North Beach Community Crèche

BU 2191-001 EQ2

Detailed Engineering Evaluation

Quantitative Report

Christchurch City Council

Christchurch City Council

North Beach Community Crèche

Detailed Engineering Evaluation Quantitative Report

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North Beach Community Crèche
BU 2191-001 EQ2

Detailed Engineering Evaluation
Quantitative Report - SUMMARY
Final

24 Rookwood Avenue, New Brighton, Christchurch

Background

This is a summary of the Stage 2 Quantitative Assessment for the North Beach Community Crèche building located at 24 Rookwood Avenue, New Brighton, Christchurch and is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011, visual inspections on 28 July 2011, 03 August 2011, 23 February 2012, 21 March 2012, and available drawings.

Key Damage Observed

Key damage observed includes:

- General cracking to internal Gib board linings, especially along board edges.
- Local deformation of ceiling finishes in the plane of the roof.
- Binding of external aluminium frame doors, particularly the doors to the covered veranda.
- A significant diagonal crack to the Gib board lining in the south west corner of the extension from lintel height to wall plate level at the door opening.
- A drop in the floor level at the south west corner of the extension of approximately 10mm.
- A separation gap between the northern elevation and the external pavers (approximately 500mm long and 200-300mm deep).

Critical Structural Weaknesses

The following critical structural weakness has been identified:

- Lack of a ceiling or roof diaphragm

Indicative Building Strength (from Initial Capacity Assessment)

Based on the information available and from undertaking a quantitative assessment, the building's seismic capacity has been assessed to be in the order of 40% NBS. The structure is therefore not classed as an earthquake prone building, but is at moderate risk.

The building has a seismic capacity of 40% NBS. In accordance with NZSEE guidelines, this relates to a relative failure risk of 5-10 times that of a building constructed to the New Building Standard, and is therefore considered to pose a moderate risk to occupancy.

Recommendations

It is recommended that:

a) A strengthening works scheme be developed to increase the seismic capacity of the building to at least 67% NBS, this will also need to consider compliance with accessibility and fire requirements;
b) A quantity surveyor be engaged to determine the costs for either strengthening the building or demolishing and rebuilding.
c) A level survey is completed to quantify the differential settlement;
d) Two CPT tests are completed to confirm the liquefaction potential.
e) The building has a seismic capacity of 40% NBS and it is therefore considered that the building can be occupied. It is noted that in accordance with NZSEE guidelines, this seismic capacity relates to a relative failure risk of 5-10 times that of a building constructed to the New Building Standard, which the NZSEE guidelines consider as posing a moderate risk to occupancy.

Contents

1 Introduction

Opus International Consultants Limited has been engaged by Christchurch City Council (CCC) to undertake a detailed seismic assessment of their North Beach Community Crèche building, located at 24 Rookwood Avenue, Christchurch following the M6.3 Christchurch earthquake on 22 February 2011.

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) on 19 July 2011.

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 Act). It is anticipated that CERA will adopt 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.

Any building with a capacity of less than 34% of new building standard (including consideration of critical structural weaknesses) will need to be strengthened to a target of 67% as required by 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).

Section 115 – Change of Use

This section requires that the territorial authority (in this case Christchurch City Council (CCC)) 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 CCC as being 67% of the strength of an equivalent new building. 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 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 4th September 2010.

The 2010 amendment includes the following:

1. A process for identifying Earthquake Prone Buildings, commencing on 1 July 2012.
2. A strengthening target level of 67% of a new building.
3. A timeframe of 15-30 years for buildings to be strengthened.
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.

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:

- 36% increase in the basic seismic design load for Christchurch (Z factor increased from 0.22 to 0.3);
- 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	Improvement of Structural Performance: 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

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). It is noted that the current seismic risk in Christchurch results in a 6% risk of exceedance 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

3.2 Minimum and Recommended Standards

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

3.2.1 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, 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.

3.2.2 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/Christchurch City Council guidelines.

3.2.3 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.

3.2.4 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 Building Description

4.1 General

The North Beach Community Crèche building is a single storey ‘L’ shaped timber frame building which comprises an original structure and also a later extension. The original building, with its main axis in an east-west orientation, was constructed in 1967, and the smaller extension to the north, adjoining at right angles to this, was constructed in 1986. For the purpose of this report these are referred to as the original building and the extension respectively.

The original building and the extension are connected by an opening across the full width of the extension. The original building is approximately 18.5m long and 5.5m wide, and the extension is approximately 7m wide and 8m long. The intersecting elevations of the building parts form two sides of an enclosed veranda structure which is constructed using timber rafters and purlins supported on timber posts.

The building is of timber frame construction with exposed timber roof trusses and lightweight profiled metal sheeting roof finishes. Partitioned rooms along the south and east elevations have suspended ceilings. Roof bracing straps and dragon ties are present in the extension only.

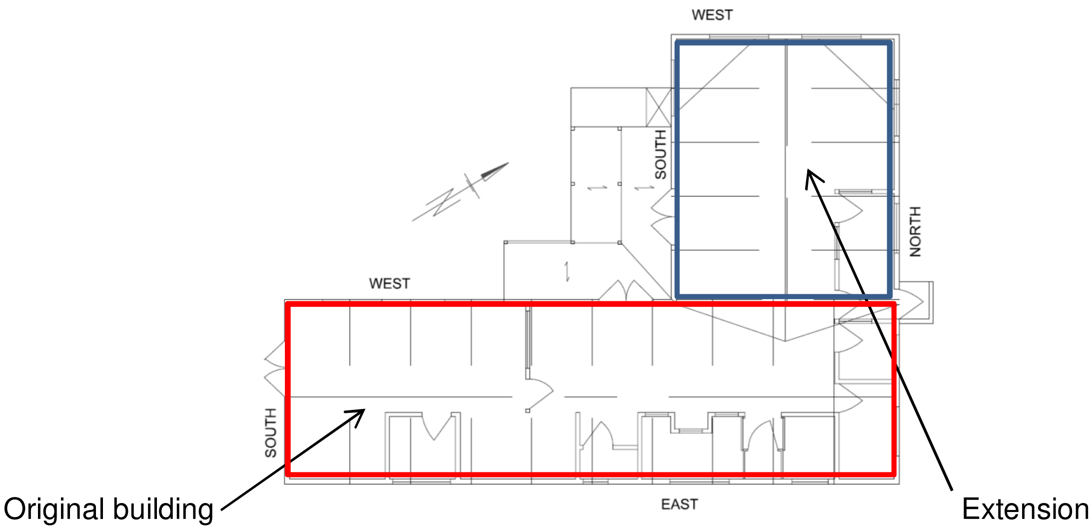


Figure 2 - Sketch to indicate layout

4.2 Gravity Load Resisting Systems

The roof construction is lightweight profiled metal sheeting on timber purlins supported by timber roof trusses spanning the full width of the original building and the extension respectively. The roof trusses span between the external timber frame walls which are supported by timber beams on piles. The external walls are finished externally with synthetic weather boards and internally with 13mm Gib Board. The suspended floor comprises timber floor joists spanning between beams, with 20mm particle board over.

Extracts from the structural drawings for the extension have been available for review. These indicate that the extension is founded on a combination of ordinary piles founded at 300mm below ground level and anchor timber piles founded at 900mm depth below ground level. Foundation details for the original building are not available, but the construction is precast concrete piles supporting timber floor joists.

4.3 Seismic Load Resisting Systems

Seismic loads are resisted by the external timber frame walls acting as in-plane shear walls and transferring loads to the foundations, where the direction of action is in the plane of the walls. This assumes that the rotation of the trusses is resisted by their connection to the purlins.

The roof cannot be fully relied upon as a diaphragm to distribute the horizontal loads to the walls. Each wall therefore resists lateral loads based on the tributary loaded width of the wall.

The calculations have considered some parts of the external wall plates acting alone to resist the horizontal forces, assisted by the internal bracing walls. However, where applicable, the provisions of NZS 3604 have been considered and checked to provide the overall assessment results.

5 Survey

5.1 Post 22 February 2011 Rapid Assessment

A structural (Level 2) assessment of the above building was undertaken on 22 June 2011 by Opus International Consultants. The site was posted with a Yellow (Y2) placard, indicating that the building access is restricted.

5.2 Further Inspections

Further inspections were undertaken as follows:

<u>Structural:</u>

- Opus International Consultants on 28 July 2011. This was a Level 3 survey;
- Opus International Consultants on 23 February 2012. This was a visual non-intrusive inspection of the building as part of the Detailed Engineering Evaluation;
- Opus International Consultants on 18 July 2012. This was an intrusive inspection with limited opening up works to areas that required further investigation.

<u>Geotechnical:</u>

- Opus International Consultants on 3 August 2011. This was an initial geotechnical site inspection;
- Opus International Consultants 21 March 2012. This was a detailed geotechnical site inspection.

Copies of the following construction drawings were provided by CCC:

- North Beach Crèche Upgrading, by John Lucas Property Management Services.
- Also provided were the design specification and roof truss specification for the extension.

These documents which refer only to the extension have been used to confirm the structural systems, and were used in support of investigating potential critical structural weaknesses (CSW) and to identify details which required particular attention.

Structural drawings have not been located for the original building.

6 Damage Assessment

The following damage has been noted:

- General cracking to internal Gib board linings, especially along board edges.
- Local deformation of ceiling finishes in the plane of the roof.
- Binding of external aluminium frame doors, particularly the doors to the covered veranda.
- A significant diagonal crack to the Gib board lining in the south west corner of the extension from lintel height to wall plate level at the door opening.
- A drop in the floor level at the south west corner of the extension of approximately 10mm.
- A separation gap between the northern elevation and the external pavers (approximately 500mm long and 200-300mm deep).

7 General Observations

The structure appears to have generally performed well during the earthquake, having sustained only minor damage during seismic events, with minor displacements of the timber frame, causing doors to bind, and localised damage to wall and ceiling finishes. The Gib board to the wall at the south-west corner has a significant diagonal crack between the lintel of the door opening and the wall plate, suggesting localised foundation settlement at this corner. The observed damage is otherwise consistent with the expected building performance for a structure of this type.

The building placard status is yellow, meaning building access is limited. This is consistent with the observed damage.

It was noted that the construction of the extension deviates from the construction drawings available, most notably in the provision of only a single wall plate.

7.1 Residual Displacements and Damage

There is evidence of some residual displacements of the timber frame by the binding of some doors. There is also a drop in the floor level at the south-west corner of the extension.

7.2 Foundations

The Geotechnical Desk Study (refer to Appendix B) discusses that the existing foundations have been damaged by recent seismic events, and details the following:

- Differential settlement of the ground beneath the structure causing the floor to be out of level throughout. In particular the floor in the north-west corner of the extension (referred to as 'eastern wing') where the building has settled by approximately 10mm. The door to the western elevation here binds.
- The ground surrounding the building shows signs of minor ground movement which require repair, including an area of less than 1m^2 of liquefaction in the children's play area, as a result of a seismic event, and a separation crack between the north elevation and the adjacent pavers over a length of approximately 500mm and to a depth of 200-300 mm.

8 Detailed Seismic Assessment

8.1 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. The following potential CSW's have been identified for each of the buildings and have been considered in the analysis:

The following critical structural weakness has been identified:

- Lack of ceiling or roof diaphragm, resulting in larger distances between bracing lines than permitted by NZS 3604:2011.

8.2 Quantitative Assessment Methodology

The roof cannot be relied upon as a diaphragm to distribute the horizontal loads around the building although some assistance to the distribution of load will be provided by the nature of the low rise of the roof trusses with purlins fixed between them.

The calculations have considered some parts of the external wall plates acting alone to resist the horizontal forces, assisted by the internal bracing walls. However, where applicable, the provisions of NZS 3604:2011 have been considered and checked, to provide the overall assessment results.

The internal partitions which act as lateral restraint to the external walls and wall plates have been assessed for their in-plane shear capacity by comparison with known systems and NZS 3604:2011.

8.3 Seismic Coefficient Parameters

The seismic coefficient parameters used in the assessment are as follows:

- Site subsoil class: D (Deep or soft soil sites)
- Hazard factor: Z = 0.3
- Importance Level: 2

8.4 Expected Ductility Factors

The expected ductility factor throughout in both north-south and east-west directions:

- $\mu = 2.00$

8.5 Detailed Seismic Assessment Results

A summary of the structural performance of the building is shown in the following table.

Note that the values given 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.

Table 2: Summary of Seismic Performance

Structural Element/System	Failure mode and description of limiting criteria	% NBS based on calculated capacity
Timber frame walls	Out of plane flexural capacity, both directions.	61%
External timber frame walls	In plane shear capacity (east-west direction).	46%
External timber frame walls	In plane shear capacity (north-south direction).	40%
Timber framed walls	In plane shear capacity.	40%
Differential settlement as a result of liquefaction	Liquefaction potential has been assessed, and there is found to be a risk of differential settlement of up to 45mm in future ultimate limit state seismic events.	N/A

8.6 Discussion of Results

The holding down fixings of the internal partition walls have been assumed to be of an arrangement typical for a building of this type and age. Further investigation would be required to identify the actual connection detail, and to facilitate proposals for improvement works.

It is recommended that a full level survey and further intrusive investigation are undertaken to quantify the differential settlement and damage to the existing foundations. Further geotechnical investigation is also recommended to confirm the site liquefaction potential, including, but not restricted to, CPT tests.

Liquefaction and ground damage, similar to that which has already occurred, can be expected during a future design seismic event.

The building has a minimum seismic capacity of 40% NBS as governed by the in-plane capacity of the timber framed shear walls, and is therefore not classed as an earthquake prone building. It is however recommended that the building is strengthened to at least 67% NBS in order to reduce the seismic risk.

The building has a seismic capacity of 40% NBS. In accordance with NZSEE guidelines, this relates to a relative failure risk of 5-10 times that of a building constructed to the New Building Standard, and is therefore considered to pose a moderate risk to occupancy.

8.7 Limitations and Assumptions in Results

Our analysis and assessment are based on an assessment of the building in its undamaged state. Therefore the current capacity of the building will 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.

9 Geotechnical Assessment

9.1 General

(Refer to the "Geotechnical Desk Study" in Appendix B.)

CERA has published residential rebuilding zones:

- Green (Go Zone): repair / rebuild process can begin

- Orange (Hold Zone): further assessment required
- Red (No Go Zone): land repair would be prolonged and uneconomic
- White (Unzoned): CBD or hillside land where geotechnical mapping and further assessment currently underway

The assessed building is located within the Green Zone.

The Department guidance breaks the Green Zone into three technical categories. Foundation requirements differ from category to category. For a quick guide see below:

- Technical Category 1 (TC1) – future land damage from liquefaction unlikely.
- Technical Category 2 (TC2) – minor to moderate land damage from liquefaction is possible in future large earthquakes.
- Technical Category 3 (TC3) – moderate to significant land damage from liquefaction is possible in future large earthquakes.

24 Rookwood Avenue is within an area classified by the above definitions as TC3

The site is indicated to have 'moderate ground damage potential' for liquefaction in the ECAN study with subsidence in the order of 100 mm to 300mm expected in a design level seismic event, based on a low groundwater scenario.

Information from a data set located 170m to the south of the building indicates that liquefaction would occur following an ultimate limit state design level seismic event, with likely differential settlement of up to 45mm.

9.2 Summary

Differential settlement has caused the floor to be out of level throughout the building. In particular the floor in the north-west corner of the extension has settled by approximately 100mm. This settlement is consistent with the separation and cracking to the concrete paving on the exterior at this location. The differential settlement has caused the door on the western elevation to bind and the timber around the foundations has moved laterally.

The existing foundations have been damaged in the recent seismic events. In order to assess the suitability of shallow foundations for the site, further site specific investigations are recommended. The amount of likely differential settlement has been estimated at up to 45mm for the purposes of this report.

It is recommended that:

- A full level survey is undertaken to quantify the differential settlement.
- Two CPT tests are completed at the site to confirm the liquefaction potential.

10 Conclusions

a) The seismic performance is governed by the in plane shear capacity of the walls. This has been calculated to be in the region of 40% NBS (46% in the east-west direction).

b) The worst case bracing capacity of the internal partitions is 41% based on the assumptions that the base plate fixings are typical for a building of this type and age.

c) Over the length of the building a differential settlement of up to 45mm can be expected in an ultimate limit state design level seismic event.

d) The lateral restraint of the piles below structural walls has not been investigated, but may require improvement to prevent these being displaced in a seismic event.

e) A level survey is recommended to quantify the differential settlement.

f) Two CPT tests are recommended to confirm the liquefaction potential.

11 Recommendations

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

b) A quantity surveyor be engaged to determine the costs for either strengthening the building or demolishing and rebuilding.

c) A level survey is completed to quantify the differential settlement.

d) Two CPT tests are completed to confirm the liquefaction potential.

e) The building has a seismic capacity of 40% NBS and it is therefore considered that the building can be occupied. It is noted that in accordance with NZSEE guidelines, this seismic capacity relates to a relative failure risk of 5-10 times that of a building constructed to the New Building Standard, which the NZSEE guidelines consider as posing a moderate risk to occupancy.

12 Limitations

a) This report is based on an inspection of the structure of the buildings and focuses on the structural damage resulting from the 22 February 2011 Canterbury Earthquake and aftershocks only. Some non-structural damage is described but this is not intended to be a complete list of damage to non-structural items.

b) Our inspections have been visual and limited-intrusive, with linings or finishes removed only locally to expose key structural elements. 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.

c) This report is prepared for CCC to assist with assessing the remedial works required for council buildings and facilities. It is not intended for any other party or purpose.

13 References

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

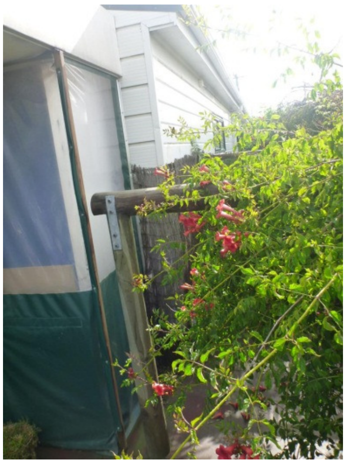
[2] NZSEE: 2006, Assessment and improvement of the structural performance of buildings in earthquakes, New Zealand Society for Earthquake Engineering.

Appendix A – Photographs

North Beach Community Crèche		
No.	**Item Description**	**Photo**
General Elevations		
1.	North Elevation (Mariotts Road)	
2.	North Elevation (Mariotts Road)	

3.	West Elevation (extension)	
4.	South-West Elevations (extension)	
5.	South-West Elevations (including covered deck area)	

6.	West Elevation (including enclosed deck area)	
7.	South Elevation	
8.	South Elevation (including covered deck area)	

9.	East Elevation	
10.	East Elevation	

General Internal		
11.	Extension (looking north)	
12.	Extension (looking north-west showing bottom chord ties)	
13.	Original Building (looking north-east) clad double roof truss forming full width opening	

14.	Extension (looking west towards gable wall)	
15.	Opening between extension and original building (looking south-west towards extension)	
16.	Extension and original building (looking south east towards original building)	

17.	Extension (looking north west) showing crack in north-west corner above door opening and bottom chord tie.	
18.	Original building (looking north)	
19.	Original building (looking towards south gable wall)	

20.	Original building (looking north towards partition wall)	
Details Internal		
21.	Deformation of the ceiling finishes in the plane of roof (extension)	
22.	Acoustic type ceiling tiles with no bracing value	

23.	Loft access in room on north elevation (Mariotts Road side)	
24.	Double truss forming the opening between the original building and the extension, as exposed within the roof void adjacent to the loft access hatch.	
25.	Timber construction of the enclosed veranda	

26.	Door on south elevation of extension, leading to the enclosed veranda, which no longer closes due to deformation of the opening.	

Appendix B – Geotechnical Appraisal

5 April 2012

Christchurch City Council
C/O:- Michael Sheffield
Property Asset Manager

6-QUCCC.87

Dear Michael

Geotechnical Desk Study – North Beach Community Crèche

1. Introduction

Christchurch City Council (CCC) has commissioned Opus International Consultants (Opus) to undertake a geotechnical desktop study and site walkover of the North Beach Community Crèche, New Brighton, Christchurch. The purpose of this study is to collate existing subsoil information and undertake an appraisal of the potential geotechnical hazards at this site and to determine whether further investigations are required. An initial site inspection and brief appraisal was completed by an Opus Engineer, on 3 August 2011. Following a request from CCC, a full site walkover was completed by Opus International Consultants on 21 March 2012.

The Geotechnical Desk Study forms part of a Detailed Engineering Evaluation prepared by Opus. A level survey has not been undertaken. The Geotechnical Desk Study has been undertaken without the benefit of any site specific investigations and is therefore preliminary in its nature.

2. Desktop Study

2.1 Site Description

The North Beach Community Crèche is located at 24 Rookwood Avenue and is bound by residential properties to the north and south, Rookwood Avenue to the west and Marriotts Road to the east. The Avon River, at its closest point, is approximately 950m southwest of the building. North New Brighton Beach is located approximately 1km to the east.

No Geotechnical Reports or site specific investigations were available from the CCC Property file.

2.2 Structural Drawings

Extracts from the Structural Drawings have been available for review (refer to Appendix D). The extracts indicate that the North Beach Community Creche is a single storey light timber framed building founded on a combination of ordinary (300mm below ground level (bgl)) and anchor timber piles (900mm bgl). Refer to the Opus Qualitative Structural Assessment Report for more detailed description of the building.

2.3 Regional Geology

The published geological map of the area, (Geology of the Christchurch Urban Area 1:25,000, Brown and Weeber, 1992) indicates the site is part of the Christchurch Formation with dominantly sand of fixed and semi-fixed dunes and beaches.

2.4 Expected Ground Conditions

A review of the Environmental Canterbury (ECan) wells database showed five wells located within approximately 350 m of the property (refer to Site Location Plan in Appendix B). The locations of Boreholes and CPT's by the Earthquake Commission have been reviewed. The nearest CPT is located 170m south of the building. Material logs available from these sources have been used to infer the ground conditions at the site as, shown in Table 1 below.

Table 1: Inferred Ground Conditions

Stratigraphy	Thickness (m)	Depth Encountered from
Clay and SAND	25.9-37.2m	Surface
Sandy GRAVEL	3.4-4.3m	25.9-26.8m
SAND	9.1-9.7m	29.3-31.1m
GRAVEL (Riccartion Formation)	-	34.8-40.2m

A groundwater depth of approximately 1m to 2m bgl has been estimated from groundwater depth contour maps (Environment Canterbury (2003) and Elder et al. (1991)).

2.5 Liquefaction Hazard

A liquefaction hazard study was conducted by the Canterbury Regional Council (ECan) in 2004 to identify areas of Christchurch susceptible to liquefaction during an earthquake. This New Brighton site is located in an area identified as having 'moderate ground damage potential' for a low groundwater scenario. According to this study, the ground may be affected by 100mm to 300mm of subsidence.

Tonkin and Taylor Ltd (T&T Ltd) have been engaged as the Earthquake Commission's (EQC) geotechnical consultants and have prepared maps showing areas of liquefaction interpreted from high resolution aerial photos for the aftershocks of February 2011, June 2011 and December 2011. There has been evidence from these aerial photos of moderate liquefaction on the site, or in the vicinity after these events.

The University of Canterbury drive-through reconnaissance 23 February – 1 March (Cubrinovski & Taylor, 2011) indicated that there was moderate to severe liquefaction in this area.

The maps that were released by the Department of Building and Housing (DBH) on 16 November 2011 indicate that the residential area surrounding the site are classified as Technical Category 3 (blue), which indicates that moderate to significant land damage from liquefaction is possible in future significant earthquakes.

A brief LiquefyPro analysis has been performed using the CPT-NBT-23 data set located 170m south of the building. The analysis indicates liquefaction would occur following an Ultimate Limit State (ULS) seismic event. Differential settlement of up to 45mm is likely to occur based on the analysis of CPT-NBT-23 in an Ultimate Limit State (ULS) seismic event data.

3. Site Walkover Inspection

A detailed walkover inspection of the exterior, interior, and adjacent paved area was carried out by Opus Geotechnical Engineer on 21 March 2012. The following observations were made (refer to the Walkover Inspection Plan and Site Photos attached to this report):

- Minor differential settlement appears to have occurred on the northern side of the crèche building. The interior floor has settled by approximately 10mm (Photo's 4 and 6).
- The concrete pavement on the north elevation of the building has cracked and separated by 5mm (Photo 5).
- A 0.5m long gap beside the concrete pavers at the east elevation entrance door was observed and appears to be approximately 200mm to 300mm deep (Photo 3).
- The west elevation exit door is jammed. Effort is required to open it.
- Timber around the perimeter of the west elevation appears to have been displaced laterally (Photo 7).
- Less than 1m^2 of liquefaction in the children's play area has occurred.

4. Discussion

The building is currently unoccupied.

Differential settlement has caused the floor to be out of level throughout the building. In particular, the floor in the north west corner of the eastern wing of the building has settled by approximately 10mm. This settlement is consistent with the separation and cracking of the concrete paving on the exterior at this location. The differential settlement has caused the door on the western elevation to jam and the timber around the foundations has moved laterally.

A CPT test 170m south of the site indicates that the underlying soils are prone to liquefaction. Based on the CPT data, the building could potentially differentially settle by up to 45mm in future ULS (0.35g) seismic events.

GNS Science indicates an elevated risk of seismic activity is expected in the Canterbury region as a result of the earthquake sequence following the 4 September 2010 earthquake. Recent advice (Geonet) indicates there is currently a 16% probability of another Magnitude 6 or greater earthquake occurring in the next 12 months in the Canterbury region. Liquefaction and ground damage similar to what has already occurred at this site is expected to reoccur, depending on the location of the epicentre. It is expected that the probability of occurrence is likely to decrease with time, following periods of reduced seismic activity.

The existing foundations have been damaged in the recent seismic events. In order to assess the suitability of shallow foundations for the site, further site specific investigations are recommended. The amount of differential settlement has been estimated for the purposes of this report. We recommend a detailed level survey is undertaken to more accurately assess the foundation performance. The level survey will help to classify the site in accordance with the Technical Categories of the DBH guidelines and determine appropriate remedial works. Two CPT's are recommended to confirm the liquefaction potential at this site.

5. Recommendations

It is recommended that;

- A full level survey is undertaken to quantify differential settlement.
- Two CPT tests are completed at the site to confirm liquefaction potential.

6. Limitation

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

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

References:

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

Cubrinovski, M; Taylor, M 2011: Liquefaction Map – DRAFT. Drive through reconnaissance 23rd February – 1st March 2011. University of Canterbury.

Environment Canterbury, Canterbury Regional Council (ECan) website:

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

ECan 2004: The Soild Facts on Christchurch Liquefaction. Canterbury Regional Council, Christchurch, 1 sheet.

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

GNS Science reporting on Geonet Website: http://www.geonet.org.nz/canterbury-quakes/aftershocks/ updated on 24 February 2012.

<u>Appendices:</u>
Appendix A: Site Photographs
Appendix B: Site Location and Walkover Plan
Appendix C: Environment Canterbury Borehole Logs and EQC CPT Log
Appendix D: Foundation Drawings

Appendix A:
Site Photographs

Photo 1: East elevation of the North Beach Community Crèche.

Photo 2: West elevation of the North Beach Community Crèche.

Photo 3: Hole beside east side entrance pavers.

Photo 4: Approximately 10mm settlement of the floor in the large room in west wing.

Photo 5: Separation and cracking of concrete shrinkage cut.

Photo 6: Settlement of the floor in the north west corner of the main room in the eastern wing.

Photo 7: Lateral displacement of timber boards.

Appendix B:
Site Location and Walkover Plan

ECan Borehole Location

CPT Locations

BH	ECan Ref	CPT	Ref
1	M35/1529	6	CPT-NBT-23
2	M35/1530		
3	M35/1627		
4	M35/1531		
5	M35/1658		

0 100m

Approximate Scale 1:1880 at A3

OPUS

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

Project: North Beach Community Creche
Geotechnical Desk Study

Project No.: 6-QUCCC.87

Client: Christchurch City Council

Site Location Plan

Drawn: Opus Geotechnical Engineer

Date: 19-Mar-12

Opus International Consultants Ltd
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20 Moorhouse Ave
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Project: North Beach Community Creche
Geotechnical Desk Study

Project No.: 6-QUCCC.87

Client: Christchurch City Council

Site Walkover Plan

Drawn: Opus Geotechnical Engineer

Date: 21-Mar-12

Appendix C:
ECan Borehole and EQC CPT Logs

Borelog for well M35/1627

Gridref: M35:870-457 Accuracy : 4 (1=high, 5=low)
Ground Level Altitude : 4.3 +MSD
Driller : not known
Drill Method : Unknown
Drill Depth : -82.9m Drill Date :

Water Level: Artesian

Depth(m)	Full Drillers Description	Formation Code
- 39.6m	Blue sand and clay	ch
- 42.7m	Blue shingle	ri
- 50.6m	Brown shingle - water at surface	ri
- 54.9m	Brown sand & gravel	ri
- 61.0m	Brown sand	br
- 61.8m	Yellow clay	br
- 63.4m	Blue clay	br
- 70.1m	Brown sand & clay	li-1
- 72.3m	Yellow clay	li-2
- 75.0m	Brown shingle	li-2
- 81.1m	Yellow sand & clay	li-2
- 83.3m	Brown shingle	li-2

Borelog for well M35/1531

Gridref: M35:870-456 Accuracy : 4 (1=high, 5=low)
Ground Level Altitude : 3.9 +MSD
Driller : not known
Drill Method : Unknown
Drill Depth : -86.59m Drill Date :

Water Level	Depth(m)	Full Drillers Description	Formation Code
Artesian		Sand	
	- 26.8m		ch
		Brown shingle	
	- 31.1m		ch
		Brown sand	
	- 40.2m		ch
		Blue & Brown gravel water at 44.2m rises to surface	
	- 50.6m		ri
		Brown sand	
	- 53.6m		br
		Blue & Brown sand	
	- 70.1m		br
		Brown shingle best flow at 73.2m rises 3m	
	- 74.4m		li-1
		Blue clay & sand	
	- 82.3m		li-2
		Brown shingle water flows 182l at surface & rises 3.7m with tide out	
	- 86.6m		li-2

Scale(m): -10, -20, -30, -40, -50, -60, -70, -80

Borelog for well M35/1530

Gridref: M35:870-458 Accuracy : 4 (1=high, 5=low)
Ground Level Altitude : 4.7 +MSD
Driller : not known
Drill Method : Unknown
Drill Depth : -85.3m Drill Date :

Environment Canterbury Regional Council

Water Level: Artesian

Depth(m)	Full Drillers Description	Formation Code
- 25.9m	Sand	ch
- 29.3m	Brown shingle	ch
- 39.0m	Sand	ch
- 49.4m	Brown shingle best water at 42.7m	ri
- 53.0m	Brown sand	br
- 65.5m	Blue sand	br
- 67.1m	Blue clay	br
- 69.5m	Yellow clay	br
- 74.1m	Brown sand & shingle	li-1
- 80.8m	Blue sand & clay	li-2
- 82.6m	Yellow clay	li-2
- 85.3m	Brown shingle water flows 136l at surface & rises 4.3m with tide in	li-2

Scale(m): -10, -20, -30, -40, -50, -60, -70, -80

Borelog for well M35/1529

Gridref: M35:866-458 Accuracy : 4 (1=high, 5=low)
Ground Level Altitude : 4.5 +MSD
Driller : not known
Drill Method : Unknown
Drill Depth : -89m Drill Date :

Environment Canterbury Regional Council

Water Level: Artesian

Depth(m)	Full Drillers Description	Formation Code
- 37.2m	Clay & sand	ch
- 43.9m	Brown shingle best water at 39.6m rises 1.2m	ri
- 67.1m	Brown sand	br
- 69.2m	Blue clay	br
- 71.9m	Brown shingle best flow at 70.7m rises 4.3m	li-1
- 72.8m	Yellow clay	li-2
- 82.3m	Brown shingle best flow at 73.8m, 273l & rises 4.6m	li-2
- 86.0m	Brown sand	li-2
- 89.0m	Brown shingle water flows 364l at surface & rises 5.2m	li-2

Scale(m): -10, -20, -30, -40, -50, -60, -70, -80

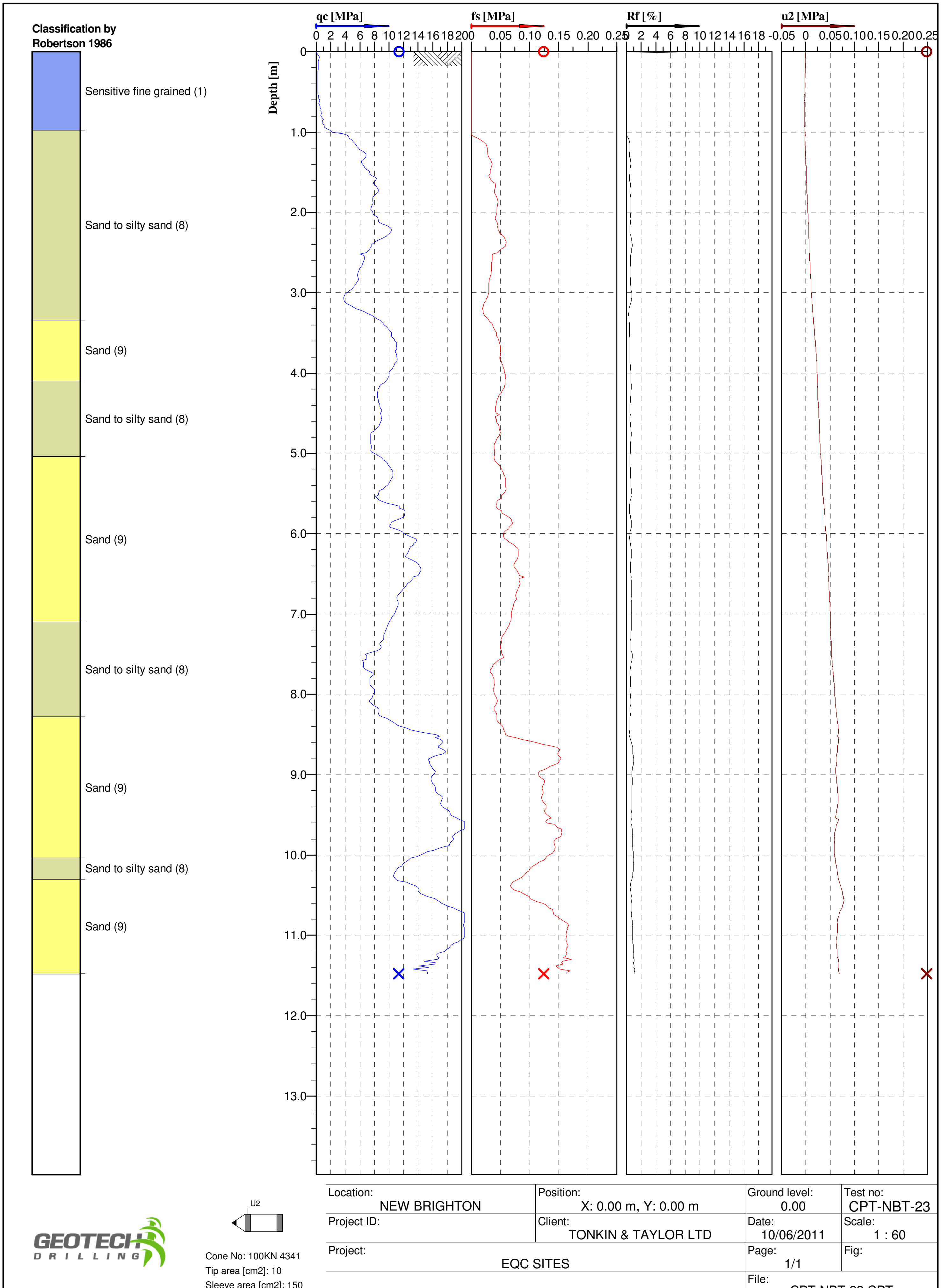
Borelog for well M35/1658

Gridref: M35:870-455 Accuracy : 4 (1=high, 5=low)
Ground Level Altitude : 3.6 +MSD
Driller : Job Osborne (& Co/Ltd)
Drill Method : Hydraulic/Percussion
Drill Depth : -92.09m Drill Date : 26/04/1929

Water Level: Artesian

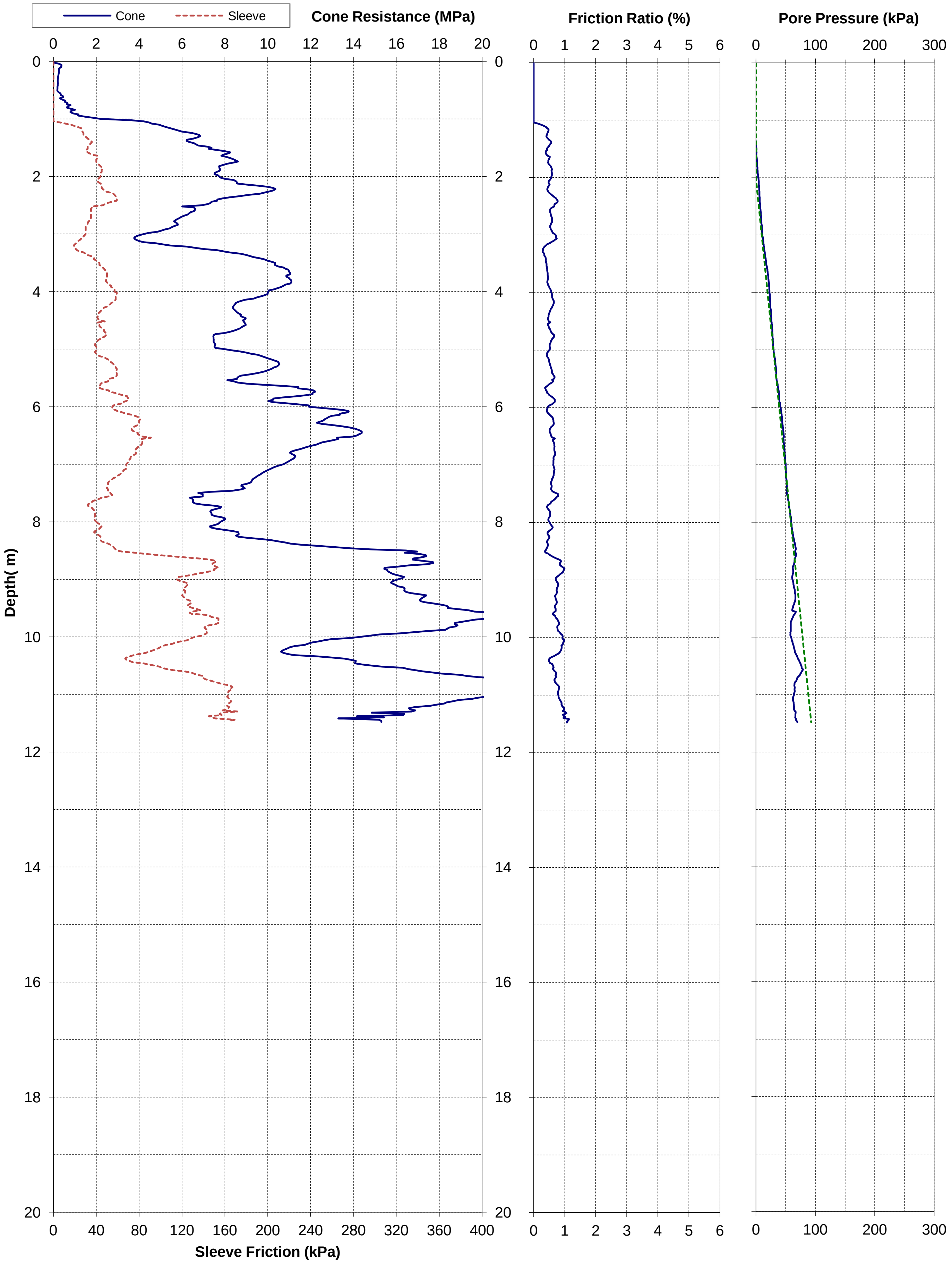
Depth(m)	Full Drillers Description	Formation Code
- 22.3m	Sand & clay	ch
- 34.8m	Blue sand	ch
- 41.8m	Blue shingle	ri
- 52.4m	Brown shingle. wl + 0.6m	ri
- 64.6m	Yellow sand & gravel	br
- 65.9m	Blue sand & clay	br
- 69.2m	Yellow clay	br
- 79.0m	Brown shingle. Water rises 2.4m	li-1
- 83.2m	Blue sand & clay	li-2
- 85.4m	Yellow sand & clay	li-2
- 92.1m	Brown shingle - water rise 4.3m	li-2

Scale(m): -10, -20, -30, -40, -50, -60, -70, -80, -90



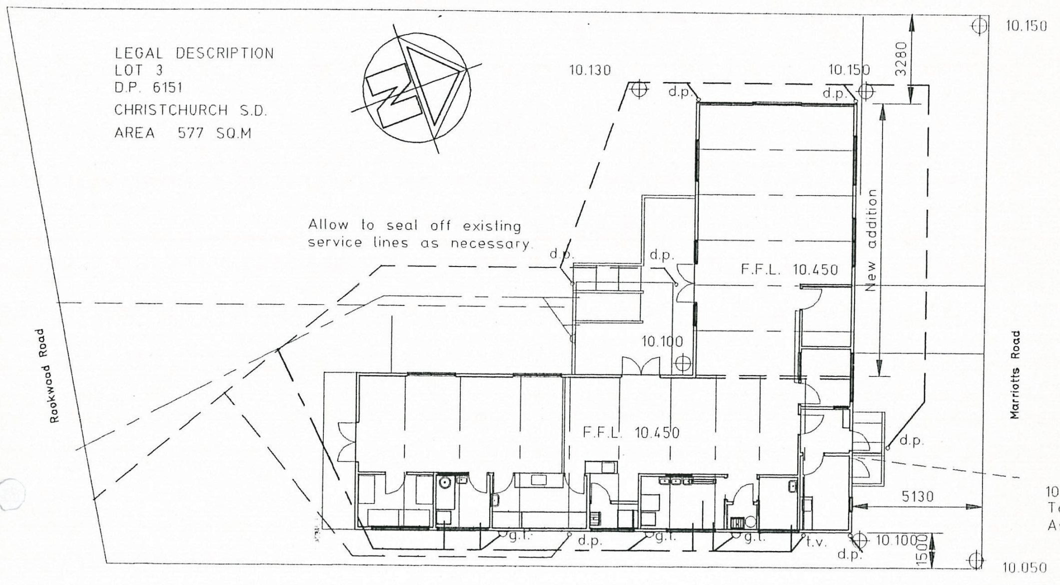
Location: NEW BRIGHTON	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT-NBT-23
Project ID:	Client: TONKIN & TAYLOR LTD	Date: 10/06/2011	Scale: 1 : 60
Project: EQC SITES		Page: 1/1	Fig:
		File: CPT-NBT-23.CPT	

Project:	Christchurch 2011 Earthquake - EQC Ground Investigations			Page:	1 of 1	CPT-NBT-23
Test Date:	10-Jun-2011	Location:	New Brighton	Operator:	Geotech	
Pre-Drill:	1.2m	Assumed GWL:	2mBGL	Located By:	Survey GPS	
Position:	2486970.7mE	5745500.6mN	3.25mRL	Coord. System:	NZMG & MSL	
Other Tests:				Comments:		



Appendix D:

Foundation Drawings

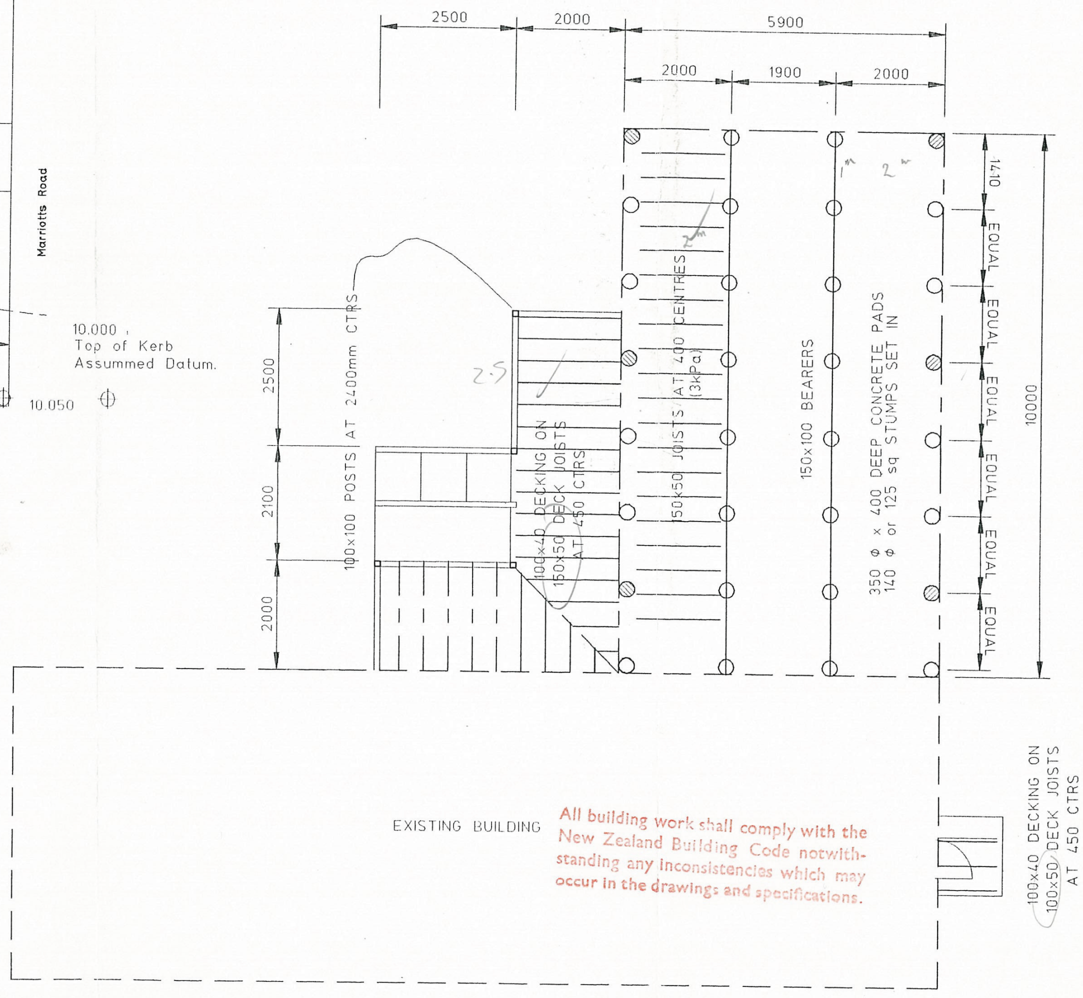


SITE PLAN Scale; 1:200

NOTE:
ALL SITEWORKS TO BE ARRANGED BY OTHERS.
DO NOT PRICE, FENCING, PAVING, ETC TO THE BUILDING SITE.

LEGEND;

EXISTING SEWER
NEW SEWER
EXISTING STORMWATER
NEW STORMWATER
EXISTING WATER SUPPLY
ELECTRICAL SUPPLY
19.950 EXISTING LEVELS
(19.980) PROPOSED LEVELS



All building work shall comply with the New Zealand Building Code notwithstanding any inconsistencies which may occur in the drawings and specifications.

FLOOR FRAMING PLAN Scale; 1:100

ANCHOR PILES
ORDINARY PILES

FILE COPY

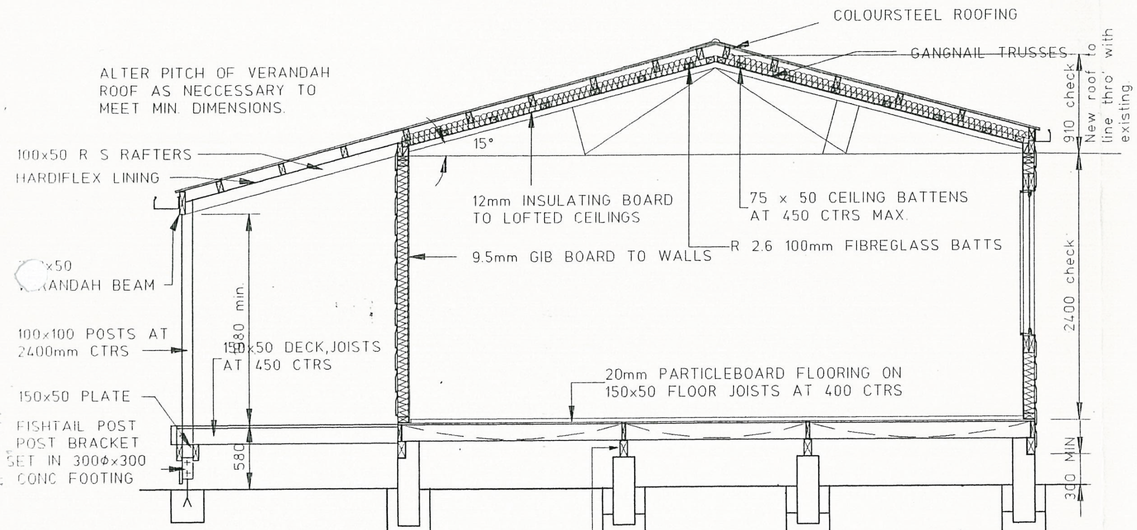
CHRISTCHURCH CITY COUNCIL
26 SEP 1996
CONSENT DOCUMENT

NORTH BEACH CRECHE UPGRADING
SITE PLAN AND FLOOR FRAMING PLAN

SCALE: AS SHOWN	
DATE: 7/95	
DRAWN: JL/GM	

JOHN LUCAS N.Z.C.D. (Arch)
PROPERTY MANAGEMENT SERVICES
Architectural Services Contract Supervision AutoCAD
The Arts Centre
2 Worcester Street
Ph: 650 597
AH: 266 244

DWG.No: nthbchr1
SHEET No: 1 OF 9 SHEETS



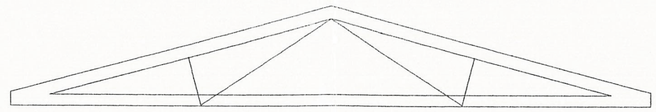
150x75 BEARERS @ 2400 MAX CTRS ON 140φ OR 125x125-M5 TIMBER ORDINARY PILES SET 200 INTO 300 DEEP CONC BASES

125x125 FOR INTERIOR PILES AND 350x350 FOR EXTERIOR ORDINARY PILES

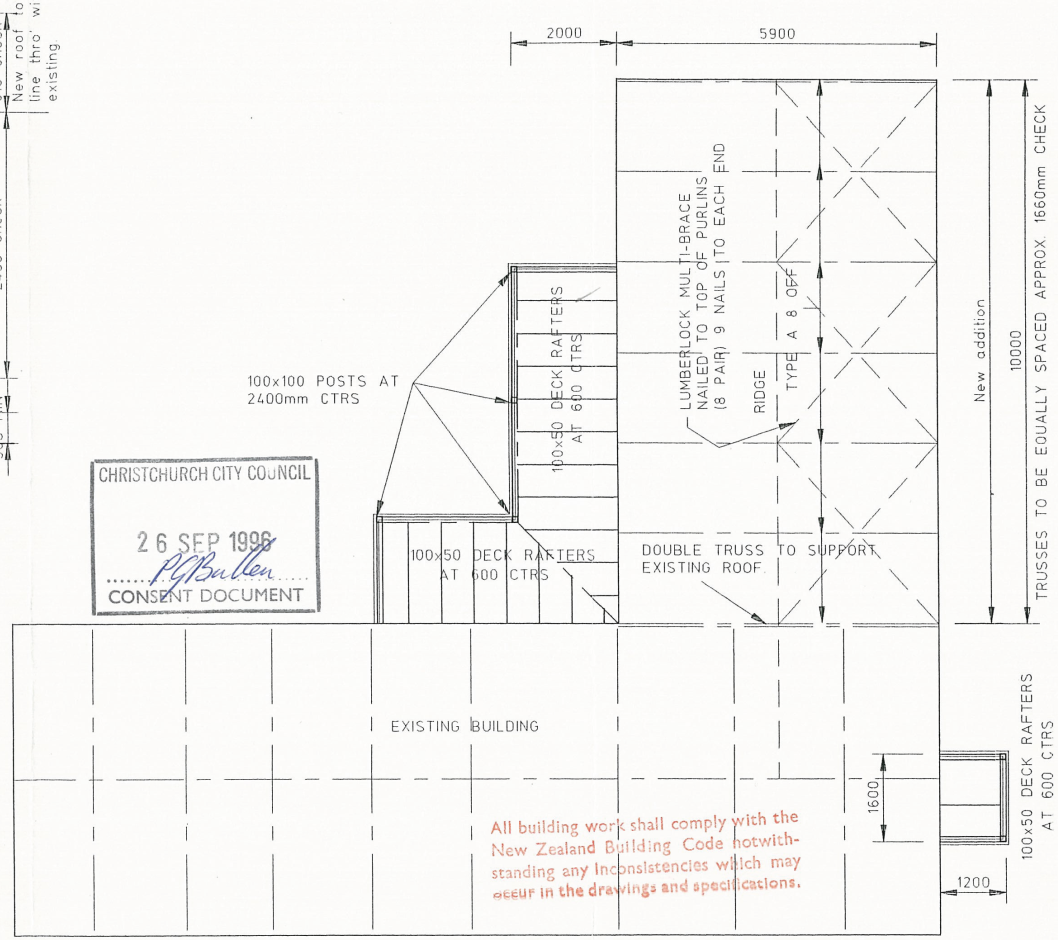
FOUNDATIONS FOR ORDINARY PILES SHALL BE AT LEAST 300 BELOW CLEARED GROUND LEVEL.

ANCHOR PILES TO BE 140φ 125x125-M5 TIMBER SET 800 INTO 350φ CONCRETE FILLED HOLES 900 DEEP WITH 100 CONCRETE PAD UNDER THE PILE.

CROSS SECTION Scale; 1:50



TYPE A 8 OFF



CHRISTCHURCH CITY COUNCIL
26 SEP 1996
P.G.Bullen
CONSENT DOCUMENT

All building work shall comply with the New Zealand Building Code notwithstanding any inconsistencies which may occur in the drawings and specifications.

ROOF PLAN Scale; 1:100

NORTH BEACH CRECHE UPGRADING SECTION, ROOF FRAMING DETAILS	SCALE: AS Shown DATE: 7/95 DRAWN: JL/GM	JOHN LUCAS N.Z.C.D. (Arch) PROPERTY MANAGEMENT SERVICES Architectural Services Contract Supervision AutoCAD The Arts Centre, 2 Worcester Street, Ph: 650 597, AH: 266 244	DWG.No: nthbchr4 SHEET No: 4 OF 8 SHEETS

Appendix C – CERA DEE Spreadsheet

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name: North Beach Community Creche
Building Address: (Unit / No: 24 / Street: Rookwood Avenue) North Beach Community Creche
Legal Description:
GPS south: (Degrees / Min / Sec)
GPS east:
Building Unique Identifier (CCC): BU 2191-001 EQ2

Reviewer: Alistair Boyce
CPEng No: 209860
Company: Opus International Consultants
Company project number: 6-QUCCC.87
Company phone number: +64 3 3635400
Date of submission: 26-Oct-12
Inspection Date: March 2012 (latest Structural)
Revision: Final
Is there a full report with this summary? yes

Site

Site slope: flat
Soil type:
Site Class (to NZS1170.5): D
Proximity to waterway (m, if <100m):
Proximity to clifftop (m, if < 100m):
Proximity to cliff base (m,if <100m):

Max retaining height (m): 0
Soil Profile (if available): Clay and SAND to min 25.9m
If Ground improvement on site, describe: -
Approx site elevation (m):

Building

No. of storeys above ground: 1 (single storey = 1)
Ground floor split? no
Storeys below ground: 0
Foundation type: other (describe)
Building height (m): 3.50
Floor footprint area (approx): 115
Age of Building (years): 45

Ground floor elevation (Absolute) (m):
Ground floor elevation above ground (m): 0.50
If Foundation type is other, describe: normal piles
height from ground to level of uppermost seismic mass (for IEP only) (m):
Date of design: 1965-1976

Strengthening present? no
If so, when (year)?
And what load level (%g)?
Brief strengthening description:

Use (ground floor): institutional
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:
Columns:
Walls:

Lateral load resisting structure

Note: Define along and across in detailed report!

Lateral system along: lightweight timber framed walls — note typical wall length (m): N/S
Ductility assumed, μ: 2.00
Period along: 0.16 — 0.00 — estimate or calculation? estimated
Total deflection (ULS) (mm): — estimate or calculation?
maximum interstorey deflection (ULS) (mm): — estimate or calculation?

Lateral system across: lightweight timber framed walls — note typical wall length (m): E/W
Ductility assumed, μ: 2.00
Period across: 0.16 — 0.00 — 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: other light — describe: external weather boarding (upvc)
Roof Cladding: Metal — describe:
Glazing: aluminium frames
Ceilings: light tiles — localised gib board in rooms
Services(list): electrical

Available documentation

Architectural: partial — original designer name/date: John Lucas
Structural: partial — original designer name/date: John Lucas
Mechanical: none — original designer name/date:
Electrical: none — original designer name/date:
Geotech report: partial — original designer name/date: Desktop - Opus Intern. Consultants

Damage

Site: (refer DEE Table 4-2)
Site performance: generally good — Describe damage: diff settlement, distortion of timber fr.

Settlement: 0-25mm — notes (if applicable):
Differential settlement: 0-1:350 — notes (if applicable): minor approx. 10mm
Liquefaction: 0-2 m²/100m² — notes (if applicable): <1m2 in play area
Lateral Spread: none apparent — notes (if applicable):
Differential lateral spread: none apparent — notes (if applicable):
Ground cracks: 0-20mm/20m — notes (if applicable): localised
Damage to area: slight — notes (if applicable):

Building:
Current Placard Status: yellow

Along — Damage ratio: 0% — Describe how damage ratio arrived at:
Describe (summary): minor cracking/deformation

Across — Damage ratio: 0%
Describe (summary): minor cracking/deformation

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

Diaphragms — Damage?: no — Describe: ceiling damaged, but not diaphragm
CSWs: — Damage?: yes — Describe: diff. settlement & possibly fixings to TF
Pounding: — Damage?: no — Describe:
Non-structural: — Damage?: yes — Describe: cracking to plasterboard/ceiling tiles

Recommendations

Level of repair/strengthening required: minor structural — Describe: Foundation remediation req't unknown
Building Consent required: no — Describe: Along = E/W
Interim occupancy recommendations: full occupancy — Describe: Accross = N/S

Along — Assessed %NBS before: 40% ##### %NBS from IEP below
Assessed %NBS after: 40%

Across — Assessed %NBS before: 40% ##### %NBS from IEP below
Assessed %NBS after: 40%

IEP

Period of design of building (from above): 1965-1976 — h_n from above: m

Seismic Zone, if designed between 1965 and 1992: — not required for this age of building / not required for this age of building

	along	across
Period (from above):	0.16	0.16
(%NBS)nom from Fig 3.3:		
Note:1 for buildings designed prior to 1976 as public buildings, to code at time, use 1.25		
Note 2: for RC buildings designed between 1976-1984, use 1.2		
Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (1.0)		
Final (%NBS)nom:	**0%**	**0%**

2.2 Near Fault Scaling Factor

Near Fault scaling factor, from NZS1170.5, cl 3.1.6:

	along	across
Near Fault scaling factor (1/N(T,D), **Factor A**:	#DIV/0!	#DIV/0!

2.3 Hazard Scaling Factor

Hazard factor Z for site from AS1170.5, Table 3.3:
Z_{1992}, from NZS4203:1992
Hazard scaling factor, **Factor B**: #DIV/0!

2.4 Return Period Scaling Factor

Building Importance level (from above):
Return Period Scaling factor from Table 3.1, **Factor C**:

2.5 Ductility Scaling Factor

	along	across
Assessed ductility (less than max in Table 3.2)		
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:		
Ductiity Scaling Factor, **Factor D**:	0.00	0.00

2.6 Structural Performance Scaling Factor:

Sp:		
Structural Performance Scaling Factor **Factor E**:	#DIV/0!	#DIV/0!

2.7 Baseline %NBS, (NBS%)b = (%NBS)nom x A x B x C x D x E — **%NBSb:** #DIV/0! — #DIV/0!

Global Critical Structural Weaknesses: (refer to NZSEE IEP Table 3.4)

3.1. Plan Irregularity, factor A: 1
3.2. Vertical irregularity, Factor B: 1
3.3. Short columns, Factor C: 1
3.4. Pounding potential
Pounding effect D1, from Table to right: 1.0
Height Difference effect D2, from Table to right: 1.0
Therefore, Factor D: 1
3.5. Site Characteristics 1

Table for selection of D1	Severe	Significant	Insignificant/none
Separation	0<sep<.005H	.005<sep<.01H	Sep>.01H
Alignment of floors within 20% of H	**0.7**	**0.8**	**1**
Alignment of floors not within 20% of H	**0.4**	**0.7**	**0.8**

Table for Selection of D2	Severe	Significant	Insignificant/none
Separation	0<sep<.005H	.005<sep<.01H	Sep>.01H
Height difference > 4 storeys	0.4	0.7	1
Height difference 2 to 4 storeys	0.7	0.9	1
Height difference < 2 storeys	1	1	1

3.6. Other factors, Factor F

	Along	Across
For ≤ 3 storeys, max value =2.5, otherwise max value =1.5, no minimum		
Rationale for choice of F factor, if not 1		

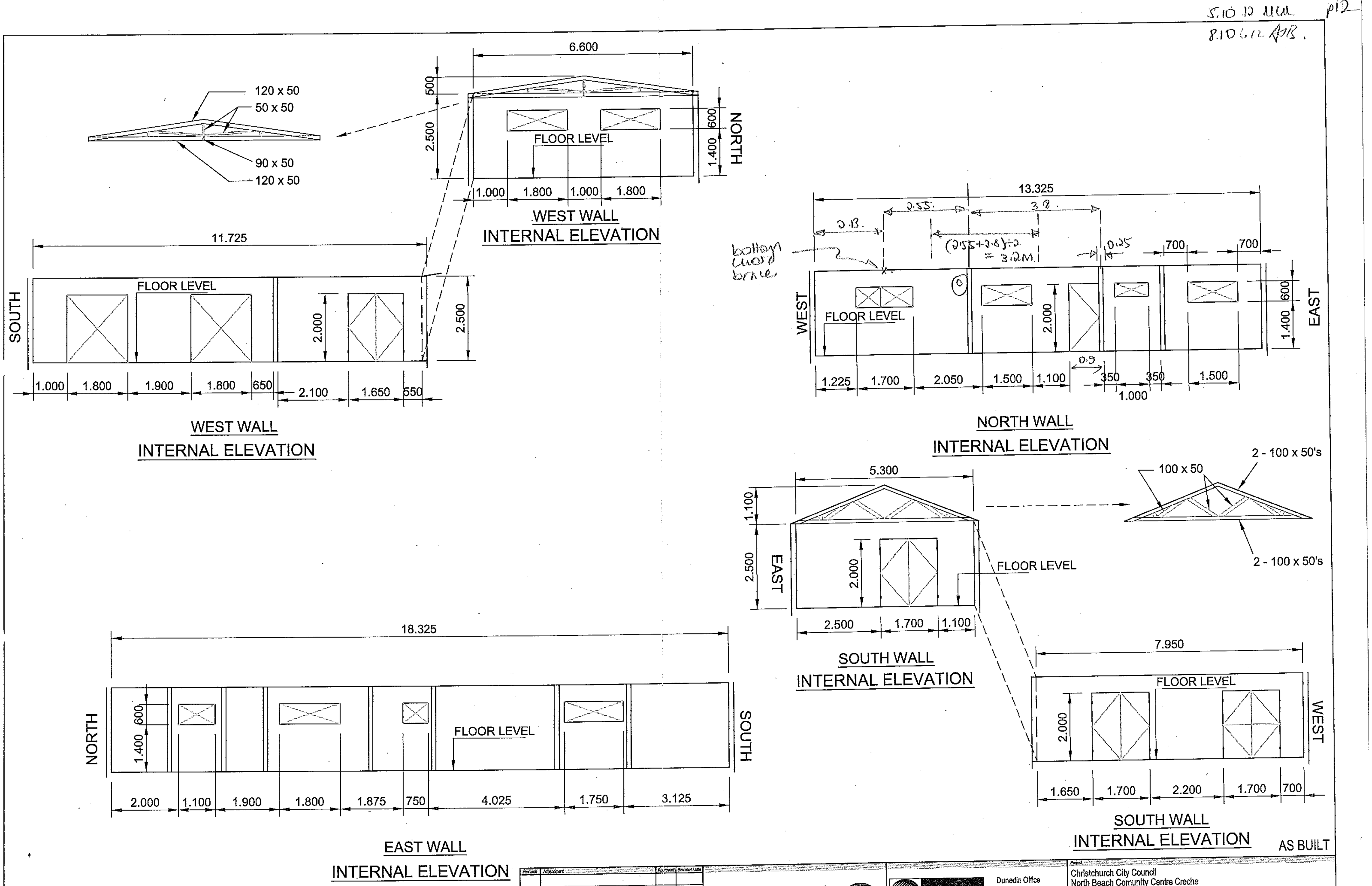
Detail Critical Structural Weaknesses: (refer to DEE Procedure section 6)
List any: — Refer also section 6.3.1 of DEE for discussion of F factor modification for other critical structural weaknesses

3.7. Overall Performance Achievement ratio (PAR) — 0.00 — 0.00

4.3 PAR x (%NBS)b: — PAR x Baseline %NBS: #DIV/0! — #DIV/0!

4.4 Percentage New Building Standard (%NBS), (before) — #DIV/0!

Appendix D – Floor Plan and Wall Elevations



Revision	Amendment	Approved	Revision Date

Christchurch City Council

OPUS

Dunedin Office
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Project: Christchurch City Council
North Beach Comunity Centre Creche
Detailed Engineering Evaluation

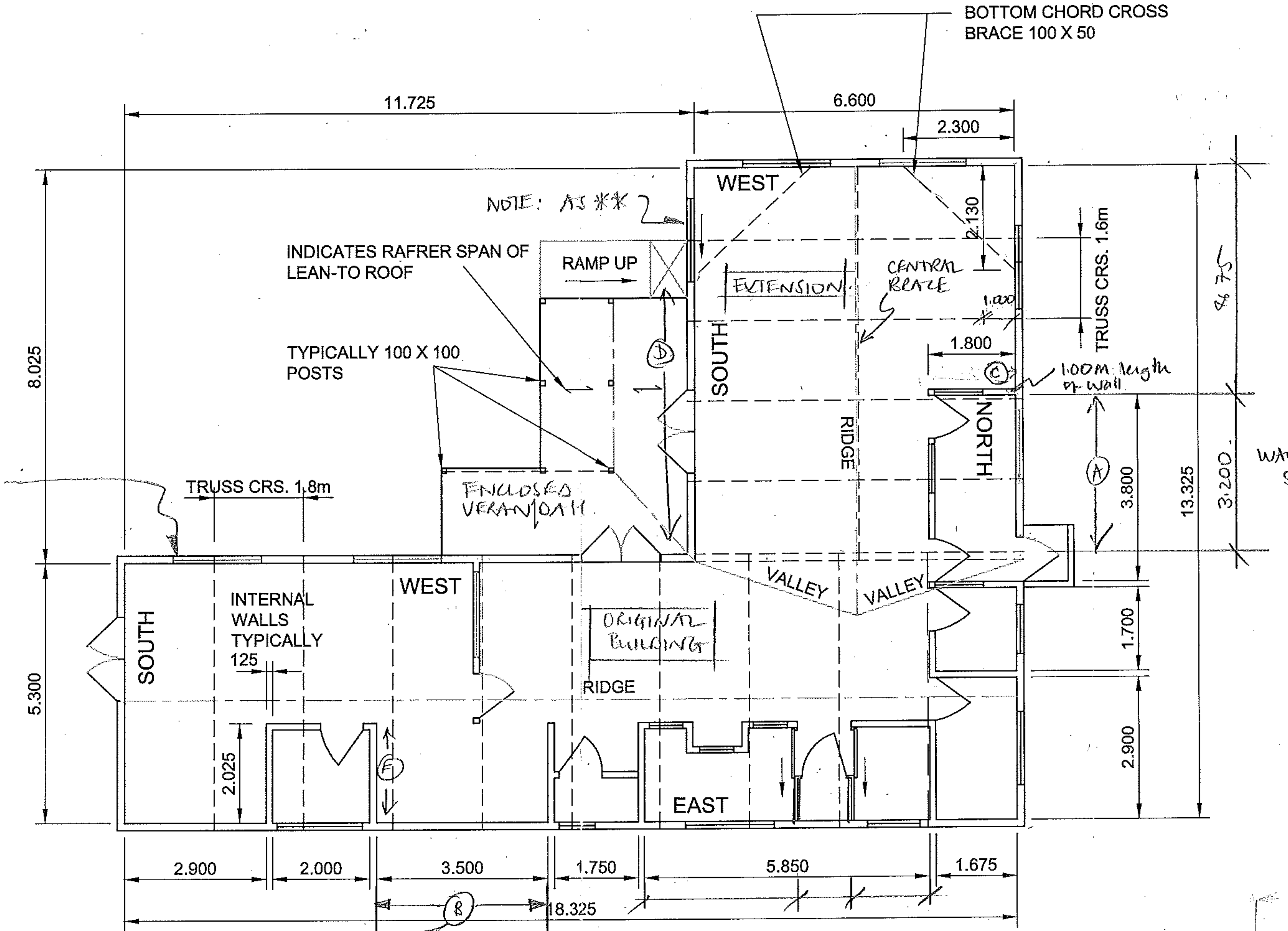
Sheet: Building Elevations

Drawn	Designed	Approved	Revision Date
MM & DW			19-03-2012

Project No	Scale	Drawing No.	Sheet No.	Revision
6-QUCCC.87	1:100 @A3	6/1366/238/6702	2	

1:1 @ A3 0 10 20 30 40 mm

Original Sheet Size A3 [420x297] Plot Date 27/03/12 @ 16:40 g:\christchurch city council\projects\6-qucc.87 north beach community creche\drawings\6-1366_238_6702_1 and 2 measure-up.dwg - 2



WALL PLATE SPAN, AS *.

** NOTE: THE WALL OF THIS ELEVATION HAS NO LATERAL SUPPORT OVER ITS LENGTH, SO IT IS ASSUMED THAT OUT OF PLANE LOADS ARE SUPPORTED BY THE OPPOSITE WALL

* WALL SPAN CONSIDERED AS WORST CASE FOR OUT OF PLANE WALL PLATE CAPACITY CHECK, AS LONGEST SPAN ON THE LATERALLY SUPPORTED ELEVATION.

1.05 x 10"

PLAN

SCALE 1 : 100

AS BUILT

Revision	Amendment	Approved	Revision Date

Christchurch City Council

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Project: Christchurch City Council, North Beach Comunity Centre Creche, Detailed Engineering Evaluation

Sheet: Building plan

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M M & D W			19-03-2012

Project No.	Scale	Drawing No.	Sheet No.	Revision
6-QUCCC.87	1:100 @A3	6/1366/238/6702	1	

1:1 @ A3 0 10 20 30 40 mm

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