Christchurch City Council

Collett Courts Complex
BE 3516 EQ2

Detailed Engineering Evaluation

Quantitative Assessment Report

Christchurch City Council

Collett Courts Complex

Quantitative Assessment Report

15 Exeter Place, Lyttelton, Christchurch

Prepared By

Timothy Blackbourn
Graduate Structural Engineer

Reviewed By

John Newall
Structural Engineer

Approved for Release By

MHalliday

Mary Ann Halliday
Principal Civil & Structural Engineer

Opus International Consultants Ltd
Christchurch Office
20 Moorhouse Avenue
PO Box 1482, Christchurch Mail Centre, Christchurch 8140
New Zealand

Telephone: +64 3 363 5400
Facsimile: +64 3 365 7858

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Summary

Collett Courts Complex
15 Exeter Street, Lyttelton, Christchurch
BE 3516 EQ2

Detailed Engineering Evaluation
Quantitative Report - Summary
Final – Version Two

Background

This is a summary of the quantitative report for the Collett Courts residential housing complex and is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011. This assessment covers all 6 residential units.

Key Damage Observed

Structural damage to the residential units was minor and was limited to cracking of wall and ceiling linings and cracking of some of the block masonry firewalls.

Two retaining walls on the border of the site have suffered significant damage as a result of the earthquakes.

Critical Structural Weaknesses

No critical structural weaknesses were found in the buildings.

Indicative Building Strength

None of the buildings on site are earthquake prone.

The buildings have a capacity of 81% NBS and are therefore deemed to be a ‘low risk’ building in a design seismic event, according to NZSEE guidelines. Their level of risk is 1-2 times that of a 100% NBS building (Figure 1).

Recommendations

It is recommended that wall lining fixings are examined to ensure nails/screws are present at 150mm centres with at least two in each corner.

A remedial works scheme for the damaged retaining walls on site should also be developed.

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1 Introduction

Opus International Consultants Limited have been engaged by the Christchurch City Council to undertake a detailed seismic assessment of the Collett Courts complex, located at 15 Exeter Street, Lyttelton following the Canterbury Earthquake Sequence that began in September 2010. The complex was built in the 1980's.

The purpose of the assessment is to determine if the buildings on site are classed as being earthquake prone in accordance with the Building Act 2004.

The seismic assessment and reporting have been undertaken based on the qualitative and quantitative procedures detailed in the Detailed Engineering Evaluation Procedure (DEEP) document (draft) issued by the Structural Engineering Society (SESOC) [3] [4].

2 Compliance

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

2.1 Canterbury Earthquake Recovery Authority (CERA)

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

Section 38 – Works

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

Section 51 – Requiring Structural Survey

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

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

It is anticipated that a number of factors, including the following, will determine the extent of evaluation and strengthening level required:

1. The importance level and occupancy of the building.

2. The placard status and amount of damage.
3. The age and structural type of the building.
4. Consideration of any critical structural weaknesses.

Christchurch City Council requires any building with a capacity of less than 34% of New Building Standard (including consideration of critical structural weaknesses) to be strengthened to a target of 67% as required under the CCC Earthquake Prone Building Policy.

2.2 Building Act

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

Section 112 - Alterations

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

The Earthquake Prone Building policy for the territorial authority shall apply as outlined in Section 2.3 of this report.

Section 115 – Change of Use

This section requires that the territorial authority is satisfied that the building with a new use complies with the relevant sections of the Building Code 'as near as is reasonably practicable'.

This is typically interpreted by territorial authorities as being 67% of the strength of an equivalent new building or as near as practicable. This is also the minimum level recommended by the New Zealand Society for Earthquake Engineering (NZSEE).

Section 121 – Dangerous Buildings

This section was extended by the Canterbury Earthquake (Building Act) Order 2010, and defines a building as dangerous if:

1. In the ordinary course of events (excluding the occurrence of an earthquake), the building is likely to cause injury or death or damage to other property; or
2. In the event of fire, injury or death to any persons in the building or on other property is likely because of fire hazard or the occupancy of the building; or
3. There is a risk that the building could collapse or otherwise cause injury or death as a result of earthquake shaking that is less than a 'moderate earthquake' (refer to Section 122 below); or
4. There is a risk that other property could collapse or otherwise cause injury or death; or

5. A territorial authority has not been able to undertake an inspection to determine whether the building is dangerous.

Section 122 – Earthquake Prone Buildings

This section defines a building as earthquake prone (EPB) if its ultimate capacity would be exceeded in a 'moderate earthquake' and it would be likely to collapse causing injury or death, or damage to other property.

A moderate earthquake is defined by the building regulations as one that would generate loads 33% of those used to design an equivalent new building.

Section 124 – Powers of Territorial Authorities

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

Section 131 – Earthquake Prone Building Policy

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

2.3 Christchurch City Council Policy

Christchurch City Council adopted their Earthquake Prone, Dangerous and Insanitary Building Policy in October 2011 following the Darfield Earthquake on 4 September 2010.

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

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

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

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

Where an application for a change of use of a building is made to Council, the building will be required to be strengthened to 67% of New Building Standard or as near as is reasonably practicable.

2.4 Building Code

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

On 19 May 2011, Compliance Document B1: Structure was amended to include increased seismic design requirements for Canterbury as follows:

- increase in the basic seismic design load for the Canterbury earthquake region (Z factor increased to 0.3 equating to an increase of 36 – 47% depending on location within the region);
- Increased serviceability requirements.

2.5 Institution of Professional Engineers New Zealand (IPENZ) Code of Ethics

One of the core ethical values of professional engineers in New Zealand is the protection of life and safeguarding of people. The IPENZ Code of Ethics requires that:

Members shall recognise the need to protect life and to safeguard people, and in their engineering activities shall act to address this need.

1.1 Giving Priority to the safety and well-being of the community and having regard to this principle in assessing obligations to clients, employers and colleagues.

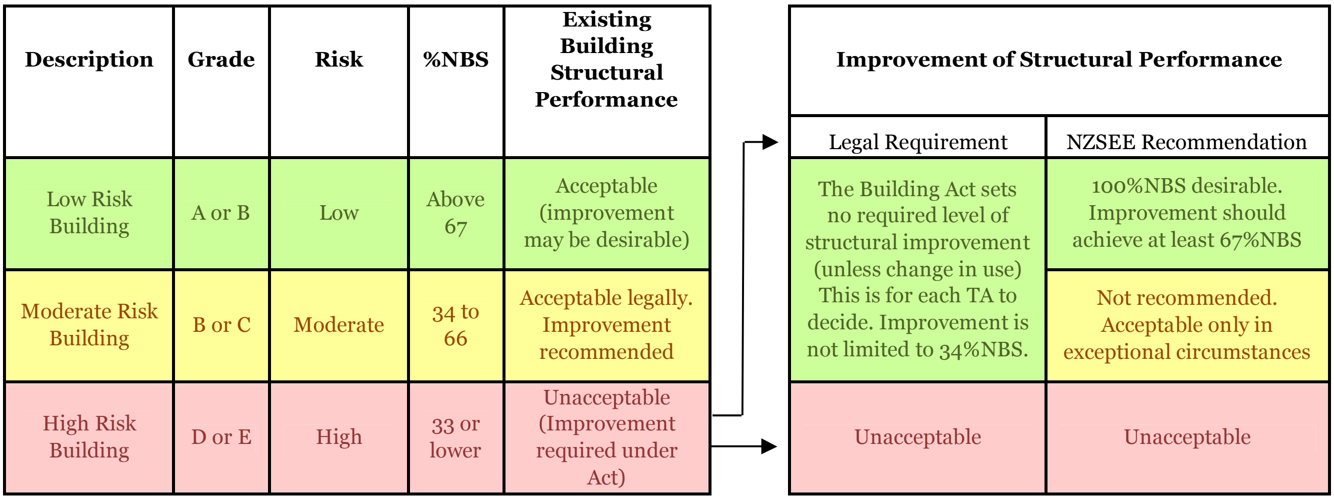
1.2 Ensuring that responsible steps are taken to minimise the risk of loss of life, injury or suffering which may result from your engineering activities, either directly or indirectly.

All recommendations on building occupancy and access must be made with these fundamental obligations in mind.

3 Earthquake Resistance Standards

For this assessment, the building's earthquake resistance is compared with the current New Zealand Building Code requirements for a new building constructed on the site. This is expressed as a percentage of new building standard (%NBS). The loadings are in accordance with the current earthquake loading standard NZS1170.5 [1].

A generally accepted classification of earthquake risk for existing buildings in terms of %NBS that has been proposed by the NZSEE 2006 [2] is presented in Figure 1 below.



Description	Grade	Risk	%NBS	Existing Building Structural Performance
Low Risk Building	A or B	Low	Above 67	Acceptable (improvement may be desirable)
Moderate Risk Building	B or C	Moderate	34 to 66	Acceptable legally. Improvement recommended
High Risk Building	D or E	High	33 or lower	Unacceptable (Improvement required under Act)

Improvement of Structural Performance	
Legal Requirement	NZSEE Recommendation
The Building Act sets no required level of structural improvement (unless change in use) This is for each TA to decide. Improvement is not limited to 34%NBS.	100%NBS desirable. Improvement should achieve at least 67%NBS
	Not recommended. Acceptable only in exceptional circumstances
Unacceptable	Unacceptable

Figure 1: NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE Guidelines

Table 1 below compares the percentage NBS to the relative risk of the building failing in a seismic event with a 10% risk of exceedance in 50 years (i.e. 0.2% in the next year).

Table 1: %NBS compared to relative risk of failure

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

3.1 Minimum and Recommended Standards

Based on governing policy and recent observations, Opus makes the following general recommendations:

3.1.1 Occupancy

The Canterbury Earthquake Order[1] in Council 16 September 2010, modified the meaning of "dangerous building" to include buildings that were identified as being EPB's. As a result of this, we would expect such a building would be issued with a Section 124 notice, by the Territorial Authority, or CERA acting on their behalf, once they are made aware of our

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[1] This Order only applies to buildings within the Christchurch City, Selwyn District and Waimakariri District Councils authority.

assessment. Based on information received from CERA to date and from the DBH guidance document dated 12 June 2012 [6], this notice is likely to prohibit occupancy of the building (or parts thereof), until its seismic capacity is improved to the point that it is no longer considered an EPB.

3.1.2 Cordoning

Where there is an overhead falling hazard, or potential collapse hazard of the building, the areas of concern should be cordoned off in accordance with current CERA/territorial authority guidelines.

3.1.3 Strengthening

Industry guidelines (NZSEE 2006 [2]) strongly recommend that every effort be made to achieve improvement to at least 67%NBS. A strengthening solution to anything less than 67%NBS would not provide an adequate reduction to the level of risk.

It should be noted that full compliance with the current building code requires building strength of 100%NBS.

3.1.4 Our Ethical Obligation

In accordance with the IPENZ code of ethics, we have a duty of care to the public. This obligation requires us to identify and inform CERA of potentially dangerous buildings; this would include earthquake prone buildings.

4 Background Information

4.1 Building Description

Collet Courts, located at 15 Exeter Place, Lyttleton, is a residential housing complex built in the 1980's and is currently managed by CCC.

The complex contains two identical single storey timber structures, each consisting of a row of 3 single bedroom residential units separated by partially grouted block masonry firewalls. The buildings have a metal tile roof supported on timber trusses. The external walls are clad with weatherboards and the internal ceiling and walls are lined with 9.5mm GIB Board. Each unit is approximately 7.5m long by 6.5m wide. The height of the roof apex is approximately 7.4 m above ground level. The building site is shown in Figure 2. Figure 3 shows a typical floor plan of the buildings

Figure 2: Aerial view of Collett Courts.

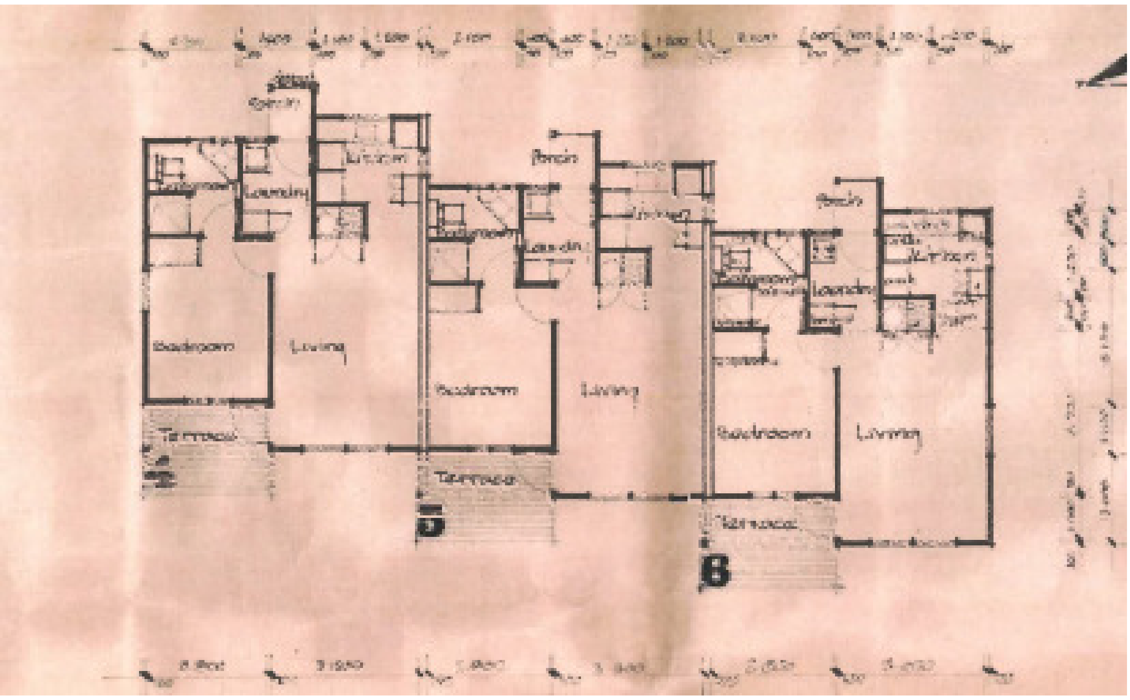


Figure 3: Typical building floor plan courtesy of Ian Krause Associates.

4.2 Gravity Load Resisting System

The building roof gravity loads are resisted by transversely spanning gangnail timber trusses at 900 centres supported on perimeter timber load bearing walls or lintels at door/window openings.

4.3 Lateral Load Resisting System

Lateral loads are resisted by gib-lined walls in transverse and longitudinal directions with the partially grouted block masonry firewalls also providing resistance in the transverse direction. Ceiling and floor diaphragms distributed loads at their respective levels.

4.4 Foundations

The buildings have suspended timber floors supported on block masonry perimeter walls and ordinary timber piles.

4.5 Survey

4.5.1 Post 22 February 2011 Rapid Assessment

A structural (Level 1) assessment of the buildings/property was undertaken on 4 March, 2011 by Opus International Consultants. Minor cracking to building linings was observed as well as cracks in the footpaths and driveways. A summary of the observed damage is provided in section 5.

4.5.2 Further Inspections

A further structural assessment of the site was undertaken on 1 November 2012 by Opus International Consultants. Unit 3 was observed to have suffered the greatest damage and so further investigation was deemed necessary. A summary of the observed damage is provided in section 5.

A geotechnical walkover inspection was conducted on 22 October, 2012.

4.6 Original Documentation

A partial set of structural drawings, courtesy of Ian Krause Associates, was available at the time of the assessment. They included:

- Site and drainage plan dated 1979.
- Foundation plan, floor plans and elevations dated 1979.
- Sections and details dated 1979.
- Firewall elevation and section dated 1979.

5 Structural Damage

This section outlines the damage to the buildings that was observed during site visits. It is not intended to be a complete summary of the damage sustained by the buildings due to the earthquakes. There may have been some forms of damage that were unable to be identified from visual inspections.

Overall, Unit 3 appeared to have suffered the highest levels of damage with minor damage also observed around all units.

5.1 Surrounding Area

The inspections identified that a retaining wall near the site had displaced, however this was considered minor, and not likely to affect the stability of the buildings on the site.

5.2 Foundations

No significant structural damage has been observed to the foundations.

5.3 Primary Gravity Structure

No significant structural damage has been observed to the gravity structure.

5.4 Primary Lateral-Resistance Structure

No significant structural damage has been observed. However some cracking of ceiling diaphragms, and the gib-lined walls was observed.

5.5 Non Structural Elements

A small separation was noticed on the interior of the unit 3 where the ceiling has come away from the masonry block partition wall. It is anticipated that there was no fixing across this joint prior to the earthquakes.

Cracking of the mortar in the masonry block partition wall was observed.

6 General Observations

The buildings appeared to have performed as reasonably expected during the earthquakes. They have suffered distributed amounts of minor damage which is consistent with the generally lightweight nature of the walls and the age of the buildings.

7 Detailed Seismic Assessment

The detailed seismic assessment has been based on the NZSEE 2006 [2] guidelines for the "Assessment and Improvement of the Structural Performance of Buildings in Earthquakes" together with the "Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury, Part 2 Evaluation Procedure" [3] draft document prepared by the Engineering Advisory Group on 19 July 2011, and the SESOC guidelines "Practice Note – Design of Conventional Structural Systems Following Canterbury Earthquakes" [5] issued on 21 December 2011.

7.1 Critical Structural Weaknesses

The term Critical Structural Weakness (CSW) refers to a component of a building that could contribute to increased levels of damage or cause premature collapse of a building. During the initial qualitative stage of the assessment the following potential CSW's were identified for each of the buildings and have been considered in the quantitative analysis.

No critical structural weaknesses were identified in the buildings.

7.2 Quantitative Assessment Methodology

The assessment assumptions and methodology have been included in Appendix 3. A brief summary follows:

Hand calculations were performed to determine seismic forces from the current building codes. These forces were distributed to walls by tributary area and relative rigidity. The capacities of the walls were calculated and used to estimate the %NBS.

7.3 Limitations and Assumptions in Results

The observed level of damage suffered by the building was deemed low enough to not affect the capacity. Therefore the analysis and assessment of the building was based on it being in an undamaged state. There may have been damage to the building that was unable to be observed that could cause the capacity of the building to be reduced; therefore the current capacity of the building may be lower than that stated.

The results have been reported as a %NBS and the stated value is that obtained from our analysis and assessment. Despite the use of best national and international practice in this analysis and assessment, this value contains uncertainty due to the many assumptions and simplifications which are made during the assessment. These include:

- Simplifications made in the analysis, including boundary conditions such as foundation fixity.
- Assessments of material strengths based on limited drawings, specifications and site inspections
- The normal variation in material properties which change from batch to batch.
- Approximations made in the assessment of the capacity of each element, especially when considering the post-yield behaviour.

7.4 Assessment

A summary of the structural performance of the buildings is shown in Table 2. Other elements within the building may have significantly greater capacity when compared with the governing elements.

Table 2: Summary of seismic performance.

Structure	**Failure mode, or description of limiting criteria based on displacement capacity of critical element.**	**% NBS based on calculated capacity.**
Block 1	Bracing capacity of the building for longitudinal loading.	89%
	Bracing capacity of the building for transverse loading.	>100%
Block 2	Bracing capacity of the building for longitudinal loading.	89%
	Bracing capacity of the building for transverse loading.	>100%
Block Masonry Firewalls	Out-of-plane bending capacity.	81%

8 Summary of Geotechnical Appraisal

8.1 General

There are no existing boreholes or cone penetrometer test (CPT) logs available within a relevant distance from the site.

Geological maps show that the site is underlain by yellow-brown wind-blown silt, possibly greater than 3m thick and commonly in multiple layers. Underlying this silt is Basaltic Volcanic Group rock comprising basaltic to trachytic lava flows interbedded with breccia and tuff.

Of particular concern from the geotechnical walkover inspection was the state of two of the retaining walls on the boundary of the site. The first is the concrete retaining wall between the site and the adjacent Catholic school, with the school on the downhill side of the wall. The wall is 0.5m to 1.75m high and approximately 150mm thick and borders the school playground. Three major cracks (5mm – 10mm wide) have been noticed in the wall. The second wall of concern is the timber pole retaining wall between the Collett Courts driveway and 19 Exeter Street, with Collett Courts on the downhill side of the wall. The wall has rotated towards the driveway and has caused deformation of a white railing that borders the driveway pavement. There is a noticeable depression in the grass field on the active side of the wall.

8.2 Liquefaction Potential

Based on available information, there is no liquefaction hazard at this site.

8.3 Summary

A lack of borehole or CPT logs means little information can be obtained about the soil on site.

Based on available information, the site has been assessed to have no liquefaction hazard.

Two of the retaining walls on site will require remediation as a result of damage sustained during the Canterbury earthquakes.

8.4 Further Work

Remedial work will be required for the concrete retaining wall on the border with the adjacent Catholic school and the timber retaining wall on the edge of the Collet Courts driveway.

9 Conclusions

- The buildings are not considered to be Earthquake Prone.
- The buildings have a capacity of 81% NBS, as limited by the out-of-plane bending capacity of the partially grouted reinforced block masonry firewalls. They are deemed to be a 'low risk' in a design seismic event according to NZSEE guidelines. The level of risk is 1-2 times that of a 100% NBS building (Figure 1).
- Two of the retaining walls on site have suffered damage during the Canterbury earthquakes and will require remedial works. However, these walls do not affect the stability of the housing units.

10 Recommendations

- The wall lining fixings are examined and improved if necessary as per the recommendations in section 11.
- A remedial works scheme to address the issues with the damaged retaining walls on site should be developed.

11 Wall Fixings

To increase confidence in the seismic performance of the buildings, it is recommended to check and modify if necessary the nail/screw pattern around the edges of critical wall linings. Nails/screws should be located at 150mm centres. Figure 4 shows which walls need to be examined and upgraded if necessary.

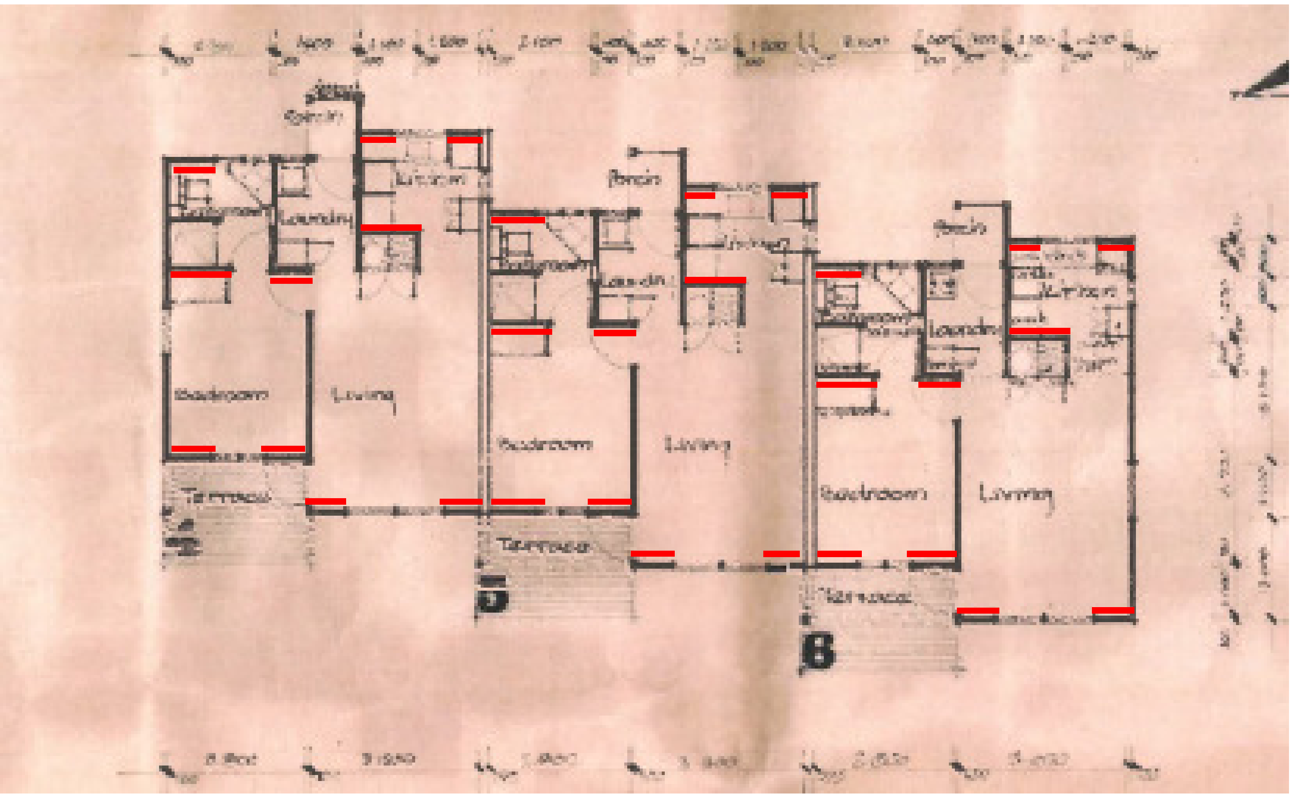


Figure 4: Walls requiring examination of lining fixings (shown in red).

12 Limitations

- This report is based on a visual inspection of the building and focuses on the structural damage resulting from the 22nd February Canterbury Earthquake and its subsequent aftershocks only. Some non-structural damage may be described but this is not intended to be a complete list of damage to non-structural items.

- Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time.

- This report is prepared for the Christchurch City Council to assist in the assessment of any remedial works required for the Collett Court complex. It is not intended for any other party or purpose.

13 References

[1] NZS 1170.5: 2004, Structural design actions, Part 5 Earthquake actions, Standards New Zealand.

[2] NZSEE (2006), Assessment and improvement of the structural performance of buildings in earthquakes, New Zealand Society for Earthquake Engineering.

[3] Engineering Advisory Group, Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury, Part 2 Evaluation Procedure, Draft Prepared by the Engineering Advisory Group, Revision 5, 19 July 2011.

[4] Engineering Advisory Group, *Guidance on Detailed Engineering Evaluation of Non-residential buildings, Part 3 Technical Guidance*, Draft Prepared by the Engineering Advisory Group, 13 December 2011.

[5] SESOC (2011), Practice Note – Design of Conventional Structural Systems Following Canterbury Earthquakes, Structural Engineering Society of New Zealand, 21 December 2011.

[6] DBH (2012), Guidance for engineers assessing the seismic performance of non-residential and multi-unit residential buildings in greater Christchurch, Department of Building and Housing, June 2012.

[7] Partial set of structural drawings, Ian Krause Associates, 1979.

Appendix 1 - Photographs

<table>
<tr><th colspan="3">Collett Courts</th></tr>
<tr><td>No.</td><td>Item description</td><td>Photo</td></tr>
<tr><td>1</td><td>Front Elevation of Units – Typical</td><td></td></tr>
<tr><td>2</td><td>Front Elevation of Units – Typical</td><td></td></tr>
<tr><td>3</td><td>Side Elevation of Units – Typical</td><td></td></tr>
</table>

4	Internal View of Lounge - Typical	
5	Damage in Interior of Unit 3 - cracking along wall to ceiling joint.	
6	Damage in Interior of Unit 3 - cracking along wall to ceiling joint.	

7	Damage in Interior of Unit 3 - cracking along wall to ceiling joint.	
8	Damage in Interior of Unit 3 – minor stepping of mortar joint.	
9	Roof Framing View – Typical	

Appendix 2 - Geotechnical Appraisal

Opus International Consultants Ltd

Opus International Consultants Ltd
Auckland Office
The Westhaven
100 Beaumont St, Auckland
New Zealand
Tel: +64 9 355 9500
Fax: +64 9 355 9680

7 December 2012

Matt Cummins
Project Manager
Capital Programme Group
Christchurch City Council
PO Box 2522
Christchurch

6-QUCC2.12/55AC

Dear Matt

Collet Courts - Geotechnical Desk Study

1 Introduction

Christchurch City Council (CCC) has requested Opus International Consultants (Opus) to provide a geotechnical desk study and walkover inspection of Collet Courts Residential Housing following the Canterbury Earthquake Sequence initiated by the 4 September 2010 earthquake.

The purpose of the geotechnical study is to assess the current ground conditions, the potential geotechnical hazards that may be present at the site, and determine whether further subsurface geotechnical investigations are necessary.

This Geotechnical Desk Study forms part of a Detailed Engineering Evaluation prepared by Opus, and has been undertaken without the benefit of any site specific investigations and is therefore preliminary in nature.

2 Desktop Study

2.1 Site Description

The Collet Courts are situated at 15 Exeter Street, Lyttelton. The units are built on a gentle slope.

On the seaside the external ground is bordered with a 1.75 m high old concrete retaining wall. On the west side the drive way is bordered with a one metre high timber retaining wall to share the property between Collet Courts and the land of 19 Exeter Street.

2.2 Available Building Drawings

There are no building drawings made available for this property.

2.3 Regional Geology

The published geological map of the area (Geology of the Christchurch Urban Area 1:25,000, Brown and Webber, Map 1, 1992) shows the site is underlain by yellow-brown wind blown silt (Loess) possibly greater than 3m thick and commonly in multiple layers.

Underlying the Loess is Basaltic Volcanic Group comprising basaltic to trachytic lava flows interbedded with breccia and tuff.

2.4 Risk of seismic activity

GNS Science indicates an elevated risk of seismic activity is expected in the Canterbury region as a result of the earthquake sequence following the 4 September 2010 earthquake. Recent advice (Geonet) indicates there is currently a 12% probability that a magnitude 6 or greater earthquake may occur in the next 12 months in the Canterbury region. Ground damage may occur in such an event, dependent on the location of the epicentre. It is expected that the probability of occurrence is likely to decrease with time, following periods of reduced seismic activity.

2.5 Results of the ECAN study

Table 1

Type of information from project orbit database (EQC)

Liquefaction and Lateral Spreading observed:	N/A
Observed ground crack locations EQC	N/A
LiDAR and digital elevation models	N/A
Vertical ground models EQC	N/A
Horizontal ground movement	N/A
Groundwater Surface Elevation	N/A
Borehole logs (pre September 2010)	N/A
CCC Borehole logs	N/A
CERA Residential zoning maps	in the green zone : repair and rebuild process can begin and normal insurance and consenting processes apply
DBH Residential Foundation Technical	N/A
CCC CBD Geological sections	N/A
EQC Suburban investigation Areas (post eq)	N/A
EQC Suburban Investigation Areas (pre eq)	N/A
Cadastral boundaries	Collet courts is within Christchurch City

2.6 Expected ground conditions

There are no existing Boreholes or Cone Penetrometer Test (CPT) logs available in the vicinity of the site. The nearest geotechnical testing locations are 360m and 400m southeast of the site. Therefore geotechnical testing is required at this site location to determine the ground profile for the material immediately beneath the ground surface.

2.7 Liquefaction Hazard/Seismic Assessment

There is no liquefaction hazard at this site. The site has been subjected to strong seismic ground shaking following the recent seismic events, particularly during the 22 February 2011 earthquake. The design earthquake for this housing complex has been taken from Project Orbit and adopting the February 2011 Earthquake of magnitude M6.3 the following Peak ground accelerations were calculated:

1) 0.1g for Serviceability Limit State (SLS), using class C soil for the site Ch,T = 1.33, Z= 0.3 (For the Canterbury Earthquake region), R_u = 0.25 (1 in 25 year annual probability of exceeding occurring.)
2) 0.4g for Ultimate Limit State (ULS), using class C soil for the site Ch,T = 1.33, Z= 0.3 (For the Canterbury Earthquake region), R_u = 1.0 (1 in 500 year annual probability of exceeding occurring.)

The conditional PGA values for Lyttelton for the 22 February earthquake has been assessed at 0.35g.

3 Inspection and level survey

3.1 Site walk-over

A walkover inspection of the exterior of the buildings and surrounding land at Collet Courts was carried out by an Opus Geotechnical Engineer on 22 November 2012. During the walkover the site was observed for any geotechnical defects and earthquake caused defects. The following observations were made (refer to the annotated Site Plan and Site Photographs attached to this report)

The buildings at the site comprised of six single storey and timber framed houses with either concrete block or brick veneer walls. No evidence of cracking of the externally exposed floor slabs was observed on the site visit of 22/11/2012. No internal inspection of floor slabs was undertaken on the site visit 22/11/2012.

The site visit has been focussed on two major defects:

- Concrete retaining wall (yard separation) between the Catholic school and Collet Courts
    - wall height is increasing from the east to the west side of the school playground from about 0.5 m to 1.75 m. Thickness approximately 150mm. Three major cracks (+/- 5 - 10 mm) were observed.
    - wall has been blocked by an ATF fence off on the sea side (school side) to prevent children climbing from the school side. Part of the fence on the wall has been taken out creating a considerable risk of falling. A safety fence on the hill site of the Collet Courts will therefore be required.
    - For reconstruction of the retaining wall the limited amount of working space on the hill side needs to be considered. Also, the downhill side is currently being used by the school and land use needs to be compromised.

- Major defect in the 20m length 1 to 1.25m height timber pole/plank retaining wall between property No 19 and Collet Courts
    - Timber wall rotated towards drive way and caused deformation of the white rail
    - Depression of the grass field on the active side of the wall

Sketches of the observed defects are added in Appendix A.2.

4 Level Survey

There is no level survey carried out at present.

5 Discussion and recommendations

As a result of the 4th September 2010 Canterbury Earthquake and the following aftershocks; cracking, with possible differential settlement has occurred in some of the properties.

The property behind the school is owned by CCC for a block of housing units. We have been assessing these including the retaining wall between the properties.

Concrete retaining wall

The wall has been recognised as an insufficient engineered wall and the observed cracks indicate that there is a potential risk that the wall will collapse in near future. Evidence of defects are three major cracks from top to bottom with a shift of max 10 mm; also the concrete wall is bulging. Whether these defects are wholly due to the earthquake(s) is unclear apart from recognising that the cracks are not old. The following solutions are proposed:

1. Semi-temporary solution: keep the existing wall but strut the wall on passive side using gabion baskets (1 high at 3 to 4 m centres)
2. Remove the existing wall and reconstruct a new gabion or concrete wall
3. Support of the integrity of the existing wall using the soil nail/shotcrete approach.

   The latter is an economic attractive solution in case the anchors can be installed under the house foundation of No 5.

An investigation and design is required for options 2 and 3

Timber retaining wall

1. It is likely that the existing wall has had insufficient embedment depth to retain the active pressure from the soil in the garden of No 19. Active soil pressure under the earthquake inertia has exceeded the passive resistance and caused severe displacement of the wall that nearly fully collapsed. It is recommended to replace the entire wall; a similar timber pole retaining wall can be used, but with sufficient embedment depth. An investigation and design is required.

6 Limitation

This report has been prepared solely for the benefit of Christchurch City Council as our client with respect to the particular brief given to us. Data or opinions in this desk study may not be used in other contexts, by any other party or for any other purpose.

It is recognised that the passage of time affects the information and assessment provided in this document. Opus's opinions are based upon information that existed at the time of the production of this Desk Study. It is understood that the Services provided allowed Opus to form no more than an opinion on the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings or any laws or regulations.

7 References

- Brown, LJ; Webber, JH 1992: Geology of the Christchurch Urban Area. Scale 1:25,000. Institute of Geological and Nuclear Sciences geological map, 1 sheet + 104p.

  http://ecan.govt.nz/services/online-services/tools-calculators/Pages/well-card.aspx

- Project Orbit, 2011: Interagency/organisation collaboration portal for Christchurch recovery effort. https://canterburyrecovery.projectorbit.com/SitePages/Home.aspx

- GNS Science reporting on Geonet Website: http://www.geonet.org.nz/canterbury-quakes/aftershocks/ updated on 9 September 2012.

- Revised Guidance on repairing and rebuilding houses affected by the Canterbury earthquake sequence. Dept. of Building and Housing November 2011.

Appendices:

Appendix A1: Site Location Plan
Appendix A2: Site photographs
Appendix B1: Land Damage (Orbit)
Appendix B2: Location of Existing Ground Investigation
Appendix C: Site Geology
Appendix D: Concrete Retaining Wall and Timber Pole Retaining Wall Sketches

Site Inspection and Report: P Cohen

Yours sincerely

Glyn East | Principal Geotechnical Engineering | Opus International Consultants Ltd
Phone +64 9 355 9560 | Mobile +64 27 472 3700 | Fax +64 9 355 9585 | Email Glyn.East@opus.co.nz
The Westhaven, 100 Beaumont St, Auckland, New Zealand
PO Box 5848, Auckland 1141, New Zealand

Visit us online: www.opus.co.nz

Appendix A:

Appendix A1: Site Location Plan
Appendix A2: Site Photographs

SOURCE: canterburyrecovery.projectorbit.com (Accessed on 5/06/12) CCC

Opus International Consultants Ltd
Christchurch Office
20 Moorhouse Ave
PO Box 1482
Christchurch, New Zealand
Tel: +64 3 363 5400 Fax: +64 3 365 7857

Project: Collet Courts
Geotechnical Desktop Study

Project No.: 6-QUCC2.12/55AC

Client: Christchurch City Council

Figure A.1 Site Location Plan

Drawn: Opus Geotechnical Engineer

Date: 21/11/2012

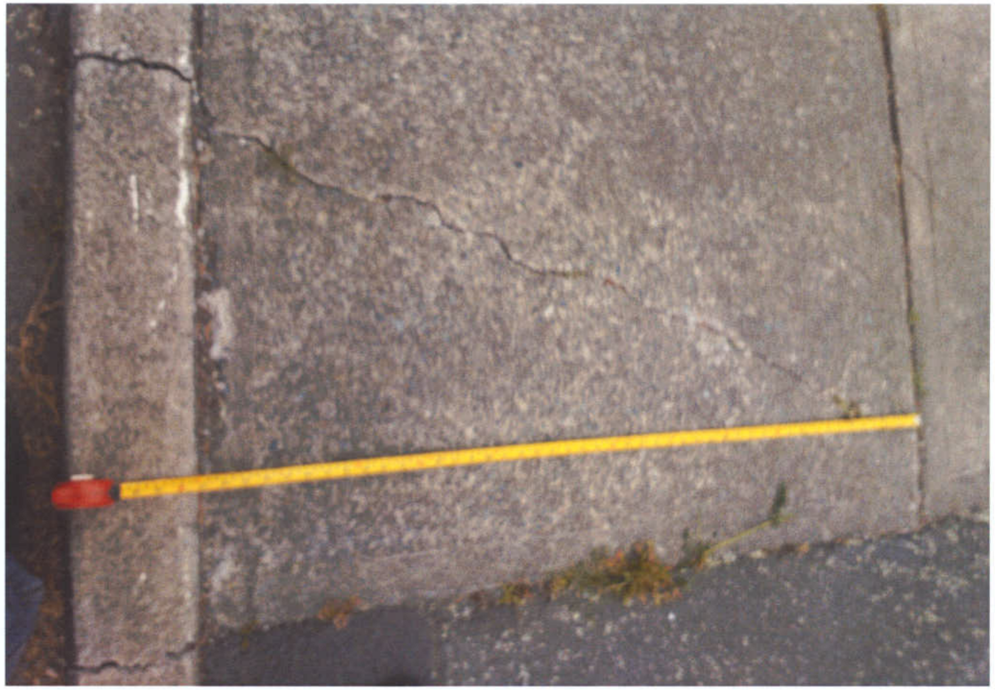
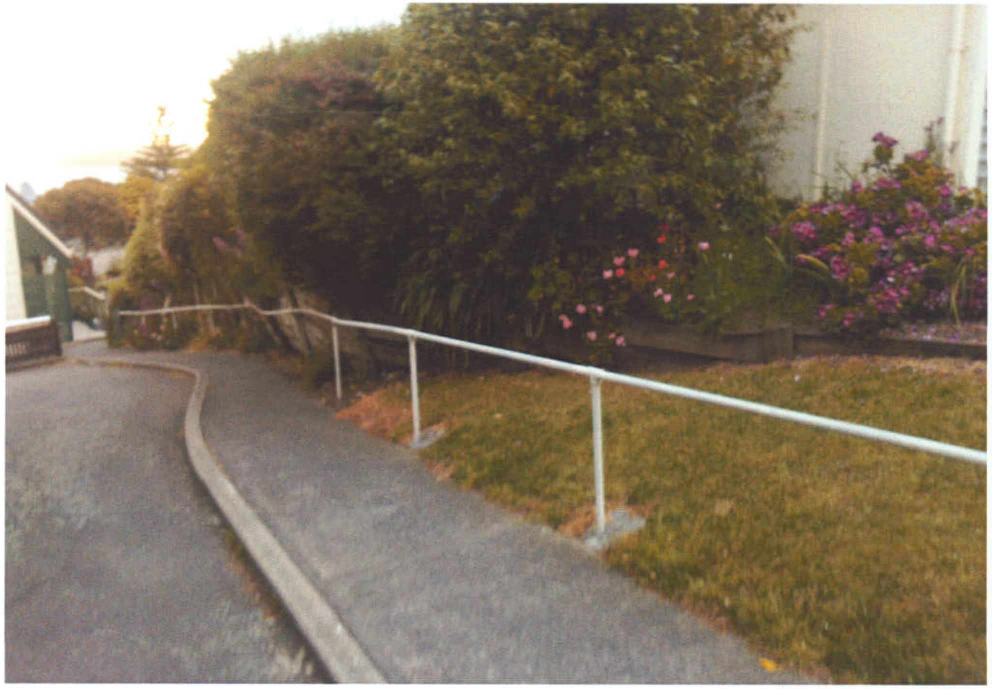
Appendix A.2:
Site Photographs


20 11 2012


COLLETT COURT

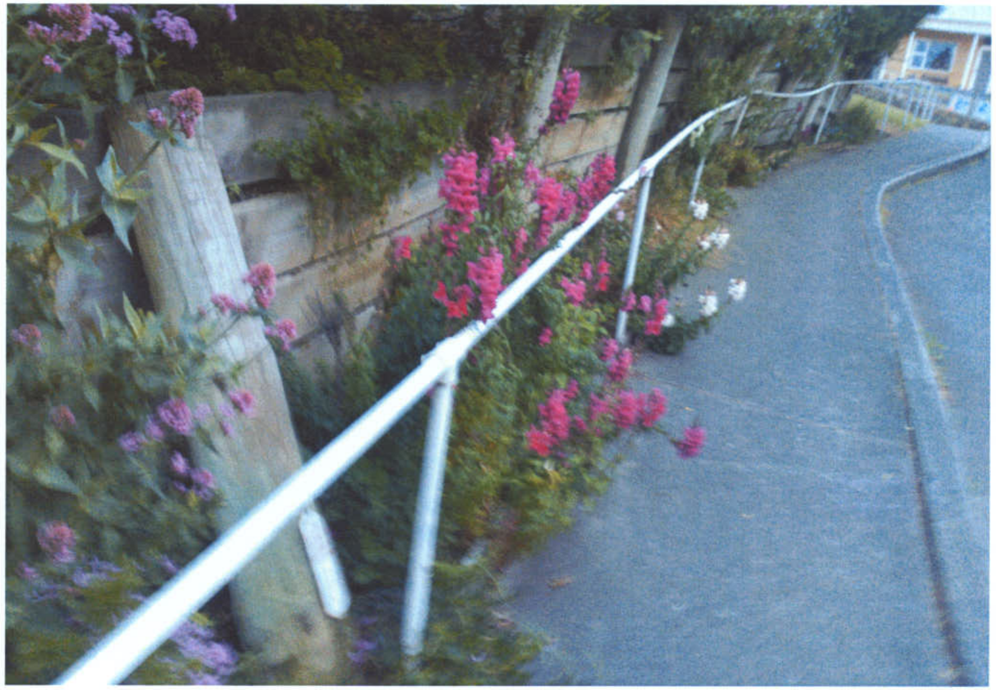

20 11 2012


COLLETT COURT
20 11 2012



LIVE
CABLES
UNDER
GROUND

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city care K
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city care KEEP CL


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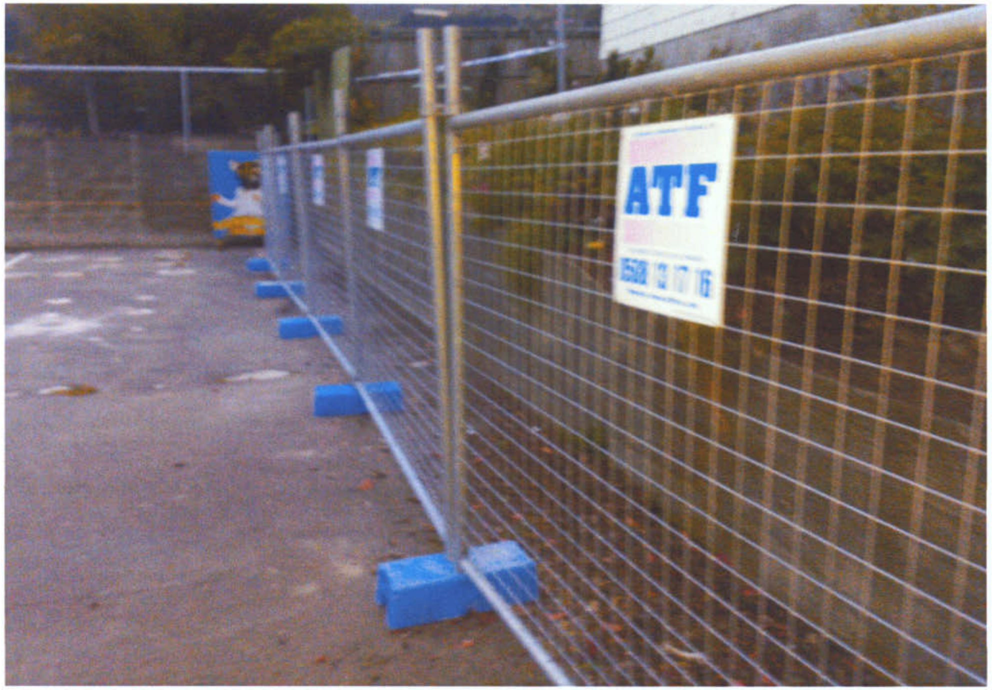
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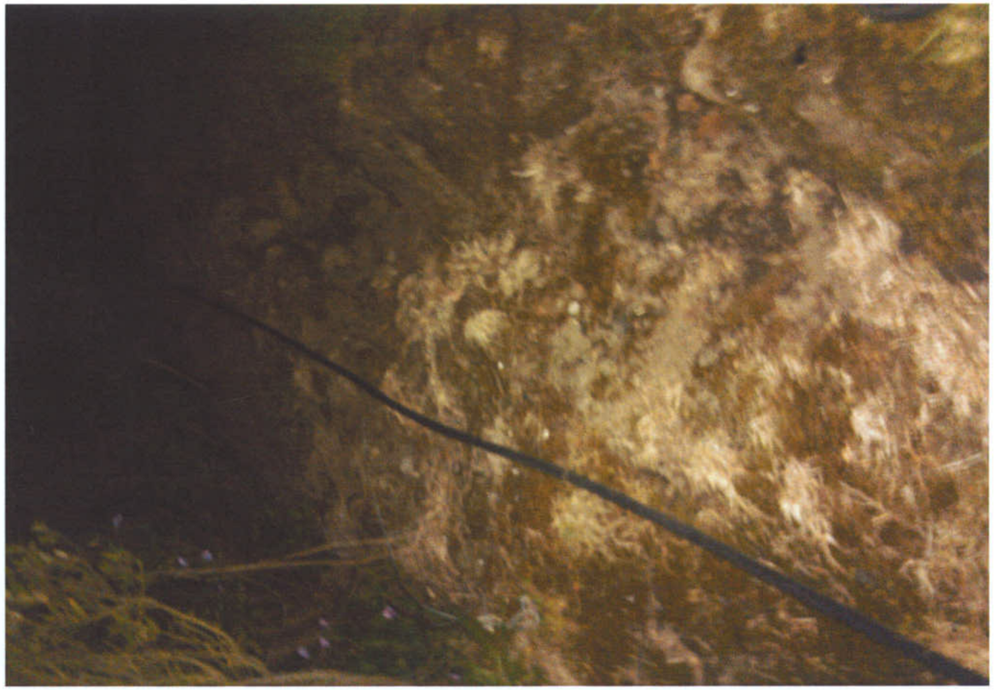

Appendix B:

Appendix B1: Earthquake Damaged Zone Plan
Appendix B2: Location plan of available ground investigation
Appendix B3: Borehole Logs

FOR RESIDENTIAL PURPOSES ONLY

Foundation Technical Category 1 (TC1):
Future land damage from liquefaction is unlikely, and ground settlements are expected to be within normally accepted tolerances. Standard foundations (NZS 3604) are acceptable subject to shallow geotechnical investigation.

Foundation Technical Category 2 (TC2):
Minor to moderate land damage from liquefaction is possible in future large earthquakes. Lightweight construction or enhanced foundations are likely to be required such as enhanced concrete raft foundations (ie, stiffer floor slabs that tie the structure together).

Foundation Technical Category 3 (TC3):
Moderate to significant land damage from liquefaction is possible in future large earthquakes. Foundation solutions should be based on site-specific geotechnical investigation and specific engineering foundation design.

Foundation Technical Category map not applicable (N/A):
Normal consenting procedures apply in these areas. This applies to non-residential properties in urban areas, properties in rural areas or beyond the extent of land damage mapping, and properties in the Port Hills and Banks Peninsula.

Legend

DBH Residential Technical Category

- ▨ Technical Category 1
- 🟨 Technical Category 2
- 🟦 Technical Category 3
- ▨ N/A - Urban Nonresidential
- 🟧 N/A - Rural & Unmapped
- ▨ N/A - Port Hills & Banks Peninsula

CERA Residential Recovery Zone

- 🟥 Red Zone

Building & Housing
CERA Canterbury Earthquake Recovery Authority
Tonkin & Taylor

△ CPT Borehole ⊕ Water well ⊕ EQC Borehole

Technical Category for residential areas

Scale: **Not to Scale**

SOURCE: canterburyrecovery.projectorbit.com (Accessed on 19/09/12)

OPUS
Opus International Consultants Ltd
Christchurch Office
20 Moorhouse Ave
PO Box 1482
Christchurch, New Zealand
Tel: +64 3 363 5400 Fax: +64 3 365 7857

Project: Collet Courts
Geotechnical Desktop Study
Project No.: 6-QUCC2.12
Client: Christchurch City Council

Figure B.1 EQ_Damaged Zone Plan

Drawn: Opus Geotechnical Engineer

Date: 4/12/2012

SOURCE: canterburyrecovery.projectorbit.com (Accessed on 5/06/12) CCC

OPUS

Opus International Consultants Ltd
Christchurch Office
20 Moorhouse Ave
PO Box 1482
Christchurch, New Zealand
Tel: +64 3 363 5400 Fax: +64 3 365 7857

Project: Collet Courts
Geotechnical Desktop Study
Project No.: 6-QUCC2.12/55AC
Client: Christchurch City Council

Figure B.2 Location of existing Ground investigation

Drawn: Opus Geotechnical Engineer

Date: 21/11/2012

Appendix B3:

Borehole Logs

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BOREHOLE LOG

Site Identification **10423-BH-01**

Sheet 1 of 2

Project:	Sumner Road retaining wall	**Coordinates:** E 399743.21, N 798497.36	**Datum:**
Client:	SCIRT	**Surface RL (m):** +39.9m	**Total Depth:** 15.0m
Site:	Sumner Road	**Commenced:** 05-Apr-12	**Contractor:** McNeills
Job No.:	10423	**Completed:** 05-Apr-12	**Driller:** McNeill

Equipment: Truck mounted Rotary Coring
Inclination: -90
Shear Vane:
Comments: SPT N values are uncorrected
Bore Diameter (mm): 85

Logged:	M Molloy
Processed:	M Molloy
Checked:	

Drilling Method: Rotary Coring
Support / Casing (m): None

Depth (m)/ [Elev.]	SOIL DESCRIPTION: (Soil Code), Soil Name [minor MAJOR], colour, structure [zoning, defects, cementing], plasticity or grain size, secondary components, structure. (Geological Formation) / ROCK DESCRIPTION: Weathering, colour, fabric, ROCK NAME (Formation Name)	Moisture Condition
0.0–1.0	Asphalt and fine to coarse GRAVEL; light grey. Gravels are sub-angular to sub-rounded. (FILL/roading material).	
1.0 [+38.9]	SILT with trace clay; yellowish brown. Very stiff, moist, low plasticity.	M
3.5 [+36.4]	Core sample becomes soft to firm, wet. Probable drill/SPT disturbance.	W
4.1 [+35.8]	Very stiff, moist SILT continues.	M
5.0 [+34.9]	Core sample becomes soft to firm, wet. Probable drill/SPT disturbance.	W
5.6 [+34.3]	Very stiff, moist SILT continues.	M
6.5 [+33.4]	Trace fine to coarse sand sized fragments of weathered basalt below 6.5m.	
8.6 [+31.3]	Clayey SILT with trace to minor fine gravels; mixed brown/orange/red. Very stiff, non to moderately plastic, moist. Gravels are 2-6mm mod weathered basalt. (Probable highly to completely weathered BASALT/TUFF)	

Core Run / Recovery (%), from top: 40, 89, 0, 100, 0, 100, 100, 100, 100, 100, 29, 0, 100, 78

Geological Fm | Classification | Graphic Log | Consistency/ Relative Density | Weathering | Estimated Rock Strength (EW VW W MS S VS ES) | RQD (%) | Defect Spacing (mm) (20 60 200 600 2000)

TESTS & SAMPLES / ROCK MASS DEFECTS: Depth, Type, Inclinations, Roughness, Texture, Aperture, Coating	
NR	
SPT 1	5,6, 9,8, 9,7, [N=33]
RX 2	
SPT 3	2,3, 4,3, 3,4, [N=14]
RX 4	
SPT 5	1,1, 1,1, 2,2, [N=6]
RX 6	
SPT 7	2,3, 3,5, 4,5, [N=17]
RX 8	
SPT 9	4,4, 7,7, 6,6, [N=26]
RX 10	
SPT 11	1,1, 1,0, 1,1, [N=3]
RX 12	
SPT 13	3,5, 5,5, 6,6, [N=22]

BOREHOLE LOG

Site Identification **10423-BH-01**

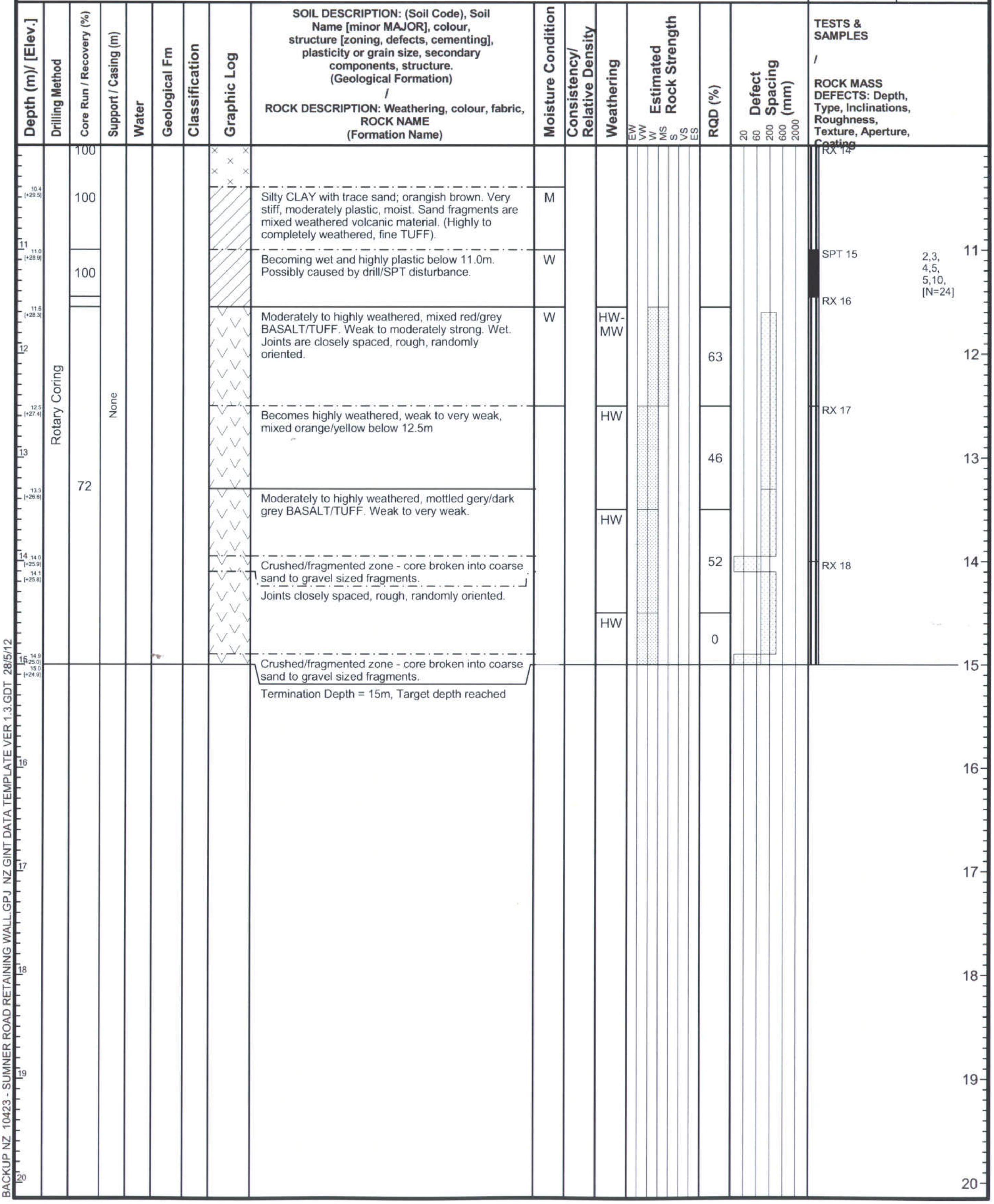
Sheet 2 of 2

Project: Sumner Road retaining wall
Client: SCIRT
Site: Sumner Road
Job No.: 10423

Coordinates: **E** 399743.21, **N** 798497.36
Surface RL (m): +39.9m
Commenced: 05-Apr-12
Completed: 05-Apr-12
Contractor: McNeills
Driller: McNeill
Datum:
Total Depth: 15.0m

Equipment: Truck mounted Rotary Coring
Shear Vane:
Bore Diameter (mm): 85
Inclination: -90
Comments: SPT N values are uncorrected

Logged: M Molloy
Processed: M Molloy
Checked:



Depth (m)/ [Elev.]	Drilling Method	Core Run / Recovery (%)	Support / Casing (m)	Water	Geological Fm	Classification	SOIL DESCRIPTION: (Soil Code), Soil Name [minor MAJOR], colour, structure [zoning, defects, cementing], plasticity or grain size, secondary components, structure. (Geological Formation) / ROCK DESCRIPTION: Weathering, colour, fabric, ROCK NAME (Formation Name)	Moisture Condition	Consistency/ Relative Density	Weathering	RQD (%)	TESTS & SAMPLES / ROCK MASS DEFECTS: Depth, Type, Inclinations, Roughness, Texture, Aperture, Coating
	Rotary Coring	100	None									RX 14
10.4 [+29.5]		100					Silty CLAY with trace sand; orangish brown. Very stiff, moderately plastic, moist. Sand fragments are mixed weathered volcanic material. (Highly to completely weathered, fine TUFF).	M				
11.0 [+28.9]		100					Becoming wet and highly plastic below 11.0m. Possibly caused by drill/SPT disturbance.	W				SPT 15 2,3, 4,5, 5,10, [N=24] RX 16
11.6 [+28.3]		72					Moderately to highly weathered, mixed red/grey BASALT/TUFF. Weak to moderately strong. Wet. Joints are closely spaced, rough, randomly oriented.	W		HW-MW	63	
12.5 [+27.4]							Becomes highly weathered, weak to very weak, mixed orange/yellow below 12.5m			HW	46	RX 17
13.3 [+26.6]							Moderately to highly weathered, mottled gery/dark grey BASALT/TUFF. Weak to very weak.			HW	52	
14.0 [+25.9]							Crushed/fragmented zone - core broken into coarse sand to gravel sized fragments.					RX 18
14.1 [+25.8]							Joints closely spaced, rough, randomly oriented.			HW	0	
14.9 [+25.0]							Crushed/fragmented zone - core broken into coarse sand to gravel sized fragments.					
15.0 [+24.9]							Termination Depth = 15m, Target depth reached					

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BOREHOLE LOG

Site Identification: **10423-BH-02**

Sheet 1 of 2

Project: Sumner Road retaining wall
Client: SCIRT
Site: Sumner Road
Job No.: 10423

Coordinates: E 399767.66, **N** 798462.44
Surface RL (m): +42.5m
Commenced: 06-Apr-12
Completed: 06-Apr-12

Datum:
Total Depth: 15.0m
Contractor: McNeills
Driller: McNeill

Equipment: Truck mounted Rotary Coring
Shear Vane:
Bore Diameter (mm): 85

Inclination: -90
Comments: SPT N values are uncorrected

Logged: R Telford
Processed: R Telford
Checked:

Depth (m)/ [Elev.]	Drilling Method	Core Run / Recovery (%)	Support / Casing (m)	Water	Geological Fm	Classification	Graphic Log	SOIL DESCRIPTION: (Soil Code), Soil Name [minor MAJOR], colour, structure [zoning, defects, cementing], plasticity or grain size, secondary components, structure. (Geological Formation) / ROCK DESCRIPTION: Weathering, colour, fabric, ROCK NAME (Formation Name)	Moisture Condition	Consistency/ Relative Density	Weathering	Estimated Rock Strength EW VW W MS S VS ES	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	TESTS & SAMPLES / ROCK MASS DEFECTS: Depth, Type, Inclinations, Roughness, Texture, Aperture, Coating	
	Vacuum	0	None					0.0 - 1.0m vacuum excavated - not logged.							NR	
1.0 [+41.5]	Rotary Coring	0	None					No sample recovered from SPT.							RX 1	
1.5 [+41.0]		55						SILT with trace clay; yellowish brown. Firm to stiff, non to slightly plastic, wet.	W							
		56													SPT 2	3,5, 5,5, 7,6, [N=23]
		19													RX 3	
		89													SPT 4	1,2, 2,3, 3,3, [N=11]
		67													RX 5	
5.0 [+37.5]		100						Occasional fine carbonised organic fragments.							SPT 6	2,3, 4,4, 4,5, [N=17]
5.5 [+37.0]		10						Poor core recovery from 5.5 - 6.5m.							RX 7	
6.5 [+36.0]		100						SILT with trace clay and trace very fine sand; yellowish brown. Silt has liquefied and flowed in core box.	W						SPT 8	2,5, 5,7, 6,7, [N=25]
		57													RX 9	
		67													SPT 10	1,1, 2,2, 2,3, [N=9]
		0													RX 11	
		70													SPT 12	13,29, *,*, *,*, [N>50]

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BOREHOLE LOG

Site Identification 10423-BH-02

Sheet 2 of 2

Project: Sumner Road retaining wall
Client: SCIRT
Site: Sumner Road
Job No.: 10423

Coordinates: **E** 399767.66, **N** 798462.44
Surface RL (m): +42.5m
Commenced: 06-Apr-12
Completed: 06-Apr-12

Datum:
Total Depth: 15.0m
Contractor: McNeills
Driller: McNeill

Equipment: Truck mounted Rotary Coring
Shear Vane:
Bore Diameter (mm): 85

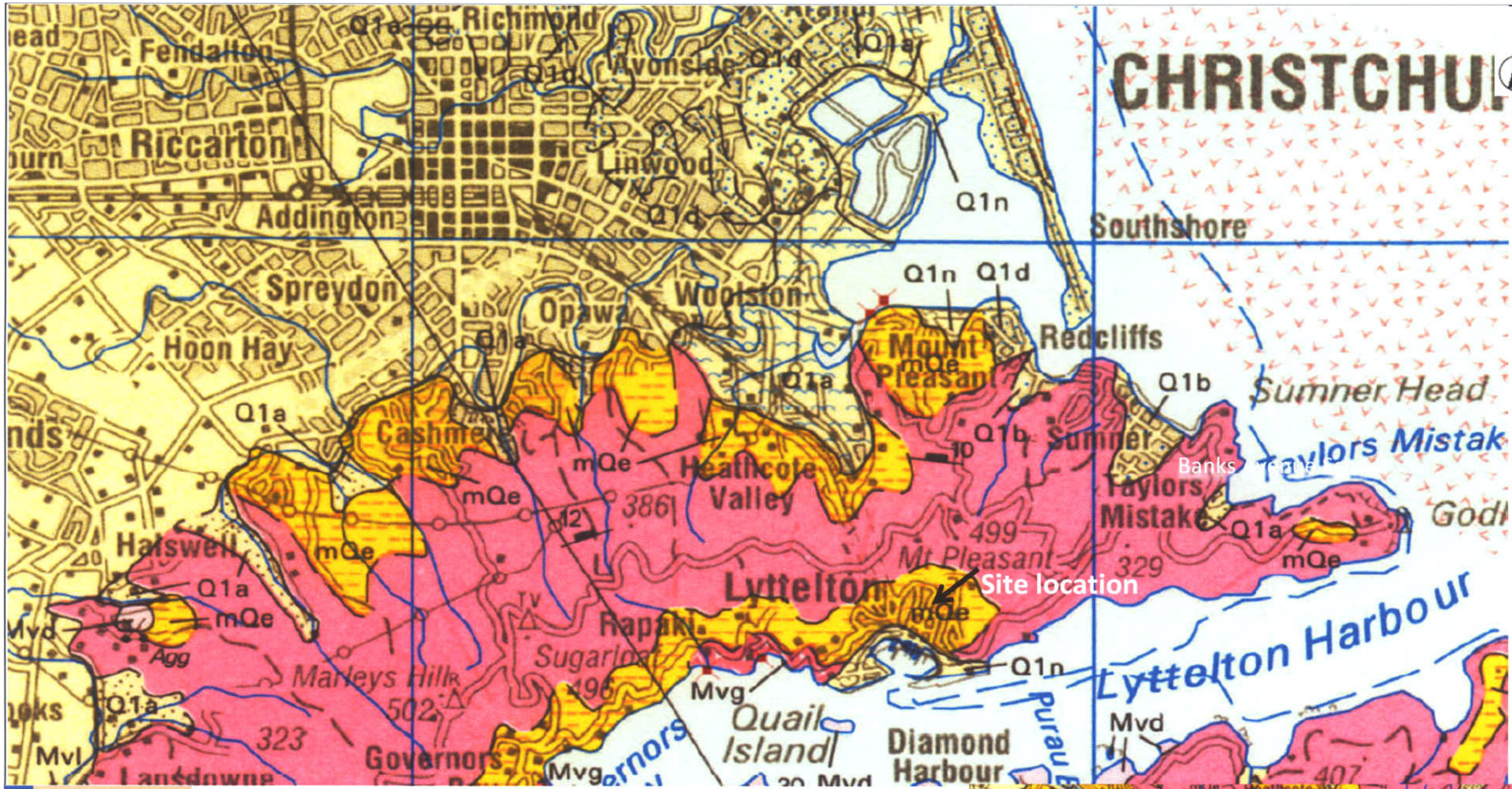
Inclination: -90
Comments: SPT N values are uncorrected

Logged: R Telford
Processed: R Telford
Checked:

Depth (m)/ [Elev.]	Drilling Method	Core Run / Recovery (%)	Support / Casing (m)	Water	Geological Fm	Classification	Graphic Log	SOIL DESCRIPTION: (Soil Code), Soil Name [minor MAJOR], colour, structure [zoning, defects, cementing], plasticity or grain size, secondary components, structure. (Geological Formation) / ROCK DESCRIPTION: Weathering, colour, fabric, ROCK NAME (Formation Name)	Moisture Condition	Consistency/ Relative Density	Weathering	Estimated Rock Strength EW VW W MS S VS ES	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	TESTS & SAMPLES / ROCK MASS DEFECTS: Depth, Type, Inclinations, Roughness, Texture, Aperture, Coating
	Rotary Coring		None						W						RX 13
10.4 [+32.1]		70						Becoming soft, slightly plastic. Occasional gravel sized fragments of moderately weathered basalt below 10.5m.							
10.7 [+31.8]								Moderately weathered, dark red/grey BASALT/TUFF. Moderately strong, closely to very closely jointed.	W		MW				
11		87											32		RX 14
12.0 [+30.5]								Crushed or very closely jointed zone.			MW				
		100											65		RX 15
12.8 [+29.7]								Becomes slightly to moderately weathered BASALT. Strong, closely jointed. Joints are randomly oriented, rough, clean or with thin silt coating.			MW-SW				
		100											91		
14		90											54		RX 16
15.0 [+27.5]								Termination Depth = 15m, Target depth reached							

Appendix C:

Site Geology

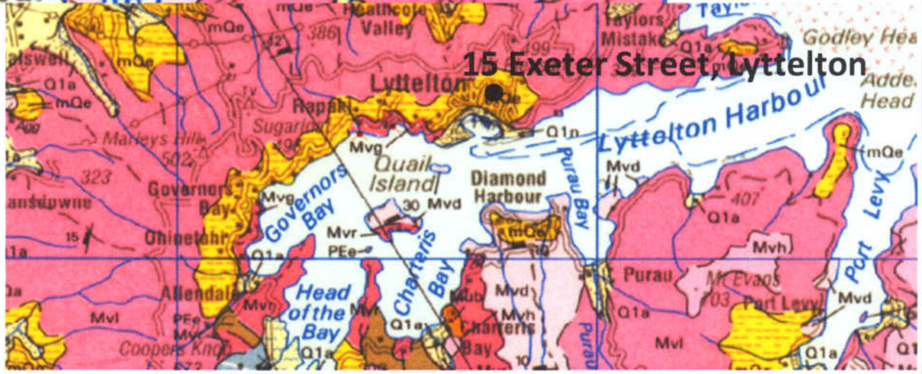


Christchurch Urban Geology: Description and Key

▨ mQe — Yellow-brown windblown silt on Banks Peninsula, greater than 3 m thick and commonly in multiple layers (mQe).

Pleistocene to Recent

SOURCE: canterburyrecovery.projectorbit.com (Accessed on 5/06/12)   NZGNI



Opus International Consultants Ltd Christchurch Office 20 Moorhouse Ave PO Box 1482 Christchurch, New Zealand Tel: +64 3 363 5400 Fax: +64 3 365 7857	**Project:**	Collet courts Geotechnical Desktop Study	**Figure C.1 Site Geology**
	Project No.:	6-QUCC22.12 / 55AC	**Drawn:** Opus Geotechnical Engineer
	Client:	Christchurch City Council	**Date:** 5/11/2012

Appendix D:

Concrete Retaining Wall and Timber Pole Retaining Wall Sketches

PC

Calculation Sheet

Project/Task/File No: Collet Courts, 15 Exeter St.

Project/Description: 6-QUCC2.12 / 155AC

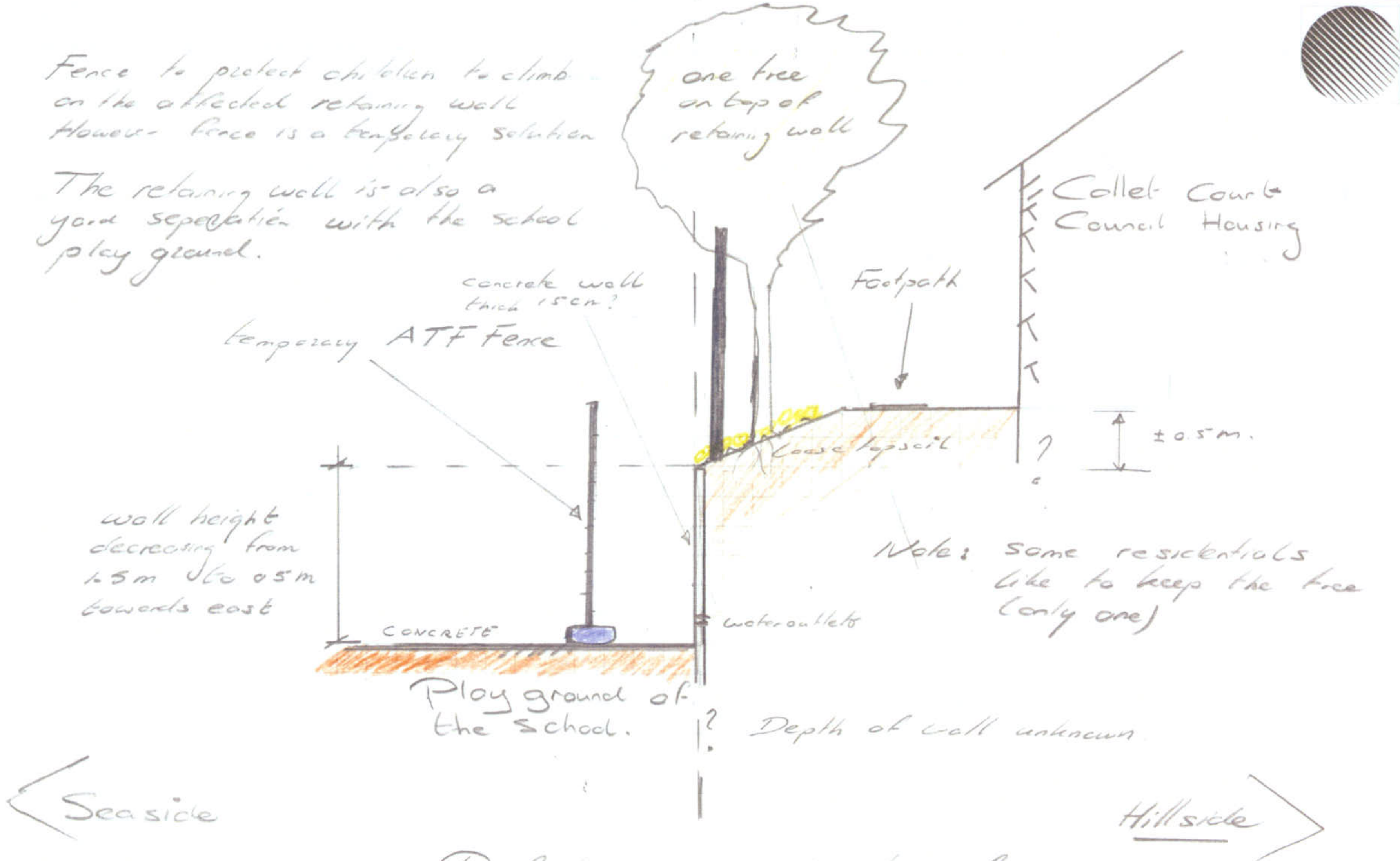
Inspection Notes

Sheet No of

Office: ChCh

Computed: 23 / 11 / 12

Checked: PCo / /



Fence to protect children to climb on the affected retaining wall However fence is a temporary solution

The retaining wall is also a yard separation with the school play ground.

Note: Some residentials like to keep the tree (only one)

Defects observed:
- 3 cracks at surface
- Bulging concrete retaining wall.

Yard seperation

PCo

Calculation Sheet

Project/Task/File No: Collet Courts, 15 Exeter St

Project/Description: 6-QUCC2.13 155AC

15 Exeter Street

Inspection Notes

Sheet No of

Office: ChCh

Computed: 23 / 11 / 12

Checked: / /

Inspection notes facing mountain. / direction of the building

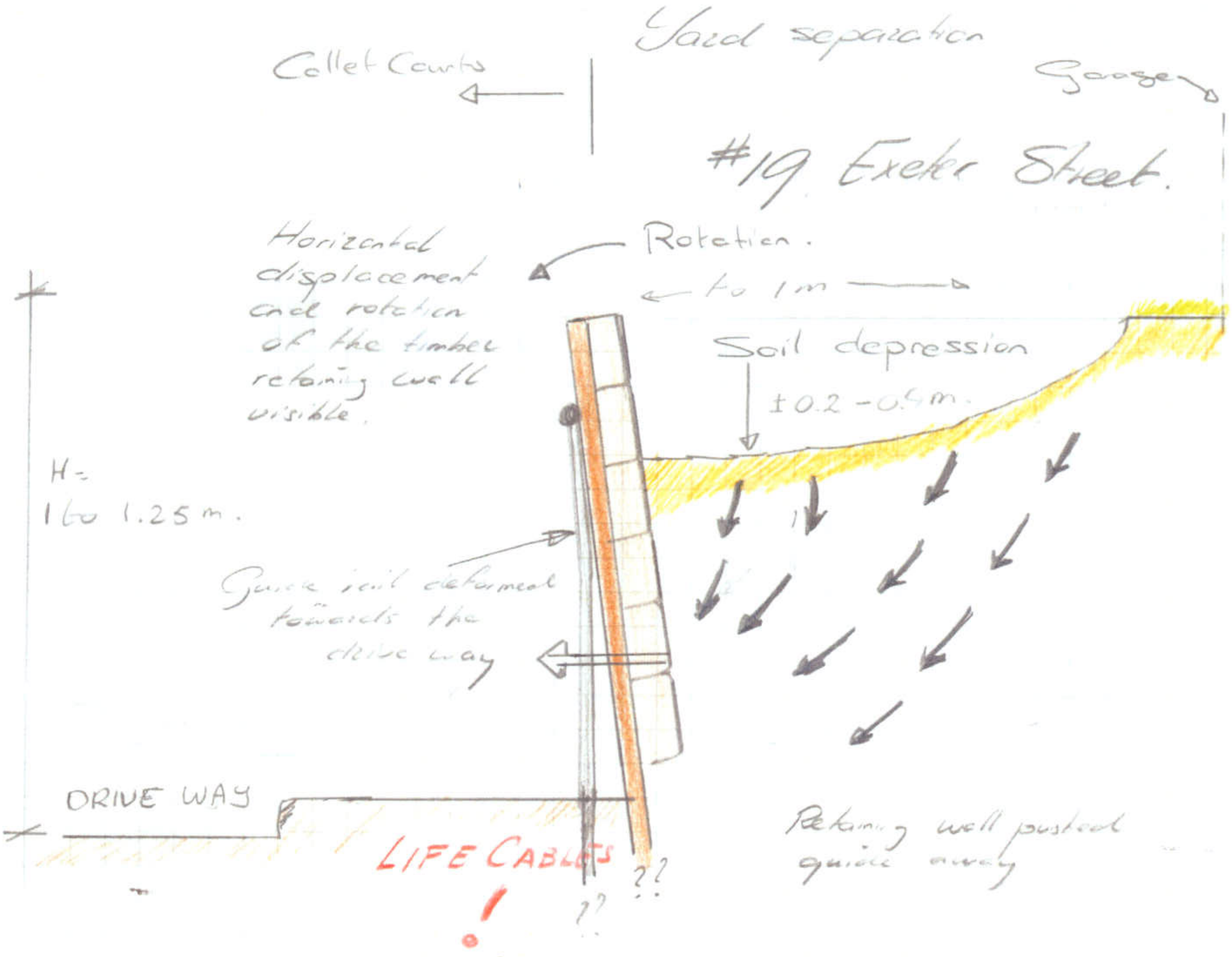
Major geotech defects:

gap width ±0.5cm top of the wall is wrinkled

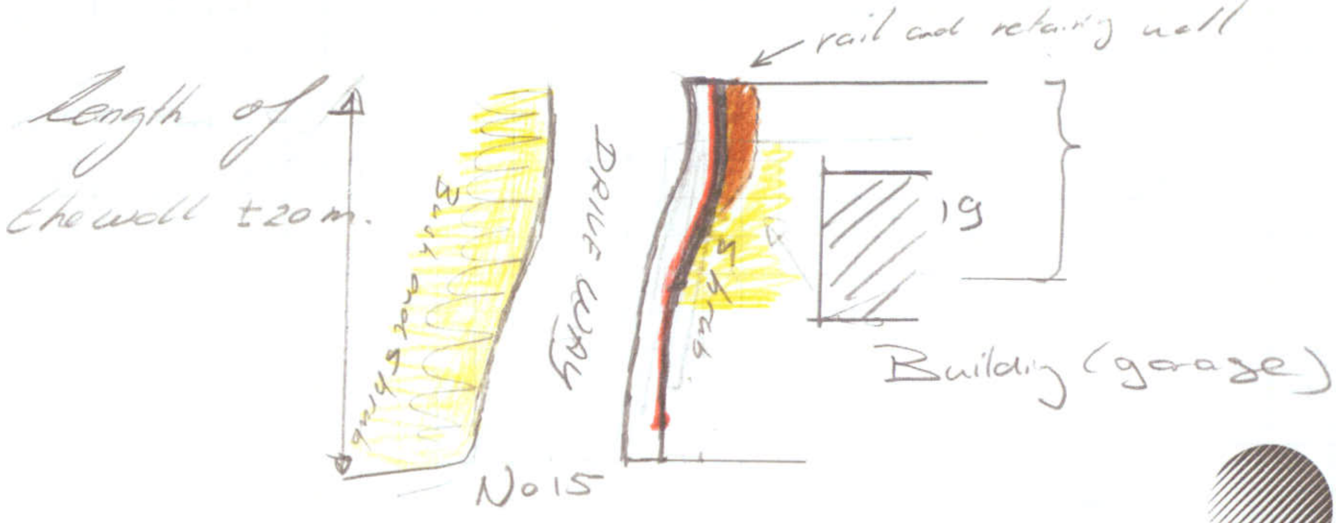
differential ±1.0cm. floor of the play ground is practically horizontal

Calculation Sheet

Project/Task/File No:	Collet Courts, 15 Exeter St.	Sheet No	of
Project/Description:	6 - Qucc2.12 /55AC	Office:	ChCh.
	Inspection Notes Collet Courts	Computed:	23 / 11 / 12
		Checked:	PCe. / /



Note at the lower side of the wall



Appendix 3 - Methodology and Assumptions

Seismic Parameters

As per NZS 1170.5:

- T < 0.4s (assumed)
- Soil: Category D
- Z = 0.3
- R = 1.0 (IL2, 50 year)
- N(T,D) = 1.0

For all analyses, a μ of 2 was assumed.

Analysis Procedure

The dimensions of the building meant that a NZS 3604 type approach was adopted and only global shear resistances in both directions were considered (i.e: the ceiling diaphragms were deemed adequate to transfer shears between lateral load resisting elements).

Base shears were calculated using NZS 1170.5 and converted into bracing units (1 kN = 20 BU's). Bracing capacities were based on the length of wall and assumed a strength of 60 BU/m of wall. Block masonry firewalls were checked for out-of-plane loading using a response spectrum analysis and assuming the walls were fixed at floor and ceiling positions. The wall stiffness's were altered to ensure the period was in the plateau of the design spectrum to ensure conservative results were obtained.

Additional Assumptions

Further assumptions about the seismic performance of the buildings were:

- Foundations and foundation connections had adequate capacity to resistance and transfer earthquake loads.
- Connections between all elements of the lateral load resisting systems are detailed to adequately transfer their loads sufficiently and are strong enough so as to not fail before the lateral load resisting elements.

Appendix 4 – CERA Spreadsheet

Detailed Engineering Evaluation Summary Data

V1.11

Location

Building Name: Collett Courts - Both Blocks

Unit No: Street

Building Address: 15 Exeter St, Lyttelton

Legal Description:

Degrees Min Sec

GPS south:

GPS east:

Building Unique Identifier (CCC): BE 3516 EQ2

Reviewer: John Newall

CPEng No: 1018146

Company: Opus International Consultants Ltd.

Company project number: 6-QUCC2.12

Company phone number: 03 363 5400

Date of submission: 4-Mar-13

Inspection Date:

Revision: Final V2

Is there a full report with this summary? yes

Site

Site slope: slope < 1in 10

Soil type: silt

Site Class (to NZS1170.5): D

Proximity to waterway (m, if <100m):

Proximity to clifftop (m, if < 100m):

Proximity to cliff base (m,if <100m):

Max retaining height (m):

Soil Profile (if available):

If Ground improvement on site, describe:

Approx site elevation (m):

Building

No. of storeys above ground: 1 single storey = 1

Ground floor split? no

Storeys below ground 0

Foundation type: other (describe)

Building height (m):

Floor footprint area (approx): 155

Age of Building (years): 30

Ground floor elevation (Absolute) (m):

Ground floor elevation above ground (m):

if Foundation type is other, describe: timber piles and masonry foundation walls

height from ground to level of uppermost seismic mass (for IEP only) (m):

Date of design: 1976-1992

Strengthening present? no

If so, when (year)?

And what load level (%g)?

Brief strengthening description:

Use (ground floor): multi-unit residential

Use (upper floors):

Use notes (if required):

Importance level (to NZS1170.5): IL2

Gravity Structure

Gravity System: load bearing walls

Roof: timber truss

Floors: timber

Beams:

Columns:

Walls:

truss depth, purlin type and cladding (unknown)

joist depth and spacing (mm) (unknown)

Lateral load resisting structure

Lateral system along: lightweight timber framed walls

Ductility assumed, μ: 2.00

Period along: 0.40 0.00

Total deflection (ULS) (mm):

maximum interstorey deflection (ULS) (mm):

Note: Define along and across in detailed report!

note typical wall length (m)

estimate or calculation? estimated

estimate or calculation?

estimate or calculation?

Lateral system across: lightweight timber framed walls

Ductility assumed, μ: 2.00

Period across: 0.40 0.00

Total deflection (ULS) (mm):

maximum interstorey deflection (ULS) (mm):

note typical wall length (m)

estimate or calculation? estimated

estimate or calculation?

estimate or calculation?

Separations:

north (mm):

east (mm):

south (mm):

west (mm):

leave blank if not relevant

Non-structural elements

Stairs:

Wall cladding: other light — describe weatherboard (Hardies)

Roof Cladding: Metal — describe pressed metal

Glazing:

Ceilings: fibrous plaster, fixed

Services(list):

Available documentation

Architectural partial — original designer name/date Opus site measurements.

Structural none — original designer name/date

Mechanical none — original designer name/date

Electrical none — original designer name/date

Geotech report none — original designer name/date

Damage

Site:
(refer DEE Table 4-2)

Site performance:

Describe damage:

Settlement: none observed — notes (if applicable):

Differential settlement: none observed — notes (if applicable):

Liquefaction: none apparent — notes (if applicable):

Lateral Spread: 0-50mm — notes (if applicable): Outward movement of retaining walls.

Differential lateral spread: none apparent — notes (if applicable):

Ground cracks: none apparent — notes (if applicable):

Damage to area: none apparent — notes (if applicable):

Building:

Current Placard Status: green

Along Damage ratio: 0%

Describe (summary):

Describe how damage ratio arrived at:

Across Damage ratio: 0%

Describe (summary):

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

Diaphragms Damage?: no Describe:

CSWs: Damage?: no Describe:

Pounding: Damage?: no Describe:

Non-structural: Damage?: yes Describe: Cracking of linings and firewalls.

Recommendations

Level of repair/strengthening required: minor non-structural — Describe: Re-stop walls, epoxy masonry cracks.

Building Consent required: no — Describe:

Interim occupancy recommendations: full occupancy — Describe:

Along Assessed %NBS before e'quakes: 81% ##### %NBS from IEP below

Assessed %NBS after e'quakes: 81%

If IEP not used, please detail assessment methodology: DEE

Across Assessed %NBS before e'quakes: 100% ##### %NBS from IEP below

Assessed %NBS after e'quakes: 100%

Opus International Consultants Ltd
20 Moorhouse Avenue
PO Box 1482, Christchurch Mail Centre,
Christchurch 8140
New Zealand

t: +64 3 363 5400
f: +64 3 365 7858
w: www.opus.co.nz