*Christchurch City Council*

# Redwood Plunket
# PRK 2179 BLDG 003B

## Detailed Engineering Evaluation

## Quantitative Assessment Report

*Christchurch City Council*

# Redwood Plunket

# Quantitative Assessment Report

## 337 Main North Rd, Redwood


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Status: Final

# Summary

Redwood Plunket
PRK 2179 BLDG 003B EQ2

Detailed Engineering Evaluation
Quantitative Report - Summary
Final


### Background
This is a summary of the quantitative report for the building structure, and is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011, visual inspections on 21 and 25 March, and available drawings.

### Key Damage Observed
Significant cracking damage has been observed to wall and ceiling linings.

### Critical Structural Weaknesses
No critical structural weaknesses have been identified in the Redwood Plunket building.

### Indicative Building Strength
The building's estimated seismic capacity is 20%NBS as limited by the out-of-plane capacity of the 90 series block infill wall. An intrusive investigation undertaken on the 14 October 2013, found that the 90 series concrete blockwork on the western face is ungrouted, and there is inadequate fixing between the blockwork and the building's columns.

The intrusive investigations also found that there is inadequate connection of the reinforced concrete wall panels to the columns for the wall panels to be considered as effective elements of the seismic load path or as adequate out-of-plane restraint for the wall panels. None of the above issues are considered CSWs as they do not affect and are not a part of the main lateral force resisting system. However, they still need to be addressed as they are brittle failures that may endanger occupants. Additionally, the intrusive investigation revealed minimal connections between the concrete frame beams and ceiling and roof diaphragms. This will need to be addressed during any strengthening investigation.

### Recommendations
We make the following recommendations:

a) Undertake a strengthening investigation to determine the details for the desired level of strengthening to elements with estimated capacities of less than 67%NBS (refer to Table 2).

b) Undertake repairs to damaged wall and ceiling cladding around the building.

# Contents

# 1 Introduction

Opus International Consultants Limited has been engaged by Christchurch City Council to undertake a detailed seismic assessment of the Redwood Plunket building, located at 339 Main North Road, Redwood, Christchurch following the Canterbury Earthquake Sequence since September 2010.

The purpose of the assessment is to determine if the building is 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:

5. 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
6. 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
7. 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

8. There is a risk that other property could collapse or otherwise cause injury or death; or
9. 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 2006. This policy was amended immediately following the Darfield Earthquake on 4 September 2010.

The 2010 amendment 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 |
|---|---|---|---|---|
| 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 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.

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

# 4 Background Information

## 4.1 Building Description

The Redwood Plunket building is a small, single storey building approximately 5 x 7.5m in plan. The external walls are concrete frames infilled with either concrete panels or blockwork, and glazing. On the east, north and south faces the concrete frames are infilled with precast, exposed aggregate panels and glazing. The rear wall is infilled with unreinforced 90 series blockwork and glazing.

The mono-slope timber framed roof falls from the front (on Main North Rd), to the back of the building on the western side. The roof is clad with profiled steel roofing and a gib lined ceiling.


Figure 2: Redwood Plunket Location (Courtesy: Google Earth).

## 4.2 Survey

### 4.2.1 Post 22 February 2011 Rapid Assessment

There was no rapid assessment form posted on the building at the time of our inspection on 11/07/2013. We understand that a rapid assessment was undertaken by Opus for the adjacent early childhood centre building; hence we assume that the Plunket building was assessed at the same time.

## 4.3 Original Documentation

No architectural or structural drawings or design calculations were available for this building.

# 5 Structural Damage

Minor to potentially significant structural damage has been observed during our visual inspection of 11 July 2013. There is cracking to the plasterboard ceiling lining, mainly around the perimeter connection to external walls. These cracks indicate that lateral displacements of the roof have occurred during seismic activity, causing movement and cracking at the plasterboard joints. The ceiling contributes to the diaphragm action of the roof, transferring load to the frames.

## 5.1 Surrounding Buildings

The adjacent building is the Redwood Early Childhood Centre building. An external survey of this building did not reveal any significant damage. An internal survey was not undertaken. The posted rapid assessment placard (green) on this building did not indicate any significant seismic issues.

## 5.2 Residual Displacements

No significant residual displacements of the buildings were identified.

## 5.3 Foundations

Liquefaction was not evident at the site. No foundation displacements or failure were identified.

## 5.4 Primary Gravity Structure

The building relies on the reinforced concrete beam and column frames to provide support to the roof. Foundations are unknown but they appear to be concrete slab-on-grade with external concrete strip footings.

# 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.

## 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. No critical structural weaknesses have been identified in the Redwood Plunket building.

## 6.2 Quantitative Assessment Methodology

The method of assessment is an evaluation using seismic loads derived from an equivalent static analysis.

Seismic load distribution has been based on considering the ceiling acting as an adequate horizontal diaphragm being able to transfer the seismic induced actions to the side walls. However, we observed significant cracking around the perimeter of the ceiling diaphragm and the intrusive investigation revealed minimal connections between the diaphragm and concrete perimeter beams. Therefore, these connections should be addressed during the strengthening investigation.

The intrusive investigation also revealed that there is no reinforcement in the concrete block wall, no adequate connection to the foundation and no connection to the concrete columns (see Figures in Appendix 1). Minimal reinforcement between the precast concrete panels and concrete columns was discovered and cannot be relied upon to resist the out-of-plane inertia of the panels or transfer adequate shear to provide in-plane lateral support for the concrete columns (see Figures in Appendix 1).

## 6.3 Limitations and Assumptions in Results

This analysis is based on an assessment of the building in its undamaged state.

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

a. Simplifications made in the analysis, including boundary conditions such as foundation fixity.
b. Assessments of material strengths based on limited drawings, specifications and site inspections. Drawings of the extensions and additions were available but no drawings of the original building were located.
c. The normal variation in material properties which change from batch to batch.
d. Approximations made in the assessment of the capacity of each element, especially when considering the post-yield behaviour.

## 6.4 Assessment

A summary of the structural performance of the building is shown in the following table (Table 2). Note that the values given generally represent the worst performing elements in the building, as these effectively define the building's capacity. Other elements within the building may have significantly greater capacity when compared with the governing elements. This should be considered further if strengthening options are developed.

Due to the nature of the structure a structural ductility factor (μ) of 1.25 has been used for all seismic resisting members in this assessment. The limiting estimated seismic capacities were found to be in the flexural capacity of the reinforced concrete columns, and we should caution that these are only based on "best estimates" of the concrete and steel reinforcement strength.

The intrusive investigation revealed that there were minimal connections of the ceiling and roof diaphragms to the lateral system (see Figures in Appendix 1). The ceiling and roof are a relatively small percentage of the building weight and the connections may be adequate to transfer the mass of the roof and ceiling to the structure through a combination of direct bearing and shear. However, the ability of the diaphragm to transfer these loads in addition to the wall loads normal to the direction of the earthquake is limited, and the connection between the diaphragm and concrete frames should be considered further during any strengthening investigation.

The building's estimated seismic capacity is 20%NBS as limited by the out-of-plane capacity of the 90 series block infill wall. An intrusive investigation undertaken on 14 October 2013, found that the 90 series concrete blockwork on the western face is ungrouted, and there is inadequate fixing between the blockwork and the building's columns (see Figures in Appendix 1). The intrusive investigations also found that there is inadequate connection of the reinforced concrete wall panels to the columns for the wall panels to be considered as effective elements of the seismic load path or as adequate out-of-plane restraint for the wall panels (see Figures in Appendix 1).

**Table 2: Summary of Seismic Performance**

| Structural Element/System | Failure Mode | % NBS based on calculated capacity |
|---|---|---|
| RC Frames | Flexure In-plane | 52 |
| Block wall infill – W Wall | Flexure Out-of-plane | 20 |
| Precast Panels – N, S & E walls | Flexure Out-of-plane | <33 |

# 7 Geotechnical Appraisal

No specific geotechnical assessment has been undertaken. The seismic site parameter used for the structural analysis was Type D, based on geotechnical advice from Opus.

# 8 Remedial Options

Remedial options for strengthening of the building should be investigated to achieve an overall seismic capacity of greater than 34%, taking into account all structural elements indicated in Table 2 with capacities less than 34. This could include removing the reinforced block and precast concrete wall infills and replacing with lighter walls.

# 9 Conclusions

a) The out-of-plane capacity of the block wall has an estimated seismic capacity of 20% NBS and precast panels have an estimated capacity of less than 33%NBS. Hence the building is classified as Earthquake-Prone. However, these are not critical structural weaknesses as the walls are not a primary element and failure will not cause collapse of the building, but it is a danger to those in close proximity to the wall. Replacement of these walls with lightweight walls will mitigate this issue.

b) The connection of the ceiling and roof diaphragms are deficient and should be addressed in any strengthening investigation.

c) Removal of the concrete panels and concrete block walls would result in a building capacity of 52%NBS or more if they are replaced with lightweight cladding. The 52%NBS capacity is governed by the capacity of the concrete frames.

# 10 Recommendations

We make the following recommendations:

a) Undertake a strengthening investigation to determine the details for the desired level of strengthening to elements with estimated capacities of less than 67%NBS (refer to Table 2).

b) Undertake repairs to damaged wall and ceiling cladding around the building.

# 11 Limitations

a) This report is based on an inspection of the structures with a focus on the damage sustained from the 22 February 2011 Canterbury Earthquake and aftershocks only.

b) 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 the time.

c) This report has been prepared for the CCC to assist with assessing remedial works required for council buildings and facilities. 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.

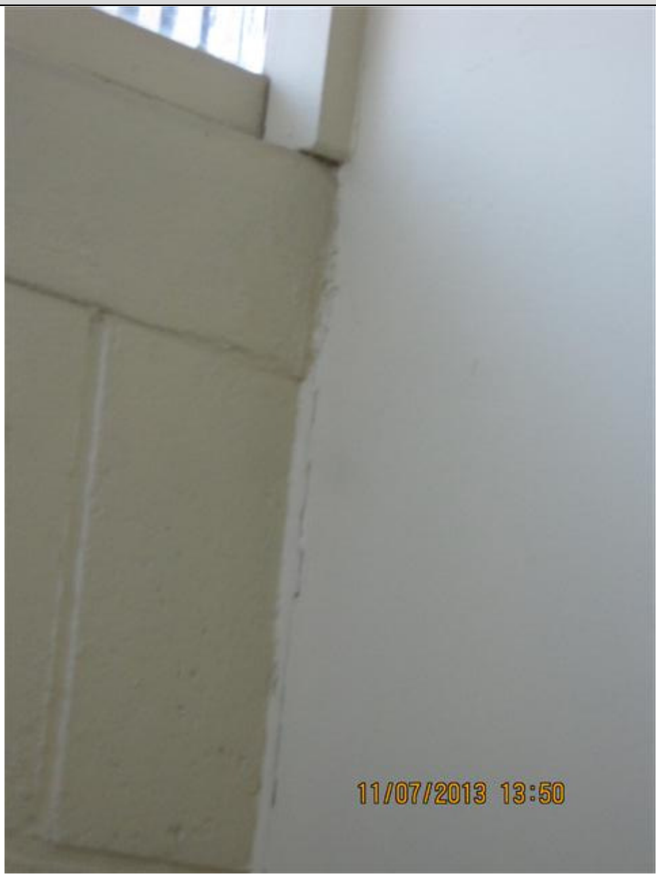
[6] DBH (2012), Guidance for engineers assessing the seismic performance of non-residential and multi-unit residential buildings in greater Christchurch, Department of Building and Housing, June 2012.

# Appendix 1 - Photographs

| No. | Description | Photo |
|---|---|---|
| 1. | View of front entrance wall from Main North Road |   |
| 2. | View of wall on northern side |   |

| No. | Description | Photo |
|---|---|---|
| 3. | View of wall panels on southern side |   |
| 4. | View of block wall on western side |   |

| No. | Description | Photo |
|---|---|---|
| 5. | Crack in wall corner |  |

| No. | Description | Photo |
|---|---|---|
| 6. | Crack in wall corner |  |
| 7. | Crack around ceiling wall interface |  |

| No. | Description | Photo |
|---|---|---|
| 8. | Crack around ceiling wall interface |  |
| 9. | Crack in ceiling wall interface |  |

| No. | Description | Photo |
|---|---|---|
| 10. | Crack in ceiling wall interface |  |
| 11. | Crack in ceiling |  |

| No. | Description | Photo |
|---|---|---|
| 12. | Crack in ceiling |  |
| 13. | Crack in ceiling |  |

| No. | Description | Photo |
|---|---|---|
| 14. | Crack along ceiling wall interface |  |
| 15. | Crack in corner of ceiling and wall |  |

| No. | Description | Photo |
|---|---|---|
| 16. | Crack in ceiling |  |
| 17. | Crack in corner of wall frame |  |

| No. | Description | Photo |
|---|---|---|
| 18. | Crack in ceiling lining |   |
| 19. | Joint between concrete column and precast concrete panel after intrusive investigation |  |

| No. | Description | Photo |
|---|---|---|
| 20. | Joint between concrete footing and precast concrete panel after intrusive investigation |  |
| 21. | Concrete column after intrusive investigation |  |

| No. | Description | Photo |
|---|---|---|
| 22. | Intrusive investigation of concrete block wall |  |
| 23. | Intrusive investigation of ceiling diaphragm |  |

| No. | Description | Photo |
| --- | --- | --- |
| 24. | Intrusive investigation of ceiling diaphragm |  |

# Appendix 2 – CERA DEE Spreadsheet

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

## Location

| | | | |
|---|---|---|---|
| Building Name: | Redwood Plunket | Reviewer: | Will Parker |
| | Unit / No: / Street | CPEng No: | 144116 |
| Building Address: | 337 Main North Rd | Company: | Opus International Consultants |
| Legal Description: | | Company project number: | 6-QC157.00 |
| | | Company phone number: | 03 363 5400 |
| | Degrees / Min / Sec | | |
| GPS south: | 43 / 28 / 39.25 | Date of submission: | 15-Jan-14 |
| GPS east: | 172 / 36 / 59.72 | Inspection Date: | 11-Jul-13 |
| | | Revision: | Final |
| Building Unique Identifier (CCC): | PRK 2179 BLDG 003B | Is there a full report with this summary? | yes |

## Site

| | | | |
|---|---|---|---|
| Site slope: | flat | Max retaining height (m): | |
| Soil type: | | 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: | mat slab | | if Foundation type is other, describe: |
| Building height (m): | 2.70 | | height from ground to level of uppermost seismic mass (for IEP only) (m): |
| Floor footprint area (approx): | 38 | | |
| Age of Building (years): | 40 | | Date of design: |
| Strengthening present? | no | | If so, when (year)? |
| | | | And what load level (%g)? |
| Use (ground floor): | public | | Brief strengthening description: |
| Use (upper floors): | | | |
| Use notes (if required): | | | |
| Importance level (to NZS1170.5): | IL2 | | |

### Gravity Structure

| | | | |
|---|---|---|---|
| Gravity System: | frame system | | |
| Roof: | timber framed | rafter type, purlin type and cladding | |
| Floors: | | | |
| Beams: | cast-insitu concrete | overall depth x width (mm x mm) | |
| Columns: | cast-insitu concrete | typical dimensions (mm x mm) | |
| Walls: | | | |

### Lateral load resisting structure

**Note: Define along and across in detailed report!**

| | | | | |
|---|---|---|---|---|
| Lateral system along: | non-ductile concrete moment frame | | | |
| Ductility assumed, μ: | 1.25 | | note typical bay length (m) | |
| Period along: | 0.40 | 0.00 | estimate or calculation? | estimated |
| Total deflection (ULS) (mm): | 1 | | estimate or calculation? | estimated |
| maximum interstorey deflection (ULS) (mm): | 1 | | estimate or calculation? | estimated |
| Lateral system across: | non-ductile concrete moment frame | | | |
| Ductility assumed, μ: | 1.25 | | note typical bay length (m) | |
| Period across: | 0.40 | 0.00 | estimate or calculation? | estimated |
| Total deflection (ULS) (mm): | 1 | | estimate or calculation? | estimated |
| maximum interstorey deflection (ULS) (mm): | 1 | | estimate or calculation? | estimated |

### Separations:

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

### Non-structural elements

| | | | |
|---|---|---|---|
| Stairs: | | | |
| Wall cladding: | other heavy | describe | Concrete block, precast concrete panels |
| Roof Cladding: | Metal | describe | profiled sheet |
| Glazing: | timber frames | | |
| Ceilings: | plaster, fixed | | |
| Services(list): | | | |

## Available documentation

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

## Damage

Site:
(refer DEE Table 4-2)

| | | | |
|---|---|---|---|
| Site performance: | no site disturbance | Describe damage: | |
| Settlement: | none observed | notes (if applicable): | |
| Differential settlement: | none observed | notes (if applicable): | |
| Liquefaction: | none apparent | notes (if applicable): | |
| Lateral Spread: | none apparent | notes (if applicable): | |
| Differential lateral spread: | none apparent | notes (if applicable): | |
| Ground cracks: | none apparent | notes (if applicable): | |
| Damage to area: | none apparent | notes (if applicable): | |

Building:

| | | | | |
|---|---|---|---|---|
| | Current Placard Status: | green | | |
| Along | Damage ratio: | 0% | Describe how damage ratio arrived at: | |
| | Describe (summary): | | | |
| Across | Damage ratio: | 0% | | |
| | Describe (summary): | | | |
| Diaphragms | Damage?: | | Describe: | |
| CSWs: | Damage?: | | Describe: | |
| Pounding: | Damage?: | | Describe: | |
| Non-structural: | Damage?: | | Describe: | |

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

## Recommendations

| | | | | |
|---|---|---|---|---|
| | Level of repair/strengthening required: | significant structural | Describe: | |
| | Building Consent required: | | Describe: | |
| | Interim occupancy recommendations: | do not occupy | Describe: | |
| Along | Assessed %NBS before e'quakes: | 33% ##### %NBS from IEP below | If IEP not used, please detail assessment methodology: | Quantitative |
| | Assessed %NBS after e'quakes: | 33% | | |
| Across | Assessed %NBS before e'quakes: | 20% ##### %NBS from IEP below | | |
| | Assessed %NBS after e'quakes: | 20% | | |

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