Walsall Courts Housing Complex
Qualitative Engineering Evaluation

Reference: 233416

Prepared for:

Christchurch City Council

Functional Location ID: BE 0488 EQ2

Address: 15 Walsall Street

Revision: 2

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

Contents

Appendices

Executive Summary – Blocks A, B, F & G

This is a summary of the Qualitative Engineering Evaluation for the Walsall Courts Housing Complex – Block 1 buildings 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**	Walsall Courts Housing Complex – Building Type 1			
Building Location ID	BU 0488-001 EQ2			**Multiple Building Site**	Y
Building Address	15 Walsall Street			**No. of residential units**	4
Soil Technical Category	TC2	**Importance Level**	2	**Approximate Year Built**	1970
Foot Print (m^2)	136 (34 per unit)	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Light weight metal sheeting roof supported on a timber truss network based on timber framed walls lined with masonry veneer (external) and gib plaster board (internal) founded on a concrete slab-on-grade.				

Qualitative L4 Report Results Summary		
Building Occupied	Y	Walsall Courts Housing Complex - Block A is currently in use.
Suitable for Continued Occupancy	Y	Walsall Courts Housing Complex - Block A 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	Some units were found to have slopes exceeding DHB guidelines (see Section 2.6).
Building %NBS From Analysis	100%	Based on capacity and demand calculations.

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

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

Executive Summary – Block C & E

This is a summary of the Qualitative Engineering Evaluation for the Walsall 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**	Walsall Courts Housing Complex – Building Type 2			
Building Location ID	BE 0488 EQ2			**Multiple Building Site**	Y
Building Address	15 Walsall Street			**No. of residential units**	2
Soil Technical Category	TC2	**Importance Level**	2	**Approximate Year Built**	1970
Foot Print (m^2)	86 (43 per unit)	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Light weight metal sheeting roof supported on a timber truss network based on timber framed walls lined with masonry veneer (external) and gib plaster board (internal) founded on a concrete slab-on-grade.				

Qualitative L4 Report Results Summary		
Building Occupied	Y	Walsall Courts Housing Complex - Block C is currently in use.
Suitable for Continued Occupancy	Y	Walsall Courts Housing Complex - Block C is suitable for continued use.
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 of report body.
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.
Levels Survey Results	Y	Some units were found to have slopes exceeding DHB guidelines (see Section 2.6).
Building %NBS From Analysis	83%	Based on capacity and demand calculations

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

Approval			
Author Signature	[signature]	Approver Signature	[signature]
Name	Luis Castillo	Name	Eric Simeone
Title	Senior Structural Engineer	Title	Senior Structural Engineer

Executive Summary – Block D

This is a summary of the Qualitative Engineering Evaluation for the Walsall 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**	Walsall Courts Housing Complex – Building Type 3			
Building Location ID	BE 0488 EQ2			**Multiple Building Site**	Y
Building Address	15 Walsall Street			**No. of residential units**	6
Soil Technical Category	TC2	**Importance Level**	2	**Approximate Year Built**	1970
Foot Print (m²)	258 (43 per unit)	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Light weight metal sheeting roof supported on a timber truss network based on timber framed walls lined with masonry veneer (external) and gib plaster board (internal) founded on a concrete slab-on-grade.				

Qualitative L4 Report Results Summary		
Building Occupied	Y	Walsall Courts Housing Complex - Block D is currently in use.
Suitable for Continued Occupancy	Y	Walsall Courts Housing Complex - Block D is suitable for continued use.
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 of report body.
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.
Levels Survey Results	Y	Some units were found to have slopes exceeding DHB guidelines (see Section 2.6).
Building %NBS From Analysis	96%	Based on capacity and demand calculations

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

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

1 Introduction

1.1 General

On 20 December 2012 Aurecon engineers visited the Walsall 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 and related aftershocks.

The scope of work included:

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

This report outlines the results of our Qualitative Assessment of damage to the Walsall Courts Housing Complex and is based on the Detailed Engineering Evaluation Guidelines as issued by the Engineering Advisory Group on 19 July 2011, visual inspections, available structural documentation as appropriate are attached herein.

2 Description of the Building

2.1 Building Age and Configuration

The Walsall Courts Housing Complex was built in 1970 and consists of 26 single storey residential units. The complex has been divided into seven separate blocks which can be identified in the image shown on the next page. Block A contains units 1-4, Block B contains units 5-8, Block C contains units 9-10, Block D contains units 11-16, Block E contains units 17-18, Block F contains 19-22 and Block G contains units 23-26. It is important to note that units within Blocks C, D and E have been physically marked as 1-10, same as for units within Blocks F and G which have been marked as units 1-8. The units in Blocks A, B F and G are referred to as Type A units and the units in Blocks C, D and E are referred to as Type B units. On the same image three different types of buildings can be identified: Building Type 1 correspond to Blocks A, B, F and G; Building Type 2 correspond to Blocks C and E and Building Type 3 correspond to Block D.

All the units are timber framed with internal gib plaster board lining and externally clad with brickwork veneer (Building Type 1 has red brick and Building Types 2 and 3 have white brick). The roofs are of light weight metal sheeting and are supported on a timber truss system. These building blocks have slab-on-grade foundation systems.

The average area of Type A unit is $34m^2$ and the Type B unit is $43m^2$.

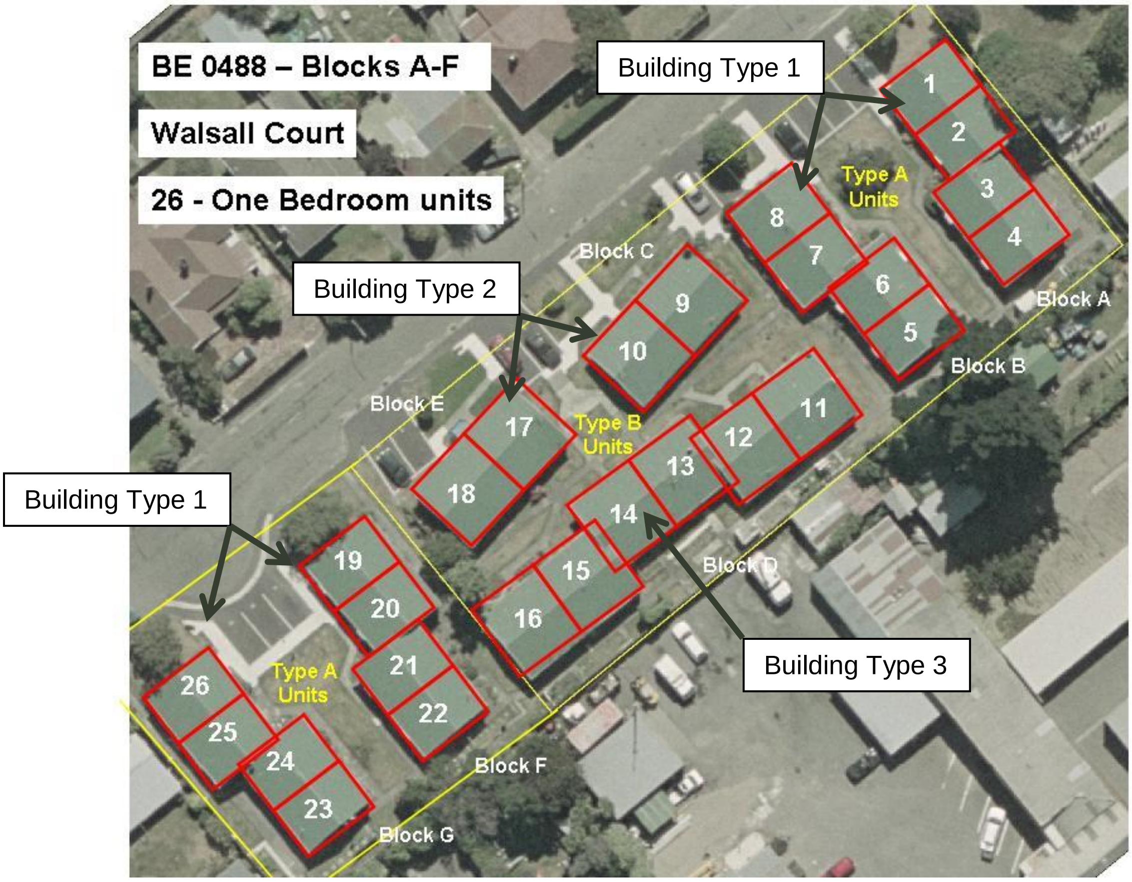


Figure 1: Aerial photograph showing Building Types, Blocks and Unit Types

2.2 Building Structural Systems Vertical and Horizontal

In all of the residential units vertical loads are carried from the roof to the timber truss system and then into the timber framed walls. Loads are then transferred down the timber frame into the slab-on-grade foundation where they are transferred into the ground.

In all building types, the horizontal loads are resisted by gib plasterboard lined timber framed walls in both the transverse and longitudinal directions. In the transverse direction a concrete block wall is present between units for fire protection purposes. The concrete block work walls provide the majority of the lateral resistant capacity for the buildings in this direction.

2.3 Reference Building Type

The units at the Walsall Courts Housing Complex are of a basic design. They have a small, simple floor plan with timber framed walls internally lined with gib plasterboard and externally clad with brick veneer.

2.4 Building Foundation System and Soil Conditions

The residential units all have concrete slab-on-grade foundations which distribute loads directly into the ground below the units. The Walsall Courts Housing Complex sits on land classified as TC2, and according to the Canterbury Earthquake Repair Authority, may experience “minor to moderate land damage from liquefaction in future significant earthquakes”.

2.5 Available Structural Documentation and Inspection Priorities

Structural documentation was not available for the Walsall Courts Housing Complex, however, due to the generic and simple nature of the buildings a significant amount of structural information could be inferred from the inspection. The inspection priorities for this report pertain to the review of damage to the building and consideration of the building's bracing adequacy.

2.6 Available Survey Information

A level survey was undertaken on the floor coverings of the building to quantify the level of unevenness. The survey was undertaken on top of existing floor finishes which may have influenced the results of the survey. The table below shows a summary of the areas and units where the slope recorded exceeds the DHB guideline of 0.5%.

Table 1: Parameters used in the Seismic Assessment

Room	Unit	Maximum slope (%)
Lounge	5	0.58
	8	0.55
	20	1.1
	21	0.7
Bedroom	4	0.7
	9	1.4
	10	0.52
	15	1.3
	18	1.1
	21	1.0
Kitchen	5	1.1
	10	0.9
	14	0.7
	16	0.5
	18	0.63
	20	0.62
	21	0.69
Back entrance	3	0.75
	5	2.3
	6	1.25
	9	1.2
	16	1.3

Please note that slopes in the bathroom have been excluded as most bathrooms had slopes greater than 0.5% to allow for drainage purposes.

3 Structural Investigation

3.1 Summary of Building Damage

The Walsall Courts Housing Complex units were in use at the time of the damage assessment. The following sections list the main damages found.

3.1.1 Blocks A and B

Minor cracking between plaster boards was noted in most units especially around window and door frames.

Behind units 5-8 there was separation between the units and external fixtures causing damage to the back entrances, drains and footpaths (photos 5-7).

3.1.2 Blocks C, D and E

Minor cracking between plaster boards was noted in most units especially around window and door frames.

There was movement between the wall and roof outside unit 11 (photo 9) and between the unit and the external drain (photo 10).

There was general step cracking to the external masonry veneer of most units (photo 11).

Unit 14 had a hairline crack running through the length of the unit (photo 12).

Along the front corner between units 14 and 15 large step cracks were visible. Cracks were also found going through the concrete slab foundation (photos 14-17). Similar damage was also noted behind unit 14.

Unit 18 appears to have undergone differential settlement with gaps opening up along the window ledge (photo 19). This unit also had step cracking through the mortar joints between the blocks which had been previously filled (photo 18). Cracks were also noted in the foundations.

3.1.3 Blocks F and G

Minor cracking between gib plaster boards was noted in most units especially around window and door frames.

In unit 25 the timber door frames have warped making it difficult to close some doors in the unit, in particular the bathroom door (photo 21).

Step cracking between bricks was noted (photo 22).

3.2 Record of Intrusive Investigation

The generic nature of the Walsall Courts Housing Complex has allowed a significant amount of structural information to be inferred from the building form and construction material. However, in regards to trying to determine the existence of reinforcement in the masonry walls a rebar scanning was performed; due to the inconsistent readings revealing nothing better than a wide-spaced arrangement of about 800 mm to centres in only one wall it was decided to considered the masonry walls as unreinforced for calculation purposes.

Although not required as part of the DEE process, we recommend that some floor coverings are removed from unit 14 to determine if the cracks noted to the foundations (photos 15 and 17) are only external or if they propagate through the unit affecting the capacity of the foundations.

3.3 Damage Discussion

The damage observed is generally considered minor. The damage is typically what is expected when similar buildings are subjected to seismic loads. In general the damage has not affected the structural capacity of the units.

4 Building Review Summary

4.1 Building Review Statement

Each unit has been reviewed based on a qualitative assessment inspection. However detailed calculations were performed to check the structural bracing capacity of the buildings.

4.2 Critical Structural Weaknesses

No critical structural weaknesses were identified as part of the building qualitative assessment. The damage noted did not affect the structural performance of the building.

The damage between units 14 and 15 (and similar cases of large step cracking) has caused a loss of strength for the masonry veneer however this does not affect the building strength as calculated in Section 5. The %NBS calculations were based the internal wall linings and not the external masonry veneer capacity. The external brick veneer is considered to be an architectural component of the building and does not contribute to the lateral load carrying capacity of the structure.

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

5.1 General

The units in the Walsall Courts Housing Complex, being of lightweight timber frame and brick work veneer construction, are intrinsically robust and have stood up well in the recent seismic events. This is evidenced by the low level of displacement related damage described in Section 3.

5.2 %NBS Assessment

5.2.1 Parameters used in the seismic assessment

Table 2: Parameters used in the Seismic Assessment

Seismic Parameter	Quantity	Comment/Reference
Site Soil Class	D	NZS 1170.5:2004, Clause 3.1.3, Deep or Soft Soil
Site Hazard Factor, Z	0.30	DBH Info Sheet on Seismicity Changes (Effective 19 May 2011)
Return period Factor, R_u	1.00	NZS 1170.5:2004, Table 3.5
Ductility Factor, μ	2.00	Lightweight timber framed walls (AS 1170.4-2007; Table 6.5 A)
	2.00	Unreinforced Masonry Walls (Assessment and Improvement of Unreinforced Masonry Buildings for Earthquake Resistance; Clause 4.3.2.4)

5.2.2 Lateral load resistance systems

The three different building types in Walsall Courts, despite the architectural differences, from a structural point of view work with the same types of lateral load resistance systems. In the transverse direction the sequence of units is sectioned by masonry walls and at the ends of the buildings the walls are timber framed. Due to the lack of information stated in the drawings provided by CCC and the random readings received from the rebar scanning procedure, performed during the site visits, it was decided to consider the masonry walls as being unreinforced. The timber framed walls located at the ends of the buildings are gib lined, only in the interior, and the exterior is covered with brick work veneer. The brick work veneer is considered as to not provide any lateral resistance capacity to the wall as a structural element.

In the longitudinal direction, the lateral load is mainly carried by the interior walls which are timber framed with gib lining on both sides and are parallel to the longitudinal axis of the building. The front and rear facades do not provide a significant contribution to the lateral load resistant system due to the remaining narrow wall sections remaining after the window and door openings are subtracted.

Since these are one-storey units with a timber framed roof the ceiling diaphragm is considered to be flexible.

The building strength assessment was carried out using detailed capacity vs demand analysis.

5.3 Assessment Results

The building strength assessment was carried out using detailed demand and capacity analysis. The following table presents the results from this assessment:

Table 3: Parameters used in the Seismic Assessment

Building Type	Blocks	Direction	%NBS	Comments
1	A, B, F, G	Longitudinal	100%	Given by the out-of-plane capacity of the masonry walls.
		Transverse	100%	Given by masonry walls
2	C, E	Longitudinal	100%	Given by the out-of-plane capacity of the masonry walls.
		Transverse	83%	Limited by the timber framed walls.
3	D	Longitudinal	100%	Given by the out-of-plane capacity of the masonry walls
		Transverse	96%	Limited by the timber framed walls located at the ends of the building.

5.3.1 Results discussion

The results from the %NBS analysis reflect the limited damage observed during the site inspection. This shows that the buildings themselves have performed well during the Canterbury earthquake sequence. The damage observed is attributed to ground movements and therefore not directly related to the lateral load carrying capacity of the units.

6 Conclusions and Recommendations

Due to the low level of damage observed to the structural components and the high %NBS values calculated for the units, it is considered that the units in the Walsall Courts Housing Complex are **suitable for continued use**. However, due to large floor level variations in certain units, it is recommended that re-levelling of the floors is undertaken.

As there is no clear evidence of any liquefaction or large ground movement in the vicinity of the Walsall Courts Housing Complex **a geotechnical investigation is currently not considered necessary**.

7 Explanatory Statement

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

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

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

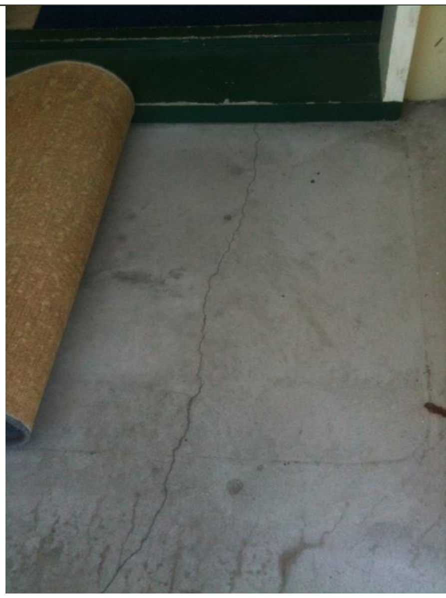
Appendix A
Site Location, Photos and Levels Survey

20 December 2012 – Walsall Courts Housing Complex Site Photographs

Ref	Description	Photograph
1	Location of the Walsall Courts Housing Complex.	
2	Aerial photograph of the Walsall Courts Housing Complex	

3	General view of Block 1 (unit 5).	
4	General view of roof structure as taken from unit 5.	
5	Damage behind units 5-8.	

6	Warping of back entrance to unit 6 from damage behind units 5-8.	
7	Damage behind units 5-8.	
8	General view of Block 2.	

9	Wall movement at unit 11 (potentially earthquake related).	
10	Separation between unit 11 and drain.	
11	Step cracking through mortar outside of unit 12.	
12	Hairline crack running through the length of unit 14.	

13	Separation between ceiling cladding and walls behind unit 14.	
14	Step cracking through mortar behind unit 14.	
15	Damage to foundations behind unit 14.	
16	Large step cracking at the front corner between units 14 and 15.	

17	Damage to foundations at the front corner between units 14 and 15.	
18	Large step cracking outside unit 18 that has previously been filled in.	
19	Movement of unit 18 (no gap at western end of window).	

20	General view of unit in Block 3.		
21	Twisted door frames in unit 25 (door does not shut properly).		
22	Step cracking between bricks.		

WALSALL COURTS HOUSING COMPLEX
CHRISTCHURCH

LOCALITY PLAN

STRUCTURAL DRAWING INDEX	
DRG. NO.	TITLE
SK-00-00	COVER
SK-00-01	SITE MAP
SK-01-01	UNIT 1
SK-01-02	UNIT 2
SK-01-03	UNIT 3
SK-01-04	UNIT 4
SK-01-05	UNIT 5
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SK-03-01	UNIT 20
SK-03-02	UNIT 21
SK-03-03	UNIT 23
SK-03-04	UNIT 25

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L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
WALSALL COURTS HOUSING COMPLEX
CHRISTCHURCH

TITLE
SITE MAP

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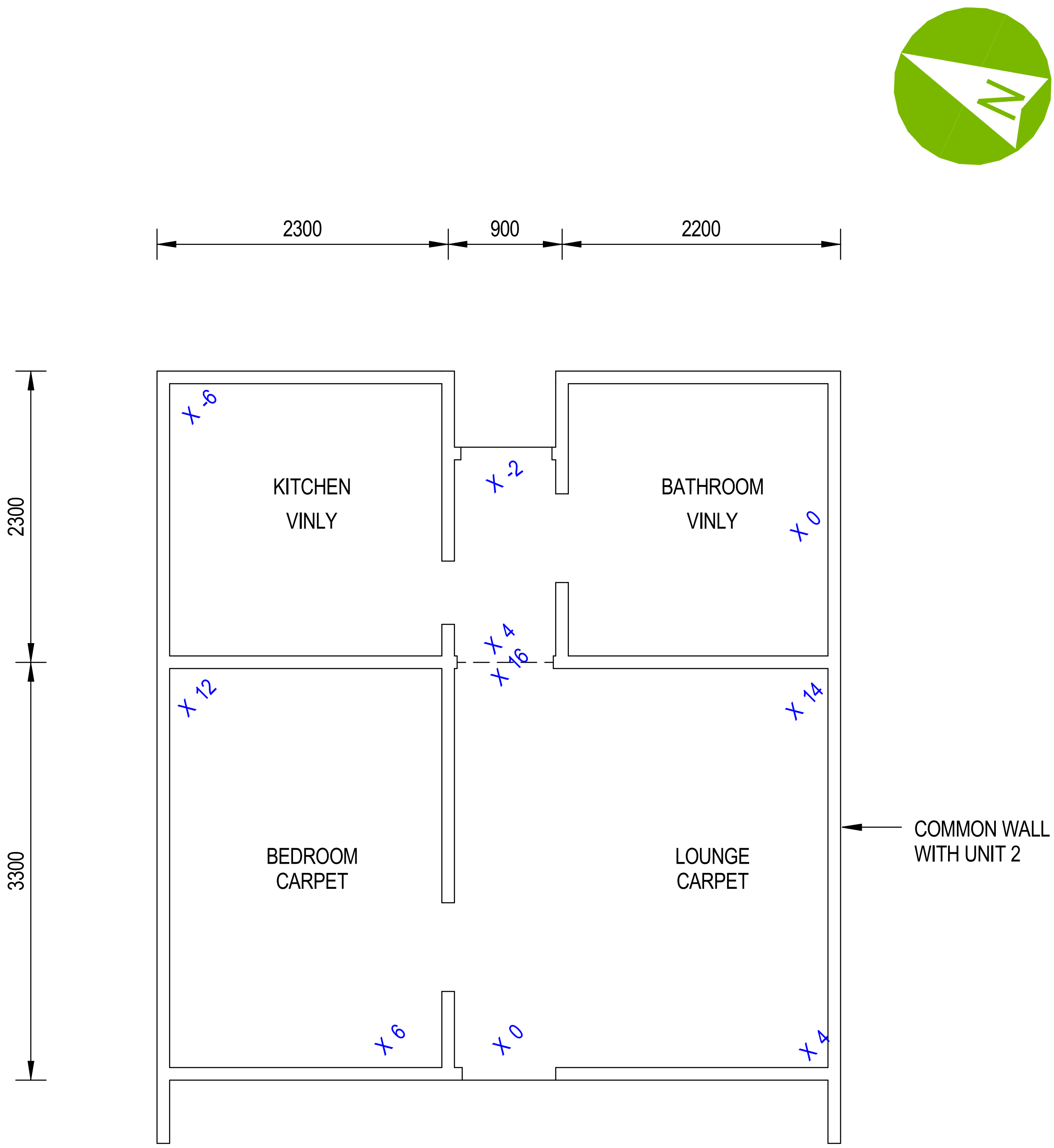

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TITLE
LEVEL SURVEY
UNIT 1

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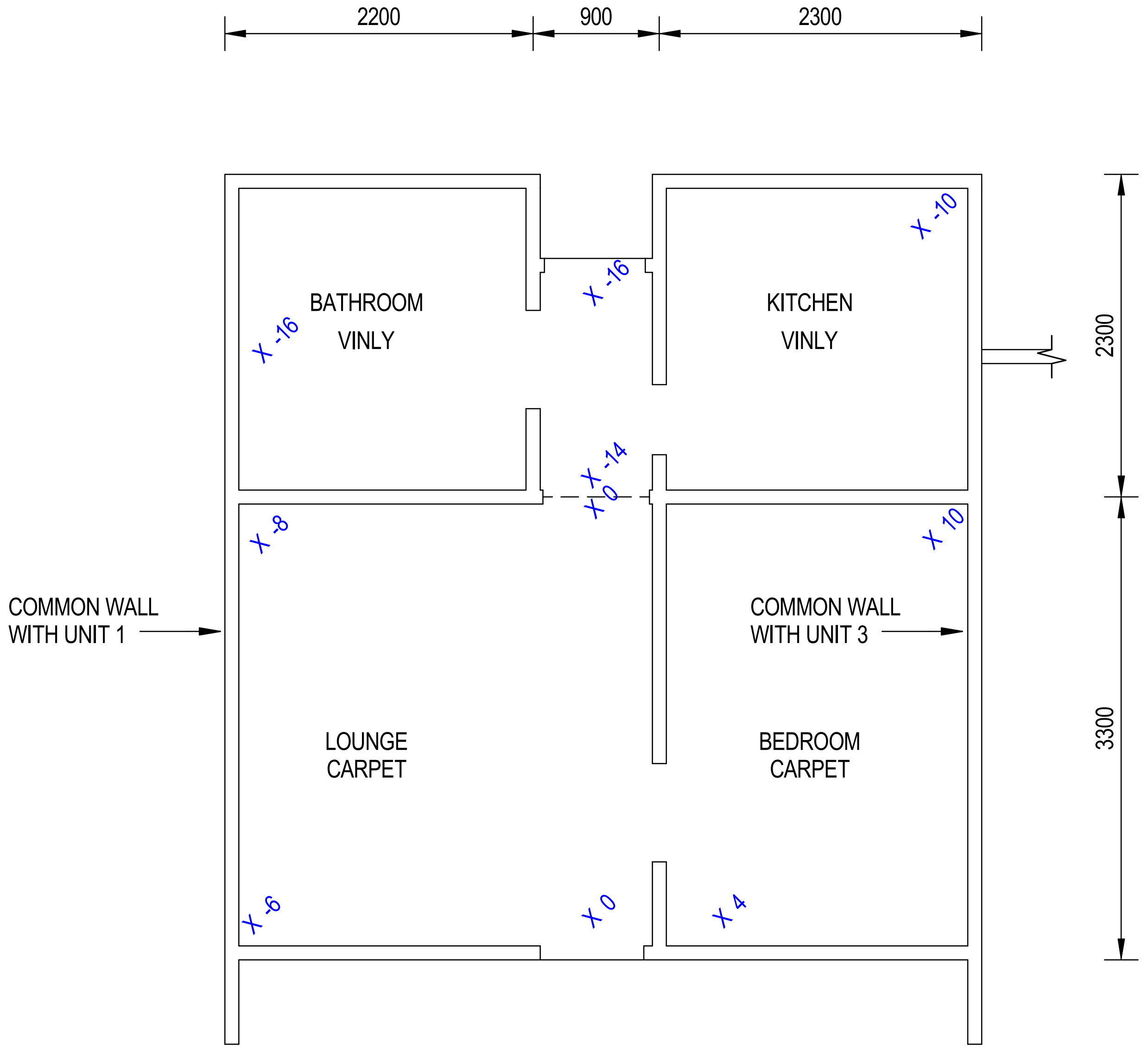

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L.CASTILLO	

PROJECT
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CHRISTCHURCH

TITLE
LEVEL SURVEY
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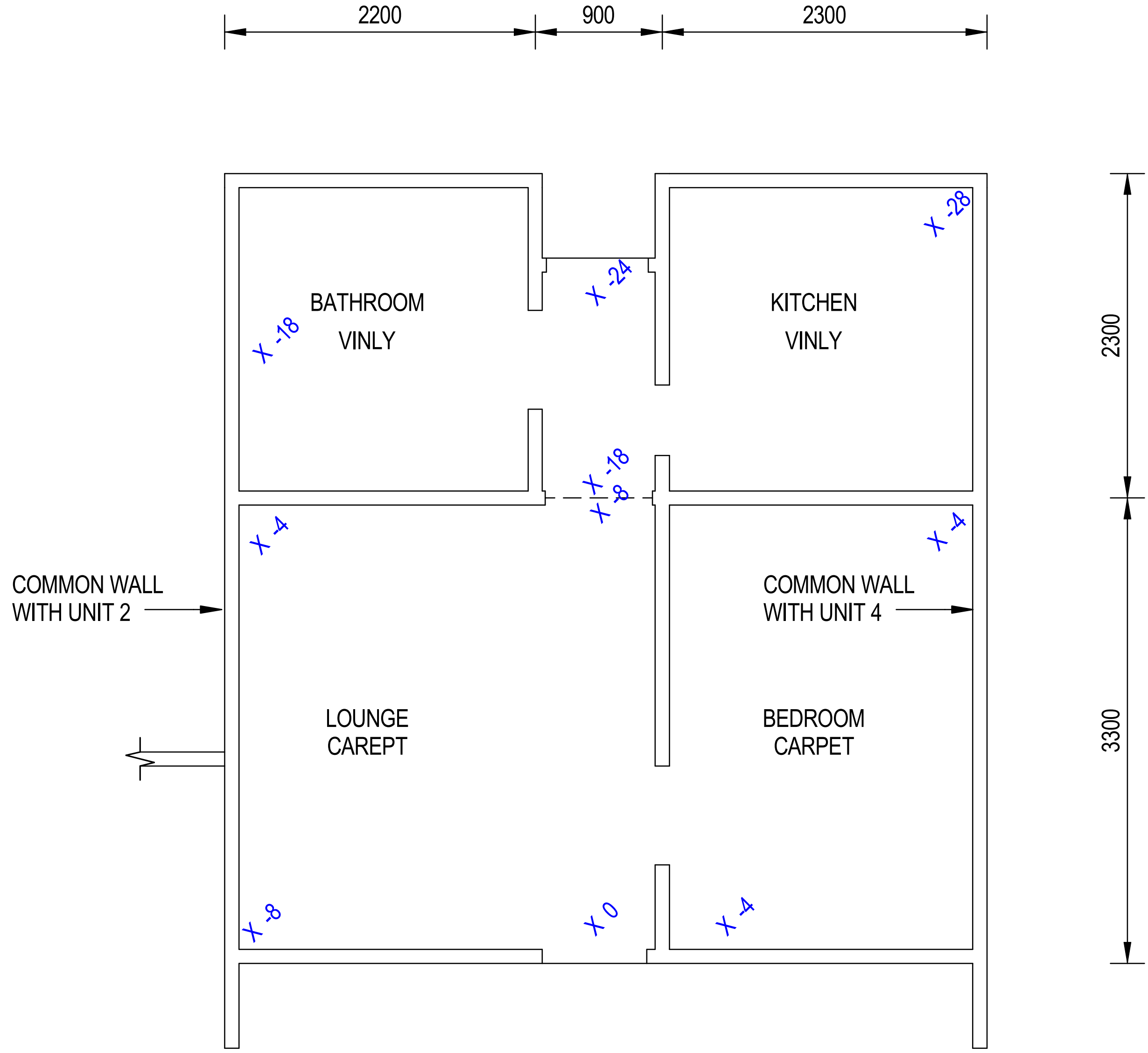

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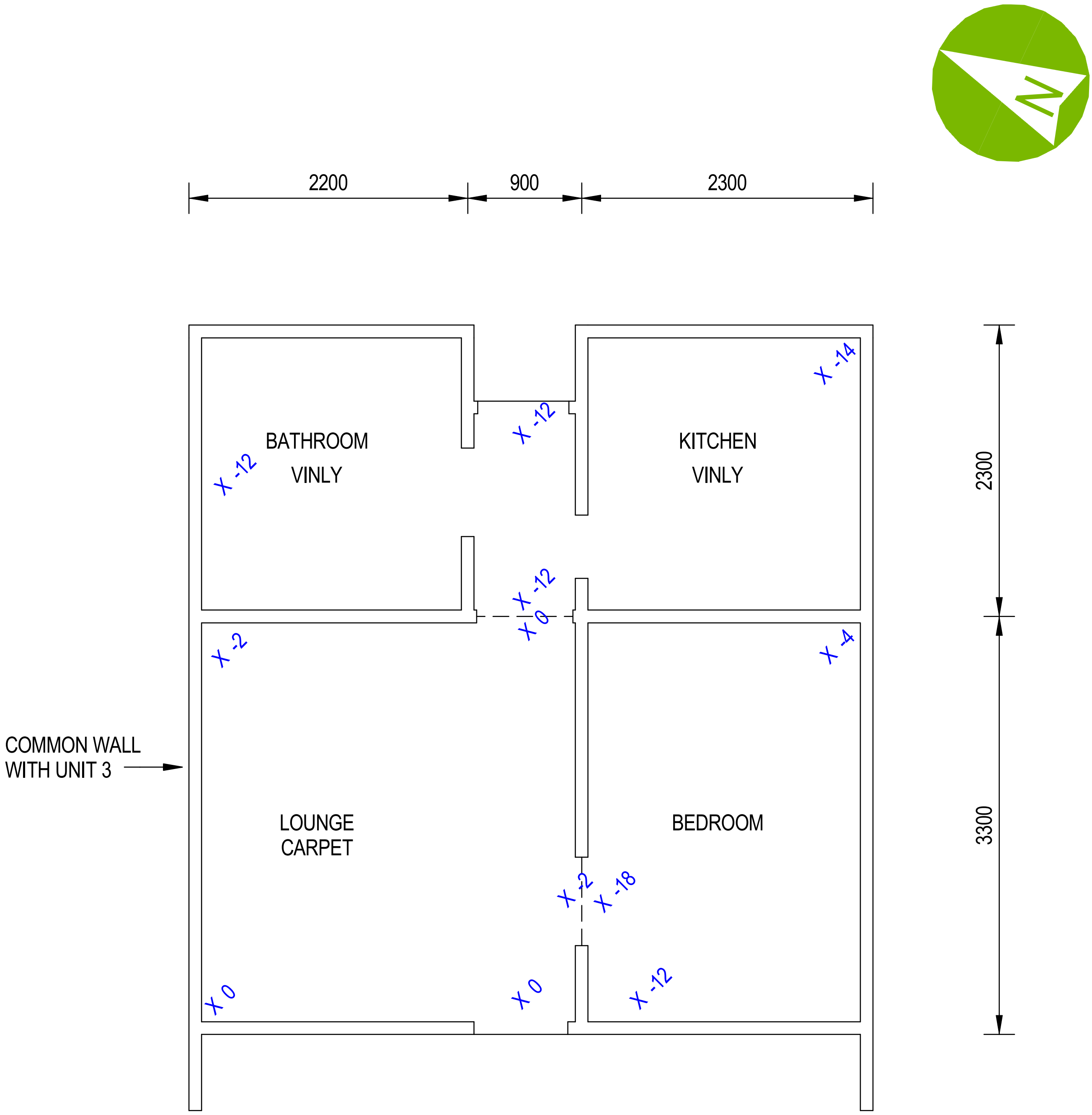

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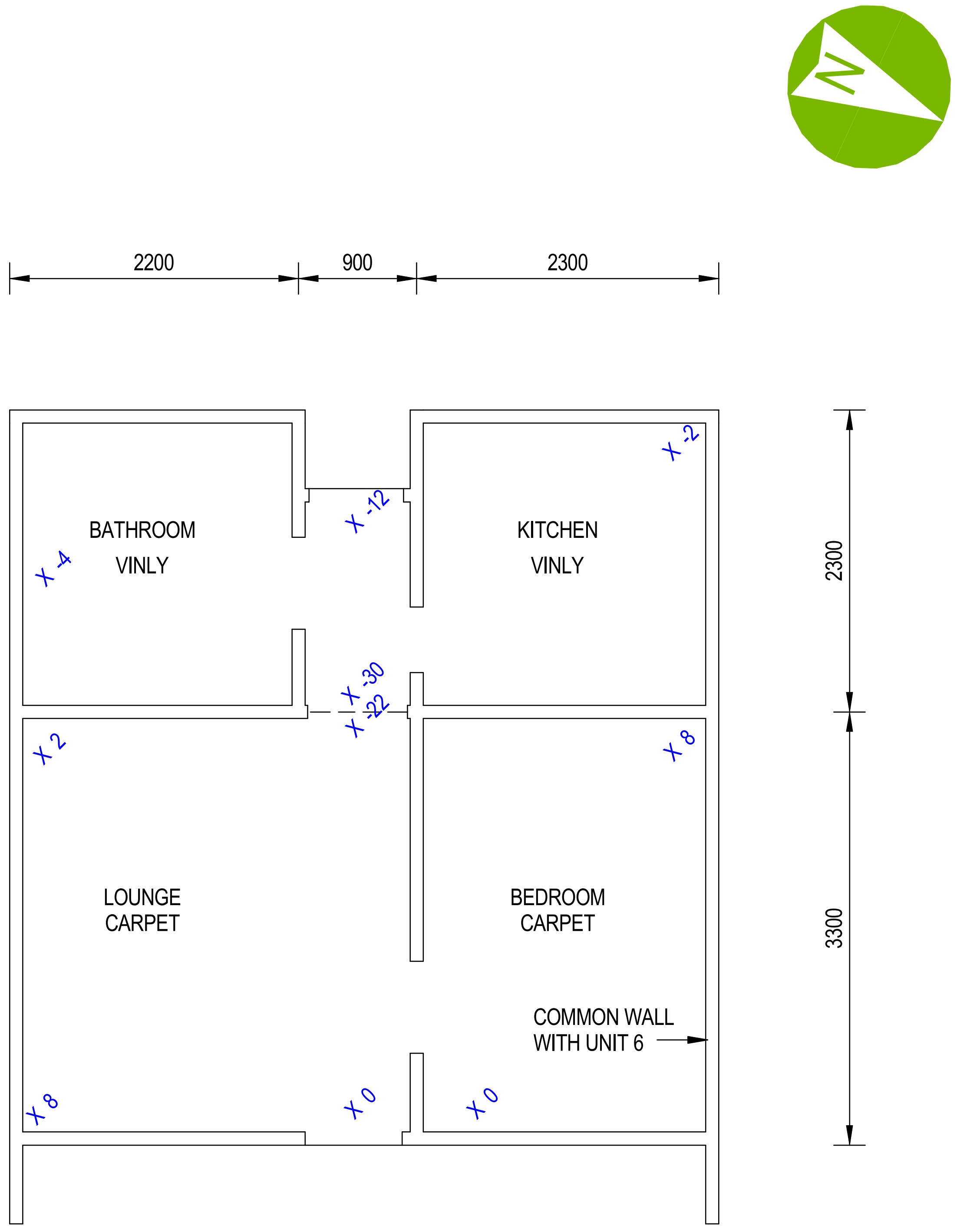

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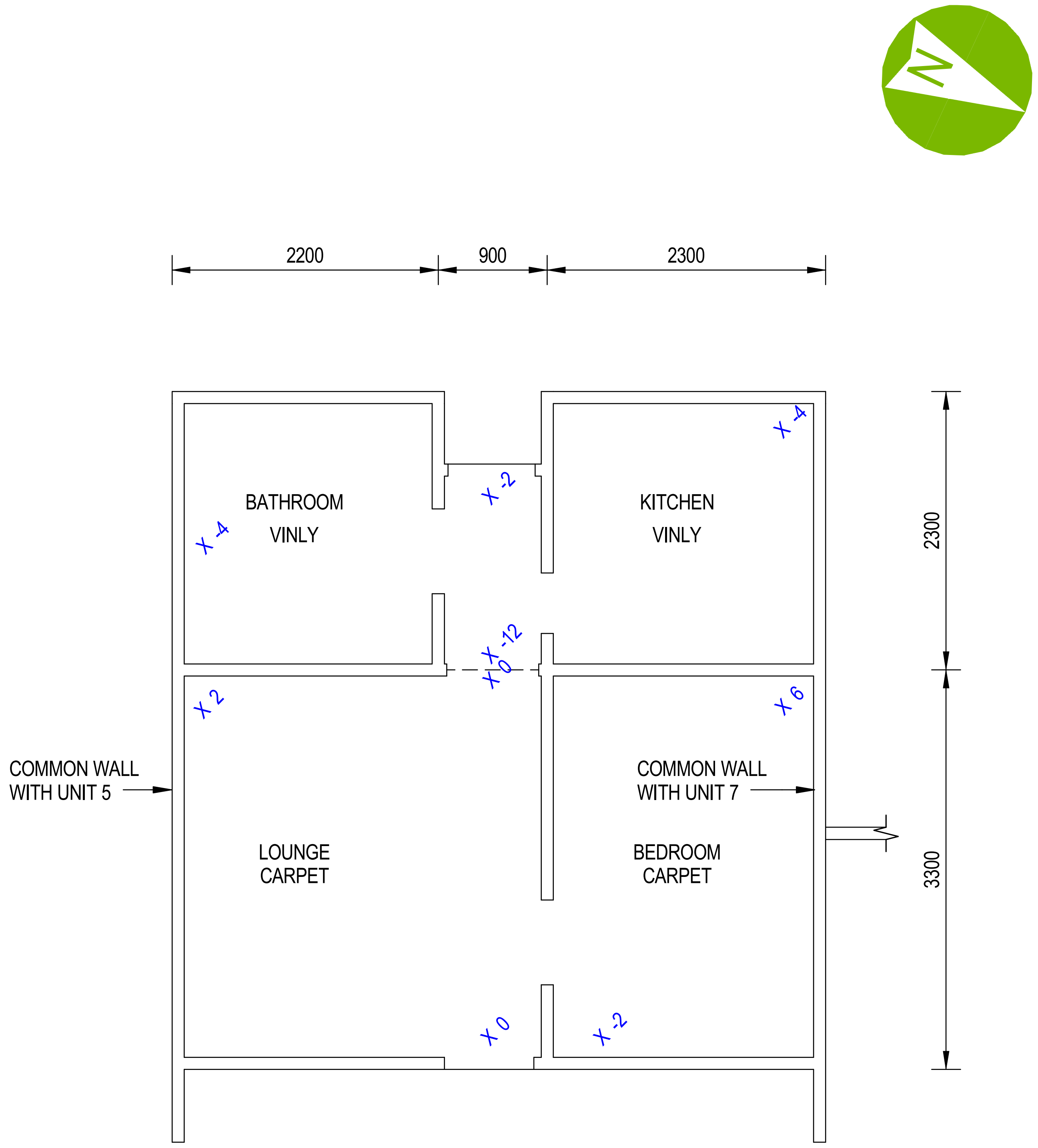

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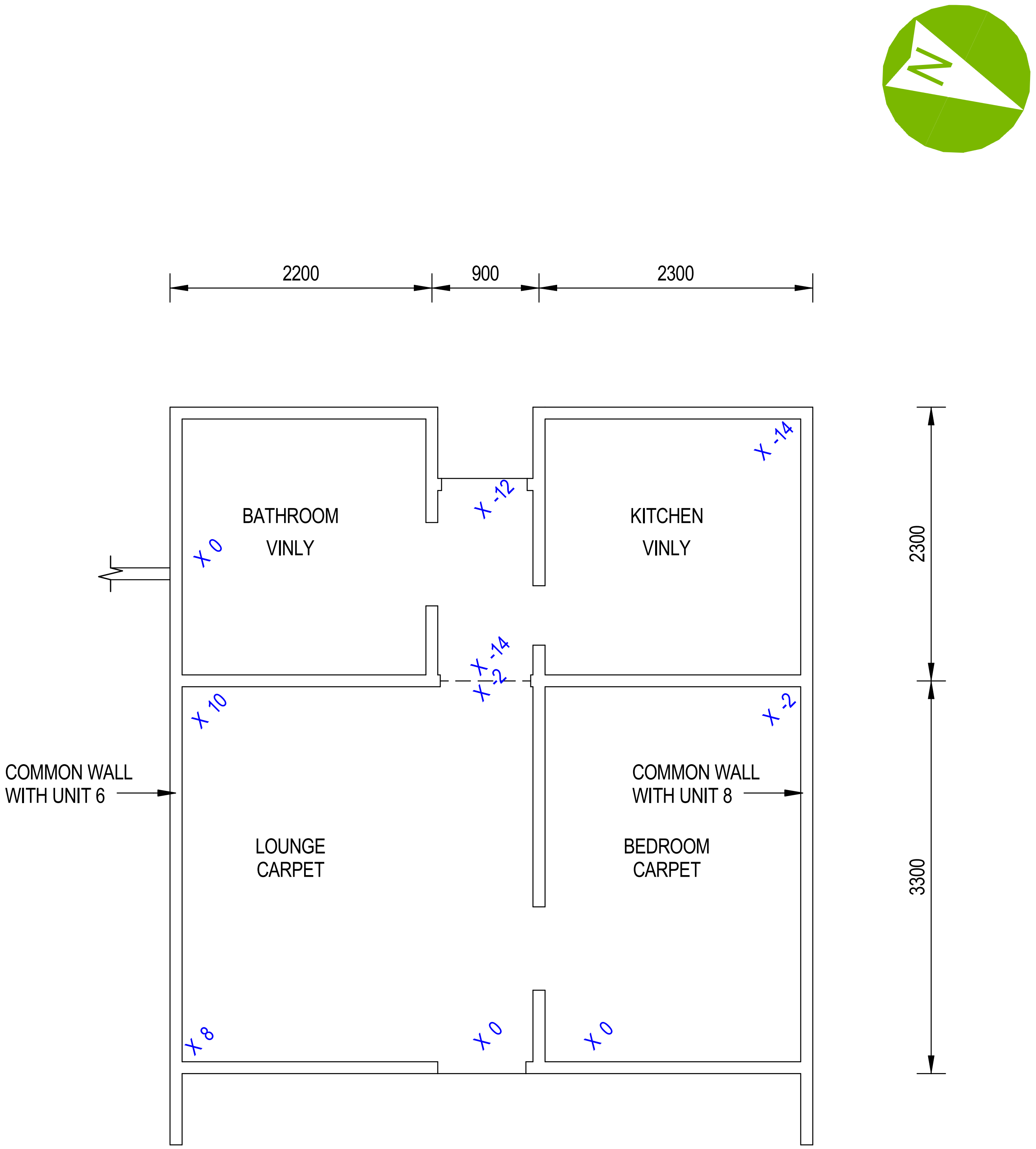

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Christchurch City Council

REV	DATE	REVISION DETAILS	APPROVAL

DRAWN	DESIGNED
D.HUNIA	A.WILLARD

CHECKED: L.CASTILLO

APPROVED: L.CASTILLO DATE

PROJECT: WALSALL COURTS HOUSING COMPLEX CHRISTCHURCH

TITLE: LEVEL SURVEY UNIT 7

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 233416

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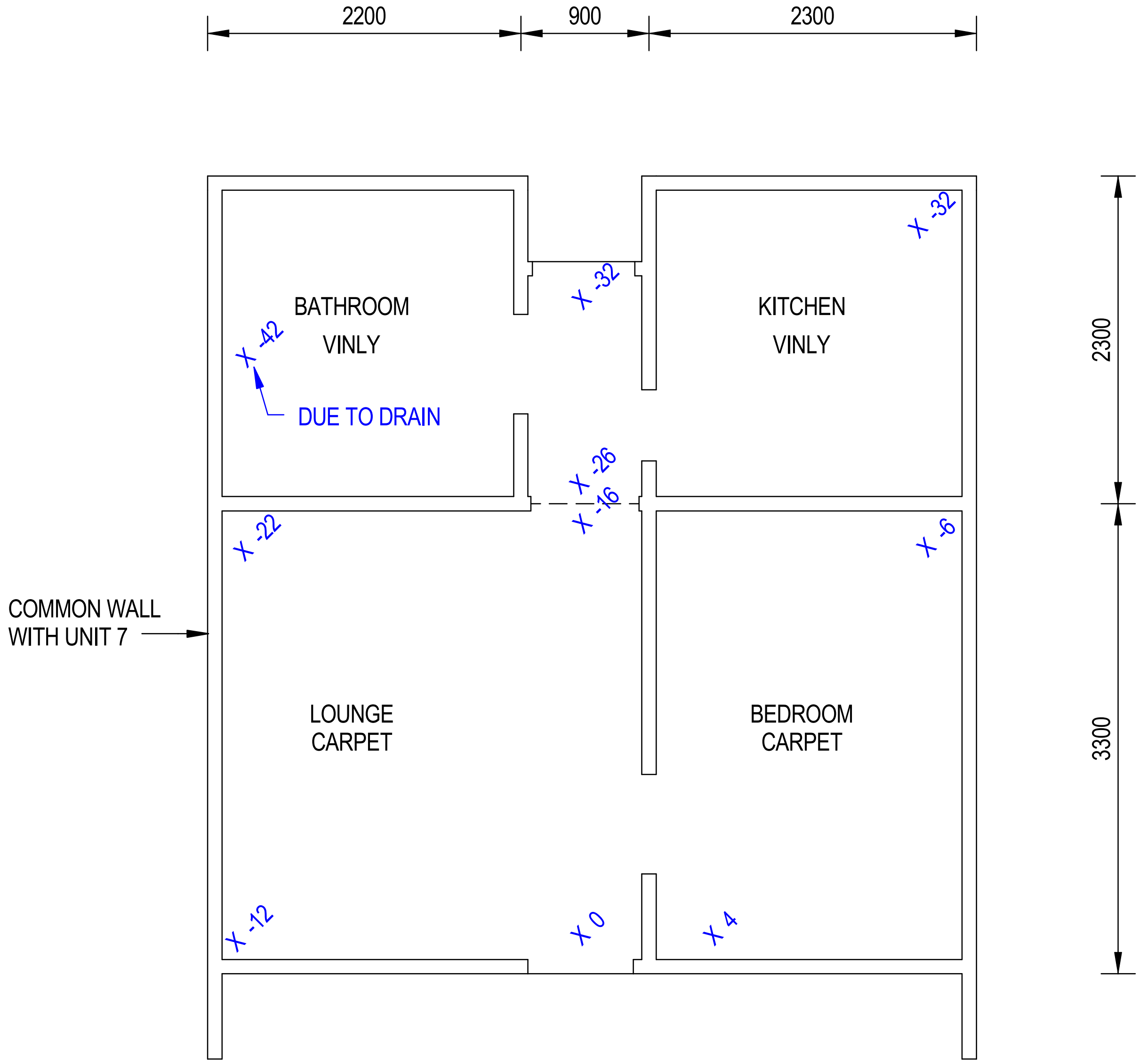

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REV	DATE	REVISION DETAILS	APPROVAL

DRAWN	DESIGNED
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APPROVED: L.CASTILLO DATE

PROJECT: WALSALL COURTS HOUSING COMPLEX CHRISTCHURCH

TITLE: LEVEL SURVEY UNIT 8

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 233416

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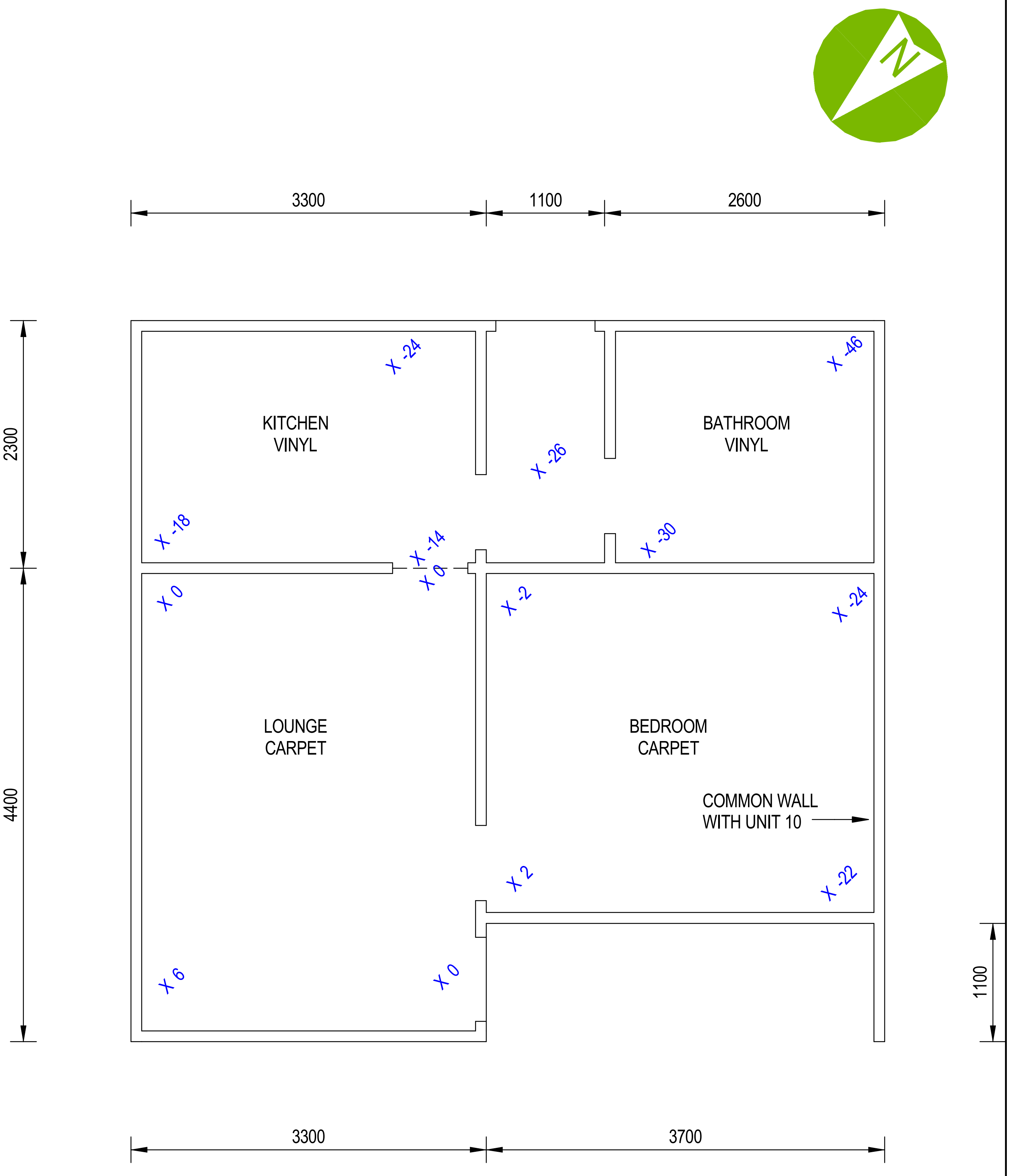

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APPROVED: L.CASTILLO
DATE

PROJECT: WALSALL COURTS HOUSING COMPLEX CHRISTCHURCH
TITLE: LEVEL SURVEY UNIT 9

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 233416
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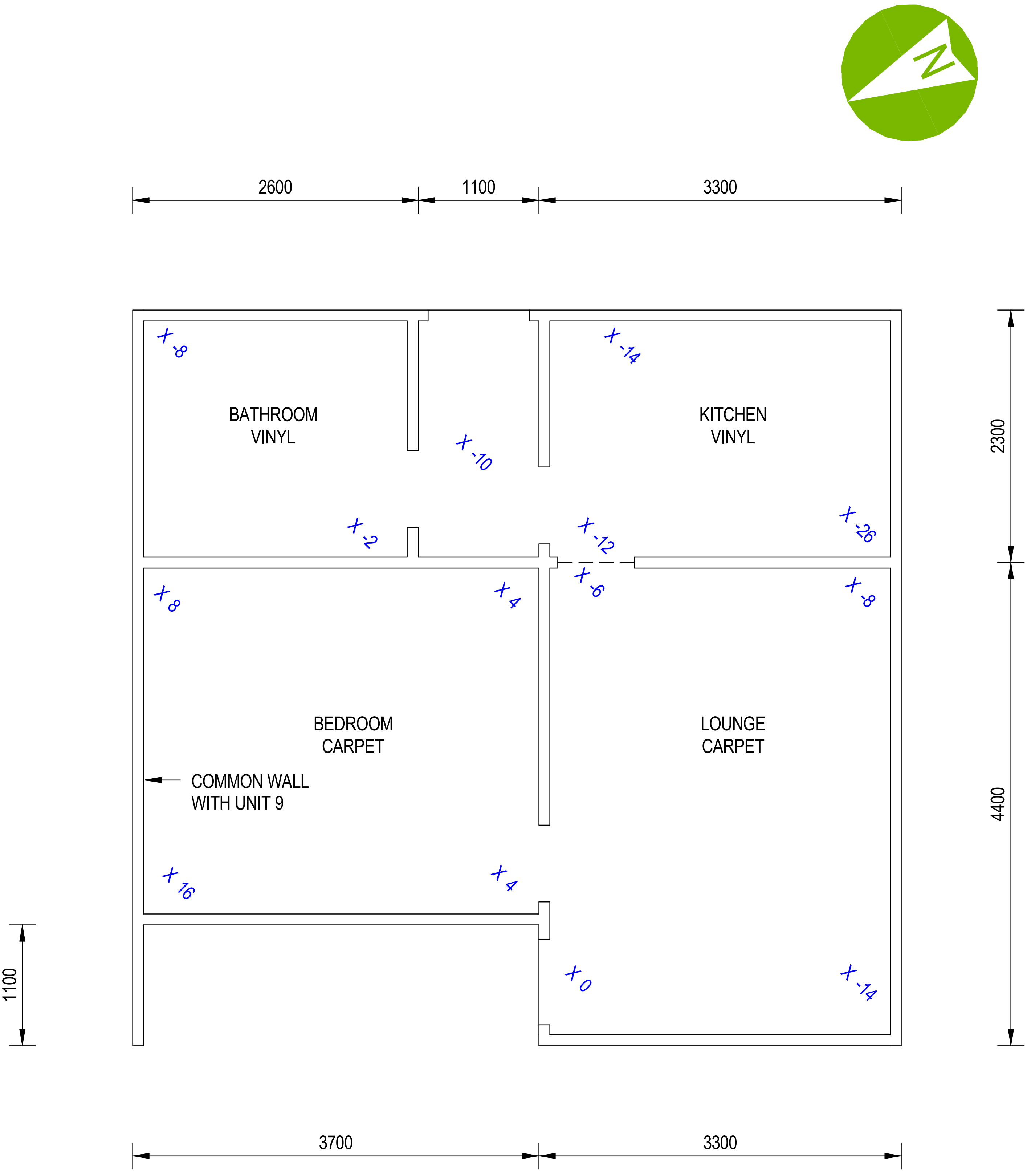

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APPROVED: L.CASTILLO DATE

PROJECT: WALSALL COURTS HOUSING COMPLEX CHRISTCHURCH

TITLE: LEVEL SURVEY UNIT 10

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No. 233416

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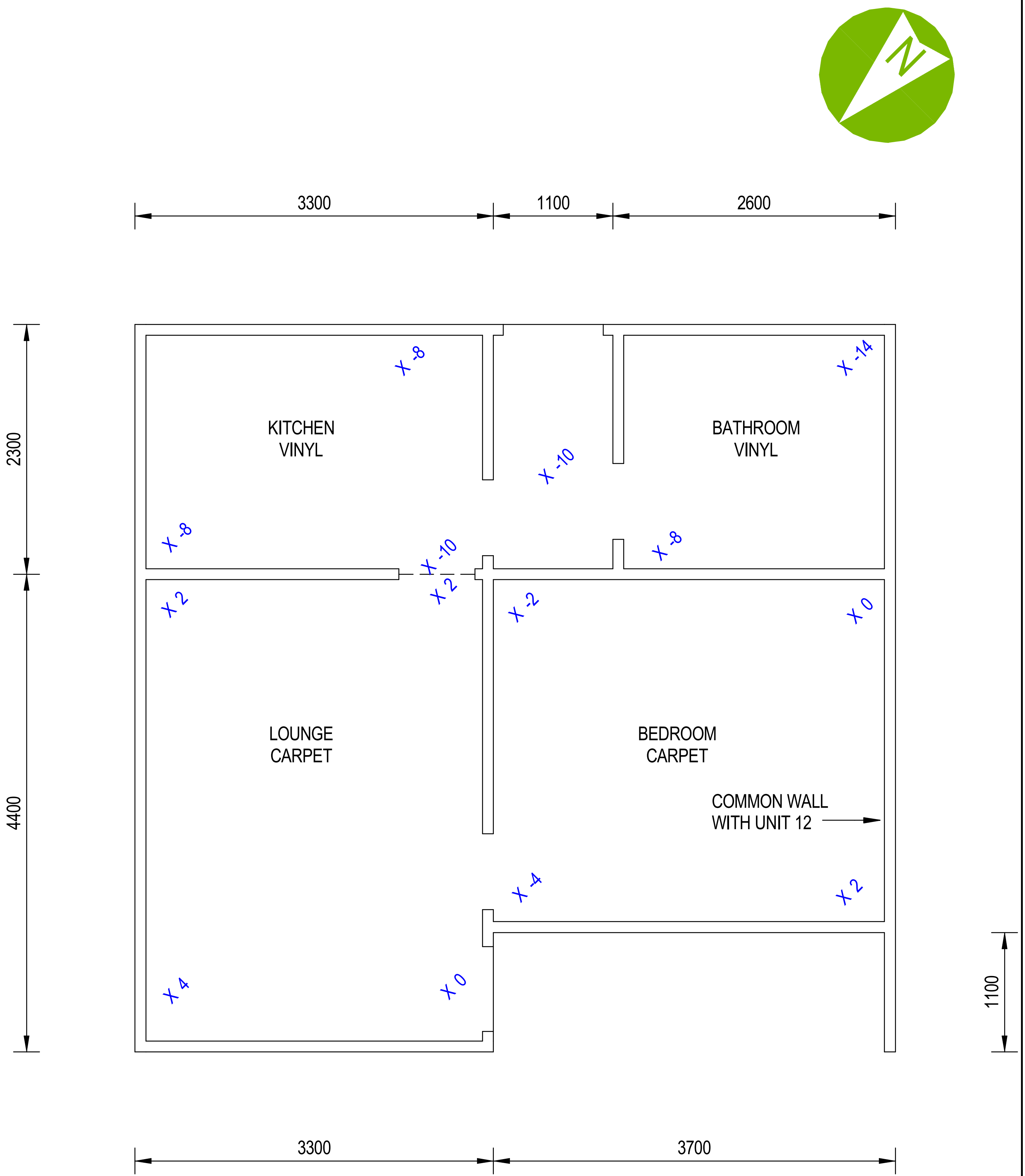

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DRAWN: D.HUNIA
DESIGNED: A.WILLARD
CHECKED: L.CASTILLO
APPROVED: L.CASTILLO
DATE

PROJECT: WALSALL COURTS HOUSING COMPLEX CHRISTCHURCH
TITLE: LEVEL SURVEY UNIT 11

PRELIMINARY
NOT FOR CONSTRUCTION
PROJECT No.: 233416
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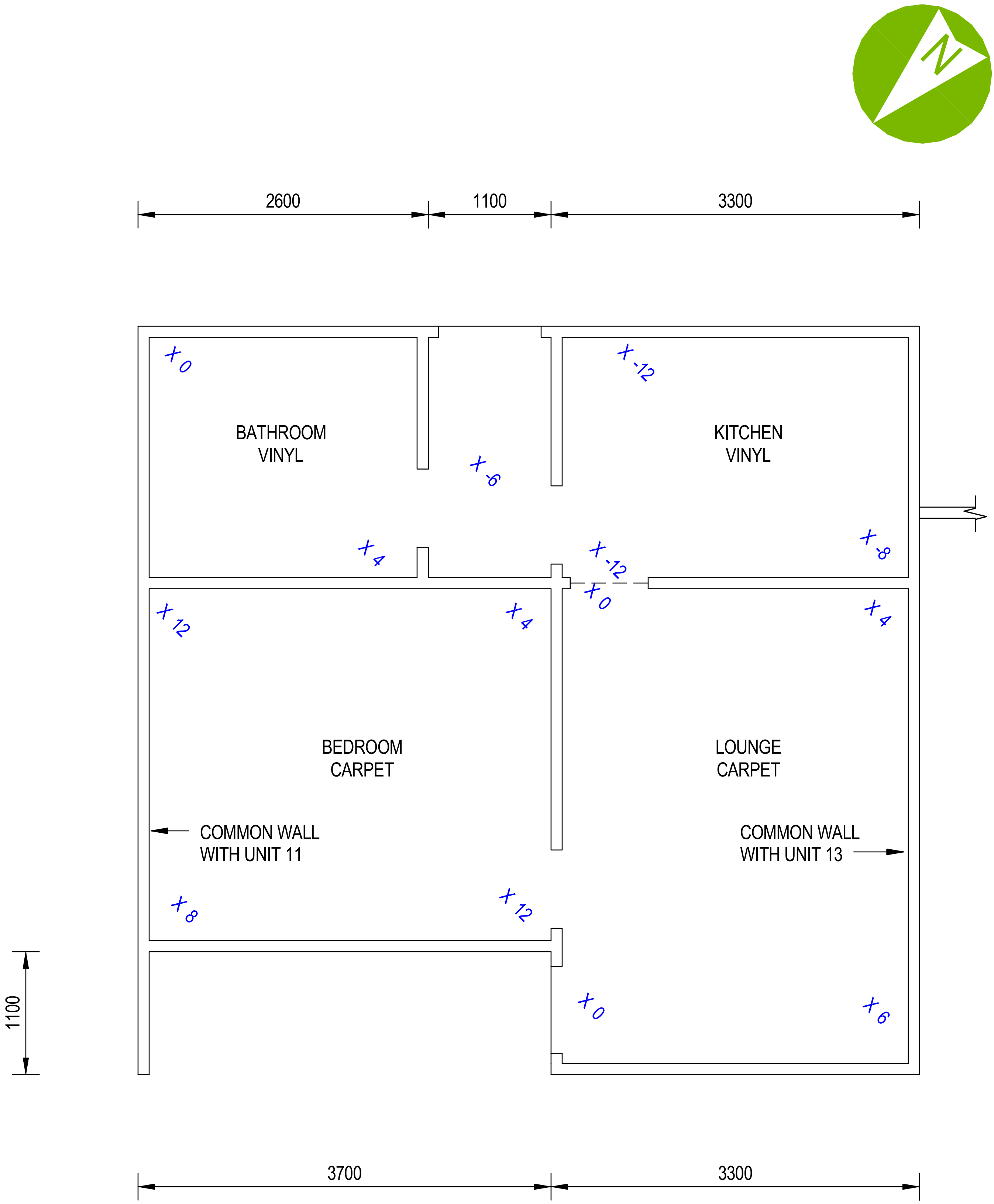

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REV	DATE	REVISION DETAILS	APPROVAL

DRAWN	DESIGNED
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CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
WALSALL COURTS HOUSING COMPLEX
CHRISTCHURCH

TITLE
LEVEL SURVEY
UNIT 12

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.
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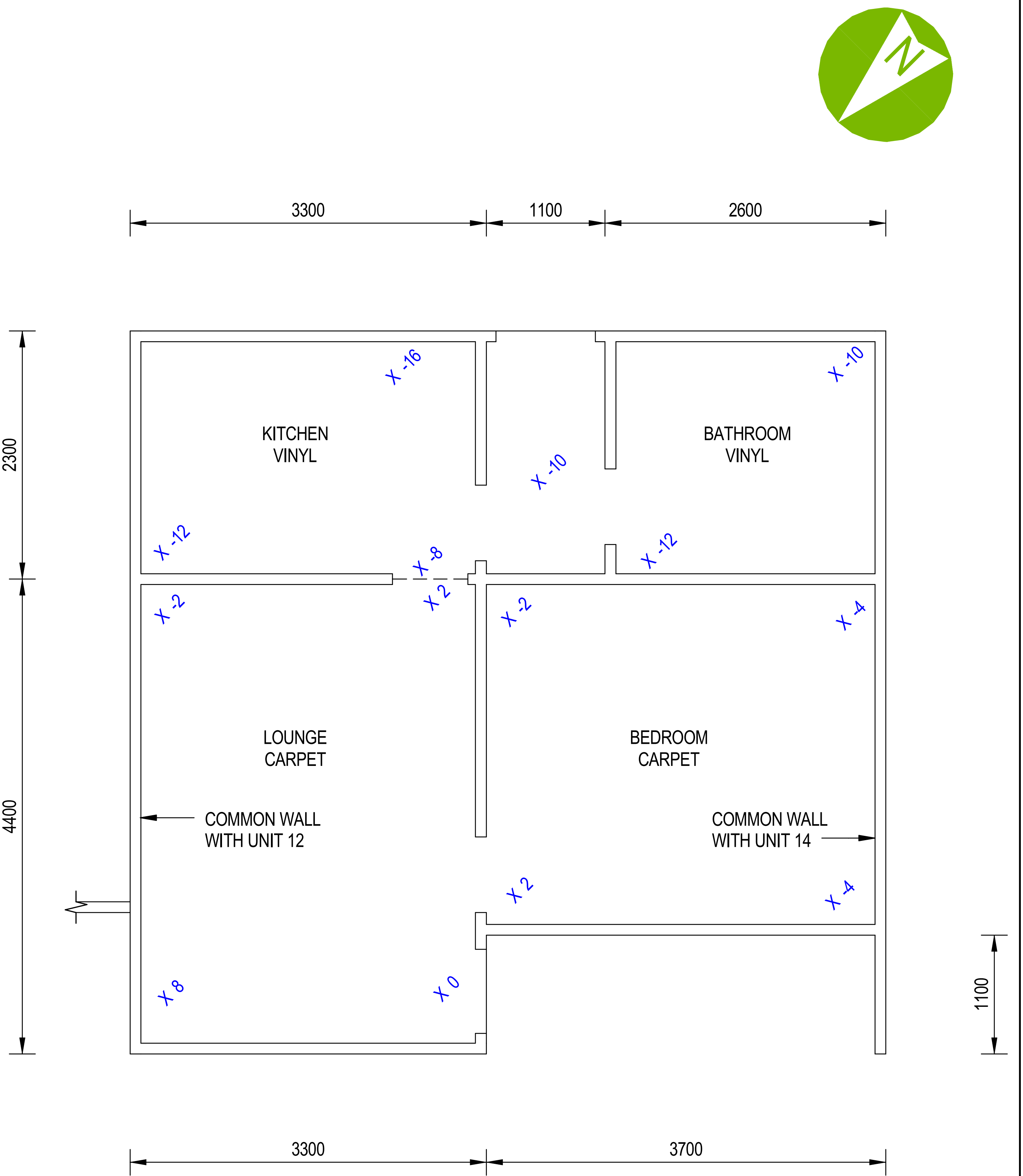

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REV	DATE	REVISION DETAILS	APPROVAL

DRAWN	DESIGNED
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CHECKED: L.CASTILLO

APPROVED: L.CASTILLO DATE

PROJECT: WALSALL COURTS HOUSING COMPLEX CHRISTCHURCH

TITLE: LEVEL SURVEY UNIT 13

PRELIMINARY
NOT FOR CONSTRUCTION

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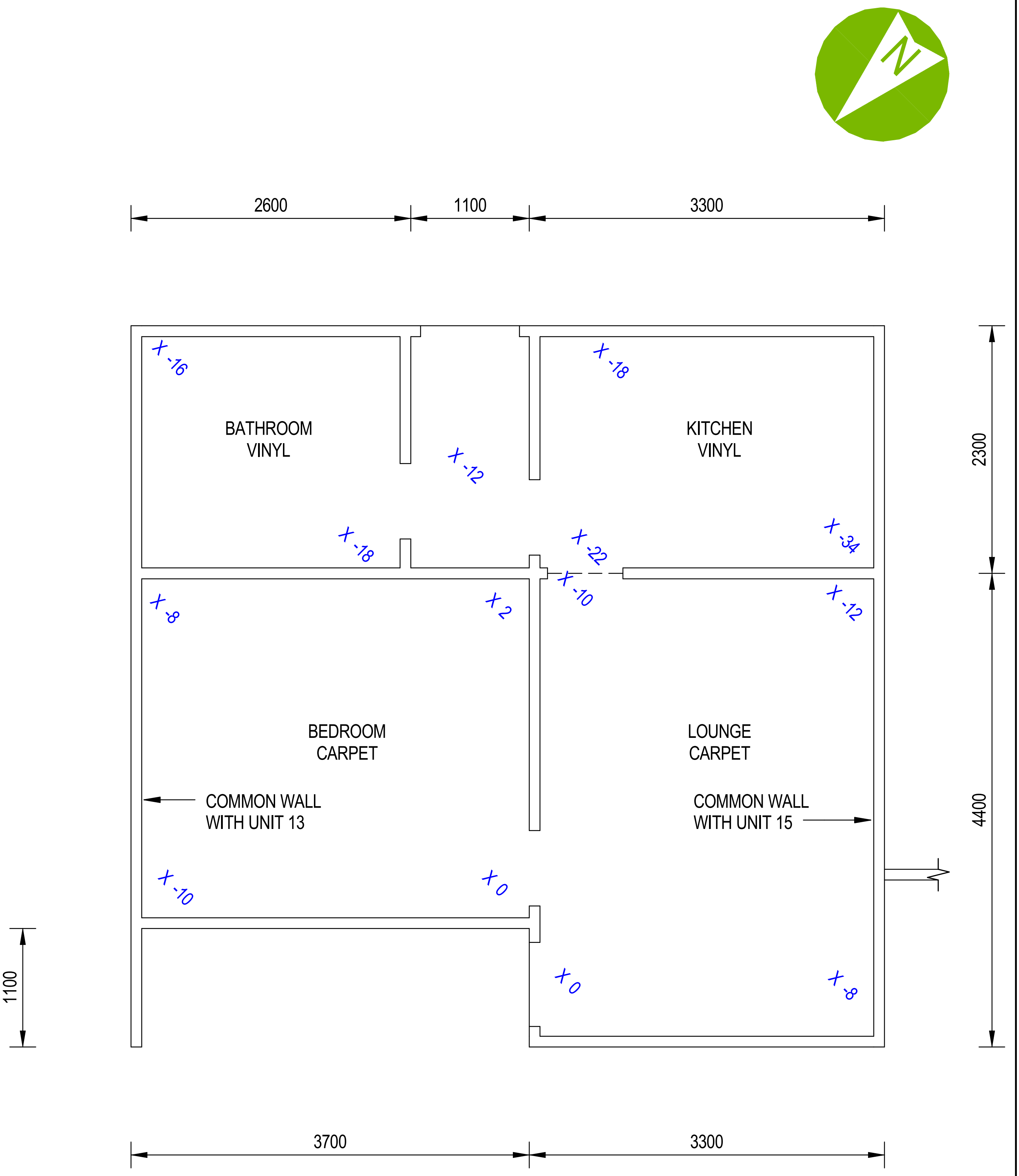

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REV	DATE	REVISION DETAILS	APPROVAL

DRAWN	DESIGNED
D.HUNIA	A.WILLARD
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
WALSALL COURTS HOUSING COMPLEX
CHRISTCHURCH

TITLE
LEVEL SURVEY
UNIT 14

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.	
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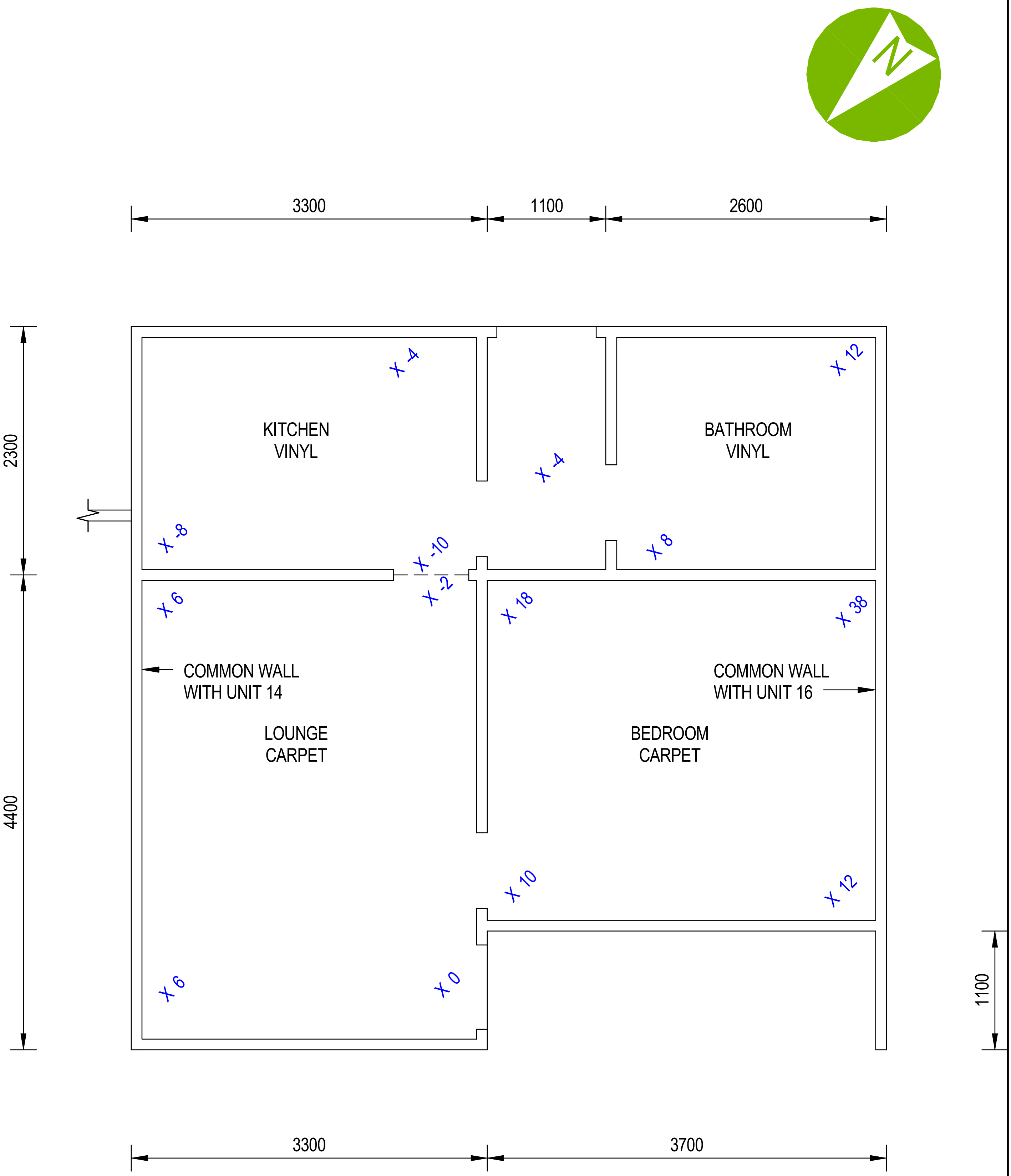

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REV	DATE	REVISION DETAILS	APPROVAL

DRAWN	DESIGNED
D.HUNIA	A.WILLARD

CHECKED: L.CASTILLO

APPROVED: L.CASTILLO DATE

PROJECT: WALSALL COURTS HOUSING COMPLEX CHRISTCHURCH

TITLE: LEVEL SURVEY UNIT 15

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 233416

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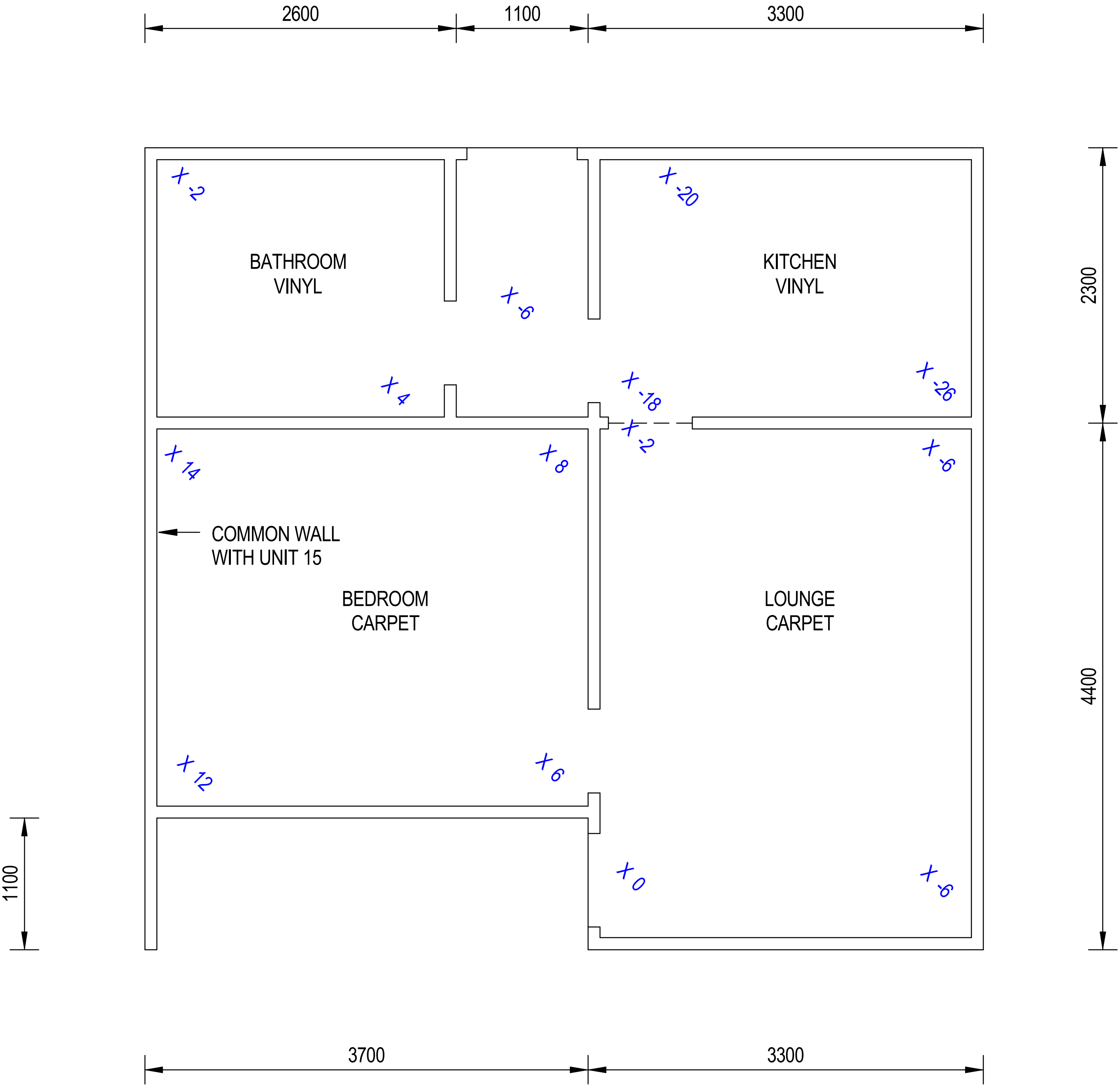

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REV	DATE	REVISION DETAILS	APPROVAL

DRAWN	DESIGNED
D.HUNIA	A.WILLARD

CHECKED: L.CASTILLO

APPROVED: L.CASTILLO DATE

PROJECT: WALSALL COURTS HOUSING COMPLEX CHRISTCHURCH

TITLE: LEVEL SURVEY UNIT 16

PRELIMINARY NOT FOR CONSTRUCTION

PROJECT No.: 233416

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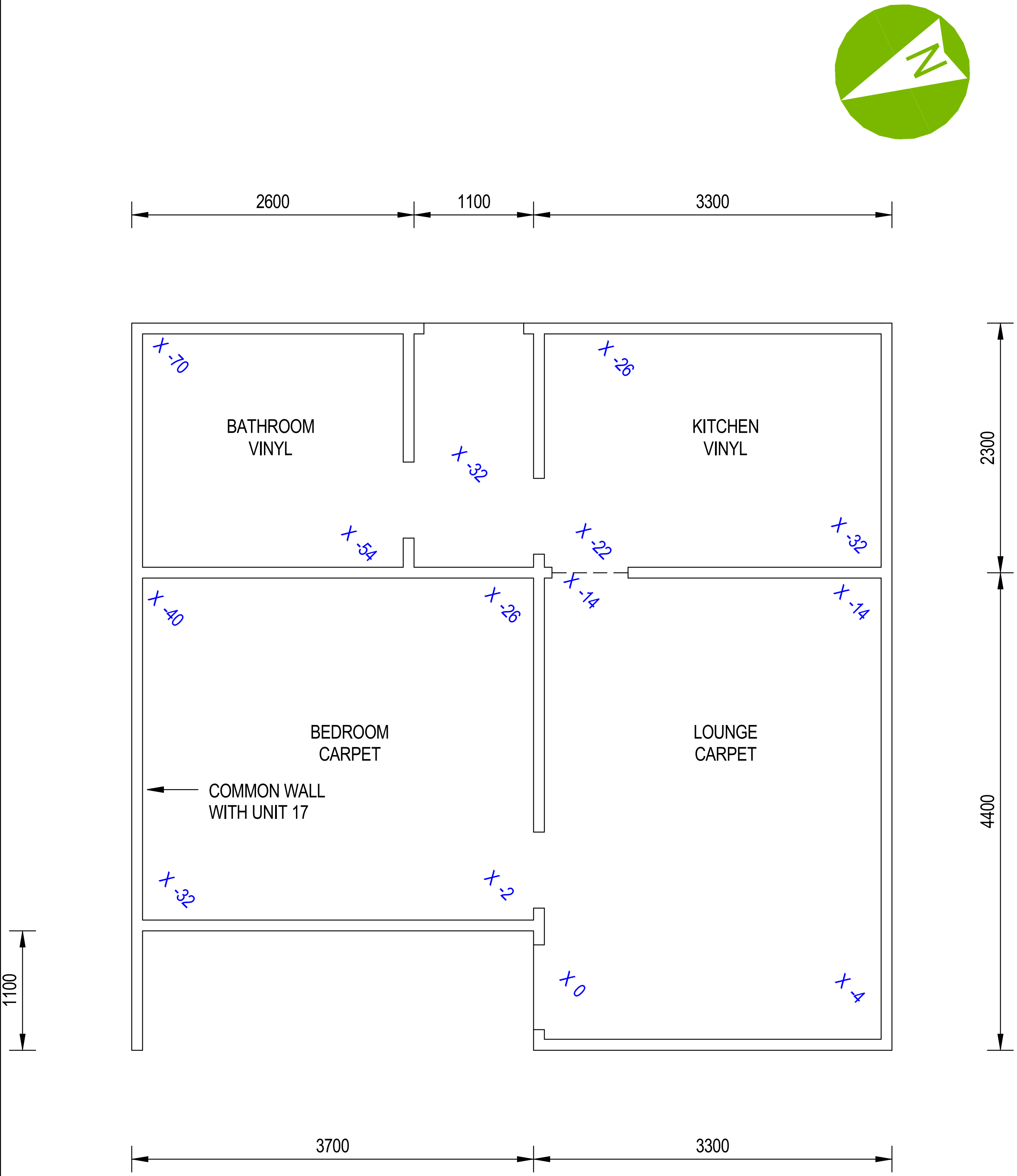

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DRAWN	DESIGNED
D.HUNIA	A.WILLARD
CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
WALSALL COURTS HOUSING COMPLEX
CHRISTCHURCH

TITLE
LEVEL SURVEY
UNIT 18

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.
233416

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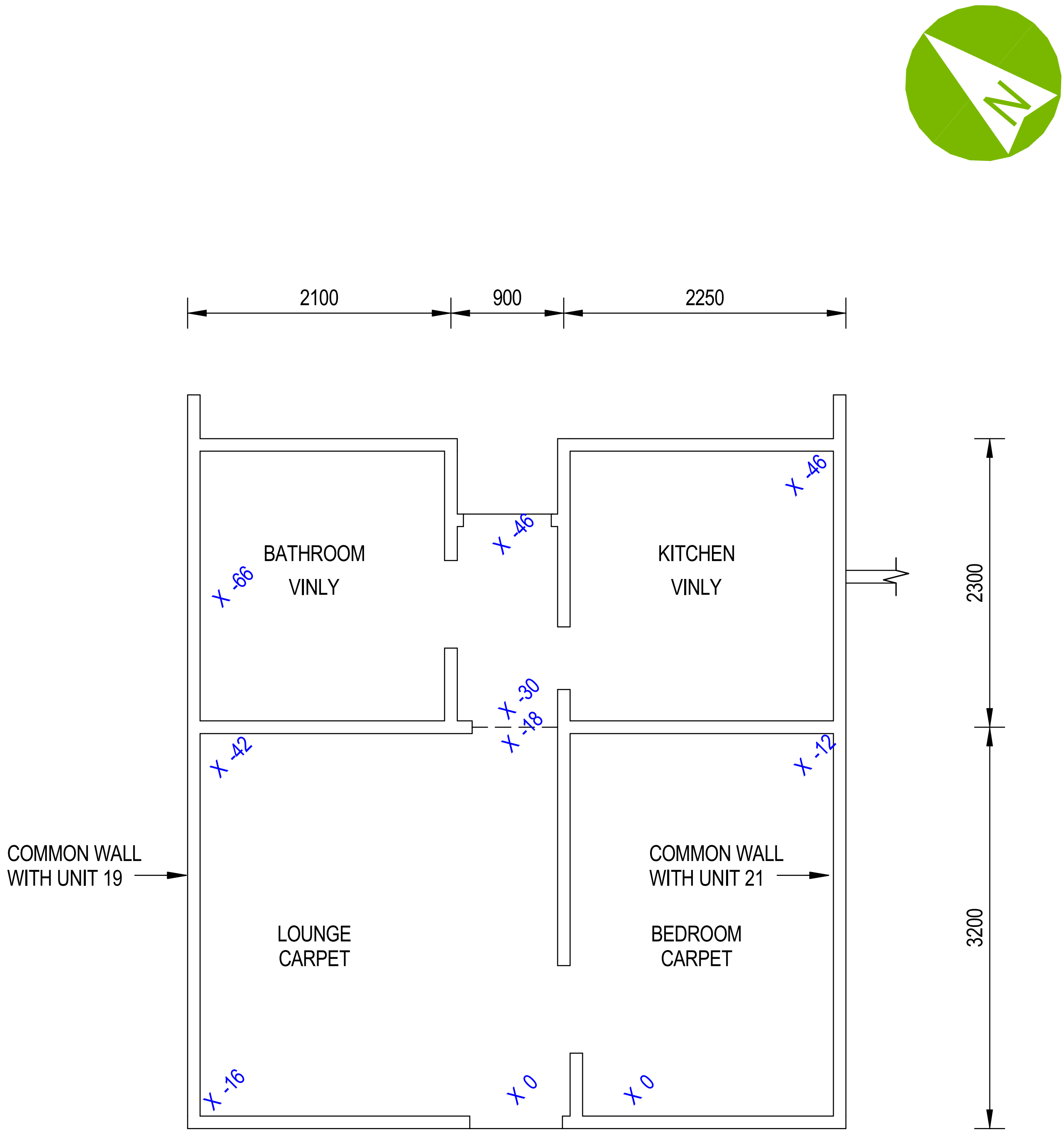

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DRAWN	DESIGNED
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APPROVED: L.CASTILLO DATE

PROJECT: WALSALL COURTS HOUSING COMPLEX CHRISTCHURCH

TITLE: LEVEL SURVEY UNIT 20

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 233416

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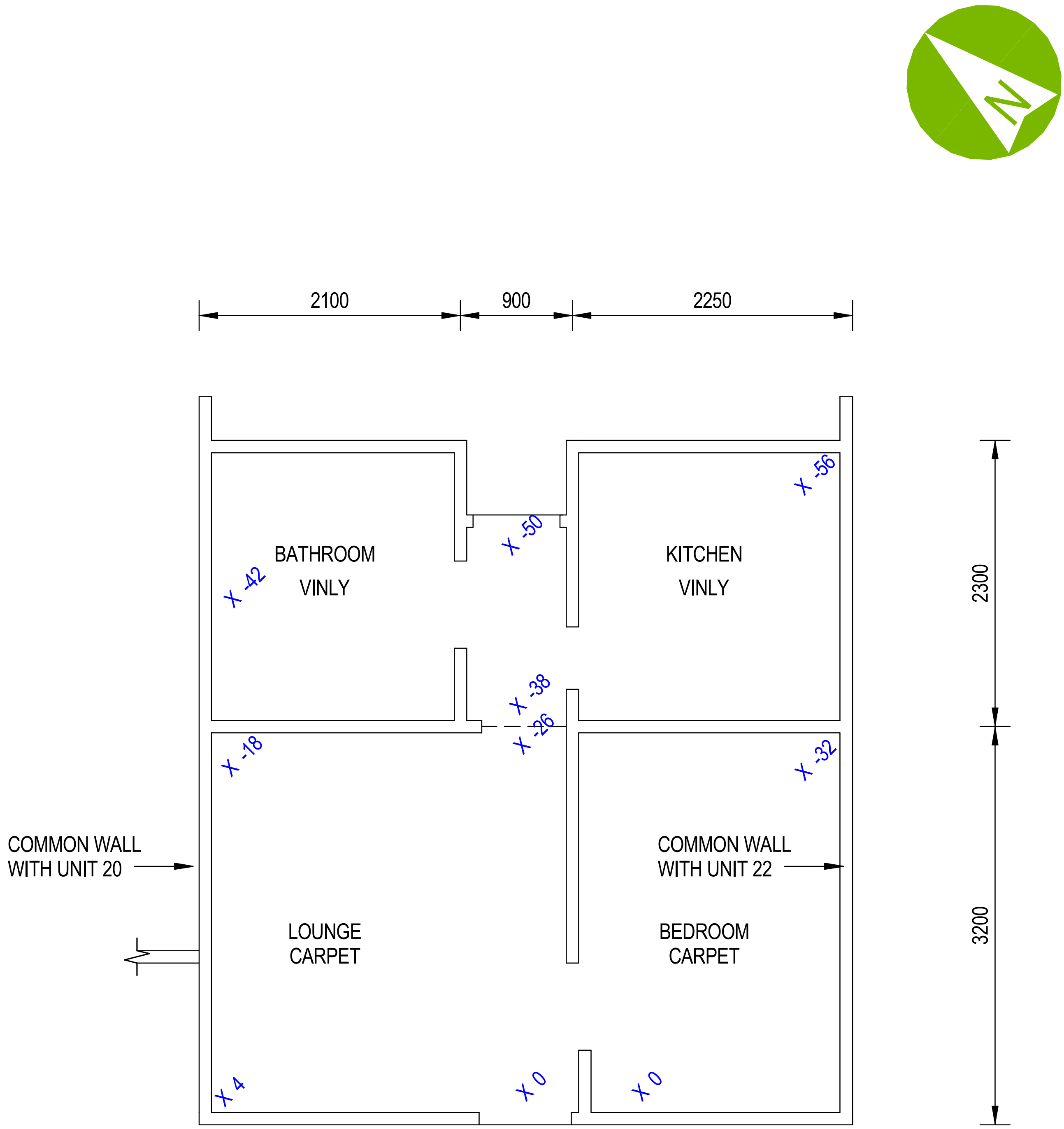

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DRAWN	DESIGNED
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CHECKED: L.CASTILLO

APPROVED: L.CASTILLO DATE

PROJECT: WALSALL COURTS HOUSING COMPLEX CHRISTCHURCH

TITLE: LEVEL SURVEY UNIT 21

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 233416

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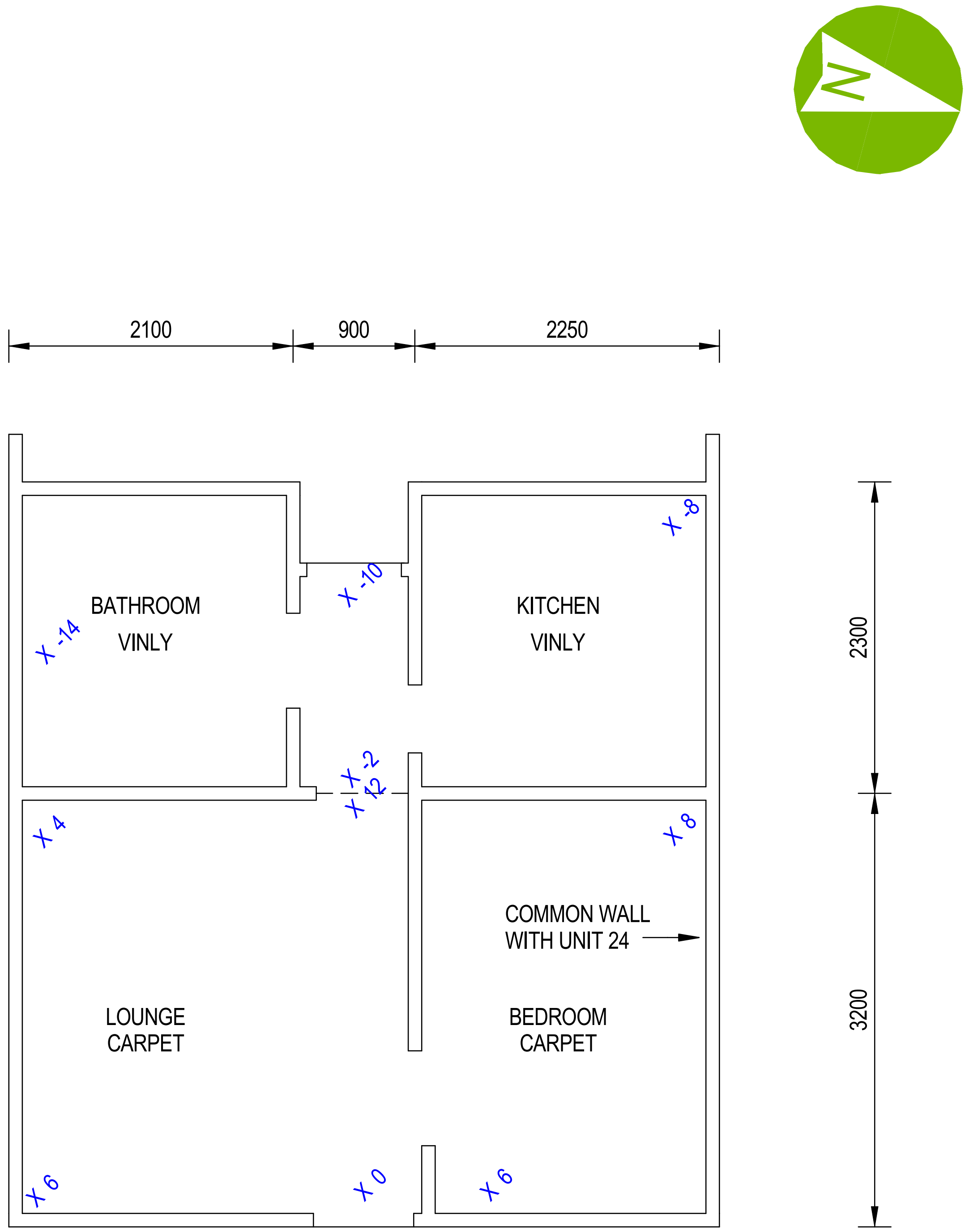

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REV	DATE	REVISION DETAILS	APPROVAL

DRAWN	DESIGNED
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CHECKED: L.CASTILLO

APPROVED: L.CASTILLO DATE

PROJECT: WALSALL COURTS HOUSING COMPLEX CHRISTCHURCH

TITLE: LEVEL SURVEY UNIT 22

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 233416

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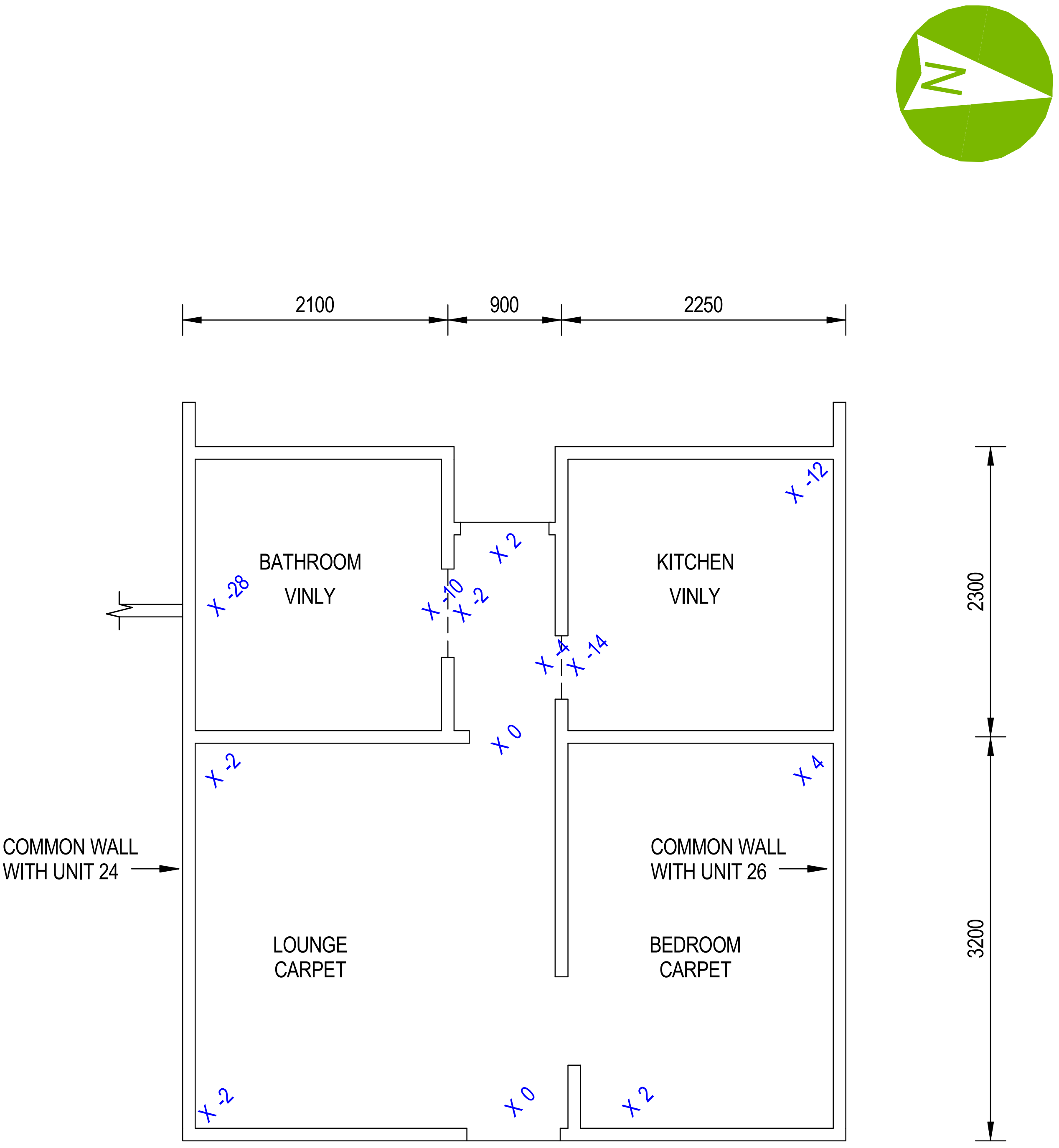

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REV	DATE	REVISION DETAILS	APPROVAL

DRAWN	DESIGNED
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CHECKED	
L.CASTILLO	
APPROVED	DATE
L.CASTILLO	

PROJECT
WALSALL COURTS HOUSING COMPLEX
CHRISTCHURCH

TITLE
LEVEL SURVEY
UNIT 23

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.	
233416	
SCALE	SIZE
1 : 50	A4
DRAWING No.	REV
SK-03-04	

Appendix B
References

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

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

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

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

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

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

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

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

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

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

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

Appendix C
Strength Assessment Explanation

New building standard (NBS)

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

Earthquake Prone Buildings

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

Christchurch City Council Earthquake Prone Building Policy 2010

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

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

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

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

Christchurch Seismicity

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

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

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

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

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

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

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

Table C1: Relative Risk of Building Failure In A

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

Appendix D
Background and Legal Framework

Background

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

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

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

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

Compliance

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

Canterbury Earthquake Recovery Authority (CERA)

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

Section 38 – Works

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

Section 51 – Requiring Structural Survey

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

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

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

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

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

Building Act

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

Section 112 – Alterations

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

Section 115 – Change of Use

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

Section 121 – Dangerous Buildings

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

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

Section 122 – Earthquake Prone Buildings

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

Section 124 – Powers of Territorial Authorities

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

Section 131 – Earthquake Prone Building Policy

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

Christchurch City Council Policy

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

The 2010 amendment includes the following:

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

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

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

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

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

Building Code

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

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

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

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

Appendix E
Standard Reporting Spread Sheet

- ✓ Building Type 1 – Blocks A, B, F and G
- ✓ Building Type 2 – Blocks C and E
- ✓ Building Type 3 – Block D

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Building Type 1 (Blocks A, B, F, G)			Reviewer:	Lee Howard
	Unit	No:	Street	CPEng No:	1008889
Building Address:	Walsall Courts	15	Walsall Street	Company:	Aurecon
Legal Description:	DP26762			Company project number:	233416
				Company phone number:	03 371 2032
	Degrees	Min	Sec		
GPS south:	43	32	37.58	Date of submission:	04/03/2013
GPS east:	172	36	31.79	Inspection Date:	20-Dec-12
				Revision:	1
Building Unique Identifier (CCC):	BE 0488 EQ2			Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:	mixed	Soil Profile (if available):	
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	9.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	
Ground floor split?	no		Ground floor elevation above ground (m):	
Storeys below ground	0			
Foundation type:	mat slab		if Foundation type is other, describe:	
Building height (m):	2.40		height from ground to level of uppermost seismic mass (for IEP only) (m):	3.5
Floor footprint area (approx):	136			
Age of Building (years):	43		Date of design:	1965-1976
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	other (specify)		Brief strengthening description:	
Use (upper floors):				
Use notes (if required):				
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	frame system		
Roof:	timber truss	truss depth, purlin type and cladding	corrugated iron on timber purlins and rafters
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	timber	type	
Columns:	timber	typical dimensions (mm x mm)	
Walls:	non-load bearing	0	

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	**Note: Define along and across in detailed report!**	note typical wall length (m)	0.80 m - 3.2 m
Ductility assumed, μ:	2.00			
Period along:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	estimated
Lateral system across:	unreinforced masonry bearing wall - brick		note wall thickness and cavity	190 mm
Ductility assumed, μ:	2.00			
Period across:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	estimated

Separations:

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

west (mm):			

Non-structural elements

Stairs:			none
Wall cladding:	plaster system	describe	Gib internal, masonry external
Roof Cladding:	Metal	describe	Light weight metal sheets
Glazing:	timber frames		
Ceilings:	plaster, fixed		
Services(list):			

Available documentation

Architectural	none	original designer name/date	
Structural	none	original designer name/date	
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	none	original designer name/date	

Damage

Site:
(refer DEE Table 4-2)

Site performance:	Good	Describe damage:	minor - none
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%		
	Describe (summary):			
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	no	Describe:	

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

Recommendations

	Level of repair/strengthening required:	minor non-structural	Describe:	
	Building Consent required:	no	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before:	100%	##### %NBS from IEP below	If IEP not used, please detail assessment methodology:
	Assessed %NBS after:	100%		
Across	Assessed %NBS before:	100%	##### %NBS from IEP below	
	Assessed %NBS after:	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):	1965-1976	h_n from above:	3.5m
Seismic Zone, if designed between 1965 and 1992:	B	not required for this age of building	
		not required for this age of building	
		along	across

	along	across
Period (from above):	0.4	0.4
(%NBS)nom from Fig 3.3:		

Note:1 for specifically design public buildings, to the code of the day: pre-1965 = 1.25; 1965-1976, Zone A =1.33; 1965-1976, Zone B = 1.2; all else 1.0	
Note 2: for RC buildings designed between 1976-1984, use 1.2	
Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (1.0)	

	along	across
Final (%NBS)nom:	**0%**	**0%**

2.2 Near Fault Scaling Factor

	along	across
Near Fault scaling factor, from NZS1170.5, cl 3.1.6:		
Near Fault scaling factor (1/N(T,D), **Factor A**:	#DIV/0!	#DIV/0!

2.3 Hazard Scaling Factor

Hazard factor Z for site from AS1170.5, Table 3.3:	
Z_{1992}, from NZS4203:1992	
Hazard scaling factor, **Factor B:**	#DIV/0!

2.4 Return Period Scaling Factor

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

2.5 Ductility Scaling Factor

	along	across
Assessed ductility (less than max in Table 3.2)		
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:		
Ductiity Scaling Factor, **Factor D**:	0.00	0.00

2.6 Structural Performance Scaling Factor:

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

	along	across
2.7 Baseline %NBS, (NBS%)b = (%NBS)nom x A x B x C x D x E — **%NBSb:**	**#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	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		
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!**

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Building Type 2 (Blocks C and E)			Reviewer:	Lee Howard
	Unit	No:	Street	CPEng No:	1008889
Building Address:	Walsall Courts	15	Walsall Street	Company:	Aurecon
Legal Description:	DP26762			Company project number:	233416
				Company phone number:	03 371 2032
	Degrees	Min	Sec		
GPS south:	43	32	37.58	Date of submission:	04/03/2013
GPS east:	172	36	31.79	Inspection Date:	20-Dec-12
				Revision:	1
Building Unique Identifier (CCC):	BE 0488 EQ2			Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:	mixed	Soil Profile (if available):	
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	9.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	
Ground floor split?	no		Ground floor elevation above ground (m):	
Storeys below ground	0			
Foundation type:	mat slab		if Foundation type is other, describe:	
Building height (m):	2.40		height from ground to level of uppermost seismic mass (for IEP only) (m):	3.5
Floor footprint area (approx):	86			
Age of Building (years):	43		Date of design:	1965-1976
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	other (specify)		Brief strengthening description:	
Use (upper floors):				
Use notes (if required):				
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	frame system		
Roof:	timber truss	truss depth, purlin type and cladding	corrugated iron on timber purlins and rafters
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	timber	type	
Columns:	timber	typical dimensions (mm x mm)	
Walls:	non-load bearing	0	

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	**Note: Define along and across in detailed report!**	note typical wall length (m)	0.80 m - 3.2 m
Ductility assumed, μ:	2.00			
Period along:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	estimated
Lateral system across:	unreinforced masonry bearing wall - brick		note wall thickness and cavity	190 mm
Ductility assumed, μ:	2.00			
Period across:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	estimated

Separations:

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

west (mm):			

Non-structural elements

Stairs:			none
Wall cladding:	plaster system	describe	Gib internal, masonry external
Roof Cladding:	Metal	describe	Light weight metal sheets
Glazing:	timber frames		
Ceilings:	plaster, fixed		
Services(list):			

Available documentation

Architectural	none	original designer name/date	
Structural	none	original designer name/date	
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	none	original designer name/date	

Damage

Site:
(refer DEE Table 4-2)

Site performance:	Good	Describe damage:	minor - none
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%		
	Describe (summary):			
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	no	Describe:	

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

Recommendations

	Level of repair/strengthening required:	minor non-structural		Describe:	
	Building Consent required:	no		Describe:	
	Interim occupancy recommendations:	full occupancy		Describe:	
Along	Assessed %NBS before:	100%	##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	
	Assessed %NBS after:	100%			
Across	Assessed %NBS before:	83%	##### %NBS from IEP below		
	Assessed %NBS after:	83%			

IEP

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

Period of design of building (from above):	1965-1976	h_n from above:	3.5m
Seismic Zone, if designed between 1965 and 1992:	B	not required for this age of building	
		not required for this age of building	

along | across

Period (from above):	0.4	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**:	0.00	0.00

2.6 Structural Performance Scaling Factor:

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

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

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

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

3.1. Plan Irregularity, factor A:	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	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		
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:	Building Type 3 (Block D)			Reviewer:	Lee Howard
	Unit	No:	Street	CPEng No:	1008889
Building Address:	Walsall Courts	15	Walsall Street	Company:	Aurecon
Legal Description:	DP26762			Company project number:	233416
				Company phone number:	03 371 2032
	Degrees	Min	Sec		
GPS south:	43	32	37.58	Date of submission:	04/03/2013
GPS east:	172	36	31.79	Inspection Date:	20-Dec-12
				Revision:	1
Building Unique Identifier (CCC):	BE 0488 EQ2			Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:	mixed	Soil Profile (if available):	
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	9.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	
Ground floor split?	no		Ground floor elevation above ground (m):	
Storeys below ground	0			
Foundation type:	mat slab		if Foundation type is other, describe:	
Building height (m):	2.40		height from ground to level of uppermost seismic mass (for IEP only) (m):	3.5
Floor footprint area (approx):	258			
Age of Building (years):	43		Date of design:	1965-1976
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	other (specify)		Brief strengthening description:	
Use (upper floors):				
Use notes (if required):				
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	frame system		
Roof:	timber truss	truss depth, purlin type and cladding	corrugated iron on timber purlins and rafters
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	timber	type	
Columns:	timber	typical dimensions (mm x mm)	
Walls:	non-load bearing	0	

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	**Note: Define along and across in detailed report!**	note typical wall length (m)	0.80 m - 3.2 m
Ductility assumed, μ:	2.00			
Period along:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	estimated
Lateral system across:	unreinforced masonry bearing wall - brick		note wall thickness and cavity	190 mm
Ductility assumed, μ:	2.00			
Period across:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	estimated

Separations:

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

west (mm):			

Non-structural elements

Stairs:			none
Wall cladding:	plaster system	describe	Gib internal, masonry external
Roof Cladding:	Metal	describe	Light weight metal sheets
Glazing:	timber frames		
Ceilings:	plaster, fixed		
Services(list):			

Available documentation

Architectural	none	original designer name/date	
Structural	none	original designer name/date	
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	none	original designer name/date	

Damage

Site:
(refer DEE Table 4-2)

Site performance:	Good	Describe damage:	minor - none
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%		
	Describe (summary):			
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	no	Describe:	

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

Recommendations

	Level of repair/strengthening required:	minor non-structural		Describe:	
	Building Consent required:	no		Describe:	
	Interim occupancy recommendations:	full occupancy		Describe:	
Along	Assessed %NBS before:	100%	##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	
	Assessed %NBS after:	100%			
Across	Assessed %NBS before:	96%	##### %NBS from IEP below		
	Assessed %NBS after:	96%			

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

Period of design of building (from above):	1965-1976	h_n from above:	3.5m
Seismic Zone, if designed between 1965 and 1992:	B	not required for this age of building	
		not required for this age of building	

along across

		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**:	0.00	0.00

2.6 Structural Performance Scaling Factor:

	along	across
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

	along	across
%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	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		
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!**

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