STRUCTURAL CONCEPTS *LIMITED*
Emajineer™ Conceptualisers
55 DUNLOP ROAD, PO BOX 3315, NAPIER, 4142, NEW ZEALAND – P (06) 842 0111 – F (06) 842 0113 – E info@structuralconcepts.co.nz

Our Ref: 1587

12 September 2011

Insight Unlimited Ltd
P.O Box 1219
GISBORNE 4040

Attention: John Radburn

Dear John,

Re: Avebury Park Residence – POST-EARTHQUAKE INSPECTION

Scope of this Report

This report covers our assessment of the structural condition of the Avebury Park Residence building at Evelyn Couzins Avenue, Christchurch, following the magnitude 6.3 earthquake on 22nd February 2011. Our assessment is based on a visual inspection inside and out, which was carried out on the 29th April 2011and again on 12th May 2011.

This report describes the damage observed, and comments on remedial work options for both temporary securing of the building, and long term repair where appropriate. This report does not cover a detailed structural strength assessment or detailed specification of remedial works, which may be required by the client following consideration of this report.

1. Scope of Investigation

On the 29th April 2011and again on 12th May 2011, we visually inspected the building including:
The exterior from ground level
The interior
We have also reviewed the Geotechnical Report completed by Land Development and Exploration Ltd (LDE).
This report is based on our assessment of the building at the time stated. Photos that are attached in Appendix A are indicative of the damage. Any subsequent loading by aftershocks, or high winds, may initiate further damage.

2. Building Description

General description:
The Avebury Park Residence is a two-storey structure consisting of timber framing with weatherboard cladding. There is a single storey addition (ablution block) attached to the south face.
The building was first constructed in 1885, with the tower added in 1907 and service wings replaced with the current ablution block at a later date.
The Avebury Park Residence is not listed as a heritage building in the current Christchurch City Plan nor is it registered as a Historic Place by the NZ Historic places Trust Pouhere Taonga. However it is noted as conservation 2 in the proposed City Plan.
The building was being used as a residential accommodation, but is currently unoccupied due to earthquake damage.

Roof construction:
Corrugated steel on timber framing.

External Wall construction:
Weatherboard cladding on timber framed construction to all other exterior walls.

Internal Wall construction:
Generally plaster on lathe on timber framing. Lath and plaster or hardboard on timber framing to interior walls.

Floor construction:
Timber joists and bearers on piles, with an unreinforced concrete perimeter foundation wall.

Structural System:
The structural system can be described as plaster on timber lathe on timber framed walls acting in in-plane shear wall action on both levels in both directions with the load then transferring to a timber floor diaphragm that transfers loads to an unreinforced (or low level reinforced) concrete ring foundations and then to the ground. The building is essentially light weight with light weight roof and cladding.

3. Strength

The strength of the building has been determined as a % NBS using methodologies provided by NZSEE.
Before September 2010:
The strength of the building before September 2010 is determined as

Top Floor	E-W	100% NBS
	N-S	100% NBS
Bottom Floor	E-W	70% NBS
	N-S	100% NBS

Chimneys	10% NBS

On day of inspection:
The strength of the building on the day of inspection is determined as

Top Floor	E-W	100% NBS
	N-S	100% NBS
Bottom Floor	E-W	45% NBS
	N-S	50% NBS
Chimneys		0% NBS

4. Damage Description

Damage caused by the February earthquake to the Avebury Park Residence is described below. Damage described is additional to earlier earthquake damage. Refer to Appendix B for marked-up drawings indicating damaged locations. The damage is typical of lathe and plaster timber framed walls and not unusual.

i. General Damage:
General damage includes cracking of plaster to walls and ceilings. Regularly spaced cracking has occurred to the ring foundation wall at approx 2m to 3m centres.

ii. Damage to South East Foundation Wall:
The foundation to the south east corner of the ablution block has been significantly damaged and has settled due to liquefaction and lateral spread. The movement is considerable and is immediately adjacent this corner and thus the chance of filling a large voids in the soils is high.

iii. Movement of Building on Foundation:
The building has moved 10m to 20mm on the exterior ring foundation. This movement is likely to be a combination lack of fixing between the subfloor structure and the foundation will plus lateral spread.

iv. Collapse of brick chimneys:
Two brick chimneys have collapsed or are damaged and need to be removed. The chimneys have caused significant damage to the ceilings immediately adjacent where they pass through same. The fireplace has been damaged in the kitchen. Subsequent to 13 June 2011 these have now collapsed to first floor and have now been removed to ground level.

v. Interior Damage to Common Room and Hallway:

Significant damage has occurred at ground floor level in the main hall and north east common room. It appears that these walls have taken the majority of the brace loading of the building.

vi. Interior Wall General damage:

There is general plaster cracking to walls and ceilings to the top floor and west side of the ground floor. This has been noted on our plan in appendix C

vii. Liquefaction and Lateral Spread:

There is general liquefaction to around but away from the building exterior. The exception to this is adjacent to the South East corner where the ground has opened up and slumped. The liquefaction is not significant but may have caused some minor movement in the foundations.

viii. Other damage:

Cracked glass to some windows.

5. Immediate Securing of the Building

The following works are required to mitigate immediate hazards, temporarily secure the building, and provide weather tightness:
Remove loose chimney bricks and remaining chimneys to ground floor level to remove any fall hazard. Plywood line chimney roof openings and flash to provide weather-tightness.
The level 2 report can be found in Appendix C shows the general arrangement of any securing required.

Due care, safety equipment and precautions must be taken when carrying out the above work. Maintain awareness of fall hazards and escape routes if entering the building.

6. Long Term Repair

This section outlines options for repair to restore the building to its pre-earthquake condition. Options for repair and/or strengthening will need to be discussed with the owner, and will be subject to revised local authority legislation. All new work has been assessed using a seismic hazard factor of Z=0.3. the Design Features report can be found in appendix E.

Although primarily it appears that the majority of the damage to the walls is in the N-S direction it should be noted from the desk top assessment that it is the E-W direction that has reduced strength. We are of the opinion that this direction be strengthened

i. South East Foundation Wall:

Demolish existing foundation wall back along both sides to adjacent corner and replace with new reinforced concrete foundation wall. See attached details in Appendix D.

The movement is considerable and replacement considered preferable to lifting via earth grouting. This is because the ground movement is immediately adjacent this corner and thus the chance of filling a large voids in the soils is high. Furthermore the foundation length is short and costs of full repair would be expected to be acceptable. We also recommend that any new foundation be mechanically tied to the existing foundation.

Install a new 6m long 150sed timber pile (at 400crs) palisade wall adjacent to these new foundation walls.

iii. Movement of Building on Foundation:

Connect the existing timber subfloor to the existing foundation wall using new brackets fixed using nails and epoxied bolts. See attached details in Appendix D.

As the connection between foundation and subfloor structure is considered vital for seismic actions we believe that attachment between foundation and subfloor structure be seriously considered to minimize any further separation between these two structural elements.

Carry out closer investigation of the pile foundations to assess if there has been any movement or tilting of pile or loss of bearing of bearers on piles. Furthermore review joists to assess if these have tilted.

iv. Chimney Repair:

Reconstruct chimneys. Light weight replicas in the form of plaster on riblath over plywood on timber framing with timber or steel structure is recommended.

Deconstruct existing chimneys to ground floor and reconstruct opening using standard timber framing techniques enclosing with standard gibboard or as required on the reinstatement sketch plan. See attached details in Appendix D.

v. Interior Repair to Common Room, Hallway and Wardens Flat/Bedroom:

The walls and ceilings requiring specific repair have been indicated on the floor plan as SW3, SW4 and SC3, SC4 respectively.

SW3 walls and SC3 ceilings require the plaster to be stripped back and the lathe repaired where broken. The lathe is to be repaired or replaced and then the wall or ceiling re-plastered. Alternatively the general option “b” below may be used.

SW4 walls SC4 ceilings are to have the plaster and lathe completely removed and replaced with new plywood or gibboard bracing/diaphragm systems. Details of this are provided in appendix D.

General repair to cracks in plaster to walls and ceilings noted as W1 and W2 and C1, C2 respectively. The suffix Indicator 1 or 2 in the label refers to the level of damage where 1 is minor and 2 moderate. Remove cracked/peeling/bubbled wallpaper to expose damaged Internal walls linings.

Repair as appropriate using one of the following:

a. Grind-out v-shape into cracked plaster. Re-plaster and overlay crack with fibreglass reinforcing mesh. Re-plaster over to provide a smooth finish.

b. Remove lath and plaster walls and replace with Braceline GIB, or plaster over corru-lath/rib-lath.
In all cases, wall ties and hold-down straps should be installed in accordance with GIB braced wall and ceiling diaphragm specifications.
Realign, re-fix and re-paint racked door frames and architraves.

vi. General Foundation Repair:
Seal all cracks in concrete foundation wall larger than 0.2mm with a pressure injected epoxy (e.g. Sikadur injectokit and Sikadur520, or similar). Seal smaller cracks by painting over with a brushable crack filler (e.g. Resene Brushable Crack Filler).

vii. General Interior Repair to Wall and Ceiling:
General repair to cracks in plaster to walls and ceilings noted as W1, W2 and C1, C2 respectively. The suffix Indicator 1 or 2 in the label refers to the level of damage where 1 is minor and 2 moderate.
Remove cracked/peeling/bubbled wallpaper to expose damaged Internal walls linings.
Repair as appropriate using one of the following:
a. Grind-out v-shape into cracked plaster. Re-plaster and overlay crack with fibreglass reinforcing mesh. Re-plaster over to provide a smooth finish.
b. Remove lath and plaster walls and replace with Braceline GIB, or plaster over corru-lath/rib-lath.
In all cases, wall ties and hold-down straps should be installed in accordance with GIB braced wall and ceiling diaphragm specifications.
Realign, re-fix and re-paint racked door frames and architraves.

The repair methods adopted above will bring this building up to 100%NBS. If the Client wished to establish a maximum of 67%NBS then the walls indicated to have strengthening work as option SW4 could be downgraded to SW3 repair. The SW4 repair is the only additional strengthening required to bring the building strength above its original condition.

The costs associated with the repairs would require the appropriate professional to visit the site to view the extent of damage.

7. Elements Not Inspected

The following is a list of elements not specifically inspected:

- Subfloor construction
- Piles
- Roof space
- Chimneys above ceiling space and above roof level
- Soils (Geotechnical report completed by LDE has been reviewed)

The L2 report makes mention of a wider scale lateral spread report by Tonkin and Taylor including the possibility of perimeter treatment and recommends that work be postponed until those recommendations are known. Subsequent to this a specific geotechnical report has been completed by LDE which gives recommendations for the treatment of the ground which should be followed.

8. Heritage Significance

The Heritage Significance has been attached as Appendix E

9. Limitations

Findings presented in this report are for the sole use of the client. The findings may not contain sufficient information for use by other parties, and as such should not be relied upon unless discussed with Structural Concepts Ltd. We have exercised our services in a professional manner using a degree of care and skill normally, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, expressed or implied, is made as to the professional advice presented in this report.

Yours faithfully
STRUCTURAL CONCEPTS LTD

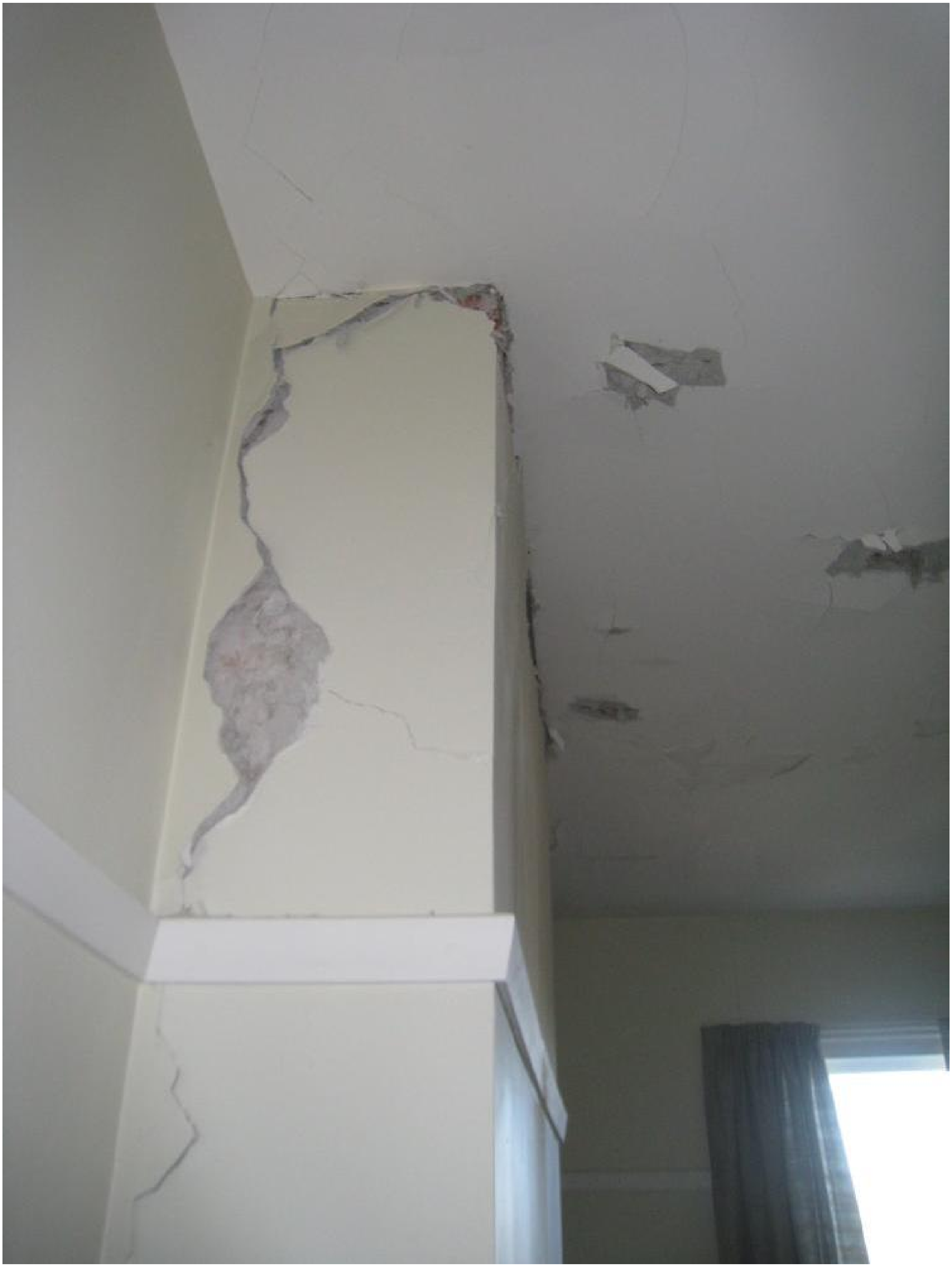
Garry Newton
BE (Civil), MIPENZ(Civil, Structural), CPEng, IntPE(NZ)

Director

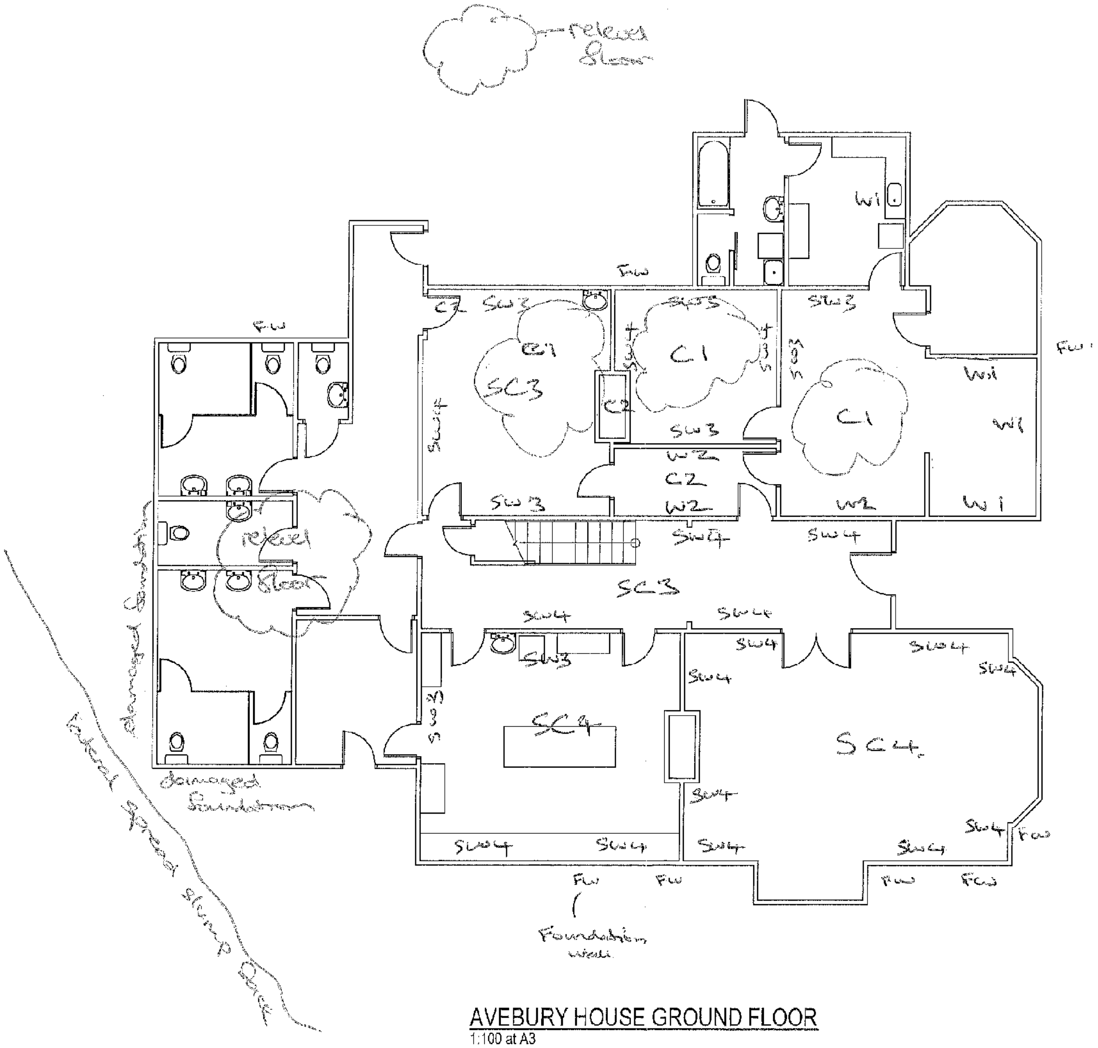
APPENDIX A. PHOTOGRAPHS

Please note that the photographs provided in this report are not high quality and are for providing information that shows the indicative damage found around the building for structural engineering assessment only.


EARTHQUAKE
Duty Security Worker



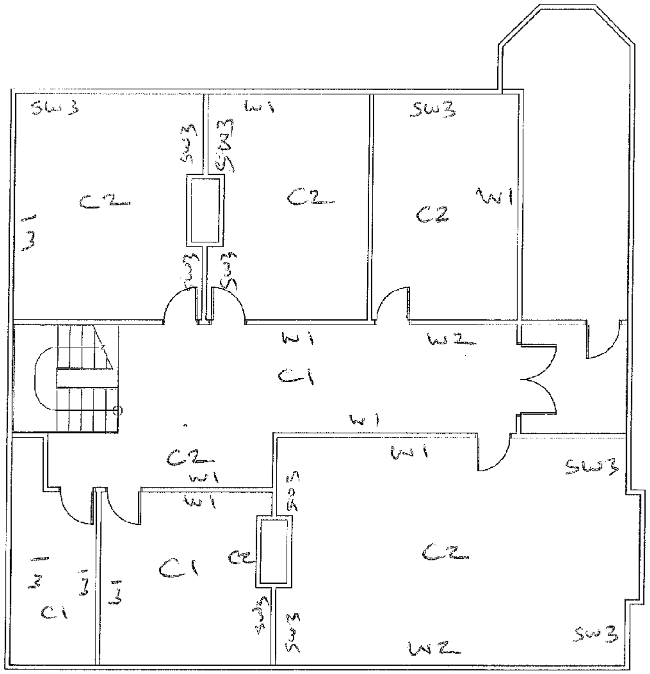
APPENDIX B. MARKED-UP DRAWING INDICATING DAMAGED LOCATIONS



AVEBURY HOUSE GROUND FLOOR

1:100 at A3

DAMAGE ASSESSMENT



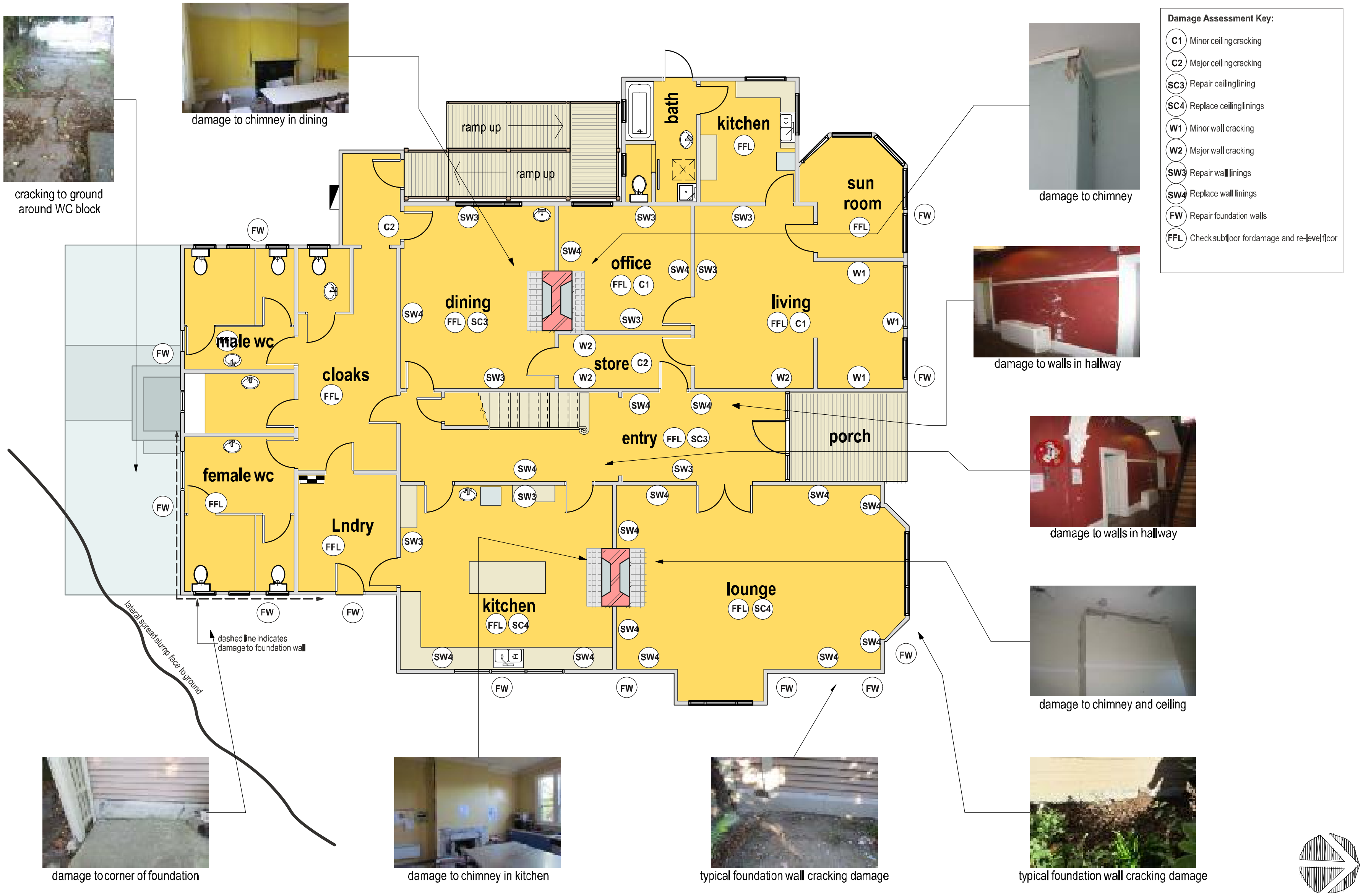
AVEBURY HOUSE FIRST FLOOR

1:100 at A3

DAMAGE ASSESMENT

see report for damage level :

C1	ceiling cracks
C2	major cracking in ceiling
W1	wall cracking
W2	major wall cracking
SW3	replace lining, or reinstate lining



Damage Assessment Key:

C1	Minor ceiling cracking
C2	Major ceiling cracking
SC3	Repair ceiling lining
SC4	Replace ceiling linings
W1	Minor wall cracking
W2	Major wall cracking
SW3	Repair wall linings
SW4	Replace wall linings
FW	Repair foundation walls
FFL	Check subfloor for damage and re-level floor

REV DATE DESCRIPTION

CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

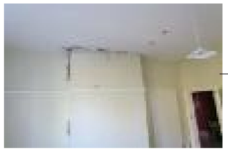
SEISMIC STRENGTHENING OF AVEBURY HOUSE CHRISTCHURCH

Reference Plan Ground Floor

emaiineer
Structural Concepts

SCL NUMBER 1587
SHEET S04
REV 0

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA


damage to chimney, ceiling and wall


damage to chimney, ceiling and wall

Damage Assessment Key:

C1	Minor ceiling cracking
C2	Major ceiling cracking
SC3	Repair ceiling lining
SC4	Replace ceiling linings
W1	Minor wall cracking
W2	Major wall cracking
SW3	Repair wall linings
SW4	Replace wall linings
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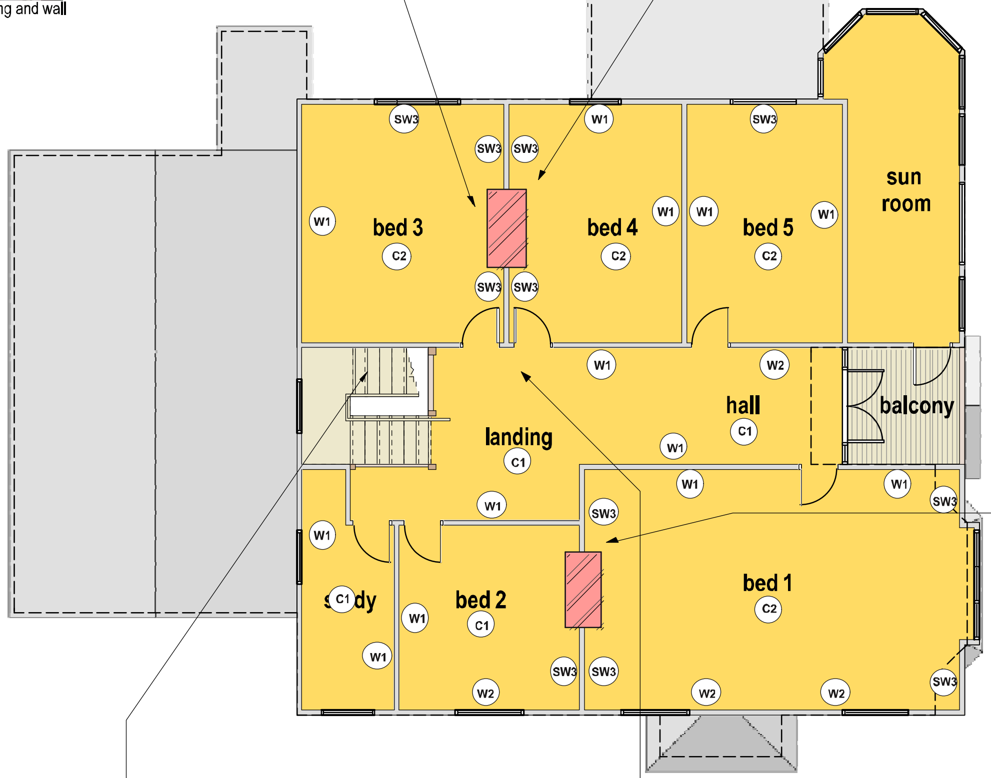
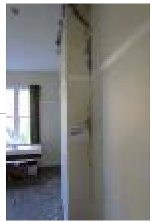
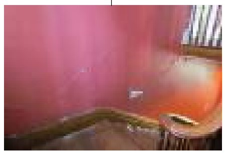
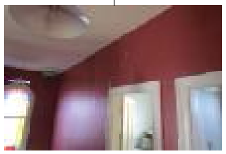



damage to chimney, ceiling and wall


damage to walls in hallway


damage to wall in hallway

REV DATE DESCRIPTION

CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF AVEBURY HOUSE CHRISTCHURCH

Reference Plan First Floor

emgineer
Structural Concepts

SCL NUMBER
1587
SHEET REV
S05 0

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA

APPENDIX C. LEVEL 2 REPORT

Christchurch Eq RAPID Assessment Form - LEVEL 2

Inspector Initials: GNB
Territorial Authority: Christchurch City
Date: 15.03.2011
Time: 3:00 PM
Final Posting (e.g. UNSAFE): Y1

Building Name: AVEBURY PARK
Short Name:
Address: 9-11 EVELYN COUSINS AVE

GPS Co-ordinates: S° E°
Contact Name: G. BANKS
Contact Phone: 021 468696

Storeys at and above ground level: 2
Below ground level: —
Total gross floor area (m²): 500 EST
Year built: 1880'S EST
No of residential Units: —

Photo Taken: [✓ Yes] No

Type of Construction

☑ Timber frame MAIN BUILDING	☐ Concrete shear wall
☐ Steel frame	☑ Unreinforced masonry
☐ Tilt-up concrete	☑ OR Reinforced masonry PIGEON CLUB ONLY
☐ Concrete frame	☐ Confined masonry
☐ RC frame with masonry infill	☐ Other:

Primary Occupancy

☐ Dwelling	☐ Commercial/ Offices
☐ Other residential	☐ Industrial
☐ Public assembly	☐ Government
☐ School	☐ Heritage Listed
☐ Religious	☑ Other – COMMUNITY

Investigate the building for the conditions listed on page 1 and 2, and check the appropriate column. A sketch may be added on page 3

Overall Hazards / Damage	Minor/None	Moderate	Severe	Comments
Collapse, partial collapse, off foundation	☑	☐	☐	MINOR (UP TO 20MM) SHIFT ON FOUNDATIONS
Building or storey leaning	☑	☐	☐	
Wall or other structural damage	☐	☑	☐	LATHE & PLASTER CRACKS
Overhead falling hazard	☑	☐	☐	
Ground movement, settlement, slips	☐	☑	☐	LATERAL SPREAD AROUND BUILDING
Neighbouring building hazard	☑	☐	☐	
Electrical, gas, sewerage, water, hazmats	☑	☐	☐	

Record any existing placard on this building: NONE

Existing Placard Type (e.g. UNSAFE):

Choose a new posting based on the new evaluation and team judgement. Severe conditions affecting the whole building are grounds for an UNSAFE posting. Localised Severe and overall Moderate conditions may require a RESTRICTED USE. Place INSPECTED placard at main entrance. Post all other placards at every significant entrance. Transfer the chosen posting to the top of this page.

INSPECTED GREEN: G1 G2
RESTRICTED USE YELLOW: [✓ Y1] Y2
UNSAFE RED: R1 R2 R3

Record any restriction on use or entry:

Further Action Recommended:

Tick the boxes below only if further actions are recommended

☐ Barricades are needed (state location):
☐ Detailed engineering evaluation recommended
☑ Structural ☑ Geotechnical ☐ Other:
☐ Other recommendations:

Estimated Overall Building Damage (Exclude Contents)

None	☐		
0-1 %	☐	31-60 %	☐
2-10 %	☐	61-99 %	☐
11-30 %	☑	100 %	☐

Sign here on completion: G. BANKS
Date & Time: 15-03.11 3:00PM
ID

Inspection ID: __________ (Office Use Only)

Structural Hazards/ Damage	Minor/None	Moderate	Severe	Comments
Foundations	☑ TO	☑	☐	MODERATE @ S/E CORNER : CRACKS, SETTLEMENT LIKELY
Roofs, floors (vertical load)	☑	☐	☐	
Columns, pilasters, corbels	☑	☐	☐	
Diaphragms, horizontal bracing	☑	☐	☐	
Pre-cast connections	N/A ☐	☐	☐	
Beam	☑	☐	☐	
Non-structural Hazards / Damage				
Parapets, ornamentation	☑	☐	☐	
Cladding, glazing	☑	☐	☐	
Ceilings, light fixtures	☑	☐	☐	
Interior walls, partitions	☑ TO	☑	☐	EXTENSIVE PLASTER CRACKS
Elevators	N/A ☐	☐	☐	
Stairs/ Exits	☑	☐	☐	
Utilities (eg. gas, electricity, water)	☑	☐	☐	
Other	☐	☐	☐	
Geotechnical Hazards / Damage				
Slope failure, debris	☑	☐	☐	
Ground movement, fissures	☐	☑	☐	SOUTH OF BUILDING UP TO 75MM, NORTH MINOR
Soil bulging, liquefaction	☐	☑	☐	

General Comment MAIN BUILDING : FOUNDATIONS STRESSED BY LATERAL SPREAD
: L&P WALLS OVERLOADED AS BRACING
: FURTHER CHIMNEY BRICKS FALLING ONTO CEILINGS. FIREPLACE DAMAGE
PIGEON CLUB : S/E CORNER SETTLEMENT DUE TO GROUND SPREAD
SOUTH BRICK FENCE : SUBSTANTIAL COLLAPSE OF DOUBLE BRICK/PIER WALL.
TOILET BLOCK : BRICK VENEER COLLAPSE.

Usability Category

Damage Intensity	Posting	Usability Category	Remarks
Light damage *Low risk*	Inspected (Green)	G1. Occupiable, no immediate further investigation required	
		G2. Occupiable, repairs required	
Medium damage *Medium risk*	Restricted Use (Yellow)	[✓ Y1.] Short term entry	MAINTAIN CORDON TO TOILETS CORDON COLLAPSED FENCE - SOUTH BDY
		Y2. No entry to parts until repaired or demolished	
Heavy damage *High risk*	Unsafe (Red)	R1. Significant damage: repairs, strengthening possible	
		R2. Severe damage: demolition likely	
		R3. At risk from adjacent premises or from ground failure	

Sketch (optional)
Provide a sketch of the entire building or damage points. Indicate damage points.

Recommendations for Repair and Reconstruction or Demolition (Optional)

MAIN BUILDING : - CHECK GROUND FLOOR LEVELS. POSSIBLE RELEVELLING S/E CORNER
- RECONSTRUCT S/E FOUNDATION
- REPAIR LATHE & PLASTER WALLS & SOME CEILINGS
- RECONSTRUCT CHIMNEYS - LIGHTWEIGHT OPTION
PIGEON CLUB - LIKELY RECONSTRUCT S/E CORNER
BRICK FENCE - LIKELY TOTAL RECONSTRUCTION NEEDED
TOILET BLOCK - RECONSTRUCT COLLAPSED WALLS

NOTE : THIS AREA WAS PREVIOUSLY IMPACTED BY LATERAL GROUND SPREADING, AND PERIMETER TREATMENT PROPOSED (SEE T&T MAP ATTACHED). IT IS POSSIBLE THIS WORK WILL BE MORE EXTENSIVE NOW. RECOMMEND NOT PROCEEDING UNTIL NEARBY WORK HAS BEEN CONFIRMED AND/OR COMPLETED.


MAIN BUILDING
TOILETS
FENCE
Google
Imagery Date: Mar 4, 2009
43°31'13.98" S 172°34'37.35" E elev 3 m
Eye alt 147 m

RIVER

- Significant settlement and ground cracking in a localised corridor trending northwest-southeast across the suburb, potentially related to a buried historic river channel feature.
- Moderate settlement and differential settlement across much of the area, accompanied by moderate volumes of ejected sand and groundwater.
- Localised areas of only minor or no ground damage, potential related to areas of ground not impacted by the historic formation of the meandering river loops.

Figure B5 illustrates the type and extent of land damage that was observed in Avonside. In this sketch, buildings/ properties where land damage has been observed are coloured yellow. Roads are illustrated by the dashed line.

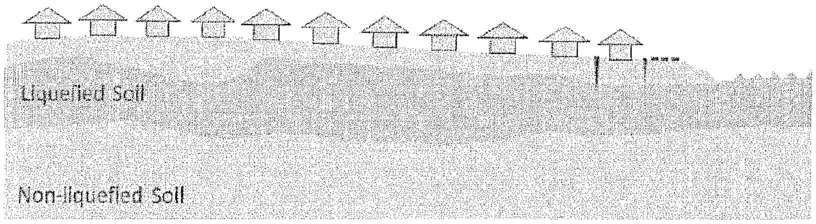


Figure B5. Schematic section of land damage in the suburb of Avonside (west to east)

1.2.3.2 Sub-surface investigations and preliminary interpretation

T&T/ EQC undertook initial ground investigations in September 2010. A more extensive programme of ground investigations is currently in progress. These investigations indicate that there is typically a 1-1.5 m thick surface crust, underlain by loose soils with moderate susceptibility to liquefaction to a depth of approximately 5 m below the existing ground level. Groundwater in this area is expected to lie close to river level, at approximately 1.5 m below ground level.

1.2.3.3 Land remediation options

Table B1.3 outlines the possible land remediation options for Avonside. An example outline plan of the extent of potential options E3 and E4 land remediation works and the extent of land Zones A, B and C is shown in Figure B6.

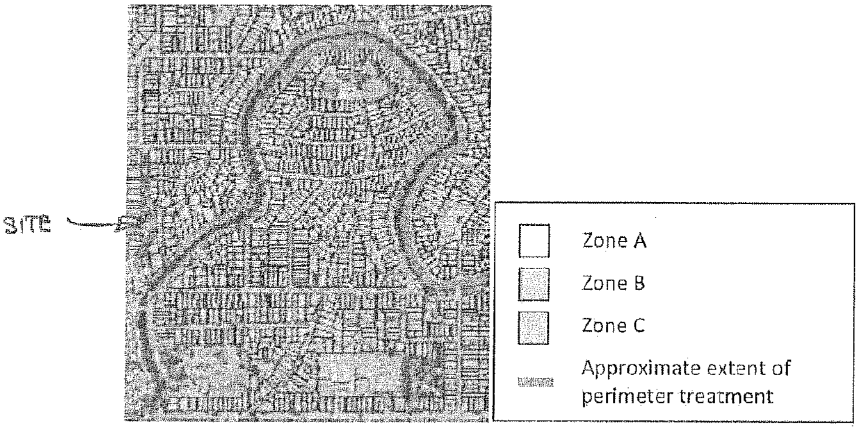


Figure B6. Indicative extent of options E3 and E4 land remediation works and location of land Zones A, B and C in the suburb of Avonside.

APPENDIX D. NEW WORKS

SEISMIC STRENGTHENING OF AVEBURY HOUSE, 7-11 EVELYN COUZINS AVE, CHRISTCHURCH

Sheet List Table

Sheet Number	Revision	Sheet Title
000	0	Cover Sheet
S00	0	Site Plan
S01	0	Existing Ground Floor Plan
S02	0	Existing First Floor Plan
S03	0	Existing Roof Plan
S04	0	Reference Ground Floor Plan
S05	0	Reference First Floor Plan
S06	0	Demolition Ground Floor Plan
S07	0	Demolition First Floor Plan
S10	0	Proposed Ground Floor Plan - Foundation Repair
S11	0	Proposed Ground Floor Plan - Wall and Ceiling Repair
S12	0	Proposed First Floor and Proposed Roof Plan
S20	0	Structural Details - Ground Floor Foundation
S21	0	Structural Details - Bracing Details
S22	0	Structural Details - Chimney
S23	0	Structural Details - Chimney Elevations

REV DATE DESCRIPTION

CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF
AVEBURY HOUSE CHRISTCHURCH
Cover Sheet

emajineer
Structural Concepts

SCL NUMBER
1587
SHEET REV
000 0

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA

| STRUCTURAL CONCEPTS | E: info@structuralconcepts.co.nz | P: +64 6 8420111 | F: +64 6 8420113 | 55 DUNLOP RD, PO BOX 3315, ONEKAWA, NAPIER 4142, NEW ZEALAND |

Site Plan Scale 1:500 @ A3

REV DATE DESCRIPTION

CLIENT
Christchurch City Council
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7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF
AVEBURY HOUSE CHRISTCHURCH
Site Plan

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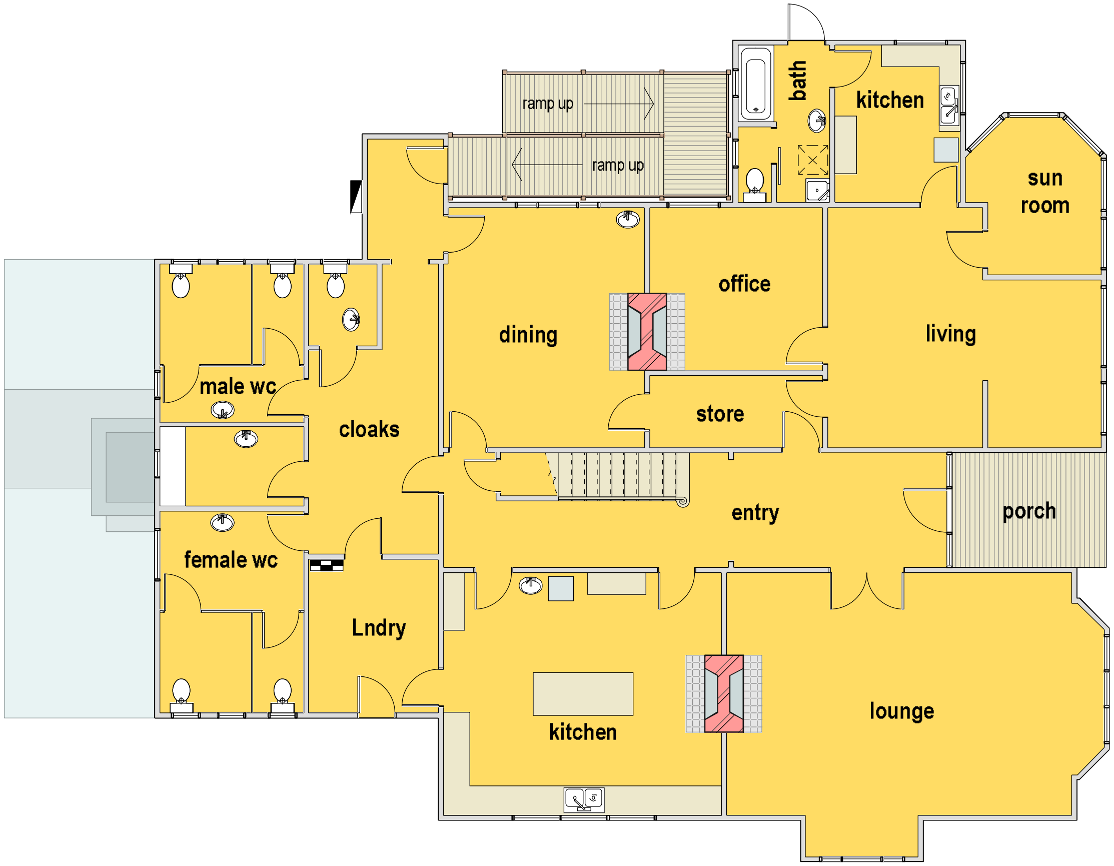
Structural Concepts

SCL NUMBER
1587
SHEET S01
REV 0

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA | STRUCTURAL CONCEPTS | E: info@structuralconcepts.co.nz | P: +64 6 8420111 | F: +64 6 8420113 | 55 DUNLOP RD, PO BOX 3315, ONEKAWA, NAPIER 4142, NEW ZEALAND |



Ground Floor Scale 1:100 @ A3

CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF
AVEBURY HOUSE CHRISTCHURCH
Existing Ground Floor Plan

emajineer
Structural Concepts

SCL NUMBER 1587
SHEET S01 REV 0

REV DATE DESCRIPTION

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA

| STRUCTURAL CONCEPTS | E: info@structuralconcepts.co.nz | P: +64 6 8420111 | F: +64 6 8420113 | 55 DUNLOP RD, PO BOX 3315, ONEKAWA, NAPIER 4142, NEW ZEALAND |

First Floor Scale 1:100 @ A3

REV DATE DESCRIPTION

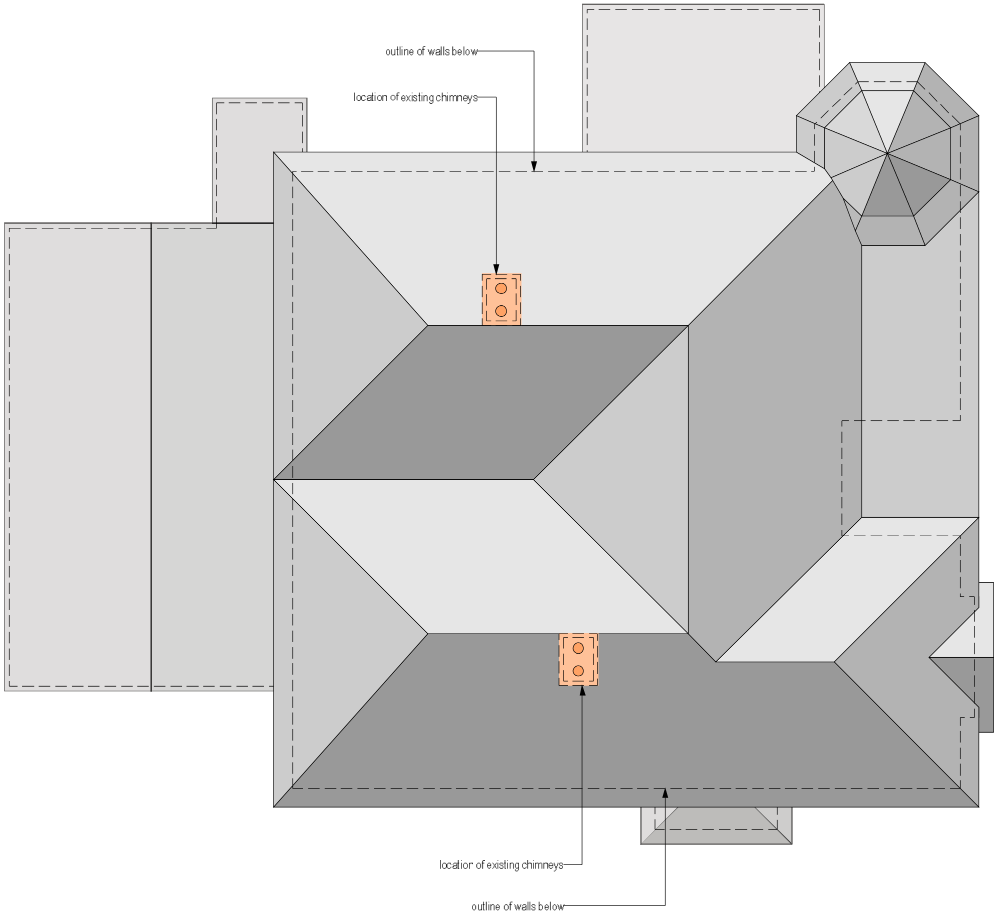
CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF
AVEBURY HOUSE CHRISTCHURCH
Existing First Floor Plan

emajineer
Structural Concepts

SCL NUMBER
1587
SHEET S02
REV 0

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA



Roof Plan Scale 1:100 @ A3

CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF
AVEBURY HOUSE CHRISTCHURCH
Existing Roof Plan

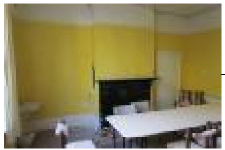
Structural Concepts

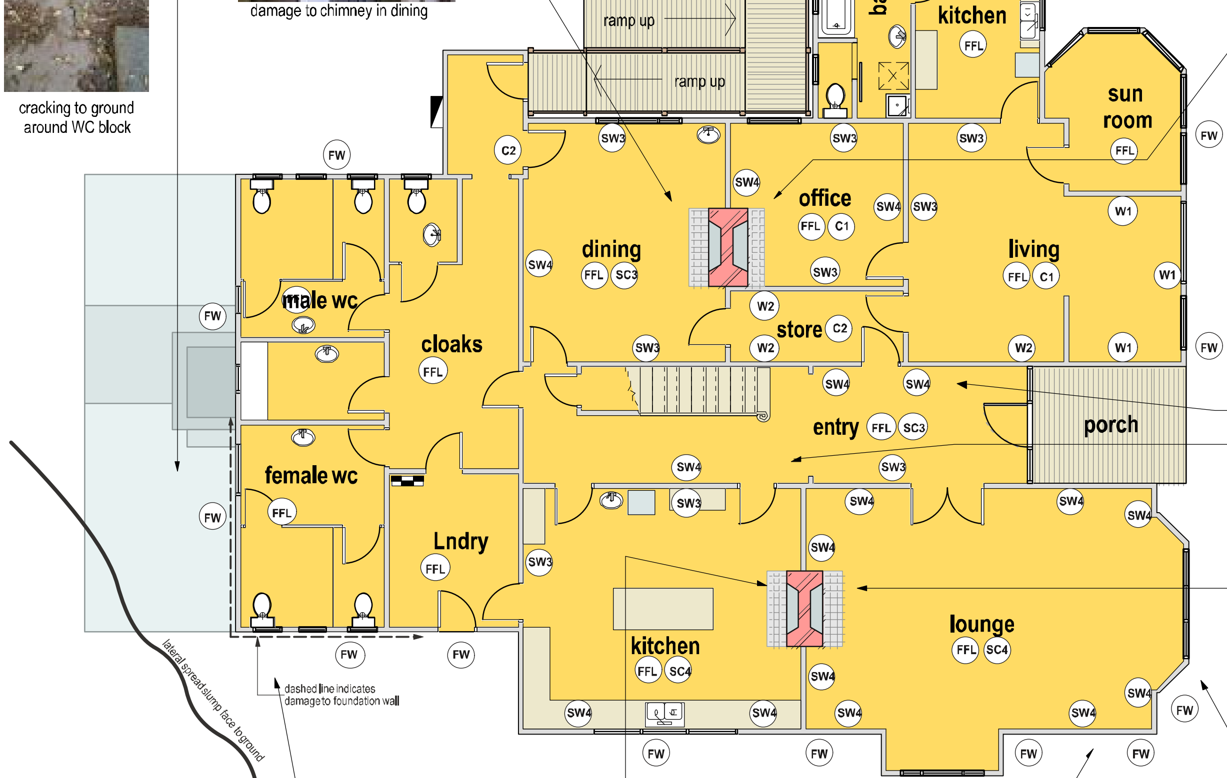
SCL NUMBER 1587
SHEET S03 REV 0

REV DATE DESCRIPTION

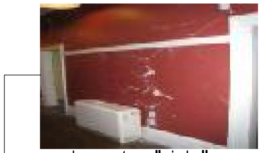
DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA | STRUCTURAL CONCEPTS | E: info@structuralconcepts.co.nz | P: +64 6 8420111 | F: +64 6 8420113 | 55 DUNLOP RD, PO BOX 3315, ONEKAWA, NAPIER 4142, NEW ZEALAND |


cracking to ground around WC block


damage to chimney in dining




damage to chimney


damage to walls in hallway

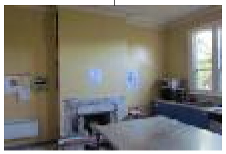

damage to walls in hallway


damage to chimney and ceiling

Damage Assessment Key:

C1	Minor ceiling cracking
C2	Major ceiling cracking
SC3	Repair ceiling lining
SC4	Replace ceiling linings
W1	Minor wall cracking
W2	Major wall cracking
SW3	Repair wall linings
SW4	Replace wall linings
FW	Repair foundation walls
FFL	Check subfloor for damage and re-level floor


damage to corner of foundation


damage to chimney in kitchen


typical foundation wall cracking damage


typical foundation wall cracking damage

REV DATE DESCRIPTION

CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF
AVEBURY HOUSE CHRISTCHURCH
Reference Plan Ground Floor

emgineer
Structural Concepts

SCL NUMBER
1587
SHEET S04
REV 0

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA

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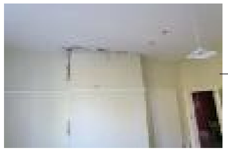
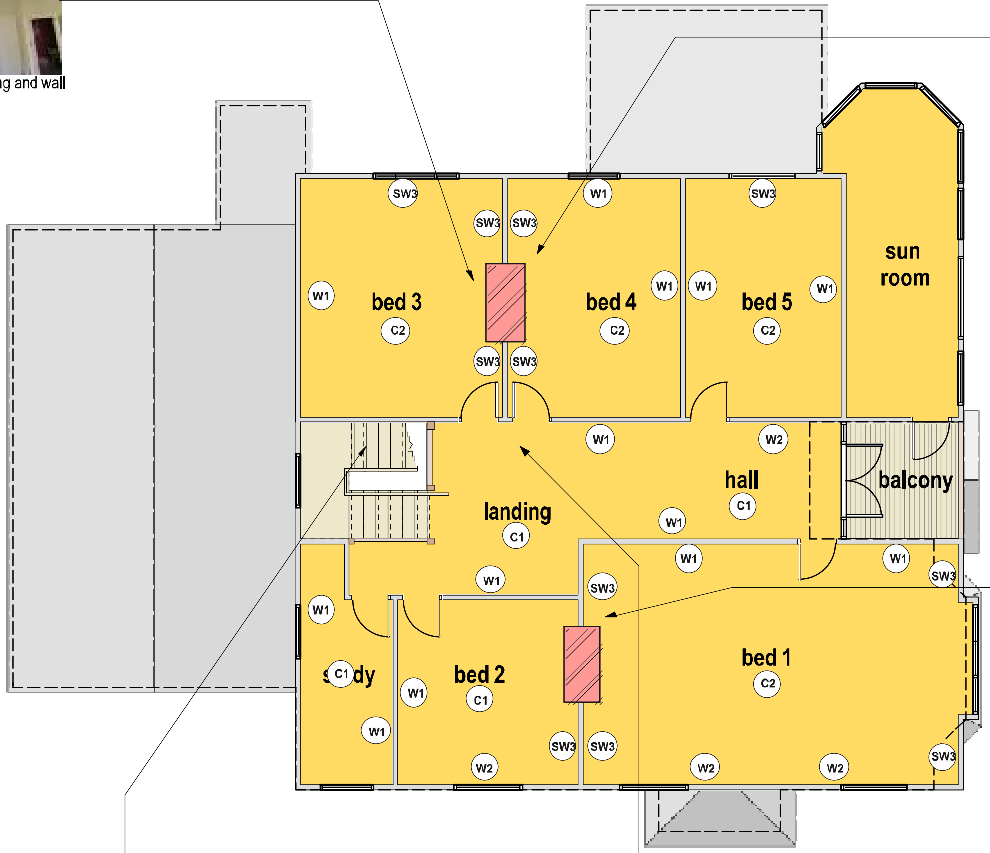
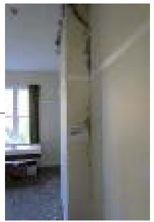

damage to chimney, ceiling and wall

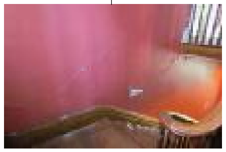

damage to chimney, ceiling and wall

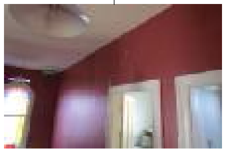
Damage Assessment Key:

- C1 Minor ceiling cracking
- C2 Major ceiling cracking
- SC3 Repair ceiling lining
- SC4 Replace ceiling linings
- W1 Minor wall cracking
- W2 Major wall cracking
- SW3 Repair wall linings
- SW4 Replace wall linings
- FW Repair foundation walls
- FFL Check subfloor for damage and re-level floor




damage to chimney, ceiling and wall


damage to walls in hallway


damage to wall in hallway

REV DATE DESCRIPTION

CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF AVEBURY HOUSE CHRISTCHURCH

Reference Plan First Floor

emaineer
Structural Concepts

SCL NUMBER 1587
SHEET S05
REV 0

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA

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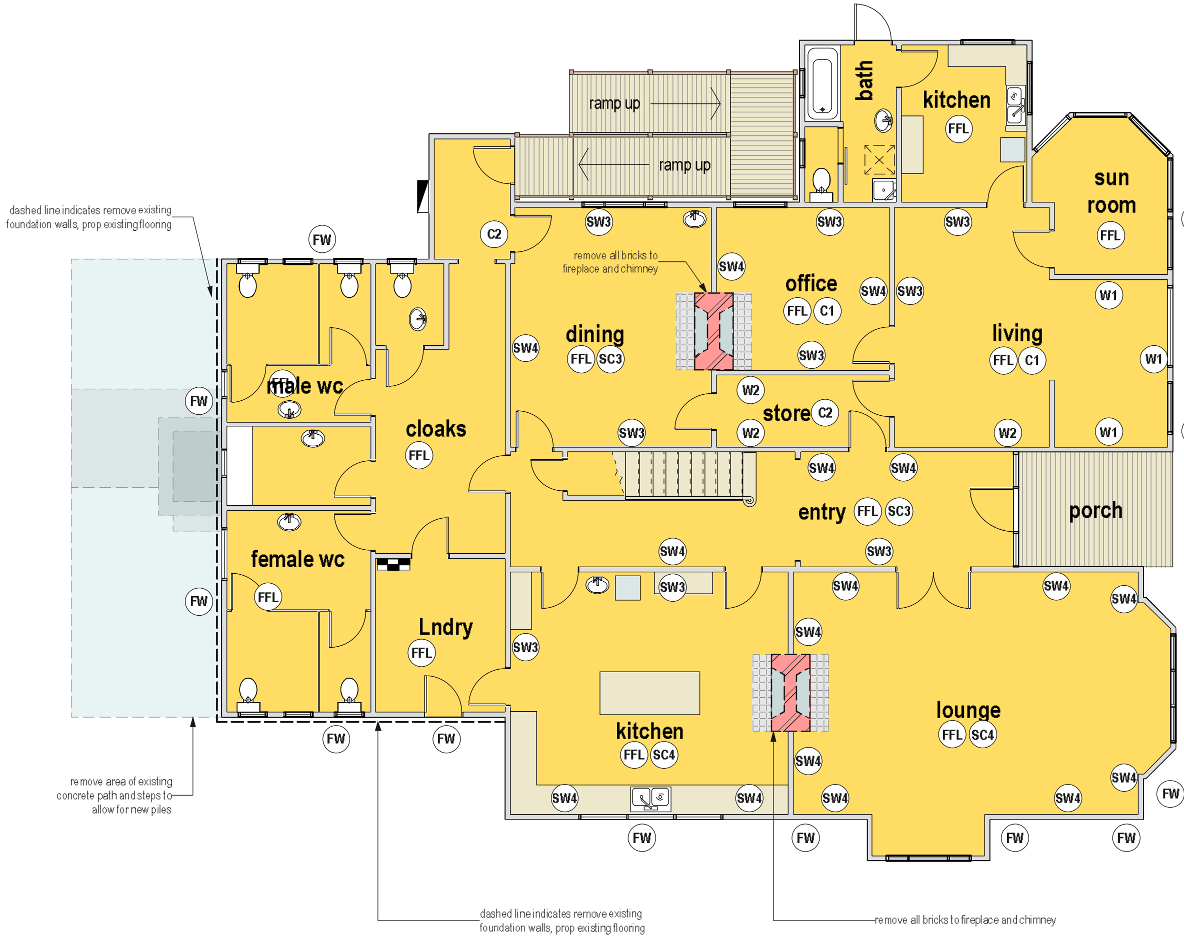


Demolition Key:

C1	Minor ceiling cracking - grind out 'V' shape along cracks to ceiling
C2	Major ceiling cracking - grind out 'V' shape along cracks to ceiling, remove loose plaster
SC3	Repair ceiling lining - strip back plaster to timber lath, remove all loose plaster
SC4	Replace ceiling linings - remove all existing plaster and timber lath to existing ceiling joists. remove all nails, etc ensure timber is sound
W1	Minor wall cracking - grind out 'V' shape along cracks to walls, remove loose plaster
W2	Major wall cracking - remove cracked, peeling or bubbled wallpaper, grind out 'V' shape along cracks, remove loose plaster
SW3	Repair wall lining - strip back plaster to timber lath, remove all loose plaster
SW4	Replace wall linings - remove all existing plaster and timber lath to existing wall framing. remove all nails, etc ensure timber is sound
FW	Replace or repair foundation walls - remove any loose and broken concrete or plaster to foundation walls as required
FFL	Check subfloor for damage and re-level floor - remove any piles showing signs of failure
▭	General demolition - remove structure shown in dashed lines, taking care to prop existing structure where required

REV DATE DESCRIPTION

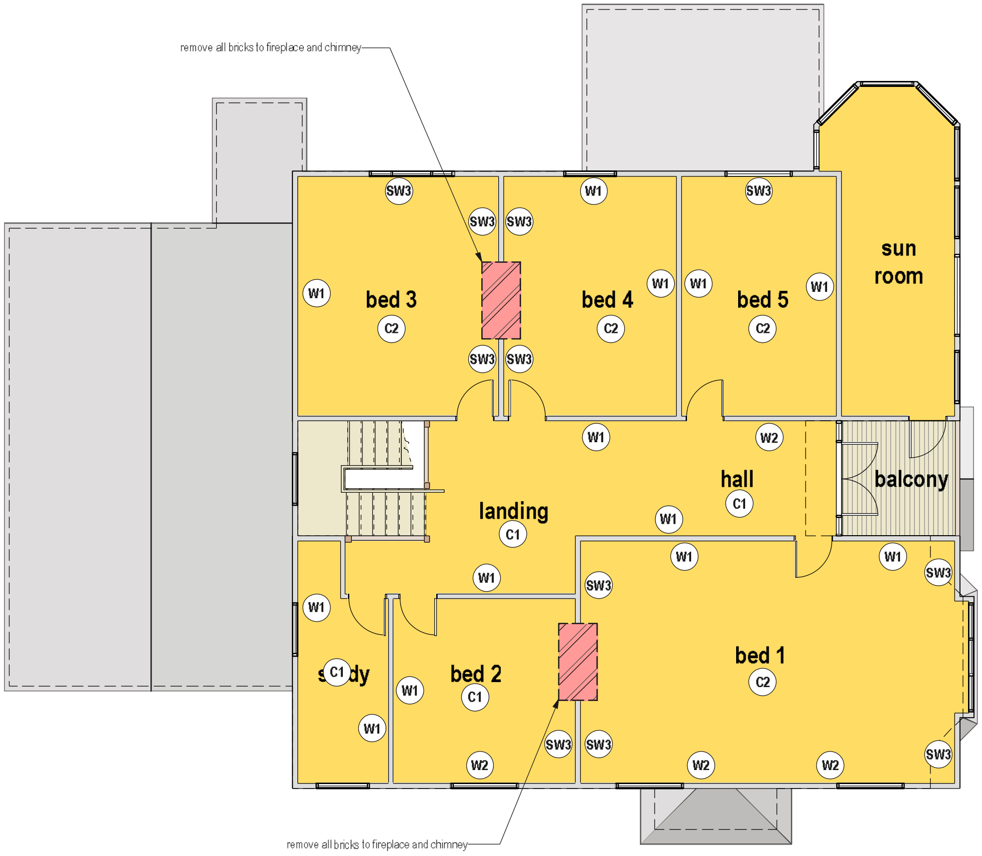
CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF
AVEBURY HOUSE CHRISTCHURCH
Demolition Plan Ground Floor

emajineer
Structural Concepts

SCL NUMBER
1587
SHEET S06
REV 0

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA | STRUCTURAL CONCEPTS | E: info@structuralconcepts.co.nz | P: +64 6 8420111 | F: +64 6 8420113 | 55 DUNLOP RD, PO BOX 3315, ONEKAWA, NAPIER 4142, NEW ZEALAND |



Demolition Key:

C1	Minor ceiling cracking - grind out 'V' shape along cracks to ceiling
C2	Major ceiling cracking - grind out 'V' shape along cracks to ceiling, remove loose plaster
SC3	Repair ceiling lining - strip back plaster to timber lath, remove all loose plaster
SC4	Replace ceiling linings - remove all existing plaster and timber lath to existing ceiling joists. remove all nails, etc ensure timber is sound
W1	Minor wall cracking - grind out 'V' shape along cracks to walls, remove loose plaster
W2	Major wall cracking - remove cracked, peeling or bubbled wallpaper, grind out 'V' shape along cracks, remove loose plaster
SW3	Repair wall lining - strip back plaster to timber lath, remove all loose plaster
SW4	Replace wall linings - remove all existing plaster and timber lath to existing wall framing. remove all nails, etc ensure timber is sound
FW	Replace or repair foundation walls - remove any loose and broken concrete or plaster to foundation walls as required
FFL	Check subfloor for damage and re-level floor - remove any piles showing signs of failure
⬚	General demolition - remove structure shown in dashed lines, taking care to prop existing structure where required

REV DATE DESCRIPTION

CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF AVEBURY HOUSE CHRISTCHURCH
Demolition Plan First Floor

emajineer
Structural Concepts

SCL NUMBER 1587
SHEET S07
REV 0

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA

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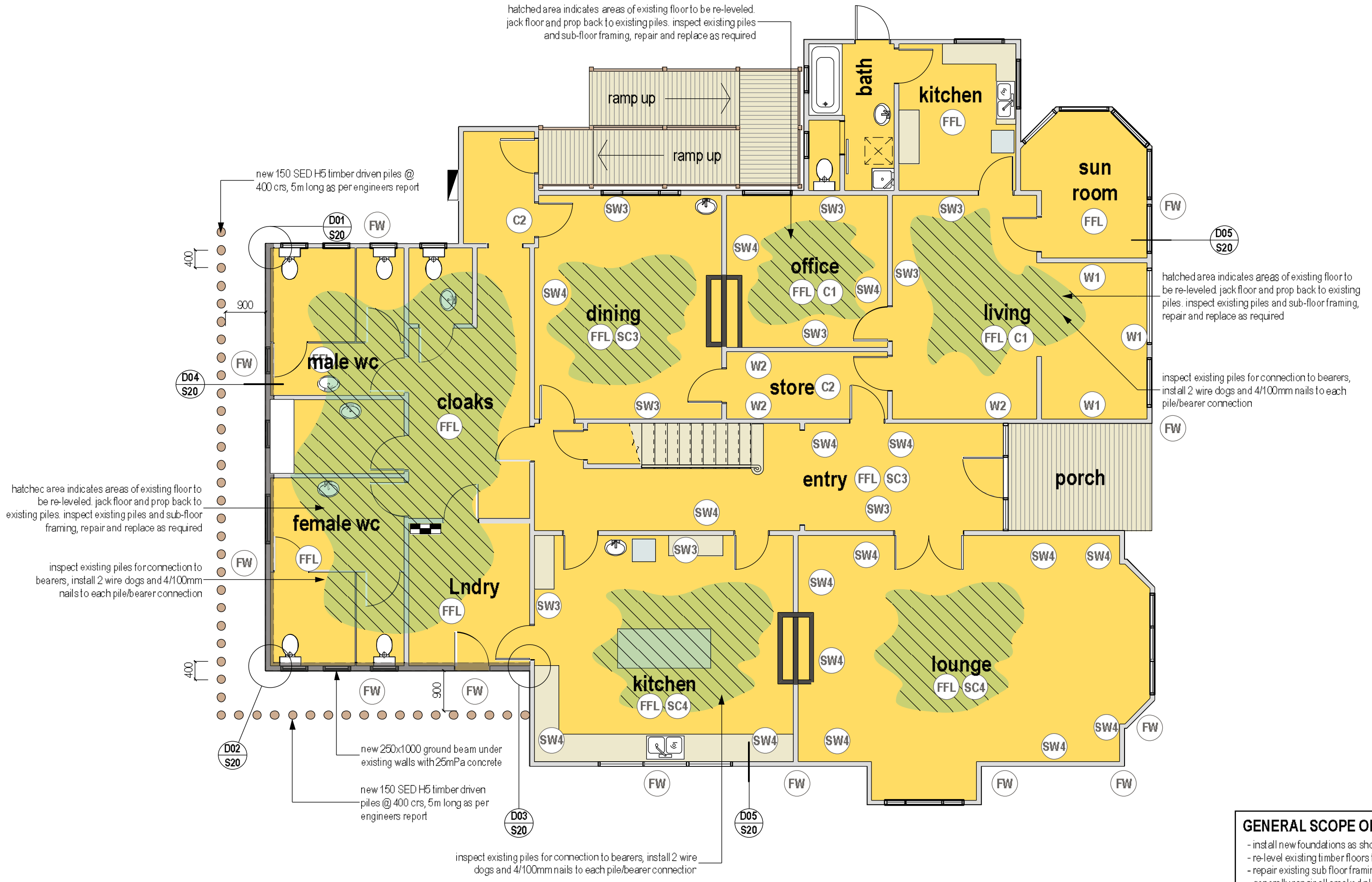

hatched area indicates areas of existing floor to be re-leveled. jack floor and prop back to existing piles. inspect existing piles and sub-floor framing, repair and replace as required

new 150 SED H5 timber driven piles @ 400 crs, 5m long as per engineers report

hatchec area indicates areas of existing floor to be re-leveled. jack floor and prop back to existing piles. inspect existing piles and sub-floor framing, repair and replace as required

inspect existing piles for connection to bearers, install 2 wire dogs and 4/100mm nails to each pile/bearer connection

new 250x1000 ground beam under existing walls with 25mPa concrete

new 150 SED H5 timber driven piles @ 400 crs, 5m long as per engineers report

inspect existing piles for connection to bearers, install 2 wire dogs and 4/100mm nails to each pile/bearer connection

hatched area indicates areas of existing floor to be re-leveled. jack floor and prop back to existing piles. inspect existing piles and sub-floor framing, repair and replace as required

inspect existing piles for connection to bearers, install 2 wire dogs and 4/100mm nails to each pile/bearer connection

NEW WORK KEY:

C1	Minor ceiling cracking - re-plaster and overlay crack with fibreglass reinforcing mesh, plaster to provide smooth finish
C2	Major ceiling cracking - replace large gaps with Braceline Gib or similar, overlay joints between old plaster and new Gib with fibreglass reinforcing mesh, plaster area to provide smooth finish
SC3	Repair ceiling lining - replace bare areas with Braceline Gib or similar over existing lath, overlay joints between old plaster and new Gib with fibreglass reinforcing mesh, plaster area to a smooth finish
SC4	Replace ceiling linings - install new 19x45 H1.2 timber ceiling battens @ 400 crs, with metal easy-dwang to all edges. install new 13mm Gib Ultraline diaphragm ceiling as per manufacturer's specifications, re-install all finishing and plaster ceiling to a smooth finish
W1	Minor wall cracking - re-plaster and overlay crack with fibreglass reinforcing mesh, plaster to provide smooth finish
W2	Major wall cracking - replace large gaps with Braceline Gib or similar, overlay joints between old plaster and new Gib with fibreglass reinforcing mesh, plaster area to provide smooth finish
SW3	Repair wall lining - replace bare areas with Braceline Gib or similar over existing lath, overlay joints between old plaster and new Gib with fibreglass reinforcing mesh, plaster area to a smooth finish
SW4	Replace wall linings - install new bracing element as detailed to manufacturer's specifications, along with all anchor fixings to floor. install 10mm Standard Gib board as per manufacturer's specifications, re-install all finishing and plaster ceiling to a smooth finish
FW	Replace or repair foundation walls - repair cracking to foundation walls as detailed in the engineers report with Sikadur injectokit and Sikadur 520 or similar. install steel brackets from existing floor structure to foundation walls as detailed.
FFL	Re-level floor and check piles for damage - replace any damaged or failed piles with a typical pile as detailed in the specifications as per NZS3604:2011. install new pile fixing to all other existing bearer / pile connections: 1 wire Dog each side of pile with 2/100mm nails

general repair to finishing: carefully remove existing skirting, architraves and scotia where required to carry out demolition. replace all salvaged items, make good any joints, etc

GENERAL SCOPE OF NEW WORKS:

- install new foundations as shown.
- re-level existing timber floors to areas shown on plans, fixing piles to bearers with 6KN connectors as per details
- repair existing sub floor framing to existing foundation walls as detailed.
- generally repair all cracked plaster to walls as per engineer's report. reinstate all existing finishes as required, finish of all walls and ceilings to be confirmed with client. see reference plans for locations of types of wall and ceiling damage
- install new timber framing to walls, floor and ceiling to replace demolished chimneys. linings and finishes to match existing walls, floor and ceiling.
- install new chimney as detailed, clad with plaster as selected, re-install existing mantels and hearths
- ensure all doors and windows open and close properly, repair if required. replace broken glass as required.
- paint and decorate all repaired walls and ceilings as instructed by client.
- carry out any other repair work as required by the engineers report and client.
- generally ensure all structure, finishes, plumbing, electrical and joinery items are repaired or replaced as required. contractor to determine extent of damage to all items on site, and confirm extent of work with client.

Ground Floor Foundation Repair

Scale 1:100 @ A3

REV DATE DESCRIPTION

CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF
AVEBURY HOUSE CHRISTCHURCH
Proposed Ground Floor Plan

emajineer
the possibilities are endless
Structural Concepts

SCL NUMBER
1587
SHEET S10
REV 0

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA

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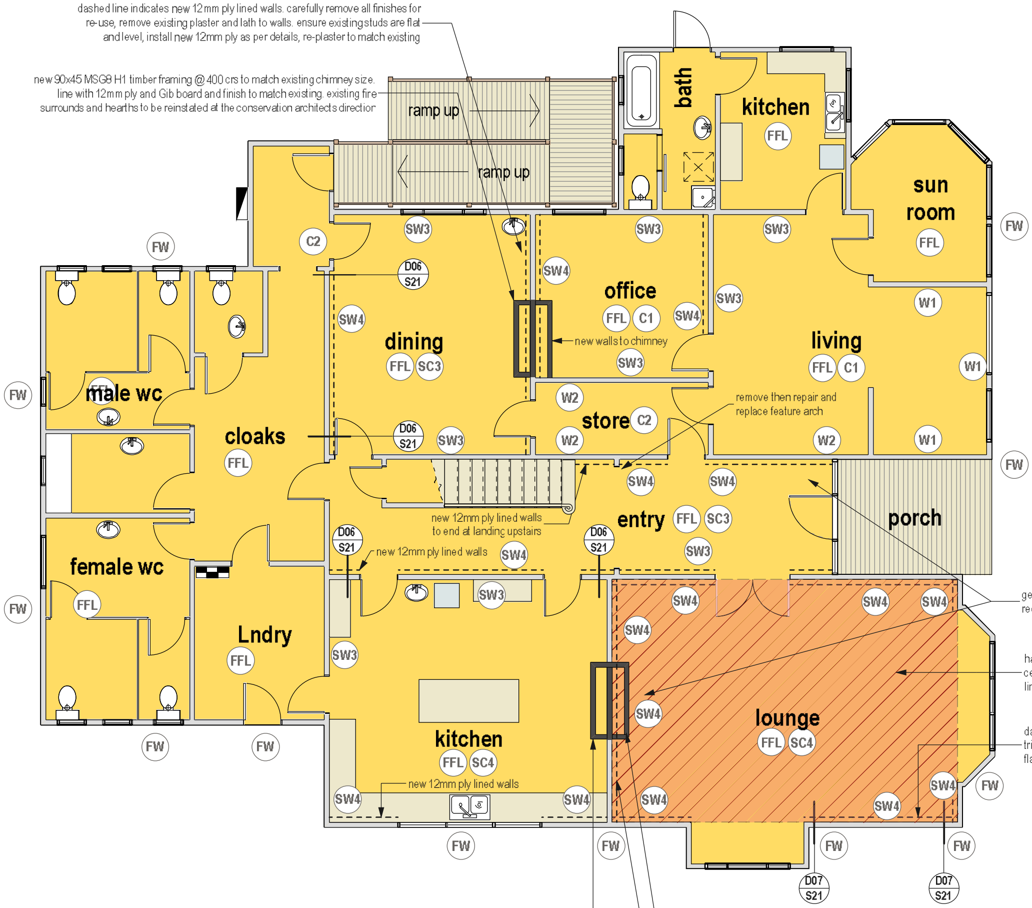

dashed line indicates new 12mm ply lined walls. carefully remove all finishes for re-use, remove existing plaster and lath to walls. ensure existing studs are flat and level, install new 12mm ply as per details, re-plaster to match existing

new 90x45 MSG8 H1 timber framing @ 400 crs to match existing chimney size line with 12mm ply and Gib board and finish to match existing. existing fire surrounds and hearths to be reinstated at the conservation architects direction

new walls to chimney

remove then repair and replace feature arch

new 12mm ply lined walls to end at landing upstairs

new 12mm ply lined walls

new 12mm ply lined walls

general repair to finishing: carefully remove existing skirting, architraves and scotia where required to carry out demolition. replace all salvaged items, make good any joints, etc

hatched area indicates areas of existing ceiling to be removed. carefully remove all finishing, trim and ceiling rose for re-use, remove existing plaster and lath ceiling. install new 13mm Gib Ultraline ceiling linings over 19x45 timber ceiling battens @ 400 crs as a ceiling diaphragm, refer to Gib specifications

dashed line indicates new 12mm ply lined walls. carefully remove all finishing and trim for re-use, remove existing plaster and lath to walls. ensure existing studs are flat and level, install new 12mm ply as per details, re-plaster to match existing

general repair to finishing: carefully remove existing skirting, architraves and scotia where required to carry out demolition. replace all salvaged items, make good any joints, etc

new 90x45 MSG8 H1 timber framing @ 400 crs to match existing chimney size. line with 12mm ply and Gib board and finish to match existing. existing fire surrounds and hearths to be reinstated at the conservation architects direction

dashed line indicates new 12mm ply lined walls. carefully remove all finishes for re-use, remove existing plaster and lath to walls. ensure existing studs are flat and level, install new 12mm ply as per details, re-plaster to match existing

NEW WORK KEY:

C1	Minor ceiling cracking - re-plaster and overlay crack with fibreglass reinforcing mesh, plaster to provide smooth finish
C2	Major ceiling cracking - replace large gaps with Braceline Gib or similar, overlay joints between old plaster and new Gib with fibreglass reinforcing mesh, plaster area to provide smooth finish
SC3	Repair ceiling lining - replace bare areas with Braceline Gib or similar over existing lath, overlay joints between old plaster and new Gib with fibreglass reinforcing mesh, plaster area to a smooth finish
SC4	Replace ceiling linings - install new 19x45 H1.2 timber ceiling battens @ 400 crs, with metal easy-dwang to all edges. install new 13mm Gib Ultraline diaphragm ceiling as per manufacturer's specifications, re-install all finishing and plaster ceiling to a smooth finish
W1	Minor wall cracking - re-plaster and overlay crack with fibreglass reinforcing mesh, plaster to provide smooth finish
W2	Major wall cracking - replace large gaps with Braceline Gib or similar, overlay joints between old plaster and new Gib with fibreglass reinforcing mesh, plaster area to provide smooth finish
SW3	Repair wall lining - replace bare areas with Braceline Gib or similar over existing lath, overlay joints between old plaster and new Gib with fibreglass reinforcing mesh, plaster area to a smooth finish
SW4	Replace wall linings - install new bracing element as detailed to manufacturer's specifications, along with all anchor fixings to floor. install 10mm Standard Gib board as per manufacturer's specifications, re-install all finishing and plaster ceiling to a smooth finish
FW	Replace or repair foundation walls - repair cracking to foundation walls as detailed in the engineers report with Sikadur injectokit and Sikadur 520 or similar. install steel brackets from existing floor structure to foundation walls as detailed.
FFL	Re-level floor and check piles for damage - replace any damaged or failed piles with a typical pile as detailed in the specifications as per NZS3604:2011. install new pile fixing to all other existing bearer / pile connections: 1 wire Dog each side of pile with 2/100mm nails

general repair to finishing: carefully remove existing skirting, architraves and scotia where required to carry out demolition. replace all salvaged items, make good any joints, etc

GENERAL SCOPE OF NEW WORKS:

- install new foundations as shown.
- re-level existing timber floors to areas shown on plans, fixing piles to bearers with 6KN connectors as per details
- repair existing sub floor framing to existing foundation walls as detailed.
- generally repair all cracked plaster to walls as per engineer's report. reinstate all existing finishes as required, finish of all walls and ceilings to be confirmed with client. see reference plans for locations of types of wall and ceiling damage
- install new timber framing to walls, floor and ceiling to replace demolished chimneys. linings and finishes to match existing walls, floor and ceiling.
- install new chimney as detailed, clad with plaster as selected, re-install existing mantels and hearths
- ensure all doors and windows open and close properly, repair if required. replace broken glass as required.
- paint and decorate all repaired walls and ceilings as instructed by client.
- carry out any other repair work as required by the engineers report and client.
- generally ensure all structure, finishes, plumbing, electrical and joinery items are repaired or replaced as required. contractor to determine extent of damage to all items on site, and confirm extent of work with client.

Ground Floor Wall and Ceiling Repair

Scale 1:100 @ A3

CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF
AVEBURY HOUSE CHRISTCHURCH
Proposed Ground Floor Plan

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the possibilities are endless
Structural Concepts

SCL NUMBER
1587
SHEET S11
REV 0

REV DATE DESCRIPTION

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA

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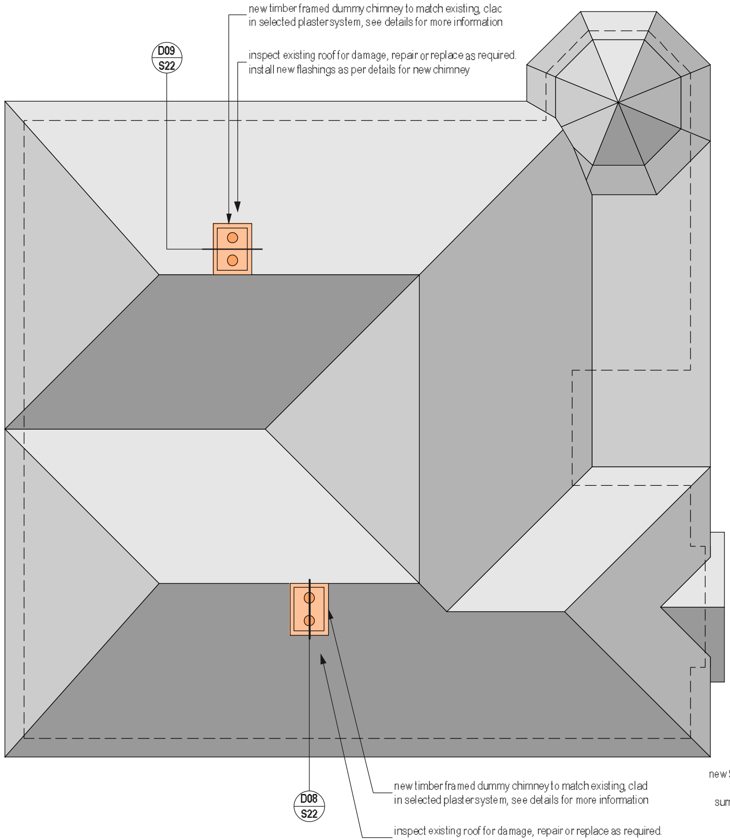


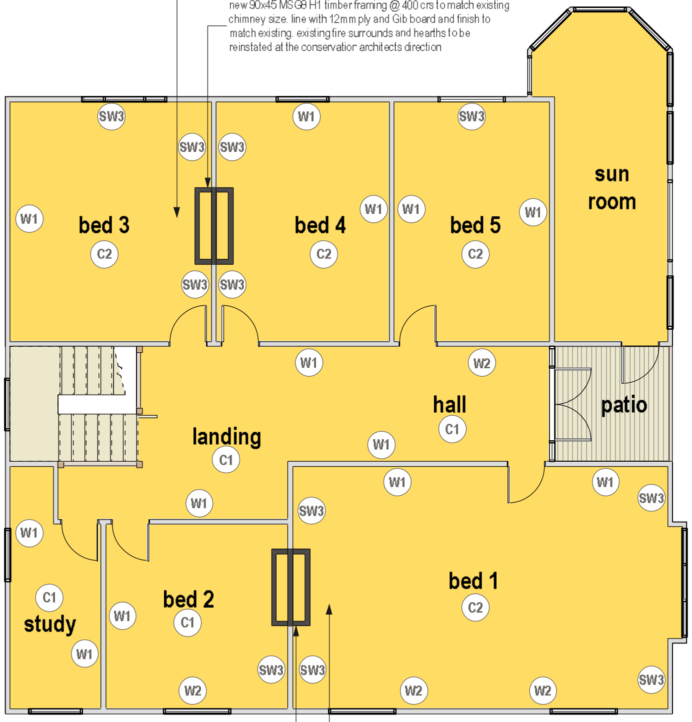
new timber framed dummy chimney to match existing, clad in selected plaster system, see details for more information

inspect existing roof for damage, repair or replace as required. install new flashings as per details for new chimney

new timber framed dummy chimney to match existing, clad in selected plaster system, see details for more information

inspect existing roof for damage, repair or replace as required. install new flashings as per details for new chimney

Roof Plan Scale 1:100 @ A3



general repair to finishing: carefully remove existing skirting, architraves and scotia where required to carry out demolition. replace all salvaged items, make good any joints, etc

new 90x45 MSG8 H1 timber framing @ 400 crs to match existing chimney size. line with 12mm ply and Gib board and finish to match existing. existing fire surrounds and hearths to be reinstated at the conservation architects direction

new 90x45 MSG8 H1 timber framing @ 400 crs to match existing chimney size. line with 12mm ply and Gib board and finish to match existing. existing fire surrounds and hearths to be reinstated at the conservation architects direction

general repair to finishing: carefully remove existing skirting, architraves and scotia where required to carry out demolition. replace all salvaged items, make good any joints, etc

First Floor Scale 1:100 @ A3

NEW WORK KEY:

C1	Minor ceiling cracking - re-plaster and overlay crack with fibreglass reinforcing mesh, plaster to provide smooth finish
C2	Major ceiling cracking - replace large gaps with Braceline Gib or similar, overlay joints between old plaster and new Gib with fibreglass reinforcing mesh, plaster area to provide smooth finish
SC3	Repair ceiling lining - replace bare areas with Braceline Gib or similar over existing lath, overlay joints between old plaster and new Gib with fibreglass reinforcing mesh, plaster area to a smooth finish
SC4	Replace ceiling linings - install new 19x45 H1.2 timber ceiling battens @ 400 crs, with metal easy-dwang to all edges. install new 13mm Gib Ultraline diaphragm ceiling as per manufacturer's specifications, re-install all finishing and plaster ceiling to a smooth finish
W1	Minor wall cracking - re-plaster and overlay crack with fibreglass reinforcing mesh, plaster to provide smooth finish
W2	Major wall cracking - replace large gaps with Braceline Gib or similar, overlay joints between old plaster and new Gib with fibreglass reinforcing mesh, plaster area to provide smooth finish
SW3	Repair wall lining - replace bare areas with Braceline Gib or similar over existing lath, overlay joints between old plaster and new Gib with fibreglass reinforcing mesh, plaster area to a smooth finish
SW4	Replace wall linings - install new bracing element as detailed to manufacturer's specifications, along with all anchor fixings to floor. install 10mm Standard Gib board as per manufacturer's specifications, re-install all finishing and plaster ceiling to a smooth finish
FW	Replace or repair foundation walls - repair cracking to foundation walls as detailed in the engineers report with Sikadur injectokit and Sikadur 520 or similar. install steel brackets from existing floor structure to foundation walls as detailed
FFL	Re-level floor and check piles for damage - replace any damaged or failed piles with a typical pile as detailed in the specifications as per NZS3604:2011. install new pile fixing to all other existing bearer / pile connections: 1 wire Dog each side of pile with 2/100mm nails

general repair to finishing: carefully remove existing skirting, architraves and scotia where required to carry out demolition. replace all salvaged items, make good any joints, etc

GENERAL SCOPE OF NEW WORKS:

- install new foundations as shown.
- re-level existing timber floors to areas shown on plans, fixing piles to bearers with 6KN connectors as per details
- repair existing sub floor framing to existing foundation walls as detailed.
- generally repair all cracked plaster to walls as per engineer's report. reinstate all existing finishes as required, finish of all walls and ceilings to be confirmed with client. see reference plans for locations of types of wall and ceiling damage
- install new timber framing to walls, floor and ceiling to replace demolished chimneys. linings and finishes to match existing walls, floor and ceiling.
- install new chimney as detailed, clad with plaster as selected, re-install existing mantels and hearths
- ensure all doors and windows open and close properly, repair if required. replace broken glass as required.
- paint and decorate all repaired walls and ceilings as instructed by client.
- carry out any other repair work as required by the engineers report and client.
- generally ensure all structure, finishes, plumbing, electrical and joinery items are repaired or replaced as required. contractor to determine extent of damage to all items on site, and confirm extent of work with client.

REV DATE DESCRIPTION

CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF
AVEBURY HOUSE CHRISTCHURCH
Proposed First Floor and Proposed Roof Plan

emajineer
Structural Concepts

SCL NUMBER
1587
SHEET S12
REV 0

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA

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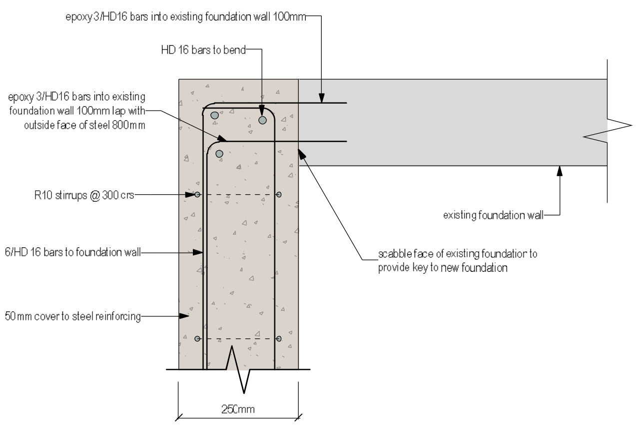
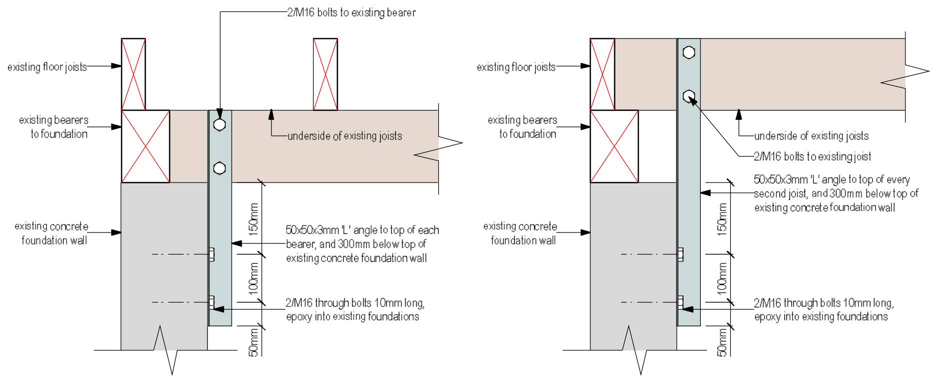
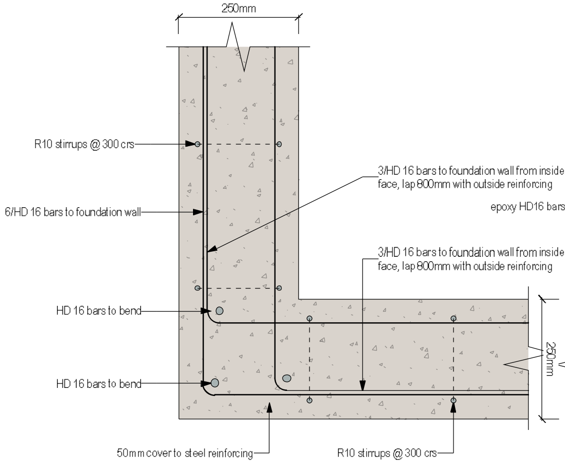


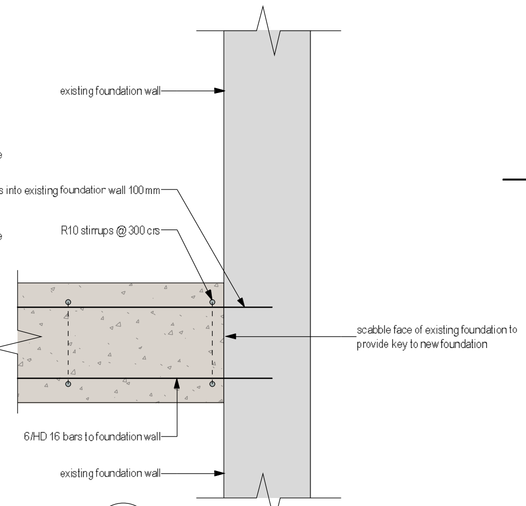
D01
S10
New Foundation to Existing Scale 1:10 @ A3



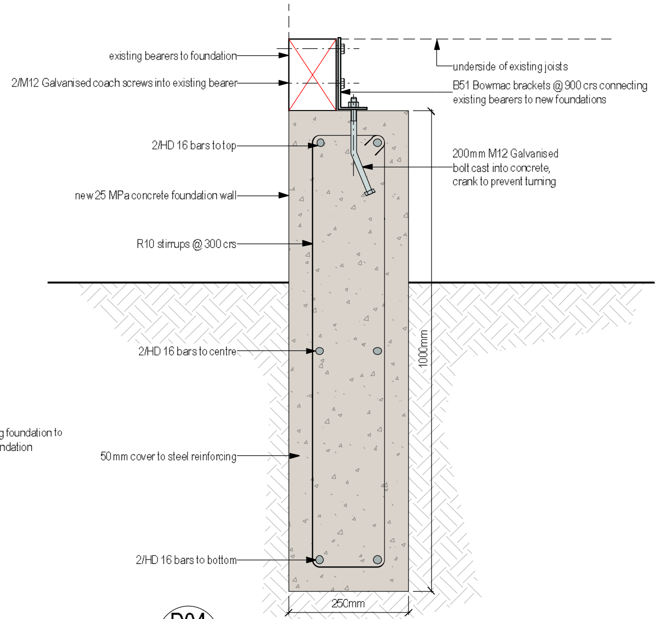
D05
S10
Fixing to Existing Foundation Wall Scale 1:10 @ A3



D02
S10
New Foundation Corner Scale 1:10 @ A3



D03
S10
New Foundation to Existing Scale 1:10 @ A3



D04
S10
New Foundation Section Scale 1:10 @ A3

REV DATE DESCRIPTION

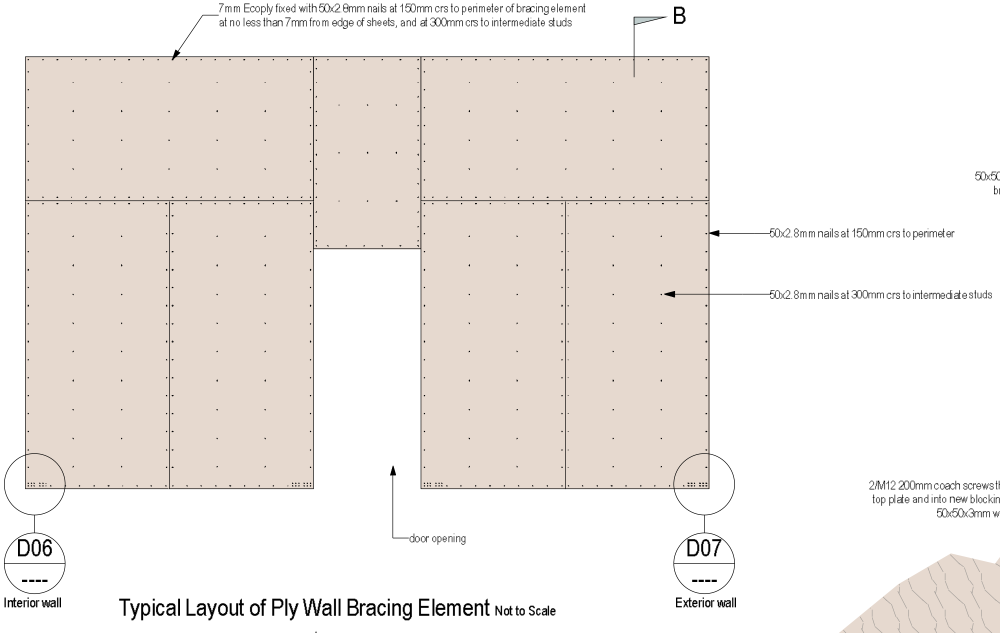
CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF
AVEBURY HOUSE CHRISTCHURCH
Foundation Details

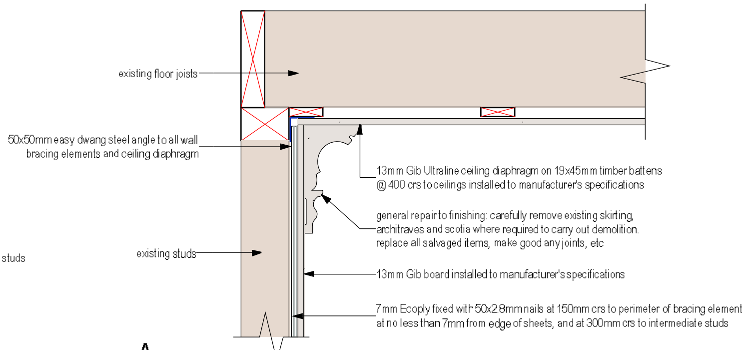
emajineer
Structural Concepts

SCL NUMBER
1587
SHEET S20
REV 0

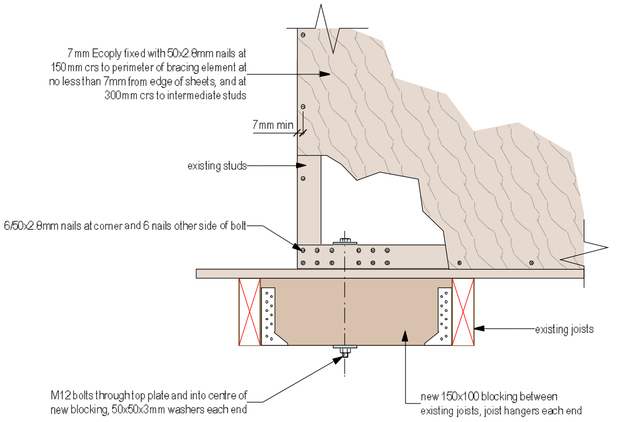
DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA | STRUCTURAL CONCEPTS | E: info@structuralconcepts.co.nz | P: +64 6 8420111 | F: +64 6 8420113 | 55 DUNLOP RD, PO BOX 3315, ONEKAWA, NAPIER 4142, NEW ZEALAND |



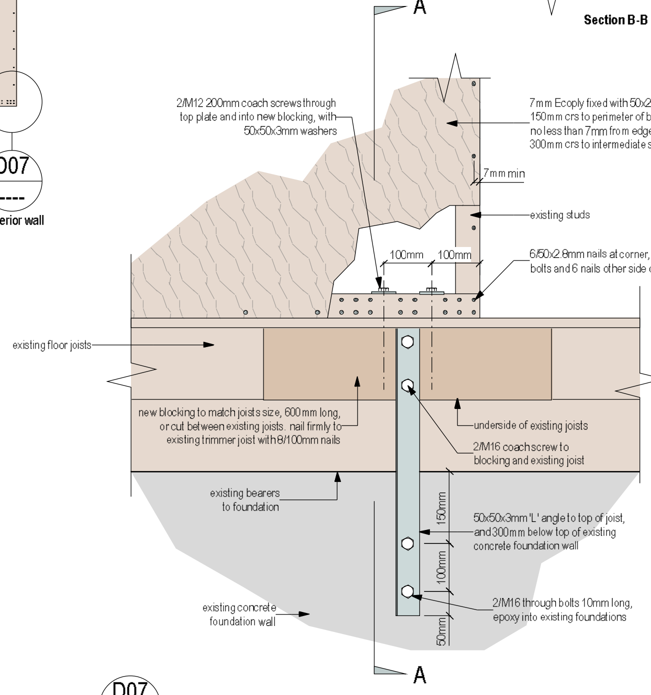
Typical Layout of Ply Wall Bracing Element Not to Scale

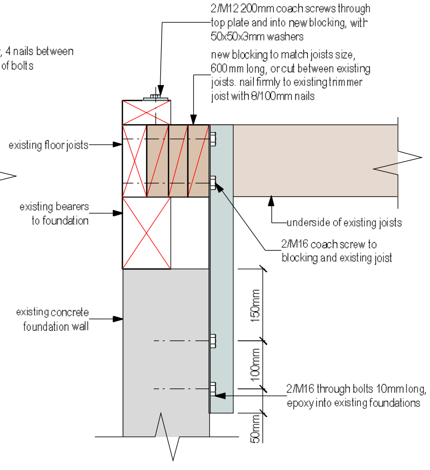


Section B-B



D06
S11
Typical Corner Detail for Internal Bracing Elements Scale 1:10 @ A3





Section A-A

D07
S11
Typical Corner Detail for External Bracing Elements Scale 1:10 @ A3

REV DATE DESCRIPTION

CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF
AVEBURY HOUSE CHRISTCHURCH
Bracing Details

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Structural Concepts

SCL NUMBER
1587
SHEET REV
S21 0

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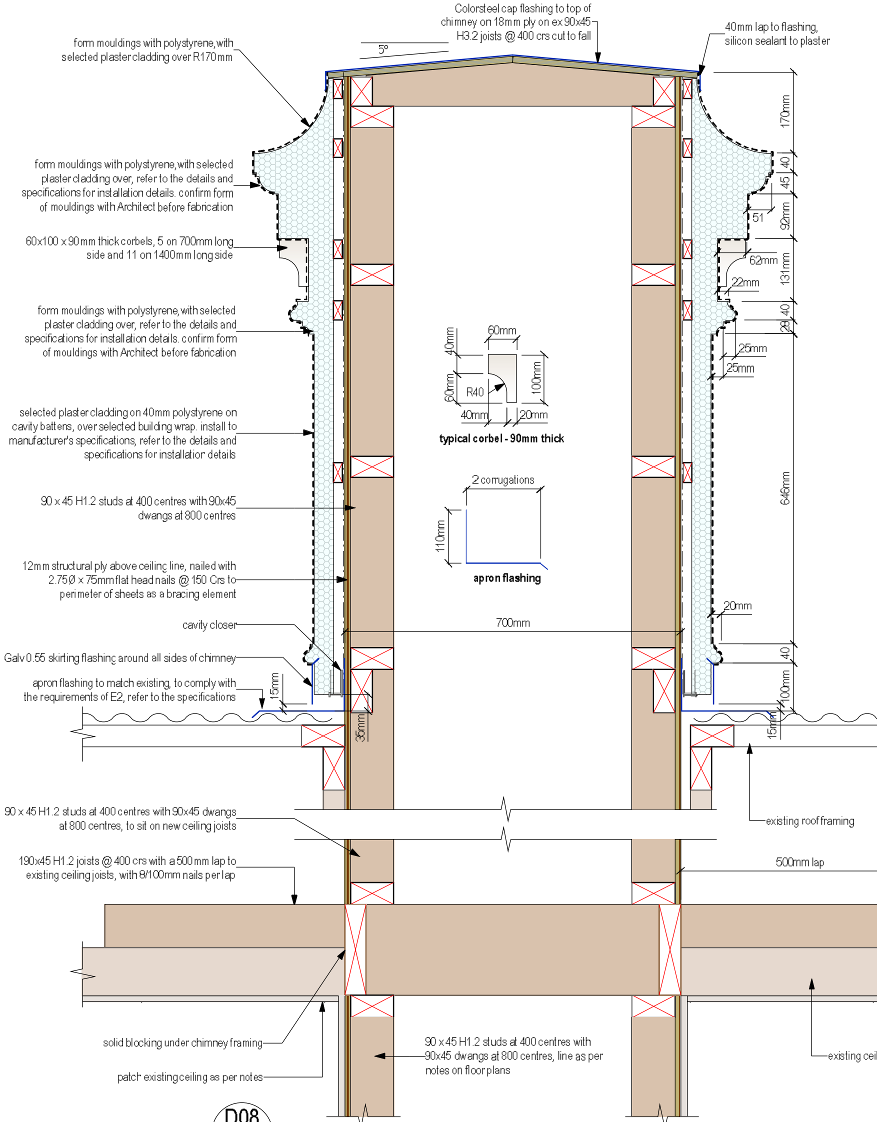
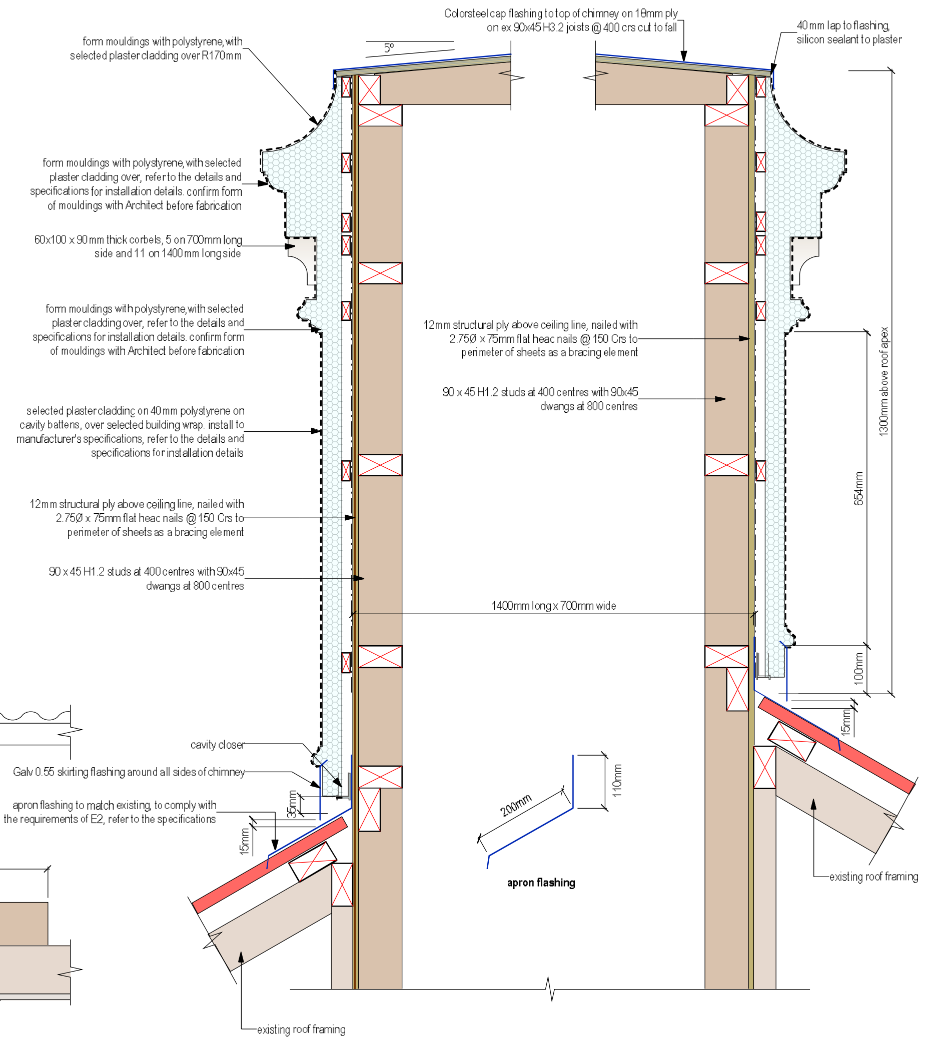


D08
S10
New Timber Framed Chimney to Ceiling Scale 1:10 @ A3



D09
S10
New Timber Framed Chimney to Roof Scale 1:10 @ A3

REV DATE DESCRIPTION

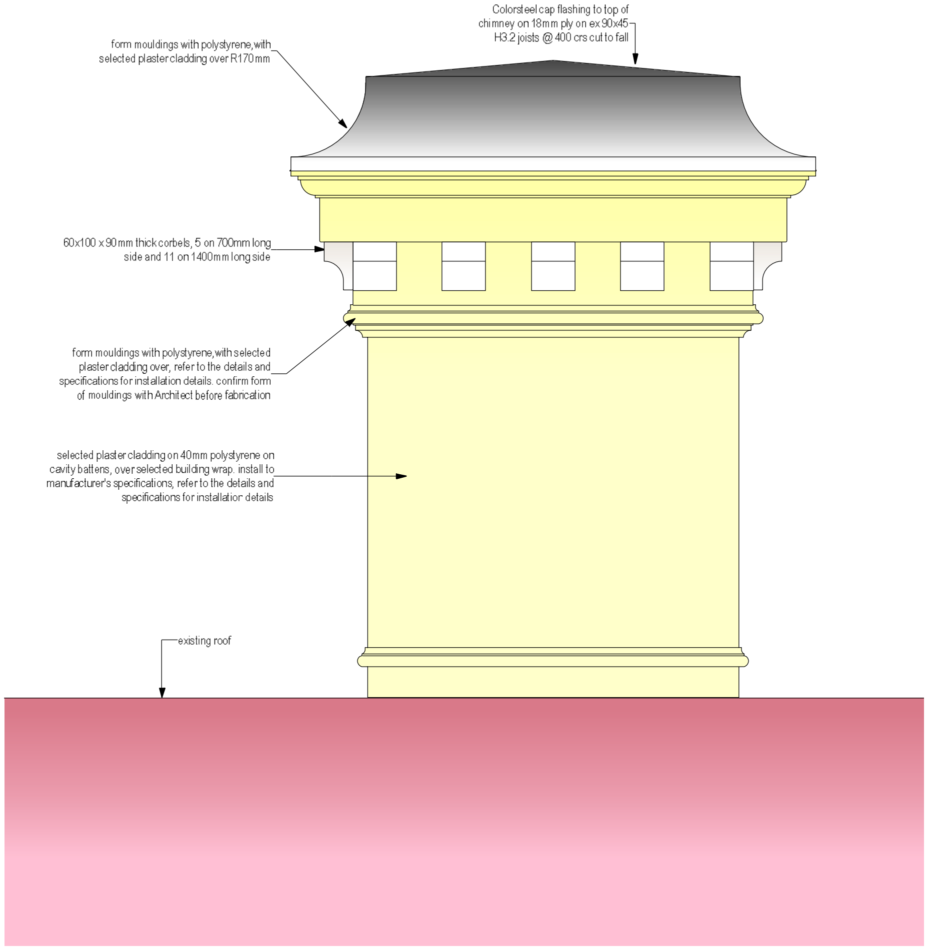
CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF AVEBURY HOUSE CHRISTCHURCH
Chimney Details

emajineer
Structural Concepts

SCL NUMBER
1587
SHEET S22
REV 0

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA



Elevation of New Timber Framed Chimney Scale 1:10 @ A3

Photo of Chimney Before Damage

Photo of House Before Damage

REV DATE DESCRIPTION

CLIENT
Christchurch City Council
PROJECT ADDRESS
7-11 Evelyn Couzins Ave, Richmond, Christchurch

SEISMIC STRENGTHENING OF
AVEBURY HOUSE CHRISTCHURCH
Chimney Elevations

emajineer
Structural Concepts

SCL NUMBER 1587
SHEET S23 REV 0

DATE Sep 2011 ACA2011 A3 | DES - | DRG TT/DJA

APPENDIX E. DESIGN FEATURES REPORT

STRUCTURAL CONCEPTS LIMITED

55 DUNLOP ROAD, PO BOX 3315, NAPIER, 4142, NEW ZEALAND, P (06) 842 0111 F (06) 842 0113, E info@structuralconcepts.co.nz

Client: Christchurch City Council

Project: Avebury House
7-11 Evelyn Couzins Ave, Christchurch

Ref: 1587

Date: 26-May-11

CALCULATIONS

BY GARRY NEWTON
BE (Civil) , MIPENZ(Civil, Structural), CPEng, IntPE(NZ)

CONTENTS

Client:	Christchurch City Council	Ref:	1587
Project:	Avebury House	Date:	26/5/11
	7-11 Evelyn Couzins Ave, Christchurch	BY:	GN
Subject:	Design Features Report		

Design Features Report

Scope

In general terms, the scope of work is as follows:

- Provide bracing design for timber frame building for a residential building.

Means of compliance

The following standards have been used:

- NZS 1170.0:2002
- NZS 1170.1:2002
- NZS 1170.5:2004

- NZS 3101:1995
- NZS 3602:2003
- NZS 3603:1993

THE STRUCTURE

General

The building is constructed using a timber stud walls, lined with plaster over timber lathe on a concrete ring foundation. The ground floor is timber over joists and bearers on piles. The roof consists of light timber framing with rafters and metal roofing. First floor consists of timber joist with T&G strip flooring. exterior walls comprise timber weatherboard over timber studs. The location of the building is Evelyn Couzins Avenue, Richmond, Christchurch. The importance level for the building has been assessed as Importance Level 2. The design life of the structure is 50 years. For the purpose of analysis, the across and along directions are as per the geometric shape.

Chosen Design Life	50 Years
Chosen Importance Level	2
Annual Probability of exceedance (inverse) Ultimate	500
Annual Probability of exceedance (inverse) Service	25

Gravity structure

Load paths:
Trusses/rafters → Walls → Floor joists → Walls → foundations

Lateral load resisting structure

Across the building
Roof → In-plane plaster walls → Floor → In-plane plaster walls → foundations

Along the building
Roof → In-plane plaster walls → Floor → In-plane plaster walls → foundations

Client:	Christchurch City Council	Ref:	1587
Project:	Avebury House 7-11 Evelyn Couzins Ave, Christchurch	Date:	26/5/11
		BY:	GN
Subject:	Design Features Report		

Significant Design Features
There are no special design features.

SOIL CONDITIONS

No specific Soils investigation or report has been completed at this time. We have noticed that there has been lateral spread and liquefaction adjacent to the building and we recomend that a specific soils report be sort to confirm design assumptions. at this stage we have assumed low bearing pressures of factored ULS 75 kPa.

DESIGN LOADS

Vertical loads

All Dead loads are listed on the gravity loads sheet at the front of these calculations.

All Live loads are listed on the gravity loads sheet at the front of these calculations.

Lateral Loads
Wind

Site wind speed	42.47	Ult (m/s)

Further information on wind speeds, internal pressures etc are on the main wind load sheets contained in these calculations.

Seismic loads
Analysis methodology

The seismic analysis has been completed in accordance with NZS 1170.5:2004. Design Spectra are in accordance with NZS 1170.5:2004 for site sub soil class D. Analysis has been completed using the Equivalent Static Method for bracing. A Seismic Hazard Factor of Z=0.3 has been used.

Across the building

Structural ductility factor (Ultimate)	μ	3.00
Structural Performance factor (Ultimate)	Sp	0.70

Along the building

Structural ductility factor (Ultimate)	μ	3.00
Structural Performance factor (Ultimate)	Sp	0.70

Client:	Christchurch City Council	Ref:	1587
Project:	Avebury House	Date:	26/5/11
	7-11 Evelyn Couzins Ave, Christchurch	BY:	GN
Subject:	Design Features Report		

Design Features Report

SERVICEBILITY CRITERIA

The following servicebility criteria have been chosen for the project:
Note: These are generally in line with those recommanded in NZS1170.2 Table C1.

Seismic deflections/storey drift	Criteria	Phenomenon controlled
Maximum allowable deflection (SLS)	spacing/200	Damage to cladding
Maximum allowable storey Drift (ULS)	height/40	Soft storey protection
Wind deflections		
Maximum allowable lateral deflection (SLS)	spacing/200	Damage to cladding
Maximum allowable vertical deflection (SLS)	span/200	Damage to cladding/finishes
Gravity deflections		
Maximum allowable deflection (SLS)	span/500	Visual sag

SOFTWARE

The following computer applications were used for the design:

Analysis type	Software used
Stuctural analysis	Excel 2009
Structural design	Excel 2009

Significant or Special Construction Features

None.

STRUCTURAL CONCEPTS LIMITED

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Client:	Christchurch City Council	Ref:	1587
Project:	Avebury House 7-11 Evelyn Couzins Ave, Christchurch	Date:	26/5/11
		BY:	GN
Subject:	Gravity Loads		

Sheet No.:	5

Loads

Roof

Corr/Trimdek CS	0.059	
Timber 20.6	0.092	
Battens 05 .4	0.034	
Purlins 05 .4	0.034	
Rockwool Insu.	0.002	
Gib Board 13	0.120	
	0.341	kPa

External Walls

Pine weather Bds.	0.160	
Timber 10.4	0.069	
90. Nogs & plates	0.067	
Rockwool Insu.	0.002	
Gib Board 13	0.120	
	0.418	kPa

Timber floor

21mm Pine deck	0.116	
Timber 20.6	0.092	
90. Nogs & plates	0.067	
Battens 05 1.2	0.011	
Rockwool Insu.	0.002	
Gypsum Plaster	0.130	
	0.417	kPa

Partitions

Timber 10.4	0.069	
90. Nogs & plates	0.089	
Gypsum Plaster	0.130	
Gypsum Plaster	0.130	
	0.418	kPa

<u>Live loads</u>

A2 other rooms	2.00	kPa
R2 Roofs	0.25	kPa

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Client:	Christchurch City Council	Ref:	1587
Project:	Avebury House 7-11 Evelyn Couzins Ave, Christchurch	Date:	26/5/11
		BY:	GN
Subject:	Seismic loads to NZS1170		

Seismic Loads to NZS 1170.5 — Sheet No.: 6

Ref:	Design	Output

Design working live 50 Years

Importance level 2

Annual Probability of exceedance (inverse) Ultimate 500

Annual Probability of exceedance (inverse) Service 25

Element			Area/length	Load Kpa	Total kN
Roof			185.00	0.34	63.07
External Walls			90.00	0.42	37.58
Partitions			120.00	0.42	50.14
			0.00	0.00	0.00
			0.00	0.00	0.00
			0.00	0.00	0.00
	1.00	0.40	0.00	0.00	0.00

150.79 kN

Element			Area/length	Load Kpa	Total kN
Timber floor			185.00	0.42	77.23
External Walls			180.00	0.42	75.16
Partitions			240.00	0.42	100.28
			0.00	0.00	0.00
			0.00	0.00	0.00
			0.00	0.00	0.00
A2 other rooms	0.50	0.40	185.00	2.00	370.00
	0.50	0.40	0.00	0.00	0.00

326.68 kN

Live load reduction

Total floor area 225.0

$$.3+\frac{3}{\sqrt{A}} \quad = \quad 0.500$$

But not less than .5

Total building weight

477.47 kN

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Client:	Christchurch City Council	Ref:	1587
Project:	Avebury House 7-11 Evelyn Couzins Ave, Christchurch	Date: BY:	26/5/11 GN
Subject:	Seismic loads to NZS1170		

Sheet No.: 7

Ref:	Design				Output
	Soil type				
	D. Deep or soft soil				
	Across the building				
	Period of building across the building		0.40		
	Does the seismic bracing have ductile capabilities but is designed as nominally ductile				☑
	Structural ductility factor (Ultimate)	m =	3.00		
	Structural ductility factor (Service SLS1)	m =	1.25		
	Hazard Factor Christchurch	Z =	0.3		
	Return period factor	Ru =	1.00		
	Return period factor	Rs =	0.25		
	Structural Performance factor (Ultimate)	Sp =	0.70		
	Structural Performance factor (Service)	Sp =	0.70		
	Spectral Shape Factor (across)	Ch(T) =	3.00		
	Near Fault factor	N(T,D) =	1.0	n/a	
	Elastic site spectra (Ultimate)	C(T) =	0.90		
	Elastic site spectra (Service)	C(T) =	0.23		
	Ultimate	km =	2.14		
	Service	km =	1.14		
	Ultimate				
	Horizontal design action coefficients (Across)	Cd(T1) =	0.29	But not less than 0.030Ru	
	Ultimate force across the building	Cd(T1) x Wi =	140.38	kN Total	
	Service		2808	BU's	
	Horizontal design action coefficients (Across)	Cd(T1) =	0.14		
	Service force across the building	Cd(T1) x Wi =	65.80	kN Total	
	Along the building				
	Period of building along the building		0.40		
	Does the seismic bracing have ductile capabilities but is designed as nominally ductile				☑
	Structural ductility factor (Ultimate)	m =	3.00		
	Structural ductility factor (Service SLS1)	m =	1.25		
	Structural Performance factor (Ultimate)	Sp =	0.70		
	Spectral Shape Factor (across)	Ch(T) =	3.00		
	Near Fault factor	N(T,D) =	1.0		
	Elastic site spectra (Ultimate)	C(T) =	0.90		
	Elastic site spectra (Service)	C(T) =	0.23		
	Ultimate	km =	2.14		
	Service	km =	1.14		
	Ultimate				
	Horizontal design action coefficients (Across)	Cd(T1) =	0.29	But not less than 0.030Ru	
	Ultimate force along the building	Cd(T1) x Wi =	140.38	kN Total	
	Service				
	Horizontal design action coefficients (Across)	Cd(T1) =	0.14		
	Service force across the building	Cd(T1) x Wi =	65.80	kN Total	

APPENDIX F. LDE GEOTECHNICAL REPORT (extract only)

LAND DEVELOPMENT & EXPLORATION LTD.

CHRISTCHURCH CITY COUNCIL

AVEBURY PARK, 9-11 EVELYN COUZINS AVE, RICHMOND

DETAILED GEOTECHNICAL INVESTIGATION REPORT

Project Reference: 10048
6 September 2011

1 INTRODUCTION

Land Development & Exploration Ltd was engaged by Insight Unlimited on behalf of Christchurch City Council to undertake a detailed geotechnical investigation of the ground beneath buildings and land at Avebury Park, 9-11 Evelyn Couzins Ave, Richmond. The buildings and land were damaged by earthquake shaking, particularly from the 22 February 2011 earthquake event.

The purpose of the investigation was to assess the stratigraphy and strength distribution of the materials beneath the property to assist with the foundation design to remediate the building on it and to reduce the potential for damage that may result from future earthquake events. This included an assessment of the potential for future liquefaction and lateral spreading arising from earthquake shaking.

This work follows on from a preliminary assessment of the property in July 2011.

2 SITUATION

2.1 Location

The Avebury Park building comprises of a 2 storey weatherboard villa located at the edge of an old alluvial terrace some 4.4m above sea level and 100m northwest of the Avon River (Figure 1). A lower terrace elevated 3.3m above sea level is located immediately to the south of the building.

The building foundations appear to be strip footings under load bearing walls, with ordinary piles under most of the internal floors.

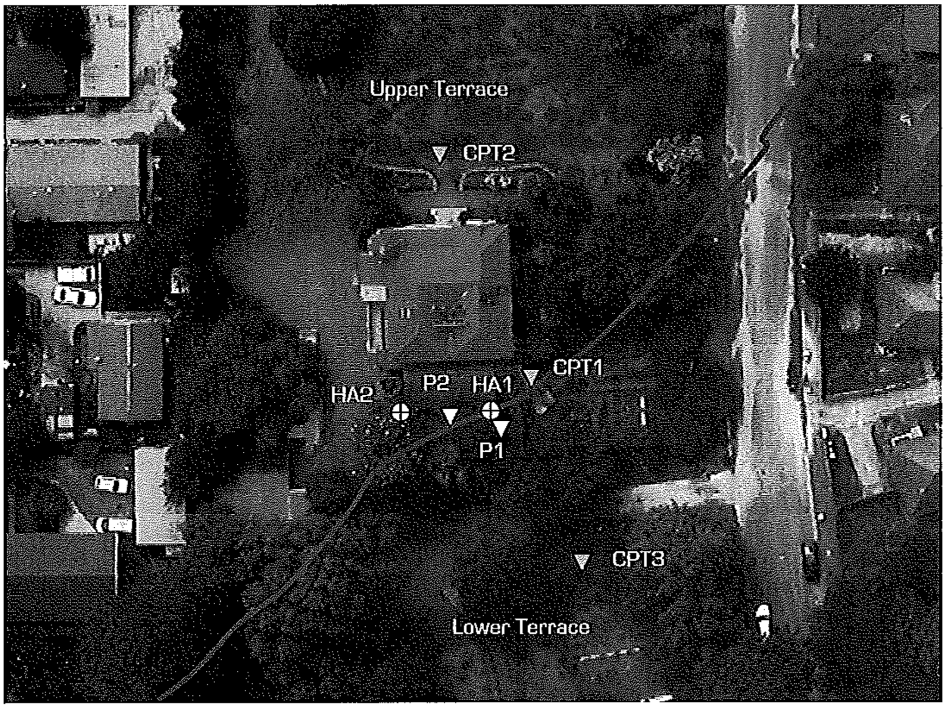

Figure 1: Aerial view of site showing location of major lateral spreading tension zone passing through the property.

Figure 2: View of southeastern corner of building affected, main tension crack location and position of CPT1.

2.2 Earthquake Damage

Earthquake damage to the building itself appears to be primarily as a result of shaking.

However, minor to moderate subsidence around the perimeter of the building as indicated by notable tilting of floors towards its peripheries (up to 100mm) indicates that liquefaction of the underlying ground has occurred, despite only minor sand ejecta being present in the immediate surrounding area and the general lack of visual evidence of subsidence around the exterior building footings. The deformation of the internal floor boards indicates that the strip footings have settled as a result of the bearing capacity of the ground being exceeded at the time of liquefaction.

In addition to minor to moderate liquefaction, the property has been affected by lateral spreading. This is indicated by the presence of the headscarp of a reasonably significant zone of lateral spreading that passes along the boundary between the lower and upper alluvial terrace immediately around the southern end of the building (Figures 1, 2 and 3). The headscarp comprises tension cracks up to 100mm wide, and a noticeable drop of up to 50mm to the southeast along its alignment. The ground immediately behind the upper side of the headscarp has slightly subsided resulting in the slight tilting of the southern wing of the building towards the southeast, and the separation of the wing from the main building by up to some 20mm. The strip footing for the wing has also separated by up to 20mm near the wing corner and approximately half way along the eastern wall strip footing as a result of land extension associated with lateral spreading. A hairline crack in the strip footing along the northern side of the main building has also occurred. Furthermore, an alignment of sand ejecta some 20m to the north of the property exists indicating the presence of a small hairline crack paralleling the main headscarp has also formed as a result of lateral spreading.

Figure 3: View of tension crack passing through southeastern corner of property and building.

Regional mapping of lateral spreading indicates that lateral spreading extends several hundred meters to the west, although the damage to buildings and land from this is relatively insignificant

2.3 Geotechnical Recommendations for Property

In terms of potential risk of future damage to the land and building, we considered it possible that regression of the headscarp beneath the southern wing of the building is possible from future earthquake events. We also considered that there is still potential for additional subsidence arising from liquefaction from future earthquake events.

Accordingly, the preliminary geotechnical assessment made the following recommendations with respect to the geotechnical issues affecting the property;

- Construct stiff strip footings along the southern and eastern sides of the wing
- Construct an underlying row of closely spaced piles (palisade wall) taken down to the gravel to provide additional bearing support and also to promote deflection of tension cracking around the building rather than beneath it.
- Re-levelling of the southern wing.
- Re-levelling of internal floors.

3 DETAILED INVESTIGATIONS

The detailed investigation of the site included the following work;

- A desk top study of published and unpublished information of the site.
- A walkover assessment of the site and surrounding area to assess its geomorphology and any features which may potentially influence the long term behaviour of the site.
- Three electronic cone penetrometer tests (CPTs) put down to depths ranging between 17.5m and 24.5m depth using a specialist rig.
- Two 50mm handaugered boreholes put down to refusal ranging between 3.6m and 3.8m depth. Measurements of the undrained shear strength were taken at 200mm intervals within cohesive soils encountered down through the boreholes using a calibrated shear vane. The soils encountered were generally logged to NZ Geotechnical Society Logging Guidelines for the field classification of soil and rock for engineering purposes.
- Two dynamic penetrometer tests put down to refusal (3.8m depth). The penetrometer tests were measured in 50mm increments to better identify lower strength zones beneath the surface.
- Observations and measurements of the soil moisture content and levels of groundwater encountered down through the boreholes. The possible seasonal variation of these levels was noted and compared to the regional groundwater table expected for the area and the timing of the investigation.
- Slope profile surveying using a tape and abney level.

The locations of the subsurface investigations are shown in Figure 2. Logs of the boreholes and penetrometer tests are also appended.

The field work was completed in winter.

All work was completed by qualified geological-geotechnical specialists.

4 ENGINEERING GEOLOGY

4.1 General

The engineering geology of the site is summarised below. It is based on an integration of published and unpublished data, the geomorphology of the site, and subsurface investigations carried out at discrete locations. The nature of the ground between the investigation points is inferred and may vary from that described. For details of the materials encountered and measurements of their respective strengths please review the appended investigation logs.

4.2 Subsurface Conditions

The investigations put down show that the building is generally underlain by stiff to very stiff silty clay, clayey silt, and loose sandy silt alluvium down to 3.8m depth overlying dense sand down to at least 24m depth (Figure 4). A wedge of non-engineered fill up to 1.1m to 1.3m thick is present beneath the southern end of the building.

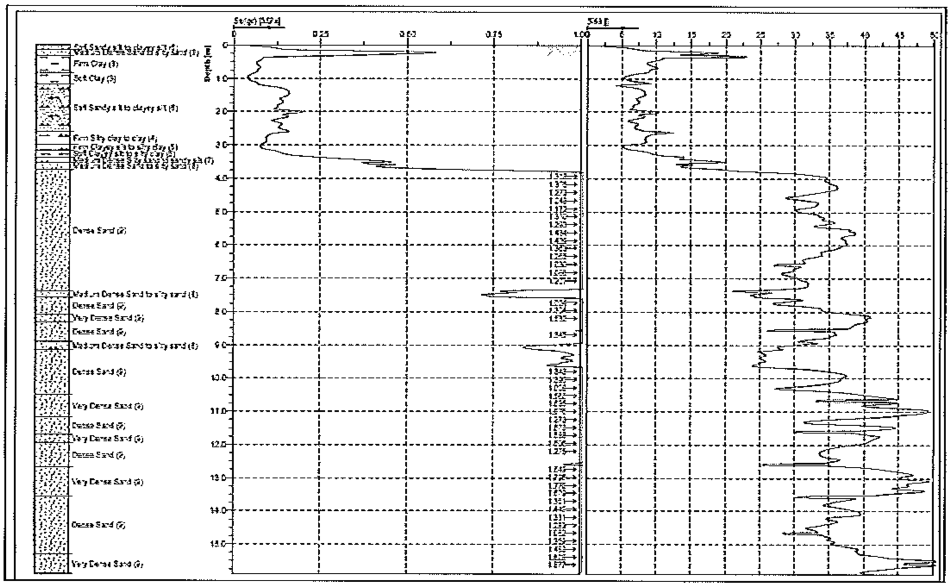

Figure 4: CPT 1 estimated profile, SPT N and Su values beneath the southeastern corner of building.

Fill

The fill comprises dark grey silt and clayey silt, with some gravel with chunks of concrete and wood. The unit appears to have been placed over the natural slope formed between the upper and lower terraces along the southern end of the building.

Undrained shear strength measurements generally range between 80kPa and 120kPa. Penetration resistance generally ranges between 0.5 and 1 blows per 50mm.

Alluvium

The underlying alluvium generally comprises stiff to very stiff clayey silt (Su 80kPa to 120kPa) underlain by loose sandy silt (generally 1 blow per 50mm). Hard silty clay (Su>230kPa) was encountered in HA1 and HA2 at the base of the unit.

Beneath the lower terrace to the south of the building CPT 3 identified a 1m thick layer of soft organic silt (Peat) at 2.0m depth. Alluvium also extends to 4.8m depth overlying a 0.7m thick layer of very dense gravelly sand in that area.

Dense Sand

The sand underlying the alluvium is dense overall (equivalent SPT N values ranging between 30 and 50). Thin beds of stiff silty clay exist at depth.

4.3 Soil Moisture Profile and Groundwater Conditions

Groundwater was encountered at 2.3m to 2.6m depth in the boreholes, which is consistent with the level of the Avon River. However, wet soils were encountered from 1.1m depth.

4.4 Site Subsoil Category

We consider that the site is a Class D deep soil site as defined by NZS 1170.5 (2004) "Structural Design Actions: Part 5: Earthquake actions – New Zealand".

Assuming a building importance level of 2, the following peak ground accelerations are considered appropriate for seismic analyses and design:

Ultimate Limit State event:	0.34g
Serviceability Limit State:	0.11g

Note that the SLS value has been calculated using a risk factor (R_s) of 0.33.

The following earthquake magnitudes are estimated[1] from the peak ground accelerations assuming rupture on a fault line beneath the Port Hills, some 10km to the southeast of the site.

Ultimate Limit State event:	M 6.6
Serviceability Limit State:	M 5.1

5 GROUND DEFORMATION POTENTIAL

5.1 Liquefaction Potential and Resultant Deformations

Analyses have been carried out using specialist software to determine what material layers beneath the site are likely to be prone to liquefaction under ULS and SLS design conditions, the resultant potential settlement at the surface due to consolidation of the liquefied sand layers, possible dry settlement due to shaking, building settlement due to the potential loss of ground bearing capacity as a result of the liquefaction of the near surface soils, and the potential for sand boil development at the surface. A review of the layers that are likely to have liquefied during the 22 February and 13 June 2011 earthquake events was also carried out using measured peak ground acceleration data.

5.1.1 Layers Subject to Liquefaction

SLS Conditions

No layers are predicted to liquefy during a SLS seismic event.

ULS Conditions

The analyses show that the saturated sandy silt layers within the 3.8m of alluvium beneath the building are likely to be prone to liquefaction during an ULS seismic event (see Figure 5).

Liquefaction of some 2m of similar alluvial sediments from 3m to 5m depth is also likely beneath the lower terrace to the east of the site (CPT3).

Liquefaction of the a few medium dense sand layers beneath the alluvium is also possible under ULS seismic loads.

22 February M6.3 earthquake

The analyses show that the medium dense to dense layers beneath the site at depth are likely to have liquefied during the February 22 M6.3 earthquake event (see Figure 6).

---

[1] Estimation using chart in Youd, Leslie, and Bartlett (2002) "Revised Multilinear Regression Equations for Prediction of Lateral Spread Displacement"

Despite this, the dense sand from 3.8m to 6.4m depth is unlikely to have liquefied and is therefore expected to be a suitable bearing layer.

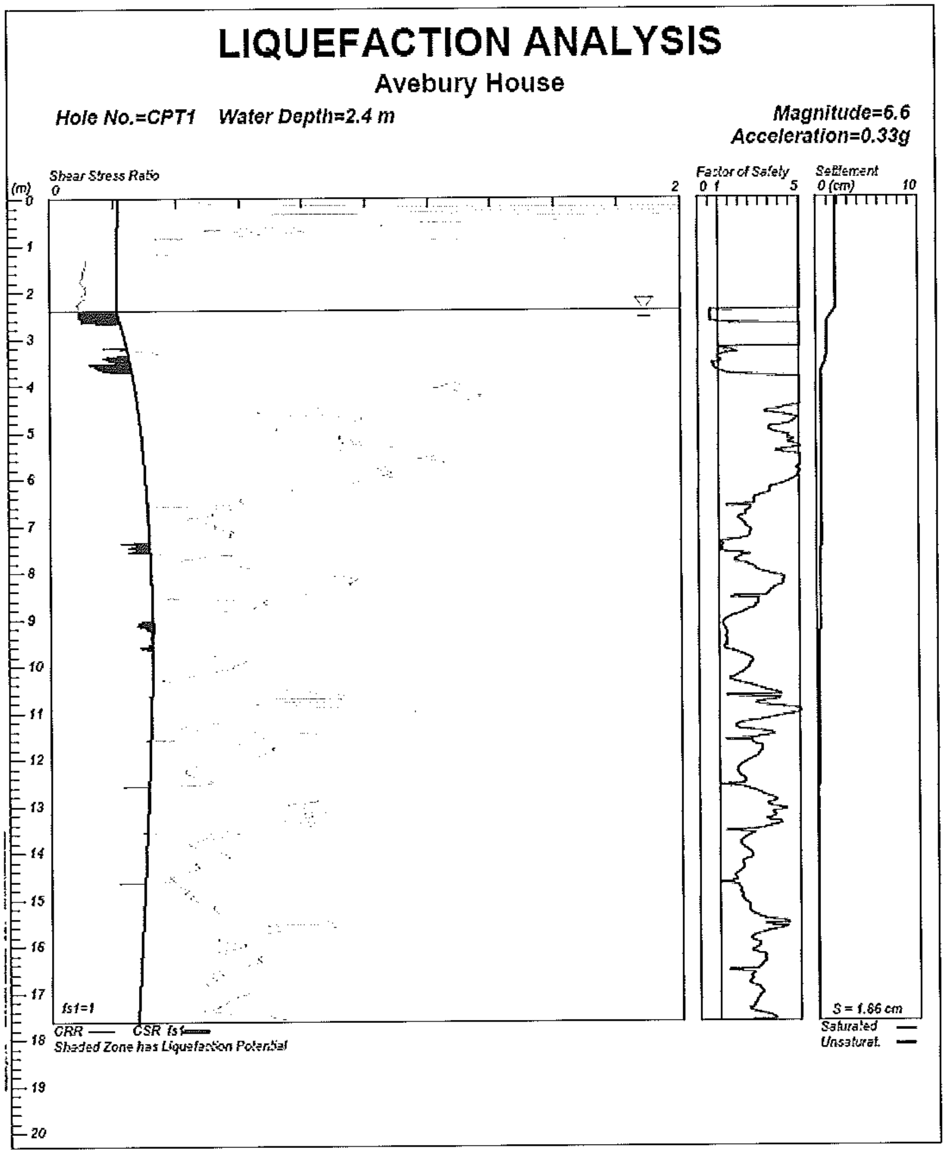

Figure 5: Layers of liquefaction potential in CPT1 for ULS seismic loads.

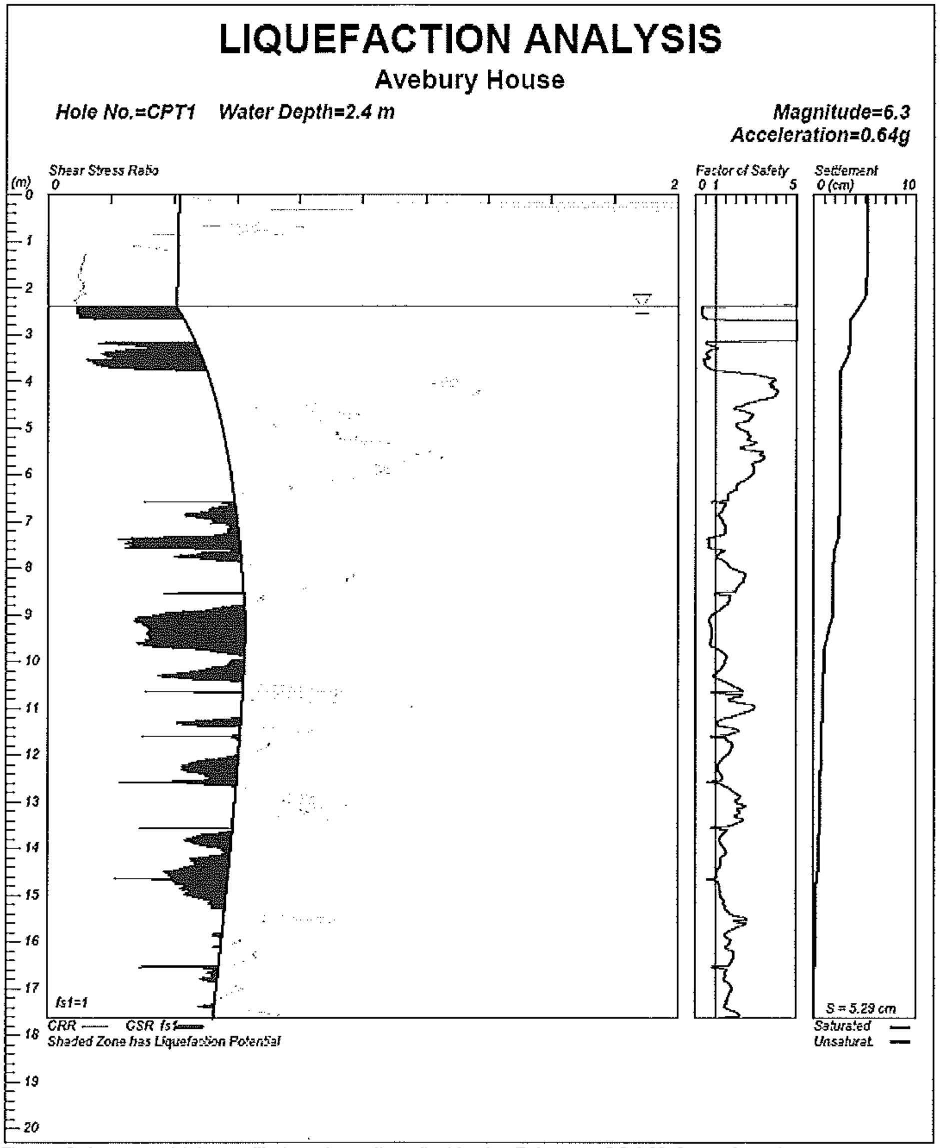

Figure 6: Layers which are likely to have liquefied in the February 22 M6.3 earthquake event.

5.1.2 Surface Settlement due to Liquefaction and Dry Settlement

The predicted surface settlement for each test location is presented below in Table 1.

Table 1: Potential surface settlements due to liquefaction

CPT	Settlement (mm) for Serviceability Limit State Event	Settlement (mm) for Ultimate Limit State Event
CPT1	0mm	19mm
CPT2	0mm	27mm

CPT3	0mm	32mm

Serviceability Limit State Conditions

In summary, no settlement is predicted to occur as result of a SLS earthquake event.

Ultimate Limit State Conditions

The potential surface settlement beneath the building under ULS conditions is 19mm to 27mm. This magnitude is generally within the tolerable vertical deformations for SLS conditions.

The variation in settlement shown between the two test sites indicates that differential settlement at the surface may potentially occur, although this is considered to be insignificant.

5.1.3 Building Settlement due to Loss of Bearing Capacity

The potential for punching failure or settlement of the building foundations due to liquefaction of the ground from 2.4m depth beneath the building has been assessed for each seismic condition. A footing width of 0.4m has been assumed, as has an undrained shear strength of the liquefied layer of 5kPa estimated using the Seed and Harder (1990) methedology.

SLS conditions

Building settlement due to a loss of ground strength beneath the foundations or punching shear failure is not expected under SLS seismic conditions.

ULS Conditions

The analyses indicate that the bearing capacity of the near surface soils is likely to be reduced under ULS seismic conditions due to the loss of strength of the materials below the groundwater table. Figure 7 shows the estimated geotechnical ultimate bearing capacity available for various footing depths (assuming a 0.4m wide footing) for this situation. In essence, greater bearing capacity is calculated to be available for shallow footings, although this is still approximately 33% of the geotechnical ultimate bearing capacity of 300kPa for footings taken to 0.45m depth. Given that much of the building is likely to be supported on shallow foundations, some settlement of the building foundations could occur under ULS seismic loads (est up to 75mm), which is consistent with the observed foundation settlement of the building following the 22 February 2011 earthquake event.

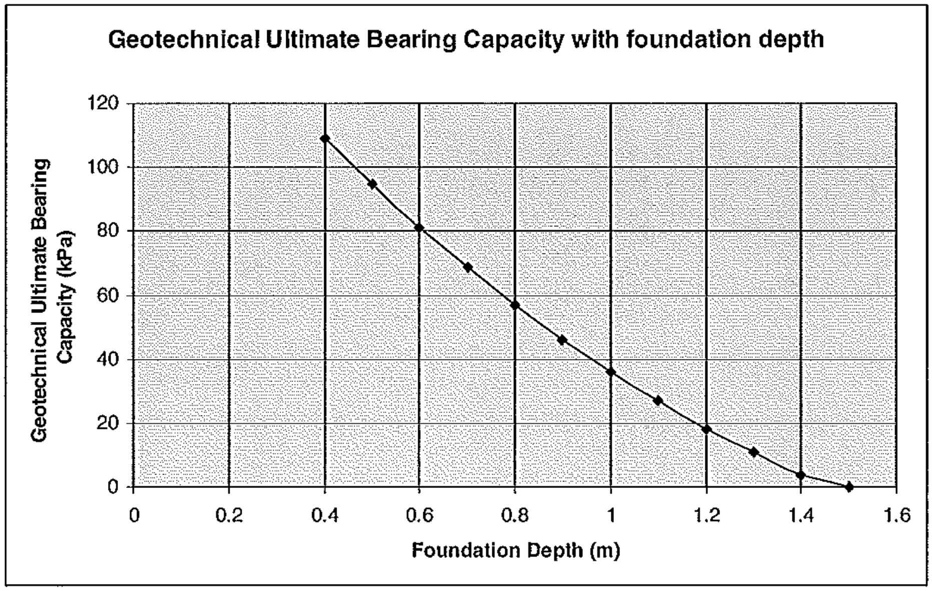

Figure 7: Geotechnical ultimate bearing capacity of footing with depth.

Accordingly, to avoid adverse settlements following a future ULS seismic event we recommend that the replacement strip footings be limited to depths less than 0.5m, unless supported on piled foundations taken to the dense sand from 3.8m depth.

5.1.4 Sand Boil Potential

No sand boiling is expected for a SLS earthquake event, however given the potential for liquefaction within the near surface soils below the groundwater table there is some potential for the development of sand boils and fissures at the surface as a result of a ULS seismic event. This is less likely to occur beneath the building and area to the west given the depth to the water table beneath the upper terrace, although ejecta could be expected in the lower terrace. This is consistent with the sand boils and resultant sand ejecta adjacent to the building following the 22 February and 13th June earthquake events.

5.2 Lateral Spreading Potential

The building is located at a major zone of tension cracking resulting from lateral spreading towards the Avon River. The tension zone is consistent with the greater level of liquefaction that is likely to have occurred beneath the lower terrace compared to that beneath the building and upper terrace. A greater level of lateral movement in the lower terrace than the upper terrace is likely, and as such the potential for tension cracking along the boundary between the two is likely for a future ULS event.

For an ULS event 130mm to 150mm is predicted to occur along the rear of the lower terrace.

Lateral movement through the alluvial layers and lower strength sand layers beneath the building is also expected, although to a lesser degree, with a lateral displacement of 60mm at the southern end of the building and 50mm at the northern end being estimated. This is consistent with the observed deformation of the site following the February 2011 earthquake event.

The laterally persistent liquefied layers identified in the soil profile indicate that much of the lateral movement beneath the site is likely to occur at 3.8m depth.

We consider that there is the potential for regression of the tension cracking beneath the southern wing from future large seismic events due to the relaxation along the zone.

5.3 Compressible Ground and Consolidation Settlement

While the 1.1m to 1.2m thick layer of fill encountered beneath the southern end of the site appears to be non-engineered, it was found to be stiff to very stiff in strength with an estimated allowable bearing capacity of 70kPa. Limiting the foundation pressures to this is recommended.

5.4 Ground Shrinkage and Swelling Potential

The near surface soils appear to be slightly expansive soils with a liquid limit below 50% based on their physical characteristics determined during testing. We consider that the effects of soil shrinkage and swelling on the foundations due to seasonal changes in soil moisture is not likely to adversely affect the building.

6 ENGINEERING RECOMMENDATIONS

6.1 Strip and Pad Footings

Depth

For design we recommend strip footings and any pad footings for the southern wing be taken to a depth of 0.4m depth.

Bearing Capacity

At that depth a geotechnical ultimate, factored (ULS, Φ=0.5) and allowable (FoS=3) bearing capacity of 210kPa, 140kPa and 70kPa is recommended.

6.2 Piles

Purpose

Piles taken into the dense sand layer below 3.8m depth are recommended to provide shear resistance against lateral spreading through the alluvial sediments immediately above that depth, and also to provide resistance for regression of tension cracking beneath the southern wing of the building.

Pile Depth

A minimum pile depth of 5.0m and maximum pile depth of 6.0m is recommended.

Lateral Load Considerations

Potential lateral movement of 6cm towards the river at 3.8m depth can be assumed.

Fixity can be assumed to exist at 3.8m depth below the southern end of the building.

End Bearing Capacity

At the recommended founding depths a geotechnical ultimate, factored (ULS, Φ=0.5) and allowable (FoS=3) end bearing capacity of 4200kPa, 2100kPa, and 1400kPa can be used for bored and cast insitu piles. These capacities can be increased by 33% for driven piles.

Skin Friction

A geotechnical ultimate, factored (ULS, Φ=0.5) and allowable (FoS=3) skin friction of 50kPa, 25kPa, and 17kPa can be assumed for static load conditions. This should be reduced by 25% for ULS seismic conditions.

Construction Issues

The excavations for bored piles may be subject to collapse below the groundwater table, although the cohesive nature of some of the alluvial layers may limit this to a certain degree.

Driven piles may be difficult to drive into the dense sands from 3.8m depth. The resultant ground shaking that is expected could adversely affect the building which should be taken into account.

6.3 Verification Checks

Verification testing of the ground by a Christchurch City Council Building Inspector or Suitably Qualified Professional is recommended to ensure that the ground conditions at the base of the foundation excavations are as described in this report, and that all unsuitable and loose materials have been removed. We should be contacted immediately if these conditions vary from that described in this report. A modification to the recommendations or design may be required.

7 OTHER CONSIDERATIONS

This report has been prepared exclusively for Insight Unlimited on behalf of the Christchurch City Council with respect to the particular brief given to us. Information, opinions and recommendations contained in it can not be used for any other purpose or by any other entity without our review and written consent. Land Development & Exploration Ltd accepts no liability or responsibility whatsoever for or in respect of any use or reliance upon this report by any third party.

Opinions given in this report are based on visual methods, and subsurface investigations at discrete locations. The nature and continuity of the subsurface materials between these locations are inferred and it must be appreciated that actual conditions could vary from that described herein. We should be contacted immediately if the conditions are found to differ from that described in this report.

Yours faithfully
LAND DEVELOPMENT & EXPLORATION LTD

Georg Winkler
Geological & Geotechnical Engineer
MIPENZ, CPEng
Managing Director

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APPENDIX A

GEOTECHNICAL INVESTIGATION PLAN

Notes:

1. Ground surface profile inferred from LiDAR data (NZAM Post February 22 2011 Earthquake Digital Elevation Model, 8-10 March 2011) to show the general ground profile through the site. The profile is for presentation of geological data and should not be relied upon for construction.
2. Subsurface conditions are inferred from borehole logs and correlations from CPT data. The nature and continuity of the subsoils away from the the investigation locations are inferred and it must be appreciated that actual ground conditions could vary from the assumed model.
3. Soil material type, density and strength have been inferred from CPT data using methodologies published in Lunne, Robertson & Powell (1997).
4. Building outline is approximate only.

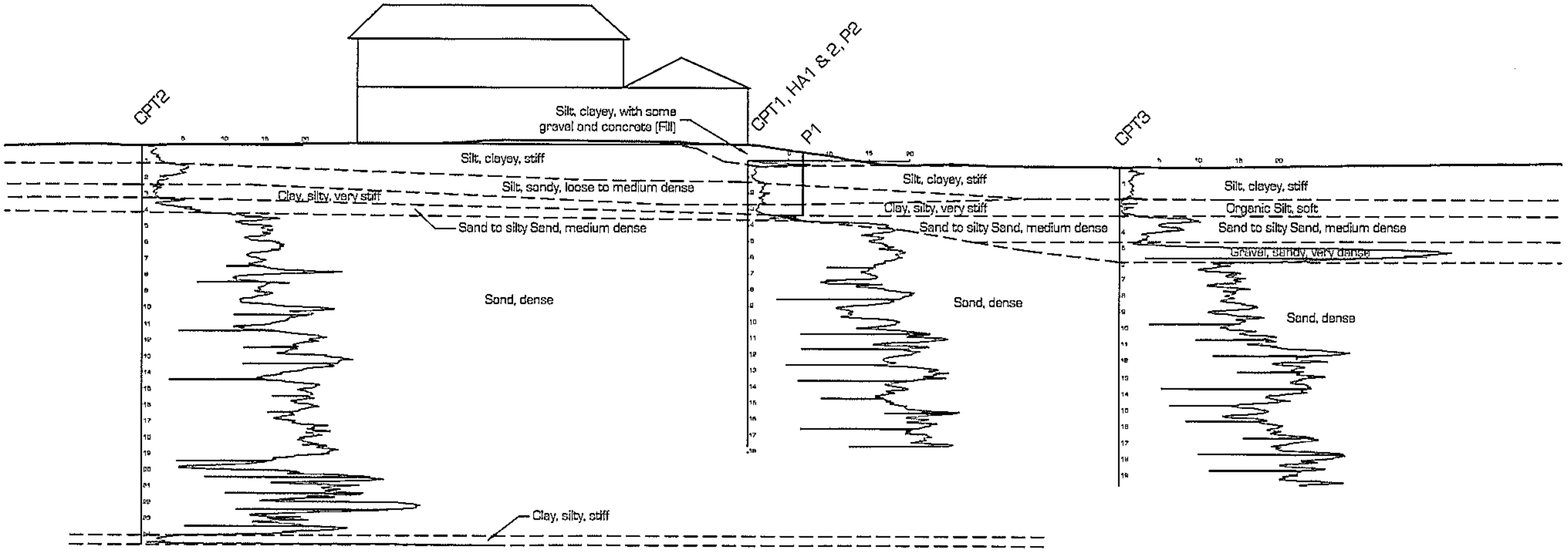
LAND DEVELOPMENT & EXPLORATION LTD.

CHRISTCHRUCH CITY COUNCIL
AVEBURY PARK, 11 EVELYN COUZINS AVE, RICHMOND
GEOLOGICAL CROSS SECTION

DRAWN:	GEW
CHECKED:	RGC
DATE:	05 Sept 2011
PROJECT:	10048
SCALE- A3:	1:250

APPENDIX B

ENGINEERING GEOLOGICAL CROSS SECTION



0 5 10m

Notes:
1. Ground surface profile inferred from LIDAR data [NZAM Post February 22 2011 Earthquake Digital Elevation Model, 8-10 March 2011] to show the general ground profile through the site. The profile is for presentation of geological data and should not be relied upon for construction.
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APPENDIX C

SUBSURFACE INVESTIGATION DATA

APPENDIX G. HERITAGE SIGNIFICANCE