*Christchurch City Council*

# Boyd Cottages Housing Complex PRO 3517

## Detailed Engineering Evaluation

## Quantitative Assessment Report – Following Structural Strengthening 2015

*Christchurch City Council*

# Boyd Cottages Housing Complex

# Quantitative Assessment Report

## 2-4 Winchester Street, Lyttelton, Canterbury 8082

### Revision History

| Revision No. | Prepared By | Description | Date |
|---|---|---|---|
| 1 | LMH | Final V1 | 29/08/2013 |
| 2 | LMH | Final V2 – Following Strengthening | 10/11/2015 |


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Approved for Release By

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Senior Structural Engineer

# Summary

Boyd Cottages Housing Complex
PRO 3517

Detailed Engineering Evaluation
Quantitative Report - Summary
Final

## Background

This is a summary of the quantitative report for the Boyd Cottages Housing Complex, and updates the strengthening works undertaken since the original report was issued in August 2013. It is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011. This assessment covers the 4 residential units on the site.

## Key Damage Observed

The key damage observed prior to repairs and strengthening was as follows:

The render finish to the ring foundation of unit 4 has spalled off in the corner.

Cracking was observed in the GIB board linings in all units especially above and below openings for doors and windows. This cracking was severe in unit 4.

Complete collapse of the external chimney on unit 4 resulting in damage to the interior of the unit.

Stepped cracking was observed in the brick veneer of all units. This cracking was moderate in units 1-3 and severe in unit 4.

## Level Survey

Floor slopes in all units, except unit 3, are greater than the 5mm/m limitation set out in the MBIE guidelines [6].

Floor re-levelling was work was undertaken in Unit 4, but not in Units 1 – 3.

## Critical Structural Weaknesses

No critical structural weaknesses were found in any of the buildings.

## Indicative Building Strength

No buildings on the site are considered to be earthquake prone.

Table A: Summary of Seismic Performance by Blocks

| Block | NBS% | NBS% after strengthening |
|---|---|---|
| PRO 3517 B001 (Block A) | 58% | 100% |
| PRO 3517 B002 (Block B) | 58% | 100% |

The residential units have capacities of 100% NBS (as a result of the structural strengthening scheme outlined below) and are limited by the in-plane shear capacity of the lined timber-framed shear walls.

### Original Recommendations

The detailed Engineering Evaluation report of August 2013 recommended the following for this complex:

1. A strengthening works scheme be developed to increase the seismic capacity of all buildings to at least 67% NBS, this will need to consider compliance with accessibility and fire requirements.

2. Removal of all remaining chimneys down to at least ceiling level.

3. A geotechnical site investigation be carried out to determine the shallow bearing capacities of the soils if this information is required for future construction on the site.

4. Cosmetic repairs be undertaken.

5. The fall hazard at unit 4 be remediated by removal of loose bricks.

### Remediation and Structural Strengthening

On the 17th of January 2014 "Earthquake Remedial Work to Boyd Cottages" was issued by Opus to the Christchurch City Council to repair the damage sustained in the Canterbury Earthquake sequence. This plan addressed the recommendations in the following way:-

1. A strengthening works scheme was developed with works completed in January 2015 increasing the seismic capacity to 100% NBS.

2. All chimneys were completely removed as part of the repair works completed in January 2015.

3. A geotechnical site investigation has not been carried out to date as there has been no new construction.

4. Cosmetic repairs were completed in January 2015 as part of the repairs works to the complex.

5. The loose brick fall hazard identified at Unit 4 was initially addressed by removal of the bricks in February 2014. The strengthening works included completely replacing brick veneers on all structures with new bricks and veneer ties in accordance with the current building code requirements.

The strengthening included adding plywood linings to increase the seismic capacity. This work has been completed as of January 2015 and increases the capacity of the structures to 100%NBS.

The repair and strengthening works met all recommendations in the Detailed Engineering Evaluation report of August 2013.

# Contents

# 1 Introduction

Opus International Consultants Limited has been engaged by Christchurch City Council to undertake a detailed seismic assessment of the Boyd Cottages Housing Complex, located at 2 - 4 Winchester Street, Lyttelton, Canterbury, following the Canterbury Earthquake Sequence since September 2010.

The purpose of the assessment is to determine if the buildings in the village 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) [2] [3] [4] [5].

# 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.

The policy includes the following:

1. A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;

2. A strengthening target level of 67% of a new building for buildings that are Earthquake Prone;

3. A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,

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

**Figure 1: NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE Guidelines [2]**

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 assessment. Based on information received from CERA to date and from the MBIE guidance document dated December 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.

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

# 4 Background Information

## 4.1 Building Descriptions

The site contains 4 residential units which were built in 1965. Units 1-3 are connected and form a block of three, while unit four is a standalone unit. A site plan showing the locations of the units is shown in Figure 2. Figure 3 shows the location of the site relative to Christchurch City.

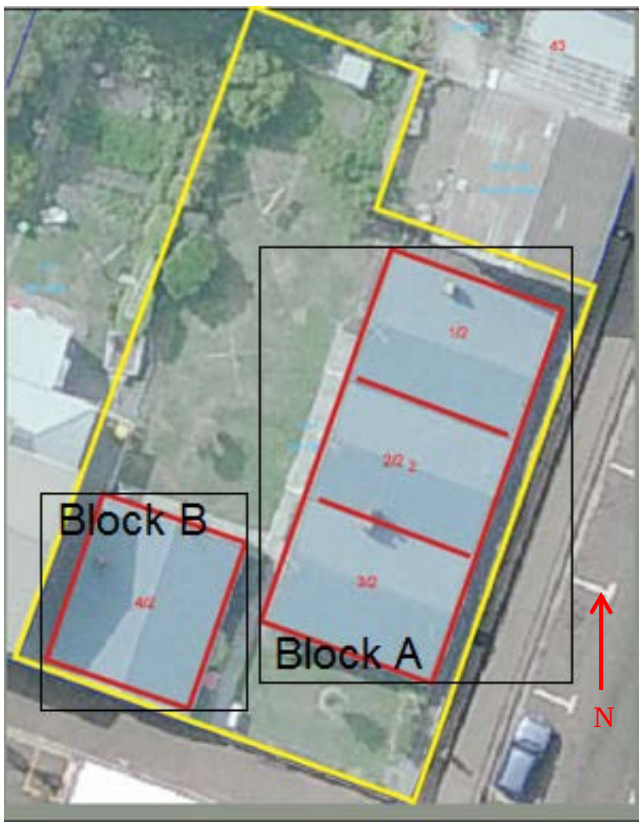



**Figure 2: Site plan of Boyd Cottages Housing Complex.**


**Figure 3: Location of site relative to Christchurch City CBD. (Source: Google Earth)**

The residential units and the residents lounge are timber-framed buildings with timber diagonal braces. The roof structure consists of timber roof trusses supporting light-weight metal roofs. Walls and ceilings are lined with GIB and GIB/pinex respectively. The external walls are clad in brick veneer.

Foundations are ordinary concrete piles with reinforced concrete perimeter walls. It should be noted that the plans for this site incorrectly indicate that concrete slabs foundations are used. Figure 4 shows a typical floor plan of a block of residential units confirmed with site measurements by Opus.

Units 1, 2 and 3 are separated by 190mm thick reinforced concrete block fire walls with reinforcement to the perimeter, this is contrary to the brick fire wall which is indicated on the drawings. We note that the brick screening walls are likely to be 2 wythes of veneer tied together.

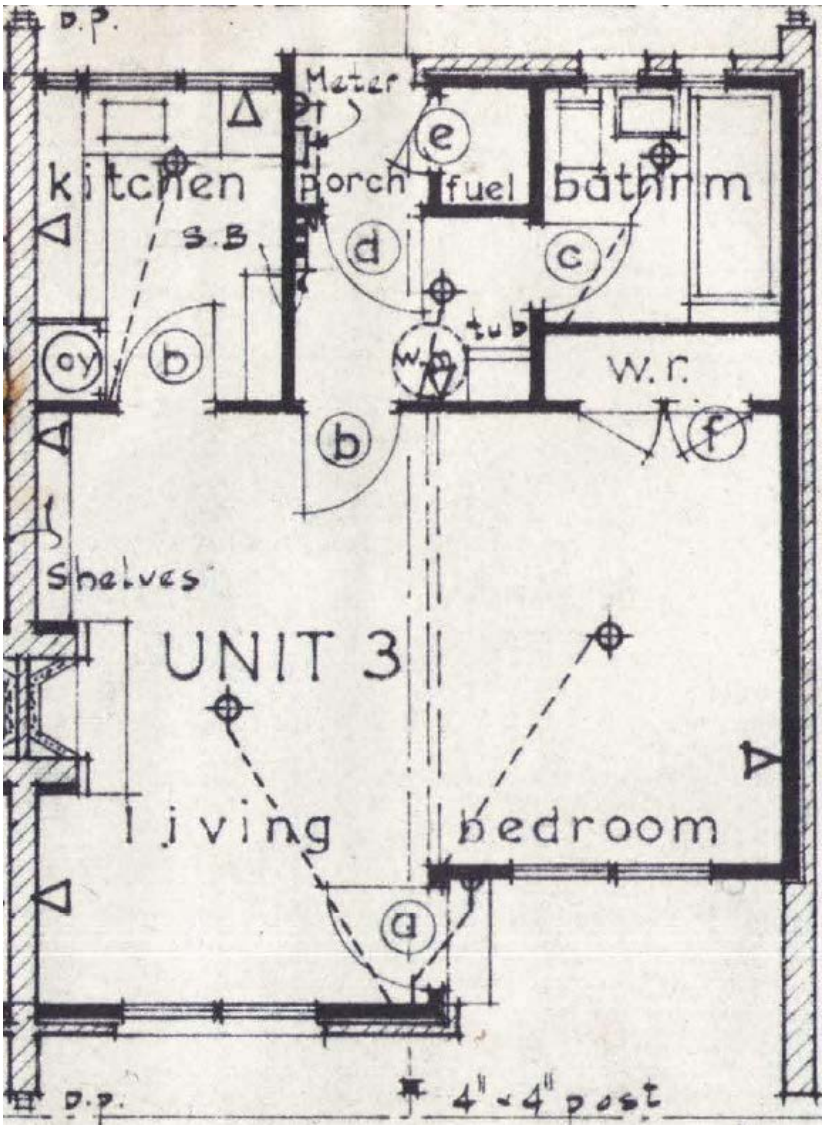



Figure 4: Partial floor plan of residential unit blocks.

## 4.2 Survey

### 4.2.1 Post 22 February 2011 Rapid Assessment

A structural (Level 1) assessment of the buildings/property was undertaken on March 4th, 2011 by Opus International Consultants. Minor cracking to building veneers was observed in Units 1-3. Moderate damage was observed to the brick veneer on unit 4 as well as a lean on the chimney which was deemed a falling hazard.

### 4.2.2 Level Survey

A full level survey was undertaken at Boyd Cottages Housing Complex as it is located in close proximity to the epicentre of the 22 February 2011 Christchurch Earthquake. The results of this survey are included in Appendix B and summarised in Table 2. This table shows that only unit 2 is less than the 5mm/m limit for floor slopes as recommended in the MBIE guidelines [6]. There is a small very local spot by the fireplace that will require

packing in unit 2. Floor re-levelling work was undertaken in Unit 4 but not on Units 1 - 3 as part of the repairs completed in January 2015

Table 2: Summary of level survey results

| Unit | Difference (mm) | Distance (m) | Slope (mm/m) | Comment |
|---|---|---|---|---|
| 1 | 22 | 2.5 | 9 | Fail |
| 2 | 32 | 2.5 | 13 | Fail |
| 3 | 30 | 6 | 5 | Pass |
| 4 | 44 | 2.8 | 16 | Fail |

## 4.3 Original Documentation

Copies of the following construction drawings were provided by CCC:

- Full architectural drawings from Lyttelton Borough Council titled "Pensioners Cottages" these drawings were completed in 1964
- Building consent application from 2002 for internal alterations to bathrooms and laundry.

The drawings have been used to confirm the structural systems, investigate potential critical structural weaknesses (CSW) and identify details which required particular attention.

Copies of the design calculations were not provided.

# 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. Some forms of damage may not be noticeable during a visual inspection due to being 'hidden' behind cladding, interior linings, etc.

Note: Any photo referenced in this section can be found in Appendix A.

## 5.1 Residual Displacements

The results of the level survey in Table 2 indicate the possibility of ground settlement due to the earthquakes in all units. Units 1, 2 and 4 exceed the 5mm/m limit set out in the MBIE guidelines. There are some local areas that exceed the values in Table 2 particularly in unit 4 where the floor was damaged due to the chimney falling inward.

## 5.2 Foundations

The render finish to the ring foundation of unit 4 has spalled off in the corner. Refer photo 9 in Appendix A. The render finish was repaired as part of the repairs completed in January 2015.

## 5.3 Primary Gravity Structure

No damage to the primary gravity structure was observed.

## 5.4 Primary Lateral-Resistance Structure

Cracking was observed in the GIB board linings in all units especially above and below openings for doors and windows. This cracking was severe in unit 4.

## 5.5 Non Structural Elements

Complete collapse of the external chimney on unit 4 resulting in damage to the interior of the unit.

Stepped cracking was observed in the brick veneer of all units. This cracking was moderate in units 1-3 and severe in unit 4.

## 5.6 General Observations

The buildings appeared to have performed reasonably well, as would be expected for buildings of this type, during the earthquakes. They have suffered distributed amounts of minor to moderate damage which is consistent with the heavy nature of the cladding and the age of the buildings.

# 6 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.

As all of the residential units have the same floor plan, the analysis was simplified by conducting the analysis of each unit block once and applying this result to all units on the site.

## 6.1 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.

## 6.2 Quantitative Assessment Methodology

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

Hand calculations were performed to determine seismic forces from the current building codes. These forces were applied globally to the structure and the capacities of the walls were calculated and used to estimate the %NBS.

## 6.3 Limitations and Assumptions in Results

The observed level of damage suffered by the buildings was deemed low enough to not affect their capacity. Therefore the analysis and assessment of the buildings was based on them being in an undamaged state. There may have been damage to the buildings that was unable to be observed that could cause the capacity of the buildings to be reduced; therefore the current capacity of the buildings 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.
- Construction is consistent with normal practise of the era in which constructed.

## 6.4 Assessment

A summary of the structural performance of the buildings is shown in the following table. Note that the values given represent the worst performing elements in the building, where these effectively define the building's capacity. Other elements within the building may have significantly greater capacity when compared with the governing elements.

**Table 3: Summary of Seismic Performance**

| Structural Element/System | Failure Mode, or description of limiting criteria based on displacement capacity of critical element. | % NBS based on calculated capacity. | % NBS after strengthening |
|---|---|---|---|
| Blocks A and B | Bracing capacity of front shear walls in longitudinal direction. | 58% | 100% |

# 7 Summary of Geotechnical Appraisal

CERA indicates that Boyd Cottages Housing Complex is located in the Port Hills 'Green Zone,' as shown in Figure 5. This classification suggests future significant earthquakes will cause negligible land damage due to liquefaction and settlement.


Figure 5 : CERA Technical Categories map

There is no evidence to suggest that further geotechnical investigation is warranted for this site. However, one will be required to determine the shallow bearing capacities of the soils if this information is required for future construction on the site.

# 8 Conclusions

None of the buildings on site are considered to be Earthquake Prone.

The residential units have a capacity of 100% NBS, as limited by the in-plane shear capacity lined shear walls. They are deemed to be a 'low risk' in a design seismic event according to NZSEE guidelines.

# 9 Original Recommendations

The detailed Engineering Evaluation report of August 2013 recommended the following for this complex:

1. A strengthening works scheme be developed to increase the seismic capacity of all buildings to at least 67% NBS, this will need to consider compliance with accessibility and fire requirements.

2. Removal of all remaining chimneys down to at least ceiling level.

3. A geotechnical site investigation be carried out to determine the shallow bearing capacities of the soils if this information is required for future construction on the site.

4. Cosmetic repairs be undertaken.

5. The fall hazard at unit 4 be remediated by removal of loose bricks.

# 10 Remediation and Structural Strengthening

On the 17th of January 2014 "Earthquake Remedial Work to Boyd Cottages" was issued by Opus to the Christchurch City Council to repair the damage sustained in the Canterbury Earthquake sequence. This plan addressed the recommendations in the following way:-

1. A strengthening works scheme was developed with works completed in January 2015 increasing the seismic capacity to 100% NBS.

2. All chimneys were completely removed as part of the repair works completed in January 2015.

3. A geotechnical site investigation has not been carried out to date as there has been no new construction.

4. Cosmetic repairs were completed in January 2015 as part of the repairs works to the complex.

5. The loose brick fall hazard identified at Unit 4 was initially addressed by removal of the bricks in February 2014. The strengthening works included completely replacing brick veneers on all structures with new bricks and veneer ties in accordance with the current building code requirements.

The strengthening included adding plywood linings to increase the seismic capacity. This work has been completed as of January 2015 and increases the capacity of the structures to 100%NBS.

The repair and strengthening works met all recommendations in the Detailed Engineering Evaluation report of August 2013.

It is still assumed that the parts of the building that have not been strengthened were built in accordance with good construction practice of the time.

# 11 Limitations

This report is based on an inspection of the buildings 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 Boyd Cottages housing complex. It is not intended for any other party or purpose.

# 12 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.

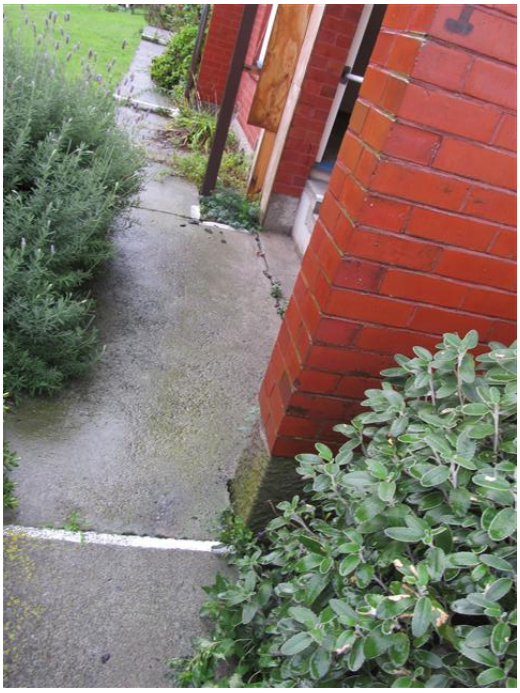
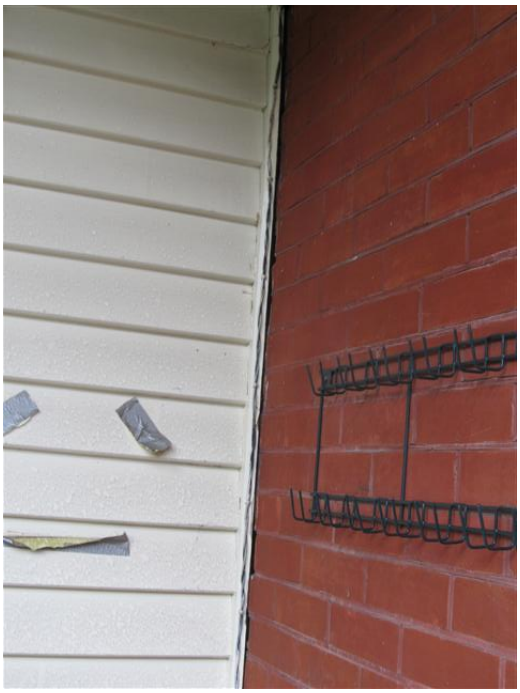
[4] Engineering Advisory Group, *Guidance on Detailed Engineering Evaluation of Non-residential buildings, Part 3 Technical Guidance*, Draft Prepared by the Engineering Advisory Group, 13 December 2011.

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

[6] MBIE (2012), Repairing and rebuilding houses affected by the Canterbury earthquakes, Ministry of Building, Innovation and Employment, December 2012.

# Appendix A – Original Report Photographs

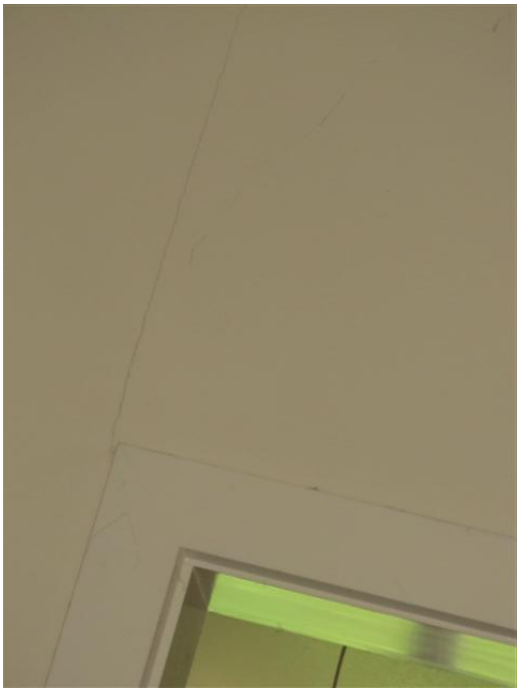
| Boyd Cottages Housing Complex | | |
|---|---|---|
| No. | Item description | Photo |
| Residental Units | | |
| 1 | Typical exterior elevation |  |
| 2 | Unit 1-4 foundations |  |

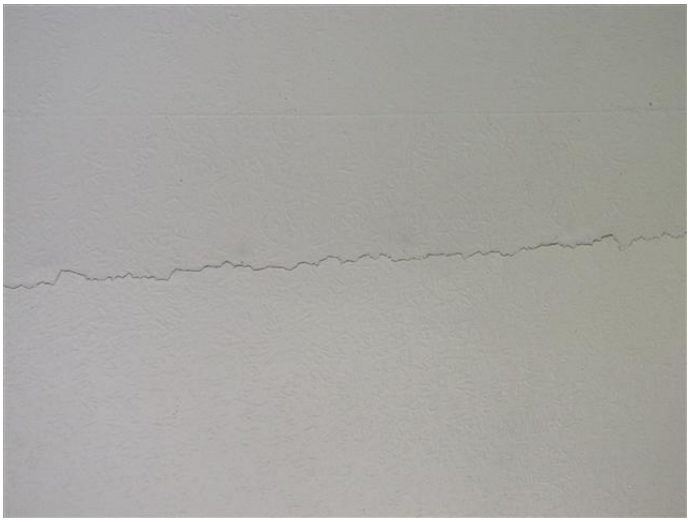
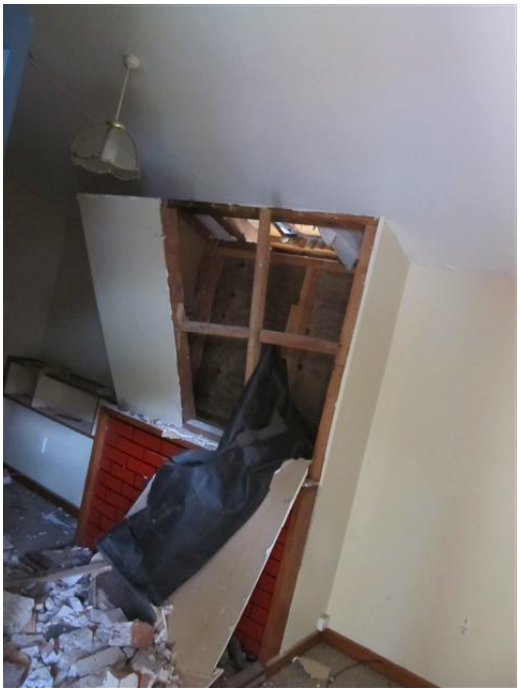
| | | |
|---|---|---|
| 3 | Cracking in walkways. |  |
| 4 | Separation between exterior brick veneer and exterior weatherboard cladding Units 1 and 4 |  |

| | | |
|---|---|---|
| 5 | Cracking to exterior brick veneer Units 1 |  |
| 6 | Typical cracking to exterior brick veneer Units 1-3 |  |
| 7 | Typical cracking to exterior brick veneer mortar joints Units 1-3 |  |

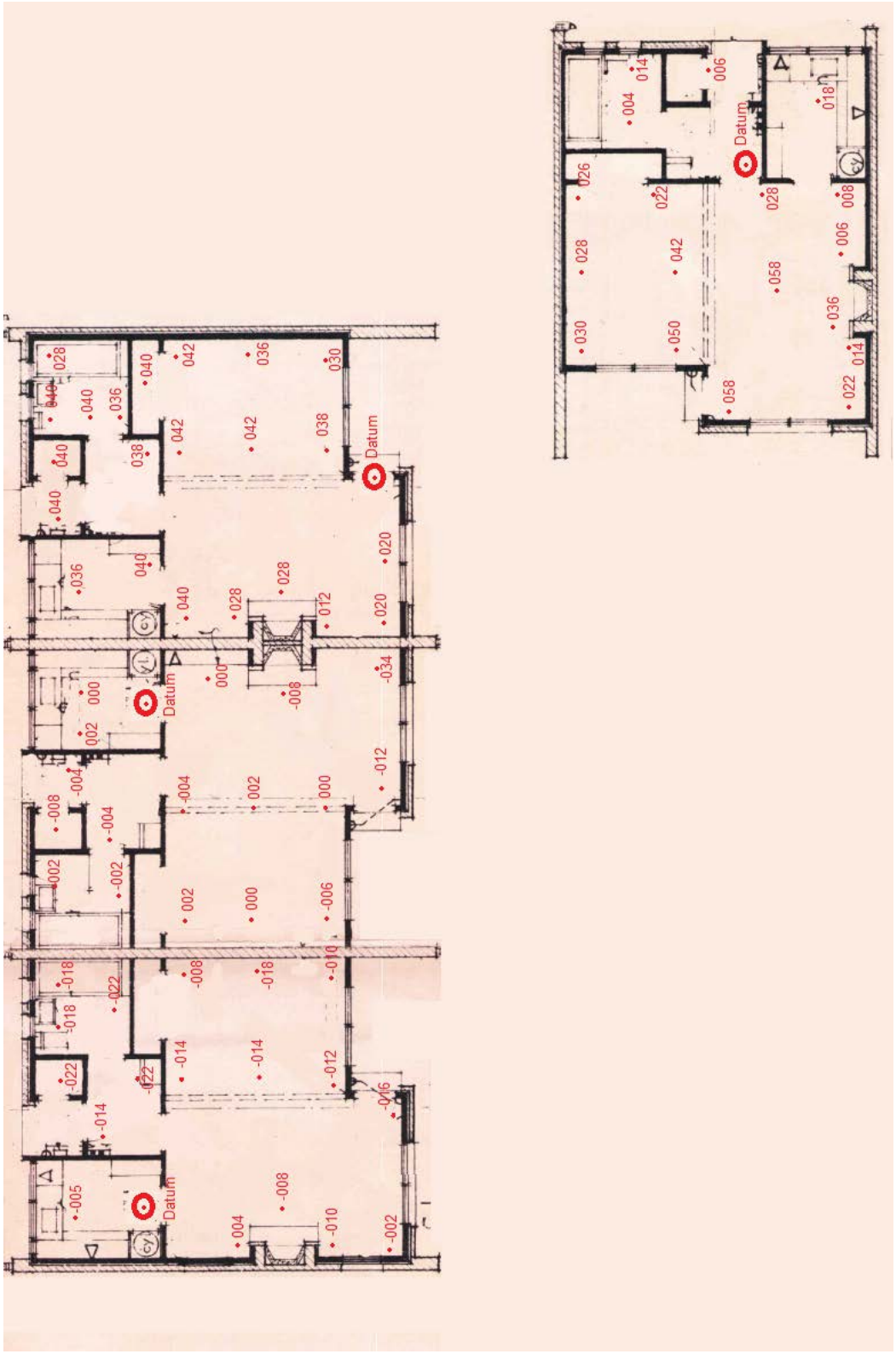
| | | |
|---|---|---|
| 8 | Unit 4 exterior ply bracing (applied after Level 1 structural assessment) |  |
| 9 | Unit 4 shattering of concrete foundation |  |
| 10 | Severe cracking to exterior veneer cladding Unit 4 |  |

| | | |
|---|---|---|
| 11 | Severe cracking to exterior veneer cladding Unit 4 |  |
| 12 | Severe stepped cracking to exterior veneer cladding Unit 4 |  |
| 13 | Units 1-4 typical interior cracking in GIB ceiling and wall lining |  |

| | | |
|---|---|---|
| 14 | Units 1-4 typical interior cracking in GIB ceiling and wall lining |  |
| 15 | Units 1-4 typical interior cracking in GIB wall lining |  |

| | | |
|---|---|---|
| 16 | Units 1-4 typical interior cracking in GIB wall lining |  |
| 17 | Unit 4 Collapsed chimney |  |

# Appendix B – Pre-strengthening Level Survey




*Note the floor layouts in this floor plan are indicative only

# Appendix C - 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 the analyses, a μ of 2 was assumed for the residential units.

## Analysis Procedure

As the units are small and have a number of closely spaced walls in both directions, the fibrous plaster board ceilings are assumed to be capable of transferring loads to all walls. It was therefore assumed that a global method could be used to carry the forces down to ground level in each direction. Bracing capacities were found by assuming a certain kN/m rating for the walls along each line. Due to the relatively unknown nature of the walls, the kN/m rating was taken as 3 kN/m for all timber walls with an aspect ratio (height: length) of less than 2:1. This was scaled down to zero kN/m at an aspect ratio of 3.5:1 as per NZSEE guidelines. %NBS values were then found through the ratio of bracing demand to bracing capacity for all walls in each direction.

## 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 D – Revised CERA DEE Spreadsheet

**Detailed Engineering Evaluation Summary Data** V1.11

**Location**

| | | | | | | |
|---|---|---|---|---|---|---|
| Building Name: | Boyd Cottages | | | | Reviewer: | Mary Ann Halliday |
| | Unit | No: | Street | | CPEng No: | 67073 |
| Building Address: | | 2 | Winchester Street | | Company: | Opus International Consultants |
| Legal Description: | | | | | Company project number: | 6-QC317.00 |
| | | | | | Company phone number: | (03) 363 5400 |
| | Degrees | Min | Sec | | | |
| GPS south: | 43 | 36 | 6.34 | | Date of submission: | Oct-15 |
| GPS east: | 172 | 43 | 22.79 | | Inspection Date: | 21/06/2013 |
| | | | | | Revision: | Final |
| Building Unique Identifier (CCC): | PRO 3517 | | | | Is there a full report with this summary? | Yes |

**Site**

| | | | |
|---|---|---|---|
| Site slope: | slope < 1in 5 | Max retaining height (m): | |
| Soil type: | gravel | Soil Profile (if available): | |
| Site Class (to NZS1170.5): | D | | |
| Proximity to waterway (m, if <100m): | | If Ground improvement on site, describe: | |
| Proximity to clifftop (m, if < 100m): | | | |
| Proximity to cliff base (m,if <100m): | | Approx site elevation (m): | |

**Building**

| | | | | |
|---|---|---|---|---|
| No. of storeys above ground: | 1 | single storey = 1 | Ground floor elevation (Absolute) (m): | |
| Ground floor split? | no | | Ground floor elevation above ground (m): | |
| Storeys below ground | 0 | | | |
| Foundation type: | isolated pads, no tie beams | | if Foundation type is other, describe: | |
| Building height (m): | 3.50 | height from ground to level of uppermost seismic mass (for IEP only) (m): | | |
| Floor footprint area (approx): | 190 | | | |
| Age of Building (years): | 49 | | Date of design: | 1935-1965 |
| Strengthening present? | no | | If so, when (year)? | |
| | | | And what load level (%g)? | |
| Use (ground floor): | multi-unit residential | | Brief strengthening description: | |
| Use (upper floors): | | | | |
| Use notes (if required): | | | | |
| Importance level (to NZS1170.5): | IL2 | | | |

Gravity Structure

| | | | |
|---|---|---|---|
| Gravity System: | load bearing walls | | |
| Roof: | timber truss | truss depth, purlin type and cladding | |
| Floors: | timber | joist depth and spacing (mm) | |
| Beams: | none | overall depth x width (mm x mm) | |
| Columns: | load bearing walls | typical dimensions (mm x mm) | |
| Walls: | partially filled concrete masonry | thickness (mm) | |

Lateral load resisting structure

| | | | | |
|---|---|---|---|---|
| Lateral system along: | lightweight timber framed walls | **Note: Define along and across in detailed report!** | note typical wall length (m) | |
| Ductility assumed, μ: | 2.00 | | | |
| Period along: | 0.10 | 0.00 | estimate or calculation? | estimated |
| Total deflection (ULS) (mm): | | | estimate or calculation? | |
| maximum interstorey deflection (ULS) (mm): | | | estimate or calculation? | |
| Lateral system across: | partially filled CMU | | note total length of wall at ground (m): | |
| Ductility assumed, μ: | 1.25 | | wall thickness (m): | |
| Period across: | 0.10 | ##### enter height above at H31 | estimate or calculation? | estimated |
| Total deflection (ULS) (mm): | | | estimate or calculation? | |
| maximum interstorey deflection (ULS) (mm): | | | estimate or calculation? | |

Separations:

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

Non-structural elements

| | | | |
|---|---|---|---|
| Stairs: | | | |
| Wall cladding: | brick or tile | describe (note cavity if exists) | |
| Roof Cladding: | Metal | describe | |
| Glazing: | timber frames | | |
| Ceilings: | fibrous plaster, fixed | | |
| Services(list): | | | |

**Available documentation**

| | | | |
|---|---|---|---|
| | | | Paul Pascoe & Linton |
| Architectural | partial | original designer name/date | Architects/31/8/1964 |
| 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: | | notes (if applicable): | |
| Differential settlement: | none observed | notes (if applicable): | |
| Liquefaction: | none apparent | notes (if applicable): | |
| Lateral Spread: | none apparent | notes (if applicable): | |
| Differential lateral spread: | none apparent | notes (if applicable): | |
| Ground cracks: | none apparent | notes (if applicable): | |
| Damage to area: | none apparent | notes (if applicable): | |

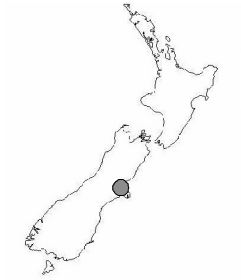
Building:

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

**Recommendations**

| | | | | |
|---|---|---|---|---|
| Level of repair/strengthening required: | none | | Describe: | |
| Building Consent required: | no | | Describe: | |
| Interim occupancy recommendations: | full occupancy | | Describe: | |
| Along Assessed %NBS before: | 100% | ##### %NBS from IEP below | If IEP not used, please detail assessment | Equivalent Static |
| Assessed %NBS after: | 100% | | methodology: | |
| Across Assessed %NBS before: | 100% | ##### %NBS from IEP below | | |
| Assessed %NBS after: | 100% | | | |

# Appendix E – Strengthening Scheme



PROJECT

# EARTHQUAKE REMEDIAL WORK TO BOYD COTTAGES

ADDRESS

## 2-4 Winchester Street, LYTTELTON

### Drawing List

| Sheet No | Sheet Name | Revision |
|---|---|---|
| A0 | Coversheet | |
| A00 | Specification | |
| A001 | Site and Location Plans | |
| A100 | Existing & Demolition Plans | |
| A101 | Demolition & New Plans | |
| A102 | New Bracing Plan | |
| A103 | New Roof Plan | |
| A200 | New Elevations | |
| A400 | Construction Details | |
| A401 | Construction Details | |

**Compliance, Approvals and Workmanship**
All Contract works must comply with the current NZ Building Act and Regulations and is to be carried out in accordance with the relevant Codes of Practice.
All necessary approvals are to be obtained before work commences.
Give all notices and arrange for the inspection of the works and materials:
- The Engineer shall be notified for inspections as specified on any Producer Statement required.
- The Contractor shall make himself familiar with all requirements of the Building Consent including any special conditions and be responsible for the arranging of all inspections required under the terms and conditions of the Building Consent.
All work is to be carried out in accordance with the Health and Safety in Employment Act 1992 and OSH requirements. All workers on site are to display valid ID tags and 'Site Safe' passports.
The site is a 'smoke free site'. (All smokers are to be off site).
The Contractor must produce and maintain a SSSP and insure they protect all subcontractors, workers and the public at all times.
All workmanship and materials shall be of the highest quality and shall be carried out in accordance with best trade practice and conforming with the drawings.
The Contractor is fully responsible to obtain all relevant local authority sign-off documents including Code of Compliance, Producer Statements, Product Warranties, Guarantees and As Built documents.

**Construction**
The Contractor is to -
- ensure all necessary insurances are in place throughout the duration of the Contract Works
- be responsible to ensure the Site is fully secure
- protect all undamaged property. ie. tiles, bathroom joinery, doors, etc.
- allow to take curtains down, store and reinstate.
- allow to protect all floor coverings.
- provide protection to all undamaged and re-useable items including whiteware, glass etc.
- provide for temporary propping as required.
- regularly dispose of all rubbish and at completion provide a full builders clean
- undertake regular Health and Safety and quality checks.
- full engineers check and sign off for all design details as per information on scope.

**General Notes**

- Do not scale off these drawings.
- Contractor is to visit site to ascertain the full extent of the required demolition and proposed works, including existing services.
- Contractor is to determine extent of demolition and construction works sequence on site in association with Client representative.
- All works shall be read in conjunction with all other construction drawings, specifications, schedule of finishes
- The Contractor must take all precautions to protect all property, including those adjoining, and shall make good, at own expense, any damage caused by and during his operations, to the satisfaction of the Local Authority or the owners, as the case may be. The Contractor shall be responsible for the weathertightness of the property and shall take all necessary steps to achieve this.
- All heavy machinery noise to be outside of normal working hours unless otherwise specified.
- Contractor shall be responsible for coordinating all new services penetrations on site.
- Existing services demolition to be carried out by mechanical services sub-contractor. Disconnect and remove redundant cables, allow to re-route electrical services to remaining equipment.
- Allow to seal all redundant services penetrations.

**TIMBER TREATMENTS TO COMPLY WITH NZS 3602:2003**

| Timber Components | Species | Grade | Treatment (to NZS 3640) | Durability |
|---|---|---|---|---|
| Roof framing | Radiata Pine | SG 8 | H1.2 | 50 years |
| Wall framing | Radiata Pine | SG 8 | H1.2 | 50 years |
| Wall framing (wing walls) | Radiata Pine | SG 8 | H3.1 | 50 years |
| Sub floor framing | Radiata Pine | SG 8 | H1.2 | 50 years |
| Deck Framing | Radiata Pine | SG 8 | H3.2 | 50 years |
| Piles | Radiata Pine | NZS 3605 | H5 | 50 years |

| Revision | Amendment | Approved | Revision Date |
|---|---|---|---|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| AS | - | SM | 17/01 14 |

Project No.: 6-QC317.03
Scale: 1 : 100

Project
Christchurch City Council
2-4 Winchester Street, Lyttelton
Earthquake Remedial Work to Boyd Cottages

Title
Coversheet

**CONSTRUCTION**

| Drawing No. | Sheet No. | Revision |
|---|---|---|
| 6/1366/360/7501 | A0 | R0 |

## SPECIFICATION

### PRELIMINARY AND GENERAL
All work shall comply with the New Zealand Building Act, the New Zealand Building Code and Approved Documents, the Building Consent, NZS 3602: 2003 and NZS 3604 2011 (including amendments 1 and 2). Comply with the Health and Safety in Employment Act, 1992 and regulations. Carry out all work in accordance with documents. Deviations shall not be permitted without permission from the Architect. Materials shall be new, unless specifically stated otherwise, and shall be of proper quality for their respective uses. Carry out all work in strict accordance with the manufacturers' instructions and specifications. Employ only qualified trades people or apprentices under close supervision. Ensure all work is complete and leave the work area clean and tidy. Remove all rubbish and redundant fixtures and fittings from the site.
Contractor is to provide a statement of completion.

### NEW STRUCTURE TO ALL AREAS
For future designs and details of all new structure, and modifications to existing foundation structures (floor slabs, ring beams, piles, blockwork, brick veneer and floor joists etc), roof structures (trusses, lintels, chimney, rafters, bracing etc), wall components and amendments to be submitted with bracing calculations, refer to Structural Engineer.

### SITE PREPARATION AND SETTING OUT
Before construction the site is to be cleared of rubbish, noxious matter and organic matter. Contractor is to advise on materials deemed hazardous. The contractor is to confirm all dimensions on site prior to any constructions works and / or manufacture if building elements.

### PROVIDE SEDIMENT AND SILT RUN OFF PROTECTION
Where required provide appropriate measures to prevent or minimise sediment generation and silt run off. Comply with territorial and other authority requirements relating to carrying out earthworks.

### CARPENTRY
All timbers and timberwork shall comply with the NZ Building Code Compliance Documents and Acceptable Solutions in particular B1/AS1 -Structure; general, B2/AS1- durability, D1/AS1- Access Routes, E1/AS1-Surface water,E2/AS1- External Moisture,E3/AS1- Internal Moisture, F2/AS1- Hazardous Building Materials, F5/AS1- Construction and demolition hazards,F7/AS1- Warning Systems, H1/AS1- Energy and Efficiency, NZS 3602:2003 "Timber and Wood based Products for Use in Building

### TIMBER TREATMENT
For any new installed timber members – refer to attached timber treatment requirements guide July 2011 (latest at time of documentation), issued by the Department of Building and Housing. Its is the contractors responsibility to ensure copies of trade literature used are the latest and most up to date versions. Also, refer to drawings

### FIXINGS
All fixings and fastenings to be used as per NZS:3604 Section 4:Durability. Specifically Tables 4.1, 4.2 and 4.3 dependant on the Exposure zone for this property, as stated on the Site Plan.

### INSULATION
All new insulation to meet NZBC requirements

### STRUCTURAL WORK
Read in conjunction with approved structural documents. At completion of work obtain relevant Producer Statements.

### ROOF CLADDING
All new roof cladding materials and installation shall comply with the NZBC, Local Authority Regulations, the NZ Roofing Manufacturers Association and the roof cladding manufacturers recommendations.

### WALL CLADDING
All new wall cladding materials and installation shall comply with the NZBC, Local Authority Regulations, and the wall cladding manufacturers recommendations. Provide additional support structure where required for fixing new cladding. Allow for new fire retardant building paper where required.

### FLASHINGS
All flashings to walls, eaves and roof connection points etc are to be installed with minimum lappings as specified on attached drawings / details. Flashings to windows to be in accordance with Approved Documentation of the New Zealand Building Code Clause E2. External moisture and in general accordance with the WANZ WIS window installation system.

### PAINTER
Allow to paint and / or seal all internal and external walls and fittings as indicated on drawings. Sub contractor to ensure all works is in accordance with client approved Paint Systems specifications.

### STORMWATER, FASCIAS, GUTTERING AND RAINWATER GOODS
All new fascias and rainwater goods are to match. Storm-water, rain water heads and down pipes discharge to new underground drainage run, connecting to existing system. Storm-water for remainder of roof areas is to discharge via new down-pipes into new underground drainage and intern into existing storm-water mainline waste system.

### PLUMBING AND DRAINAGE
All plumbing work to be in accordance with the New Zealand Building Code and Approved Documents in particular B2/AS1,VM1, E1/AS1,VM1, G12/AS1,VM1, G13/AS1,AS2, VM1, VM2 and any Local Authority by-laws.
Give all notices and arrange for the inspection of the works and materials.
The work is to be carried out by Licensed and Registered Plumbers using adequate and proper equipment and methods in accordance with best trade practice.
Allow to disconnect and reconnect fittings as necessary for earthquake repairs.
Extend existing services and install new fittings as indicated on drawings. The contractor shall supply all associated piping and miscellaneous plumbing fitting to complete installation.

### ELECTRICAL
The Electrical work shall be carried out in accordance with the New Zealand Building Code and Approved Documents G9/AS1,VM1and the Electrical Safety Regulations 1993. All wiring shall be concealed.
The Electrician shall obtain all consents, arrange all inspections and issue a compliance certificate at the completion of the contract.
Allow to disconnect and reconnect fittings as necessary for earthquake repairs and allow to upgrade if/as necessary to complete the above and achieve compliance with the Building Code. Co-ordinate with the Builder to reinstate power points, light fittings etc in relined walls and ceilings.
The Builder shall provide all dwanging required for fixing lights, switches, and plugs. etc. Co-operate with the Builder for positions of these dwangs.

### SERVICES IN GENERAL
All sub contractors (plumbers, electricians etc) are to provide the main contractor a full set of 'as built' drawings on completion of works. Main contractor to provide all necessary documentation to obtain the Code of Compliance Certificate from the local authority and make copied available to the client.

### SMOKE ALARMS
Smoke Alarms are to be installed in accordance with New Zealand Building Code Acceptable Solution F7/AS1 Section 3:
The Smoke alarms **may** be battery powered and are not required to be interconnected. They shall provide a hush facility button which silences the alarm for 60 seconds minimum (this allows the cause of a nuisance alarm to be cleared without removing the battery to silence the smoke alarm), and shall have an alarm test facility readily accessible by building occupant.
Smoke alarms shall be listed or approved by a recognized national Authority as complying with at least one of ; UL 217, CAN/ULC S531, AS 3786. BS 5446: Part1.
Location of smoke alarms shall be: on the escape routes on all levels within the unit. On levels containing sleeping spaces, the smoke alarms shall be located either: in every sleeping space or within 3 metres of every sleeping space door. In this case, the smoke alarms must be audible to sleeping occupants on the other side of closed doors.
Additional smoke alarms must located in each space that must be passed through to get to a safe place (outside).
Installation of smoke alarms shall be: on or near the ceiling in accordance with AS 1670.6 and the manufacturers instructions.

### ASBESTOS
Ensure any existing materials that may be Asbestos are handled in accordance to the NZ Guidelines for the management and Removal of Asbestos, 3rd Edition by the New Zealand Demolition and Asbestos Association (NZDAA) for the Ministry of Business, Innovation and Employment.

### GENERAL
All the above works are to be carried out to NZS 3604: 2011 (including amendments part 1 and 2). All works are to meet the requirements of the Local Authority Building Inspector. All works are to be in strict accordance with designs and details of a suitably qualified Structural Engineer.

### BUILDING CONSENT APPLICATION
The contractor is to ensure that any / all works on site are carried out in strict accordance with NZS 3604: [2011] and all relevant sections of the Approved New Zealand Building Codes. All works relating to the installation of the cladding system is to be carried out in strict accordance with the manufacturers' details and specifications. Other than the proposed works indicated on the drawings – for the purposes of this application it is assumed that all aspects of the existing property has been built to the approved building consent documentation approved by the Local Authority. The contractor is to advise the client representative and local authority building inspector immediately of any areas deemed to be of sub standard quality / workmanship or of any aspects of work which is not in accordance with the approved documentation. This application and all associated documentation has been produced for the sole purpose of obtaining a Building Consent Approval notice only and is not in any form what so ever intended as documentation for building works on site.

| Revision | Amendment | Approved | Revision Date |
|---|---|---|---|

NOT TO SCALE


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| AS | . | SM | 17/01 14 |

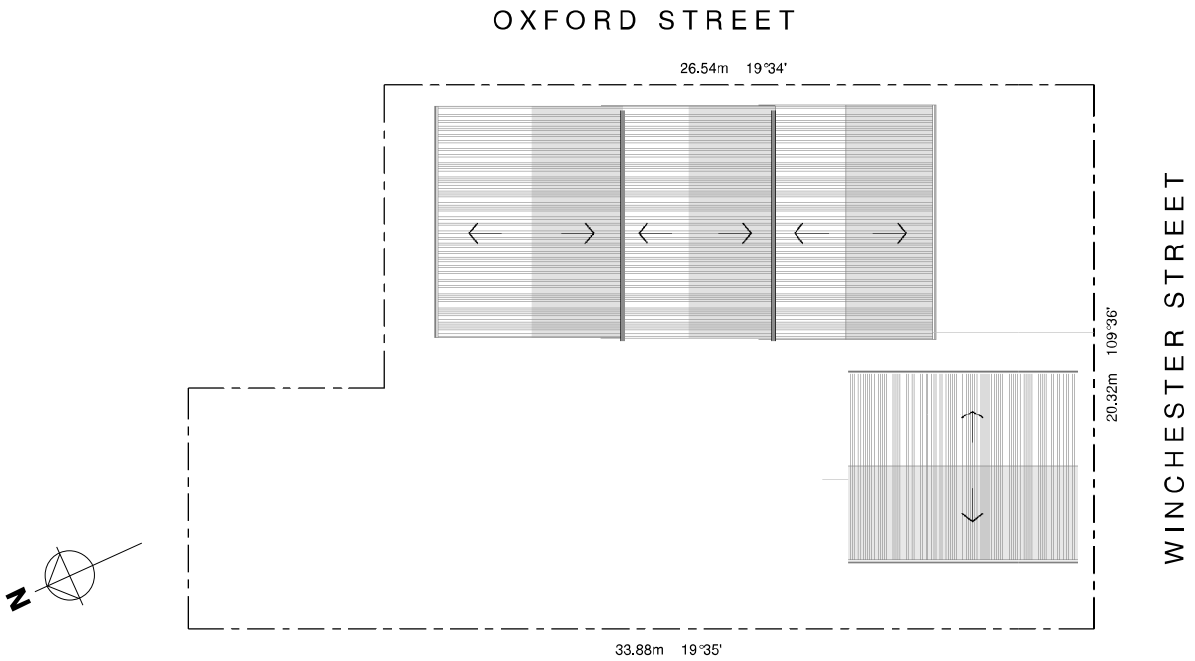
Project No.: 6-QC317.03 Scale: 1 : 100

Project
Christchurch City Council
2-4 Winchester Street, Lyttelton
Earthquake Remedial Work to Boyd Cottages

Title
Specification

**CONSTRUCTION**

Drawing No.: 6/1366/360/7501 Sheet No.: A00 Revision: R0




1 Site Plan
1 : 200

| Revision | Amendment | Approved | Revision Date |
|---|---|---|---|

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Project
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2-4 Winchester Street, Lyttelton
Earthquake Remedial Work to Boyd Cottages

Title
Site and Location Plans

CONSTRUCTION

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|---|---|---|
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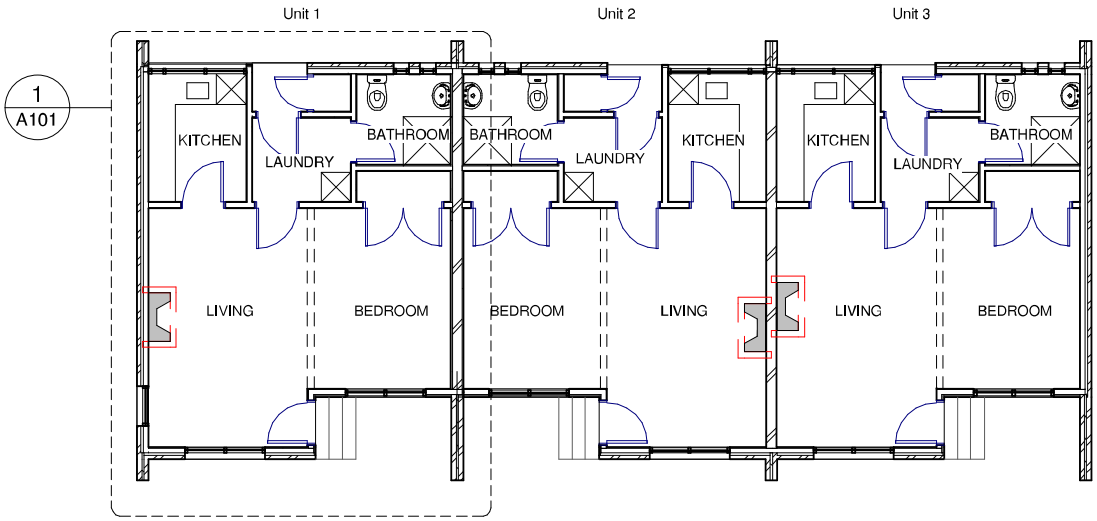
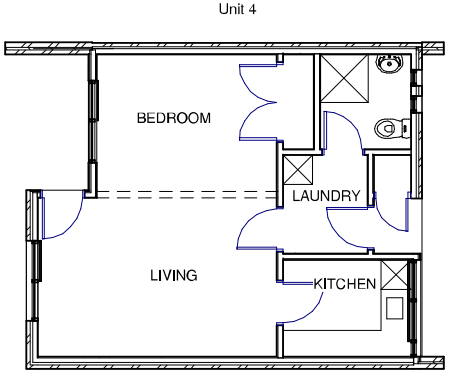



1 Existing & Demolition Plan - Unit 1-4

1 : 100




| Revision | Amendment | Approved | Revision Date |
|---|---|---|---|

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Project No.: 6-QC317.03

Scale: 1 : 100

Project:
Christchurch City Council
2-4 Winchester Street, Lyttelton
Earthquake Remedial Work to Boyd Cottages

Title:
Existing & Demolition Plans

CONSTRUCTION

| Drawing No. | Sheet No. | Revision |
|---|---|---|
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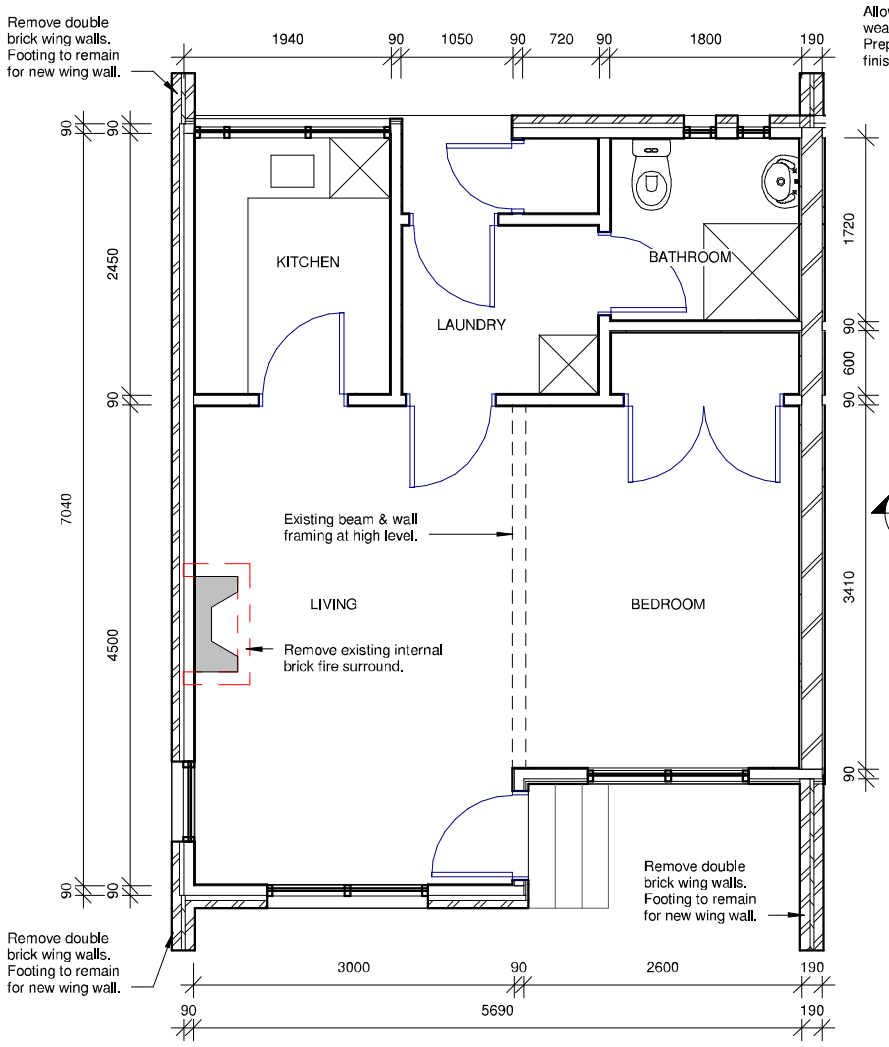
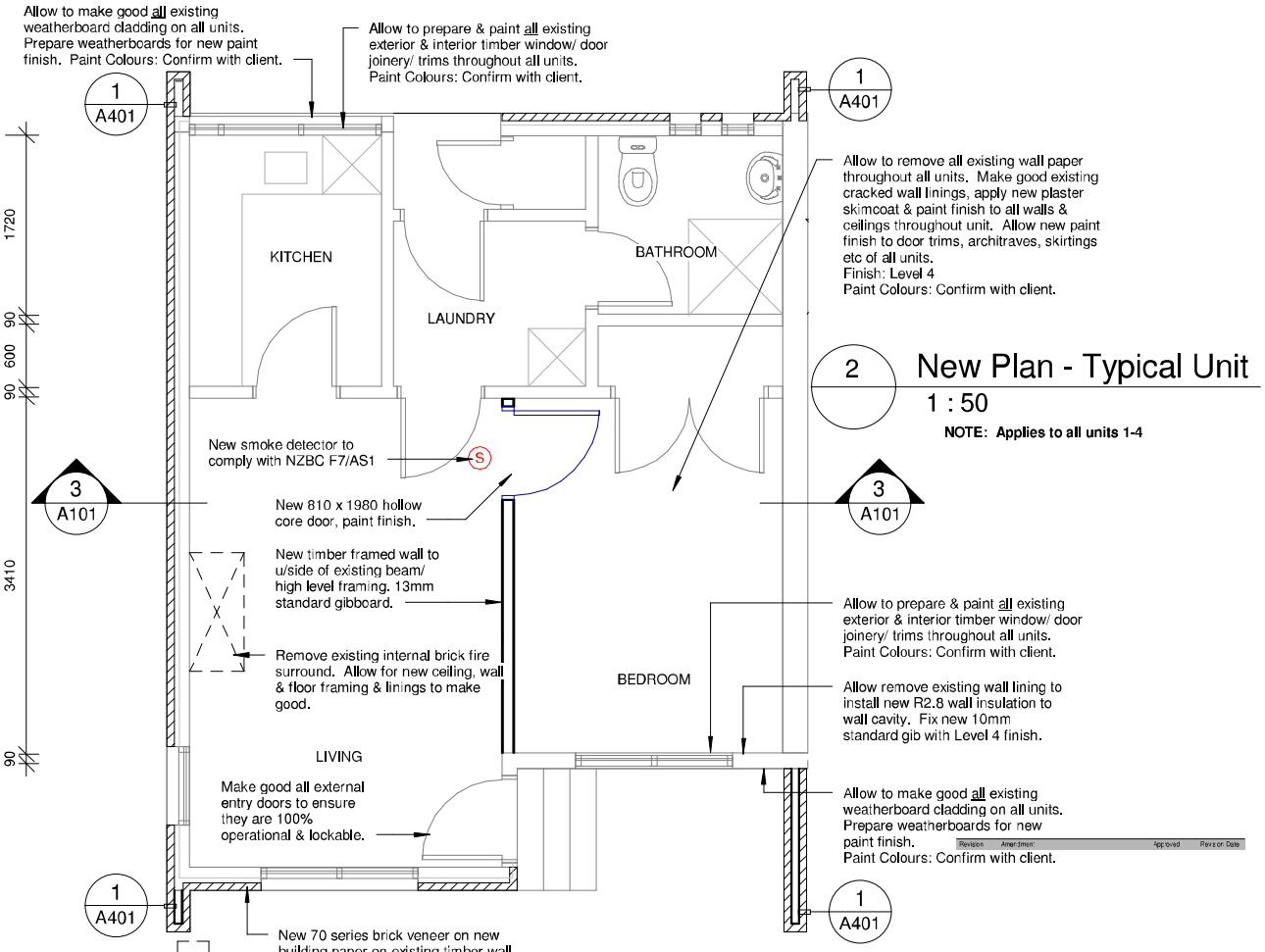



1 / A100 — Existing & Demolition Plan - Typical Unit

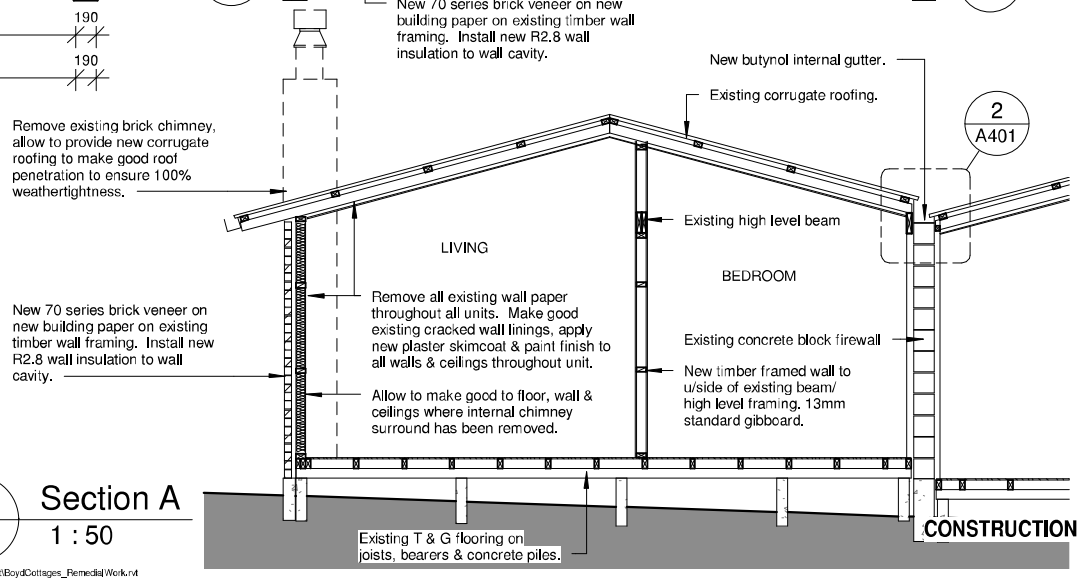
1 : 50




2 — New Plan - Typical Unit

1 : 50

**NOTE: Applies to all units 1-4**




3 / A101 — Section A

1 : 50

**General Notes:**

Notes are not in construction sequence. Contractors to determine construction sequence in association with client & architect.

Read in conjunction with all other construction drawings, specification.

Contractor to visit site during the pricing period to help ascertain the full extent of the demolition & new building works.

Protect all floor coverings during construction contract works.

**Demolition Notes:**

1) Wall & Ceiling Linings:
Allow to remove all existing wall paper throughout all units. Make good existing cracked wall linings, apply new plaster skimcoat & paint finish to all walls & ceilings. Walls to have Level 4 finish.

2) Exterior Cladding:
Remove all existing brick veneer cladding & sills to all units on site.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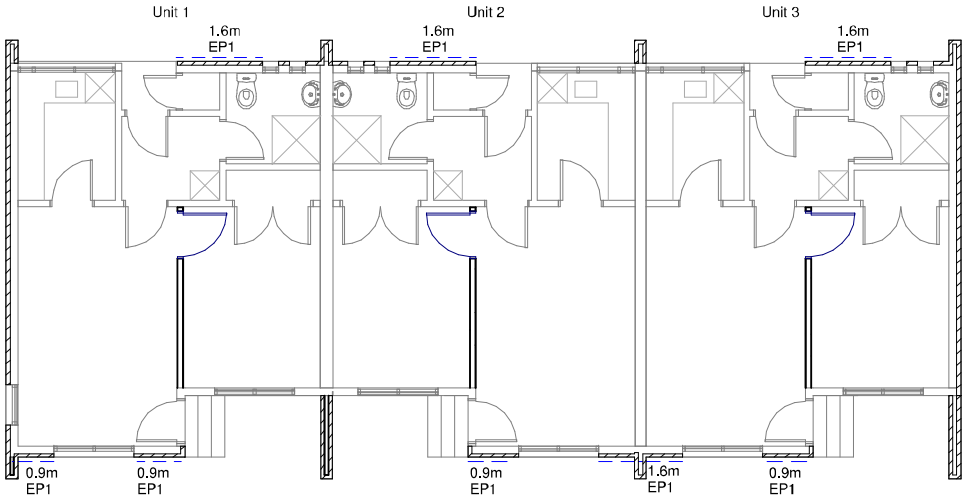
Project No.: 6-QC317.03 Scale: As indicated

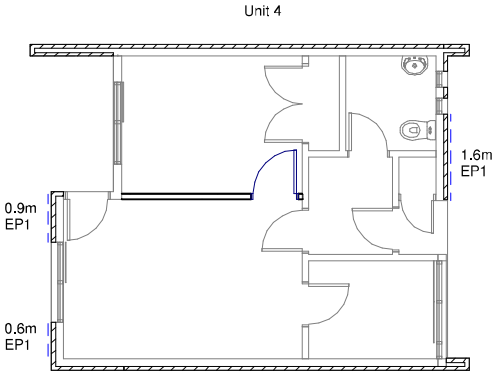
Project: Christchurch City Council
2-4 Winchester Street, Lyttelton
Earthquake Remedial Work to Boyd Cottages

Title: Demolition & New Plans

| Drawing No. | Sheet No. | Revision |
|---|---|---|
| 6/1366/360/7501 | A101 | R0 |


Original sheet size A3 (420x297) Plot date: 28/07/2014 10:10:39 a.m. Y:\6-QUAKE.01\CCC_PM_CURRENT SH 2013\6-QC317.03 - Boyd Cottages Remedial works\Revit\BoydCottages_Remedial Work.rvt




**Bracing Notes:**

**EP1** = New 7mm Ecoply to exterior wall framing face to 2.4m height. Fix new GIB Handibrace hold down @ bottom of each panel end.

Nails @ 150 crs around perimeter, 300 crs intermediate.

Nails 50 x 2.8mm galv.

1 New Bracing Plan - Unit 1-4

1 : 100

| Revision | Amendment | Approved | Revision Date |
|---|---|---|---|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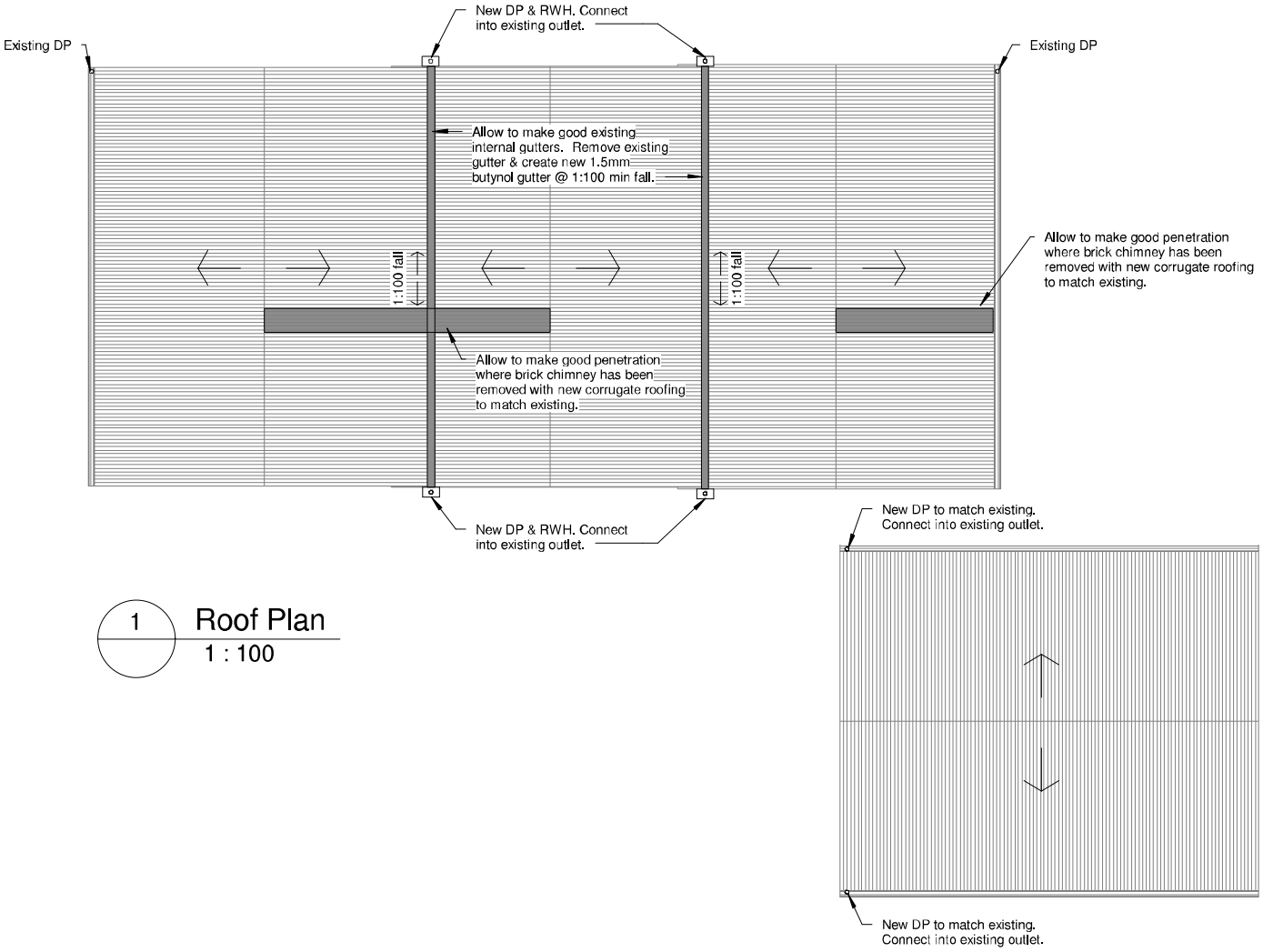
Project No.: 6-QC317.03 Scale: 1 : 100

Project:
Christchurch City Council
2-4 Winchester Street, Lyttelton
Earthquake Remedial Work to Boyd Cottages

Title:
New Bracing Plan

CONSTRUCTION

| Drawing No. | Sheet No. | Revision |
|---|---|---|
| 6/1366/360/7501 | A102 | R0 |




1 Roof Plan
1 : 100

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|---|---|---|---|


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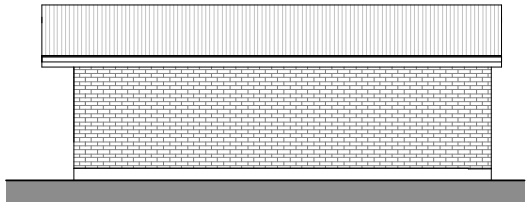
Project No.: 6-QC317.03
Scale: 1 : 100

Project
Christchurch City Council
2-4 Winchester Street, Lyttelton
Earthquake Remedial Work to Boyd Cottages

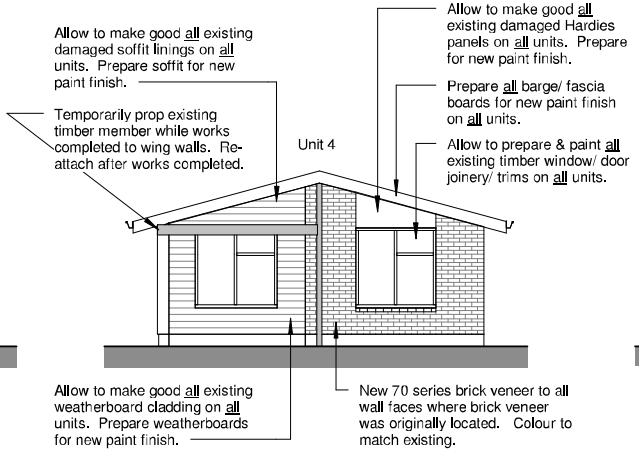
Title
New Roof Plan

CONSTRUCTION

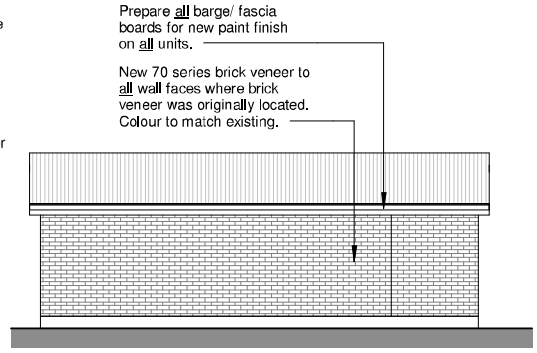
| Drawing No. | Sheet No. | Revision |
|---|---|---|
| 6/1366/360/7501 | A103 | R0 |



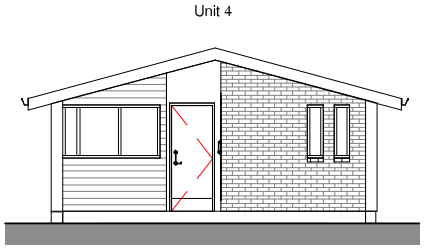
1 New West Elevation (Unit 4)
1 : 100



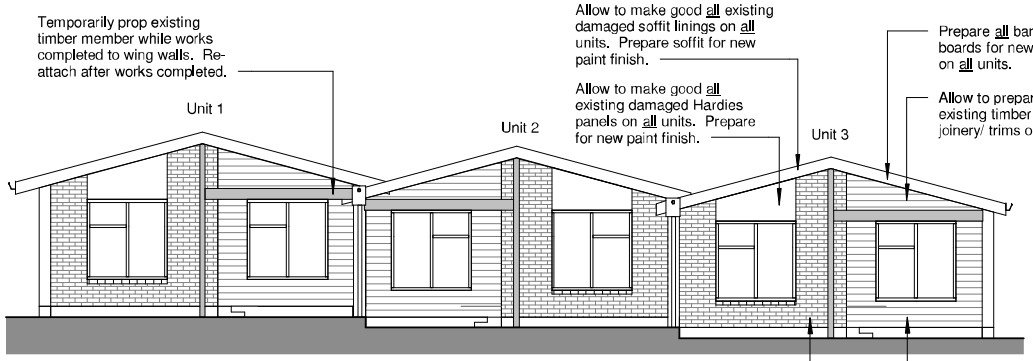

2 New North Elevation
1 : 100



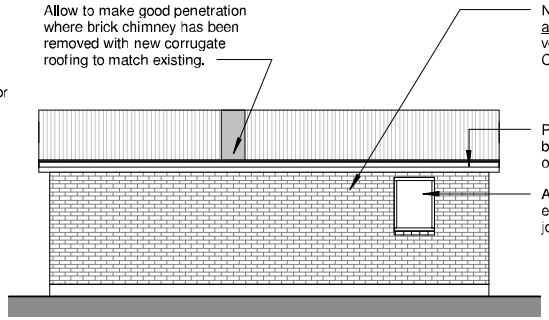

3 New East Elevation
1 : 100



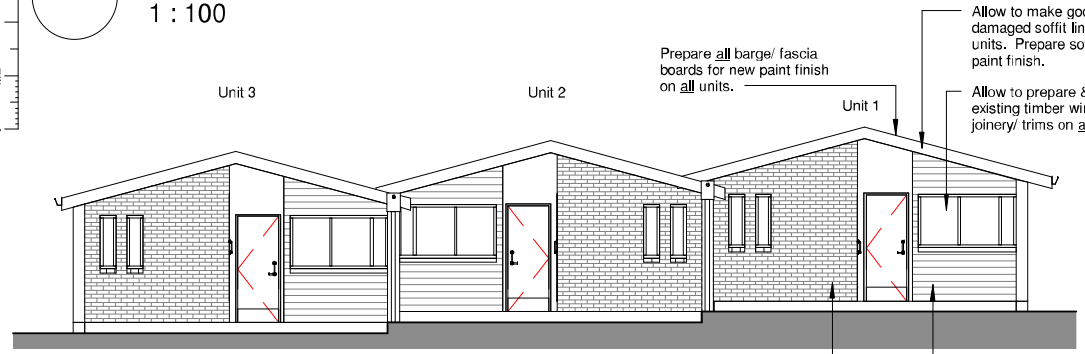

4 New South Elevation
1 : 100



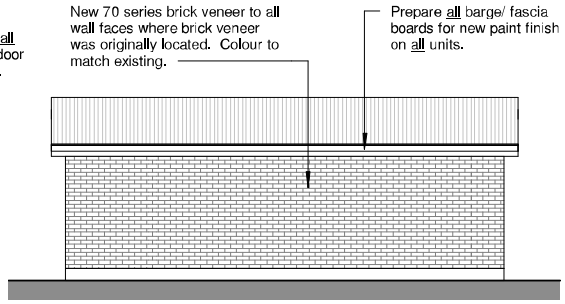

5 New West Elevation (Unit 1-3)
1 : 100




6 New North Elevation (Unit 1)
1 : 100




7 New East Elevation (Unit 1-3)
1 : 100




8 New South Elevation (Unit 3)
1 : 100

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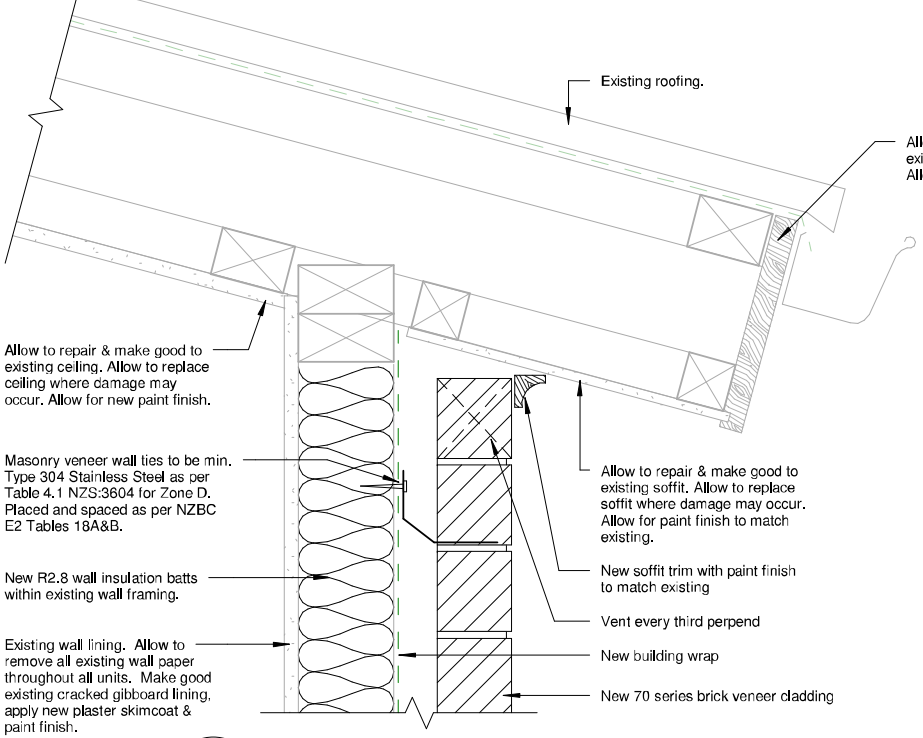
Project No.: 6-QC317.03
Scale: 1 : 100

Project:
Christchurch City Council
2-4 Winchester Street, Lyttelton
Earthquake Remedial Work to Boyd Cottages

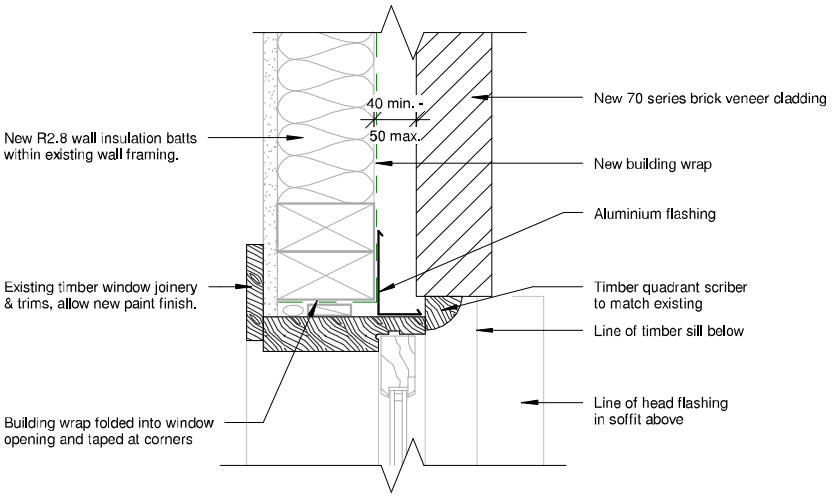
Title:
New Elevations

| Drawing No. | Sheet No. | Revision |
|---|---|---|
| 6/1366/360/7501 | A200 | R0 |

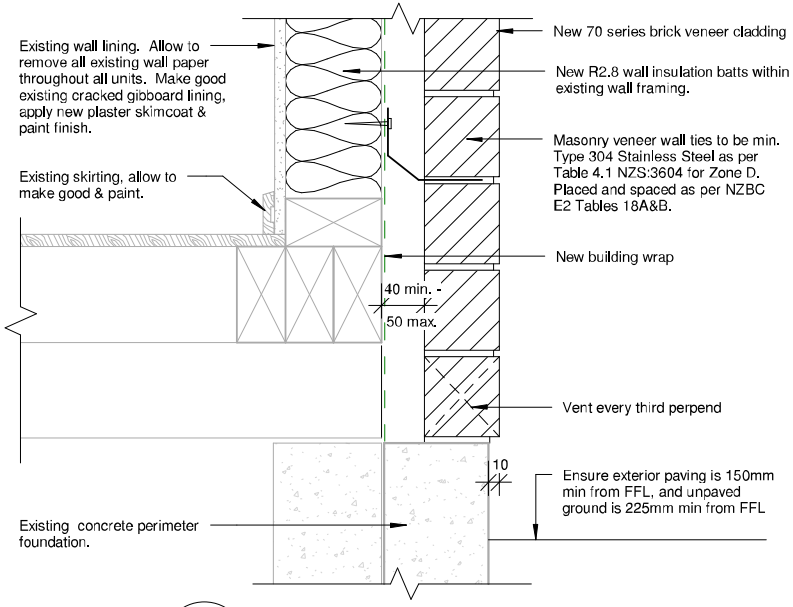

Original sheet size A3 (420x297) Plot date: 28/07/2014 10:10:40 a.m. Y:\6-QUAKE.01\CCC_PM_CURRENT SH 2013\6-QC317.03 - Boyd Cottages Remedial works\Revit\BoydCottages_Remedial Work.rvt



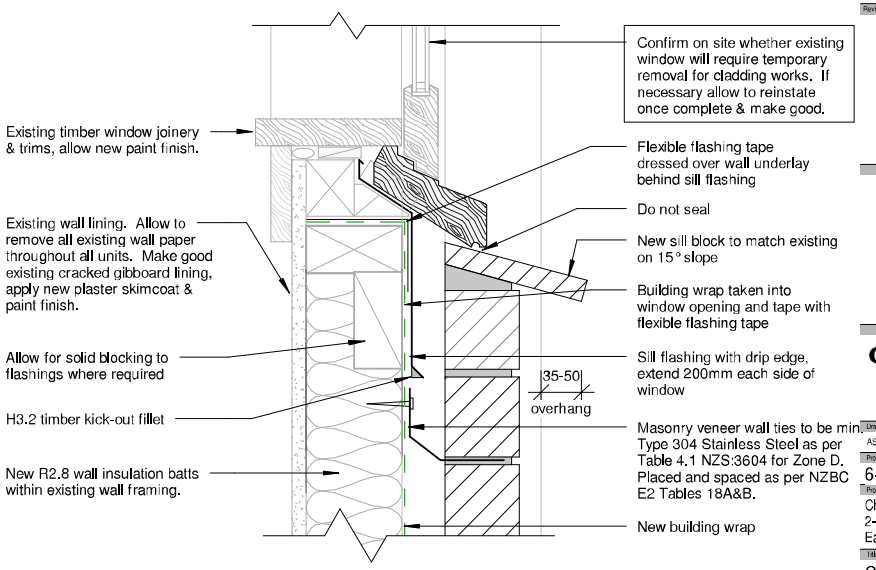

## 1 Brick Cladding to Soffit
1 : 5




## 4 Brickwork - Timber window jamb
1 : 5




## 2 Brick Cladding Base to Ring Beam
1 : 5




## 3 Brickwork - Timber framed window sill
1 : 5

**CONSTRUCTION**

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|---|---|---|---|
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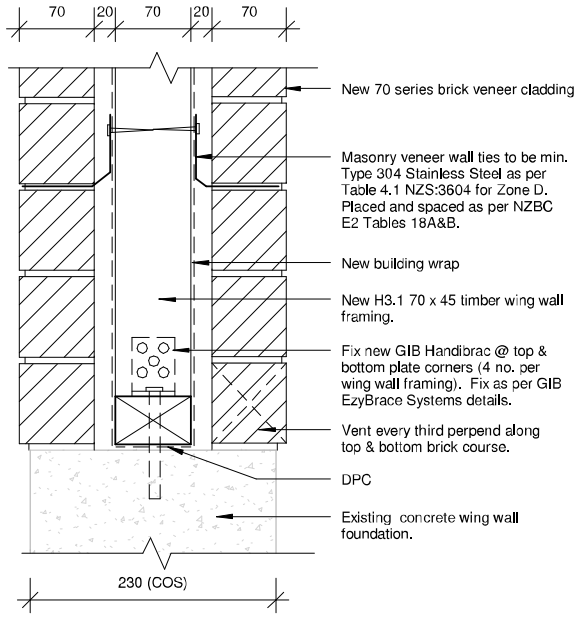
Project No.: 6-QC317.03 Scale: 1 : 5

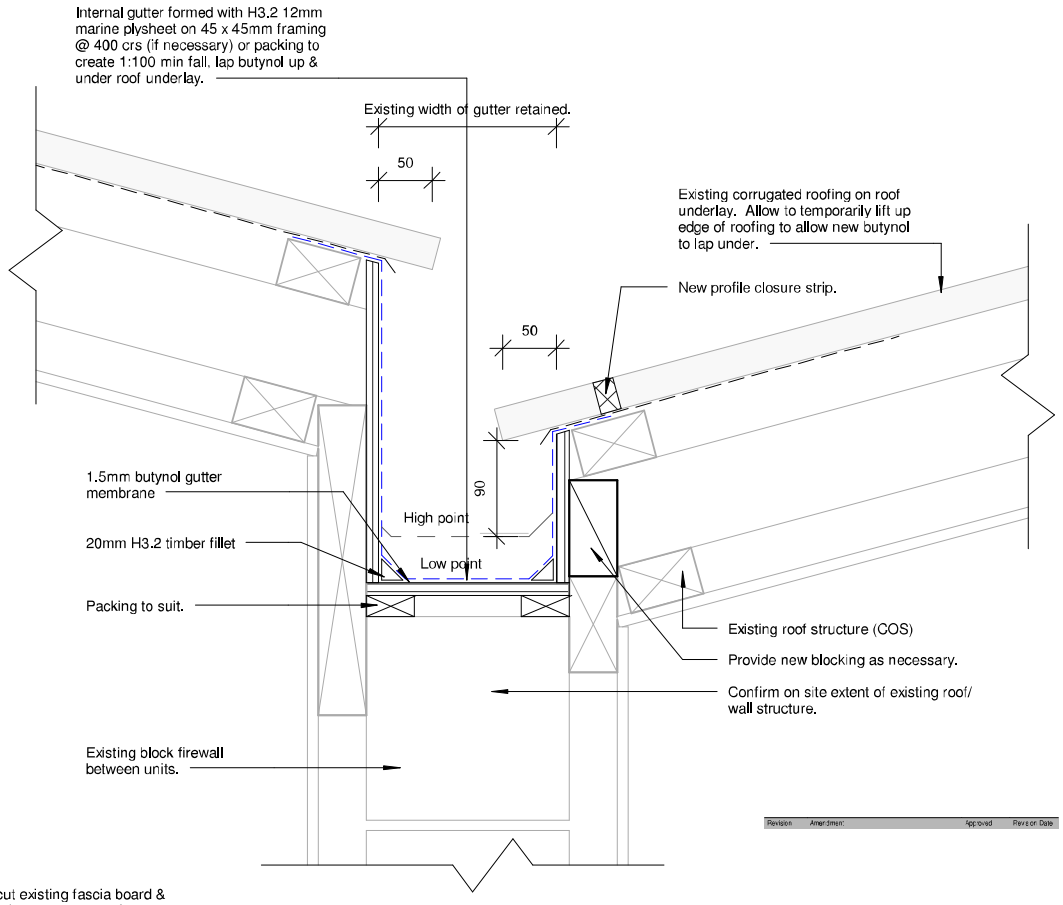
Project
Christchurch City Council
2-4 Winchester Street, Lyttelton
Earthquake Remedial Work to Boyd Cottages

Title
Construction Details

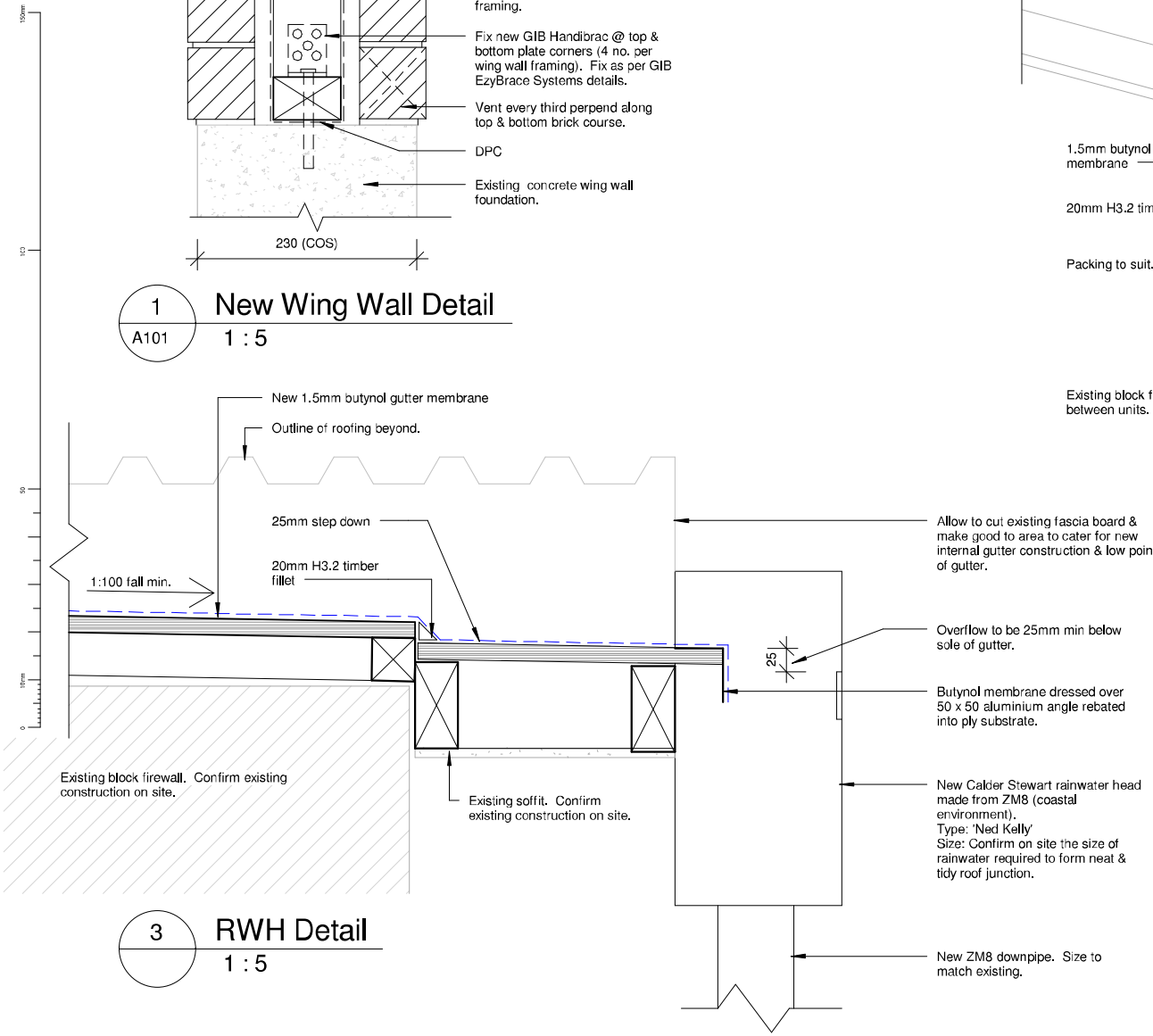
| Drawing No. | Sheet No. | Revision |
|---|---|---|
| 6/1366/360/7501 | A400 | R0 |




1 / A101 **New Wing Wall Detail**
1 : 5




2 / A101 **Internal Gutter Detail**
1 : 5




3 / RWH Detail
1 : 5

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Project No.: 6-QC317.03
Scale: 1 : 5

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Christchurch City Council
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Earthquake Remedial Work to Boyd Cottages

Title
Construction Details

**CONSTRUCTION**

| Drawing No. | Sheet No. | Revision |
|---|---|---|
| 6/1366/360/7501 | A401 | R0 |

Original sheet size A3 (420x297) Plot date: 28/07/2014 10:10:40 a.m. Y:\6-QUAKE.01\CCC_PM_CURRENT SH 2013\6-QC317.03 - Boyd Cottages Remedial works\Revit\BoydCottages_RemedialWork.rvt

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