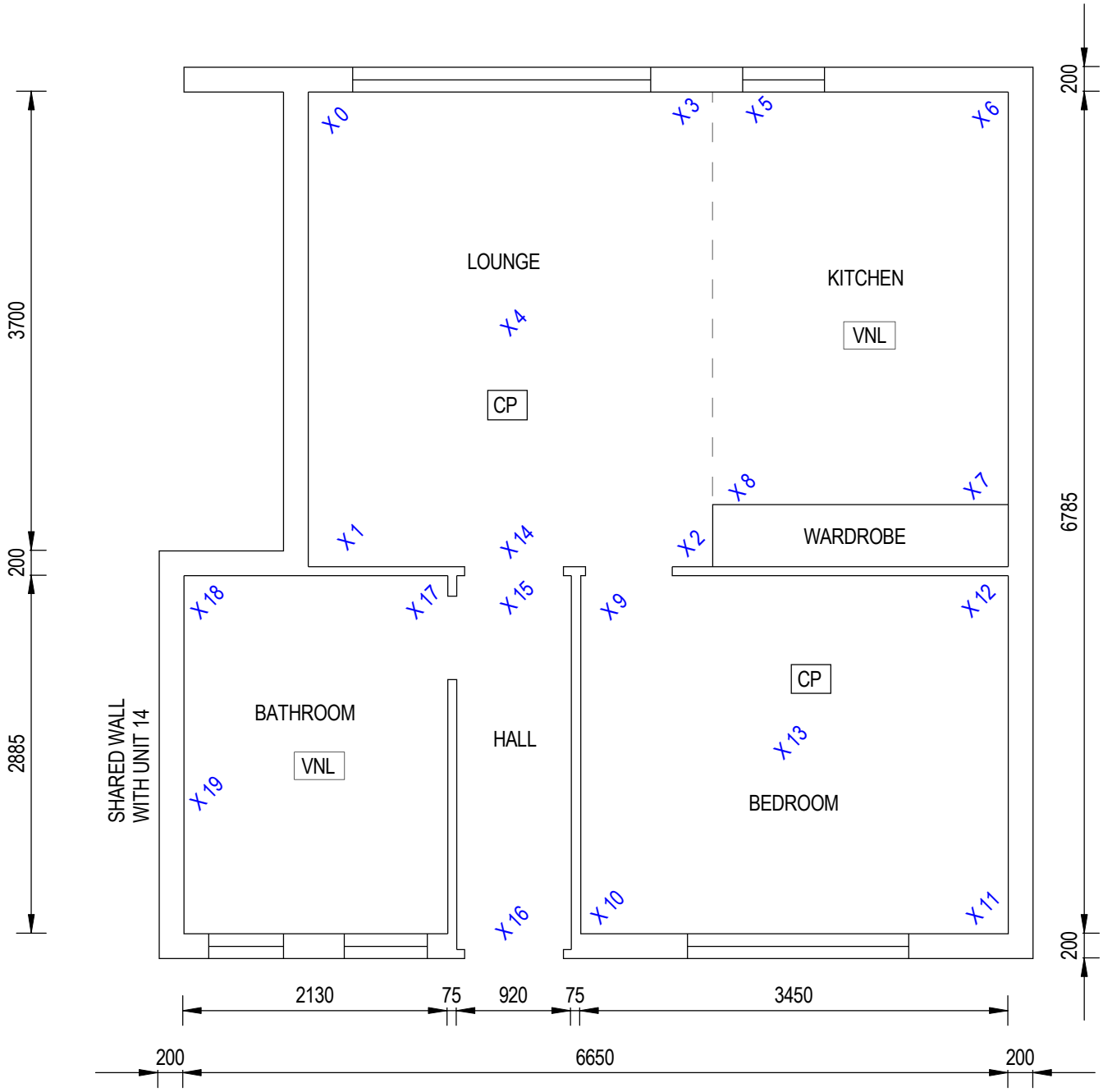
DRAWING No.	REV
S-01-13	A

LEGEND

X? INDICATES LOCATION OF READING

CP CARPET

VNL VINYL



UNIT 15

1 : 50

2/04/2013 4:38:00 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-04-13	FLOOR LEVEL SURVEYS	L.CASTILLO

DRAWN	DESIGNED
D.HUNIA	N/A
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
CHRISTCHURCH
KING STREET

TITLE
FLOOR LEVEL SUVEY
UNIT 15

PRELIMINARY
NOT FOR CONSTRUCTION

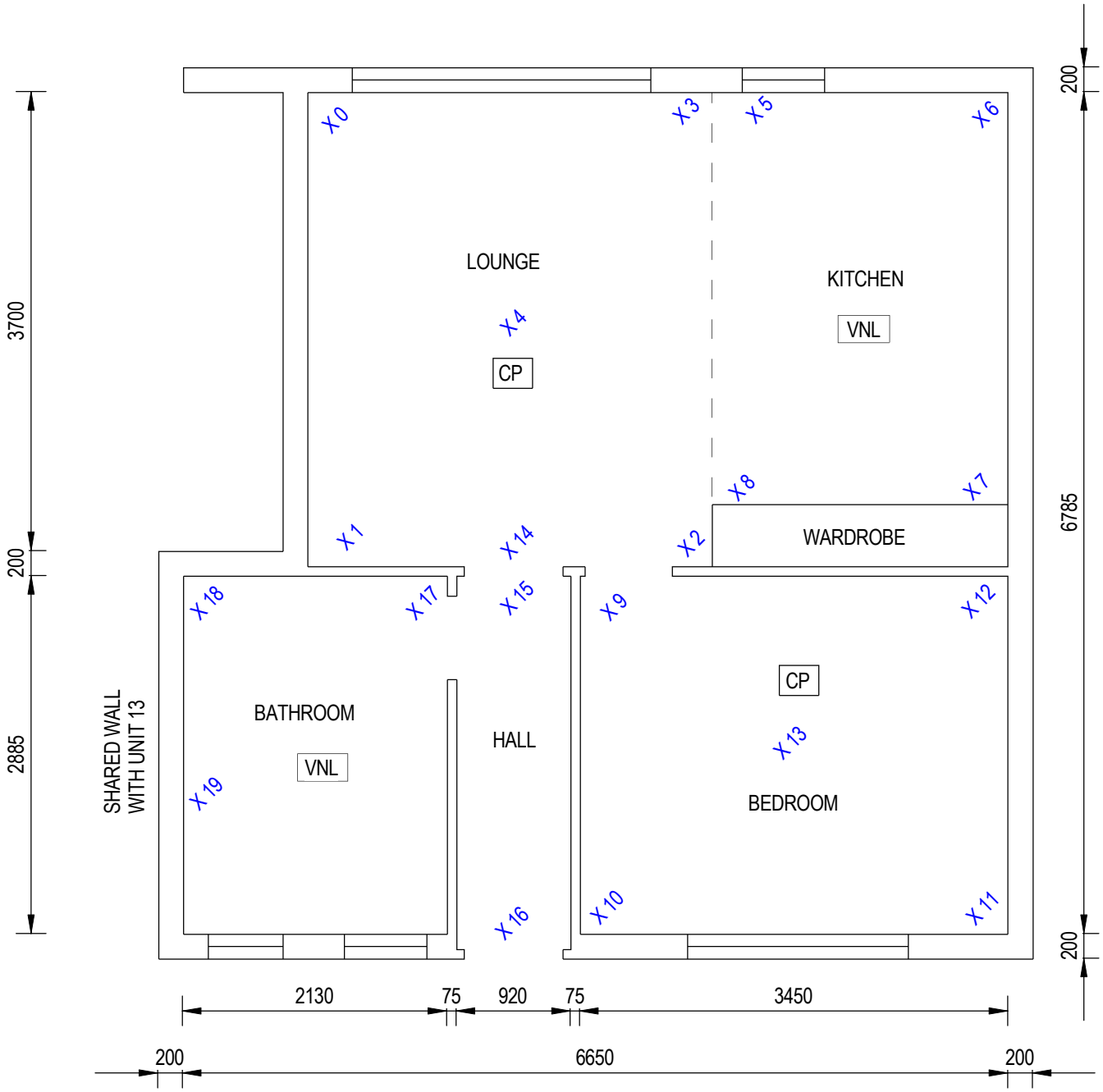
PROJECT No.	
233415	
SCALE	SIZE
1 : 50	A4
DRAWING No.	REV
S-01-14	A

LEGEND

X? INDICATES LOCATION OF READING

CP CARPET

VNL VINYL



UNIT 16

1 : 50

2/04/2013 4:38:01 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-04-13	FLOOR LEVEL SURVEYS	L.CASTILLO

DRAWN	DESIGNED
D.HUNIA	N/A
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
CHRISTCHURCH
KING STREET

TITLE
FLOOR LEVEL SUVEY
UNIT 16

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.	
233415	
SCALE	SIZE
1 : 50	A4
DRAWING No.	REV
S-01-15	A

LEGEND

X? INDICATES LOCATION OF READING

CP CARPET

VNL VINYL

UNIT 17

1 : 50

2/04/2013 4:38:02 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-04-13	FLOOR LEVEL SURVEYS	L.CASTILLO

DRAWN	DESIGNED
D.HUNIA	N/A
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
CHRISTCHURCH
KING STREET

TITLE
FLOOR LEVEL SUVEY
UNIT 17

PRELIMINARY
NOT FOR CONSTRUCTION

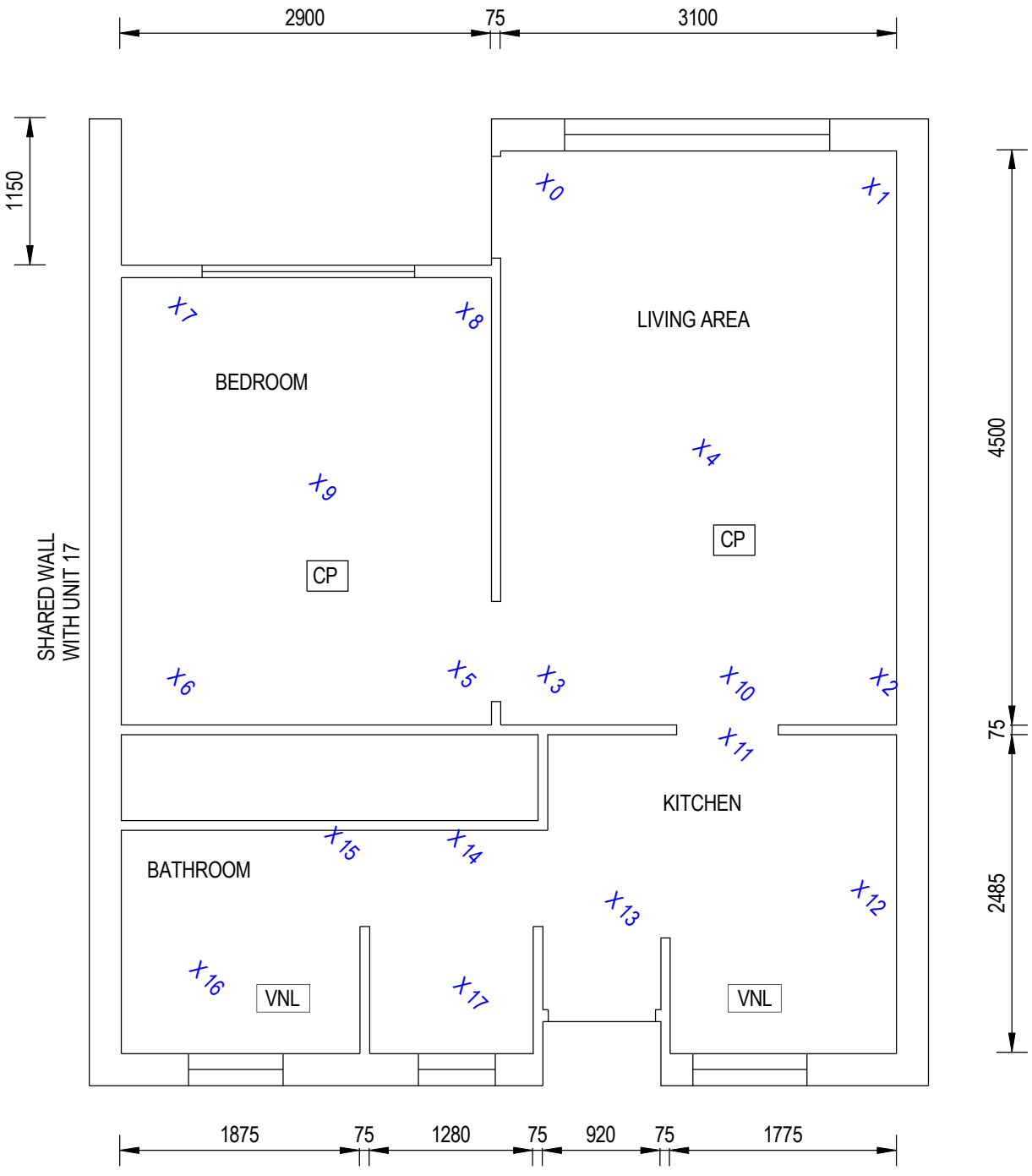
PROJECT No.	
233415	
SCALE	SIZE
1 : 50	A4
DRAWING No.	REV
S-01-16	A

LEGEND

x? INDICATES LOCATION OF READING

CP CARPET

VNL VINYL



UNIT 18

1 : 50

2/04/2013 4:38:03 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-04-13	FLOOR LEVEL SURVEYS	L.CASTILLO

DRAWN	DESIGNED
D.HUNIA	N/A
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
CHRISTCHURCH
KING STREET

TITLE
FLOOR LEVEL SUVEY
UNIT 18

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.
233415

SCALE	SIZE
1 : 50	A4

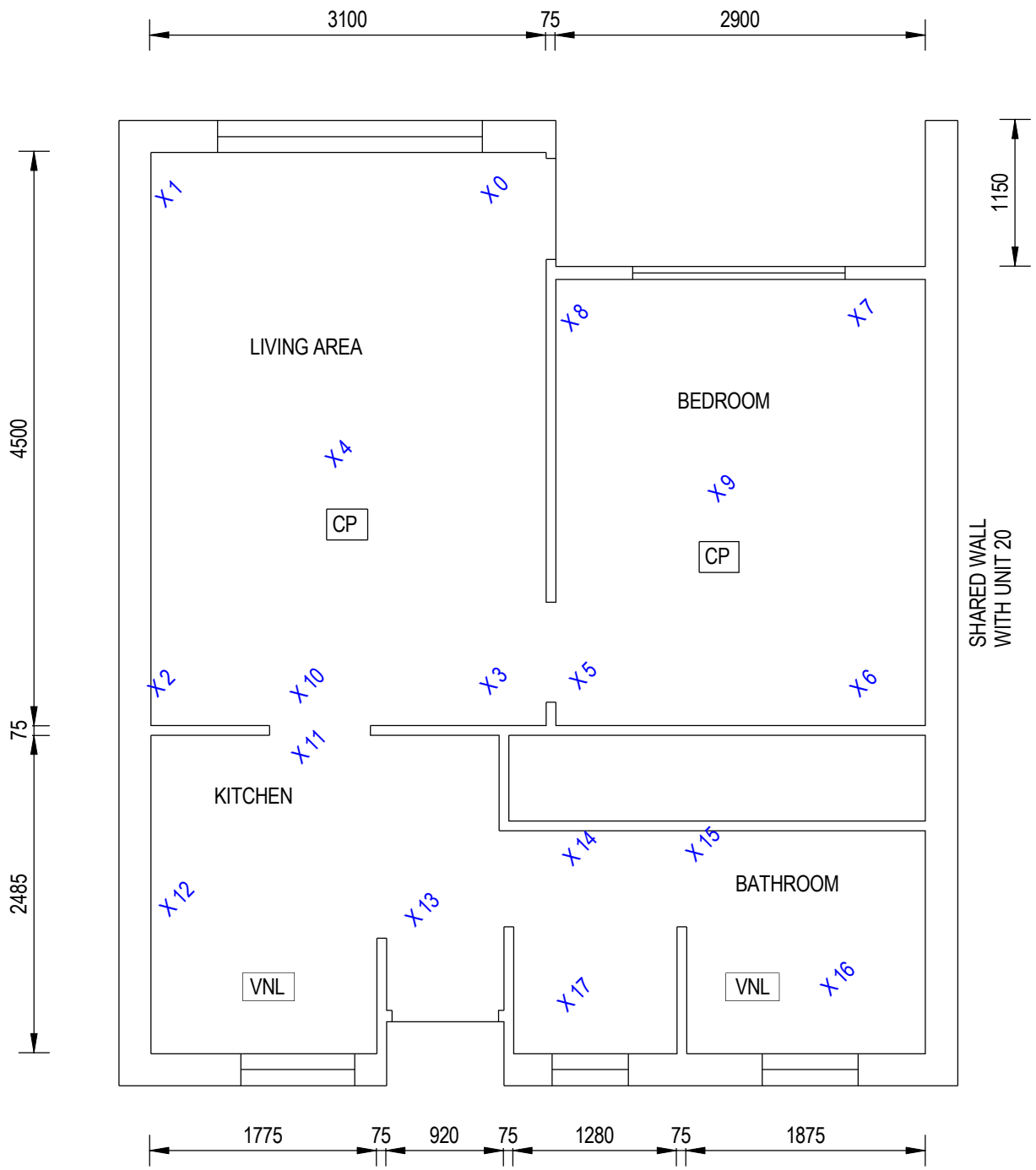
DRAWING No.	REV
S-01-17	A

LEGEND

X? INDICATES LOCATION OF READING

CP CARPET

VNL VINYL



UNIT 19

1 : 50

2/04/2013 4:38:04 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-04-13	FLOOR LEVEL SURVEYS	L.CASTILLO

DRAWN	DESIGNED
D.HUNIA	N/A
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
CHRISTCHURCH
KING STREET

TITLE
FLOOR LEVEL SUVEY
UNIT 19

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.
233415

SCALE 1 : 50 | SIZE A4

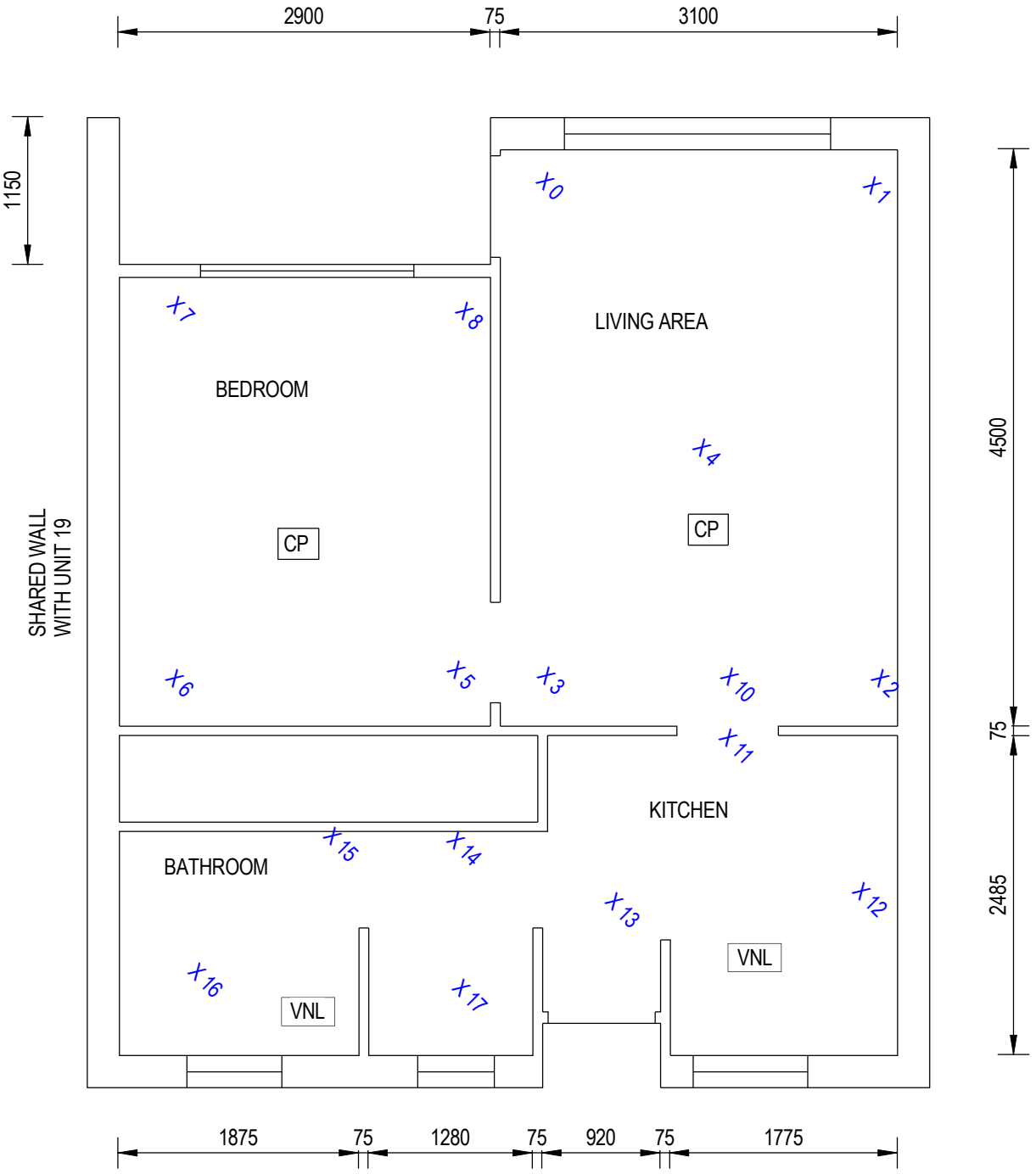
DRAWING No. S-01-18 | REV A

LEGEND

x2 INDICATES LOCATION OF READING

CP CARPET

VNL VINYL



UNIT 20

1 : 50

2/04/2013 4:38:05 p.m.

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CLIENT
Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL
A	02-04-13	FLOOR LEVEL SURVEYS	L.CASTILLO

DRAWN	DESIGNED
D.HUNIA	N/A
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
CHRISTCHURCH
KING STREET

TITLE
FLOOR LEVEL SUVEY
UNIT 20

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.
233415

SCALE	SIZE
1 : 50	A4

DRAWING No.	REV
S-01-19	A

Appendix B
References

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

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

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

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

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

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

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

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

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

Appendix C
Strength Assessment Explanation

New building standard (NBS)

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

Earthquake Prone Buildings

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

Christchurch City Council Earthquake Prone Building Policy 2010

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

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

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

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

Christchurch Seismicity

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

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

The likely capacity of this building has been derived in accordance with the New Zealand Society for Earthquake Engineering (NZSEE) guidelines 'Assessment and Improvement of the Structural Performance of Buildings in Earthquakes' (AISPBE), 2006. These guidelines provide an Initial Evaluation Procedure that assesses a buildings capacity based on a comparison of loading codes from when the building was designed

and currently. It is a quick high-level procedure that can be used when undertaking a Qualitative analysis of a building. The guidelines also provide guidance on calculating a modified Ultimate Limit State capacity of the building which is much more accurate and can be used when undertaking a Quantitative analysis.

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

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

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

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

Table C1: Relative Risk of Building Failure In A

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

Appendix D
Background and Legal Framework

Background

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

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

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

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

Compliance

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

Canterbury Earthquake Recovery Authority (CERA)

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

Section 38 – Works

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

Section 51 – Requiring Structural Survey

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

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

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

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

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

Building Act

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

Section 112 – Alterations

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

Section 115 – Change of Use

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

Section 121 – Dangerous Buildings

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

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

Section 122 – Earthquake Prone Buildings

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

Section 124 – Powers of Territorial Authorities

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

Section 131 – Earthquake Prone Building Policy

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

Christchurch City Council Policy

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

The 2010 amendment includes the following:

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

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

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

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

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

Building Code

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

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

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

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

Appendix E
Standard Reporting Spread Sheet

- ✓ Blocks A and D
- ✓ Block C
- ✓ Block D

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Blocks A and D				Reviewer:	Lee Howard
		Unit	No:	Street	CPEng No:	1008889
Building Address:	CCC Residential appartment		146	king st	Company:	Aurecon
Legal Description:					Company project number:	233415
					Company phone number:	03-366-8021
		Degrees	Min	Sec		
GPS south:		43	33	18.26	Date of submission:	23/01/2013
GPS east:		172	38	38.63	Inspection Date:	10/12/2012
					Revision:	1
Building Unique Identifier (CCC):	BE1061 EQ2				Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	0
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):	10.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	10.00
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):	5.00		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	240			
Age of Building (years):	37		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 framed	rafter type, purlin type and cladding	
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	timber	type	
Columns:	load bearing walls	typical dimensions (mm x mm)	
Walls:	partially filled concrete masonry	thickness (mm)	

Lateral load resisting structure

Lateral system along:	other (note)	**Note: Define along and across in detailed report!**	describe system	Partially filled masonry walls
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:	other (note)		describe system	Partially filled masonry walls / timber lined walls
Ductility assumed, μ:	2.00			
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:	cast insitu	notes	
Wall cladding:	brick or tile	describe (note cavity if exists)	
Roof Cladding:	Heavy tiles	describe	
Glazing:	aluminium frames		
Ceilings:	light tiles		
Services(list):			

Available documentation

Architectural	partial	original designer name/date	Enterprise Homes Ltd
Structural	partial	original designer name/date	Enterprise homes Ltd
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:	none observed	notes (if applicable):	
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	none apparent	notes (if applicable):	
Lateral Spread:	none apparent	notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

	Current Placard Status:	green	
Along	Damage ratio:	0%	Describe how damage ratio arrived at:
	Describe (summary):		
Across	Damage ratio:	0%	$Damage\_Ratio = \frac{(\%NBS\,(before) - \%NBS\,(after))}{\%NBS\,(before)}$
	Describe (summary):		
Diaphragms	Damage?:	no	Describe:
CSWs:	Damage?:	no	Describe:
Pounding:	Damage?:	no	Describe:
Non-structural:	Damage?:	yes	Describe: Minor cracking

Recommendations

	Level of repair/strengthening required:	none		Describe:	
	Building Consent required:	no		Describe:	
	Interim occupancy recommendations:	full occupancy		Describe:	
Along	Assessed %NBS before e'quakes:	75%	##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	detailed calculations
	Assessed %NBS after e'quakes:	75%			
Across	Assessed %NBS before e'quakes:	100%	##### %NBS from IEP below		
	Assessed %NBS after e'quakes:	100%			

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

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

Seismic Zone, if designed between 1965 and 1992:	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

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:	0.30
Z_{1992}, from NZS4203:1992	0.8
Hazard scaling factor, **Factor B:**	3.333333333

2.4 Return Period Scaling Factor

Building Importance level (from above):	2
Return Period Scaling factor from Table 3.1, **Factor C**:	0.80

2.5 Ductility Scaling Factor

	along	across
Assessed ductility (less than max in Table 3.2)	2.00	2.00
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:	1.57	1.57
Ductiity Scaling Factor, **Factor D**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

Sp:	0.700	0.700
Structural Performance Scaling Factor **Factor E**:	1.428571429	1.428571429

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:	significant	0.7
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	insignificant	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	2.0	2.0
Rationale for choice of F factor, if not 1		

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

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

3.7. Overall Performance Achievement ratio (PAR)		**1.40**	**1.40**
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:	Block B				Reviewer:	Lee Howard
		Unit	No:	Street	CPEng No:	1008889
Building Address:	CCC Residential appartment		146	king st	Company:	Aurecon
Legal Description:					Company project number:	233415
					Company phone number:	03-366-8021
		Degrees	Min	Sec		
GPS south:		43	33	18.26	Date of submission:	23/01/2013
GPS east:		172	38	38.63	Inspection Date:	10/12/2012
					Revision:	1
Building Unique Identifier (CCC):	BE1061 EQ2				Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	0
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):	10.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	10.00
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):	5.00		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	138			
Age of Building (years):	37		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 framed	rafter type, purlin type and cladding	
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	timber	type	
Columns:	load bearing walls	typical dimensions (mm x mm)	
Walls:	partially filled concrete masonry	thickness (mm)	

Lateral load resisting structure

Lateral system along:	other (note)	**Note: Define along and across in detailed report!**		Partially filled masonry walls
Ductility assumed, μ:	2.00		describe system	
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:	other (note)			Partially filled masonry walls / Timber lined walls
Ductility assumed, μ:	2.00		describe system	
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:	cast insitu	notes	
Wall cladding:	brick or tile	describe (note cavity if exists)	
Roof Cladding:	Heavy tiles	describe	
Glazing:	aluminium frames		
Ceilings:	light tiles		
Services(list):			

Available documentation

Architectural	partial	original designer name/date	Enterprise Homes Ltd
Structural	partial	original designer name/date	Enterprise homes Ltd
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:	none observed	notes (if applicable):	
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	none apparent	notes (if applicable):	
Lateral Spread:	none apparent	notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

	Current Placard Status:	green	
Along	Damage ratio:	0%	Describe how damage ratio arrived at:
	Describe (summary):		
Across	Damage ratio:	0%	$Damage\_Ratio = \frac{(\%NBS\,(before) - \%NBS\,(after))}{\%NBS\,(before)}$
	Describe (summary):		
Diaphragms	Damage?:	no	Describe:
CSWs:	Damage?:	no	Describe:
Pounding:	Damage?:	no	Describe:
Non-structural:	Damage?:	yes	Describe: Minor cracking

Recommendations

	Level of repair/strengthening required:	none		Describe:
	Building Consent required:	no		Describe:
	Interim occupancy recommendations:	full occupancy		Describe:
Along	Assessed %NBS before e'quakes:	41%	##### %NBS from IEP below	If IEP not used, please detail assessment methodology: detailed calculations
	Assessed %NBS after e'quakes:	41%		
Across	Assessed %NBS before e'quakes:	72%	##### %NBS from IEP below	
	Assessed %NBS after e'quakes:	72%		

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

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

Seismic Zone, if designed between 1965 and 1992:	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

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:	0.30
Z_{1992}, from NZS4203:1992	0.8
Hazard scaling factor, **Factor B:**	3.333333333

2.4 Return Period Scaling Factor

Building Importance level (from above):	2
Return Period Scaling factor from Table 3.1, **Factor C**:	0.80

2.5 Ductility Scaling Factor

	along	across
Assessed ductility (less than max in Table 3.2)	2.00	2.00
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:	1.57	1.57
Ductiity Scaling Factor, **Factor D**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

Sp:	0.700	0.700
Structural Performance Scaling Factor **Factor E**:	1.428571429	1.428571429

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:	significant	0.7
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	insignificant	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	2.0	2.0
Rationale for choice of F factor, if not 1		

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

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

3.7. Overall Performance Achievement ratio (PAR)		**1.40**	**1.40**
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:	Block C				Reviewer:	Lee Howard
		Unit	No:	Street	CPEng No:	1008889
Building Address:	CCC Residential appartment		146	king st	Company:	Aurecon
Legal Description:					Company project number:	233415
					Company phone number:	03-366-8021
		Degrees	Min	Sec		
GPS south:		43	33	18.26	Date of submission:	23/01/2013
GPS east:		172	38	38.63	Inspection Date:	10/12/2012
					Revision:	1
Building Unique Identifier (CCC):	BE1061 EQ2				Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	0
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):	10.00

Building

No. of storeys above ground:	2	single storey = 1	Ground floor elevation (Absolute) (m):	10.00
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):	8.00		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	290			
Age of Building (years):	37		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 framed	rafter type, purlin type and cladding	
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	timber	type	
Columns:	load bearing walls	typical dimensions (mm x mm)	
Walls:	partially filled concrete masonry	thickness (mm)	

Lateral load resisting structure

Lateral system along:	other (note)	**Note: Define along and across in detailed report!**		Partially filled masonry walls
Ductility assumed, μ:	2.00		describe system	
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:	other (note)			Partially filled masonry walls / timber lined walls
Ductility assumed, μ:	2.00		describe system	
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:	cast insitu	notes	
Wall cladding:	brick or tile	describe (note cavity if exists)	
Roof Cladding:	Heavy tiles	describe	
Glazing:	aluminium frames		
Ceilings:	light tiles		
Services(list):			

Available documentation

Architectural	partial	original designer name/date	Enterprise Homes Ltd
Structural	partial	original designer name/date	Enterprise homes Ltd
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:	none observed	notes (if applicable):	
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	none apparent	notes (if applicable):	
Lateral Spread:	none apparent	notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):			
Across	Damage ratio:	0%	$Damage\_Ratio = \frac{(\%NBS\,(before) - \%NBS\,(after))}{\%NBS\,(before)}$	
	Describe (summary):			
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	yes	Describe:	Minor cracking

Recommendations

	Level of repair/strengthening required:	none	Describe:	
	Building Consent required:	no	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	42% ##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	detailed calculations
	Assessed %NBS after e'quakes:	42%		
Across	Assessed %NBS before e'quakes:	100% ##### %NBS from IEP below		
	Assessed %NBS after e'quakes:	100%		

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

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

Seismic Zone, if designed between 1965 and 1992:	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

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:	0.30
Z_{1992}, from NZS4203:1992	0.8
Hazard scaling factor, **Factor B:**	3.333333333

2.4 Return Period Scaling Factor

Building Importance level (from above):	2
Return Period Scaling factor from Table 3.1, **Factor C**:	0.80

2.5 Ductility Scaling Factor

	along	across
Assessed ductility (less than max in Table 3.2)	2.00	2.00
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:	1.57	1.57
Ductiity Scaling Factor, **Factor D**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

Sp:	0.700	0.700
Structural Performance Scaling Factor **Factor E**:	1.428571429	1.428571429

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:	significant	0.7
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	insignificant	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	2.0	2.0
Rationale for choice of F factor, if not 1		

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

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

3.7. Overall Performance Achievement ratio (PAR)		**1.40**	**1.40**
4.3 PAR x (%NBS)b:	PAR x Baselline %NBS:	**#DIV/0!**	**#DIV/0!**
4.4 Percentage New Building Standard (%NBS), (before)			**#DIV/0!**

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