

EARTHQUAKE REPAIR

425 & 427 ARMAGH STREET



BCN/2025/9208

Exemption from building consent
21/11/2025

Doherty, Amy

Notwithstanding any drawings or specifications
accepted herein, all building work must comply
with the New Zealand Building Code.

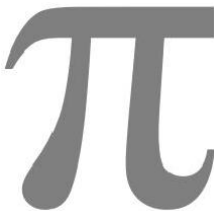
GENERAL REPAIR METHODOLOGY:

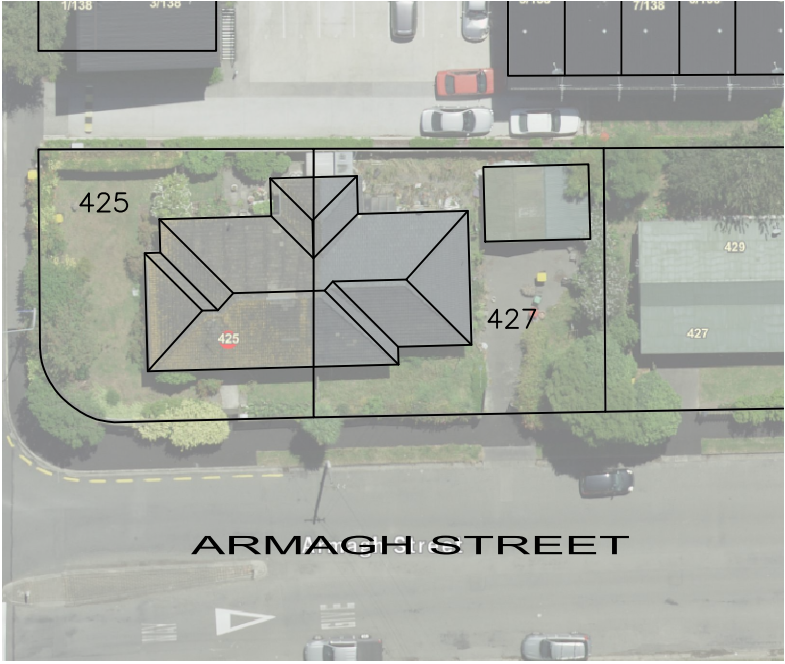
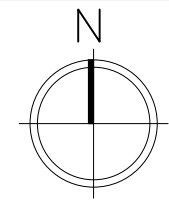
1. CONTRACTOR TO LOCATE EXISTING SERVICES PRIOR TO EXCAVATION
2. DISCONNECT ALL SERVICES
3. REMOVE PERIPHERAL STRUCTURES WHERE REQUIRED AND STORE ON-SITE
4. WHERE PERIPHERAL STRUCTURES REMAIN, DISCONNECT FROM STRUCTURE PRIOR TO RELEVELLING
5. EXCAVATE FOR RELEVELLING PADS AS SHOWN ON DWG 02
6. INSTALL LIFTING SYSTEM
7. INCREMENTALLY LEVEL THE AREAS AS SHOWN IN DWG 02 BY USING A MECHANICAL JACKING TECHNIQUE
8. ENSURE FIREWALL IS RELEVELLED WITH ADJACENT FOUNDATION
9. RELEVEL GROUND FLOOR TO TARGET LEVEL AS SHOWN ON DWG 02
10. ONLY RELEVEL THE RESIDENTIAL BUILDING TO ITS PREVIOUS CONDITION – ENSURE ALL DOORS AND WINDOWS ARE FUNCTIONING FOLLOWING RELEVELLING WORKS
11. INSPECT CONNECTIONS OF SUPERSTRUCTURE & FOUNDATION ELEMENTS TO FIREWALL AND REPAIR OR REPLACE WHERE REQUIRED
12. CONNECT PILES TO BEARERS AND CONNECT PACKERS WHERE INSTALLED
13. REPLACE DAMAGED PILES AND PILES OUT OF VERTICAL AS REQUIRED AND ACCORDING TO STRUCTURAL DETAILS IN DWG. 03
14. REPLACE PILES WHERE PACKERS EXCEED 100mm HEIGHT
15. WHERE BEARERS ARE NOTCHED PLACE REMEDIAL PLATES AS PER MBIE GUIDANCE & DETAILS IN THIS DWG SET
16. REMOVE EXISTING BUILDING RUBBLE WITHIN SUBFLOOR SPACE
17. REMOVE EXISTING CONCRETE CHIMNEY FOUNDATION WHERE NEW PILES ARE TO BE LOCATED
18. PROP EXISTING ROOF AT NO. 425 IN THE DINING/KITCHEN/LOUNGE AREAS
19. REMOVE WALLS AS SHOWN IN DWG 04
20. INSTALL NEW SG8 TIMBER STUDS AS PER DETAILS ON DWG 04
21. INSTALL NEW REMEDIAL TIMBER LVL BEAM AS PER DETAILS IN DWG 04 & CONNECT TO EXISTING ROOF BEAM
22. FILL ALL EXCAVATED HOLES AND REINSTATE GROUND TO NGL
23. REPAIR DAMAGED CONCRETE PERIMETER FOUNDATION AS PER TABLE 01 ON DWG. 05
24. REPAIR CONSEQUENTIAL DAMAGE DUE TO RELEVELLING WORKS AS NECESSARY
25. REPLACE OR RECONNECT PERIPHERAL STRUCTURES
26. RE-CONNECT SERVICES

NOTE:

ALL WORK AS PER NZBC
PROJECT SITE & SEDIMENT CONTROL PLAN AS PER 01

CONTRACTOR TO CONFIRM ALL DIMENSIONS ON SITE
DO NOT SCALE THESE DRAWINGS

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05	GENERAL NOTES	0	11/11/25
04	STRUCTURAL DETAILS	0	11/11/25
03	PROPOSED REPAIR	0	11/11/25
02	EXISTING LAYOUT & SURVEY	0	11/11/25
01	SITE LOCATION & SEDIMENT CONTROL	0	11/11/25
00	TITLE PAGE	0	11/11/25
Drawing	Drawing Title	Revision	Date
	PI CONSULTING STRUCTURAL CIVIL SEISMIC NEW ZEALAND AUSTRALIA CHRISTCHURCH +64 27 923 7782 admin@piconsulting.co	Drawn	SP NOV'25
		Designed	SP NOV'25
		Checked	AP NOV'25
		CPEng Approval	AP NOV'25
		Signature 	
Client	SAM KNIGHT & ESTHER CALJE	Scale	AS SHOWN A3
Project	EARTHQUAKE REPAIR 425 & 427 ARMAGH STREET LINWOOD, 8011 CHRISTCHURCH, NEW ZEALAND	Drawing No S275 - 0 - 01	
		Revision	0



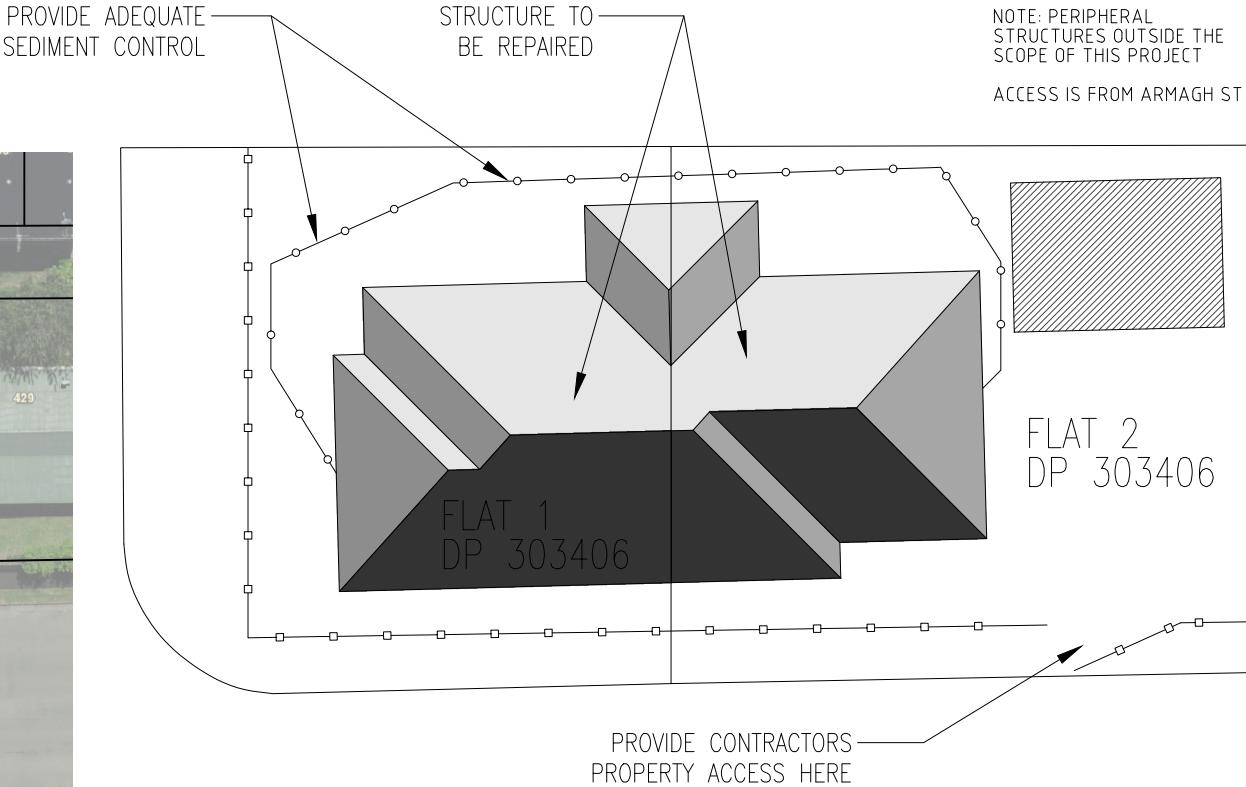
SITE LOCATION

1:500

SITE DESCRIPTION:

ADDRESS:	425 ARMAGH STREET, LINWOOD	427 ARMAGH STREET, LINWOOD
LEGAL DESCRIPTION:	FLAT 1 DP 303406 ON LOT 4 DP 10444 HAVING SHARE IN 1007m ²	FLAT 2 DP 303406 ON LOT 4 DP 10444 HAVING SHARE IN 1007m ²
CLIMATIC ZONE:	5	
EARTHQUAKE ZONE:	2	
EXPOSURE ZONE:	C	
WIND REGION:	A	
WIND ZONE:	MEDIUM	
LAND CLASSIFICATION:	TC2	
PROPERTY AREA: (BOTH UNITS APPROX.)	710 m ² (UNCHANGED)	
COVERAGE:		
GROUND FLOOR (BOTH UNITS APPROX.)	185 m ² (UNCHANGED)	
GEOTECHNICAL:		
200 kPa UBC	0.70 mbgl	
300 kPa UBC	1.10 mbgl	

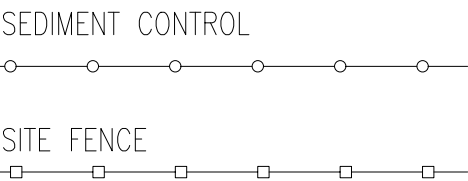
NOTE:
ALL MEASUREMENTS OBTAINED FROM CANTERBURY MAPS AND LINZ DATA. CONTRACTOR TO CONFIRM ALL MEASUREMENTS ON SITE. DO NOT SCALE THESE DRAWINGS



SEDIMENT CONTROL & SITE ACCESS

1:250

LEGEND:



6. Control sediment at the foot of the site
Follow the steps below to keep sediment on your site and stop overspill onto public areas:

- Retain any existing grass cover adjacent to the footpath or kerb and channel (as explained in section 5) and make sure vehicles don't drive over it
- Use sediment fences and decanting earth bunds to control and capture sediment in stormwater (For public safety and efficient sediment control, keep sediment fences within the property boundaries unless you have council approval to use public land for these.)

The most efficient sediment barrier for building sites is usually a specifically manufactured geotextile sediment fence. The use of filter cloth or shade cloth is not permitted. A properly constructed sediment fence may be all that is required for sediment control on a properly managed flat building site (refer figure 9).

Sediment fences

Sediment fences should be located downslope of the disturbance, and ideally along a line of constant land level to prevent concentration of stormwater runoff. Where this cannot be achieved, sections of sediment fence should have 'returns' directed up slope for 1-2 metres to control concentration of stormwater run-off.

In areas where it is impractical to bury the lower edge of the sediment fence, the lower 200 mm (min) portion of the fabric should be placed on the ground up slope of the fence and buried under a 100 mm (min) layer of coarse aggregate, 20-40 mm - refer figure 10).

Figure 9 Sediment fence construction details

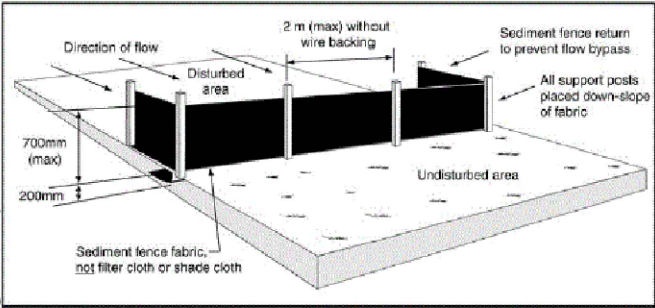
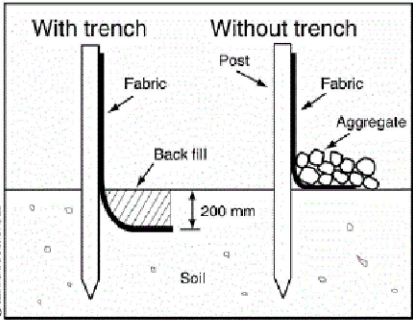


Figure 10 Alternative sediment fence installations (with and without a trench)

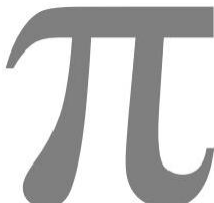


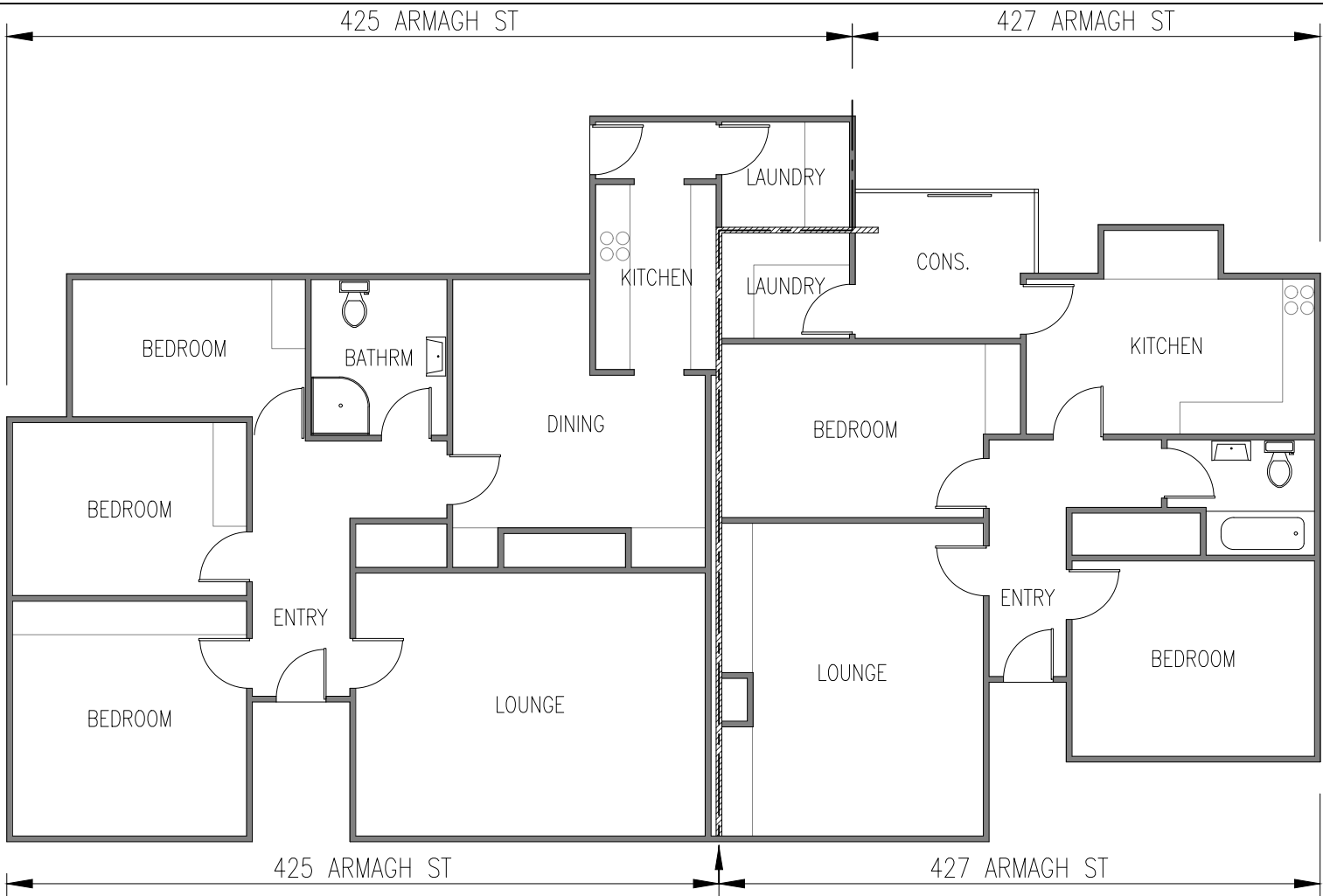
SEDIMENT CONTROL MEASURES

NTS

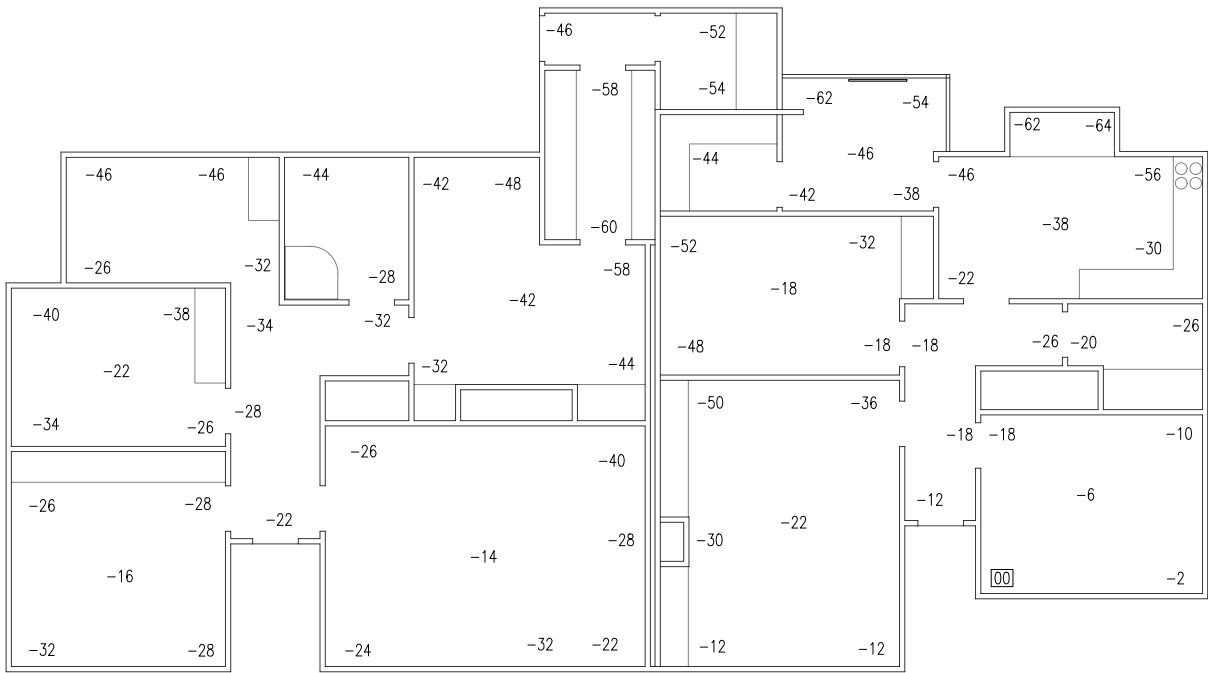
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Reference Drawings	Rev.	Revision		Name	Date	Approved

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	EARTHQUAKE REPAIR 425 & 427 ARMAGH STREET LINWOOD			Checked	AP	NOV'25	
				CPEng Approval	AP	NOV'25	
				Signature 			
			Scale	AS SHOWN	A3		
			Drawing No S275 - 0 - 01				
			Revision 0				



EXISTING LAYOUT
1:100



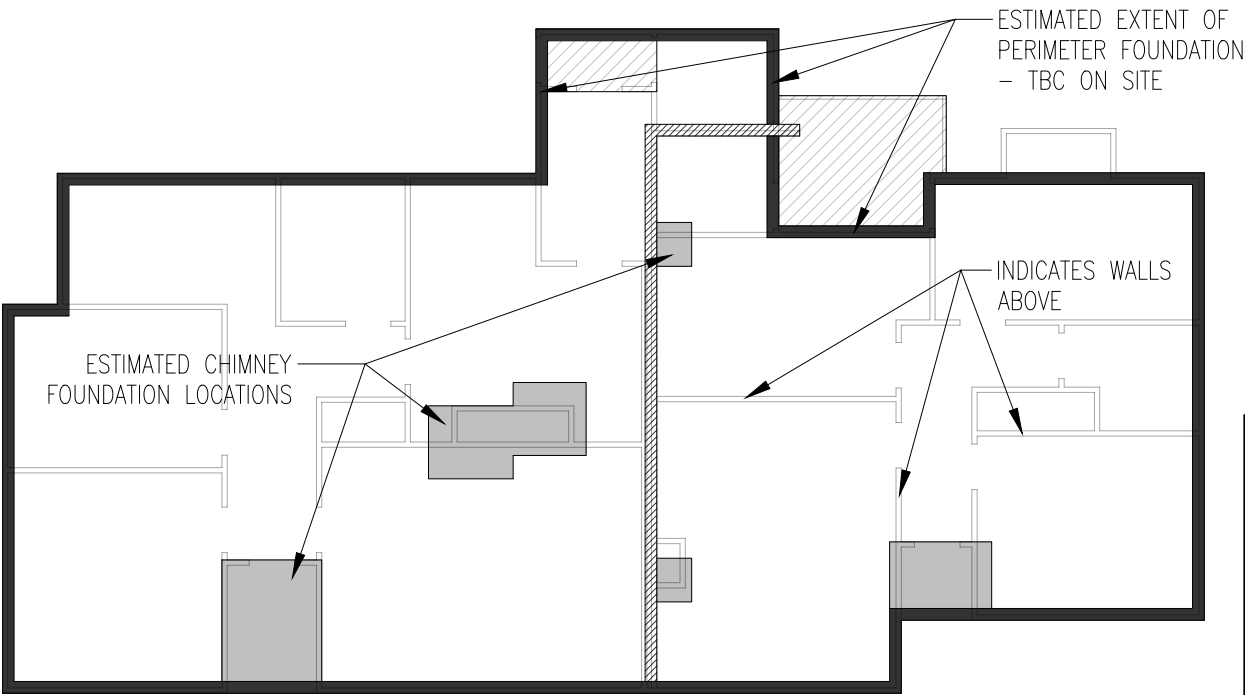
FLOOR LEVEL SURVEY
1:125

- NOTES:
- FLOOR LEVEL SURVEY BY NZCSE DATED 26/02/25 & CONFIRMED BY PI CONSULTING ON 29/10/25
 - FLOOR LEVELS REDUCED TO CONSIDER COVERINGS
 - FLOOR LEVELS ARE CONSIDERED ACROSS ENTIRE MULTI UNIT BUILDING FOOTPRINT
 - FOUNDATION LAYOUT AS PER PROVIDED DOCUMENTATION & SUBFLOOR INSPECTION FOOTAGE – CONTRACTOR TO CONFIRM LOCATION AND EXTENT OF PILES & CONCRETE FOUNDATIONS
 - SEE DWG 03 FOR PROPOSED REPAIR WORK
 - SEE DWG 03 FOR RELEVELLING PAD LAYOUT & DETAILS
 - SEE DWG 03 FOR PACKING DETAILS & NOTCHED BEARER DETAILS
 - SEE DWG 04 FOR PROPOSED INTERNAL ALTERATIONS AT NO. 425
 - SEE DWG 04 FOR REPLACEMENT & NEW PILE DETAILS

LEGEND:

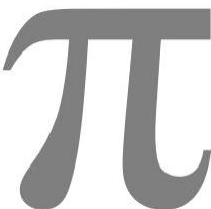
- EXISTING REINFORCED CONCRETE PERIMETER FOUNDATION
- EXISTING FIREWALL FOUNDATION
- EXISTING FLOOR SLABS
- EXISTING CHIMNEY FOUNDATIONS

EXISTING FOUNDATION LAYOUT
1:125



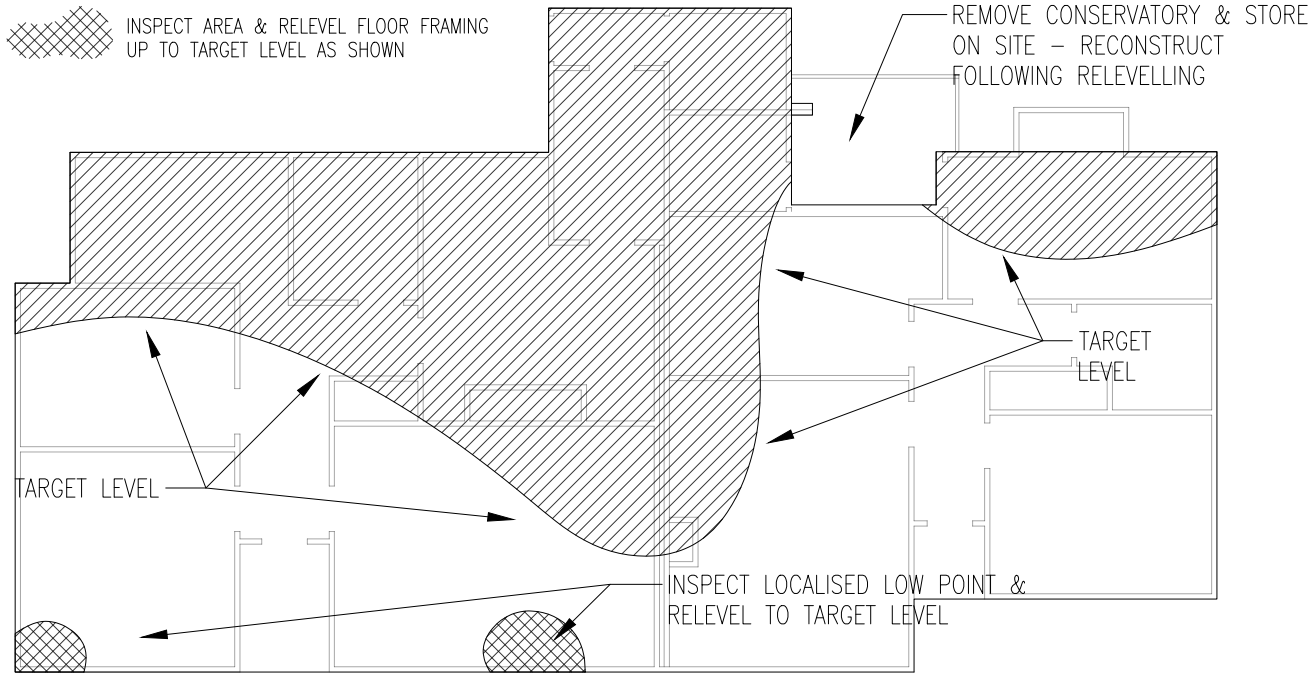
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				CPEng Approval	AP	NOV'25	
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			Revision			0	

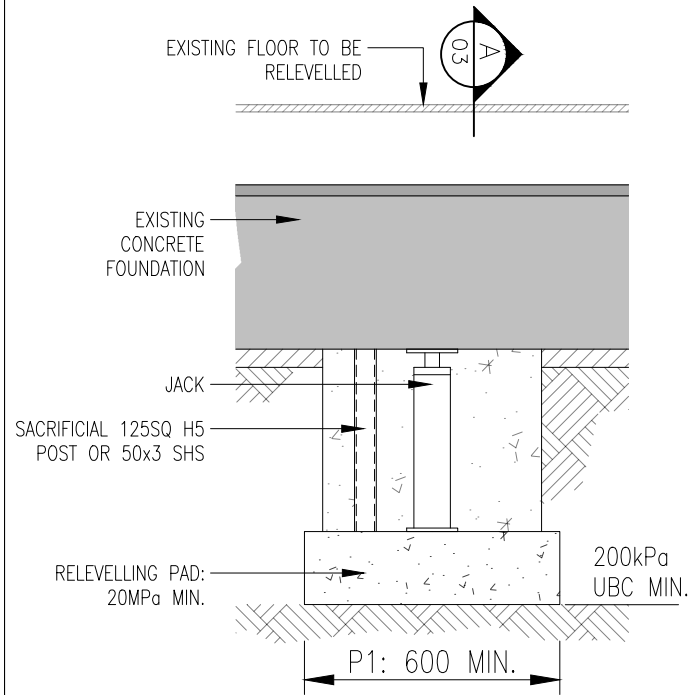
LEGEND:

- RELEVEL PERIMETER FOUNDATION & INTERNAL PILES UP TO TARGET LEVEL AS SHOWN
- INSPECT AREA & RELEVEL FLOOR FRAMING UP TO TARGET LEVEL AS SHOWN



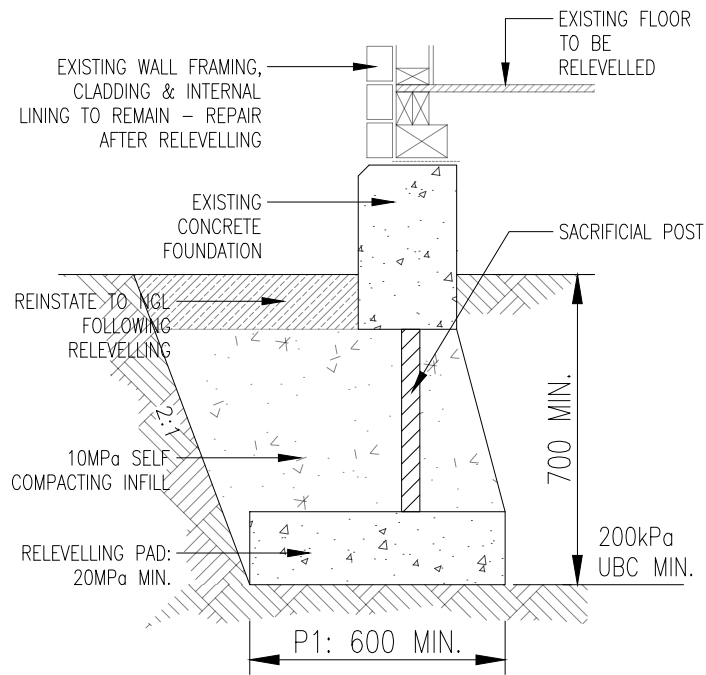
PROPOSED REPAIR ARRANGEMENT

1:125



RELEVELLING PAD DETAIL

1:20



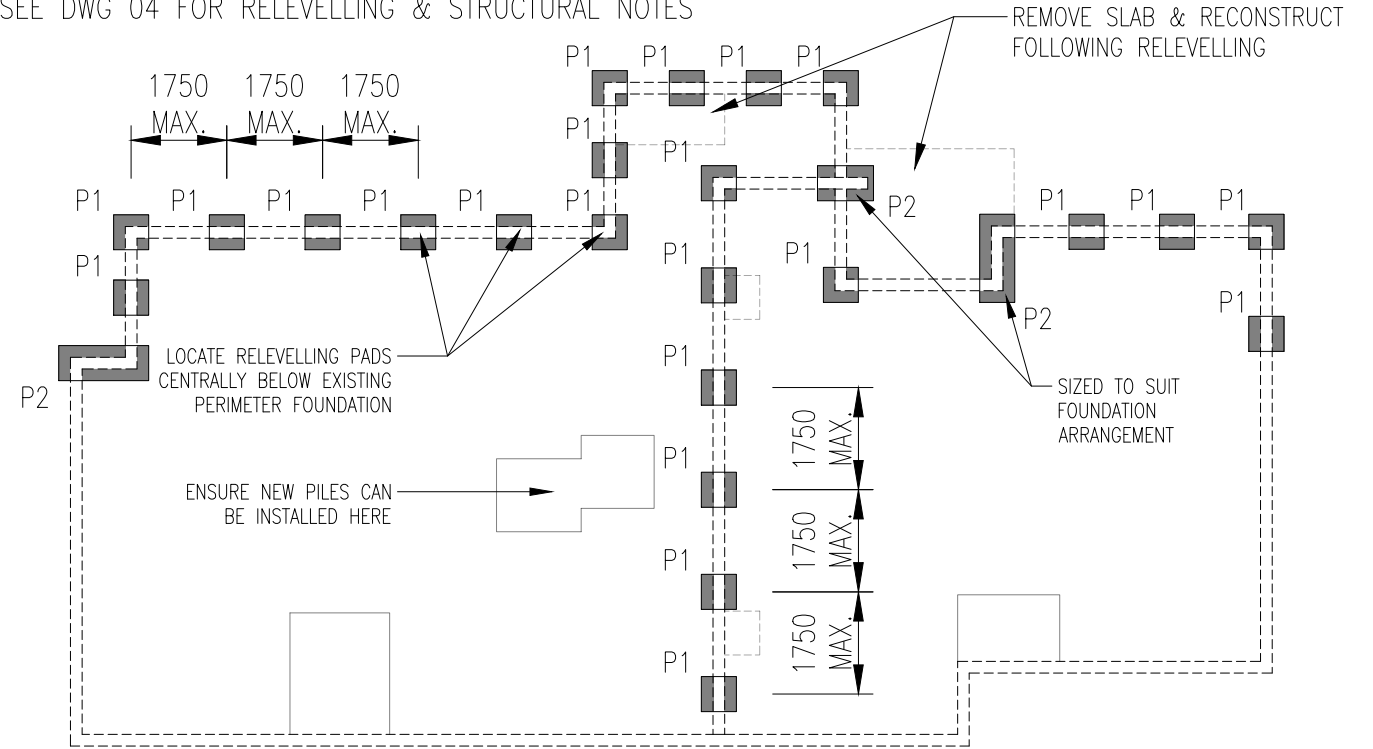
SECTION A-A

1:20

PAD DETAILS:

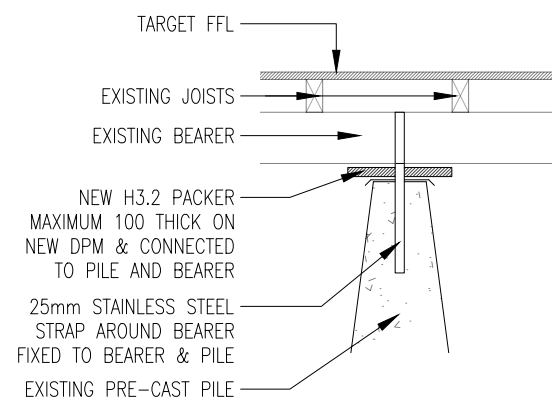
- P1: 600x600mm x 250 DEPTH 0.70 mbgl SPACING @ 1750 MAX
- P2: TO SUIT x 250 DEPTH 0.70 mbgl

SEE DWG 04 FOR RELEVELLING & STRUCTURAL NOTES



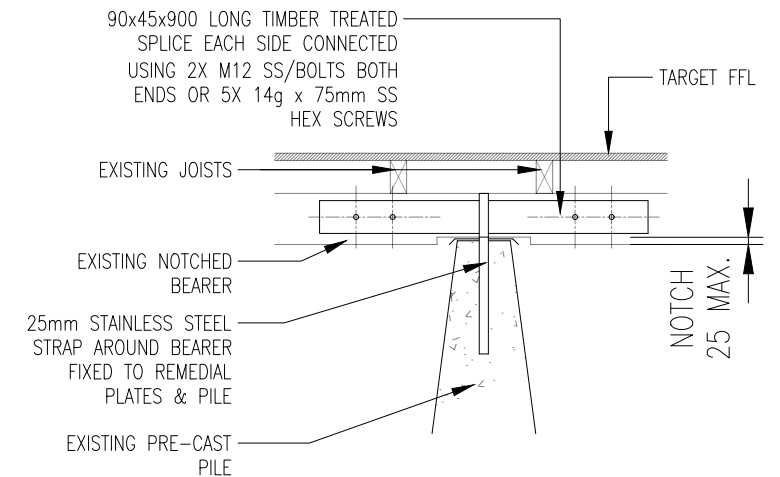
RELEVELLING PAD LAYOUT

1:125



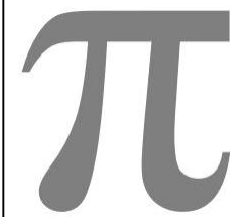
PACKING DETAIL

1:20



BEARER NOTCH DETAIL

1:20



PI CONSULTING
STRUCTURAL CIVIL SEISMIC
NEW ZEALAND AUSTRALIA

CHRISTCHURCH
+64 27 923 7782
admin@piconsulting.co

Client SAM KNIGHT & ESTHER CALJE

Project PROPOSED RELEVELLING & REPAIR

EARTHQUAKE REPAIR
425 & 427 ARMAGH STREET
LINWOOD

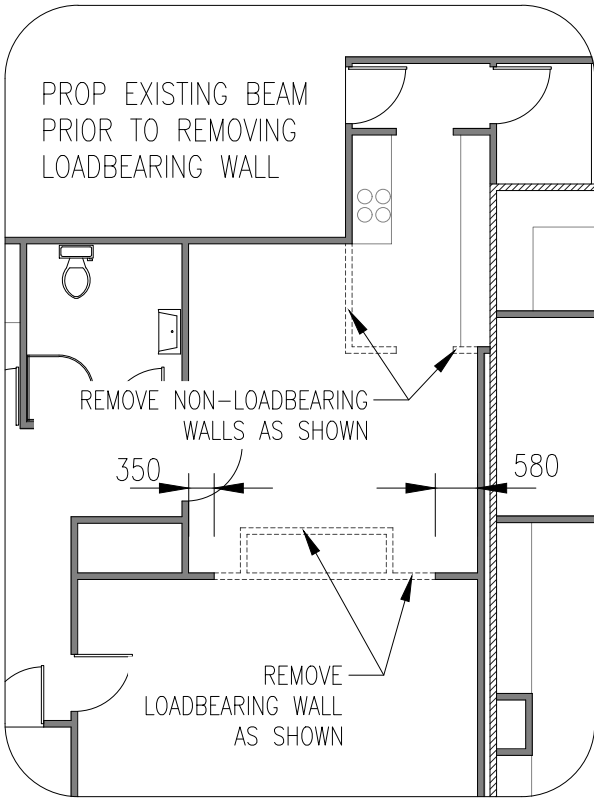
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Designed	SP	NOV'25
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CPEng Approval	AP	NOV'25

Signature

Scale AS SHOWN A3

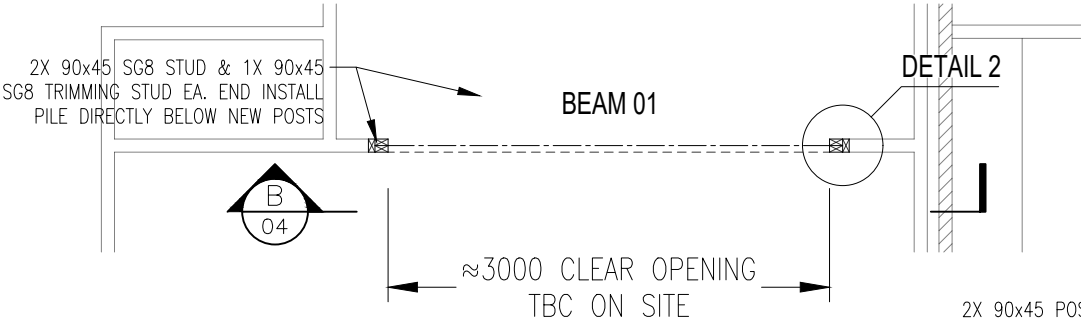
Drawing No
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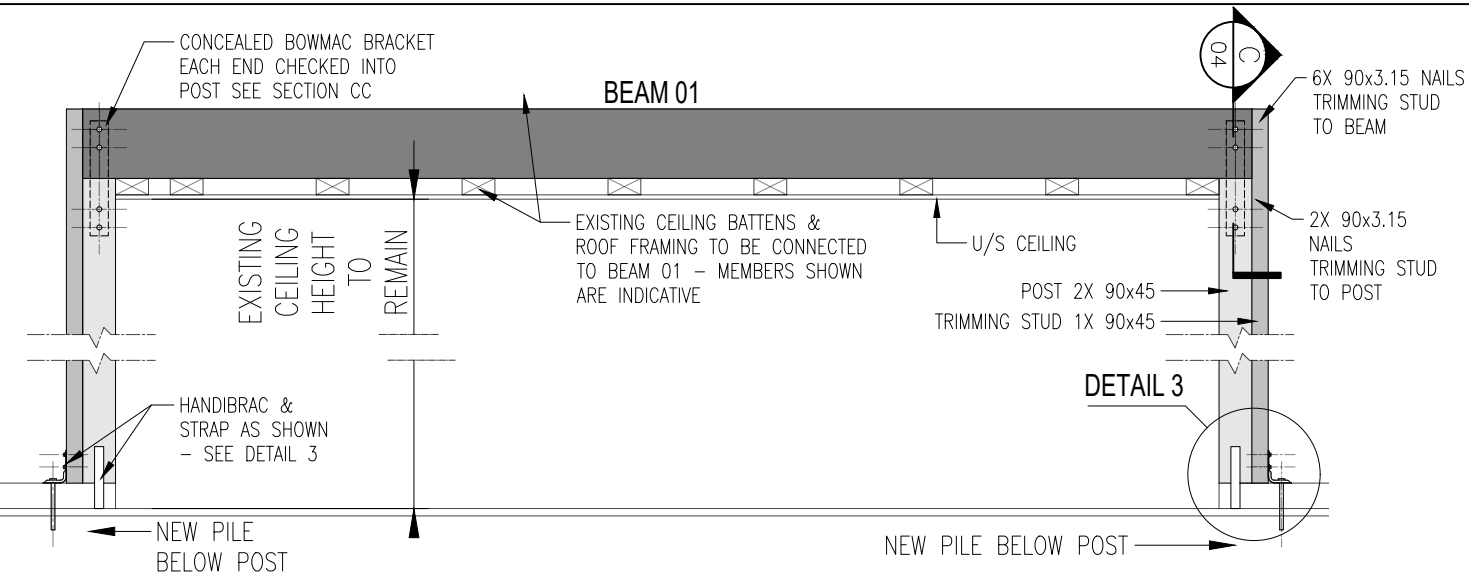
PROPOSED DEMOLITION
1:100

NOTE: INSTALL NEW PILE DIRECTLY BELOW
NEW POST – 2X NO. REQUIRED

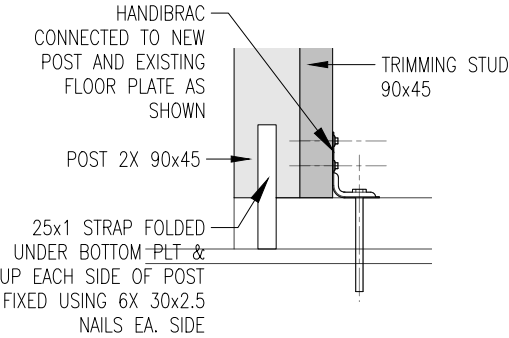


PROPOSED BEAM 01: LOCATION
1:50

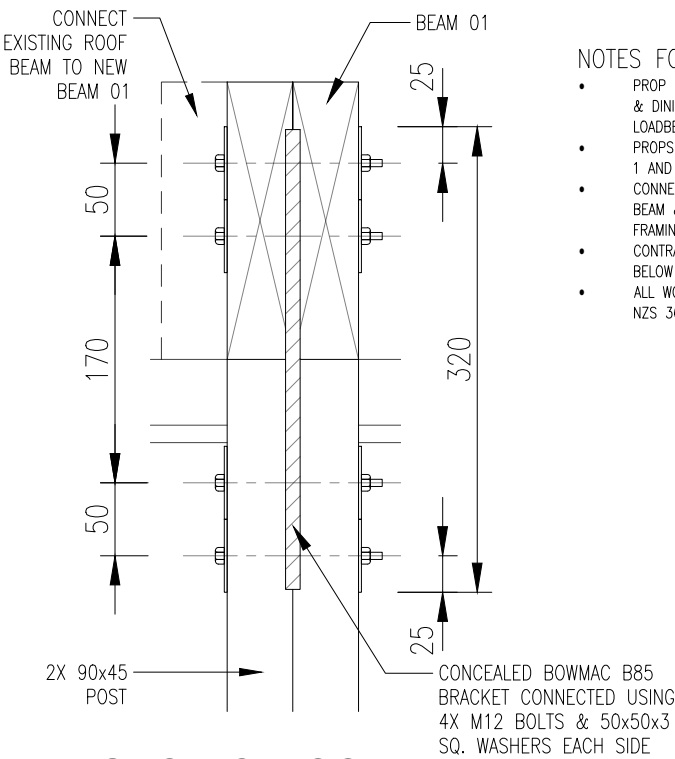
BEAM LEGEND:
BEAM 01 2X 190x45 LVL11



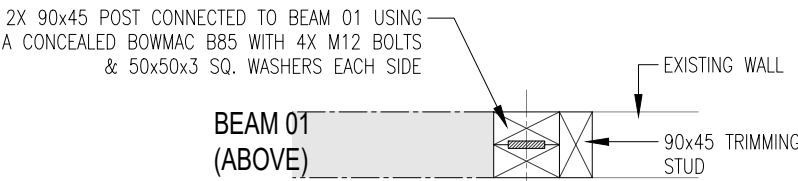
VIEW ON B
1:20



DETAIL 3
1:10



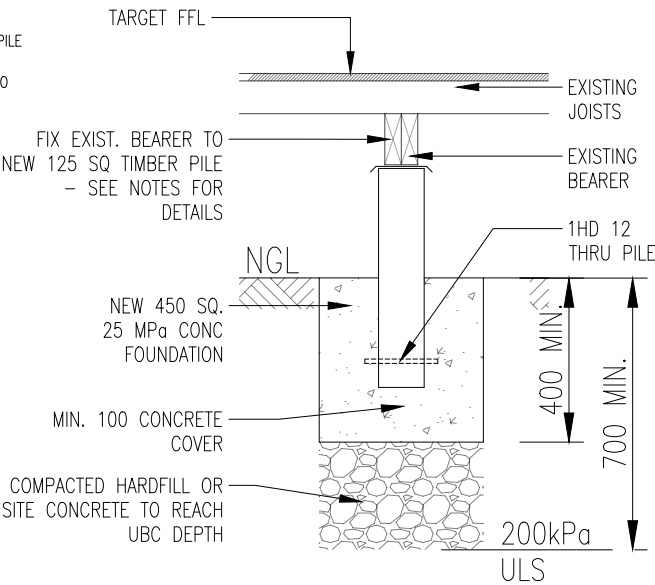
SECTION CC
1:5



DETAIL 2
1:10

- NOTES:
- FOR REPLACEMENT AND/OR ADDITIONAL PILES INSTALL 125SQ TIMBER TREATED PILES CONNECTED TO EXISTING BEARERS USING 2X 100x3.75 SKEW NAILS AND 1X WIRE DOG EACH SIDE OR EQUIVALENT PILE-BEARER FIXING
 - WHERE BEARERS ARE RELEVELLED:
 - PLACE TIMBER TREATED PACKER AND CONNECT USING 2X 25x1 THK STRAPS WITH 2X 30x3.15 FLAT NAILS TO BEARER EACH SIDE
 - CONNECT PACKER TO BEARER WITH STAINLESS STEEL SKEWS
 - WHERE BEARERS ARE NOTCHED:
 - INSTALL 2X SPLICE PLATES EACH SIDE OF BEARER & CONNECT USING M12 STAINLESS STEEL BOLTS AS SHOWN IN DETAIL ON DWG 03
 - ALL CONNECTIONS TO NZS3604
 - ALL REINFORCEMENT GRADE 500E
 - CONTRACTOR TO RELEVEL RESIDENTIAL BUILDING TO ITS CONDITION PRIOR TO THE CES
 - CONTRACTOR TO MONITOR THE SUPERSTRUCTURE AND ENSURE ALL DOORS AND WINDOWS ARE FUNCTIONING
 - REPAIR ALL INTERNAL LININGS FOLLOWING RELEVELLING
 - ALL SUBFLOOR CONNECTIONS STRICTLY ACCORDING TO NZS3604
 - ENSURE DPM IS INSTALLED BETWEEN BEARER OR PACKER & PILES
 - INSPECT CONCRETE BLOCK FIREWALL FOLLOWING RELEVELLING & REINSTATE DAMAGED CONNECTIONS AS REQUIRED
 - REPAIR CONCRETE PERIMETER FOUNDATION ACCORDING TO TABLE 1 ON DWG 05

- NOTES FOR ALTERATION:
- PROP ROOF FRAMING FRAMING IN LOUNGE & DINING AREA PRIOR TO REMOVING LOADBEARING WALL
 - PROPS TO REMAIN IN PLACE UNTIL BEAM 1 AND ALL CONNECTIONS ARE INSTALLED
 - CONNECT EXISTING BEAM TO NEW LVL11 BEAM & CONNECT ROOF STRUTS & FRAMING TO BEAM 1
 - CONTRACTOR TO PLACE ADDITIONAL PILE BELOW EACH NEW 90x90 SGB POST
 - ALL WORK COMPLETED ACCORDING TO NZS 3604 AND THE CURRENT NZBC



NEW PILE DETAIL
1:20

PI CONSULTING
STRUCTURAL CIVIL SEISMIC
NEW ZEALAND AUSTRALIA
CHRISTCHURCH
+64 27 923 7782
admin@piconsulting.co

Client SAM KNIGHT & ESTHER CALJE
Project INTERNAL ALTERATIONS - NO. 425
EARTHQUAKE REPAIR
425 & 427 ARMAGH STREET
LINWOOD

Drawn	SP	NOV'25
Designed	SP	NOV'25
Checked	AP	NOV'25
CPEng Approval	AP	NOV'25
Signature <i>Alan Pearson</i>		

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Drawing No S275 - 0 - 04		
Revision	0	

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Reference Drawings	Rev.	Revision		Name	Date	Approved

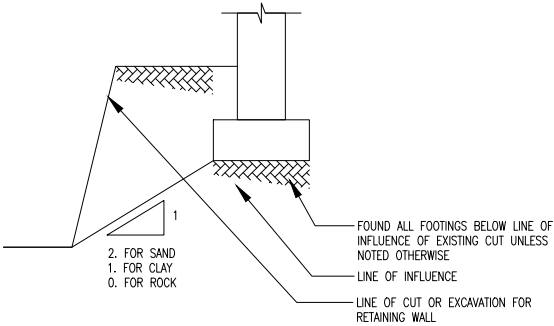
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GENERAL

- G1. READ THESE DRAWINGS IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER WORKING DRAWINGS, SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT.
- G2. PROVIDE ALL WORKMANSHIP AND MATERIALS IN ACCORDANCE WITH THE REQUIREMENTS OF THE CURRENT EDITIONS OF THE NZ BUILDING ACT, THE NZ BUILDING CODE, THE NEW ZEALAND STANDARDS AND THE BY-LAWS AND ORDINANCES OF THE RELEVANT BUILDING CONSENT AUTHORITY.
- G3. COMPLY AS THE BUILDER, WITH REQUIREMENTS OF THE WORKPLACE HEALTH & SAFETY ACT.
- G4. REFER ANY CONFLICT BETWEEN THESE NOTES, THE SPECIFICATION, THE DRAWINGS OR ANY OTHER RELEVANT DOCUMENTS TO THE ENGINEER FOR DECISION PRIOR TO PROCEEDING WITH THE WORK.
- G5. DO NOT OBTAIN DIMENSIONS BY SCALING THE DRAWINGS. FOR SETTING OUT DIMENSIONS AND LEVELS REFER TO ARCHITECTURAL DRAWINGS.
- G6. THE BUILDER IS RESPONSIBLE FOR THE PROVISION OF ALL SHORING TO MAINTAIN THE STABILITY AND INTEGRITY OF EXCAVATIONS AND ADJACENT STRUCTURES. PROVIDE DETAILS, FOR REVIEW BY THE ENGINEER, OF ANY NECESSARY TEMPORARY WORKS, INCLUDING SHORING, PRIOR TO COMMENCING CONSTRUCTION.
- G7. DURING CONSTRUCTION IT IS THE BUILDER'S RESPONSIBILITY TO MAINTAIN THE STRUCTURE IN A STABLE CONDITION AND TO ENSURE NO PART IS OVERSTRESSED.
- G8. THE DESIGN AND DRAWINGS ARE COPYRIGHT AND MAY NOT BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT THE WRITTEN PERMISSION OF PI CONSULTING LTD.
- G9. FIRE-RESISTANCE LEVELS (FRL'S) REQUIRED FOR THE VARIOUS STRUCTURAL ELEMENTS MUST BE CONFIRMED BY THE BUILDING SURVEYOR OR ARCHITECT.

FOUNDATIONS

- F1. THE MINIMUM SAFE ULTIMATE BEARING CAPACITY OF FOUNDATION MATERIAL SHALL BE: SLABS & FOOTINGS : 200 kPa. IN NATURAL SUBSTRATE UNLESS NOTED OTHERWISE (U.N.O.)
- F2. FOUNDATION MATERIAL SHALL BE APPROVED BY THE ENGINEER PRIOR TO PLACING CONCRETE.
- F3. THE BASES OF FOOTING EXCAVATIONS SHALL BE FINISHED CLEAN AND HORIZONTAL AND BE EMBEDDED 300 INTO NATURALLY OCCURRING MATERIAL.
- F4. FOUNDING LEVELS WHERE SHOWN ARE FOR TENDER PURPOSES ONLY.
- F5. ANY PROPOSED FOOTING EXCAVATION NEAR BOUNDARIES, OTHER STRUCTURES OR SERVICES SHALL BE APPROVED BY THE ENGINEER.
- F6. SUBGRADE SHALL BE APPROVED MATERIAL COMPACTED TO 98% STANDARD DRY DENSITY DETERMINED BY TESTING TO THE RELEVANT PART OF NZS 4402:1986 U.N.O.
- F7. LOCATE ALL NEW FOOTINGS RELATIVE TO LINE OF CUT/EXCAVATION INCLUDING EXCAVATIONS AS SHOWN BELOW:



GENERAL NOTES

MASONRY

- M1. ENSURE ALL WORKMANSHIP AND MATERIALS ARE IN ACCORDANCE WITH NZS 4230, THE DRAWINGS & PROJECT SPECIFICATIONS.
- M2. WHERE MASONRY SUPPORTS CONCRETE SLABS OR BEAMS, LAY THE TOP COURSE WITH FROGS DOWN AND COVERED WITH 2 LAYERS OF APPROVED SLIP JOINT MATERIAL.
- M3. WALLS SHOWN SHADED ON PLAN ARE LOAD BEARING. SEPARATE NON-LOAD BEARING WALLS UNDER SLABS FROM THE SLAB BY 15mm OF APPROVED COMPRESSIBLE MATERIAL. WHERE MASONRY ABUTS SLAB DOWNTURNS, FORM A 15mm GAP BETWEEN BRICKWORK AND SIDE OF DOWNTURN.
- M4. DO NOT ERECT MASONRY SUPPORTED BY CONCRETE SLABS OR BEAMS UNTIL ALL FORMWORK AND PROPS UNDER HAVE BEEN REMOVED.
- M5. PROVIDE ALL BRICKS OF ULTIMATE COMPRESSIVE STRENGTH F'UC= 20 MPa U.N.O.
- M6. PROVIDE ALL HOLLOW CONCRETE MASONRY OF ULTIMATE COMPRESSIVE STRENGTH F'UC = 15 MPa U.N.O.
- M7. PROVIDE CLASSIFICATION M3 MASONRY MORTAR U.N.O. NOTE THAT WITHIN 100m FROM NON-SURF COAST, OR 1KM FROM SURF COAST, PROVIDE CLASSIFICATION M4 MASONRY MORTAR.
- M8. CUT NO CHASES INTO LOADBEARING MASONRY WITHOUT THE APPROVAL OF THE ENGINEER.
- M9. PROVIDE MOVEMENT CONTROL JOINTS VERTICALLY FOR FULL HEIGHT OF WALL AS FOLLOWS:
FOR GENERAL MASONRY, AT 8m MAXIMUM CENTRES & 4m MAXIMUM FROM CORNERS.
FOR ARTICULATED MASONRY, AT 6m MAXIMUM CENTRES & 4m MAXIMUM FROM CORNERS.
PROVIDE 15mm MINIMUM JOINTS WITH AN APPROVED COMPRESSIBLE FILLER, TIED TOGETHER EVERY 4TH COURSE WITH AN MET 3.3 MASONRY SLIDING TIE OR APPROVED EQUIVALENT.
- M10. CONSTRUCT HOLLOW WALLS TO FULL HEIGHT OR MAXIMUM 3m BEFORE FILLING CORES. PROVIDE CLEANOUT OPENINGS AT THE BASE OF ALL CORES TO BE FILLED.
- M11. CORE FILL F'UC = 20 MPa CONCRETE WITH 10mm AGGREGATE, 180 SLUMP U.N.O.
- M12. CONSTRUCT HOLLOW MASONRY RETAINING WALLS USING "DOUBLE U BLOCKS".
- M13. UNREINFORCED MASONRY WALLS HAVE NOT BEEN DESIGNED UNLESS NOTED.

LOADINGS

- L1. SUPERIMPOSED FLOOR LOADS ARE GENERALLY IN ACCORDANCE WITH AS/NZS1170.1 AND SPECIFICALLY:
1.5 kPa GENERALLY
2.0 kPa BALCONIES
2.5 kPa STAIRS
- L2. WIND LOADS ARE IN ACCORDANCE WITH AS/NZS1170.2 FOR:
TERRAIN CATEGORY: 2.5 REGION: A7
TOPOGRAPHIC MULTIPLIER OF: 1.0
SHIELDING MULTIPLIER OF: 1.0

L2.2 SNOW LOADS ARE IN ACCORDANCE WITH AS/NZS 1170.3
0.9kPa

L2.3 EARTHQUAKE LOADS ARE IN ACCORDANCE WITH NZS 1170.5

CRACK REPAIR				
	NO ACTION NECESSARY	REPAIR BY EPOXY INJECTION	REPAIR BY GROUT INJECTION	BREAK OUT AND RECAST
CRACK WIDTHS	LESS THAN 1 mm	BETWEEN 1 mm AND 10 mm	BETWEEN 10 mm AND 20 mm	GREATER THAN 20 mm
CONSIDERATIONS		VERTICAL MISALIGNMENTS ACROSS CRACKS ARE SUFFICIENTLY MINOR TO HAVE NEGLIGIBLE EFFECT ON THE FINISHED SURFACE		

TABLE 1

STEELWORK

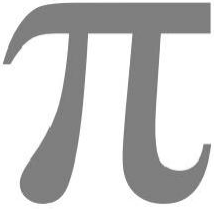
- S1. ENSURE MATERIALS, FABRICATION AND ERECTION ARE IN ACCORDANCE WITH NZS 3404, ITS REFERENCED DOCUMENTS AND THE SPECIFICATION.
- S2. SHOP DRAWINGS ARE TO BE APPROVED BY THE ENGINEER PRIOR TO FABRICATION
- S3. PROVIDE ALL WELDS AS 6mm CONTINUOUS FILLET FROM E41XX ELECTRODES, ALL BOLTS AS M16-4.6/S AND ALL CLEATS AND GUSSETS AS 10mm PLATE U.N.O.
- S4. FOR BOLTS, THE FOLLOWING NOTATION IS USED:
4M16-4.6/S DENOTES 4 X M16 COMMERCIAL GRADE BOLTS SNUG TIGHT.
6M20-8.8/TF DENOTES 6 X M20 HIGH STRENGTH STRUCTURAL BOLTS FULLY TENSIONED IN A NO SLIP JOINT.
8M24-8.8/TB DENOTES 8 X M24 HIGH STRENGTH STRUCTURAL BOLTS FULLY TENSIONED IN A BEARING JOINT.
- S5. LEAVE MATING SURFACES OF TF CONNECTIONS UNPAINTED AND FREE OF MILL SCALE AND RUST.
- S6. TIGHTEN BOLTS IN TF AND TB CONNECTIONS USING THE PART TURN METHOD OR LOAD INDICATING WASHERS. DO NOT USE CALIBRATED TORQUE WRENCHES. USE A HARDENED WASHER UNDER THE BOLT HEAD OR NUT, WHICHEVER IS ROTATED. THE RE-USE OF FULLY TENSIONED BOLTS IS PROHIBITED.
- S7. PROVIDE ALL CLEATS AND DRILL ALL HOLES NECESSARY FOR FIXING STEEL TO STEEL OR TIMBER.
- S8. FABRICATE STEEL BEAMS AND TRUSSES SPANNING GREATER THAN 5m WITH AN UPWARD PRE CAMBER OF 1/500 SPAN U.N.O.
- S9. PREPARE STRUCTURAL STEELWORK TO CLASS 2 AND PAINT WITH ZINC PHOSPHATE PRIMER TO THICKNESS OF 70 MICROMETRES U.N.O.
- S10. HOT DIP GALVANISE ALL EXPOSED EXTERNAL STEELWORK AND ALL STEELWORK BUILT INTO AN EXTERNAL MASONRY SKIN, IN ACCORDANCE WITH GRADE HDG600 TO AS/NZS 2312.
- S11. WITHIN 100m FROM THE NON-SURF COAST OR 1 KM FROM THE SURF COAST, HOT DIP GALVANISE ABOVE IN ACCORDANCE WITH GRADE HDG900 TO AS/NZS 2312.
- S12. PROVIDE FIRE PROTECTION TO ALL STEELWORK AS REQUIRED.
- S13. ENSURE ALL COLD FORMED SECTIONS CONFORM TO AS/NZS 4600 AND ARE ROLL-FORMED FROM STEEL STRIP, MINIMUM YIELD STRESS 450 MPa, 300 g/m2 MINIMUM ZINC COATING MASS U.N.O.

TIMBER

- T1. ENSURE ALL WORKMANSHIP AND MATERIALS ARE IN ACCORDANCE WITH NZS 3603:1993 AND NZS 3604:2011, THEIR REFERENCED DOCUMENTS AND THE SPECIFICATION.
- T2. PROVIDE ALL INTERIOR TIMBER AS SG6 (DRY) U.N.O.
- T3. PROVIDE ALL EXTERNAL TIMBER AS SG8 (DRY) U.N.O.
- T4. WHERE THE USE OF TREATED TIMBER FOR DURABILITY IS NOTED ON THE STRUCTURAL DRAWINGS, ENSURE IT COMPLIES WITH THE PARAMETERS: EXPOSURE ZONE C IN ACCORDANCE WITH NZS 3604.
- T5. INSTALL PROPRIETARY TIMBER CONNECTORS IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS.
- T6. RETIGHTEN BOLTED CONNECTIONS IN UNSEASONED TIMBER PRIOR TO THE FIXING OF CLADDING.
- T7. TIMBER ELEMENTS OR TIMBER FRAMING HAVE NOT BEEN DESIGNED UNLESS NOTED.
- T8. ALL TRUSSES TO BE PRE-CAMBERED UPWARD 1/240 SPAN U.N.O.

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.	.	.	.	.	.	.
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.	.	0	ISSUED FOR CONSENT	SP	11/11/25	AP
Reference Drawings		Rev.	Revision		Name	Approved

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PI CONSULTING

STRUCTURAL CIVIL SEISMIC

NEW ZEALAND AUSTRALIA

CHRISTCHURCH

+64 27 923 7782

admin@piconsulting.co

Client

SAM KNIGHT & ESTHER CALJE

Project

GENERAL NOTES

EARTHQUAKE REPAIR

425 & 427 ARMAGH STREET

LINWOOD

Drawn	SP	NOV'25
Designed	SP	NOV'25
Checked	AP	NOV'25
CPEng Approval	AP	NOV'25
Signature 		
Scale	AS SHOWN	A3
Drawing No S275 - 0 - 05		
Revision		0

CONSENT INDEX

425 & 427 ARMAGH STREET

LINWOOD

CHRISTCHURCH

8011

π

CLIENT: *Sam Knight & Esther Calje*

DATE: *11 November 2025 (r0)*

PROJECT NR: *S275*

PI CONSULTING LTD
Christchurch
027 923 7782
admin@piconsulting.co

**DOCUMENT CONTROL*****Document Prepared by:*****Pi Consulting Ltd**

20 Rossall Crescent
Christchurch
New Zealand

Phone: +64 27 923 7782

Email: admin@piconsulting.co

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DOCUMENT TRANSMITTAL

Revision	Date	Author	Reviewer	Description
0	11 November 2025	Stefan Pienaar B Eng MEngNZ	A Pearson CPEng	Issue to Client



1. PRODUCER STATEMENT
2. MEMORANDUM
3. CONSTRUCTION MONITORING SCHEDULE
4. ASSESSMENTS & SOILS REPORTS
5. DESIGN FEATURES REPORT
6. CALCULATIONS
7. DRAWINGS



association
of
consulting
and
engineering



PRODUCER STATEMENT – PS1 DESIGN

BUILDING CODE CLAUSE(S): B1, B2, VM1, VM4

JOB NUMBER: S275

ISSUED BY: Pi Consulting Ltd
(Engineering Design Firm)

TO: Sam Knight and Esther Calje
(Owner/Developer)

TO BE SUPPLIED TO: Christchurch City Council
(Building Consent Authority)

IN RESPECT OF: Structural Design of Foundation Repair for 425 & 427, Internal Alterations at Nr. 425 only
(Description of Building Work)

AT: 425 & 427 Armagh Street
(Address, Town/City)

LEGAL DESCRIPTION: Flat 1 and 2 DP 303406 on Lot 4 DP 10444 having share in 1007 m2

N/A ☐

We have been engaged by the owner/developer referred to above to provide (Extent of Engagement):

Structural Design of Specific Building Elements and Supervision Services

in respect of the requirements of the Clause(s) of the Building Code specified above for Part only, as specified in the Schedule, of the proposed building work.

The design carried out by us has been prepared in accordance with:

- ☒ Compliance documents issued by the Ministry of Business, Innovation & Employment (Verification method/acceptable solution) B1/VM1/VM4, B2 and/or;
- ☐ Alternative solution as per the attached Schedule.

The proposed building work covered by this producer statement is described on the drawings specified in the Schedule, together with the specification, and other documents set out in the Schedule.

On behalf of the Engineering Design Firm, and subject to:

- Site verification of the following design assumptions: See Design Features Report Ref: S275.
- All proprietary products meeting their performance specification requirements;

I believe on reasonable grounds that:

- the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the Schedule, will comply with the relevant provisions of the Building Code and that;
- the persons who have undertaken the design have the necessary competency to do so.

I recommend the CM 3 level of construction monitoring.

I, (Name of Engineering Design Professional) Alan Pearson, am:

- ☒ CPEng number 1024104

and hold the following qualifications B Eng, CPEng, CMEngNZ, FIEAust

The Engineering Design Firm holds a current policy of Professional Indemnity Insurance no less than \$200,000

The Engineering Design Firm is not a member of ACE New Zealand.

SIGNED BY (Name of Engineering Design Professional): Alan Pearson

(Signature below):

Alan Pearson

ON BEHALF OF (Engineering Design Firm): Pi Consulting Ltd

Date: 11/11/2025

Note: This statement has been prepared solely for the Building Consent Authority named above and shall not be relied upon by any other person or entity. Any liability in relation to this statement accrues to the Engineering Design Firm only. As a condition of reliance on this statement, the Building Consent Authority accepts that the total maximum amount of liability of any kind arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in tort or otherwise, is limited to the sum of \$200,000.

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.

SCHEDULE to PS1

Please include an itemised list of all referenced documents, drawings, or other supporting materials in relation to this producer statement below:

DFR: S275 REP01 425 & 427 Armagh Street Design Features Report r0
Design Memorandum: S275 MEM 425 & 427 Armagh Street r0
Construction Monitoring Schedule: S275 SCH 425 & 427 Armagh Street r0
Project Drawing Set: S275 DWG 425 & 427 Armagh Street 00-05 r0

GUIDANCE ON USE OF PRODUCER STATEMENTS

Information on the use of Producer Statements and Construction Monitoring Guidelines can be found on the Engineering New Zealand website
<https://www.engineeringnz.org/engineer-tools/engineering-documents/producer-statements/>

Producer statements were first introduced with the Building Act 1991. The producer statements were developed by a combined task committee consisting of members of the New Zealand Institute of Architects (NZIA), Institution of Professional Engineers New Zealand (now Engineering New Zealand), Association of Consulting and Engineering New Zealand (ACE NZ) in consultation with the Building Officials Institute of New Zealand (BOINZ). The original suite of producer statements has been revised at the date of this form to ensure standard use within the industry.

The producer statement system is intended to provide Building Consent Authorities (BCAs) with part of the reasonable grounds necessary for the issue of a Building Consent or a Code Compliance Certificate, without necessarily having to duplicate review of design or construction monitoring undertaken by others.

PS1 DESIGN Intended for use by a suitably qualified independent engineering design professional in circumstances where the BCA accepts a producer statement for establishing reasonable grounds to issue a Building Consent;

PS2 DESIGN REVIEW Intended for use by a suitably qualified independent engineering design review professional where the BCA accepts an independent design professional's review as the basis for establishing reasonable grounds to issue a Building Consent;

PS3 CONSTRUCTION Forms commonly used as a certificate of completion of building work are Schedule 6 of NZS 3910:2013 or Schedules E1/E2 of NZIA's SCC 2011²

PS4 CONSTRUCTION REVIEW Intended for use by a suitably qualified independent engineering construction monitoring professional who either undertakes or supervises construction monitoring of the building works where the BCA requests a producer statement prior to issuing a Code Compliance Certificate.

This must be accompanied by a statement of completion of building work (Schedule 6).

The following guidelines are provided by ACE New Zealand and Engineering New Zealand to interpret the Producer Statement.

Competence of Engineering Professional

This statement is made by an engineering firm that has undertaken a contract of services for the services named, and is signed by a person authorised by that firm to verify the processes within the firm and competence of its personnel.

The person signing the Producer Statement on behalf of the engineering firm will have a professional qualification and proven current competence through registration on a national competence-based register such as a Chartered Professional Engineer (CPEng).

Membership of a professional body, such as Engineering New Zealand provides additional assurance of the designer's standing within the profession. If the engineering firm is a member of ACE New Zealand, this provides additional assurance about the standing of the firm.

Persons or firms meeting these criteria satisfy the term "suitably qualified independent engineering professional".

Professional Indemnity Insurance

As part of membership requirements, ACE New Zealand requires all member firms to hold Professional Indemnity Insurance to a minimum level.

The PI Insurance minimum stated on the front of this form reflects standard practice for the relationship between the BCA and the engineering firm.

Professional Services during Construction Phase

There are several levels of service that an engineering firm may provide during the construction phase of a project (CM1-CM5 for engineers³). The building Consent Authority is encouraged to require that the service to be provided by the engineering firm is appropriate for the project concerned.

Requirement to provide Producer Statement PS4

Building Consent Authorities should ensure that the applicant is aware of any requirement for producer statements for the construction phase of building work at the time the building consent is issued as no design professional should be expected to provide a producer statement unless such a requirement forms part of the Design Firm's engagement.

Refer Also:

- ¹ Conditions of Contract for Building & Civil Engineering Construction NZS 3910: 2013
- ² NZIA Standard Conditions of Contract SCC 2011
- ³ Guideline on the Briefing & Engagement for Consulting Engineering Services (ACE New Zealand/Engineering New Zealand 2004)
- ⁴ PN01 Guidelines on Producer Statements

www.acenz.org.nz

www.engineeringnz.org

CERTIFICATE OF DESIGN WORK

MEMORANDUM FROM LICENSED BUILDING PRACTITIONER

Section 30C and Section 45, Building Act 2004

The Building

Street address 425 & 427 Armagh Street

Suburb Linwood Town/city Christchurch

Postcode 8011 Building consent no.

The Owner

Name(s) Sam Knight (425) and Esther Calje (427)

Email Phone

Address 425 & 427 Armagh St

Basis for providing this memorandum

I am providing this memorandum in my role as the **specialist** designer who carried out or supervised specific Primary structure elements of restricted building work (RBW) design work as described in this memorandum. Other designers will provide memoranda covering the remaining RBW design work. Refer also to the attached PS1.

Identification of restricted building work (RBW) design work

I, **Alan Pearson** carried out or supervised the following RBW design work:

Primary structure: B1

Design work that is RBW	Description (as required) and reference to plans and specifications	Carried out or supervised
Foundations and subfloor framing ☒		Supervised
Retaining walls ☒		Supervised
Beams ☒	LVL11 Timber Beam at Nr 425 only	Supervised
Portal ☒		Supervised
Bracing ☒		Supervised
Other (primary) ☒	Relevelling of existing foundation only - see project drawing set Ref: S275	Supervised

Note: SED = Elements subject to Specific Engineering Design outside of the scope of NZS3604:2011, unless otherwise noted.

Initial Alan Pearson Date 11/11/2025

Waivers and modifications

Are waivers or modifications of the Building Code required?

No

If yes, please provide details of the waivers or modifications:

Building Code clause	Waiver/modification required
----------------------	------------------------------

--	--

Issued by

Name	Alan Pearson	Design entity/company	Pi Consulting
Chartered status	CPEng	Chartered no.	1024104
Email	admin@piconsulting.co	Website	www.piconsulting.co
Phone (daytime)	0279237782	Phone (after hours)	0279237782
Mobile			
Postal address	35 Russell Lilley Dr, Rolleston		
Physical address	35 Russell Lilley Dr, Rolleston		

Declaration

I, **Alan Pearson**, LBP state that I have applied the skills and care reasonably required of a competent design professional in carrying out or supervising the RBW described in this memorandum and that based on this, I certify that the RBW described in this memorandum:

- complies with the Building Code; or
- complies with the Building Code subject to any waiver or modification of the Building Code described in this memorandum.

Signature



Date 11/11/2025

CONSTRUCTION MONITORING SCHEDULE RESIDENTIAL

Schedule of inspections for

Address 425 & 427 Armagh St, Linwood

We confirm that **Pi Consulting Ltd** have been engaged to undertake construction monitoring of the specific engineering design items to an Engineering New Zealand/ACENZ CM **03** level and propose to undertake at least the following site inspections:

No.	Item of inspection	Timeframe
-----	--------------------	-----------

(Delete any that do not apply)

1	Foundation Excavations	At completion to facilitate bearing verification
2	Timber post & beam installation	Prior to placement of Lining
3	Final Inspection and Floor Level Survey	At completion of works
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

Notes:

- The above items of inspection are the minimum required to enable **Pi Consulting Ltd** to issue a PS4 – Producer Statement Construction Review for the specific engineering design items.
- The above items of inspection do not cover work constructed in accordance with NZS 3604:2011, for which inspections are to be undertaken by the Building Consent Authority.
- The Contractor/Builder is to provide **Pi Consulting Ltd** at least 24 hours' notice of the requirement for an inspection. The above timeframes are indicative, the Engineer and Contractor are to agree the timing of inspection prior to work commencing on site.
- A copy of this inspection schedule is to be held on site during the works, and the Contractor/Builder is to provide reasonable and safe access to enable works to be inspected according to the schedule.
- The above schedule does not necessarily represent the actual number of inspections to be undertaken. The number of inspections will depend on the construction method, sequence of the works and whether or not unforeseen conditions or difficulties are encountered on site.

DESIGN FEATURES REPORT

425 & 427 ARMAGH STREET

LINWOOD

CHRISTCHURCH

8011

CLIENT: *Sam Knight & Esther Calje*

DATE: *11 November 2025 (r0)*

PROJECT NR: *S275*



PI CONSULTING LTD
Christchurch
027 923 7782
admin@piconsulting.co

**DOCUMENT CONTROL*****Document Prepared by:*****Pi Consulting Ltd**

20 Rossall Crescent
Christchurch
New Zealand

Phone: +64 27 923 7782

Email: admin@piconsulting.co

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DOCUMENT TRANSMITTAL

Revision	Date	Author	Reviewer	Description
0	11 November 2025	Stefan Pienaar B Eng MEngNZ	A Pearson CPEng	Issue to Client

DESIGN FEATURES REPORT - 425 427 Armagh St

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1. INTRODUCTION

1.1. Objective

This Design Features Report (DFR) is a detailed document defining the structure's design criteria and recording key decisions or outcomes. It outlines design loading, structural modelling assumptions, material properties, foundation requirements and design standards. The DFR also defines the calculation procedure and checking principles to be followed, providing an explanation of the design.

1.2 Scope

The scope is in accordance with the Design Brief and Conditions of Engagement. In general terms, the scope of work related to the design of earthquake repairs at the Multi-Unit Building situated 425 & 427 Armagh Street, Linwood, Christchurch.

In summary:

- Provide Technical Documentation for the releveling of the single storey Multi-Unit Residential Building (MUB)
- Provide Technical Documentation for the isolated internal alteration of a wall at Nr. 425 only
- Provide Working Drawings for re-leveling structural works (425 & 427) and internal alterations (425)

Exclusions:

- Bracing Design – all existing bracing remains, where bracing elements are damaged, they will be repaired
- Structural Design of a New Foundation System– the existing foundation system of the MUB is to remain;
 - where the foundation has been damaged, it will be repaired locally using conventional repair techniques and as per details in the project specific drawing set
- Architectural detailing
- Compliance with E2, E3

1.3 Means of Compliance

The design of the structure complies with the New Zealand Building Code (NZBC), specifically Section B1 and B2

The following standards have been used:

- AS/NZS1170.0:2001
- NZS3101:2006
- NZS3404:1997
- NZS3603:1993 with amendments
- NZS3604:2011

- NZBC B1/VM4
- MBIE Guidance document: Repairing and rebuilding houses affected by the Canterbury earthquakes

1.4 Referenced Documents

The following documents were referenced when completing the Design:

Author	Type	Title	Revision/Date
MBIE/CERA	Electronic Database	Canterbury Geotechnical Database	Current
NZCSE	Structural Assessment Report & Soil Assessment	TR001: Technical Report – 425 Armagh St	26 March 2025
NZCSE	Structural Assessment Report & Soil Assessment	TR001: Technical Report – 427 Armagh St	26 March 2025
UNDERFLOOR INSPECTIONS	Subfloor Inspection Report	425 Armagh Street, Linwood	20 February 2025
UNDERFLOOR INSPECTIONS	Roof space Inspection Report	425 Armagh Street, Linwood	26 February 2025
CANTERBURY CLAIMS	Assessment Report	427 Armagh Street, Linwood	2 February 2024
VARIOUS	Property Files	425 & 427 Armagh St – Property Files	Current

2. THE STRUCTURE & PROPOSED WORK

2.1 General

The Residential Building is a Multi-Unit Building (MUB) constructed using timber load bearing framing on a reinforced concrete perimeter and internal pile foundation. A detached garage consists of a concrete floor slab. The roof cladding consists of concrete tiles, and the wall cladding consists of a clay brick veneer. A concrete block firewall separates Unit 425 and 427 and is supported on its own reinforced concrete foundation.

2.2 Earthquake Repairs

The MUB was damaged during the Canterbury Earthquake Sequence (CES) as determined by the NZCSE Structural Assessment Reports and it is the current homeowners' intention to restore the structure to a condition prior to the CES. The MUB foundation is to be relevelled using a mechanical jacking technique.

The existing superstructure will be repaired following releveling works. It is likely that consequential damage of the internal lining and external cladding may occur after releveling works is complete. Internal linings must be repaired by the contractor according to the plasterboard manufacturer's requirements where necessary.

2.2.1 Releveling Methodology

Importantly, the MUB will be repaired as a single Residential Building and according to recommendations contained in the MBIE Guidance document Part E: Repairing MUB's

The foundation system of the MUB has settled differentially by approximately 64 mm across the footprint. The extent of differential settlement has resulted in excessive floor slopes which require repair. The foundation, including the firewall foundation, will be relevelled mechanically by jacking the height to target levels as described in the project drawing set. Jacks will be placed below bearers internally and incrementally levelling the structure to target levels. The bearers will be packed and reconnected to the piles.

Following releveling, the MUB will be restored to a condition that pre-dates the Canterbury Earthquake Sequence.

2.3 Internal Alterations

It is the owner of 425 Armagh Street's intention to remove approximately 3.00 m of internal loadbearing wall and approximately 3.00 m of internal non-loadbearing wall to create an open space within the Dining and Lounge areas. Where the loadbearing wall is to be removed, a remedial timber beam will be placed supported by new studs and a new pile at each end. The ceiling at the wall will be propped, the wall removed, and the remedial timber beam and associated pile foundations will be installed. The timber beam is designed to cater for the imposed gravity loads.

The removed wall does not impact the ability of the superstructure to withstand lateral loads, and the bracing system will therefore remain.

2.4 Summary of Proposed Work

In summary:

- Disconnect all services
- Disconnect the bearers from piles at the areas requiring releveling
- Install lifting system and ensure MUB weight is taken by lifting equipment
- Relevel floor in increments to the required design target floor level
- Place props at Nr. 425 only and below the existing ceiling and roofbeams
- Remove proposed wall sections as shown in the Project Drawing Set
- Install new LVL11 Timber Beam
- Repair consequential damage where necessary
- Connect services

Where required, remove peripheral connected structures and store on site. Once releveling is completed, replace the peripheral structures.

2.5 Lateral Bracing Capacity

The existing MUB bracing capacity has not been compromised by the CES and it is therefore not necessary to replace all existing internal linings. The inherent capacity of the MUB to resist lateral loads is adequate and the earthquake repairs will increase the MUB's lateral bracing capacity. This is achieved by repairing the existing lining where required and replacing irreparably damaged wall linings with rated plasterboard.

It is expected that only the new bracing element specified as part of internal alterations is required, all other existing bracing elements will remain and may be repaired according to standard industry accepted repair techniques.

3. GEOTECHNICAL CONSIDERATIONS

The site is classified as TC2 land according to the Canterbury Geotechnical Database and confirmed in a site-specific geotechnical report completed by others and is contained in each Structural and Geotechnical Assessment Report. An ultimate bearing capacity of 200 kPa has been identified at a typical depth of 600 mmbgl below the topsoil and 300 kPa identified at approximately 1,100 mmbgl.

The proposed concrete releveling pads and new pile foundations will be founded at a depth to accommodate the imposed loads. All excavations will be inspected prior to placing concrete.

4. DESIGN LOADS

4.1 General

For the purposes of consideration of loading, generally adopted typical gravity and surface loads have been assumed and are detailed in the attached calculation sheets.

The lateral bracing capacity of the MUB has not been compromised by the CES and a new bracing design is therefore not required. All relevelling work is therefore considered temporary and purely intended to restore the MUB floor levels only.

This earthquake repair design is therefore not to be considered as strengthening or structural betterment.

4.2 Imposed Loads

It is assumed that for the duration of the work, the MUB will not be occupied and therefore not subjected to Live Loads, however, a factored Live Load has been allowed for in designing the temporary structural works for relevelling.

Imposed Loads according to ASNZS1170 are adopted and specified in the attached calcsheets.

4.2.1 Vertical loads:

See attached calculation sheets for Imposed Loads.

4.2.2 Design Life and Durability

Design Life

Temporary Works (where required):

6 months

Note: Non-structural elements and cladding specification are by others and are not covered by this design features report.

Permanent Elements (where required):

50 years

Durability Provisions

Durability provisions are achieved by: Acceptable Solutions B2/AS1

Timber: NZS 3602: 2003 Part 1 is an acceptable solution for meeting durability through treatment in accordance with the standard.

Light Timber Framing Structures: NZS 3604:1999 is an acceptable solution for meeting durability requirements of buildings within its scope and includes framing and metal fixings.

Alternative Solutions

Structural Steel: There is no acceptable solution available for structural steel and protection is provided through surface treatment in accordance with NZS/AS 2312:2002.

4.3 Material Properties (Typical)

Concrete Strengths

Temporary Foundations: 20 MPa

Permanent Foundations: 25 MPa

Structural Steel

Rolled Steel Sections: 300MPa – Grade 300 L0 to AS 3679.1

Steel Plate General 250 MPa – Grade HA250 to AS1594

Steel Plate (special) 300 MPa – Grade 300 MOD

CHS Hollow Sections TBC

Bolt Grades: Grade 4.6 mild steel and Grade 8.8 high strength

Structural Timber

Walls As per manufacturer's specifications, where necessary specified on Pi Consulting drawings as SG8 for walls

Flooring As per manufacturer's specifications

Beams As per manufacturer's specifications

Timber Connections

Interior, enclosed Mild steel, galvanised

All other Stainless Steel

5. CONTRACTOR AND SUB-CONTRACTORS

The following professionals have been appointed by the Client to complete work:

1. Releveling Contractor: **Heritage House Relevelers**

6. DRAWINGS

The project is described in the following drawing documentation, Pi Consulting Project Reference S275:

DWG NO	DESCRIPTION	REV	STATUS
00	TITLE PAGE	0	ISSUED FOR CONSENT
01	SITE LOCATION & SEDIMENT CONTROL	0	ISSUED FOR CONSENT
02	EXISTING LAYOUT & SURVEY	0	ISSUED FOR CONSENT
03	PROPOSED REPAIR	0	ISSUED FOR CONSENT
04	STRUCTURAL DETAILS	0	ISSUED FOR CONSENT
05	GENERAL NOTES	0	ISSUED FOR CONSENT

Date	26 March 2025	Job Ref.	CLM/2011/189031
Address	425 Armagh Street, Linwood, Christchurch 8011	Author	J McCloskey
Client	Natural Hazards Commission Toka Tū Ake	Version	V1.1 Approved
		Status	Issued for Information

TR001: Technical Report – Desktop Technical Review & Structural Inspection



This Technical Report has been prepared by NZ Civil & Structural Engineers Ltd (NZCSE) at the request of its Client, Natural Hazards Commission Toka Tū Ake, in accordance with the scope of engagement provided.

This Technical Report has been prepared exclusively for the Client's use and no liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person without our prior written permission.

1. Overview

Site Summary			
Site Location	425 Armagh Street, Linwood, Christchurch 8011		
Legal Description	Flat 1 DP 303406 on Lot 4 DP 10444 having share in 1007 m2		
MBIE Technical Category	Green Zone, Technical Category 2, Yellow – Minor to moderate land damage possible		
Topography	Flat and level		
Soil Type	Dominantly alluvial sand and silt overbank deposits		
Identified HAIL Site	No	Flood Management Area	No

Building Summary			
MBIE Foundation	Perimeter concrete footing – Type B2	Occupied	Yes
Walls	Heavyweight – Bricks	Levels	One
Roof	Heavyweight – Concrete Tiles	Floor Plan Area	Approx 95m ²
Age	Circa 1945	Date of Visit	29/01/2025
Peripherals	External Garage (Adjoined with garage for 427 Armagh Street)		

Background Summary	
- NZCSE has read the Engineering Letter of Engagement provided on 17/01/2025 by the Natural Hazards Commission Toka Tū Ake (formerly EQC). Information provided is summarised below. - An assessment of the property was undertaken by EQC on 15/02/2011, reporting wall & ceiling cracks in the kitchen, dining room, bathroom, and bedroom 2; wall lining cracks in bedroom 1 and the laundry; ceiling cracks in the family room. No damage was recorded for the lounge or entry/hallway. Exterior damage was recorded in the way of ridge tile mortar cracking on the south, plus 1.5m of tile damage and flashing repair required for the chimney. - Another assessment was carried out on 24/09/2011, recording additional damage: - Ceiling cracks added in the laundry and bedroom 1 - Wall cracks added in the entry/hallway - Dining room door added for easing and repainting - Window trims added to gap fill & paint in the dining room, kitchen, bathroom, bedrooms 1 & 2, and the sunroom (family room) - Plaster cracking on the exterior north elevation plus 0.2m² of broken bricks; similar damage on south elevation plus additional crack repairs to the walls of the entry porch; plaster repairs only to the west elevation; 2 l/m of ring cracks were recorded and an area of soffit to be re-nailed. - Mortar cracking to the masonry partition wall. - It is understood the property was sold in 2012, prior to the CHRP repairs being carried out. The previous homeowner advised EQC in Nov 2011 that a building report stated the house was on a lean, but there is no record of a copy of this report being presented to EQC. - FEQR scoped the property to be repaired in July 2012, including some additional repairs and one variation order (credit). It is understood managed repairs were carried out in late 2012. No foundation releveling works were carried out. - A bump in the firewall with the neighbouring unit (427 Armagh Street) was raised with EQC via a new claim on 28 July 2015. This appears to have been desktop assessed. As the issue was raised as a chimney related issue and the chimney removed in this unit was away from the firewall, the claim was declined and the customer advised to contact FEQR. - It is understood the property was sold again in Feb 2024 to the current owner.	

Background Summary Continued

8. Following unrepaired EQ damage being noted on the building exterior during a recent site visit to discuss Drainage damage, both units were reviewed by NHC at a second site visit undertaken on 18 November 2024. Dislevelment issues were recorded at the site visit and the Assessment reports that followed recommended an Engineering review of the building.
9. NZ Civil & Structural Engineers Ltd (NZCSE) has subsequently been engaged by the Natural Hazards Commission Toka Tū Ake, in the capacity of independent experts, to review all relevant third-party documents, attend site and perform suitable investigations to assess the property for outstanding earthquake damage, and provide guidance on lawful repair of this damage.
10. A structural assessment, full level survey, and shallow geotechnical investigations were carried out by NZCSE on 29/01/2025.

2. Third Party Documentation

The following section provides a summary of key information gathered from third party documents, and where appropriate includes interpretation of this information by NZCSE. This commentary should be read in conjunction with the full documentation.

Date	Document Information	NZCSE Document Summary
Various	Christchurch City Council – <i>Property Files</i>	There are no documents on file for the construction of the dwelling or garage. The property files contain the following relevant information: • 1977: Building Permit, plans, and specifications on file to enclose carport to form a garage (second garage adjoined to original). • 1978: Building Permit and drawings on file to erect concrete block wall fence. • 1987: Building Permit, plans, and specifications on file to construct fire wall between the two flats. • 1988: Building Permit to construct a Conservatory on 427 Armagh Street • 2001: Subdivision application. • 2011: Rapid EQ Assessment Form Level 1 lists: No Damage. <u>NZCSE Comments:</u> • The building has existed late 1940's according to the historic aerial imagery. No property file records relating to the origin construction found on the council files. The property file records indicate the concrete partition wall was constructed to ceiling level when the building was first constructed but was extended to the roofline in 1987. A block wall extension to this wall was also added along the north elevation at this time to form a complaint firebreak between the two units,
15/02/2011	EQC – File Note / Statement of Claim Checklist / Scope of Works / Sketch	The File Note contains the following relevant information. Damage Description • Land ○ There is no evidence of any land damage at this dwelling • Dwelling

Date	Document Information	NZCSE Document Summary
	CLM/2010/067031	○ This dwelling has minor cosmetic damage, cracks in the walls & ceiling, there is step cracking in the laundry wall. ○ Externally the only visible damage was on the roof where the ridge capping needs to be repointed. • Was a full inspection done? ○ A full inspection on the roof, in roof space was carried out – the ridge capping needs to be repainted ○ The under-sub-floor space was inspected & no damage found The Statement of Claim Checklist contains the following repair strategy. • Dining Room ○ 4.1 x 3.5. ○ Cracks in walls & ceiling. ▪ Rake out stop paint walls. Strip lining paper, stop hand, paint. • Kitchen ○ 3.2 x 1.8. ○ Cracks in ceiling. ▪ Rake out stop paint ○ Cracks in walls. ▪ Rake out stop & paint • Family Room ○ 2.6 x 3.7 ○ Cracks in ceiling. ▪ Strip wallpaper, rake out stop hang wallpaper & paint • Bedroom 1 ○ 3.9 x 3.1 ○ Cracks in walls ▪ Rake out stop, paint. • Bedroom 2 ○ 3.9 x 2.7 ○ Cracks in ceiling & walls. ▪ Rake out stop paint walls. ▪ Strip lining paper, stop, hang, paint. • Bathroom ○ Cracks in walls & ceiling ▪ Rake out, stop, paint. • Laundry ○ 4.1 x 1.4 ○ Cracks in blocks ▪ Rake out step cracking & paint. • Roof ○ South ridge capping repointed. ○ Replace 1.5m² tiles ○ Reflash chimney <u>NZCSE Comments:</u> • This assessment was undertaken prior to the February 2011 earthquake event.

Date	Document Information	NZCSE Document Summary
06/09/2011	EQC – <i>Land Engineering Report / Photos</i>	This report contains the following relevant information. • Undulating lawn >50mm • Block wall fence fallen over • Front path slightly more undulating but most from tree roots • Pavers are undulating >10mm • Potential Remedial Works: ○ Locally repair undulations by trimming off undulation or fill depression.
24/09/2011	EQC – Assessment / Scope of Works CLM/2011 /189031	The Scope of Works contains the following relevant information. Main Building • Elevation (North wall) ○ Wall Cladding (Brick Veneer) ▪ Remove, dispose and replace bricks 0.20m² ○ Wall Cladding (Stucco) ▪ Grind out, epoxy fill and repair stucco to affected area 0.50m² ▪ Paint wall 2.48m² • Elevation (South wall) ○ Porch / Veranda ▪ Grind out and epoxy fill 7.00 l/m ▪ Paint surface 12.00m² ○ Wall Cladding (Brick Veneer) ▪ Remove, dispose and replace bricks 0.20m² ○ Wall Cladding (Stucco) ▪ Grind out, epoxy fill and repair stucco to affected area 0.20m² ▪ Paint wall 2.48m² • Elevation (East wall): No damage • Elevation (West wall) ○ Wall Cladding (Stucco) ▪ Grind out, epoxy fill and repair stucco to affected area 0.20m² ▪ Paint wall 2.30m² • Foundations (Ring foundation) ○ Ring foundation ▪ Grind out and epoxy fill cracks 2.00 l/m ▪ Solid Plaster Repair 4.00m² • Roof ○ Fascia / Barge (Timber) ▪ Nail back ▪ Gap fill • Dining Room ○ Ceiling ▪ Rake out and stop 4.50 l/m ▪ Remove, dispose and replace lining paper 15.21m² ▪ Paint ceiling 15.21m² ○ Door (Internal) ▪ Ease and repaint door/varnish 1.00 No of ○ Wall covering ▪ Rake out and stop 2.00 l/m ▪ Paint wall 40.56m² ○ Window

Date	Document Information	NZCSE Document Summary
		▪ Gap fill and paint jambs / sills 6.80 l/m • Kitchen ○ Ceiling ▪ Rake out and stop 1.00 l/m ▪ Paint Ceiling 5.04m² ○ Wall covering ▪ Rake out and stop 1.20 l/m ▪ Paint wall 28.84m² ○ Window ▪ Gap fill and paint jambs / sills 6.00 l/m • Laundry ○ Ceiling ▪ Gap fill and paint 3.84m² ○ Wall covering ▪ Grind out and re-mortar 0.50 l/m ▪ Paint wall 17.60m² • Bathroom ○ Ceiling ▪ Gap fill and paint 5.04m² ○ Wall covering ▪ Gap fill cracks 2.00 l/m ▪ Paint wall 24.30m² ○ Window ▪ Gap fill and paint jambs / sills 6.20 l/m • Room (Other) (Sunroom) ○ Built in wardrobe ▪ Gap fill cracks 2.40 l/m ▪ Paint only 3.64m² ○ Ceiling ▪ Remove, dispose and replace wall paper – paint 7.68m² ○ Trim ▪ Gap fill and paint trims 11.20 l/m ○ Window ▪ Gap fill and paint jambs / sills 12.60 l/m • Bedroom (Beside sunroom) ○ Ceiling ▪ Remove, dispose and replace wall paper – paint 9.72m² ○ Trim ▪ Gap fill and paint trims 12.60 l/m ○ Window ▪ Gap fill and paint jambs / sills 6.40 l/m • Lounge ○ Wall covering ▪ Rake out and stop 1.50 l/m ▪ Paint wall 49.40m² • Hallway ○ Wall covering ▪ Rake out and stop 2.50 l/m ▪ Paint wall 43.68m² • Bedroom (Beside front door) ○ Ceiling

Date	Document Information	NZCSE Document Summary
		▪ Rake out and stop 3.00 l/m ▪ Paint ceiling 11.84m² ○ Wall covering ▪ Rake out and stop 5.00 l/m ▪ Paint wall 35.88m² ○ Window ▪ Gap fill and paint jambs / sills 14.00 l/m <u>NZCSE Comments:</u> • On the scope inspection documentation, the wall cladding material was defined as brick cladding and stucco. The majority of the cladding is red brick; however, between the top of the brick cladding and the underside of the timber soffit, there is a series of precast concrete sections. These sections act as a lintels above the windows and as a feature between the wall cladding and the roof. These concrete sections are plastered, and we understand the assessor referred to them as stucco. We note that these sections required crack repairs. However, the cracks seem to be due to the separations between each of the precast concrete sections. These gaps require infilling because of movement or settlement caused by earthquake-related forces.
11/07/2012	Photos / Scope of Works	Photos on file show the chimney and fireplace. The Scope of Works includes the following repairs. EXTRA TO EQC SCOPE OF WORKS • Elevation West ○ Grind out remortar cracks 0.5 LM • Elevation North ○ Remove dispose replace vent 1 ea ○ Remortar vents 3 ea ○ Grind out remortar cracks 1.2 LM ○ Sand, gap fill, paint 5 LM • Dining Room ○ Prep and paint total door surround 5.2 LM • Kitchen ○ Remove dispose replace lining paper 7.6m² • Bedroom beside sunroom ○ Rake out plaster paint walls 32.76m² • Lounge ○ Rake out plaster paint ceiling 22.14m² • Bedroom beside front ○ Refit wardrobe doors 2 ea ○ Refix gib 15m² • Chimney ○ Concrete, 2 pot, to base (Note: may be reinforced) 1 ea REMOVE DAMAGE TO SCOPE OF WORKS • Elevation North ○ Remove dispose replace bricks .2m² • Dining room

Date	Document Information	NZCSE Document Summary
		○ Ease and repaint door 1 ea • Bedroom beside front door ○ Gap fill paint jambs and sills 14 LM • Room Other Sunroom ○ Gap fill cracks (wardrobe) 2.4 LM ○ Paint only (wardrobe) 3.64m² <u>NZCSE Comments:</u> • Damage to the roof tile sand leaks had been reported by the owner at the time. We understand this was due to be repairs as part of the chimney removal.
October 2012	Fletcher EQR – Works Order(s) / Tender Analysis / Contractor Invoices	30/10/2012: Claim: 2011/189031 – Works order has been approved to PB Goosey Ltd for the CHRP repairs. 16 & 17/07/2012: Emergency Repairs carried out to secure chimney – costs on file. 02/10/2012: Quotation of \$37,700.00 on file from PB Goosey Ltd for the CHRP repairs: • We have allowed to complete work detailed in the Scope of Work dated 24 September 2011 • Health and safety expenses i.e. scaffolding, electrician • We have allowed to complete additional works at 425 Armagh Street resulting from 13/06/2011 and 23/12/11 earthquakes and detailed on the Extra to EQC Scope of Work document . <u>NZCSE Comments:</u> • Damage to the roof tiles and leaks were reported by the owner at the time. We understand this was due to be repaired as part of the chimney removal. • The chimney that was removed was described as a two-pot, solid concrete-reinforced structure. A description of the work done to secure the chimney was included in this document package, which also mentioned the replacement of 6 sheets of gib lining in both the lounge and the dining room when the chimney structure was removed. This involved the reconstruction of wall framing. • During the NZCSE assessment, we noted that the HWC tank and cupboards have been installed in this wall, alongside the old fireplace location. It is likely these were included in the works.
13/02/2013	PB Goosey Ltd – Final Account Agreement & Variation to Works Order	A negative variation was submitted at the same time as the completion notification for the following: Reason for Submitting a Variation: <i>Work not completed at request of homeowner.</i> • Bedroom beside sunroom ○ Walls – Rake out, plaster and paint -32.76m² ○ Ceiling – Remove wallpaper and paint -9.72m² ○ Trims – Gap fill and trims -12.6m² ○ Window – Gap fill and paint jambs / sills -6.4m²

Date	Document Information	NZCSE Document Summary
06/08/2013	EQC – Land Inspection Sketch	The sketch includes 425, 427, and 429 Armagh Street. Notes relevant to 425 Armagh Street include: • Evacuation C1 – .4x.1x.1 • Evacuation concrete slab & path – C2 • Large tree roots surface damaged – C3
07/01/2014	EQC – Land Damage Allocation Summary & Review	Damage to land (CUP) • C1 & C3 – Lawn – 62.5m² • C2 – Path – 17.1m²
25/11/2015	EQR – Homeowner Correspondence	CLM/2015/003436 The claim number indicates that the homeowner at the time contacted EQC to lodge a new claim for damage. Response includes: <i>I have been advised the repairs carried out to your property by Fletcher EQR included the removal of the whole chimney at the centre of the house.</i> <i>This work included constructing wall framing and installing new gib etc.</i> <i>The damage you have noted to the wall in the lounge/living area is where the chimney was located.</i> This was referred back to CLM/2011/189031. <u>NZCSE Comments:</u> • The chimney was removed to floor level and the mass concrete footing left in place.
Undated	Drainage Inspection Sketch	A drainage inspection was carried out at 427 Armagh Street.
22/11/2024	Natural Hazards Commission Toka Tū Ake – Floor Levels	A site inspection was carried out at the property, and floor levels were taken across both units (425 & 427 Armagh Street).

Date	Document Information	NZCSE Document Summary

3. Observations & Findings

The following section presents an overview of structural observations and findings noted during the recent engineering inspection performed by NZCSE. Photographs and drawings that are referenced within the body of this report are provided in Appendix A & B respectively.

3.1. General

- The subject property is part of a multi-unit building comprising two units, addressed as 425 and 427 Armagh street. Property file records show the existing partition wall was extended to roofline from ceiling height between 425 and 427 Armagh street in 1987. The wall was also extended to form a divide between the laundry areas of both dwellings along the north elevation.
 - The scope of NZCSE's engagement includes both adjoining units. Whilst the focus of this report is 425 Armagh St, consideration has been provided of the overall structure and holistic performance. A separate report relating to 427 Armagh street has also been provided to our client.
- Property layout and local features (Photo Set 1):
 - For ease of reference, the elevation facing Armagh street is referred to as the south elevation.
 - The following information has been obtained from review of aerial imagery:
 - 1940-1944 earliest available aerial imagery of the property, showing the original property
 - 1945-1949 aerial imagery shows the new dwelling and original garage.
 - 1960-1964 aerial imagery shows the carport against the garage
 - 1980-1984 aerial imagery shows the second garage (carport permitted to be enclosed in 1978).
- For external views of the dwelling, refer to Photo Set 2.
- Homeowner information:
 - The current owner purchased the property in 2024, after the Canterbury Earthquake Sequence (CES) and after the managed earthquake repairs were completed.
 - Based on our conversation with the homeowner and the Toka Tū Ake EQC engineering letter of engagement, we understand that the homeowner's concerns relate primarily to the following:
 - The floor falls towards the masonry partition wall and towards the north.
 - Undulation along the roof plane is noticeable either side of the partition wall between the units.
 - The roof gutters for both building 425 and 427 Armagh street were replaced in the past year
- The scope of our engagement is to review the original assessment and the repairs carried out to the multi-unit building as a whole and provide recommendations on any potential remediation and further repairs that should be carried out where necessary.

3.2. Foundations – (refer to SK4 for subfloor layout)

- Foundations of the multi-unit building are categorised as Type B2 (timber-framed superstructure with heavyweight cladding supported by concrete perimeter foundation wall and internal piles) in accordance with Table 2.1 of MBIE Guidance Document (Photo Set 3).
 - A perimeter foundation excavation was carried out along the west elevation window which identified it to be embedded approximately 350mm below ground level (BGL) (Photo 3A). According to the shallow geotechnical testing carried out on site, the foundations are bearing within the organic topsoil layers where long term settlement would be expected to occur.
 - The configuration of the dwelling construction shows the subfloor bearers run from north to south in the same direction as the partition wall.
 - The perimeter foundation was scanned for reinforcing using a Hilti PS50 Multidetector which did not confirm the presence of steel reinforcing. Given the age of construction and absence of cracks, it is likely the foundation does contain some reinforcing steel. Photo 3D.

- The *Cavity Critter* report show the internal face of the perimeter wall and partition wall is in reasonable condition with only a few minor cracks identified. Some of the cold joints have been identified as cracking by the Cavity critter report. We note that the perimeter foundation cracks have not been previously repaired or infilled. The post-earthquake scopes allowed for 2;in m of foundation crack repairs a including plaster repairs.
- Externally, NZCSE has observed minimal cracked with damage to the perimeter foundation of 425 Armagh street. Two of the perimeter cracks align with the cracks in the inside face of the perimeter wall.
- Based upon the contents of the Cavity Critter *Underfloor Inspection Report*, the following observations have been made (Refer to SK4 Subfloor Plan)
 - 425 Armagh street is supported by a perimeter concrete foundation with a suspended timber floor supported on 58x precast concrete piles. All piles have a damp-proof membrane of varying thicknesses (DPM) with no structural fixing's connection between pile and bearer. None of the piles appear to have been packed or the bearers notched in the past.
 - The bearer along the west elevation and the bearer ends along the north and south elevations are supported on the perimeter foundation walls foundation. The concrete plinths have a DPM layer with no clear structural connections between the plinth and bearer.
 - The ground is exposed with no polyethene ground sheet present and there are large amounts of broken concrete roof tiles spread across the subfloor between the piles, likely from the original construction.
 - No subfloor repair work was proposed in the post-earthquake scopes or contractor quotations.

3.3. Floors & Fixtures

- A level survey was undertaken throughout the Multi-Unit Building using a Zip Level Pro2000 (Refer to SK1 Floor Levels and SK2 Contours Plan):
 - A total floor height variation of 52 mm was measured across the 425 Armagh street footprint with slopes exceeding 0.5% (1 in 200).
 - The following notable slope trends were observed across the floor plan:
 - The floor exhibits an overall trend of falling from south to North with the lowest point located in the north east corner of the floor plan in the kitchen , adjacent to the masonry partition wall.
 - The partition wall was also found to fall from south to north and the floor slopes across the dining and kitchen notably fall towards the wall as illustrated on SK2.
 - Overall the foundation settlement mechanism can be described as non-planar tilt settlement falling to treads the north elevation and to the east towards the partition wall dividing the two p properties.
- The following information was recorded during the assessment:
- **Bedrooms 1 & 2**
 - The floor in both rooms falls toward the slope at the western perimeter. However, only cosmetic issues with the wall linings were noted in these rooms post-earthquake. The level recorded across the built-in wardrobe in Bedroom 2 shows that it was constructed level, with a 12 mm slope in the floor to the north. The cabinetry appears to predate the earthquake, indicating that the foundation may have had some pre-existing floor slope before the event.
 - No damage to the functionality of the windows or doors in these rooms was recorded
- **Sunroom**
 - The floor and ceiling levels fall from south to north across the room, and the window sill along the west elevation follows the floor slope trend.
 - The original EQC scope allowed for crack repairs to the plastered concrete beams on top of external walls along this elevation, as well as some mortar crack repairs between the cladding. Recent photos

of this external elevation suggest there were some mortar repairs between the sunroom and in the internal corners beside Bedroom 2 (photo 4A).

- Levels recorded across the fitted wardrobe indicate that the wardrobe was installed level above the sloping floors. The post-earthquake repairs required the gaps to be filled and the framing to be repainted, suggesting there was some earthquake movement. However, the majority of the settlement towards the north in this room likely existed prior to the earthquake, at the time the wardrobe framing was installed. (photo 4B)

- **Dining area and Kitchen and Laundry**

- The floors and ceiling slopes fall toward the heavyweight partition wall, with particularly steep slopes across the kitchen and the door opening between the kitchen and dining rooms.
- The door head between the kitchen and dining room falls by 12mm across the opening. The door itself has been removed. The post-earthquake scope included filling and repairing the gaps around the door framing suggesting some movement of the partition wall next to this door has occurred.
- The post-earthquake EQC assessment report noted that the wall and ceiling were cracked, and the door was sticking, suggesting some settlement damage has occurred towards the partition wall.
- In the background document for the chimney removal under emergency works (Section 2 of this report), the chimney that was removed was described as a two-pot solid concrete-reinforced structure. The work done to secure the chimney included the replacement of 6 sheets of gib lining in both the lounge and the dining room when the chimney structure was removed. This also involved the reconstruction of wall framing.
- Photos 4C & 4D show the underside of the fitted storage cupboards above the fridge. These were measured with a digital spirit level and found to fall by 7mm/m, which is less than the 20mm/m slope measured across the floor. This would indicate that the wall had settled to some extent prior to the installation of the cupboards, and some additional settlement has occurred since that time. The background documents states that the adjacent plasterboard linings were replaced as part of the post-earthquake chimney removal works and it is possible the damage to these cupboards was repaired at that time.
- The kitchen wall and ceiling linings required crack repairs after the CES, and the window framing required gap filling and painting. This suggests that the level of damage in the kitchen was relatively minor, again indicating that the settlement of the partition wall existed to some degree prior to the earthquakes. We would expect to see greater levels of structural damage if the floor and ceiling slopes were primarily caused by the 2011 earthquakes.
- We understand that the shower room, which is accessed through the kitchen, was called the laundry at the time of the 2011 earthquake. This room is believed to have been modified since that time, with new wall and floor tiles installed. Photo 5A show that a spa bath has been installed, and the floor appears to have been modified to form a wet room with a drain in the center of the room. The grout lines are masked with tape, and it appears the works in this room were ongoing at the time of our assessment. The door to this room also appears to have been fitted since the earthquakes. These modifications were not found in the property files. Cracks to the Block partition wall in this room was identified in the post-earthquake scopes and a mortar repair was recommended. The width and length of the cracking was not specified in the original assessment document. Step cracking suggests that some differential settlement occurred to this partition wall.

- **Lounge**

- The floor in the lounge falls to the north along the side of the partition wall. The fireplace, which was removed during post-earthquake repairs, has been converted into a storage cupboard that contains the hot water cylinder (HWC).
- Photo set 5 shows that the HWC does not have any restraints and is seated on a timber shelf nailed to the wall framing. We recommend that the support framing be strengthened and seismic restraints be fitted to the tank. From the background document, it is likely that this tank was adjusted as part of the chimney removal works when the cupboard was reframed and relined.
- Apart from the chimney removal works, the lounge consists mainly of cosmetic repairs with no issues to the windows or doors.

3.4. Walls

- The walls of both dwellings are timber-framed and clad externally with heavyweight red brick veneer cladding. The partition wall is a reinforced masonry block wall extending from the floor to the underside of the roof that was installed circa 1987. No obvious outstanding damage to the brick veneer outside 425 Armagh street was identified during the site assessment.
- The property file records suggest the partition wall between the two units comprises reinforced masonry wall with reinforced bond beams at the ceiling and roof line level. The intertenancy partition wall was unable to be inspected for internal cracking damage below ceiling level due to the wall being lined with plasterboard. No damage to the wall above the ceiling line within the roof space was identified.
- The walls are lined internally with plasterboard. It is understood that primarily cosmetic repairs were carried out as part of earthquake managed repairs. The following internal wall observations were made during the NZCSE site inspection (Photo 5E):
 - Minor ceiling cracks in the dining room adjacent to the kitchen door was identified.
- A verticality check was undertaken in order to determine the incline of walls and other vertical elements, using a Bosch DNM 120 L Professional digital spirit level (refer to SK3 Verticalities Plan):
 - Internal walls in the center of the dwelling were found to be predominantly plumb. The walls running in the north-south and east-west directions did not follow any particular tilt trend. We noted that the wall linings replaced after the earthquakes in the lounge and dining room, around the location of the removed chimney, were not tilting in the direction of the corresponding floor slopes. Similarly, the bathroom has been renovated since the earthquakes, with the walls and floor retiled, and no overall wall tilt trend was identified in this area of the dwelling.

3.5. Roof

- A limited visual inspection of the internal roof space and the partition wall above ceiling height was carried out as part of the NZCSE site assessment. The following was noted (see Photo Set 6):
 - The concrete tiles are supported by tile battens spanning across rafters connected to a ridge board. The tiles are secured to the battens and rafters using wire ties. The rafters are supported by underpurlins with timber struts, and the ridge board is supported by timber props. The underpurlins are further supported by props fixed back to the top of the internal walls running through the centre of the dwelling.
 - The roof plane appears to be sagging when viewed externally. This is assessed to be primarily due to a lack of internal support. It is common to observe undulations across the roof plane in dwellings of this era, especially where heavyweight concrete roof tiles have been used as cladding. To rectify this issue, it is recommended that additional struts be installed at the ends of the underpurlins to eliminate the undulations and provide additional structural support.
 - The partition wall was viewed from inside the roof space, and no step cracking was identified. It was noted that the wall above the ceiling line is constructed using a combination of poured in-situ

concrete and masonry concrete blocks. No cracking was identified on the wall from the roof pace hatch. The walls below the ceiling line are constructed using masonry blocks, as confirmed during an inspection of the laundry at 427. The EQC assessor also noted that these walls were constructed using masonry blocks during the post-earthquake assessment, prior to the installation of the current wall tiles.

- The internal ceilings are lined with plasterboard. It is understood that only cosmetic repairs were originally required as part of earthquake-managed repairs, with no localized lining replacement deemed necessary following the CES. Minor cracks were observed in the dining room ceilings (Photo 5E).
- The owners informed us that the external gutters have been fully replaced within the past year across both dwellings at 425 and 427 Armagh Street.

3.6. Garage (Photo Set 7)

The garage for 425 Armagh Street is the original garage structure constructed in the late 1940s. The enclosed carport garage for 427 Armagh Street was added circa 1978.

- The garage walls are timber-framed with cement sheet cladding, and the roof is covered with lightweight corrugated iron sheets.
- A level survey was undertaken throughout both garages using a Zip Level Pro2000 (refer to SK1 Floor Levels and SK2 Contours Plan):
 - A total floor height variation of 16mm was measured across the footprint of the 427 Armagh Street garage slab only. The combined level variance across both garages was found to 108mm, however this variance was measured across the slab footprint for lean to extension garage for 425 Armagh Street and this settlement is not deemed to be earthquake related. (refer to the NZCSE report for 425 Armagh street)
 - Overall, the floor slab falls towards the vehicular door.
 - A 10mm level variance was measured across the door head. The vehicle tilting doors are functional. Verticality measurements show the wall framing generally tilts to the west, however several of the wall studs are bowed. The bottom of an exterior cladding sheet along the north elevation needs to be refixed however we consider this to be a general maintenance issue.
 - No damage was noted to the garage during the post-earthquake assessments.
 - There is no evidence to suggest that the 2011 earthquakes have had a material impact on the garage structure. Therefore, it is assessed that no repairs are deemed necessary.

4. Shallow Geotechnical Investigations

4.1. General

The following section provides an overview of the geotechnical investigation and is based upon a site walkover, shallow soil investigations and a desktop review of the New Zealand Geotechnical Database (NZGD).

- The location of test sites and results of hand auger & Scala penetrometer investigations are provided in Appendix D.
- Soil classification has been carried out in line with 'Field Descriptions of Soils and Rocks' by NZ Geotechnical Society Dec 2005, and Scala penetrometer testing performed in accordance with NZS 4402 Test 6.5.2:1988 – Determination of the Penetration Resistance of a Soil.

4.2. Desktop Study

A desktop study of information available on the NZGD was undertaken on 10/03/2025 and recorded the following:

- Moderate to severe liquefaction on and immediately surrounding the property following the 22 February 2011, event was interpreted from aerial photography. Minor liquefaction was observed surrounding the property following the June 2011 Event. The property was not mapped following the 4 September 2010 event.
- No ground crack locations have been mapped on the site or on the adjacent properties.
- Information from the Property Summary Report, based on Lidar survey data, indicates that the property has undergone a mean cumulative elevation change of -0.22m as a result of the CES. A portion of this movement is indicated to be tectonic (-0.18m).

4.3. Site Walkover Assessment

A site walkover assessment was conducted on 29/01/2025.

- At the time of inspection, the property showed some evidence of land damage attributable to the effects of liquefaction/liquefaction ejecta:
 - Cracking and settlement of the concrete pavement at the front was observed. this damaged was also noted in the EQC land damage team assessed to have been made worse by the 2011 earthquakes .

4.4. Shallow Investigations

Subsurface testing completed on 29/01/2025 comprised:

- Two hand augers (HA) to a maximum depth of 2.5m below ground level (BGL) with engineering geological logging of materials recovered, and;
- Two Scala penetrometer tests to a maximum depth of 2.6m BGL to assess soil bearing capacity.

4.5. Sub Surface Conditions

Inferred subsoil conditions from combined investigations:

- HA 01 is situated along the east elevation of 427 Armagh street , in front of the garages. The soil profile consists of a 0.4m thick layer of topsoil over silt and sand to the full depth of investigations (2.5m BGL). The HA was discontinued at 2.5m BGL due difficult retrieval (vacuum pressure). Ground water was encountered at 1.7m below ground.
- SC 01 indicates that Ultimate Bearing Capacity (UBC) of 200kPa and 300kPa is consistently achieved from below the topsoil layer and at 1.1 m BGL respectively.
- HA 02 is located in the garden adjacent to the west elevation of 425 Armagh street . The soil profile consists of a 0.5m thick layer of topsoil over varying quantities of interspersed silt with sand to the full depth of

investigations (2.5m BGL). The hand auger was discontinued at 2.5m BGL due to inferred gravels. Ground water was encountered at 2.2m below ground.

- SC 02 indicates that Ultimate Bearing Capacity (UBC) of 200kPa and 300kPa is consistently achieved from below the topsoil layer and at 1.1 m BGL respectively.

4.6. Ground Water Regime

The groundwater table was estimated based on results of HA investigations and data available on the New Zealand Geotechnical Database. Based upon information from the well logs reviewed, the water table in this region is indicated to exist at approximately 1.0m-2.5m below ground level and is subject to change as a result of seasonal variation.

5. Conclusions & Recommendations

5.1. Assessment of Damage

Key findings of the engineering assessment are as follows:

- The subject property is part of a multi-unit building comprising two adjoining units, referred to as 425 and 427 Armagh Street. The focus of this report is on 425 Armagh Street. However, in accordance with industry guidance and best practices (i.e., Part E of the MBIE Guidance Document), due consideration has also been given to the adjoining unit at 427 Armagh Street, and the overall structure has been assessed holistically.
- Structural survey measurements, including levels and wall verticality, have been taken across floors, window frames, doorways, and ceilings, and have been analysed for indicators of structural damage. A total floor height variance of 52 mm has been recorded across the floors of 425 Armagh Street. The floors slope toward the heavyweight partition wall, which was extended circa 1988. Mortar cracking damage was noted along this wall in the post-earthquake scope, including damage to the adjacent wall lining, which indicates that the wall has settled to a degree during the CES.
- No recent external brick veneer damage or external perimeter foundation damage was observed across the multi-unit building, indicating that the building has not continued to settle since the earthquake-managed repairs were completed.
- Moderate to severe liquefaction was observed around the property following the February 2011 event, including earthquake-related land damage in front of the property, as noted by the EQC land team. This suggests there has likely been liquefaction at depth that could have caused some settlement of the foundation systems across both dwellings at 425 and 427 Armagh Street. The heavyweight partition wall has settled and caused the floors in both dwellings to slope inward toward the wall, as illustrated on the contour plan SK2.
- Our assessment found evidence that a portion of the internal floor height variance across the dwelling occurred prior to the CES (refer to Section 3.3 of this report). Some of the internal repairs carried out after the earthquakes, particularly the wall linings replaced in the dining room and lounge, and the removal of the concrete chimney, have masked the effects of settlement caused by the 2011 earthquakes.
- Based on a review of third-party documents, site observations, structural survey measurements, and discussions with the owners and tenants, we believe the dwelling has experienced a material change due to settlement damage caused by the Canterbury earthquake sequence. To address this settlement, a partial foundation lift is considered necessary to repair the effects of the Canterbury earthquakes.
- We note the settlement across the adjacent garage structures is deemed to have existed prior to the CES and no damage was recorded to the structure following the earthquakes to suggest the settlement has been materially worsened by the earthquakes. No garage repairs are necessary as a result of the 2011 CES.
- Proposed repair works are listed in Section 5.2 below.

5.2. Repair of Damage – Refer to Appendix C – SK5 Conceptual Repair Plan

The following repairs are proposed to remediate earthquake managed repairs and address outstanding earthquake related damage to 425 Armagh street half of the multi-unit building. The following repairs to 425 Armagh street should be carried out in conjunction with the repairs for 427 Armagh street due to the shared partition wall , external brick veneer, and roof tiles.

- Relevel the perimeter foundation wall and intertenancy wall footing using portable jacks in accordance with Lifting Option 1, Appendix A1.1 of the MBIE guidance document. Refer to SK5 with proposed lifting point locations at 1.5metre centres. Depth to bearing for the underpin dunnage to be 800mm below ground. The dimension of the underpins to be 600mm square.

- The internal floor area can be lifted by packing between the internal piles and the subfloor bearers to the required height. Install 12kN bearer end fixings above the piles that are to be packed. An estimated 20 internal piles will require packing in conjunction with foundation lift. Recommended lift heights are noted on SK5.
- Given the extent of the proposed lift, we recommend that allowance be made for a suitably qualified geotechnical engineer to be engaged to carry out the geotechnical construction monitoring during the works and to confirm the bearing depth and size of the underpin excavations.
- Allow to grind out, clean, and fully fill internal perimeter foundation cracks.
- Fit restraint straps to the hot water cylinder in the lounge and replace the timber support framing to extend to the floor.
- Repair outstanding damaged to the roof tiles and roof framing after the lift.
- We also recommend the owners install additional timber struts to support underpurlins in the roof space to reduce the sag effect of the framing. This repair is to address deficiencies in the original construction as opposed to earthquake related damage.

5.3. Expected Consequential Damage

- Removal of adjacent concrete paving and vegetation around the perimeter of the building to facilitate releveling works.
- During the lift, some internal lining damage is expected to occur along with functionality issues of fixtures, which should be addressed accordingly following releveling work.
- Allow to remove the mass concrete slab adjacent to the north elevation perimeter wall, which is proposed to be lifted.

5.4. Compliance

- It is our understanding that repair work at the property, as outlined above, may be categorised as building work requiring a building consent. It may be possible for this work to be performed as exempt building work under Schedule 1 (2) of the Building Act 2004, however this will be at the discretion of the local building consent authority.

6. Appended Documents

The following documents are appended to this report:

Appendix A: Relevant Site Photographs

Appendix B: Structural Survey Drawings

Appendix C: Conceptual Repair Plan

Appendix D: Shallow Geotechnical Investigations

Appendix E: Relevant Third-Party Documents

Appendix F: Cavity Critter Subfloor Report

Inspected & Prepared By:



JOHN MCCLOSKEY

Senior Structural Engineer

BEng (Hons) Engineering, CPEng 1024064,
CENG MIEI

7. Limitations

This report and documentation have been prepared by NZCSE at the request of its client and are exclusively for the client's use. No responsibility or liability to any third party is accepted by NZCSE for any loss or damage whatsoever arising out of the use of or reliance on this report by any third party.

No structural analysis has been carried out to assess the strength of the buildings and/or structures or to determine whether or not they comply with the current and/or any previous Building Code. NZCSE has not made any assessment of structural stability or building safety in connection with any future earthquake events.

This report and documentation are limited by the restricted ability to carry out inspections. This report and documentation does not comment on structural damage that is not reasonably noted through visual inspection, including any structural damage that is in inaccessible places or has occurred latently.

NZCSE has assumed that any and all documentation and information provided by the client and/or any third party relating to the buildings and/or structures is accurate and reliable. This documentation and information includes but is not limited to Council records, plans, details, and geotechnical information. No responsibility or liability is accepted by NZCSE for any loss or damage whatsoever stemming from inaccuracies in any and all documentation and information provided by the client and/or any third party.

As outlined in the scope of work, NZCSE has been engaged by the client to carry out an assessment and provide conclusions and recommendations relating to the observed structural damage to the relevant buildings and/or structures. Although some observations and comments may relate to non-structural elements, these comments should be read only in the context of adding completeness to this process. Recommendations provided by NZCSE are limited to those that relate specifically to the New Zealand Building Code Clause 'B1 Structure'. It is recommended that all non-structural elements that are governed by the New Zealand Building Code and Acceptable Solutions/Verification Methods, including but not limited to geotechnical considerations, 'B2 Durability' and 'E2 External Moisture', are to have direct involvement from the appropriate consultants, professionals and industry experts. No responsibility or liability is accepted by NZCSE for any loss or damage whatsoever stemming from non-structural related issues.

Without limiting any of the above, NZCSE'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.



Appendix A

Relevant Site Photographs

Photo Set 1: Property Layout and Local Features.



Photo 1A – Screenshot of latest aerial imagery from canterburymaps.govt.nz showing property layout and simplified cardinal directions.



Photo 1B – 1940-1944 earliest available aerial imagery of the property, showing the original property (now 3 titles).

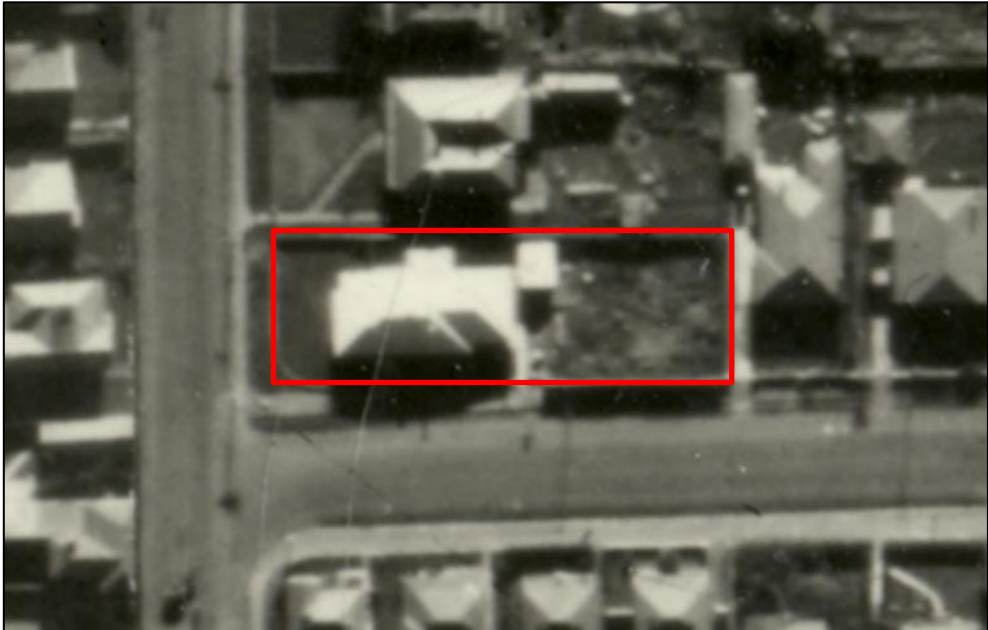


Photo 1C – 1945-1949 aerial imagery shows the new dwelling and original garage.

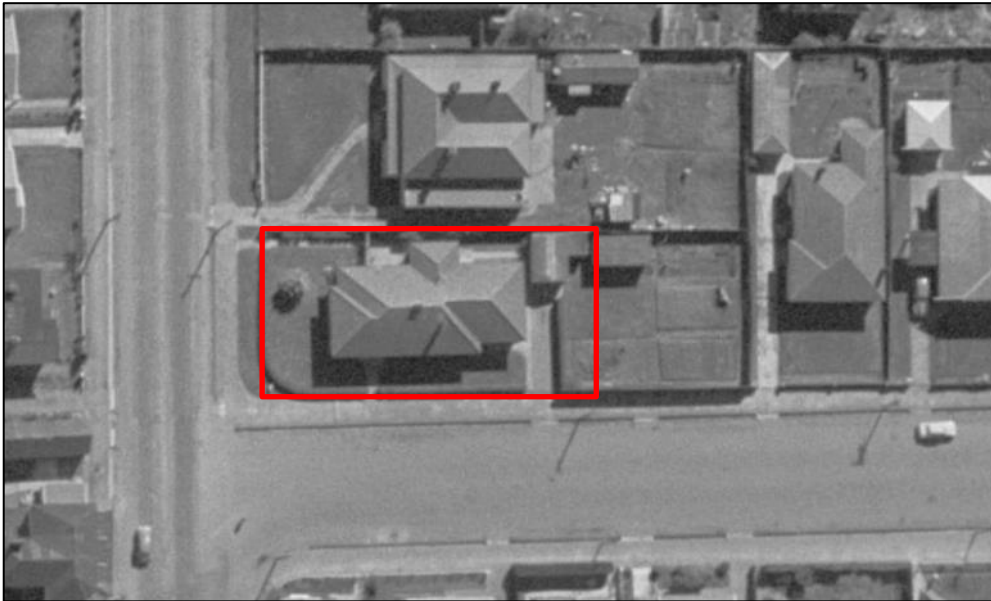


Photo 1D – 1960-1964 aerial imagery shows the carport against the garage.



Photo 1E – 1980-1984 aerial imagery shows the second garage (carport permitted to be enclosed in 1978).



Photo 1F – 2015-2019 aerial imagery shows the chimney has been removed down to the roof level post 2011 earthquakes..

Photo Set 2: External Elevations.



Photo 2A – South elevation (street facing).



Photo 2B – West elevation.



Photo 2C – Northwest elevation.

Photo Set 3: Foundations.



Photo 3A –350mm Perimeter Foundation embedment depth along the west elevation.

Photo 3B – Foundation crack at vent along the south elevation.



Photo 3C – Minor foundation crack at subfloor vent along the north elevation below dining room window.

Photo 3D – No reinforcing was detected in the perimeter foundation wall.

Photo Set 4: Floors & Fixtures.



Photo 4A – Mortar crack repairs along the internal corner between the sunroom and the bedroom2 .

Photo 4B –Built in wardrobe was tilting in direction the floor slope but the framing was measured to be level over the sloping floor.



Photo 4C –Built in storage units in the south west of corner of the dining room. Floor falls 20mm/m, to a greater degree than the wall mounted units.



Photo 4D – underside of the storage units sloping toward the partition wall by 7mm/m

Photo Set 5: Floors and Fixtures 2.



Photo 5A – Laundry room converted to a wet room with a spa bath installed after 2011. Grout repairs were ongoing at the time of our site assessment.



Photo 5B –Storage closet installed in place of old concrete chimney that was removed as part of post-earthquake repairs. Wall linings around the opening were also replaced.



Photo 5C –HWC without restraints inside the lounge closet.



Photo 5D – HWC timber support framing should be replaced/ strengthened.



Photo 5E – Ceiling cracking in dingy room beside entrance to kitchen.

Photo Set 6: Roof Observations.



Photo 6A – Poured concrete partition wall above the ceiling level.



Photo 6B – Partition block wall. No cracking damaged observed. Gaps evident between the roof tiles and the partition wall.



Photo 6C – Roof plane sagging towards the middle due to inadequate underpurlin support .



Photo 6D – Internal view of the precast concrete beams running above the external brick veneer.

Photo Set 7: Garage Observations



Photo 7A – South elevation of adjoining garages.



Photo 7B – Garage slab and upstand was undamaged with no signs of previous repairs or settlement cracking.



Photo 7C –Garage West elevation



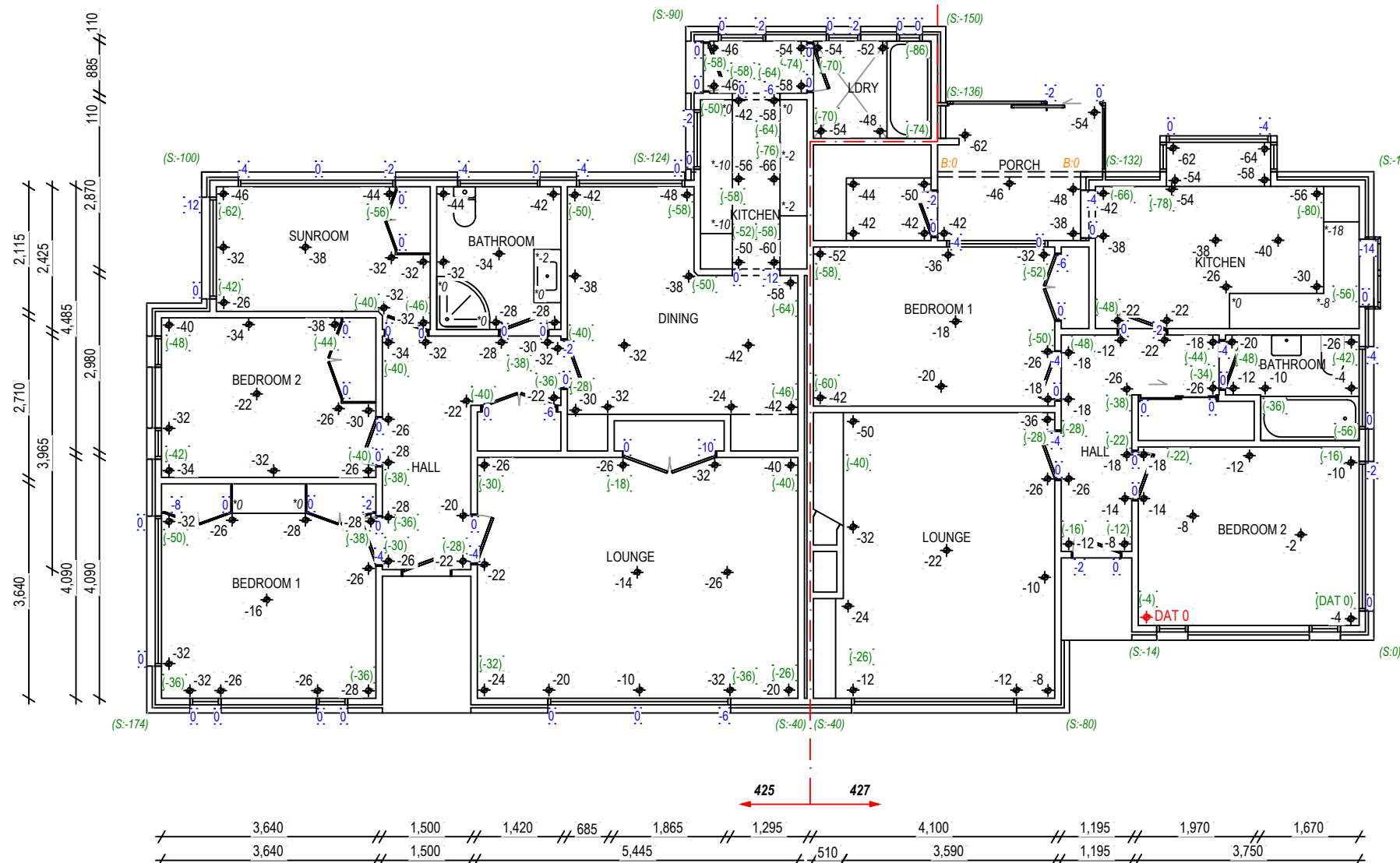
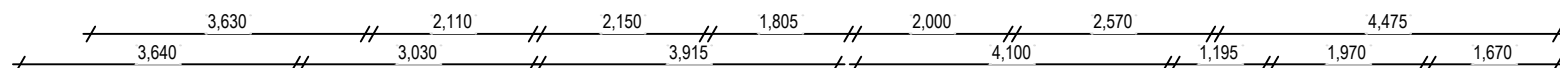
Photo 7D – North Elevation. Cladding sheet need to be refixed.



Appendix B

Structural Survey Drawings

SHEET	DESCRIPTION	SCALE	VERSION
SK1	FLOOR LEVELS	1:100 / A3	1
SK2	CONTOURS PLAN	1:100 / A3	1
SK3	VERTICALITIES PLAN	1:100 / A3	1
SK4	SUBFLOOR PLAN	1:100 / A3	1

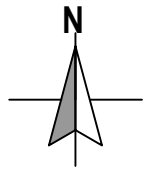


- 0 FLOOR LEVELS (ADJUSTMENTS FOR FLOOR COVERINGS HAVE BEEN MADE)
- (-X) CEILING LEVELS
- (S:-X) SOFFIT LEVELS
- B:-X LEVEL TO BASE OF BEAM
- X LEVELS TAKEN AT DOOR HEADS AND WINDOW SILLS
- *-X LEVEL TAKEN TO TOP OF UNIT

- MEASUREMENTS SHOWN ARE IN mm UNLESS STATED OTHERWISE
- LEVELS RECORDED WITH A ZIP LEVEL PRO-2000
- PLANS TO BE PRINTED IN FULL COLOUR



DRAWING NO.	SK1
-------------	-----



LOCATION PLAN

SCALE: NTS

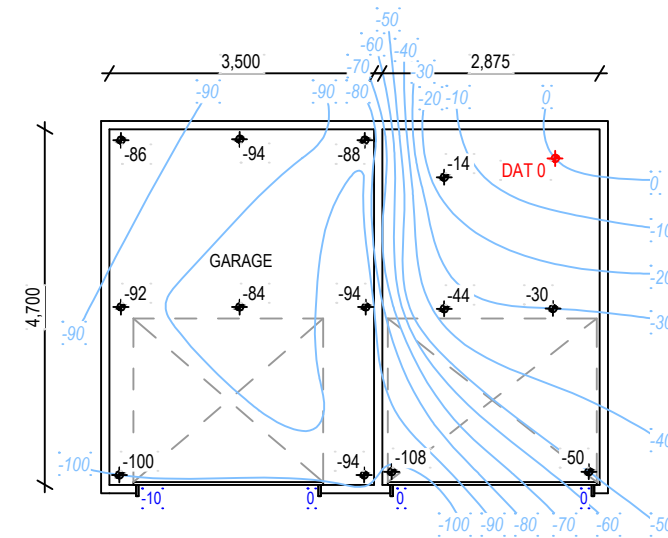


KEY:

- 0 FLOOR LEVELS (ADJUSTMENTS FOR FLOOR COVERINGS HAVE BEEN MADE)
- (-X) CEILING LEVELS
- (S-X) SOFFIT LEVELS
- B-X LEVEL TO BASE OF BEAM
- X LEVELS TAKEN AT DOOR HEADS AND WINDOW SILLS
- *X LEVEL TAKEN TO TOP OF UNIT

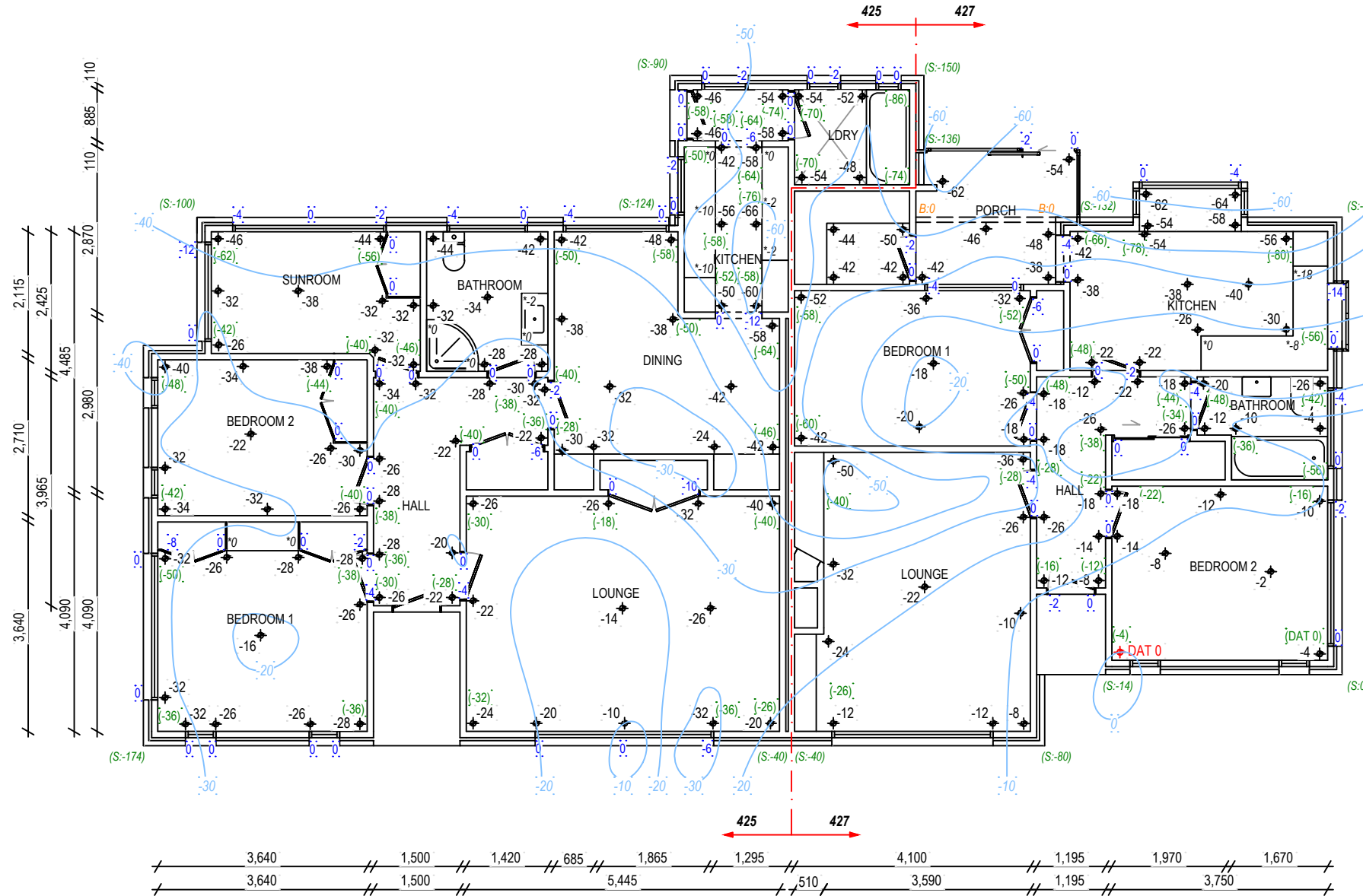
NOTES:

- MEASUREMENTS SHOWN ARE IN mm UNLESS STATED OTHERWISE
- LEVELS RECORDED WITH A ZIP LEVEL PRO-2000
- PLANS TO BE PRINTED IN FULL COLOUR



GARAGE CONTOURS PLAN

SCALE 1:100



DWELLING CONTOURS PLAN

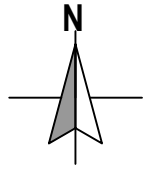
SCALE 1:100



SHEET TITLE
CONTOURS PLAN

ADDRESS:
425 & 427 ARMAGH STREET, LINWOOD,
CHRISTCHURCH 8011

SCALE @ A3
1:100
DATE
26/02/2025
DRAWING NO.
SK2



LOCATION PLAN

SCALE: NTS

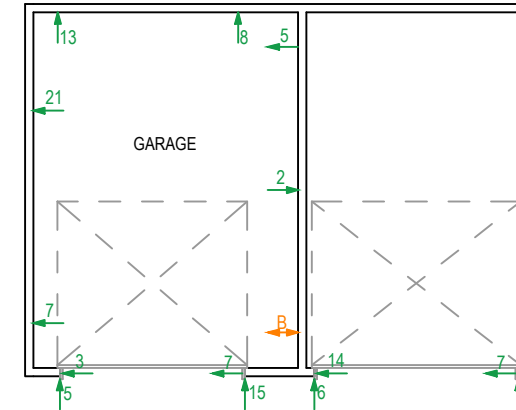


KEY:

- DISPLACEMENT AND DIRECTION (mm)
- PLUMB
- BOWED

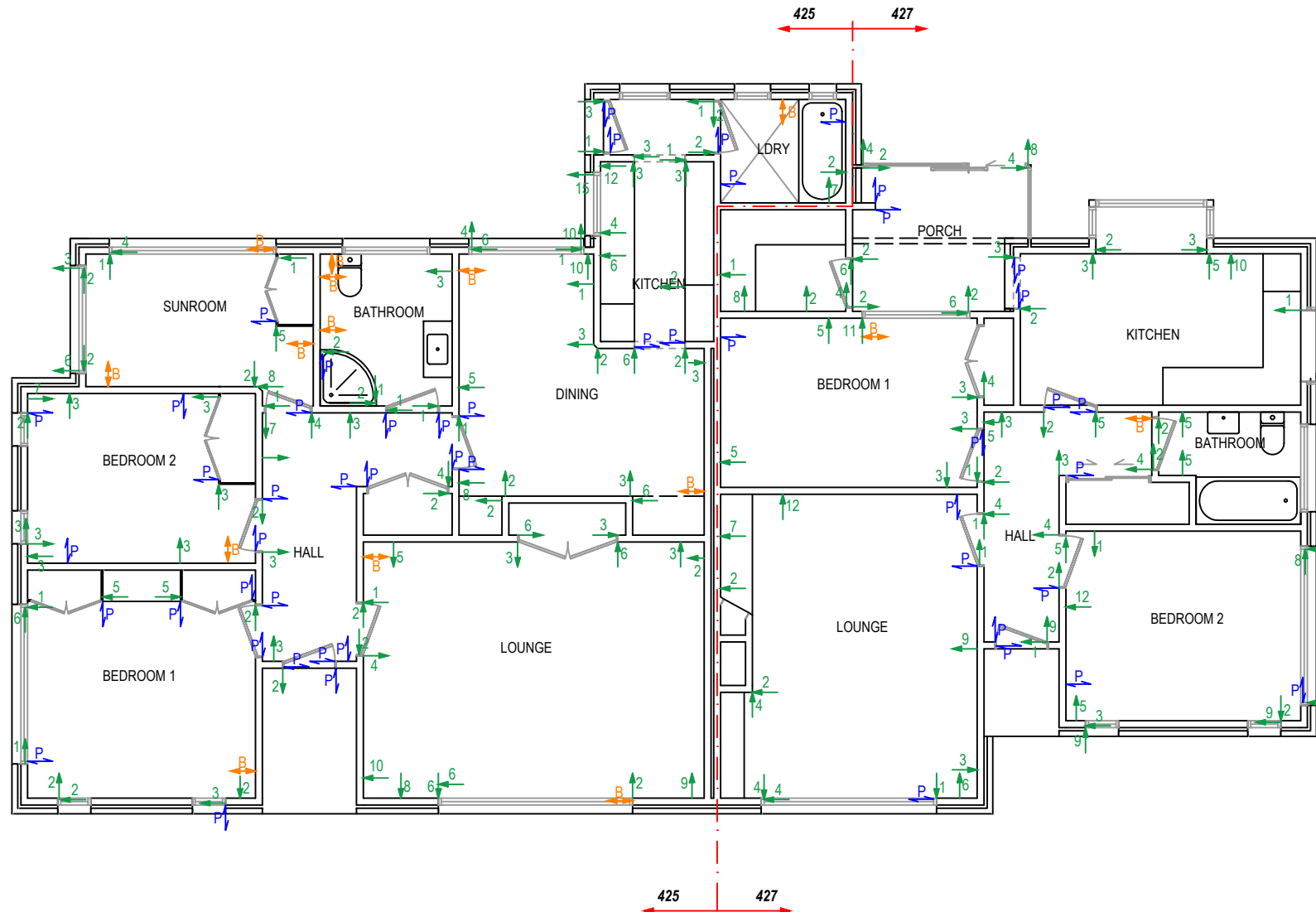
NOTES:

- MEASUREMENTS SHOWN ARE IN mm UNLESS STATED OTHERWISE
- LEVELS RECORDED WITH A BOSCH DNM 120L DIGITAL LEVEL
- PLANS TO BE PRINTED IN FULL COLOUR



GARAGE VERTICALITIES PLAN

SCALE 1:100



DWELLING VERTICALITIES PLAN

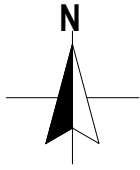
SCALE 1:100



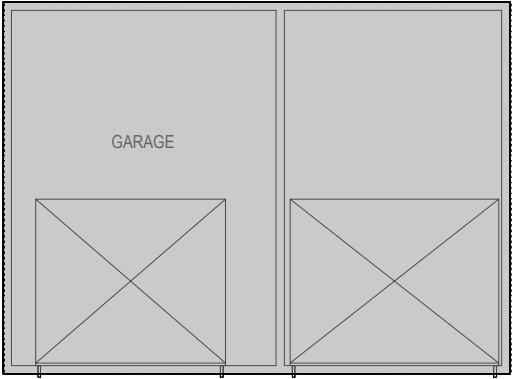
SHEET TITLE
VERTICALITIES PLAN

ADDRESS:
425 & 427 ARMAGH STREET, LINWOOD,
CHRISTCHURCH 8011

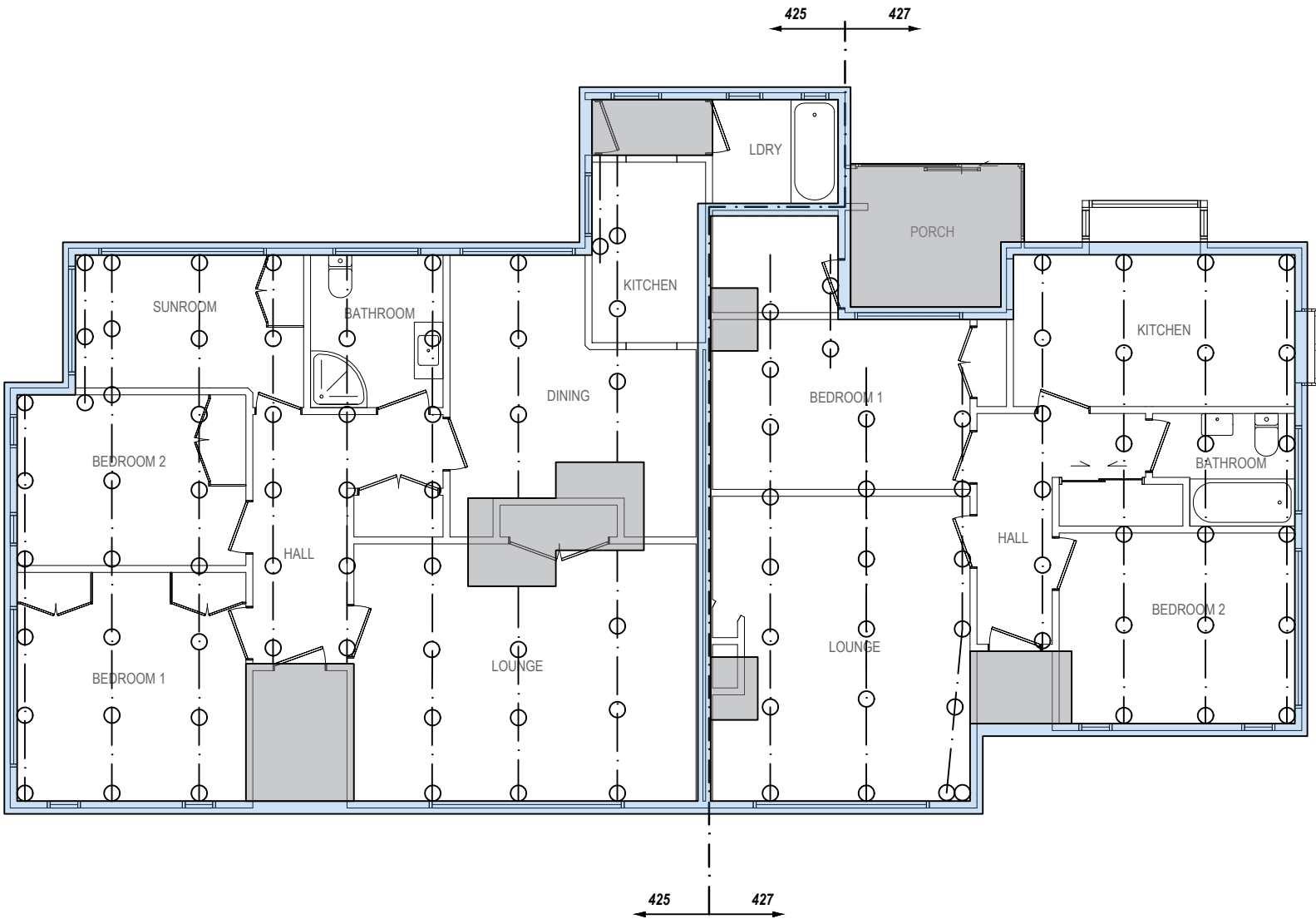
SCALE @ A3
1:100
DATE
26/02/2025
DRAWING NO.
SK3



LOCATION PLAN
SCALE: NTS



GARAGE FOUNDATION PLAN
SCALE 1:100



DWELLING FOUNDATION PLAN
SCALE 1:100

KEY:

-  CONCRETE PERIMETER WALL FOUNDATION
-  CONCRETE SLAB
-  BEARER LINE
-  PRECAST CONCRETE PILE

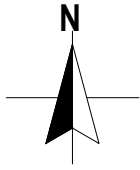


SHEET TITLE FOUNDATION PLAN	SCALE @ A3 1:100
	DATE 26/02/2025
ADDRESS: 425 & 427 ARMAGH STREET, LINWOOD, CHRISTCHURCH 8011	DRAWING NO. SK4



Appendix C

Conceptual Repair Plan

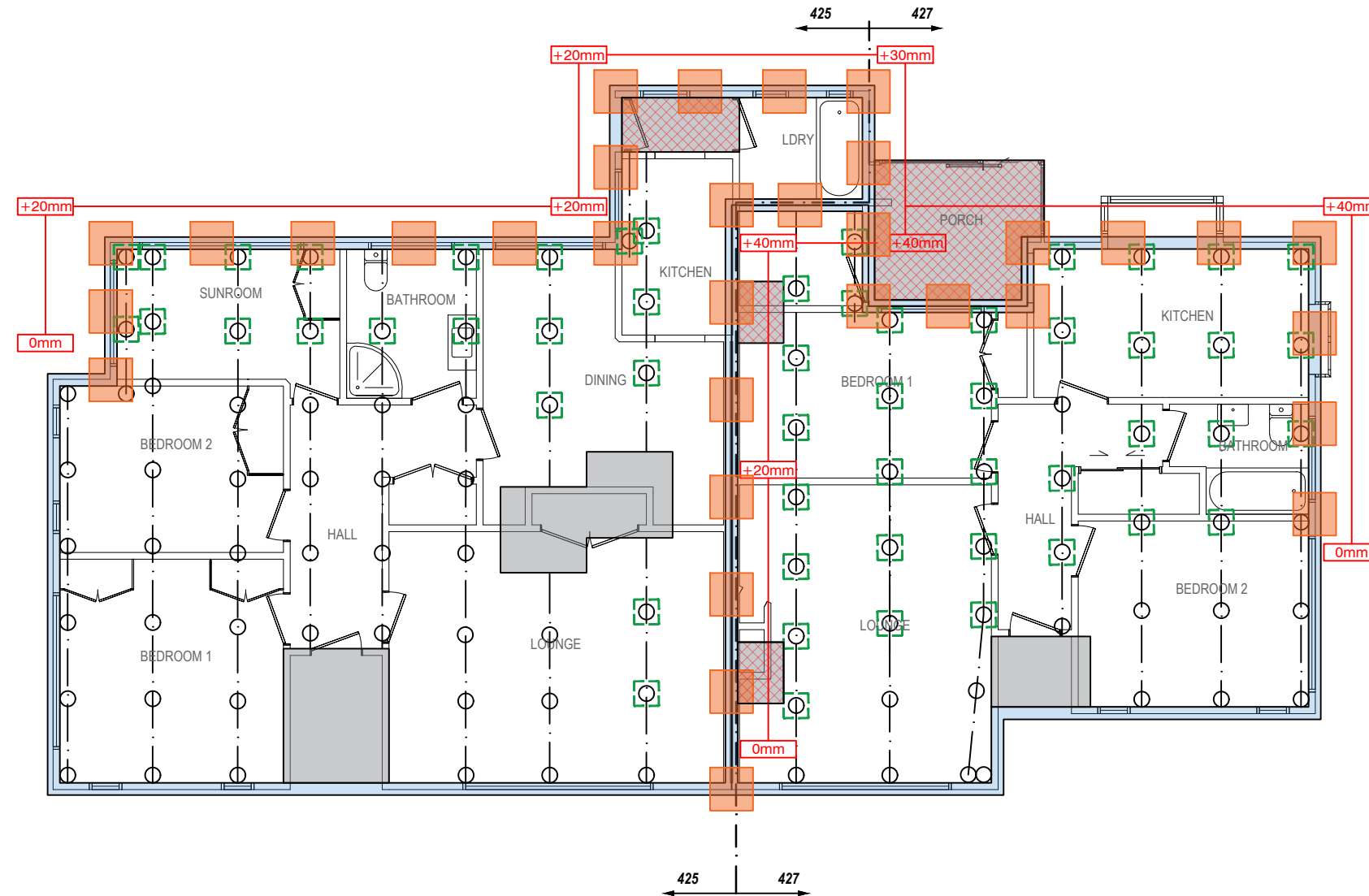


CONCEPTUAL REPAIRS:

-  UNDERPIN THE PERIMETER FOUNDATION BY **+XXmm** OFF CONCRETE PADS @ 1.5 CENTERS MAX.
-  RELEVEL THE INTERNAL SUSPENDED TIMBER FLOORS BY PACKING BETWEEN THE PILES & BEARERS.
-  REMOVE SLABS.



LOCATION PLAN
SCALE: NTS



KEY:

-  CONCRETE PERIMETER WALL FOUNDATION
-  CONCRETE SLAB
-  BEARER LINE
-  PRECAST CONCRETE PILE

CONCEPTUAL REPAIR PLAN
SCALE 1:100



SHEET TITLE CONCEPTUAL REPAIR PLAN	SCALE @ A3 1:100
	DATE 26/02/2025
ADDRESS: 425 & 427 ARMAGH STREET, LINWOOD, CHRISTCHURCH 8011	DRAWING NO. SK5



Appendix D

Shallow Geotechnical Investigations



Test locations are approximate (scaled and aligned using aerial imagery)
Aerial imagery obtained from [Canterburymaps.govt.nz](https://canterburymaps.govt.nz)



Appendix E

Relevant Third-Party Documents

Contents:

	DOCUMENT TITLE	SOURCE	DATE
1.	Relevant Property File Extracts	Christchurch City Council	Various
2.	Underfloor Inspection	Cavity Critter	20/02/2025



Appendix E

Christchurch City Council Property File Extracts

CITY OF CHRISTCHURCH

CITY ENGINEER'S DEPARTMENT

P.O. BOX 237, CHRISTCHURCH, NEW ZEALAND

Mr Bergh,
425 Armagh Street,
CHRISTCHURCH



8 September 1977

re Building Application No. 702 BU/1/2

B7/7
Mr O'Malley

Dear Sir/Madam, your application for permission to

enclose carport to form garage at 425 Armagh Street

has now been approved. Before work is commenced the undermentioned fees must be paid and a building permit uplifted from this office.

Vehicle Crossing	\$
Builders Water Supply	
Water Connection Charge	
Building Permit Fee	3.00
Building Research Levy	
Street Damage Deposit	
	<u>3.00</u>

The Building Permit Application is approved subject to the following conditions:

1. The stormwater being connected to the existing disposal system and piped to the street side channel.

If the permit is not uplifted within three months of this date the application will be cancelled and the plans disposed of.

Yours faithfully

for Deputy General Manager and City Engineer

c.c. Mr Hart,
425 Armagh Street,
CHRISTCHURCH

LIN 3

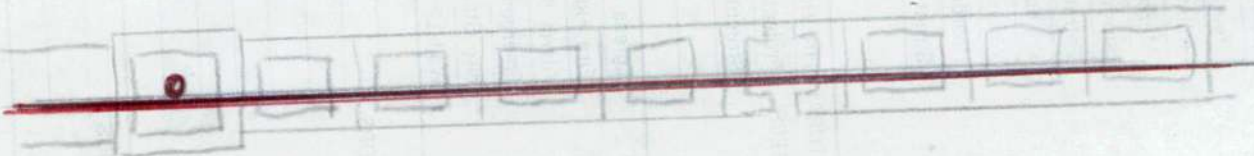
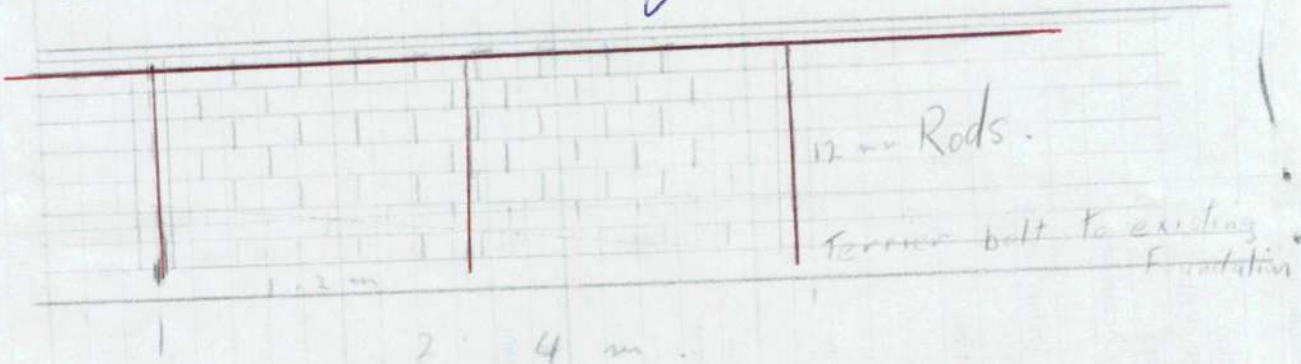
425 ARMAGH ST
ENCLOSE CARPORT

[Signature]

LIN

77-1580

CHRISTCHURCH CITY COUNCIL
Approved Subject to the By-Laws
21 SEP 1978
[Signature]
For City Engineer



BUILDING INSPECTORS	Fire Zone and Resistance		
	Siting (By laws)		
	Light and Ventilation		
	Room Sizes and Stud Ht.		
	Heating and Storage		
	Toilet and Laundry Accommod.		
	Mezzanine Floors		
	Storm Water and Section Levels		
	Entrance Levels		
	Projections over Street		
	Verandahs		
	Hoardings		
	Street Numbers		
STRUCTURAL ENGINEERS	Fire Resistance Requ.		
	Projections over Street		
	Structural Stability		
EGRESS OFFICER	Egress and Exit Signs		
	Fire Fighting Equipment		
	Alarm Systems		
	Emergency Lighting		
	Fire Stops		
HEALTH NSPECTORS	Wall Linings		
DANGEROUS GOODS NSPECTORS			
WATER NSPECTOR			

425 Armagh St

12 mm Rod

12 mm Rod 1-2

Shamrock Road

Site of Proposed Block fence
to be built on existing concrete wall.



Fence 6" Block.
8" Block Columns
7 Courses high
Tensar bolts 1 sh
4 Top Courses.
bond beam with
 $\frac{1}{2}$ " rod concrete filled

CCC 702.

3/48/33

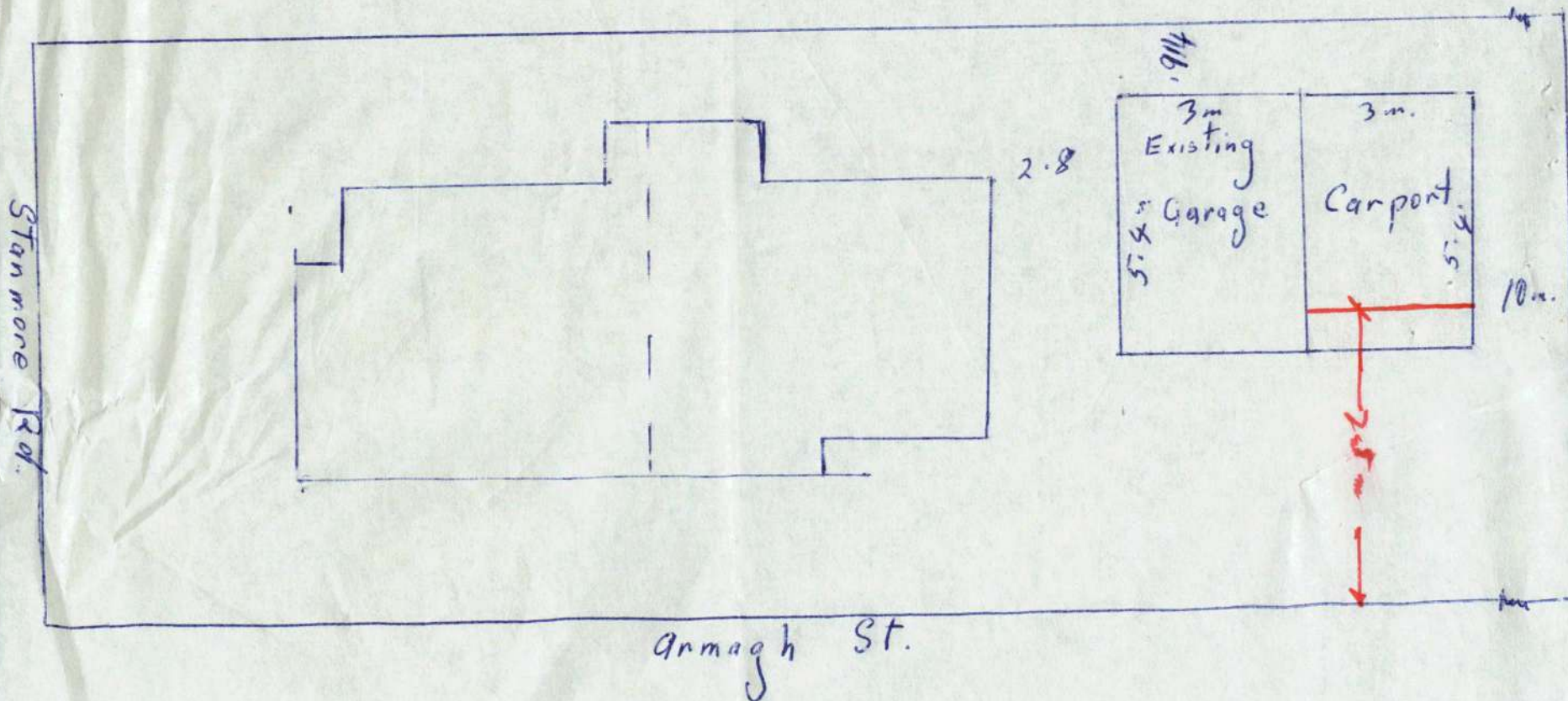
Mr M. Hart.

425 Armagh St.

Enclose existing carport as
garage.

Sewer not involved on this plan.

CHRISTCHURCH	
PLAN No. 43	
LETTER REF.	
J.H.S.	J6
INSP.	3/5/77
DATE	
DRAINAGE BOARD	



L/N-77-1580

Details of Carport

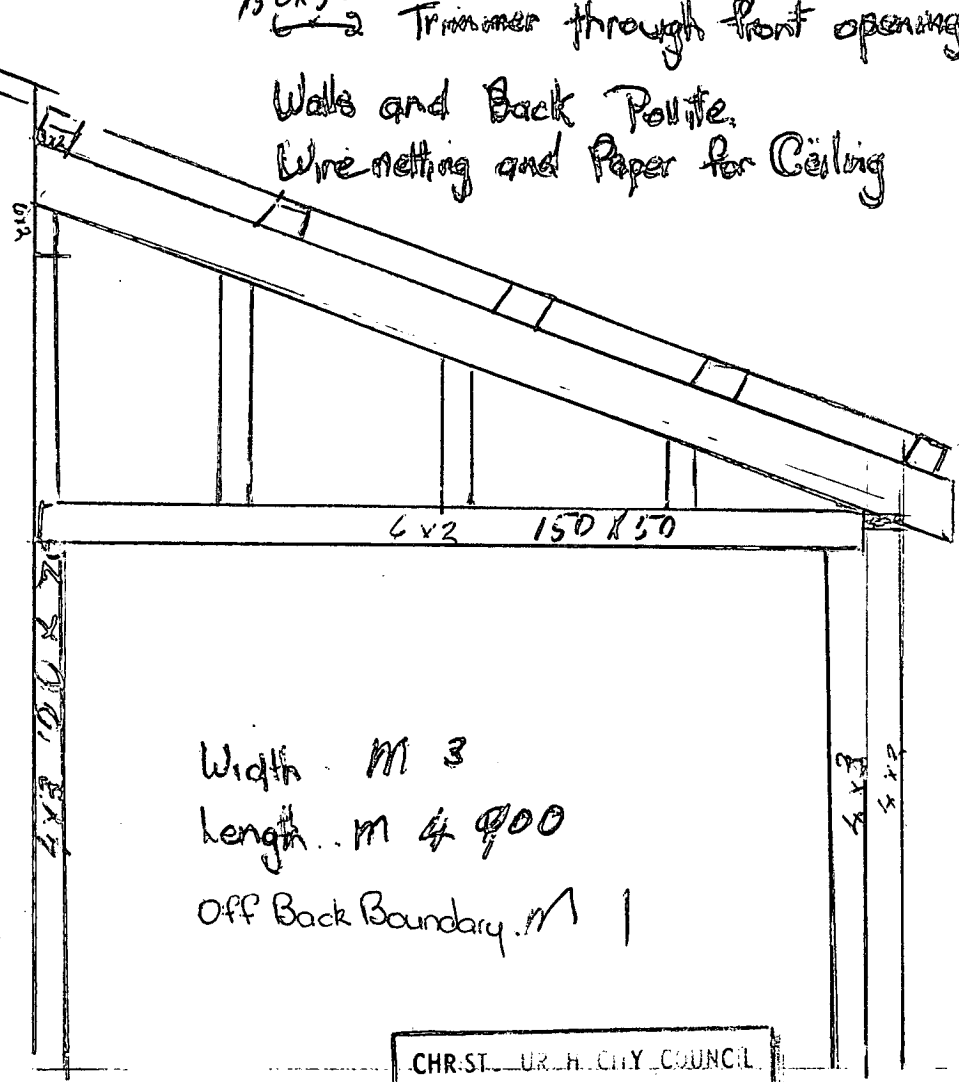
425 Armagh St.

$\frac{100 \times 50}{4 \times 2}$ Plates
 $\frac{125 \times 50}{5 \times 2}$ Rafters
 $\frac{75 \times 50}{3 \times 2}$ Purlins
 $\frac{150 \times 50}{6 \times 2}$ Trimmer through front opening

Studs Setting 400 - Dwangs at 600.
 Settings 750.
 Setting 750.

Walls and Back Pointe.
 Wire netting and Paper for Ceiling

Existing Garage.



Width m 3
 Length m 4 @ 00
 Off Back Boundary m 1

CHRSTCHURCH CITY COUNCIL
 Approved Subject to the By-Laws
 8 SEP 1977
 [Signature]
 For City Engineer

3

SPECIFICATION

FOR

Garage

AT

1425 Armagh St.

OWNER

M. R. Hart

FOUNDATIONS

Concrete

CLASS OF TIMBER

SPACING

Sleepers

/

Floor Joists

/

Flooring

Concrete

Plates

4x2

Studs

4x2

18"

Bracings

4x2

2 per Wall

Rafters

4x2

3ft

Purlins

4x2

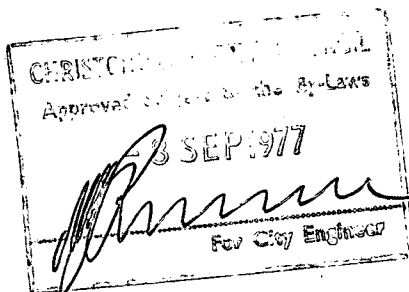
2ft

Wall Covering

Plite

Roof Covering

Iron



DEPT.	APPLICATION NO.	PERMIT NO.	Initial
TOWN PLANNING	Zoning	R/2.	
	Siting (ordinances)	Dis Cont Bldg. Check dwelling	
	Coverage	or flat	
	Density		
	Height		
	Outbuildings (height area)		
	Signs		
SURVEYOR	Building Restrictions		
	C.D.B. Widening		
	C.D.B. Clearance		
	Cash in lieu of Reserve		
	D.P. or Title Amalgamation		
	Unit Title		
TRAFFIC ENGINEERS	Access		
	Off Street Loading		
	Off Street Parking		
	Turning Space		
	Motorway		
	Street Works		
STREET- WORKS	Vehicle Barriers		
	Sealing of Areas		
	Location of Gully Traps etc.		
	Culverts and Accesses		
	Drainage		
BUILDING INSPECTORS	Fire Zone and Resistance		
	Siting (By laws)		
	Light and Ventilation		
	Room Sizes and Stud Ht.		
	Heating and Storage		
	Toilet and Laundry Accommod.		
	Mezzanine Floors		
	Storm Water and Section Levels		
	Entrance Levels		
	Projections over Street		
	Verandahs		
	Hoardings		
	Street Numbers		
	Insulation		
	Access for Handicapped		
Unit Title			
STRUCTURAL ENGINEERS	Fire Resistance Requ.		
	Projections over Street		
	Structural Stability		
EGRESS OFFICER	Egress and Exit Signs		
	Fire Fighting Equipment		
	Alarm Systems		
	Emergency Lighting		
	Fire Stops		
	Wall Linings		
HEALTH INSPECTORS			
DESIGN OFFICE			
DANGEROUS GOODS INSPECTORS			
WATER INSPECTOR			

Species coming

10/5-
OK by TE. JH

Preliminary comment by District Building Inspector on initial site inspection: Where appropriate				Tick appropriate
Front ☐ Rear ☐ Corner ☒	APP NO. 6084			
Street Number OK ☒ Check ☐	ROW Access Yes ☐ No ☐			
C/T Attached ☐ Letter Sent ☐	ZONE			
Pegging Cert Required ☐				

				Commercial
Boundary Pegs -	Yes	No	☒	Entrance level
Earthworks Permit -	Yes	No	☒	Projections/Sc
Site Levels	OK	Low	☒	Verandahs
Ground Conditions -	OK	Suspect	☒	Roofdrains
Stormwater -	CDB	Soak Pit	☒	Structural Stab.
Under/channels -	To site channel	Via existing (Ind)	☒	Drains

Subject to.

(1) 2
(2) 4
(3) Compliance with the attached
single story plan will be
attached to the plans.

AM

To: The City Engineer,
Christchurch City Council

Date 11-2-1988

I/we hereby apply for a Building Permit for the work described below and in accordance with the plans and specifications deposited herewith in duplicate:

EMPLOYER FOR WHOM WORK IS BEING CARRIED OUT	DESIGNER
Name:	Name: <i>C. J. ...</i>
Address:	Address:
Contract Phone No.	Contract Phone No. <i>873/61</i>

SITE AND LEGAL DESCRIPTION 254
Street Address: 425 ARMAGAN ST.
Lot No. 11 DP No. 10644
Site Area CT No. _____

FLOOR AREA (M²)
New Building: _____ Additions: _____
Estimated Value: 3500 ✓

DESCRIPTION OF WORK AND MAIN PURPOSE OF USE: *Five walls*

WATER CHARGE

Connection

Signature of Applicant: *[Signature]*

Name of Applicant: *KIM M. F.*

[illegible]

See Bu/40/254/425

CITY WORKS AND PLANNING DEPARTMENT
P.O. BOX 237, CHRISTCHURCH, NEW ZEALAND

K I Milne
47 Rura Road
CHRISTCHURCH

20 February 1987

re Building Application No. 4084 BU/40/254425
Mr R O'Malley

Dear Sir/Madam, your application for permission to

has now been approved. Before work is commenced the undermentioned fees must be paid and a building permit uplifted from this office.

Water Connection Charge	\$	
Subdivision Fee		
Building Permit Fee		37.40
Building Research Levy		
Vehicle Crossing		
Drainage Permit/ Footpath Opening Fee		
Total GST Inclusive		37.40

The Building Permit Application is approved subject to the following amendments to your proposal.

1. The foundation being taken down to an approved solid bearing.
2. Compliance with the amendments shown on the plans.
3. Compliance with the ~~attached~~ single storey fire wall details attached to the plans.

86-3910

If the permit is not uplifted within three months of this date the application will be cancelled and the plans disposed of.

cc M R & J M Hart
425 Armagh Street
CHRISTCHURCH

P W A Ltd 34759

LIN	RI	3910
AREA	ZONE	CONSEC. NO.

The building for which this permit is issued to be commenced within SIX months and completed within 12 months of date of this permit. **A4084 BU/40/254/425**

DESIGNER: Owner

NAME _____ ADDRESS _____ Date issued 6/3/87

OWNER/PROPRIETOR		BUILDER	
Name	M R & J M Hart	Name	K I H Line
Mailing Address	425 Armagh Street	Mailing Address	47 Buro Road
	CHRISTCHURCH		CHRISTCHURCH

PROPERTY ON WHICH BUILDING IS TO BE ERCTED/DEMOLISHED	
SITE	
Street No.	425
Street Name	Armagh Street
Town/District	

LEGAL DESCRIPTION	
Valuation Roll No.	
Lot	4
D.P.	10444
Section	Block
Survey District	

DESCRIPTION OF PROPOSED WORK AND MAIN PURPOSE OF USE	
Erect fire walls for flats	

FLOOR AREA		DWELLING UNITS	
Whole	Sq. Feet	Number	
ESTIMATED VALUE			
\$			
TOTAL		3,500	

NATURE OF PERMIT (CHECK BOX)	
☐ NEW BUILDING	include domestic garages and domestic outbuildings
☐ FOUNDATIONS ONLY	
☐ ALTERED, REPAIRED, EXTENDED, CONVERTED, RE-SITED.	include installation of heating appliances
☐ NEW CONSTRUCTION	
☐ OTHER THAN BUILDINGS	include demolitions
☐ DOMESTIC GARAGES	
☐ AND DOMESTIC OUTBUILDINGS	

Permission is hereby granted for the work described above as proposed in the application, and in accordance with the plans, particulars and other documents submitted to me, such work to be subject at anytime during progress to my inspection, and to be carried out in strict conformity with all requirements of the Christchurch City Building Bylaw and other Bylaws for the time being in force, and to other regulations respectively affecting such work.

I solemnly declare the estimated value of the building to be
under \$ 3,500 and agree to comply and ensure compliance
with all Bylaws and Civic Regulations, it being expressly understood
that the issuing of a Permit does not dispense with any obligation
to comply with all said Bylaws and Regulations though not called
for in the specific permit. I am on the plans submitted.

Signature: [Signature]

Receipt No. 21424
Value of Work \$ 3,500
Value of Fee INCLUDING GST \$37.40

(or City Engineer)

(Owner/Proprietor or Authorised Agent)

Value of Levy INCLUDING GST: \$

I/We agree to pay the full cost of reinstatement of any damage to the roads (including carriageways, kerbs, channels, culverts and crosswalk footpaths, berms, verges and services) which results from the execution of the above.

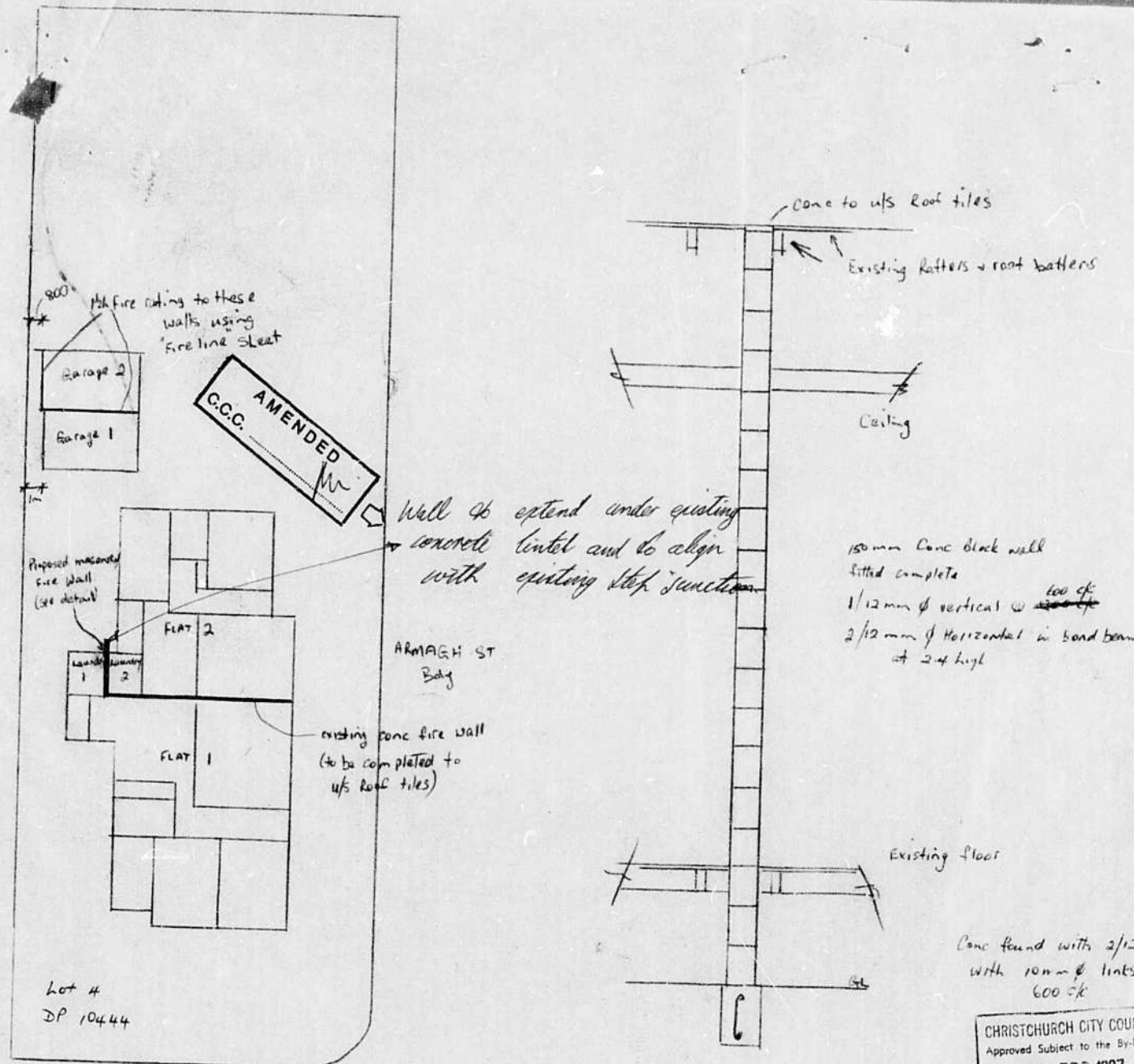
Signature _____ (Owner/Proprietor or Authorised Agent)

Application and Agreement for Water Supply
in accordance with the provisions of the Water Supply Act, 1946

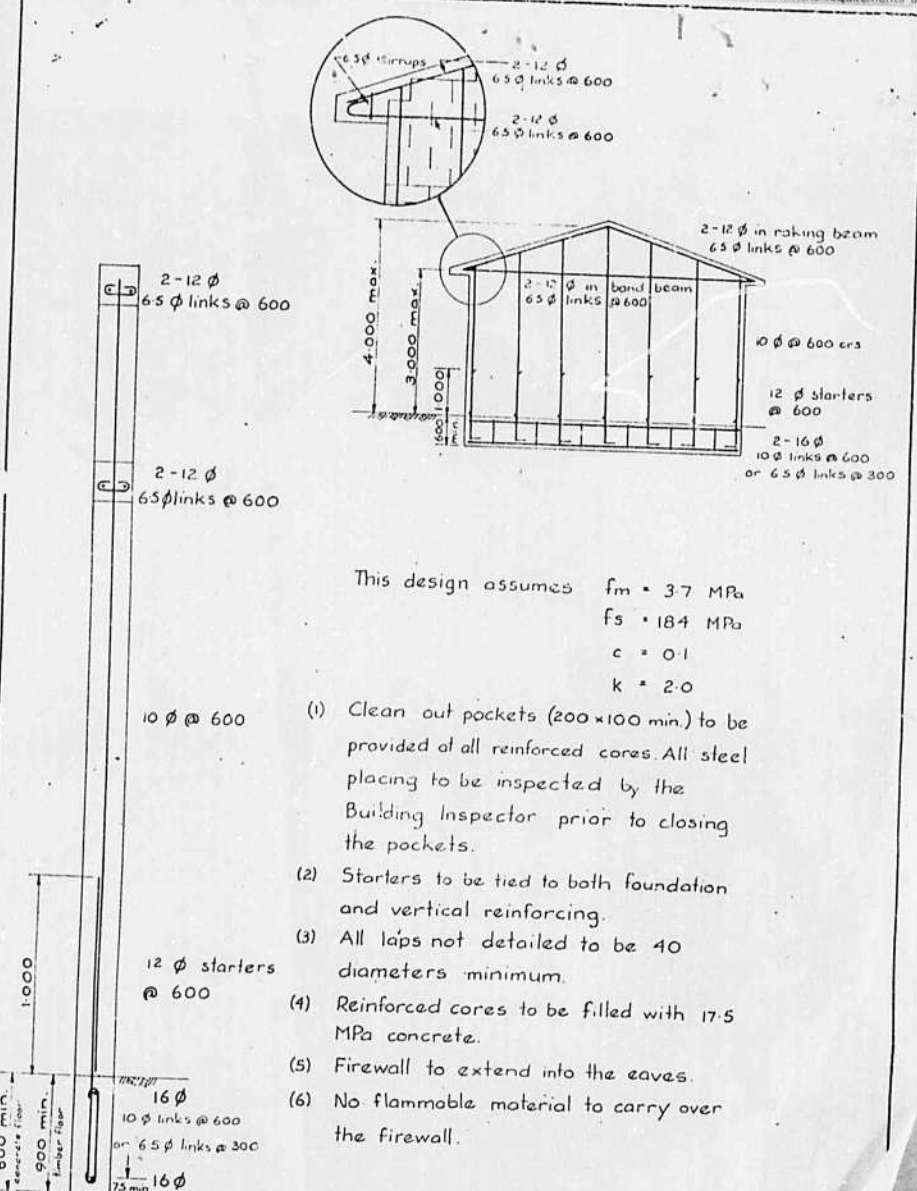
I hereby apply for a (metered) water supply in accordance with the requirements of the Christchurch City By Law No. 107 (Water Supply and Planting) I agree to accept a supply in accordance with the requirements and

CHRISTCHURCH		DISTRICT No.	BOOK No.	
DRAINAGE BOARD		10	127	0086
BOX 13006				
Foul Water Drainage	NA	Block Plan	130.55	
Stormwater Drainage	NA	J.H.S.		
Sanitary Plumbing	NA	Letter Ref.		
INSPECTOR	T.R. Loughlin		DATE	18.7.87

CCC 4084
MR HART
425 ARMAUGH ST
ERECT FIRE WALLS



Proposed alterations to flats & Garage to obtain separate titles at 425 ARMAGH ST. for Mr & Mrs M Hart



This design assumes

$f_m = 3.7$	MPa
$f_s = 184$	MPa
$c = 0.1$	
$k = 2.0$	

Clean out pockets (200x100 mm) to be provided of all reinforced cores. All steel placing to be inspected by the Building Inspector prior to closing the pockets.

Starters to be tied to both foundation and vertical reinforcing.

All laps not detailed to be 40 diameters minimum.

Reinforced cores to be filled with 17.5 MPa concrete.

Firewall to extend into the eaves.

No flammable material to carry over the firewall.

Note: Where this design is not adequate (e.g. to the CHURCH CITY conditions, wall dimensions, or other factors) or subject to variation from these details must be supported by design calculations or a design certificate.

SINGLE STOREY FIRE W
CHRISTCHURCH CITY CO.



Appendix E

Cavity Critter Subfloor Report – 20/02/2025

Cavity Critter

Under floor Inspections

www.underfloorinspections.co.nz

106 Raddens Road

Ohoka

RD2 Kaiapoi 7692

021 343156

gideon@underfloorinspections.co.nz

Report prepared for: NHC

Property address: 425 Armagh Street, Linwood

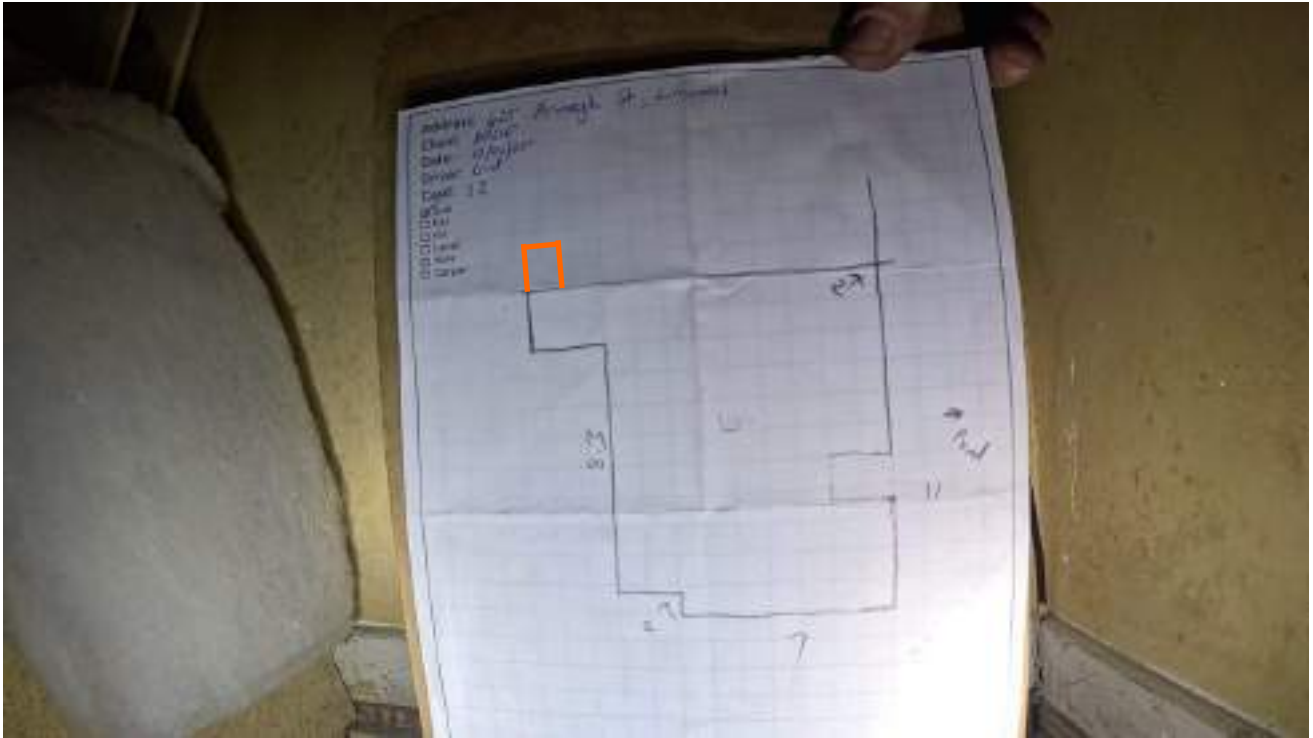
Date: 20 February 2025

Prepared by: Gideon Couper LBP Site 2 100074

Numbers corresponded to floor layout plan. Arrows represent which direction the photo was taken from.



1: Photo for legal purposes, showing who did the job and when. The layout of these units is a little confusing and I believe that this unit extends into the area marked in orange but I couldn't get into this area.



2: This is a view of the party wall. The foundations are average quality type “B” foundations. There is a lack of fine sand and cement along with spider webs in some areas, making it hard to discern finer cracks, if they exist. The ground level height does vary a lot but it is all covered with building rubble and does not appear to be liquefaction.



3: View of foundation.



4: View along foundation with chimney breast to the left.



5: View of the chimney breast.



6: View of foundation.



7: View of foundation.



8: View of foundation.



9: View along ring foundation and we can see a vent, but the foundation appears to finish before the vent.



10: There appears to be a concrete base here.



11: The home has precast concrete piles. These are concreted into the ground but not connected to the bearers. We do see one cracked pile.



12: Precast concrete pile with no connection.



13: View of bearer meeting chimney breast. There are some non-compliant issues with the wiring seen in this home. They could also be a significant hazard to anybody operating under the floor. This relates specifically to unclipped wires. An electrical inspector could be consulted regarding this.



14: View of ring foundation with piles to the right.



15: Precast concrete pile with no connection.



16: Precast concrete pile with no connection.



17: View of foundation with what may be a crack.



18: Precast concrete pile with no connection.



19: View of bearer meeting chimney breast.



20: View of the chimney breast.



21: View of bearer meeting chimney breast.



22: Precast concrete pile with no connection.



23: Precast concrete pile with no connection. There are several large piles of tile rubbish as seen here.



24: View of ring foundation with cracking.



25: Precast concrete pile with no connection.



26: Precast concrete pile with no connection.



27: Precast concrete pile with no connection.



28: Precast concrete pile with crack in the foundation.



29: Precast concrete pile with no connection.



30: Precast concrete pile with no connection.



31: Precast concrete pile with no connection.



32: Precast concrete pile with no connection.



33: Precast concrete pile with no connection.



34: Precast concrete pile with no connection. I would note that the heat pump drain is wrapped in these wires which go up to exit the subfloor, meaning the drain would be ineffective.



35: View of ring foundation with main water pipe into the home and there are indications that the pipe is heavily corroded in ground and may be either leaking, or close to leaking.



36: View of ring foundation.



37: Precast concrete pile with no connection.



38: Precast concrete pile with no connection. The communication cable has not been laid in a compliant manner and would easily be damaged by people accessing the subfloor.



39: Precast concrete pile with no connection.



40: Precast concrete pile with no connection.



41: Precast concrete pile with no connection.



42: View of toilet stump. The taller these are the more likely it is that they will snap at ground level. Evidence of this can usually be seen as dampness on the ground around the stump. This is not evident here but as the sewage pipes away from here are clay, it would be a good idea to check these.



43: View of bearer meeting ring foundation.



44: Precast concrete pile with no connection.



45: Precast concrete pile with no connection.



46: Precast concrete pile with no connection.



47: Precast concrete pile with no connection.



48: Precast concrete pile with no connection.



49: Precast concrete pile with no connection.



50: View of concrete base.



51: View of concrete base.



52: View of ring foundation with concrete base to the left.



53: Precast concrete pile with no connection.



54: Precast concrete pile with no connection.



55: This pile is cracked.



56: Precast concrete pile with no connection.



57: Precast concrete pile with no connection.



58: Precast concrete pile with no connection.



59: Precast concrete pile with no connection.



60: Precast concrete pile with no connection.



61: View of piles.



62: Precast concrete pile with no connection.



63: View of piles.



64: View of ring foundation.



65: Precast concrete pile with no connection.



66: Precast concrete pile with no connection.



67: Precast concrete pile with no connection.



68: Precast concrete pile with no connection.



69: Precast concrete pile with no connection.



70: View of ring foundation with cracking.



71: View of ring foundation.



72: Precast concrete pile with no connection.



73: Precast concrete pile with no connection.



74: Precast concrete pile with no connection.



75: Precast concrete pile with no connection.

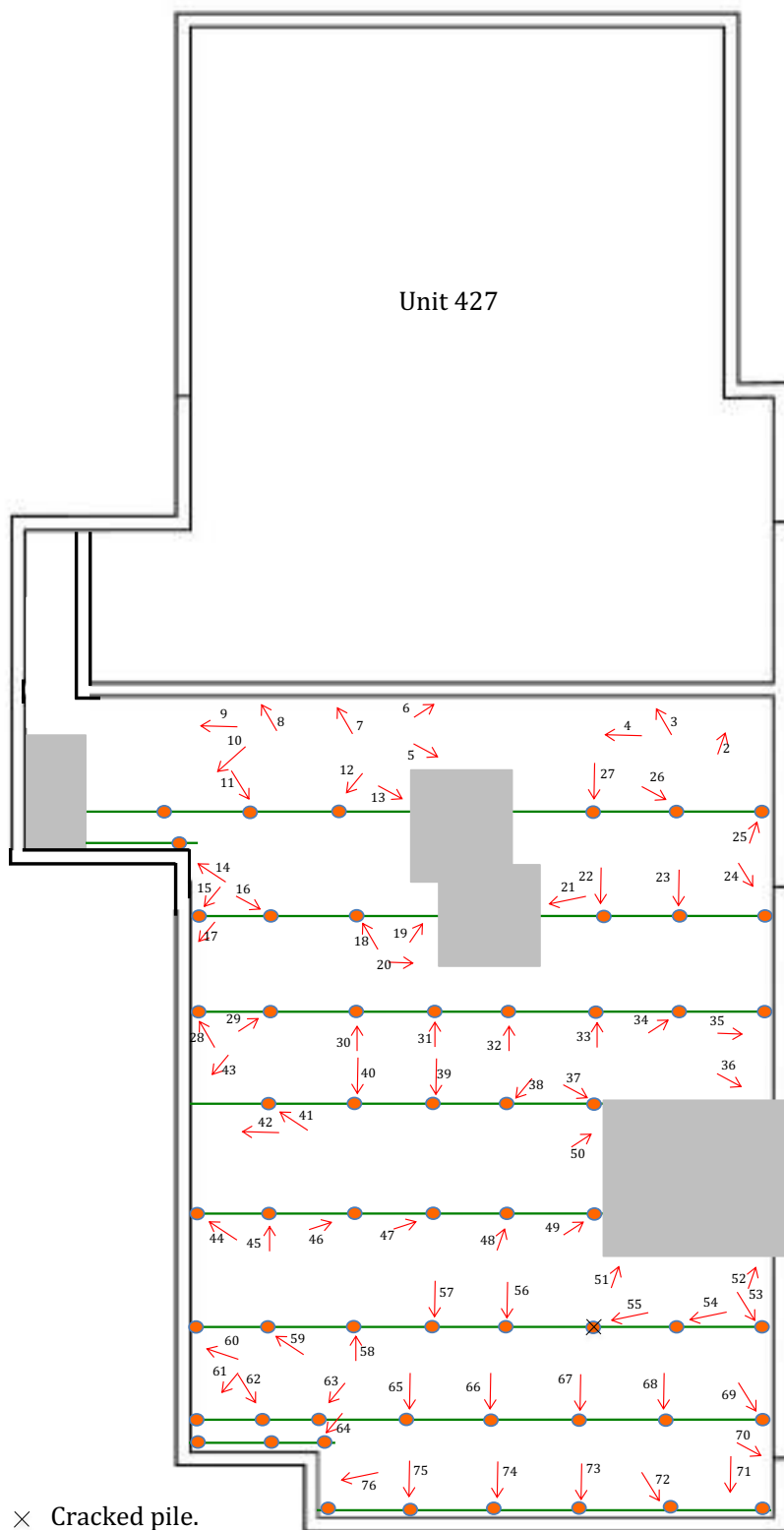


76: Precast concrete pile with no connection.



House floor plan

Numbers corresponded to floor layout plan. Arrows represent which direction the photo was taken from. Plan is also supplied as a separate file to assist with reading of the report.



Subfloor plan 425 Armagh Street, Linwood

This report has been prepared in accordance with and is subject to our document Cavity Critter – Terms Of Trade. Our Terms of Trade include information on the service provided, the limitations of the service, and a limitation of liability. This report must be read in conjunction with our Terms of Trade. A copy will be made available upon request

Some customers will request us to provide the report, either without any commentary or with a limited commentary (on the basis that those customers will be making their own assessment of the photographs provided). Our report needs to be read in conjunction not only with our Terms of Trade but also with the instructions (particular to each report) provided by the customer.

Under no circumstances will we accept liability for the contents of this report to anyone other than the original customer. If you are not the original customer for this report, then (unless you have our specific written permission) you may not rely on its contents for any purpose.

Date	26 March 2025	Job Ref.	CLM/2011/122912
Address	427 Armagh Street, Linwood, Christchurch 8011	Author	J McCloskey
Client	Natural Hazards Commission Toka Tū Ake	Version	V1.1 Approved
		Status	Issued for Information

TR001: Technical Report – Desktop Technical Review & Structural Inspection



This Technical Report has been prepared by NZ Civil & Structural Engineers Ltd (NZCSE) at the request of its Client, Natural Hazards Commission Toka Tū Ake, in accordance with the scope of engagement provided.

This Technical Report has been prepared exclusively for the Client's use and no liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person without our prior written permission.

1. Overview

Site Summary			
Site Location	427 Armagh Street, Linwood, Christchurch 8011		
Legal Description	Flat 2 DP 303406 on Lot 4 DP 10444 having share in 1007 m2		
MBIE Technical Category	Green Zone, Technical Category 2, Yellow – Minor to moderate land damage possible		
Topography	Flat and level		
Soil Type	Dominantly alluvial sand and silt overbank deposits		
Identified HAIL Site	No	Flood Management Area	No

Building Summary			
MBIE Foundation	Dwelling: Perimeter concrete footing – Type B2; Conservatory: Slab on Grade – C2	Occupied	Yes
Walls	Heavyweight – Bricks	Levels	One
Roof	Heavyweight – Concrete Tiles	Floor Plan Area	Approx 73m ²
Age	Circa 1945	Date of Visit	29/01/2025
Peripherals	External Garage (Adjoined with garage for 425 Armagh Street)		

Background Summary	
- NZCSE has read the Engineering Letter of Engagement provided on 17/01/2025 by the Natural Hazards Commission Toka Tū Ake (formerly EQC). Information provided is summarised below. - The property was first assessed by EQC on 14/02/2011. Damage included: - Interior: Wall & ceiling linings cracks in the Kitchen/Dining room and Entry Hallway; wall lining cracks in the Lounge, Bedrooms 1 & 2, and the Bathroom; cornice cracking in the Lounge and Bedroom 1; tile grout cracking (walls) in the Kitchen & Bathroom and floor tiles in the Kitchen (1x cracked tile). The Bedroom 1 door was noted as binding and damage recorded in the Rear entry (conservatory) included 1.8m² of mortar cracking and soffit/fascia separation. - Exterior: 1.0m of mortar cracking was recorded on the East (E) elevation (plus the cracking recorded in the rear porch (above)) and plaster cracking in the front porch; 1.0m of ring foundation cracking; 15m of Roof ridge tile mortar cracking and; cracking to the chimney top plaster. - A second assessment was carried out on 23/05/2011 after the February 2011 earthquake. Additional damage recorded: - Interior: The ceiling was damaged in the Lounge & Bedrooms 1 & 2. The Bedroom 2 door was noted as binding. - Exterior: plaster cracking (top of walls) was recorded. The chimney was recorded as structurally damaged above the roof. - Emergency works (EW) involving removing the chimney top and securing the roof was undertaken on 427 Armagh Street under EQC's Emergency Works (EQ) provisions in March 2011. - The owner of 427 Armagh Street applied to opt out of the PMO repair program in early 2012. EQC's subsequent cash settlement of the claim was then based upon a customer provided Spence Consultants Ltd. quotation, paid on invoice. - It is understood the property changed hands in early 2012 and then again in 2018.	

Background Summary Continued

7. A bump in the wall in the neighbouring unit (425 Armagh Street) was raised with EQC in March 2015. This was assessed by EQC in January 2016 and concluded as not EQ-related.
8. Following unrepaired EQ damage being noted on the building's exterior during a recent site visit to discuss drainage damage, both units were reviewed by NHC at a second site visit undertaken on 18 November 2024. Dislevelment issues were recorded at the site visit and an engineering review of the building was recommended in the assessment report that followed the site visit.
9. NZ Civil & Structural Engineers Ltd (NZCSE) has subsequently been engaged by the Natural Hazards Commission Toka Tū Ake, in the capacity of independent experts, to review all relevant third-party documents, attend site and perform suitable investigations to assess the property for outstanding earthquake damage, and provide guidance on lawful repair of this damage.
10. A structural assessment, full level survey, verticality survey, and shallow geotechnical investigations were carried out by NZCSE on 29/01/2025.

2. Third Party Documentation

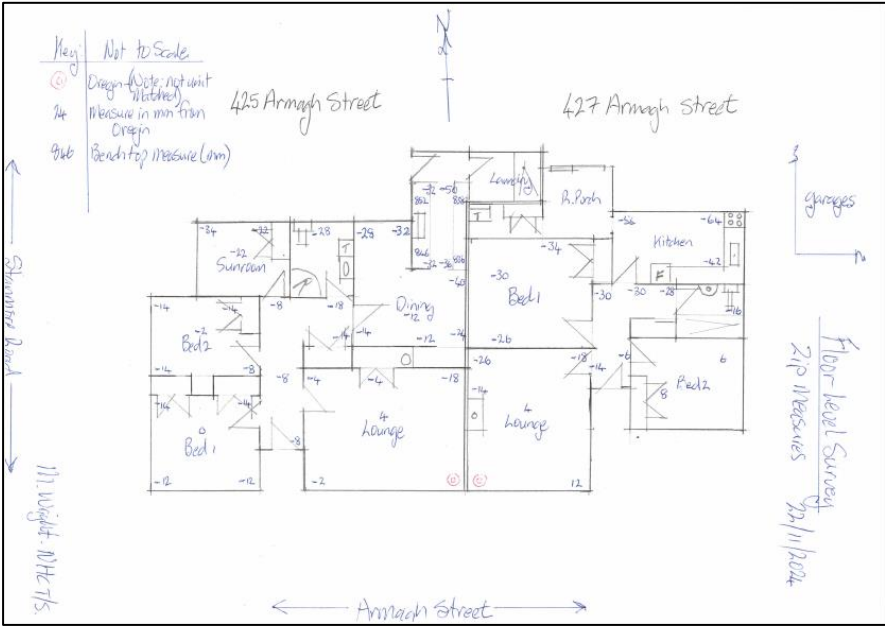
The following section provides a summary of key information gathered from third party documents, and where appropriate includes interpretation of this information by NZCSE. This commentary should be read in conjunction with the full documentation.

Date	Document Information	NZCSE Document Summary
Various	Christchurch City Council (CCC) – <i>Property Files</i>	There are no documents on file for the construction of the dwelling or garage. The property files contain the following relevant information: • 1977: Building Permit, plans, and specifications on file to enclose carport to form a garage (second garage adjoined to original). • 1978: Building Permit and drawings on file to erect concrete block wall fence. • 1987: Building Permit, plans, and specifications on file to construct fire wall between the two flats. • 1988: Building Permit to construct a Conservatory on 427 Armagh Street • 2001: Subdivision application. • 2011: Rapid EQ Assessment Form Level 1 lists: No Damage. <u>NZCSE Comments:</u> • The building has existed since the late 1940's according to the historic aerial imagery. No property file records relating to the origin construction found on the council files. The property file records indicate the concrete partition wall was constructed to ceiling level when the building was first constructed but was extended to the roofline in 1987. A block wall extension to this wall was also added along the north elevation at this time to form a complaint firebreak between the two units,
20/12/2010	Homeowner Photos	Photos on file show EQ damage as submitted by the homeowner at this time. <u>NZCSE Comments:</u>

Date	Document Information	NZCSE Document Summary
		These photos were taken prior to the February 2011 earthquake. The photos show minimal interior cosmetic damage. The chimney has vertical crack running through the stack and some external veneer cracking is evident.
14/02/2011	EQC – File Note / Statement of Claim Checklist / Scope of Works / Sketch CLM/2010 /011835	The File Note contains the following relevant information. Damage Description - Land - No Claim - Dwelling - Minor damage to dwelling interior & exterior - Chimney Damaged - Minor cosmetic damage to plaster finish. The Statement of Claim Checklist contains the following repair strategy. - Lounge - Wall crack – 0.30m - Rake out stop paint. - Cornice mitre crack – 0.10m - Gap fill, paint scotia - Dining Room - Tile grout crack – 2.00m - Rake out grout, seal with silicon - Wall crack – 5.00m - Rake out, stop, paint - Ceiling crack – 1.00m - Rake out, stop, paint. - Kitchen - Broken tile – 0.60m² - Replace tiles - Front Porch - Plaster cracking – 5.00m - Grind out, plaster re finish stucco, paint - Bedroom 1 - Door sticking - Remove door, ease, paint, re hang. - Scotia separation – 0.10m - Gap fill, paint - Bedroom 2 - Wall crack – 1.00m - Rake out, stop, paint - Bathroom - Wall crack – 1.00m - Rake out, stop, paint - Bath tile grout cracks – 0.60m² - Re grout. - Entry / Hall(s) - Wall crack – 1.00m - Rake out, stop, paint - Ceiling crack – 0.80m

Date	Document Information	NZCSE Document Summary
		▪ Rake out, stop, paint • Rear Entry ○ Brickwork cracking – 1.80m² ▪ Rake out, re point brickwork, paint bricks ○ Conservatory fascia separation – 2.00m ▪ Seal with silicone ○ Timber frame plaster separation – 2.00m ▪ Gap fill, paint • Roof ○ Broken tiles (3) ▪ Replace ○ Ridge capping 15.00m ▪ Rebed capping. • External Walls – East ○ Brickwork cracking – 1.00m ▪ Grind out mortar re point brickwork • Chimney ○ Chimney cracked – above roof. Minor crack 0.6 to plaster – chimney is sound. ▪ Replaster crack • Foundations ○ Crack – plaster finish foundation – 0.20m ▪ Grind out crack, plaster. • Supplementary Notes: ○ Primary heat source – heat pump in lounge. <u>NZCSE Comments:</u> • The scope predates February 2011 earthquake. • Minor levels of damage were recorded. • Bedroom doors were reportedly sticking in the centre of the dwelling where steep slopes have recently been measured. These doors were proposed to be eased and repainted. • No foundation releveling works were proposed at this time.
15/03/2011	Homeowner – Emergency Works Documents	A letter, photos, and invoice on file show the homeowner arranged to have emergency repairs to the chimney completed after damage caused by the 22 February 2011 earthquake.
23/05/2011	EQC – Inspection File Note / Scope of Works / Sketch CLM/2011/122912	The File Note contains the following relevant information. Damage Description • Land ○ No visible damage and none claimed/reported • Dwelling ○ Minor cracks to brickwork and concrete skirt on exterior and minor, cosmetic wall/ceiling cracks (and a little separation around some door/window frames) in most rooms. ○ The decommissioned chimney was brought down (after 22 Feb event) & roof made weather proof.

Date	Document Information	NZCSE Document Summary
		• Was a full inspection done? ○ Inspected: ▪ All rooms ▪ All accessible external surfaces ▪ In roof (not on roof: conc tiles too steep) ▪ Sub-floor space The Statement of Claim Checklist contains the following repair strategy. • Lounge ○ Rake, stop & paint walls (18.0 x 2.7) and ceiling (5.0 x 4.0) • Kitchen ○ Rake, stop & paint walls (13.8 x 2.7) ○ Rake, stop & paint ceiling (4.5 x 2.4) ○ Tiles separations (corner) 4.0 Hrs ○ Replace 1.0m floor tiles • Bedroom 1 ○ Rake, stop & paint walls (7.8 x 2.7) and ceiling (4.1 x 2.3) ○ Ease door • Conservatory ○ Paint only 3 walls (7.6 x 2.4) • Bedroom 2 ○ Rake, stop & paint walls (7.6 x 2.7) and ceiling (3.8 x 3.0) ○ Ease door • Bathroom ○ Fill & paint (8.2 x 2.7) walls only • Entry / Hall(s) ○ Rake, stop & paint walls (12.8 x 2.7) and ceiling (7.7m²) • Entry Main Door ○ Fill & paint 3 walls (4.0 x 2.4) • Roof ○ Replaster ridge cap (2.0 L/M) ○ Inspected roof cavity • External Walls ○ North ▪ Cracking to stucco: grind out, fill, restucco & paint (2.2m²) ▪ Blockwork cracking: grind out & remortar (0.4 L/M – 3 hrs) ▪ Replace 2 bricks (2 hrs) ○ South ▪ Cracking to stucco: grind out, fill, restucco & paint (2.3m²) ○ East ▪ Cracking to stucco: grind out, fill, restucco & paint (1.5m²) ▪ Replace 1 brick (2 hrs) ▪ Wall cracks: grind out crack & remortar (1.0 L/M – 4 hrs) ○ West ▪ Intertenancy/common wall • Chimney ○ Replace above roof (0.5 x 0.6 x 1.5) • Foundations ○ Replaster 2.8m² on skirt • Services ○ Claimant is having plumber examine sewers outlet – intermittent backflow

Date	Document Information	NZCSE Document Summary
06/09/2011	EQC – Land Inspection Photos	The annotated aerial photo notes “Paver undulations >10mm” between the conservatory and the garages. Photos recorded show the precast concrete beams above the veneer panels have separated due to wall settlement.
2012	Opt-Out & Cash Settlement Documents CLM/2011/122912	12/01/2012: Signed forms for the homeowner to opt out of the CHRP repairs programme. 16/01/2012: Quotation for \$18,000 including GST from Spence Consultants Ltd: <i>Based on EQC Scope dated 23 May 2011.</i> 30/03/2012: Invoice for \$16,100 Inc GST from Spence Consultants Ltd. A letter on file from EQC shows this was cash settled to the homeowner in July 2012.
22/11/2024	Natural Hazards Commission Toka Tū Ake – Floor Levels	A site inspection was carried out at the property, and floor levels were taken across both units (425 & 427 Armagh Street). 
04/12/2024	Natural Hazards Commission Toka Tū Ake – Assessment Report	A site visit was conducted to assess the dwelling after exterior damage was noted during a recent visit to discuss drainage damage with the drainlayer. Conclusions:

Date	Document Information	NZCSE Document Summary
		- Floor dislevelment across the home exceeds MBIE guidance tolerances both on a global and localised basis and as the cause of the global tilt is not clear, this dislevelment should be assessed by an appropriately qualified engineer. - Drainage issues on the property remain unresolved at the time of this report. <u>NZCSE Comments:</u> - NZCSE has been engaged based on the outcome of this report.
12/02/2025	Cavity Critter – Underfloor Inspection Report	See notes under Section 3.2 <i>Foundations</i> below for further information. A full copy of this report has been attached in Appendix E.

3. Observations & Findings

The following section presents an overview of structural observations and findings noted during the recent engineering inspection performed by NZCSE. Photographs and drawings that are referenced within the body of this report are provided in Appendix A & B respectively.

3.1. General

4. The subject property is part of a multi-unit building comprising two units, addressed as 425 and 427 Armagh street. Property file records show the existing partition wall was extended to roofline from ceiling height between 425 and 427 Armagh street in 1987. The wall was also extended to form a divide between the laundry areas of both dwellings along the north elevation.
 - The scope of NZCSE's engagement includes both adjoining units. Whilst the focus of this report is 427 Armagh Street, consideration has been provided of the overall structure and holistic performance. A separate report relating to 425 Armagh Street has also been provided to our client.
- Property layout and local features (Photo Set 1):
 - For ease of reference, the elevation facing Armagh street is referred to as the south elevation.
 - The following information has been obtained from review of aerial imagery:
 - 1940-1944 is the earliest available aerial imagery of the property, shows the original property.
 - 1945-1949 aerial imagery shows the new dwelling and original garage.
 - 1960-1964 aerial imagery shows the carport against the garage.
 - 1980-1984 aerial imagery shows the second garage (carport permitted to be enclosed in 1978).
- For external views of the dwelling, refer to Photo Set 2.
- Homeowner information:
 - The current owner purchased the property circa 2018, after the Canterbury Earthquake Sequence (CES) and after the 2011 earthquake repairs were completed. The property has been tenanted ever since.
 - Based on our conversation with the homeowner and the Natural Hazards Commission Toka Tū Ake engineering letter of engagement, we understand that the homeowner's concerns relate primarily to the following:
 - Possible earthquake damage to the drainage and whether the foundation settlement and floor slopes across the dwelling have been caused by earthquake settlement from the 2011 earthquakes.
 - The homeowner informed us of the following private renovations and internal alterations carried out since purchasing the property in 2013:
 - The roof gutters for both 425 and 427 Armagh Street were replaced in the past year.
 - No structural alterations have been carried out to the dwelling and garage since taking ownership of the property in 2018.
- The scope of our engagement is to review the original earthquake assessments and subsequent repairs that were carried out to the multi-unit building and provide recommendations on any potential remediation required and whether any further repairs are required to address outstanding earthquake related damage.

3.2 Foundations – (refer to SK4 Foundation Plan for subfloor layout)

- Foundations of the multi-unit building are categorised as Type B2 (timber-framed superstructure with heavyweight cladding supported by concrete perimeter foundation wall and internal piles) in accordance with Table 2.1 of MBIE Guidance Document (Photo Set 3).
 - A perimeter foundation excavation was carried out along the west elevation of 425 Armagh Street that shares the same foundation construction as 427 Armagh Street. The embedment depth was found to be embedded approximately 350mm below ground level (BGL) (Photo 3A).

- According to the NZCSE shallow geotechnical testing carried out on site, the perimeter foundations are embedded within the weaker organic topsoil layer where long term foundation settlement is expected to occur.
- The configuration of the dwelling construction shows the subfloor bearers run from north to south in the same direction as the internal heavyweight partition wall between the two dwellings.
- The perimeter foundation was scanned for reinforcing using a Hilti PS50 Multidetector which did not confirm the presence of steel reinforcing. Given the age of construction and absence of cracks, it is likely that the foundation does contain some reinforcing steel, refer to Photo 3D.
 - The *Cavity Critter* report shows the internal face of the perimeter wall and partition wall is in reasonable condition with only a few minor cracks identified. It should be noted that the northeast perimeter foundation section was unable to be accessed due to obstructions within the subfloor.
 - Most of the foundation cracks identified on the exterior were found along the south and east perimeter foundation. We note that the perimeter foundation cracks have not been previously repaired or infilled as shown in Photo Set 3. However, the post-earthquake scopes allowed for 2.8m² of perimeter foundation plaster repairs.
- Externally, NZCSE has observed several cracks to the perimeter foundation of 427 Armagh Street along the southeast and eastern elevation coinciding with the floor falling from south to north along the eastern elevation.
- Based upon the contents of the *Cavity Critter Underfloor Inspection Report*, the following observations have been made (Refer to SK4 Foundation Plan):
 - 427 Armagh Street is supported by a perimeter concrete foundation with a suspended timber floor supported on 47x precast concrete piles. Most of the internal piles have a damp-proof membrane (DPM) of varying thicknesses and have no structural fixings between the pile and bearer. None of the piles appear to have been packed and none of the bearers appear to have been notched in the past.
 - The bearer ends are supported on the perimeter foundation wall.
 - The subfloor report shows areas of broken concrete roof tiles spread across the subfloor between the piles, likely remaining from the when the multi-unit building was constructed.
 - Access to the northeast corner of the subfloor below the kitchen area was restricted due to stacked subfloor insulation and building waste material.

3.3 Floors & Fixtures

- A level survey was undertaken throughout the multi-unit building using a Zip Level Pro2000 (Refer to SK1 Floor Levels and SK2 Contours Plan):
 - A total floor height variation of 64mm was measured across the 427 Armagh Street footprint with numerous slopes exceeding 0.5% (1 in 200).
 - The following notable slope trends were observed across the floor plan:
 - The floor exhibits an overall trend of falling from south to north with the lowest point located in the northeast corner of the kitchen.
 - Additionally, the partition wall was found to fall from south to north and the floor slopes across the lounge and bedroom 1 were recorded to fall towards the partition wall, as illustrated on SK2.

The following information was noted during NZCSE's internal assessment, refer to relevant photo sets in Appendix A:

- **Lounge**
 - The heavyweight partition wall that divides 425 and 427 Armagh Street forms the western wall in the lounge. The floor levels across the lounge fall from south to north with the steepest slopes present in the northwest corner of the room found to fall towards the partition wall.

- The slopes across the floor are mirrored by the ceilings. We understand that no wall or ceiling linings have been replaced in this room since the earthquakes, however cracking damage to the ceilings and walls was noted in the post-earthquake scopes.
- No damage to the functionality of the windows or doors in this room was recorded in the post-earthquake scopes. We noted the presence of lining creasing damage above the door which is indicative of differential settlement across the door opening (photo 4E) The floors across the door opening vary by 10mm on the inside of the room.
- The chimney is located alongside the partition wall and according to the council record, the partition wall was retrofitted circa 1987 after the chimney was constructed. It is unclear if the chimney is connected to the partition wall. It is important to note that the subfloor images taken in this area of the dwelling are obscured by the sagging insulation and debris present within the subfloor.
- We understand that the chimney was constructed with reinforced concrete and was removed to below the roofline after the earthquakes. The structure below the ceiling height was deemed to be safe. NZCSE did not see any signs of wall lining damage either side of the chimney to indicate ongoing movement of the remaining chimney structure has occurred since the work was carried out.
- **Bedroom 1**
 - The floor across this room has settled differentially with a high point in the centre room and the steepest slopes present in the northwest corner. Overall, the floors fall to the north and towards the partition wall that forms the western wall of the room.
 - The original EQC scope allowed for crack repairs to the wall and for the door to be removed, eased, painted and rehung. The door head level falls north by 4mm across the opening while the corresponding floor falls by 8mm to the north.
 - Levels recorded across the fitted wardrobe indicate that the wardrobe is tilting in the same direction as the floor. The doors were slightly racked in the framing and the doors are rubbing against the framing when fully closed. The floor is falling to the north across the opening.
 - The window between the bedroom 1 and the laundry is painted shut and were unable to be opened.
- **Bedroom 2**
 - The floor across this room is reasonably level with an overall floor level variance of 18mm, falling towards the north. The door head and windowsills were found to be level.
 - The post February 2011 EQC scope allowed for the door to be eased, however the door head is level and the floor level variance across the door is minor. The door frame is tilting to the north, so it is possible that the door framing was slightly racked which meant the door required easing.
- **Hallway, Bathroom and Kitchen (photo sets 3&4)**
 - The floor and ceiling across the hallway and bathroom follow the overall slope trend of the dwelling and fall towards the north. The bathroom door head falls in the same direction as the floor towards the north.
 - The bathtub and floor levels in the east-west direction are approximately level
 - Post earthquake repair to the bathroom and hallway involved filling the lining cracks and repainting. No wall or ceiling lining required replacement.
 - The floor level across the kitchen falls relatively uniformly from south to north as illustrated by the contours on SK2.
 - The kitchen benchtop was found to mirror the floor and ceiling slopes.
 - Brick cladding cracking and separations were identified along the concrete beams that are seated on top of the veneer along the eastern elevation (Photos 3E and 3F). This damage was noted in the post-earthquake scopes and EQC land assessment. It appears that some of these repairs were carried out, however several of the separations along the top of the wall remain unrepaired.

- **Laundry and porch**

- The porch is founded on a concrete slab-on-grade and is a step down from the kitchen and laundry floor level. The slab was scanned using a Hilti PS50 Multidetector and no reinforcing was detected. Photo 4D shows minor separations between the concrete lintel and the soffit framing.
- The partition wall dividing the two dwellings forms the west and north wall of the laundry. The post-earthquake scopes allowed for mortar crack repairs to the blockwork and for the wall to be repainted which suggests some differential settlement occurred along this wall during the CES. No cracks were identified along the visible area of wall during the NZCSE assessment.

3.4 Walls

- The walls of both dwellings are timber-framed and clad externally with a heavyweight red brick veneer cladding. The partition wall (extended above ceiling height circa 1987) is constructed from reinforced concrete and masonry extending from the floor to the underside of the roof.
 - During the NZCSE site inspection, some mortar cracking was identified along the east elevation of 427 Armagh Street outside the kitchen.
- The property file records suggest the partition wall between the two units comprises reinforced masonry blocks with reinforced bond beams at the ceiling and roof line level. Most of the intertenancy partition wall below ceiling level was unable to be inspected for internal cracking damage due to the wall being lined with plasterboard. No damage to the wall above the ceiling level was visible within the roof space.
 - The EQC post-earthquake scope noted cracking damage to the partition wall with a repair and repaint allowed for in the cash settlement provided.
- The walls are lined internally with plasterboard. It is understood that primarily cosmetic repairs were carried out as part of earthquake managed repairs. The following internal wall observations were made during the NZCSE site inspection:
 - Minor wall lining cracks was identified above the lounge door indicating some settlement has occurred in this area.
 - The partition wall was scanned using a rebar scanner and reinforcing was detected.
- A verticality check was undertaken in order to determine the incline of walls and other vertical elements, using a Bosch DNM 120 L Professional digital spirit level (refer to SK3 Verticalities Plan):
 - Overall, the internal walls and door frames were found to tilt in the general direction of the foundation slopes to the north and towards the partition wall.

3.5 Roof (Photo Set 6)

- A limited visual inspection of the internal roof space and the partition wall above ceiling height was carried out as part of the NZCSE site assessment. The following was noted :
 - The concrete tiles are supported by tile battens spanning across rafters connected to a ridge board. The tiles are secured to the battens and rafters using wire ties. The rafters are supported by under purlins with timber struts, and the ridge board is supported by timber props. The under purlins are further supported by props fixed back to the top of the internal walls running through the centre of the dwelling.
 - The roof plane appears to be sagging when viewed externally. This is assessed to be primarily due to a lack of internal support. It is common to observe undulations across the roof plane in dwellings of this construction era, especially where heavyweight concrete roof tiles have been used as cladding. To rectify this issue, it is recommended that additional struts are installed at the ends of the under purlins to reduce the undulations and provide additional structural support.
 - The partition wall was viewed from inside of the roof space, and no step cracking was identified. It was noted that the wall above the ceiling line is constructed using a combination of poured in-

situ concrete and masonry concrete blocks. No cracking was identified on the wall when viewed from the internal roof access.

- An unrestrained concrete header tank was identified in the roof space. We recommend this is restrained or removed if it is no longer in use.
- The internal ceilings are lined with plasterboard. It is understood that only cosmetic repairs were originally required as part of earthquake-managed repairs, with no localised lining replacement deemed necessary following the CES.
- The owners informed us that the external gutters have been fully replaced within the past year across both dwellings at 425 and 427 Armagh Street.

3.6 Garage (Photo Set 7)

- The garage for 427 Armagh Street is the lean-to structure on the right-hand side of the original garage building. It was originally a carport and was enclosed in 1978 to form an adjoined garage space. We understand the concrete slab was initially part of the driveway paving.
- The garage walls are timber-framed with cement sheet cladding, and the roof is covered with lightweight corrugated iron cladding. The garage is currently being used for storage, and the slab is partially covered linoleum.
- A level survey was undertaken throughout both garages using a Zip Level Pro2000 (refer to SK1 Floor Levels and SK2 Contours Plan):
 - A total floor height variation of 108 mm was measured across the footprint of the 425 Armagh Street garage, with slopes exceeding 0.5% (1 in 200).
 - The concrete slab falls from the northeast corner to the southwest corner, towards the vehicular door.
 - The garage door head was measured to be level across a 58 mm slab fall. The vehicle tilting doors are functional. Verticality measurements show the wall framing generally follows the floor slopes.
 - No damage was noted to the garage during the post-earthquake assessments.
 - There is no evidence to suggest that the 2011 earthquakes have had a material impact on the garage structure. No repairs are deemed necessary.

4. Shallow Geotechnical Investigations

4.1. General

The following section provides an overview of the geotechnical investigation and is based upon a site walkover, shallow soil investigations and a desktop review of the New Zealand Geotechnical Database (NZGD).

- The location of test sites and results of hand auger & Scala penetrometer investigations are provided in Appendix D.
- Soil classification has been carried out in line with 'Field Descriptions of Soils and Rocks' by NZ Geotechnical Society Dec 2005, and Scala penetrometer testing performed in accordance with NZS 4402 Test 6.5.2:1988 – Determination of the Penetration Resistance of a Soil.

4.2. Desktop Study

A desktop study of information available on the NZGD was undertaken on 10/03/2025 and recorded the following:

- Moderate to severe liquefaction on and immediately surrounding the property following the 22 February 2011, event was interpreted from aerial photography. Minor liquefaction was observed surrounding the property following the June 2011 Event. The property was not mapped following the 4 September 2010 event.
- No ground crack locations have been mapped on the site or on the adjacent properties.
- Information from the Property Summary Report, based on Lidar survey data, indicates that the property has undergone a mean cumulative elevation change of -0.22m as a result of the CES. A portion of this movement is indicated to be tectonic (-0.18m).

4.3. Site Walkover Assessment

A site walkover assessment was conducted on 29/01/2025.

- At the time of inspection, the property showed some evidence of land damage attributable to the effects of liquefaction/liquefaction ejecta:
 - Cracking and settlement of the concrete pavement at the front of the property was observed. This damaged was noted in the EQC land damage team, therefore it is assessed to have been made worse by the 2011 earthquakes.

4.4. Shallow Investigations

Subsurface testing completed on 29/01/2025 comprised:

- Two hand augers (HA) to a maximum depth of 2.5m below ground level (BGL) with engineering geological logging of materials recovered, and;
- Two Scala penetrometer tests to a maximum depth of 2.6m BGL to assess soil bearing capacity.

4.5. Sub Surface Conditions

Inferred subsoil conditions from combined investigations:

- HA 01 is situated along the east elevation of 427 Armagh Street, in front of the garages. The soil profile consists of a 0.4m thick layer of topsoil over silt and sand to the full depth of investigations (2.5m BGL). The HA was discontinued at 2.5m BGL due difficult retrieval (vacuum pressure). Ground water was encountered at 1.7m below ground.
- SC 01 indicates that Ultimate Bearing Capacity (UBC) of 200kPa and 300kPa is consistently achieved from below the topsoil layer and at 1.1 m BGL respectively.
- HA 02 is located in the garden adjacent to the west elevation of 425 Armagh Street. The soil profile consists of a 0.5m thick layer of topsoil over varying quantities of interspersed silt with sand to the full depth of

investigations (2.5m BGL). The hand auger was discontinued at 2.5m BGL due to inferred gravels. Ground water was encountered at 2.2m below ground.

- SC 02 indicates that Ultimate Bearing Capacity (UBC) of 200kPa and 300kPa is consistently achieved from below the topsoil layer and at 1.1 m BGL respectively.

4.6. Ground Water Regime

The groundwater table was estimated based on results of HA investigations and data available on the New Zealand Geotechnical Database. Based upon information from the well logs reviewed, the water table in this region is indicated to exist at approximately 1.0m-2.5m below ground level and is subject to change as a result of seasonal variation.

5. Conclusions & Recommendations

5.1. Assessment of Damage

Key findings of the engineering assessment are as follows:

- The subject property is part of a multi-unit building comprising two adjoining units, referred to as 425 and 427 Armagh Street. The focus of this report is on 427 Armagh Street. However, in accordance with industry guidance and best practices (i.e., Part E of the MBIE Guidance Document), due consideration has also been given to the adjoining unit at 425 Armagh Street, and the overall structure has been assessed holistically.
- Structural survey measurements, including levels and wall verticality, have been taken across floors, window frames, doorways, and ceilings, and have been analysed for indicators of structural damage. A total floor height variance of 64 mm has been recorded across the floors of 427 Armagh Street. The floors slope towards the north elevation and towards the heavyweight partition wall. Mortar cracking damage was noted along this wall in the post-earthquake scope, including damage to the adjacent wall lining, which indicates that the wall has settled to a degree during the CES.
- Mortar crack repairs have been undertaken along the eastern elevation of the dwelling, however cracks to the perimeter foundation have not been repaired.
- Moderate to severe liquefaction was observed around the property following the February 2011 event, including earthquake-related land damage at the front of the property, as noted by the EQC land team. This suggests there has likely been liquefaction that has caused some settlement of the foundation systems across both dwellings at 425 and 427 Armagh Street.
- The heavyweight partition wall has settled and caused the floors in both dwellings to slope inward toward the wall, as illustrated on the contour plan SK2. We also note the post-earthquake EQC land assessment photos dated September 2011, recorded undulations in the pavement alongside the eastern elevation and damage to the eastern wall where the foundations have settled.
- It is probable that the foundations have settled to an extent prior to the CES. We would expect to see greater levels of structural damage to the internal linings and external cladding if all of the settlement measured across the footprint was caused by the 2011 earthquakes.
- Based on a review of third-party documents, site observations, structural survey measurements, and discussions with the owners and tenants, we believe the dwelling has experienced a material change due to settlement damage caused by the Canterbury earthquake sequence. To address this settlement, a partial foundation lift is considered necessary to repair the effects of the Canterbury earthquakes.
- Proposed repair works are listed in Section 5.2 below.

Garages:

- We note the settlement across the adjacent garage structures is deemed to have existed prior to the CES and no damage was recorded to the structure following the earthquakes to suggest the settlement has been materially worsened by the earthquakes.
- No repairs are required for the external garage.

5.2. Repair of Damage – Refer to Appendix C – SK5 Conceptual Repair Plan

The following repairs are proposed to remediate earthquake managed repairs and address outstanding earthquake related damage to 427 Armagh Street (half of the multi-unit building.) The following repairs to 427 Armagh Street should be carried out in conjunction with the repairs for 425 Armagh Street due to the shared partition wall, external brick veneer, and roof structure.

- Relevel the perimeter foundation wall and intertenancy wall footing using portable jacks in accordance with Lifting Option 1, Appendix A1.1 of the MBIE guidance document. Refer to SK5 with proposed lifting

point locations at 1.5m centres. Depth to bearing for the underpin dunnage is to be 800mm below ground level. The dimension of the underpin pads is to be 600mm square.

- The internal floor area can be lifted by packing between the internal piles and the subfloor bearers to the required height. Install 12kN bearer end fixings above the piles that are to be packed. An estimated 36x internal piles will require packing in conjunction with foundation lift. Recommended lift heights are noted on SK5.
- Allow to remove the remainder of the defunct chimney down to ground level, similar to the works carried out in the neighbouring 425 Armagh Street.
- Given the extent of the proposed lift, we recommend that allowance be made for a suitably qualified geotechnical engineer to be engaged to carry out the geotechnical construction monitoring during the works and to confirm the bearing depth and size of the underpin excavations.
- Allow to grind out, clean, and fully fill internal perimeter foundation cracks. 7x perimeter foundation cracks along the north, west, and south perimeter walls.
- Repair outstanding damage to the roof tiles and roof framing after the lift.
- We also recommend the owners install additional timber struts to support underpurlins in the roof space to reduce the sag of the framing. This repair is to address deficiencies in the original construction as opposed to earthquake related damage.

5.3. Expected Consequential Damage

- Removal of adjacent concrete paving and vegetation around the perimeter of the building to facilitate releveling works.
- During the lift, some internal lining damage is expected to occur along with functionality issues of fixtures, which should be addressed accordingly following releveling work.
- Allow to remove the mass concrete slab in the porch and to allow access to underpin the foundation. Reconstruct the slab when the foundation releveling is completed.

5.4. Compliance

- It is our understanding that repair work at the property, as outlined above, may be categorised as building work requiring a building consent. It may be possible for this work to be performed as exempt building work under Schedule 1 (2) of the Building Act 2004, however this will be at the discretion of the local building consent authority.

6. Appended Documents

The following documents are appended to this report:

Appendix A: Relevant Site Photographs

Appendix B: Structural Survey Drawings

Appendix C: Conceptual Repair Plan

Appendix D: Shallow Geotechnical Investigations

Appendix E: Relevant Third-Party Documents

Appendix F: Cavity Critter Subfloor Report

Inspected & Prepared By:



JOHN MCCLOSKEY

Senior Structural Engineer

BEng (Hons) Engineering, CPEng 1024064,
CENG MIEI

7. Limitations

This report and documentation have been prepared by NZCSE at the request of its client and are exclusively for the client's use. No responsibility or liability to any third party is accepted by NZCSE for any loss or damage whatsoever arising out of the use of or reliance on this report by any third party.

No structural analysis has been carried out to assess the strength of the buildings and/or structures or to determine whether or not they comply with the current and/or any previous Building Code. NZCSE has not made any assessment of structural stability or building safety in connection with any future earthquake events.

This report and documentation are limited by the restricted ability to carry out inspections. This report and documentation does not comment on structural damage that is not reasonably noted through visual inspection, including any structural damage that is in inaccessible places or has occurred latently.

NZCSE has assumed that any and all documentation and information provided by the client and/or any third party relating to the buildings and/or structures is accurate and reliable. This documentation and information includes but is not limited to Council records, plans, details, and geotechnical information. No responsibility or liability is accepted by NZCSE for any loss or damage whatsoever stemming from inaccuracies in any and all documentation and information provided by the client and/or any third party.

As outlined in the scope of work, NZCSE has been engaged by the client to carry out an assessment and provide conclusions and recommendations relating to the observed structural damage to the relevant buildings and/or structures. Although some observations and comments may relate to non-structural elements, these comments should be read only in the context of adding completeness to this process. Recommendations provided by NZCSE are limited to those that relate specifically to the New Zealand Building Code Clause 'B1 Structure'. It is recommended that all non-structural elements that are governed by the New Zealand Building Code and Acceptable Solutions/Verification Methods, including but not limited to geotechnical considerations, 'B2 Durability' and 'E2 External Moisture', are to have direct involvement from the appropriate consultants, professionals and industry experts. No responsibility or liability is accepted by NZCSE for any loss or damage whatsoever stemming from non-structural related issues.

Without limiting any of the above, NZCSE'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.



Appendix A

Relevant Site Photographs

Photo Set 1: Property Layout and Local Features.



Photo 1A – Screenshot of latest aerial imagery from canterburymaps.govt.nz showing property layout and simplified cardinal directions.



Photo 1B – 1940-1944 earliest available aerial imagery of the property, showing the original property (now 3 titles).

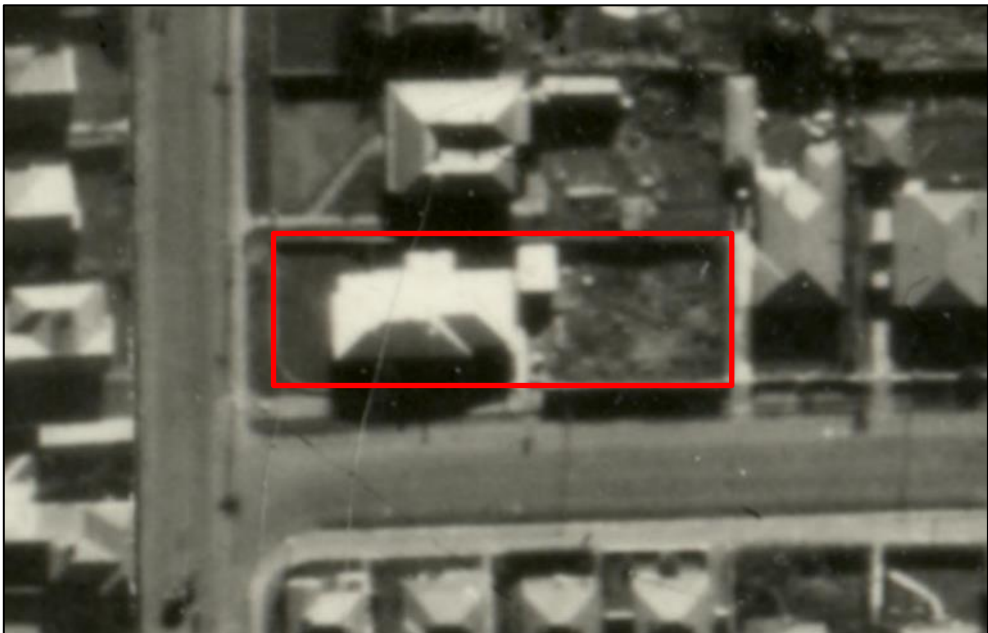


Photo 1C – 1945-1949 aerial imagery shows the new dwelling and original garage.

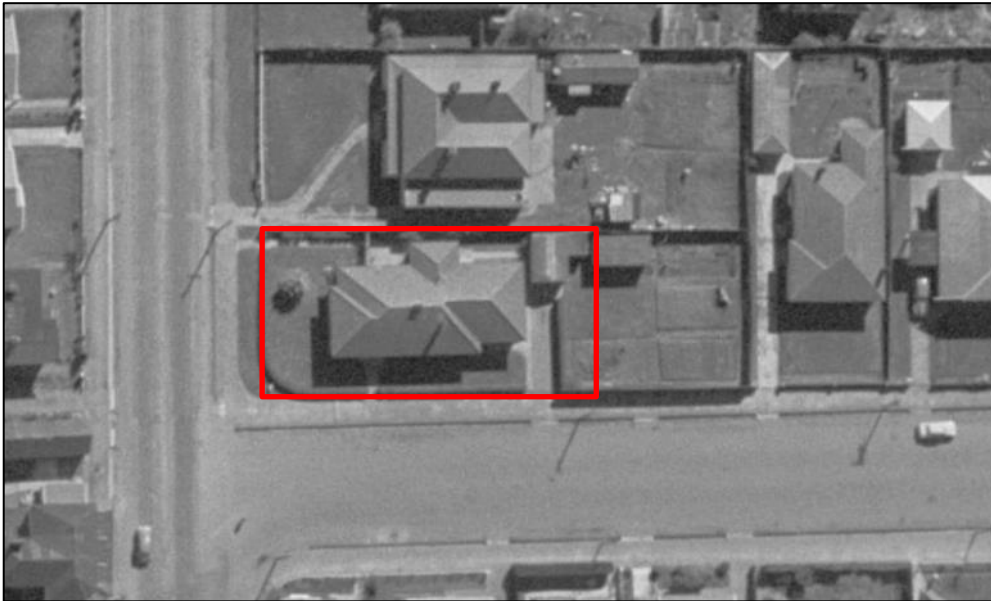


Photo 1D – 1960-1964 aerial imagery shows the carport against the garage.



Photo 1E – 1980-1984 aerial imagery shows the second garage (carport permitted to be enclosed in 1978).



Photo 1F – 2010-2014 first (clear) aerial imagery of the conservatory at 427 Armagh Street.



Photo 1G – 2015-2019 aerial imagery shows the chimney has been removed down to roof level.

Photo Set 2: External Elevations.



Photo 2A – South elevation (street facing).



Photo 2B – East elevation.



Photo 2C – Northeast elevation.

Photo Set 3: Foundations.



Photo 3A –350mm Perimeter Foundation embedment depth along the west elevation.



Photo 3B – Foundation crack at vent along the east elevation.



Photo 3C – Plaster and foundation cracks along the north elevation



Photo 3D – No reinforcing was detected in the perimeter foundation wall.



Photo 3E – Separation of the concrete beam above the cladding panel and cracking through the top brick. New mortar suggest recent cladding settlement cracks repairs along the east elevation.



Photo 3F –Separation at the corner joints of the precast concrete beam above the veneer panels at the exterior north east corner of the kitchen.

Photo Set 4: Floors & Fixtures.



Photo 4A –Kitchen floors , ceilings and built in benchtops all fall to the north.



Photo 4B Kitchen bench along the eastern wall falling to the north by 9mm/m , following the floor and ceilings.



Photo 4C – Porch area used as storage.



Photo 4D –Minor separation between the timber trim and the concrete lintel above the porch.



Photo 4E –Minor wall lining damage above the lounge door indication of foundation settlement and racking of the internal wall framing.

Photo Set 6: Roof Observations.



Photo 6A – Unrestrained Concrete water tank in the roof space .



Photo 6B – Partition wall is partly constructed from poured in situ concrete above the ceiling line. Concrete pour joins (cold joins) can be seen.



Photo 6C – Roof plane sagging towards the middle due to inadequate roof framing underpurlin support .



Photo 6D – Newer masonry block wall (Partition wall extension) above the Laundry extending to the rooftiles constructed circa 1987.

Photo Set 7: Garage Observations



Photo 7A – South elevation of adjoining garages.



Photo 7B – Garage was full of storage at the time of the assessment. Door head was measured to be level over sloping concrete slab.



Photo 7C –Garage east elevation . Cladding is undamaged,. No stormwater guttering has been fitted.



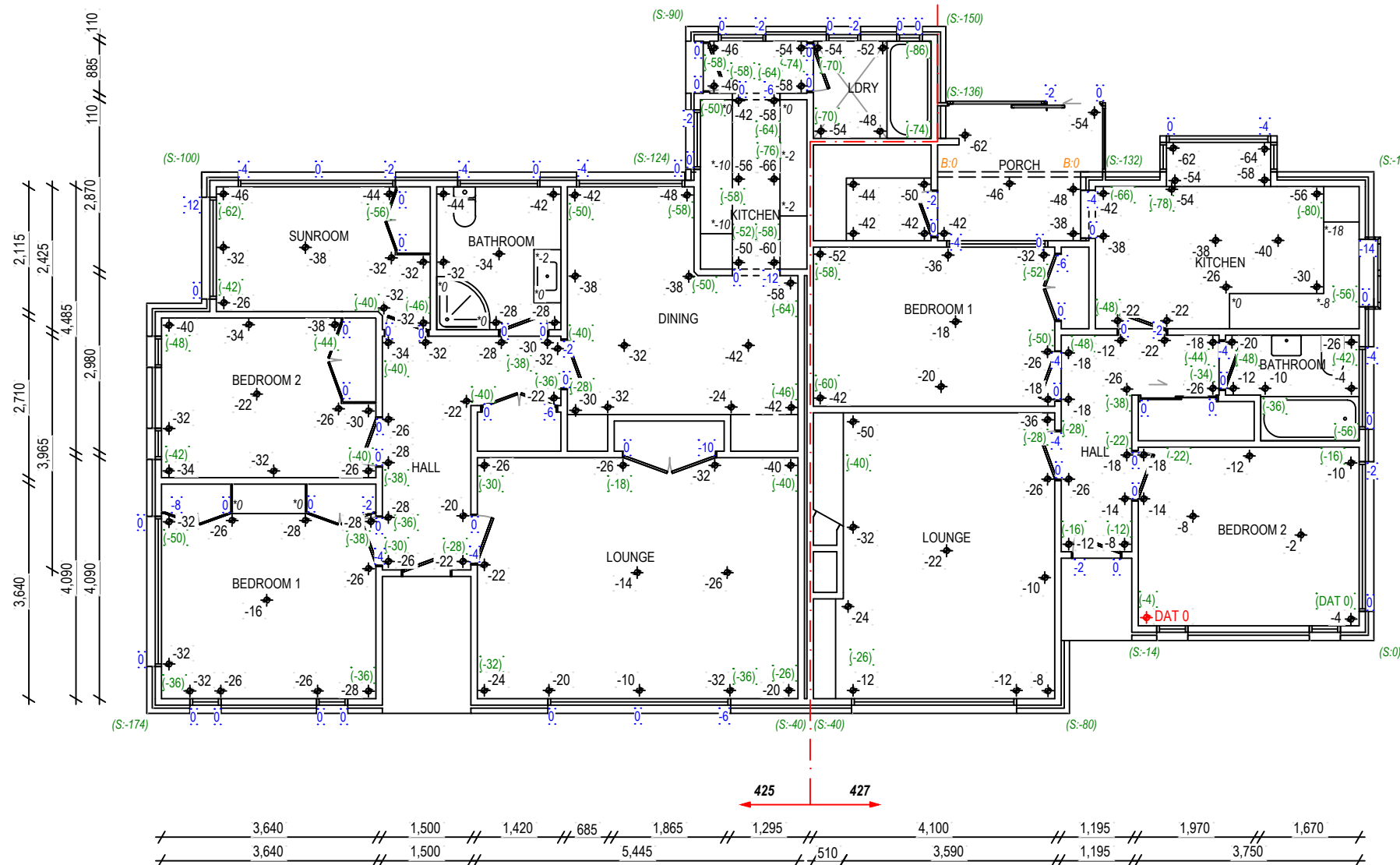
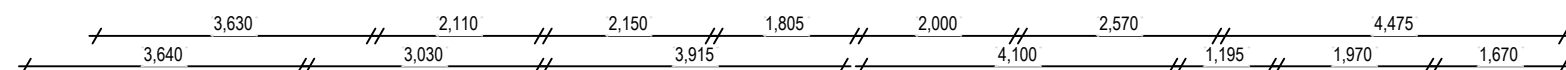
Photo 7D – North Elevation. Cladding sheet need to be refixed.



Appendix B

Structural Survey Drawings

SHEET	DESCRIPTION	SCALE	VERSION
SK1	FLOOR LEVELS	1:100 / A3	1
SK2	CONTOURS PLAN	1:100 / A3	1
SK3	VERTICALITIES PLAN	1:100 / A3	1
SK4	SUBFLOOR PLAN	1:100 / A3	1

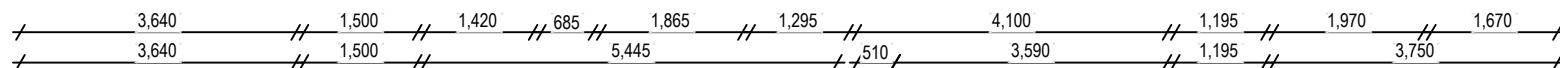
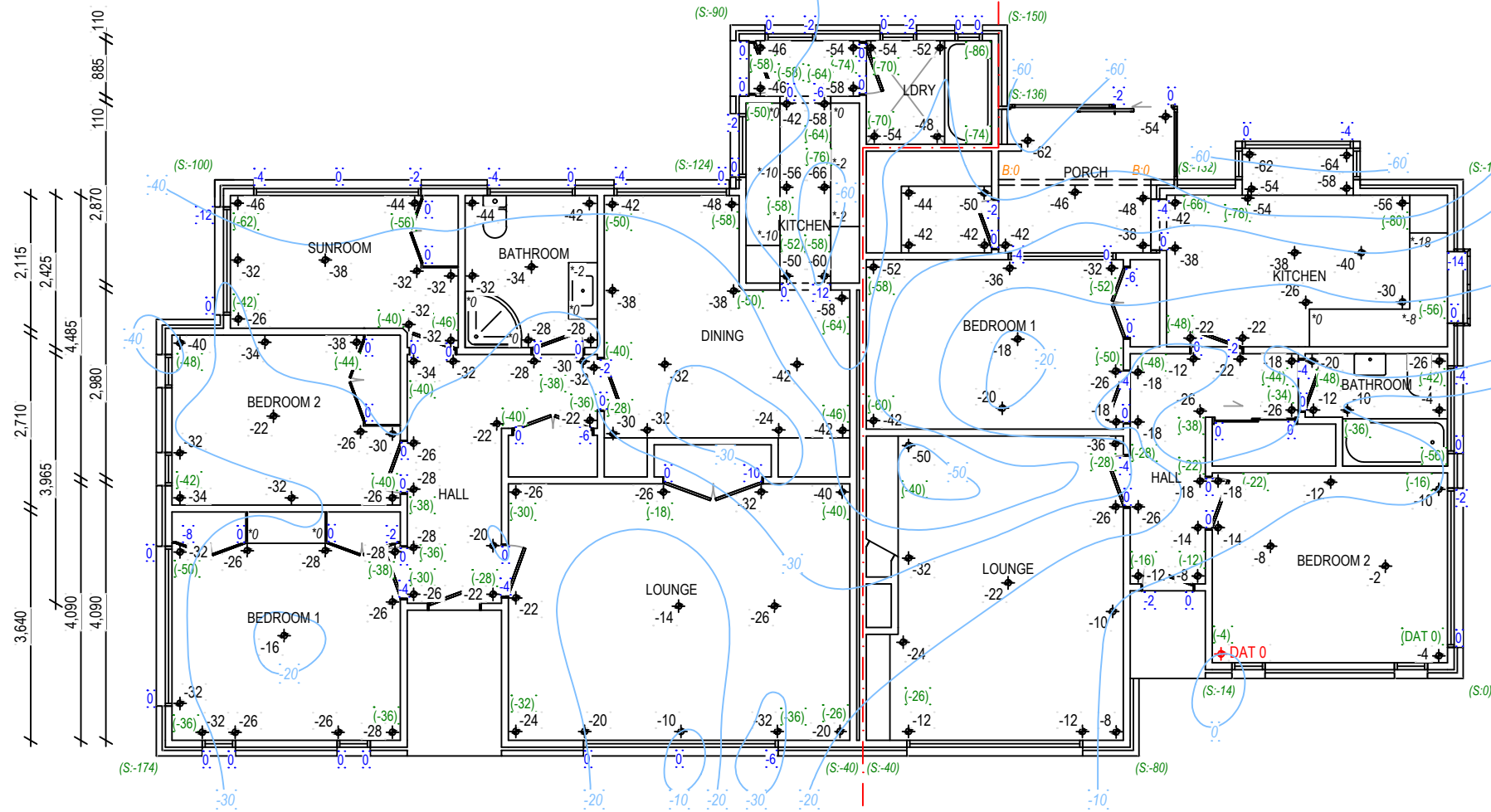
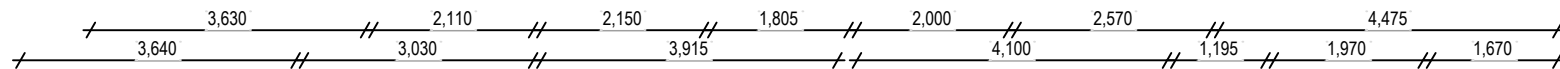
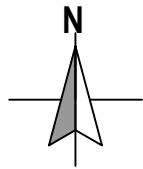


- 0 FLOOR LEVELS (ADJUSTMENTS FOR FLOOR COVERINGS HAVE BEEN MADE)
- (-X) CEILING LEVELS
- (S:-X) SOFFIT LEVELS
- B:-X LEVEL TO BASE OF BEAM
- X LEVELS TAKEN AT DOOR HEADS AND WINDOW SILLS
- *-X LEVEL TAKEN TO TOP OF UNIT

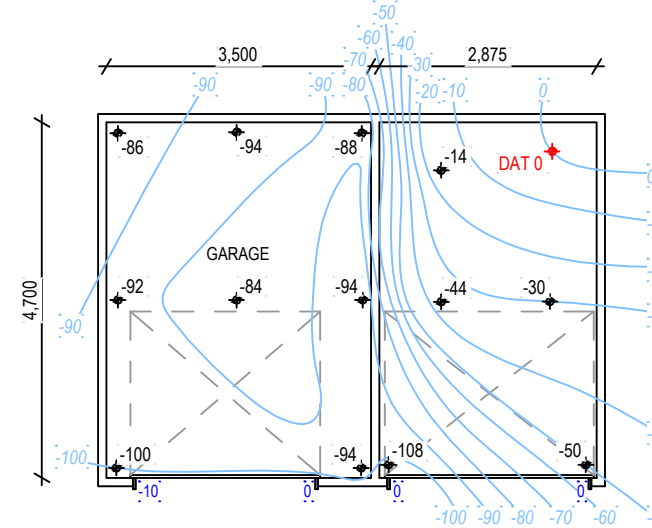
- MEASUREMENTS SHOWN ARE IN mm UNLESS STATED OTHERWISE
- LEVELS RECORDED WITH A ZIP LEVEL PRO-2000
- PLANS TO BE PRINTED IN FULL COLOUR



DRAWING NO.	SK1
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DWELLING CONTOURS PLAN
SCALE 1:100



GARAGE CONTOURS PLAN
SCALE 1:100



LOCATION PLAN

SCALE: NTS



KEY:

- 0 FLOOR LEVELS (ADJUSTMENTS FOR FLOOR COVERINGS HAVE BEEN MADE)
- (-X) CEILING LEVELS
- (S-X) SOFFIT LEVELS
- B-X LEVEL TO BASE OF BEAM
- X LEVELS TAKEN AT DOOR HEADS AND WINDOW SILLS
- *X LEVEL TAKEN TO TOP OF UNIT

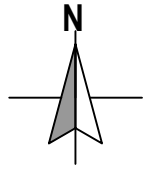
NOTES:

- MEASUREMENTS SHOWN ARE IN mm UNLESS STATED OTHERWISE
- LEVELS RECORDED WITH A ZIP LEVEL PRO-2000
- PLANS TO BE PRINTED IN FULL COLOUR



SHEET TITLE CONTOURS PLAN
ADDRESS: 425 & 427 ARMAGH STREET, LINWOOD, CHRISTCHURCH 8011

SCALE @ A3 1:100
DATE 26/02/2025
DRAWING NO. SK2



LOCATION PLAN

SCALE: NTS

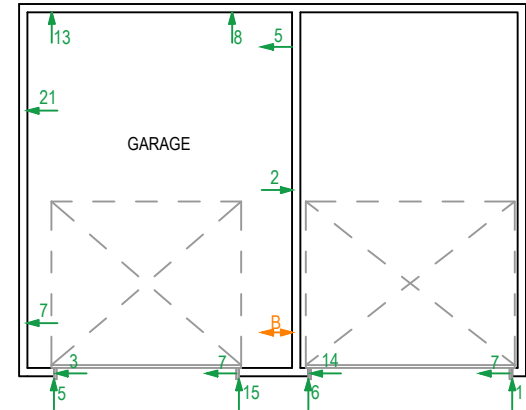


KEY:

- DISPLACEMENT AND DIRECTION (mm)
- PLUMB
- BOWED

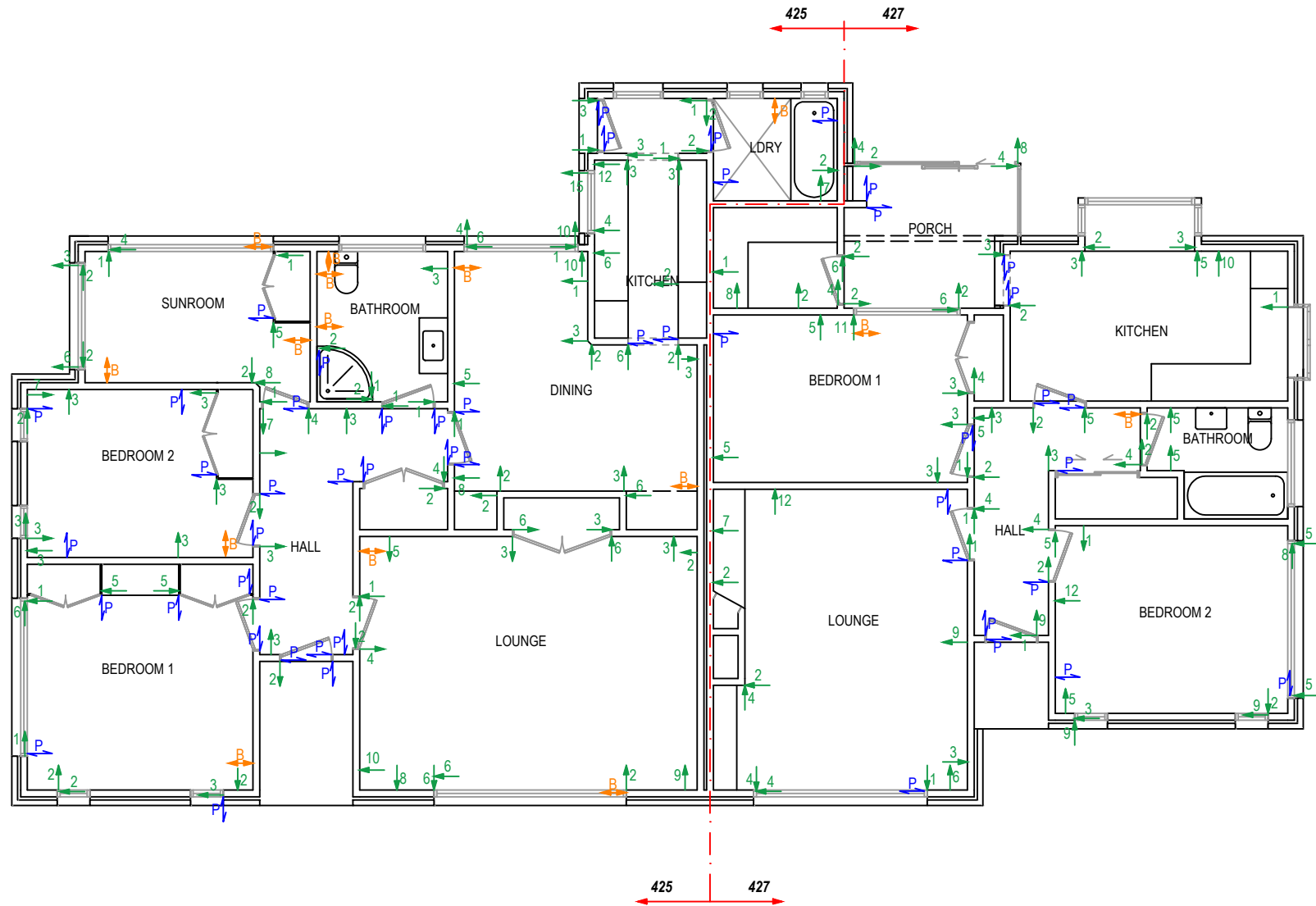
NOTES:

- MEASUREMENTS SHOWN ARE IN mm UNLESS STATED OTHERWISE
- LEVELS RECORDED WITH A BOSCH DNM 120L DIGITAL LEVEL
- PLANS TO BE PRINTED IN FULL COLOUR



GARAGE VERTICALITIES PLAN

SCALE 1:100



DWELLING VERTICALITIES PLAN

SCALE 1:100



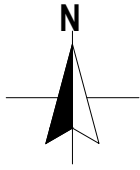
SHEET TITLE
VERTICALITIES PLAN

ADDRESS:
425 & 427 ARMAGH STREET, LINWOOD,
CHRISTCHURCH 8011

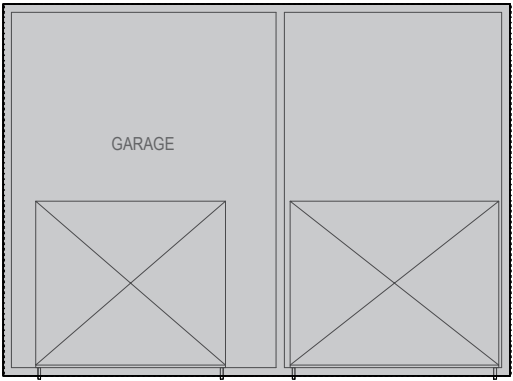
SCALE @ A3
1:100

DATE
26/02/2025

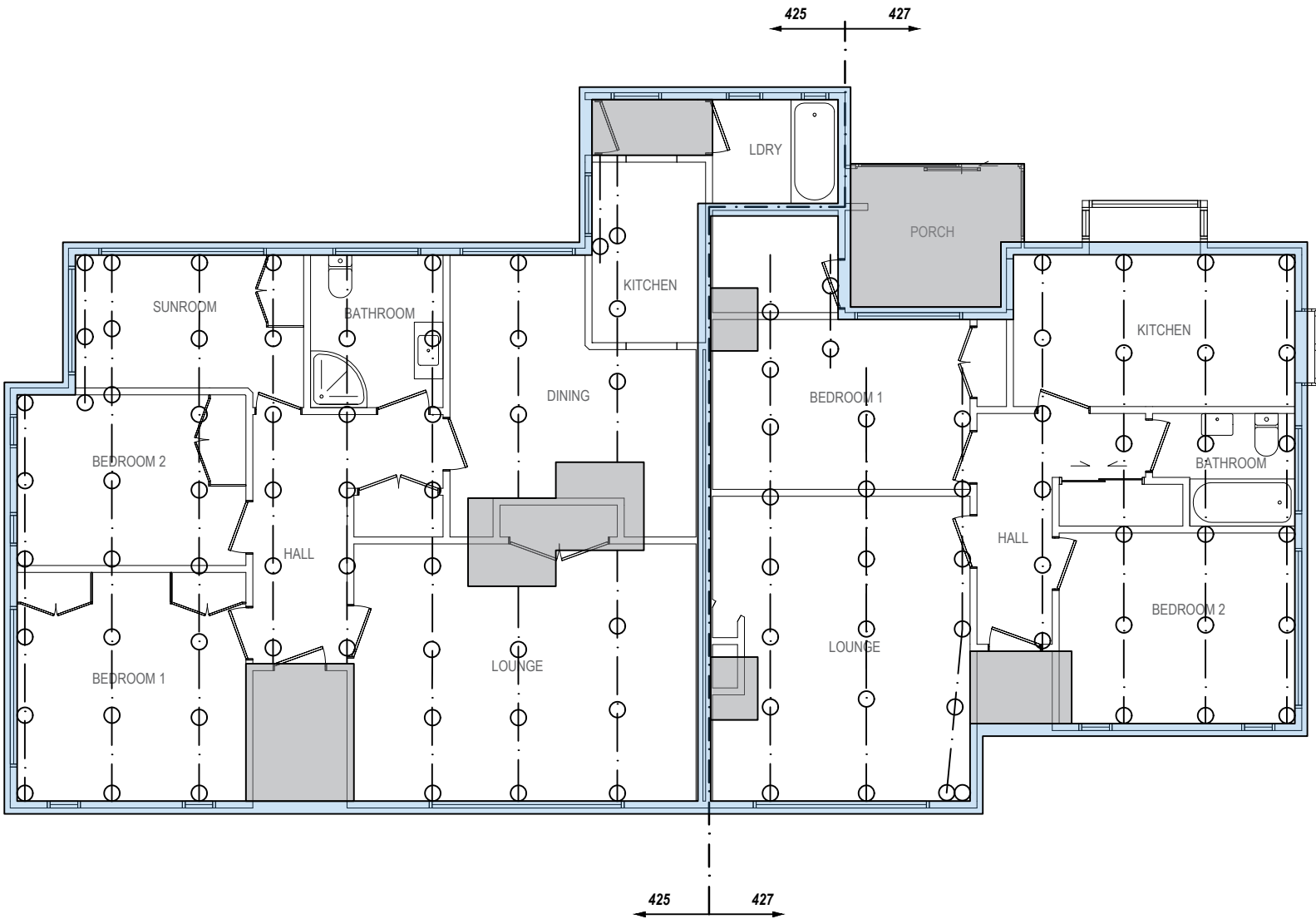
DRAWING NO.
SK3



LOCATION PLAN
SCALE: NTS



GARAGE FOUNDATION PLAN
SCALE 1:100



DWELLING FOUNDATION PLAN
SCALE 1:100

KEY:

-  CONCRETE PERIMETER WALL FOUNDATION
-  CONCRETE SLAB
-  BEARER LINE
-  PRECAST CONCRETE PILE

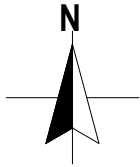


SHEET TITLE FOUNDATION PLAN	SCALE @ A3 1:100
	DATE 26/02/2025
ADDRESS: 425 & 427 ARMAGH STREET, LINWOOD, CHRISTCHURCH 8011	DRAWING NO. SK4



Appendix C

Conceptual Repair Plan



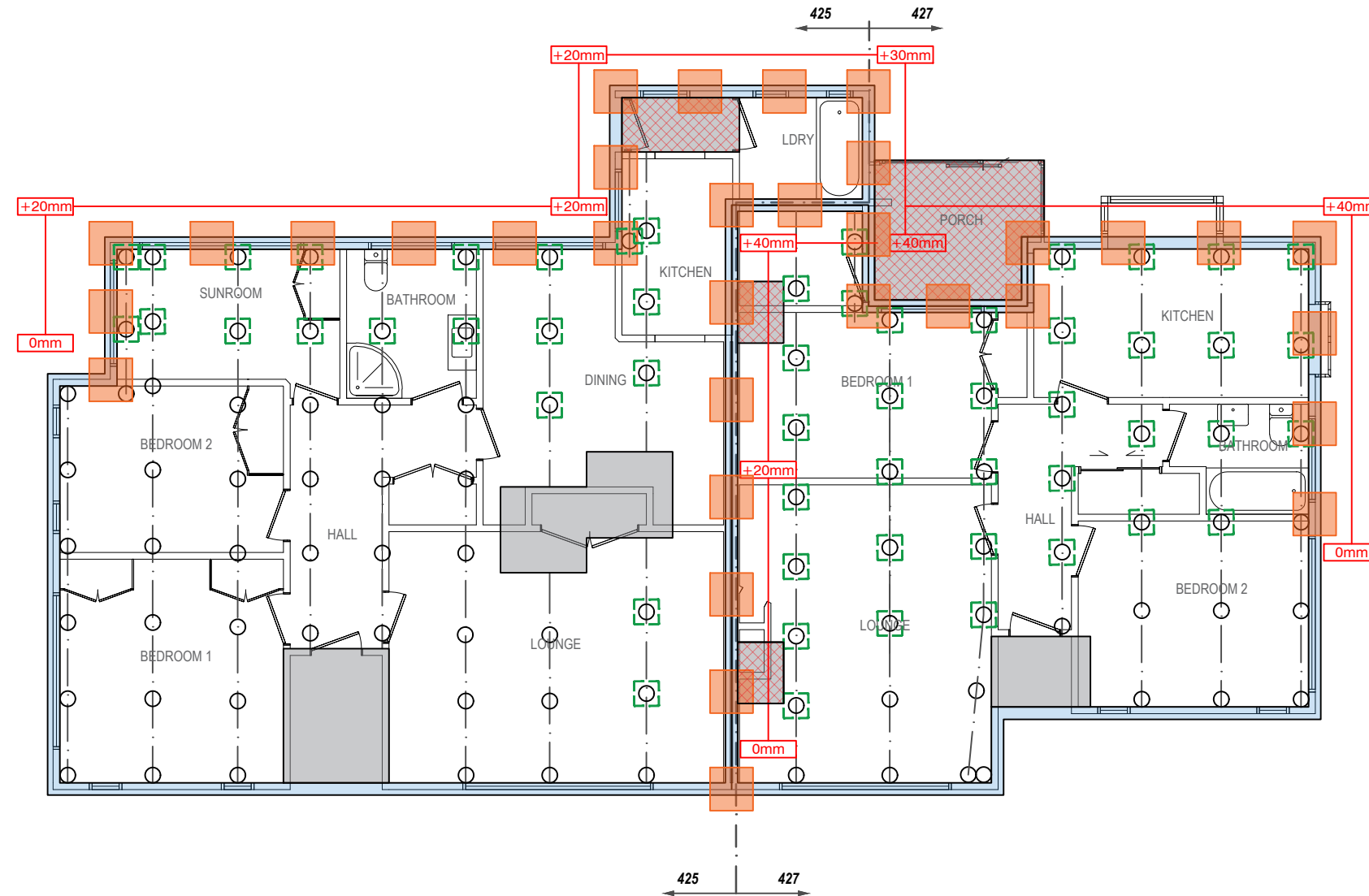
CONCEPTUAL REPAIRS:

-  UNDERPIN THE PERIMETER FOUNDATION BY **+XXmm** OFF CONCRETE PADS @ 1.5 CENTERS MAX. UNDERPINS TO BE 800mm DEEP AND 600mm SQUARE SUBJECT TO GEOTECHNICAL ENGINEERING APPROVAL AT THE DESIGN STAGE.
-  RELEVEL THE INTERNAL SUSPENDED TIMBER FLOORS BY PACKING BETWEEN THE PILES & BEARERS.
-  REMOVE SLABS.
REPLACE THE PORCH SLAB IN 427 ARMAGH STREET AFTER THE FOUNDATION LIFT IS COMPLETE.

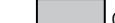
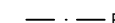


LOCATION PLAN

SCALE: NTS



KEY:

-  CONCRETE PERIMETER WALL FOUNDATION
-  CONCRETE SLAB
-  BEARER LINE
-  PRECAST CONCRETE PILE

CONCEPTUAL REPAIR PLAN

SCALE 1:100



SHEET TITLE CONCEPTUAL REPAIR PLAN	SCALE @ A3 1:100
ADDRESS: 425 & 427 ARMAGH STREET, LINWOOD, CHRISTCHURCH 8011	DATE 26/02/2025
	DRAWING NO. SK5



Appendix D

Shallow Geotechnical Investigations



Test locations are approximate (scaled and aligned using aerial imagery)
Aerial imagery obtained from [Canterburymaps.govt.nz](https://canterburymaps.govt.nz)

NZ CIVIL & STRUCTURAL ENGINEERS LTD		NZCSE Civil and Structural Engineers Ltd		SHALLOW GEOTECHNICAL INVESTIGATIONS	
NZCSE.COM				COMBINED HAND AUGER AND SCALA PENETROMETER	
10/31-33 Tyne Street, Addington Christchurch 8011				HA/SC 01	
admin@nzcse.com					
PROJECT: 425 & 427 Armagh Street, Linwood, Christchurch 8011		TESTED / SUPERVISED BY: J. Gill & M.Christie			
CLIENT: Natural Hazards Commission Toka Tū Ake		DATE: 29/01/2025			
TEST LOCATION: Refer to Attached Site Layout Plan S2.0		CHECKED BY: J McCloskey (03/03/2025)			
DEPTH (mm)	HAND AUGER: STRATA DESCRIPTION	GRAPHIC LOG	WATER LEVEL	SCALA PENETROMETER: BLOWS / 100mm	DEPTH (mm)
				051015	
500	0.0m - [Topsoil] Oranic SILT, some fine sand, trace rootlets, gravels & charcoal fragments, brown, loose, dry, non-plastic.	XX silt X			



Appendix E

Relevant Third-Party Documents

Contents:

	DOCUMENT TITLE	SOURCE	DATE
1.	Relevant Property File Extracts	Christchurch City Council	Various
2.	Underfloor Inspection	Cavity Critter	20/02/2025



Appendix E

Christchurch City Council Property File Extracts

CITY OF CHRISTCHURCH

CITY ENGINEER'S DEPARTMENT

P.O. BOX 237, CHRISTCHURCH, NEW ZEALAND

Mr Bergh,
425 Armagh Street,
CHRISTCHURCH



8 September 1977

re Building Application No. 702 BU/1/2

B7/7
Mr O'Malley

Dear Sir/Madam, your application for permission to

enclose carport to form garage at 425 Armagh Street

has now been approved. Before work is commenced the undermentioned fees must be paid and a building permit uplifted from this office.

Vehicle Crossing	\$
Builders Water Supply	
Water Connection Charge	
Building Permit Fee	3.00
Building Research Levy	
Street Damage Deposit	
	<u>3.00</u>

The Building Permit Application is approved subject to the following conditions:

1. The stormwater being connected to the existing disposal system and piped to the street side channel.

If the permit is not uplifted within three months of this date the application will be cancelled and the plans disposed of.

Yours faithfully

for Deputy General Manager and City Engineer

c.c. Mr Hart,
425 Armagh Street,
CHRISTCHURCH

LIN 3

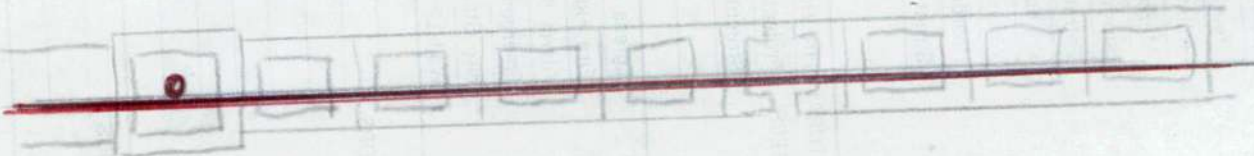
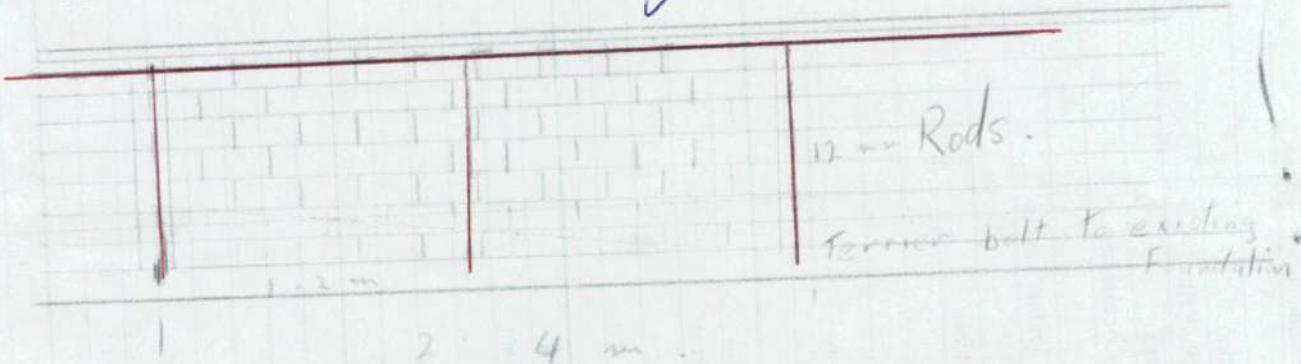
425 ARMAGH ST
ENCLOSE CARPORT

[Signature]

LIN

77-1580

CHRISTCHURCH CITY COUNCIL
Approved Subject to the By-Laws
21 SEP 1978
[Signature]
For City Engineer



BUILDING INSPECTORS	Fire Zone and Resistance		
	Siting (By laws)		
	Light and Ventilation		
	Room Sizes and Stud Ht.		
	Heating and Storage		
	Toilet and Laundry Accommod.		
	Mezzanine Floors		
	Storm Water and Section Levels		
	Entrance Levels		
	Projections over Street		
	Verandahs		
	Hoardings		
	Street Numbers		
STRUCTURAL ENGINEERS	Fire Resistance Requ.		
	Projections over Street		
	Structural Stability		
EGRESS OFFICER	Egress and Exit Signs		
	Fire Fighting Equipment		
	Alarm Systems		
	Emergency Lighting		
	Fire Stops		
HEALTH NSPECTORS	Wall Linings		
DANGEROUS GOODS NSPECTORS			
WATER NSPECTOR			

425 Armagh St

12 mm Rod

12 mm Rod 1-2

Shamrock Road

Site of Proposed Block fence
to be built on existing concrete wall.



Fence 6" Block.
8" Block Columns
7 Courses high
Tensar bolts 1 sh
4 Top Courses.
bond beam with
1/2" rod concrete filled

CCC 702.

3/48/33

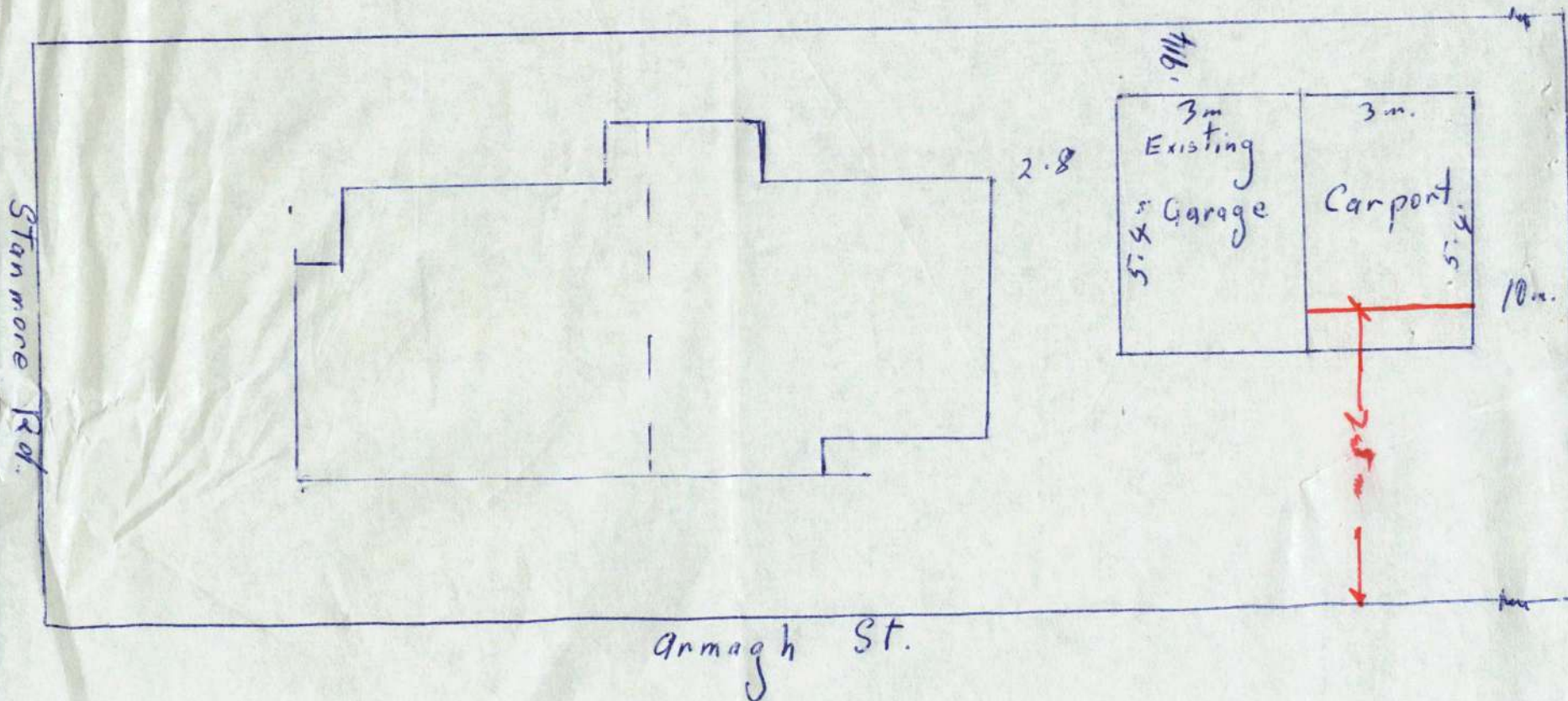
Mr M. Hart.

425 Armagh St.

Enclose existing carport as
garage.

Sewer not involved on this plan.

CHRISTCHURCH	
PLAN No. 43	
LETTER REF.	
J.H.S.	16
INSP.	3/5/77
DATE	
DRAINAGE BOARD	



L/N-77-1580

Details of Carport

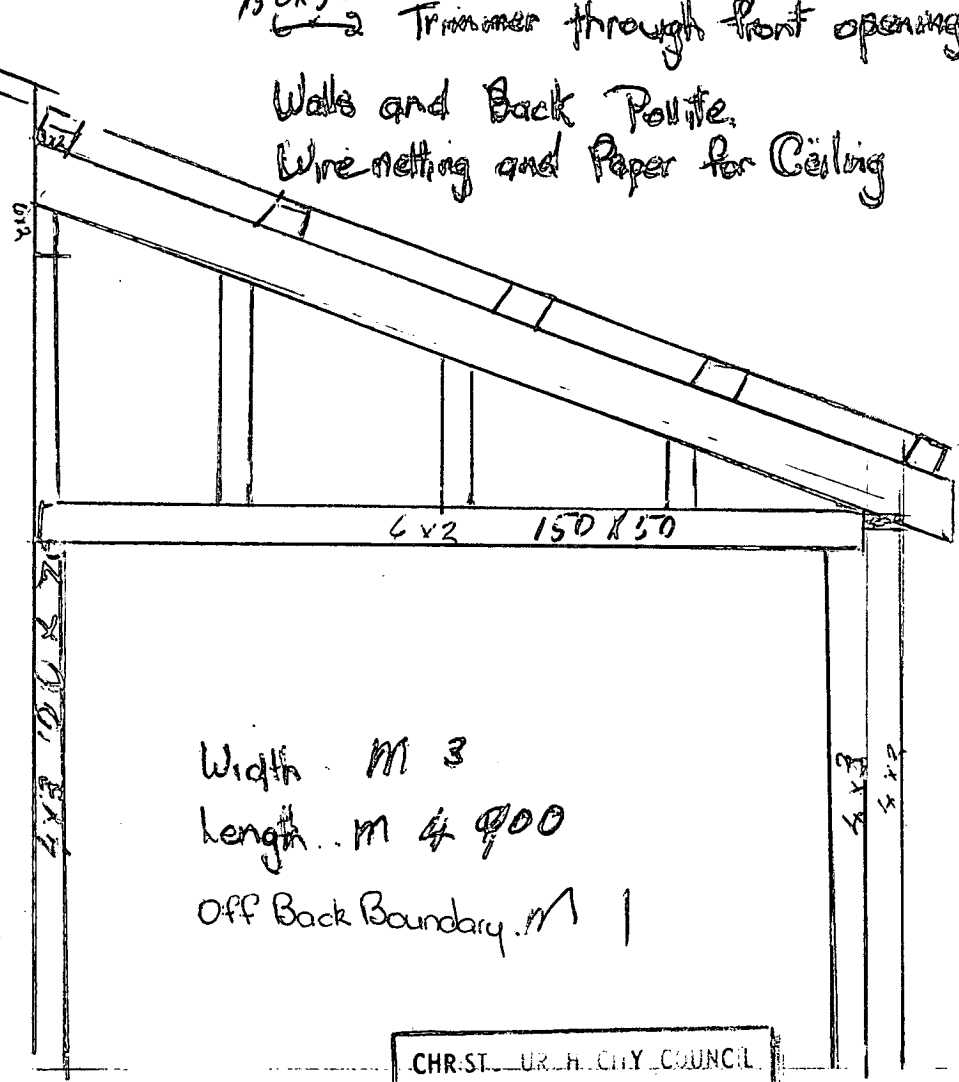
425 Armagh St.

- 100x50
4x2 Plates
- 125x50
5x2 Rafters
- 75x50
3x2 Purlins
- 150x50
6x2 Trimmer through front opening

Studs Setting 400 - Dwangs at 600.
Settings 750.
Setting 750.

Walls and Back Pointe.
Wire netting and Paper for Ceiling

Existing Garage..



Width m 3
length m 4 @ 00
Off Back Boundary m 1

CHRISTCHURCH CITY COUNCIL
Approved Subject to the By-Laws
8 SEP 1977
[Signature]
For City Engineer

S P E C I F I C A T I O N

FOR

Garbage

AT

1425 Armagh St.

OWNER

M. R. Hart

FOUNDATIONS

Concrete

C L A S S O F T I M B E R

S P A C I N G

Sleepers

/

Floor Joists

/

Flooring

Concrete

Plates

4x2

Studs

4x2

18"

Bracings

4x2

2 per Wall

Rafters

4x2

3ft

Purlins

4x2

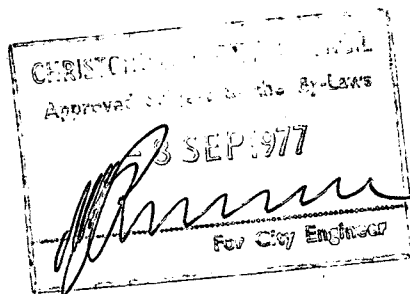
2ft

Wall Covering

Plite

Roof Covering

Iron



DEPT.	APPLICATION NO.	PERMIT NO.	Initial
TOWN PLANNING	Zoning	R/2.	
	Siting (ordinances)	Dis Cont Bldg. Check dwelling	
	Coverage	or flat	
	Density		
	Height		
	Outbuildings (height area)		
	Signs		
SURVEYOR	Building Restrictions		
	C.D.B. Widening		
	C.D.B. Clearance		
	Cash in lieu of Reserve		
	D.P. or Title Amalgamation		
	Unit Title		
TRAFFIC ENGINEERS	Access		
	Off Street Loading		
	Off Street Parking		
	Turning Space		
	Motorway		
	Street Works		
STREET- WORKS	Vehicle Barriers		
	Sealing of Areas		
	Location of Gully Traps etc.		
	Culverts and Accesses		
	Drainage		
BUILDING INSPECTORS	Fire Zone and Resistance		
	Siting (By laws)		
	Light and Ventilation		
	Room Sizes and Stud Ht.		
	Heating and Storage		
	Toilet and Laundry Accommod.		
	Mezzanine Floors		
	Storm Water and Section Levels		
	Entrance Levels		
	Projections over Street		
	Verandahs		
	Hoardings		
	Street Numbers		
	Insulation		
	Access for Handicapped		
Unit Title			
STRUCTURAL ENGINEERS	Fire Resistance Requ.		
	Projections over Street		
	Structural Stability		
EGRESS OFFICER	Egress and Exit Signs		
	Fire Fighting Equipment		
	Alarm Systems		
	Emergency Lighting		
	Fire Stops		
	Wall Linings		
HEALTH INSPECTORS			
DESIGN OFFICE			
DANGEROUS GOODS INSPECTORS			
WATER INSPECTOR			

Species coming

10/5-
OK by TE. JH

CHRISTCHURCH

DRAINAGE BOARD BOX 13006	DISTRICT		BOOK No.	0086
	No.	No.		
Foul Water Drainage	NA	NA	Block Plan	130.5
Stormwater Drainage	NA	NA	J.H.S.	
Sanitary Plumbing	NA	NA	Letter Ref.	
INSPECTOR	T.R. Longden			DATE 15.2.57

CCC 4054

MR HART

425 ARNAGH ST

ERECT FIRE WALLS

100mm

pl fire siding to these walls using fire line sheet

Garage 2

Garage 1

C.C. AMENDED

Well to extend under existing concrete lintel and to align with existing slab junction

ARMAGH ST

Bay

existing conc fire wall (to be completed to up to roof tiles)

FLAT 2

FLAT 1

Proposed extended fire wall (see detail)

100mm

100mm Conc brick wall fitted complete

1/12 mm ϕ vertical @ 400 c/c

2/12 mm ϕ horizontal in sand beam at 24" long

Existing Roof tiles

Existing Rafter + roof battens

Casting

Existing floor

One found with 2/c with rebar & lines 600 c/c

Lot 4

DP 10444

STANMERDALE RD

CHRISTCHURCH CITY COUNCIL

Approved Subject to H&S

22 FEB 1997

for info

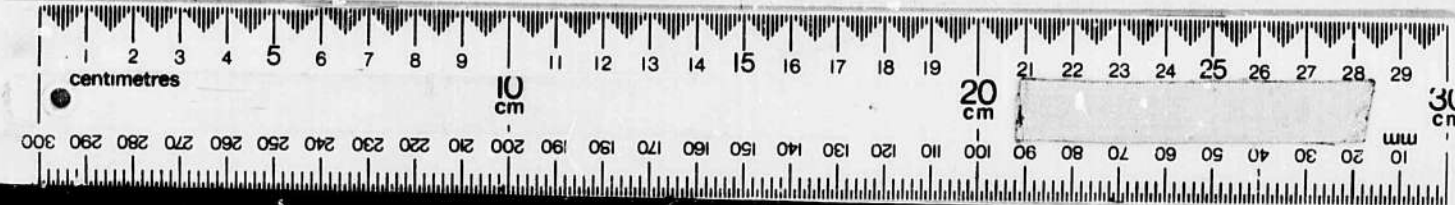
reposed alterations to Flats + Garages to obtain separate titles at 42.5 Remuera St. for Mr + Mrs M. Hart

BUILDING PERMIT		CHRISTCHURCH CITY COUNCIL		LIN	R1	3910
The building in the application for this permit is issued to be commenced within SIX months and completed within 12 months of date of this permit. A0404				BU40/254/425		
DESIGNER: Owner	NAME	ADDRESS				
OWNER/PROPRIETOR Name M R & J H Hart Mailing Address 425 Armagh Street CHRISTCHURCH		Date Issued 6 3 87				
BLINDER Name I I Milne Mailing Address 47 Burr Road CHRISTCHURCH		LEGAL DESCRIPTION Valuation Ref No. Lot 4 D.P. 10444 Section Block Survey District				
PROPERTY ON WHICH BUILDING IS TO BE ERECTED/DISMISSED						
SITE Street No. 425 Street Name Armagh Street Town District						
DESCRIPTION OF PROPOSED WORK AND MAIN PURPOSE OF USE Erect fire walls for flats						
FLOOR AREA Work to be done Number		DWELLING UNITS				
Building Plumbing Electrical Other		Estimated Value 3,500				
Permission is hereby granted for the work described above as proposed in the application, and in accordance with the plans, particulars and other documents submitted. No such work to be carried out at any time during the period of the permit, and no work to be carried out in contravention of the provisions of the Christchurch City Building Bylaws and other Bylaws for the time being in force, and no other regulations respectively affecting such work.						
I solemnly declare that the estimated value of the building to be erected under this permit is 3,500 and agree to comply and ensure compliance with all of the Rules and Code Regulations, and in being expressly understood that the issuing of a Permit does not dispense with any obligation to comply with all said Building and Regulations though not called for in the application, and to comply with the plans submitted.						
Signature: <i>[Signature]</i> (Owner/Proprietor or Authorized Agent)						
I agree to pay the full cost of reinstatement of any damage to the roads (including carriageways), kerbs, channels, culverts and crossings, footpaths, drains, verges and services which are the result of the execution of the work authorized by this permit.						
Signature: _____ (Owner/Proprietor or Authorized Agent)						
Application and Agreement for Water Supply In accordance with the requirements of the Christchurch City By Law No. 107 (Water Supply and Plumbing) I hereby apply for a (metered/unmetered) water supply for the purpose of _____ and agree to accept a supply in accordance with the requirements and conditions of the Christchurch City Waterworks Department.						

Note: Where this design is not adequate due to conditions, wall dimensions, or other factors, variation from these details must be supported by design calculations or a design certificate.

Single Storey Fire Wall

CHRISTCHURCH CITY COUNCIL





Appendix E

Cavity Critter Subfloor Report – 20/02/2025

Cavity Critter

Under floor Inspections

www.underfloorinspections.co.nz

106 Raddens Road

Ohoka

RD2 Kaiapoi 7692

021 343156

gideon@underfloorinspections.co.nz

Report prepared for: NZCSE

Property address: 427 Armagh Street, Linwood

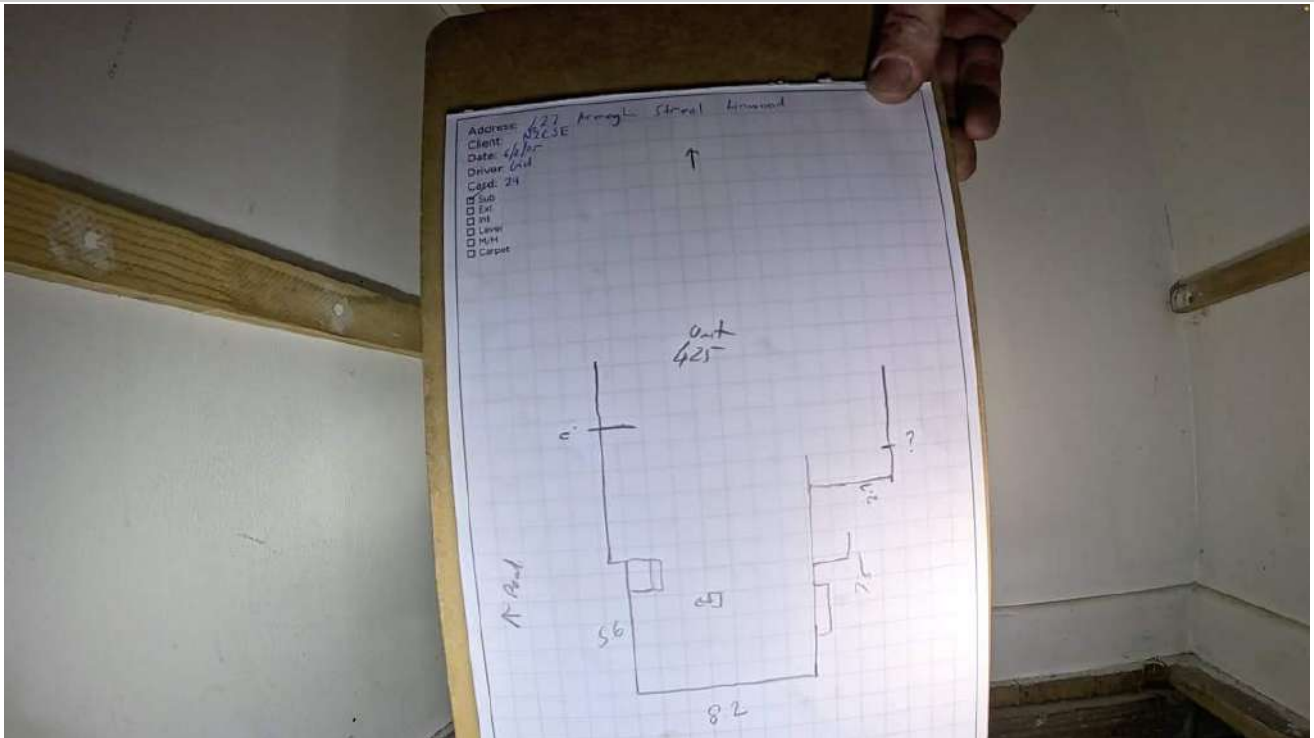
Date: 12 February 2025

Prepared by: Gideon Couper LBP Site 2 100074

Numbers corresponded to floor layout plan. Arrows represent which direction the photo was taken from.



1: Photo for legal purposes, showing who did the job and when.



2: The foundations are average quality type “B” foundations. There is a lack of fine sand and cement along with spider webs in some areas, making it hard to discern finer cracks, if they exist. There is also a high level of borer in some of the subfloor timber, as seen here.



3: View along party wall foundation.



4: View of foundation.



5: There are a lot of services and batts that have been pulled down that obstructed our access.



6: The home has precast concrete piles. These maybe concreted into the ground but the polythene obscures this. They are not connected to the bearers. None appear damaged or to have moved from their original positions although this does not preclude changes in height.



7: Precast concrete pile with no connection.



8: Precast concrete pile with no connection.



9: Precast concrete pile with no connection.



10: Precast concrete pile with no connection.



11: I think that there is a concrete base here, but I am not completely sure of the layout.



12: View of foundation.



13: Precast concrete pile with no connection. It is important to note that rodents have been using the insulation for nesting. The yellow marks represent their urine, and they have also caused many of the batts to fall down.



14: View of bearer meeting concrete base.



15: Precast concrete pile with no connection.



16: Precast concrete pile with no connection.



17: Precast concrete pile with no connection.



18: Precast concrete pile with no connection.



19: Precast concrete pile with no connection.



20: View of concrete base with pile to the left.



21: Precast concrete pile with no connection.



22: We couldn't get into this area.



23: View of piles.



24: View of foundation.



25: Precast concrete pile with no connection.



26: Precast concrete pile with no connection.



27: Precast concrete pile with no connection.



28: Precast concrete pile with no connection.



29: View of bearer meeting concrete base.



30: View of concrete base.



31: Precast concrete pile with no connection.



32: There are some non-compliant issues with the wiring seen in this home. They could also be a significant hazard to anybody operating under the floor. This relates specifically to unclipped wires. An electrical inspector could be consulted regarding this. The communication cables have also not been laid in a compliant manner and would easily be damaged by people accessing the subfloor.



33: Precast concrete pile with no connection. Here we see a heat pump drain. It is discharging to ground but should be vented to the outside.



34: View of concrete base.



35: Precast concrete pile with no connection.



36: View of ring foundation with concrete base to the right.



37: Precast concrete pile with no connection.



38: Precast concrete pile with no connection.



39: Precast concrete pile with no connection.



40: Precast concrete pile with no connection.



41: Precast concrete pile with no connection.



42: Precast concrete pile with no connection.



43: Precast concrete pile with no connection and the pile leans to the right.



44: The ground level appears to drop in this area.



45: Precast concrete pile with no connection and the pile leans to the right.



46: View along ring foundation with services.



47: Precast concrete pile with no connection.



48: Precast concrete pile with no connection.



49: Precast concrete pile with no connection.



50: We were unable to proceed any further.



House floor plan

Numbers corresponded to floor layout plan. Arrows represent which direction the photo was taken from. Plan is also supplied as a separate file to assist with reading of the report.

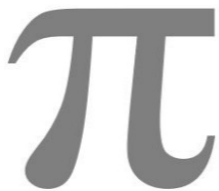


Subfloor plan 427 Armagh Street, Linwood

This report has been prepared in accordance with and is subject to our document Cavity Critter – Terms Of Trade. Our Terms of Trade include information on the service provided, the limitations of the service, and a limitation of liability. This report must be read in conjunction with our Terms of Trade. A copy will be made available upon request

Some customers will request us to provide the report, either without any commentary or with a limited commentary (on the basis that those customers will be making their own assessment of the photographs provided). Our report needs to be read in conjunction not only with our Terms of Trade but also with the instructions (particular to each report) provided by the customer.

Under no circumstances will we accept liability for the contents of this report to anyone other than the original customer. If you are not the original customer for this report, then (unless you have our specific written permission) you may not rely on its contents for any purpose.



PI CONSULTING LTD

STRUCTURAL CIVIL FORENSIC SEISMIC

Commercial

admin@piconsulting.co

Residential

+64 27 923 7782

Industrial

New Zealand

Australia

Project:

425 427 ARMAGH ST

Project Nr:

S275

Title:

RELEVEL CALCULATIONS

Date:

13/11/2025

Client:

Sam Knight
& Esther Calje

By:

SP

Page:

1

BUILDING DESCRIPTION:

SINGLE STOREY

MULTI UNIT BUILDING

Structure: Residential
Foundation Type: Type B
No. of Storeys: 1
Storey Height: 2.40 m
Location: Christchurch

BUILDING PARAMETERS:

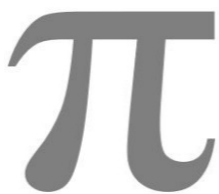
Land Classification: TC2
Hazard Factor: 0.30
Climate Zone: 5
Earthquake Zone: Zone 2
Exposure Zone: C
Wind Zone: Medium
ULS Bearing Pressure: 200 kPa
Bearing Pressure Depth: 0.80 mbgl
Reduction Factor: 2 Temporary

DESIGN METHODOLOGY:

Total Differential Settlement: 64 mm Ground
Relevelling Method: Mechanical jack and pack of concrete perimeter foundation & internal firewall using jacking pads
Pack internal piles
Isolated internal joist levelling

MATERIAL PARAMETERS:

Concrete Strength (Existing): 20 MPa
Concrete Strength (New): 25 MPa
Steel Grade: 300 MPa
Timber Grade: SG8

**A LOAD STATEMENT**

Concrete Geometry

	kN/m ³	width	depth	thickn.	kPa	kN/m
G						
Foundation: Type B	25.00	0.30	0.60			4.50
Ground Floor:	0.40		0.10		0.40	
Ground Floor Wall: Heavy Timber					2.67	
First Floor: None	0.00				0.00	
First Floor Wall: None					0.00	
Roof Load: Heavy Roof					0.85	
Other:					0.00	
Q						
Ground Floor Live: Residential - Construction Phase					0.75	
First Floor Live: Residential - Construction Phase					0.75	
Roof Live: Roof - Construction Phase					0.10	
Other: None					0.00	

NOTE:

B GEOMETRY (WORST CASE)

	m	
Pile Spacing:	1.00	(or slab contribution)
Floor Contribution:	0.50	
Distance to GF Wall:	3.60	(average)
Distance to FF Wall:	3.60	(average)

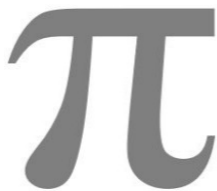
C TOTAL LOADS (INCL. STOREY HEIGHT OF: 2.40 m)

Load onto Perimeter	Ground		First		Roof		Other		kN/m
G:	11.11	+	0.00	+	1.53	+	0.00	=	12.64
Q:	0.75	+	1.35	+	0.18	+	0.00	=	2.28

D LOAD COMBINATIONS (FOR TEMPORARY WORKS ONLY)

E1:	1.35	G				=	17.06
E2:	1.20	G	+	1.50	Q	=	18.59

Critical Load Case: = 18.59



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Commercial

admin@piconsulting.co

Residential

+64 27 923 7782

Industrial

New Zealand

Australia

Project:

425 427 ARMAGH ST

Project Nr:

S275

Title:

RELEVEL CALCULATIONS

Date:

13/11/2025

Client:

Sam Knight
& Esther Calje

By:

SP

Page:

3

E SELECT PAD GEOMETRY

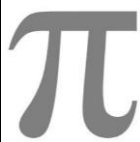
PAD GEOMETRY	Spacing:	1.75 m	Size:	L	0.60 m	Depth:	0.30 m
PAD DENSITY	Concrete:	25 kN/m ³		B	0.60 m		
Pad SW:						kN	2.70
Load on Pad:							32.52
Load on Soil:							35.22

F CHECK BEARING PRESSURE

Pressure on Soil:	A _{PAD}	=	0.36 m ²				
	P _{UBC}	=	200 kPa				
Available	P _{ALL}	=	100 kPa				
Applied	P _{ULS}	=	98 kPa	F.o.S.	=	1.02	OK

G CHECK PERIMETER FOUNDATION

Beam Area:	A _{BEAM}	=	0.18 m ²				
Reinforcement:	diameter	=	12 mm				
	No.	=	1				
	A _{S,PROV}	=	113 mm ²				
	Steel Grade	=	200 MPa				
Concrete:	Strength	=	17.50 MPa				
	M _{ULS}	=	4.68 kNm				
	V _{ULS}	=	16.26 kNm				
	M _{BEAM}	=	7.93 kNm	F.o.S.	=	1.70	OK
	V _{BEAM}	=	60.24 kNm	F.o.S.	=	3.70	OK



PI CONSULTING LTD
STRUCTURAL CIVIL FORENSIC SEISMIC
Commercial admin@piconsulting.co
Residential +64 27 923 7782
Industrial
New Zealand Australia

Project:	425 427 ARMAGH ST	Project Nr:	S275
Title:	Timber Beam Design - ROOF SPACE BEAM 01	Date:	10/11/2025
Client:	Sam Knight	By:	SP
		Page:	1

SPECIFIC ENGINEERING DESIGN: SUBFLOOR BEAM
NZS3603 & 1720.1:2022
ASNZS1170.0

BEAM REF: 01
DWG REF: 04
DETAIL 1

ARRANGEMENT			
Span 1:	3.00 m	(max)	
Spacing:	3.00 m	(or tributary distance)	
G:	0.40 kPa	=	1.20 kN/m
Q:	0.25 kPa	=	0.75 kN/m
W:	0.80 kPa	=	2.40 kN/m
S:	0.40 kPa	=	1.20 kN/m

LOAD FACTORS			
	ULS	SLS	COMB1 COMB2
G:	1.35	1.10	1.20 0.90
Q:	1.50	0.70	1.50 0.40
W:	1.00	1.00	1.00 1.00
S:	1.00	1.00	1.00 1.00

E _d 1: G	=	1.75 kN/m	ULS
E _d 2: G+Q	=	2.57 kN/m	ULS
E _d 3: G+W	=	3.48 kN/m	ULS
E _d 4: G+Q+W	=	4.37 kN/m	ULS
E _d 5: G+Q+S	=	3.17 kN/m	ULS
E _d 6: G+Q Short T	=	1.85 kN/m	SLS
E _d 7: G+Q Long T	=	1.62 kN/m	SLS
E _d 8: G+Q+S	=	3.05 kN/m	SLS
E _d 9: G+W	=	3.48 kN/m	SLS

SELECT BEAM		S.G.	5.70 kN/m ³
Material:	LVL11		
Width:	90 mm		
Depth:	190 mm		

TOLERANCES		Allowable Deflection Ratio	Long Term Deflection Factor
Δ Ratio:	400		
Δ Factor:	2.00		

PROPERTIES		G	0.73 GPa
φ	0.80	Z _x	541.50 x10 ³ mm ³
f _b	39.36 MPa	I _x	51.44 x10 ⁶ mm ⁴
f _s	6.00 MPa	A _s	17.10 x10 ³ mm ²
E	11.00 GPa		
m	0.10 kN/m		

TIMBER K-VALUES		Medium
k1	0.80	Nil
k4	1.00	
k5	1.00	
k8	1.00	

MAXIMUM DISTRIBUTED LOADS	
SLS _{MAX}	= 3.48 kN/m
ULS _{MAX}	= 4.37 kN/m

CALCULATED RESULT	
Moments	
M _{SLS,MAX} :	3.92 kNm
M _{ULS,MAX} :	4.91 kNm
Shear	
V _{ULS,MAX} :	6.55 kN
Deflection	
Δ _{ST} :	6.49 mm
Δ _{LT} :	12.97 mm

DESIGN	
Strength	
φMn = φk1,k4,k5,k8,Z _x ,f _b	= 13.64 kNm
Shear	
φVn = φk1,k4,k5,k8,A _s ,f _s	= 65.66 kN
Deflection	
Δ _{ALL} = L/Allow. D Ratio	= 7.50 mm

SUMMARY				
	ALLOWABLE		CALCULATED	FoS
Strength:	13.64	>	4.91	OK 2.78
Shear:	65.66	>	6.55	OK 10.03
Deflection:	7.50	>	6.49	OK 1.16

MODELED RESULT		USE? NO
Moments		
M _{SLS,MAX} :	3.80 kNm	
M _{ULS,MAX} :	3.80 kNm	
Shear		
V _{ULS,MAX} :	8.00 kN	
Deflection		
Δ _{ST} :	4.70 mm	
Δ _{LT} :	4.70 mm	

DESIGN	
Strength	
φMn = φk1,k4,k5,k8,Z _x ,f _b	= N/A kNm
Shear	
φVn = φk1,k4,k5,k8,A _s ,f _s	= N/A kN
Deflection	
Δ _{ALL} = L/Allow. D Ratio	= N/A mm

SUMMARY				
	ALLOWABLE		CALCULATED	FoS
Strength:	N/A	>	3.80	N/A N/A
Shear:	N/A	>	8.00	N/A N/A
Deflection:	N/A	>	4.70	N/A N/A

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