Christchurch City Council
BU 0626-001 EQ2
St Albans Crèche
3 Thames St

QUANTITATIVE ASSESSMENT REPORT

FINAL

- Rev B
- 14 December 2012

Christchurch City Council

BU 0626-001 EQ2
St Albans Crèche
3 Thames St

QUANTITATIVE ASSESSMENT REPORT

FINAL

- Rev B
- 14 December 2012

Sinclair Knight Merz
142 Sherborne Street
Saint Albans
PO Box 21011, Edgeware
Christchurch, New Zealand
Tel: +64 3 940 4900
Fax: +64 3 940 4901
Web: www.skmconsulting.com

Contents

Document history and status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
A	28/11/2012	C Paverd	N Calvert	28/11/2012	Draft for Client Approval
B	14/12/2012	N Calvert	N Calvert	14/12/2012	Final Issue

Distribution of copies

Revision	Copy no	Quantity	Issued to
A	1	1	Christchurch City Council
B	1	1	Christchurch City Council

Printed:	14 December 2012
Last saved:	14 December 2012 10:25 AM
File name:	ZB01276.001.BU 0626-001 EQ2.Quantitative.Report.B.docx
Author:	Nigel Chan
Project manager:	Nick Calvert
Name of organisation:	Christchurch City Council
Name of project:	Christchurch City Council Structures Panel
Name of document:	ZB01276.001.BU 0626-001 EQ2.Quantitative.Report.A.docx
Document version:	B
Project number:	ZB01276.001

1. Executive Summary

1.1. Background

A Quantitative Assessment was carried out on the building located at 3 Thames St. The crèche located on this site comprises of two separate structural areas, these are the office and the day care. The offices are located at the north of the property and the day care is located directly adjacent to these to the south and is constructed from timber framing with metal cladding. An aerial photograph illustrating these areas is shown below in Figure 1. The Crèche building is assumed to be of circa 1965 design and construction consisting of steel clad roofing on a light timber framed roof. Walls are light timber framing with lathe and plaster linings providing bracing. The floor system is a timber floor sitting on timber framing supported by internal concrete piles and a concrete perimeter strip footing. Detailed descriptions outlining the buildings age and construction type is given in Section 5 of this report.

▪ **Figure 1 Aerial Photograph of 3 Thames Street**

This Quantitative report for the building structure is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011, visual inspections on 03 April 2012 and 04 April 2012, level survey on 30 August 2012 and intrusive investigations on 31 August 2012, available drawings and calculations.

1.2. Key Damage Observed

Key damage observed includes:-

- Perimeter ring beam cracking and spalling
- Cracking ranging from hairline to 0.6mm
- Lathe and plaster hairline cracking
- Major out of level in the south of the main crèche building

1.3. Critical Structural Weaknesses

- No potential critical structural weaknesses were found

1.4. Indicative Building Strength

As described in the Engineering Advisory Group's "Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings" (from July 2011) we have assessed the percentage of new building standard seismic resistance using the quantitative method. Our assessment included consideration of geotechnical conditions, existing earthquake damage to the building and structural engineering calculations to assess both strength and ductility/resilience.

The assessments were based on the following:

- On-site investigation to assess the extent of existing earthquake damage including limited intrusive investigation.
- Qualitative assessment of critical structural weaknesses (CSWs) based on review of available structural drawings and inspection where drawings were not available.
- A geotechnical investigation has been undertaken, a copy of which is included here as Appendix 2. We have based this report on the geotechnical findings from the report
- Assessment of the strength of the existing structures taking account of the current condition.

Any building that is found to have a seismic capacity less than 33% of the new building standard is required to be strengthened up to a capacity of at least 67%NBS.

Based on the information available, and using the Quantitative Assessment Procedure, the buildings original capacity has been assessed to be in the order of 55%NBS and post earthquake capacity in the order of 55%NBS. No critical structural weaknesses were found in the buildings. This assessment has been made without full structural drawings and is accordingly limited.

The building has been assessed to have a seismic capacity in the order of 55% NBS and is therefore not potentially earthquake prone.

Please note that structural strengthening is required by law for buildings that are confirmed to have a seismic capacity of less than 33% NBS.

1.5. Recommendations

It is recommended that:

a) The current placard status of the building is changed to green 1.

b) We consider that barriers around the building are not necessary.

c) Options to bring the building to a target of 67% are investigated

d) Areas of damage are repaired and the floor is relevelled.

2. Introduction

Sinclair Knight Merz was engaged by Christchurch City Council to carry out a Quantitative Assessment of the seismic performance of St Albans Creche located at 3 Thames St.

The scope of this quantitative analysis includes the following:

- Analysis of the seismic load carrying capacity of the building compared with current seismic loading requirements or New Buildings Standard (NBS). It should be noted that this analysis considers the building in its damaged state where appropriate.
- Identify any critical structural weaknesses which may exist in the building and include these in the assessed %NBS of the structure.
- Preparation of a summary report outlining the areas of concern in the building as well as identifying strengthening concepts to 67%NBS for any areas which have insufficient capacity if the building is found to be an earthquake prone building.

The recommendations from the Engineering Advisory Group[1] were followed to assess the likely performance of the structures in a seismic event relative to the New Building Standard (NBS). 100% NBS is equivalent to the strength of a building that fully complies with current codes. This includes a recent increase of the Christchurch seismic hazard factor from 0.22 to 0.3[2].

This assessment identified that the seismic capacity of the building was likely to be 61% of the New Building Standard (NBS). A quantitative assessment was recommended to confirm the initial assessment findings and to determine a more accurate seismic rating of the building. It also recommended a level survey be carried out on the main crèche building accompanied by intrusive investigation under the building to identify the possible cause of the out of level issues.

At the time of this report a level survey was carried out on 30 August 2012 and an intrusive site investigation in the subfloor and roof space had been carried out on 31 August 2012. Partial Construction drawings for the offices, toilet block and crèche alterations were made available, and these have been considered in our evaluation of the building. The building description below is based on a review of the drawings and our visual inspections.

---

[1] EAG 2011, *Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury - Draft*, p 10
[2] http://www.dbh.govt.nz/seismicity-info

3. Compliance

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

3.1. 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 carry out a full structural survey before the building is re-occupied.

We understand that CERA will 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). It is anticipated that CERA will adopt the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011. This document sets out a methodology for both qualitative and quantitative assessments.

The qualitative assessment is a desk-top and site inspection assessment. It is based on a thorough visual inspection of the building coupled with a review of available documentation such as drawings and specifications. The quantitative assessment involves analytical calculation of the buildings strength and may require non-destructive or destructive material testing, geotechnical testing and intrusive investigation.

It is anticipated that factors determining the extent of evaluation and strengthening level required will include:

- The importance level and occupancy of the building
- The placard status and amount of damage
- The age and structural type of the building

- Consideration of any critical structural weaknesses
- The extent of any earthquake damage

3.2. Building Act

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

3.2.1. 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 any alteration. This effectively means that a building cannot be weakened as a result of an alteration (including partial demolition).

3.2.2. Section 115 – Change of Use

This section requires that the territorial authority (in this case Christchurch City Council (CCC)) be satisfied that the building with a new use complies with the relevant sections of the Building Code 'as near as is reasonably practicable'. Regarding seismic capacity 'as near as reasonably practicable' has previously been interpreted by CCC as achieving a minimum of 67%NBS however where practical achieving 100%NBS is desirable. The New Zealand Society for Earthquake Engineering (NZSEE) recommend a minimum of 67%NBS.

3.2.3. Section 121 – Dangerous Buildings

The definition of dangerous building in the Act was extended by the Canterbury Earthquake (Building Act) Order 2010, and it now defines a building as dangerous if:

- 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
- 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
- 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
- there is a risk that that other property could collapse or otherwise cause injury or death; or
- a territorial authority has not been able to undertake an inspection to determine whether the building is dangerous.

3.2.4. 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 ground shaking 33% of the shaking used to design an equivalent new building.

3.2.5. 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.

3.2.6. Section 131 – Earthquake Prone Building Policy

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

3.3. 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 of the 4th September 2010.

The 2010 amendment includes the following:

- A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;
- A strengthening target level of 67% of a new building for buildings that are Earthquake Prone. Council recognises that it may not be practicable for some repairs to meet that target. The council will work closely with building owners to achieve sensible, safe outcomes;
- A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,
- 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.

We anticipate that any building with a capacity of less than 34%NBS (including consideration of critical structural weaknesses) will need to be strengthened to a target of 67%NBS of new building standard as recommended by the Policy.

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.

3.4. 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.

After the February Earthquake, on 19 May 2011, Compliance Document B1: Structure was amended to include increased seismic design requirements for Canterbury as follows:

a) Hazard Factor increased from 0.22 to 0.3 (36% increase in the basic seismic design load)
b) Serviceability Return Period Factor increased from 0.25 to 0.33 (80% increase in the serviceability design loads when combined with the Hazard Factor increase)

The increase in the above factors has resulted in a reduction in the level of compliance of an existing building relative to a new building despite the capacity of the existing building not changing.

4. 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 new building standard load requirements have been determined in accordance with the current earthquake loading standard (NZS 1170.5:2004 Structural design actions - Earthquake actions - New Zealand).

The likely capacity of this building has been derived in accordance with the New Zealand Society for Earthquake Engineering (NZSEE) guidelines 'Assessment and Improvement of the Structural Performance of Buildings in Earthquakes' (AISPBE), 2006. These guidelines provide an Initial Evaluation Procedure that assesses a buildings capacity based on a comparison of loading codes from when the building was designed and currently. It is a quick high-level procedure that can be used when undertaking a Qualitative analysis of a building. The guidelines also provide guidance on calculating a modified Ultimate Limit State capacity of the building which is much more accurate and can be used when undertaking a Quantitative analysis.

The New Zealand Society for Earthquake Engineering has proposed a way for classifying earthquake risk for existing buildings in terms of %NBS and this is shown in Figure 2 below.

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

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

Table 1 below provides an indication of the risk of failure for an existing building with a given percentage NBS, relative to the risk of failure for a new building that has been designed to meet current Building Code criteria (the annual probability of exceedance specified by current earthquake design standards for a building of 'normal' importance is 1/500, or 0.2% in the next year, which is equivalent to 10% probability of exceedance in the next 50 years).

.

- **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

5. Building Details

Our evaluation was based on visual and intrusive inspections, our site sketches and the original building drawings of the additions and alterations dated; April 1991 by Harding Consulting Engineers LTD (Internal renovations and wall removal), March 1998 by Gang Nail Group LTD, November 1992 drawn by DesignDraft. The structural drawings show most of the structural members, their materials and the rigor of the detailing.

5.1. Building description

Crèche

The building is a 1950's-1960's light timber framed structure originally constructed as a residential property. The foundations consist of a concrete perimeter ring beam with concrete piles supporting the internal joists. Externally the building has an approximately 25mm stucco cladding. The roof structure consists of light timber framing, timber rafters and light steel cladding. From available drawings dated 1991, alterations were carried out to open internal areas in the early 90's by removing internal dividing walls and supporting roof loads on new roof beams. A light timber framed ablution block has also been added to the structure during the early 90's. The internal lining of the structure is lathe and plaster throughout the original structure and plasterboard within the ablution block. The ablution block has a slab on grade foundation.

Offices

The office building was constructed after 2000 and is a single storey light timber framed Versatile garage. The foundation consists of a concrete slab on grade, external cladding is light steel. The roof is light steel cladding on a timber frame. Bracing is provided via two systems. The southern half of the structure is used as an office and has a GIB lining; the northern half used as storage is braced using Tensioned multi-brace.

5.2. Gravity Load Resisting system

Crèche

The Timber framed roof is supported by the original internal timber framed walls, where internal walls were removed to open the crèches main area roof beams were designed by Harding Consulting Engineers Ltd. The foundation consists of a perimeter ring beam and internal concrete piles for the original building and a slab on grade for the ablution block.

Offices

The offices and storage room consist of a timber truss roof supported by external timber framed walls. The foundation has been designed for habitable use and consists of a concrete floor slab on a concrete slab foundation on grade separated with a vapour barrier.

5.3. Seismic Load Resisting system

Crèche

Roof loads are transferred to supporting shear walls through the timber roof diaphragm and lathe and plaster ceiling. Additional roof bracing has been specified in the available drawings for the large eastern room roof. Lateral load is carried to the floor diaphragm by the internal lathe and plaster cladding. Load transfer to the ground is by floor diaphragm to cantilever action of the concrete piles internally and sliding resistance of the perimeter ring beam

Offices

The lateral loads from roof down are transferred through diagonal Multi-Brace bracing to the external timber framed walls. Lateral load is transferred through the walls via internal cladding in the offices as well as through diagonal Multi Brace strapping to the concrete slab on grade.

5.4. Building Damage

SKM undertook visual inspections on the following dates 03 April 2012 and 04 April 2012. A level survey was carried out by City Care on 30 April 2012 and an intrusive investigation in the subfloor and roof space on 31 April 2012.

The following areas of damage were observed during the inspections:

External

1) Cracking/ spalling to the foundation perimeter ring beam typically at building corners or ventilation points approx 1mm cracking photo 18 and >2mm cracking photo 16. Refer to Photo 13, Photo 14, Photo 15, Photo 16, Photo 17, Photo 18, Photo 19, Photo 20.

2) Vertical cracking $\leq$ 0.3mm to the exterior stucco, typical at the points where external and internal framing meet. Refer to Photo 6, Photo 7, Photo 8, Photo 9, Photo 10, Photo 11, Photo 12, Photo 21, Photo 23, Photo 24.

Internal

3) Cracking to lathe and plaster wall and ceiling linings with instances of spalling. Refer to Photo 28.

4) The internal piles and the perimeter foundation supporting the floor have settled in varying amounts causing the floor to be out of level. The slopes in the floor were measured to be between 0.5% -2% in most areas with the south most room having the greatest slope of 3%. This is outside the criteria outlined in the "Department of Building and Housing, Revised guidance on repairing and rebuilding houses affected by the Canterbury earthquake sequence". All piles and bearers were visually confirmed to have adequate connection and hence it is not believed that there is any risk of bearers falling off piles.

6. Available Information and Assumptions

6.1. Available Information

Following our inspections on the 03 April 2012 and 04 April 2012, and intrusive investigations on 31 August 2012, SKM carried out a seismic review on the structures. This review was undertaken using the available information which was as follows:

- April 1991 by Harding Consulting Engineers LTD (Internal renovations and wall removal)
- November 1992 drawn by DesignDraft (Addition of ablution block)
- March 1998 by Gang Nail Group LTD (Office)
- SKM site measurements and inspection findings.

6.2. Survey

A level survey was carried out on 31 August 2012 by City Care.

6.3. Design Criteria and Assumptions

The following design criteria and assumptions made in undertaking the assessment include:

- The building was built according to the drawings and according to good practice at the time. We have reviewed the building and from our visual inspection the structure appears to be built in accordance with the drawings.
- The soil on site is class D as described in AS/NZS1170.5:2004, Clause 3.1.3, Soft Soil. The ultimate bearing capacity is greater than 300kPa beyond 1.0 mbgl. The soils beneath the foundations are considered to lie outside the definition of "good ground" due to moderate to severe liquefaction risk at the site.
- Standard design criteria for typical office and factory buildings as described in AS/NZS1170.0:2002:
  - 50 year design life, which is the default NZ Building Code design life.
  - Structure Importance Level 2. This level of importance is described as 'normal' with medium or considerable consequence for loss of human life, or considerable economic, social or environmental consequence of failure.
- The building has a short period less than 0.4 seconds.
- Site hazard factor, Z = 0.3, NZBC, Clause B1 Structure, Amendment 11 effective from 1 August 2011
- The seismic demand of the building was calculated using NZS3604, using a floor loading of 3kPa.

- The concrete piles have been assumed to have shallow concrete footings. The dimensions assumed have been taken from past experience of similar buildings
- The perimeter concrete foundation has been assumed to be nominally reinforced with 150x500 dimensions
- The following material properties were used in the analyses:
- **Table 2: Material Properties**

Material	Material Property
Tongue and Groove floor diaphragm	Diaphragm capacity = 4.2 kN/m
Friction angle of Soil	φ = 30º
Unit weight of soil	γ = 17kN/m3
Lathe and Plaster internal lining	Shear capacity = 55Bu/m

The detailed engineering analysis is a post construction evaluation therefore it has the following limitations:

- It is not likely to pick up on any concealed construction errors (if they exist)
- Other possible issues that could affect the performance of the building such as corrosion and modifications to the structure will not be identified unless they are visible and have been specifically mentioned in this report.
- The detailed engineering evaluation deals only with the structural aspects of the structure. Other aspects such as building services are not covered.

6.4. The Detailed Engineering Evaluation (DEE) process

The DEE is a procedure written by the Department of Building and Housing's Engineering Advisory Group and grades buildings according to their likely performance in a seismic event. The procedure is not yet recognised by the NZ Building Code but is widely used and recognised by the Christchurch City Council as the preferred method for preliminary seismic investigations of buildings[3].

The procedure of the DEE is as follows:

1) Qualitative assessment procedure

[3] http://resources.ccc.govt.nz/files/EarthquakeProneDangerousAndInsanitaryBuildingsPolicy2010.pdf

a. Determine the building's status following any rapid assessment that have been done
b. Review any existing documentation that is available. This will give the engineer an understanding of how the building is expected to behave. If no documentation is available, site measurements may be required
c. Review the foundations and any geotechnical information available. This will include determining the zoning of the land and the likely soil behaviour, a site investigation may be required
d. Investigate possible Critical Structural Weaknesses (CSW) or collapse hazards
e. Assess the original and post earthquake strength of the building (this assessment is subsequently superseded by the quantitative assessment)

2) Quantitative procedure

a. Carry out a geotechnical investigation if required by the qualitative assessment
b. Analyse the building according to current building codes and standards. Analysis accounts for damage to the building.

The DEE assessment ranks buildings according to how well they are likely to perform relative to a new building designed to current earthquake standards, as shown in Table 3. The building rank is indicated by the percent of the required New Building Standard (%NBS) strength that the building is considered to have. Earthquake prone buildings are defined as having less than 34 %NBS strength which correlates to an increased risk of approximately 20 times that of 100% NBS[4]. Buildings that are identified to be earthquake prone are required by law to be strengthened within 30 years of the owner being notified that the building is potentially earthquake prone[5]. This timeframe is likely to be adjusted by CERA and Table 6 below contains the likely new recommendations.

[4] NZSEE 2006, *Assessment and Improvement of the Structural Performance of Buildings in Earthquakes*, p 2-2
[5] http://resources.ccc.govt.nz/files/EarthquakeProneDangerousAndInsanitaryBuildingsPolicy2010.pdf

- **Table 3: DEE Risk classifications**

Description	Grade	Risk	%NBS	Structural performance
Low risk building	A+	Low	> 100	Acceptable. Improvement may be desirable.
	A		100 to 80	
	B		80 to 67	
Moderate risk building	C	Moderate	67 to 33	Acceptable legally. Improvement recommended.
High risk building	D	High	33 to 20	Unacceptable. Improvement required.
	E		< 20	

The DEE method rates buildings based on the plans (if available) and other information known about the building and some more subjective parameters associated with how the building is detailed and so it is possible that %NBS derived from different engineers may differ.

This assessment describes only the likely seismic Ultimate Limit State (ULS) performance of the building. The ULS is the level of earthquake that can be resisted by the building without catastrophic failure. The DEE does also consider Serviceability Limit State (SLS) performance of the building and or the level of earthquake that would start to cause damage to the building but this result is secondary to the ULS performance.

The NZ Building Code describes that the relevant codes for determining %NBS are primarily:

- AS/NZS 1170 Structural Design Actions
- NZS 3101:2006 Concrete Structures Standard
- NZS 3404:1997 Steel Structures Standard
- NZS4230:2004 Design of Reinforced Concrete Masonry Structures
- NZS 3603:1993 Timber Structures Standard
- NZS 3604:2011 Timber Framed Buildings

7. Results and Discussions

7.1. Critical Structural Weaknesses

The building has no critical structural weaknesses

7.2. Analysis Results

The equivalent static force method was used to analyse the seismic capacity of the building. The results of the analysis are reported in the following table as %NBS. The results below are calculated for the building in its damaged state. The building results have been broken down into their seismic resisting elements.

(%NBS = probable strength / new building standards)

Table 4: DEE Results

Seismic Resisting Element	Action	Seismic Rating %NBS
Creche subfloor – Transverse	Shear	55%
Crèche Lateral Walls – Longitudinal	Shear	61%
Office - Multibrace	Axial	96%
Crèche Lateral Walls – Transverse	Shear	73%
Creche subfloor – Longitudinal	Shear	100%

7.3. Recommendations

The quantitative assessment carried out on the St Albans Crèche indicates that the building has a seismic capacity between 33% and 67% of NBS and is therefore classed as being in the category of 'Moderate Risk Building'.

It is recommended the building be strengthened to a target of at 67%

8. Conclusion

SKM carried out a quantitative assessment on St Albans Creche located at 3 Thames Street. This assessment concluded that the building is classified not Earthquake Prone.

- **Table 5: Quantitative assessment summary**

Description	Grade	Risk	%NBS	Structural Performance
Crèche	C	Moderate	55	Acceptable legally, Improvement recommended
Office	A	Low	96	Acceptable, Improvement may be desirable

Strengthening is recommended on the Crèche building to bring the seismic capacity up to at a minimum of 67% of NBS.

It is recommended that:

a) The current placard status of the building is changed to green 1, this is due to the fact that there is adequate connection between piles and bearers and as such collapse is unlikely.
b) We consider that barriers around the building are not necessary.
c) Options to bring the building to a target of 67% are investigated
d) Areas of damage are repaired and the floor is relevelled.

9. Limitation Statement

This report has been prepared on behalf of, and for the exclusive use of, SKM's client, and is subject to, and issued in accordance with, the provisions of the contract between SKM and the Client. It is not possible to make a proper assessment of this report without a clear understanding of the terms of engagement under which it has been prepared, including the scope of the instructions and directions given to, and the assumptions made by, SKM. The report may not address issues which would need to be considered for another party if that party's particular circumstances, requirements and experience were known and, further, may make assumptions about matters of which a third party is not aware. No responsibility or liability to any third party is accepted for any loss or damage whatsoever arising out of the use of or reliance on this report by any third party.

Without limiting any of the above, in the event of any liability, SKM's liability, whether under the law of contract, tort, statute, equity or otherwise, is limited in as set out in the terms of the engagement with the Client.

It is not within SKM's scope or responsibility to identify the presence of asbestos, nor the responsibility of SKM to identify possible sources of asbestos. Therefore for any property pre-dating 1989, the presence of asbestos materials should be considered when costing remedial measures or possible demolition.

Should there be any further significant earthquake event, of a magnitude 5 or greater, it will be necessary to conduct a follow-up investigation, as the observations, conclusions and recommendations of this report may no longer apply Earthquake of a lower magnitude may also cause damage, and SKM should be advised immediately if further damage is visible or suspected.

10. Appendix 1 – Photos

Photo 1: Creche (north end)– Timber framed building approximately 1950's-1960s Construction. 1990's Ablution block to the right of the photo

Photo 2: Offices – late 1990's to early 2000's construction. The versatile garage was purposely built and divided to have an office to the south (left of shot) and storage in the north.

Photo 3: Creche South face

Photo 4: West side looking South along the creche

	
Photo 5: West side looking North along Creche to offices	Photo 6: Typical cracking in stucco cladding, approx 0.5mm or less
	
Photo 7: One of the larger exterior cladding cracks	Photo 8:Approximately 0.6mm

Photo 9: Cladding damage at the South east entry

Photo 10: Cracking approx 0.3mm

Photo 11: South west corner damage

Photo 12: Close up of the displace section of Stucco cladding

Photo 13: Cracking and spalling typical at foundation ventilation points

Photo 14: close up of perimeter ring beam damage

Photo 15: Cracking to the perimeter ringbeam south east corner

Photo 16: Full depth cracking throughthe perimeter ringbeam with approx 150 x 150 mm spalled area of covering plaster

	
Photo 17: Further damage on the south face of the South east corner ring beam	Photo 18: Potentially full depth cracking. Spalling of the plaster finishing
	
Photo 19: Photo of south wall perimeter ring beam showing plaster layer on concrete	Photo 20: Detail of perimeter ring beam

Photo 21: Typical cracking seen around wall penetrations

Photo 22: Damage to the roof flashing, unlikely to be EQ damage

Photo 23: Vertical cracking typical around the building where internal timber framing is at a junction with exterior

Photo 24: Cracking hairline – 0.3mm typically

Photo 25: Main creche open area, severe settlement of the carpeted area

Photo 26: Open area of wall showing lathe and plaster bracing

Photo 27: Roof opening showing lathe and plaster ceiling system

Photo 28: Typical damage to the lathe and plaster wall also seen in the ceiling lathe and plaster

	
Photo 29: Distinct slope in the floor of the large eastern room. Room dips predominantly towards the south.	Photo 30: Room appears to bowl centred on the south wall of the main eastern room
	
Photo 31: Estimating the slop using a spirit level	Photo 32: Approximate 2% slope

Photo 33: Southern room dips to the north

Photo 34: Severe dip to the North

Photo 35: slope not approximated onsite but likely greater than 2% when compared to Photo 31

Photo 36: Office and storage building

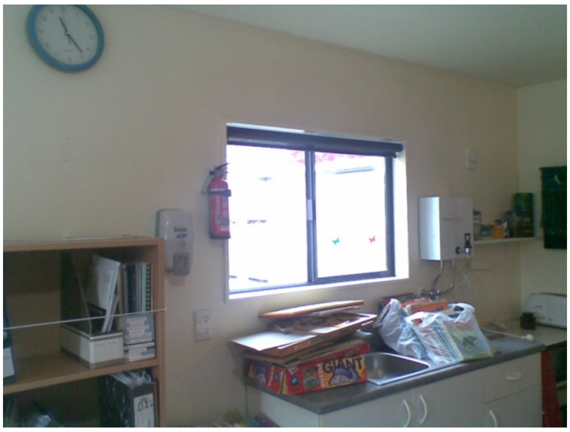


Photo 37: Office is approx 10 years old and showed little sign of damage with no noticable separation of GIB linings along joins or cracking	Photo 38: Storage area exposed roofing and bracing. Bracing appeared taught indicating low or no yielding
	
Photo 39: Detail of roof apex	Photo 40: No damage to the timber trusses was observed

	
Photo 41: View of the Creche Subfloor	Photo 42: View of Creche roof space

11. Appendix 2 – SKM Quantitative Geotechnical Interpretive Report

Christchurch City Council
BU 0626-001 EQ2
St Albans Crèche
3 Thames St

GEOTECHNICAL INTERPRETIVE REPORT

DRAFT

- Rev A
- 15 November 2012

Christchurch City Council
BU 0626-001 EQ2
St Albans Crèche
3 Thames St

GEOTECHNICAL INTERPRETIVE REPORT

DRAFT

- Rev A
- November 12

Sinclair Knight Merz
142 Sherborne Street
St Albans
PO Box 21011, Edgeware
Christchurch, New Zealand
Tel: +64 3 940 4900
Fax: +64 3 940 4901
Web: www.globalskm.com

Contents

Document history and status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
A	15/11/2012	J Seward	N Calvert	15/11/2012	Draft for client approval

Distribution of copies

Revision	Copy no	Quantity	Issued to
A	1	1	Christchurch City Council

Printed:	15 November 2012
Last saved:	15 November 2012 04:28 p.m.
File name:	ZB01276.001_Quantitative_GIR.docx
Author:	David Bae
Project manager:	Nick Calvert
Name of organisation:	Christchurch City Council
Name of project:	St Albans Crèche
Name of document:	Geotechnical Interpretive Report
Document version:	A
Project number:	ZB01276.001

1. Introduction

SKM has been commissioned by Christchurch City Council to provide a Quantitative Detailed Engineering Evaluation (DEE) for the property at 3 Thames Street.

A site specific geotechnical investigation has been undertaken as part of the evaluation to provide a quantitative assessment of the static foundation bearing capacity and a basic visual assessment of liquefaction potential.

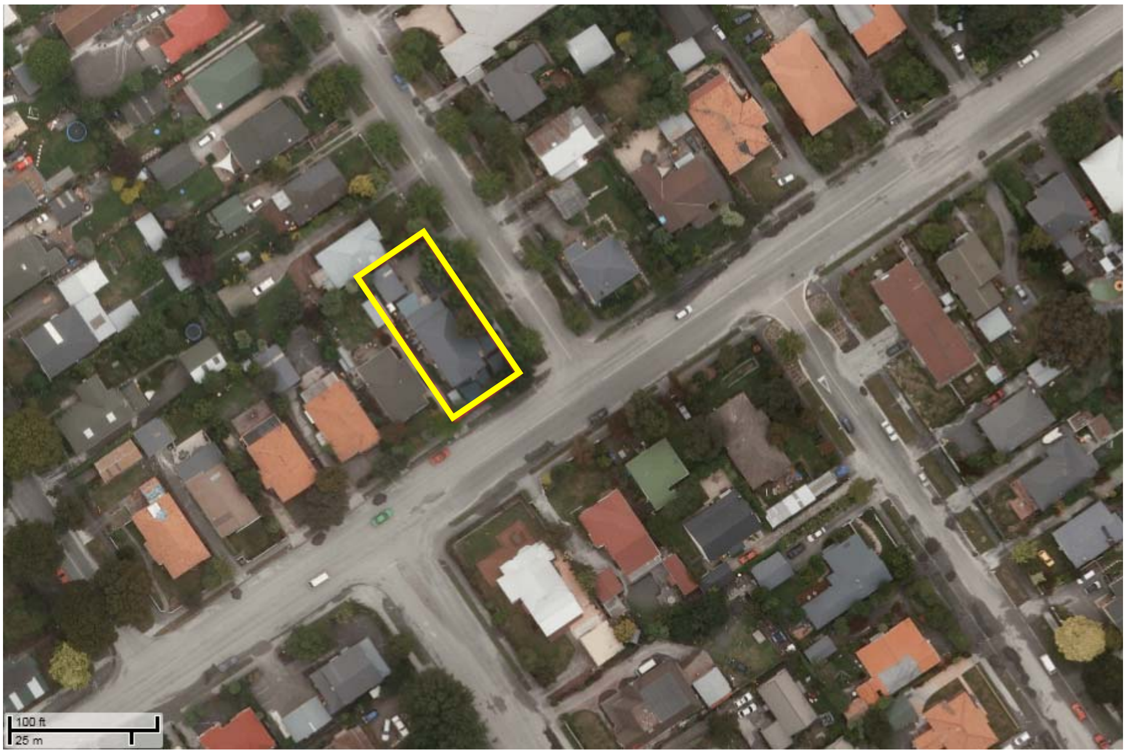
The scope of geotechnical works comprised the following:

- Undertake subsurface investigations involving three hand-auger boreholes and dynamic cone penetrometer (DCP) tests to a depth of 3 m
- Assessment of aerial photography
- Assessment of static bearing capacity
- Preparation of an interpretive report identifying shallow ground conditions at the site

2. Site description

The site is located at 3 Thames Street, St Albans, to the north of Christchurch Central. The site has relatively flat topography at approximately 7 metres above sea level (masl). The Department of Building and Housing (DBH) technical category is TC2.

The site comprises two separate buildings, the main Crèche building and the office. Both buildings are a single storey structure and utilise timber framing for the walls, floor and roof. The main Crèche building suffered some differential settlement as a result of the Canterbury earthquake and as a consequence will require re-levelling.



- **Figure 1: Aerial photograph of the site, Thames Street, St Albans (north upwards). Site marked in yellow.**

3. Existing geotechnical information

3.1. Investigation by third parties

A desk study of available information and selected logs in the area from Project Orbit Database identified three bore logs in the vicinity of the site (<210 m) with depths ranging from 6 m to 9 m. Based on the data obtained subsurface material generally consists of clay and clayey silt to a depth of 3 m, overlying sand and silty sand with possible sandy gravel. These records have been used to supplement our recent investigation data for the geotechnical assessment of the site.

3.2. Regional geology

The 1:25,000 geological map of the Christchurch urban area (Brown and Weeber, 1992) indicates that the site is predominantly underlain by alluvial sand and silt overbank deposits of the Springston Formation.

4. Geotechnical investigation

4.1. General

The ground investigation was carried out on 11 September 2012. It comprised three hand-auger boreholes including shear vane tests with follow on DCP tests adjacent to the boreholes.

A Geotechnical Engineer from SKM was onsite and logged the soil samples obtained in accordance with New Zealand Geotechnical Society (NZGS) guidelines.

The hand-auger boreholes were drilled to a maximum depth of 3 m in targeted locations in order to give a good representation of the subsurface conditions. The locations of the boreholes and DCP tests are shown on the site plan in Appendix A, and the logs of the core samples can be found in Appendix B. The DCP test results are shown on the logs.

4.1.1. Geological model

Ground conditions encountered were generally consistent across the site comprising:

- **Table 1 – Geological Ground Model**

Depth range (mBLG)	Soil type
0 – 0.2	Topsoil
0.2 – 0.8	Silty sand / Silt
0.8 – 1.6	Sandy silt / Silt with minor clay
1.6 – 3.0	Silt with some clay / Clayey silt

Based on the materials obtained the soil profile is consistent with the geological map of the area.

4.2. Groundwater observations

The water table was encountered in all three hand-augers ranging from 0.95 m to 1.14 m below ground level (mbgl).

5. Geotechnical Considerations

5.1. Seismic site subsoil class

The scope of ground investigation was limited to a shallow depth of 3 m; therefore, the site has been evaluated as NZS1170.5 Class D (deep or soft soils) based on estimates of the depth to underlying rock from published data..

5.2. Liquefaction

Aerial photography taken after the 22 Feb 2011 event indicates significant evidence of liquefied material ejected at surface around the site, particularly to the south and east of the site. A relative level survey of the building was completed on 30 August 2012 which shows a differential settlement of up to 112 mm.

Based purely on visual evidence liquefaction risk is expected to be moderate to severe at this site. The clayey silt layer near the surface is unlikely to be susceptible to liquefaction; however, the high groundwater table combined with the sand layers inferred to be underlying the site pose a risk of liquefaction.

5.3. Lateral spread

Due to the distance (> 1km) from any unrestricted boundaries (i.e. river or water body) the site is assumed to be at negligible risk for lateral spreading movement.

5.4. Geotechnical parameters

This section provides the geotechnical parameters adopted for a quantitative DEE. The parameters are based on empirical correlations and in-situ test results.

- **Table 2 – Geotechnical Parameters**

Material	Depth (mbgl)	DCP blow counts per 50 mm penetration[1]	Peak undrained shear strength, S_u (kPa)	Effective Angle of Internal Friction (Degrees) [2]	Relative Density (%) [3]
Sandy SILT	0.15 – 0.8	1 (0-2)	180	28-30	15
Sandy SILT / SILT	0.8 – 1.6	2 (0-3)	150 (38-170)	28-30	43
SILT / Clayey SILT	1.6 – 3.0	4 (2-7)	160 (132-205)	28-30	70

Notes: (1) First value is typical, second (in round brackets) is range
(2) Parameters estimated from relative density values, published data – Meyerhoff G.G (1956)
(3) Parameters estimated from DCP blow counts, published data – NZGS guidelines (2005)

These values are based on site conditions at the time of the investigation. BH1 indicates a slightly different profile than, BH2 and BH3 as may indicate either fill or slight changes in ground conditions. BH2 and BH3 are assumed to represent the typical shallow ground conditions beneath the site.

5.5. Foundation capacity

Based on the qualitative structural assessment (SKM, 7/5/12), the foundation systems consist of a concrete perimeter strip footing with internal timber piles for the main Crèche building, whereas the office building is supported a slab on grade or raft foundation.

The existing foundation drawings are limited to the toilet block and the storage room which show a strip footing approximately 0.2 m wide and 0.3 m deep with a slab on grade flooring system.

The bearing capacity of the soils under the foundations has been assessed using the chart correlating the penetration rate of dynamic cone penetrometer with allowable bearing capacity (M.J. Stockwell, 1977). In order to estimate the ultimate bearing capacity a factor three has been applied to the allowable capacity, and the results are shown in table 3. An appropriate soil strength reduction factor of 0.5 should be used for the assessment of the limit state bearing capacity.

- **Table 3 – Ultimate bearing capacity of the soil**

Depth range (mBLG)	Estimated ultimate bearing capacity (kPa)
0.15 – 1.0	<300
1.0 – 1.6	390
1.6 – 3.0	600

The very stiff silt layer indicated in two of the boreholes at the site provides an ultimate bearing capacity greater than 300 kPa from 1.0 m depth and would satisfy the requirement of ‘good ground’ in terms of bearing capacity as described in New Zealand Standard 3604:2011 (Timber-framed Buildings);

However, the modification to the definition of “good ground” made for the Canterbury Earthquake Region excludes ground where liquefaction and/or lateral spread could occur. Since the site is located in the Technical Category 2 area where it may be subject to land damage from liquefaction in future significant earthquakes, the soils immediately beneath the site are considered to lie outside the definition of “good ground”. Foundations where ‘good ground’ has not been established need to be subject to specific engineering design.

Given the type and size of the structure, foundation repairs or rebuild could be carried out in accordance with the DBH guidelines, "*Revised guidance on repairing and rebuilding houses affected by the Canterbury earthquake sequence*". Based on a common empirical rule that differential settlement is equal to about one-half of the maximum calculated settlement, current damage to the foundations would be greater than implied by the TC2 categorisation (i.e. greater than 100 mm overall liquefaction-induced settlement). However this is strictly a rough approximation; therefore the foundation technical category should be confirmed by undertaking either an absolute level survey or a deep geotechnical site investigation before repair or replacement options for foundations should be considered.

If the foundation category is confirmed to be TC3, specific engineering design would be required for repairing and rebuilding the existing foundations whereas in the case of TC2, it is recommended to apply repair or rebuild approaches outlined for TC2 in the DBH guidelines.

6. Conclusions

- Shallow ground investigation consisting of three hand-auger boreholes and Dynamic Cone Penetrometer tests confirmed the site to be underlain by topsoil to approximately 0.15 m, overlying silty sand to clayey silt to a target depth of 3.0 m.
- Groundwater table was encountered in all three hand-auger boreholes which ranged from 0.95 m to 1.14 mbgl.
- The stiff silt layer at the site provides a geotechnical ultimate bearing capacity greater than 300 kPa from 1.0 m depth; however, the soils under the foundations are considered to lie outside the definition of "good ground" due to a moderate to severe liquefaction risk at the site.
- It is believed that the site in its current state is susceptible to varying degrees of seismically induced liquefaction in a future earthquake event; therefore, irrespective of the bearing capacity of the soils at the site, based upon the results of the DCP testing, the site does not comply with the intent of the "good ground" definition in the NZS3604:2011.
- Subsequently, foundations need to be subject to specific engineering design which may be based on the DBH guidelines, "*Revised guidance on repairing and rebuilding houses affected by the Canterbury earthquake sequence*". Before repair or replacement options for foundations can be considered, the site's technical category should be confirmed by undertaking either an absolute level survey or a detailed geotechnical site investigation including CPT.

7. Limitations

This report was prepared to provide a quantitative assessment of the static foundation bearing capacity relating to the specific site in accordance with the scope of works as defined in the contract between SKM and our Client. Data or opinions contained within the report may not be used in other contexts or for any other purposes without our prior review and agreement.

This report does not purport to completely describe all the site characteristics and properties. The nature of the ground has been inferred using experience and judgement and it must be appreciated that actual conditions could vary from those described herein.

We request the opportunity to review our interpretations during further investigation or construction if the exposed site conditions are significantly different from those interpreted in this report.

This report has been prepared on behalf of, and for the exclusive use of, SKM's client, and is subject to, and issued in accordance with, the provisions of the contract between SKM and the Client. It is not possible to make a proper assessment of this report without a clear understanding of the terms of engagement under which it has been prepared, including the scope of the instructions and directions given to, and the assumptions made by, SKM. The report may not address issues which would need to be considered for another party if that party's particular circumstances, requirements and experience were known and, further, may make assumptions about matters of which a third party is not aware. No responsibility or liability to any third party is accepted for any loss or damage whatsoever arising out of the use of or reliance on this report by any third party.

Without limiting any of the above, in the event of any liability, SKM's liability, whether under the law of contract, tort, statute, equity or otherwise, is limited in as set out in the terms of the engagement with the Client.

It is not within SKM's scope or responsibility to identify the presence of asbestos, nor the responsibility of SKM to identify possible sources of asbestos. Therefore for any property pre-dating 1989, the presence of asbestos materials should be considered when costing remedial measures or possible demolition.

Should there be any further significant earthquake event, of a magnitude 5 or greater, it will be necessary to conduct a follow-up investigation, as the observations, conclusions and recommendations of this report may no longer apply Earthquake of a lower magnitude may also cause damage, and SKM should be advised immediately if further damage is visible or suspected.

8. References

Brown LJ and Weeber JH. 1992: Geology of the Christchurch Urban Area. Scale 1:25,000. Institute of Geological and Nuclear Sciences geological map1. 1 sheet + 104 p. Institute of Geological and Nuclear Sciences Ltd, Lower Hutt, New Zealand.

Meyerhof, G. G. 1956. Penetration tests and bearing capacity of cohesionless soils. JSMFD, ASCE, vol. 82, SM1, Jan pp.1-19.

New Zealand Geotechnical Society, 2005. *Guidelines for the Field Classification and Description of Soil and Rock for Engineering Purposes*.

Stockwell, M.J. 1977. Determination of Allowable Bearing Pressures Under Small Structures. New Zealand Engineering (32:6). Wellington, New Zealand. 15 June, 1977.

Terzaghi et al. 1996, Soil Mechanics in Engineering Practice, 3rd Edition, Jon Wiley & Sons Inc., New York.

Appendix A Site Plan


NOTES:
- Not to scale
- Positions are approximate only and plotted on aerial photographs taken after the 22 Feb 2011 event
HAND-AUGER BOREHOLE LOCATION
3 Thames St, Christchurch
Date: 14/09/12
BY: DB
PROJECT#: ZB01276.001
BH1
BH2
BH3
Thames St
Westminster St
N

Appendix B Borehole Logs

SKM

Preliminary Log of Investigation

Project: **CCC - Structural Enineering Service**

Location: **3 Thames St** Project No: **ZB01276.001**

Hole ID: **1**

Client: **Christchurch City Council**

Date: **11/09/2012**

R.L. (m)	Depth (m)	Drilling Method	In-Situ Testing	Sampling	DCP (Blows per Drive)	Geology Legend	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
	0.0							TOPSOIL: Fine to medium SAND with trace gravel, dark brown. Moist; gravel is fine to coarse. **(Topsoil)**	R	
	0.15							Silty fine to medium SAND, light brown. Loose, moist. **(Springston Formation)**	Spy	
	0.5							*0.40m: with trace silt*		
								0.70m: wet		
								0.70m: with some silt		
	1.0		$I_{vp}38/I_{vr}10$				1	Sandy SILT, light brown mottled orange. Firm, wet, non-plastic; sand is fine to medium. **(Springston Formation)**	Spy	
								1.00m: saturated		
	1.5		$I_{vp}160/I_{vr}63$					SILT with minor clay, light grey mottled orange. Very stiff, wet, low plasticity. **(Springston Formation)**	Spy	
								Clayey SILT, light grey. Very stiff, wet, low plasticity. **(Springston Formation)**	Spy	
								1.80m to 1.85m: with some wood fragments		
	2.0		$I_{vp}146/I_{vr}59$							
	2.5		$I_{vp}174/I_{vr}70$							
	3.0		$I_{vp}205/I_{vr}66$							

1 terminated at 3.00m. Target Depth

Started: 11/09/2012

Finished: 11/09/2012

Driller:

Plant:

Logged: DB

Checked: ME

Depth Related Remarks

From	Remarks

Groundwater Observations

No.	Struck (m)	Date	Observations	Standing (m)
1.	1m		After rods removed.	

Remarks

(1) Co-ordinates derived from aerial photos (NZTM). (2) Shear vane calibration due 10/8/12. (3) Backfilled with in-situ soil.

Co-ordinates:
5183083.30mN
1570830.90mE

Inclination: -90°

Preliminary Log of Investigation

Project: CCC - Structural Enineering Service

Location: 3 Thames St | **Project No:** ZB01276.001 | **Hole ID:** 2

Client: Christchurch City Council | **Date:** 11/09/2012

Depth (m)	In-Situ Testing	Description of Strata	Geological Unit
0.0		SILT with minor sand, dark brown. Very stiff, moist, non-plastic. **(Springston Formation)** *0.30m to 0.40m: with some sand* *0.40m: light brown mottled orange* *0.60m: with trace sand*	Spy
0.5	I_{vp}181/I_{vr}83		
0.8		Sandy SILT, light brown mottled orange. Very stiff, wet, non-plastic; sand is fine to medium **(Springston Formation)** *1.00m: saturated*	Spy
1.0	I_{vp}170/I_{vr}67		
1.2		SILT with trace sand, light brown, mottled orange. Very stiff, wet, non-plastic; sand is fine. **(Springston Formation)** *1.30m: without sand* *1.40m: with some wood fragments*	Spy
1.5	I_{vp}160/I_{vr}70		
1.6		Clayey SILT, light grey. Very stiff, wet, low plasticity. **(Springston Formation)** *2.10m to 2.20m: wood layer present*	Spy
2.0	I_{vp}139/I_{vr}52		
2.5	I_{vp}167/I_{vr}70		
3.0	I_{vp}181/I_{vr}76		

Groundwater: 1 (struck at 0.95m)

2 terminated at 3.00m. Target Depth

Started: 11/09/2012

Finished: 11/09/2012

Driller:

Plant:

Logged: DB

Checked: ME

Depth Related Remarks

From	Remarks

Groundwater Observations

No.	Struck (m)	Date	Observations	Standing (m)
1.	0.95m		After rods removed.	

Co-ordinates:
5183071.10mN
1570855.60mE

Inclination: -90°

Remarks
(1) Co-ordinates derived from aerial photos (NZTM). (2) Shear vane calibration due 10/8/12. (3) Backfilled with in-situ soil.

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

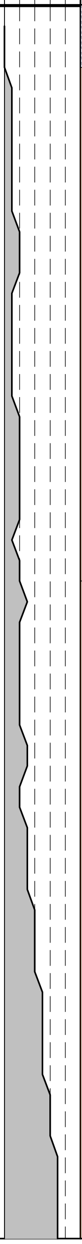
Preliminary Log of Investigation

Project: CCC - Structural Enineering Service

Location: 3 Thames St **Project No:** ZB01276.001 **Hole ID:** 3

Client: Christchurch City Council **Date:** 11/09/2012

R.L. (m)	Depth (m)	Drilling Method (Shift Details / Casing Diameter (mm))	In-Situ Testing	Sampling	DCP (Blows per Drive) 2 4 6 8	Geology Legend	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
	0.0							TOPSOIL: SILT with trace sand and gravel, dark brown. Moist, non-plastic; sand is fine; gravel is fine to coarse, subangular to subrounded. **(Topsoil)**	R	
								SILT with trace sand, dark brown. Very stiff, moist, non-plastic; sand is fine. **(Springston Formation)**		
	0.5		I_{vp}181/I_{vr}87							
								0.60m: light brown mottled orange	Spy	
	1.0		I_{vp}153/I_{vr}49					*1.00m: grey*		
							1 ∇			
								1.20m: saturated		
	1.5		I_{vp}132/I_{vr}42					SILT with some clay, grey. Very stiff, wet, low plasticity. **(Springston Formation)**		
	2.0		I_{vp}132/I_{vr}38							
								2.10m to 2.30m: with minor organic material (wood)	Spy	
	2.5		I_{vp}153/I_{vr}83							
	3.0		I_{vp}167/I_{vr}90							



3 terminated at 3.00m. Target Depth

Started: 11/09/2012

Finished: 11/09/2012

Driller:

Plant:

Logged: DB

Checked: ME

Depth Related Remarks

From *Remarks*

Groundwater Observations

No.	*Struck (m)*	*Date*	*Observations*	*Standing (m)*
1.	1.14m		After rods removed.	

Remarks

(1) Co-ordinates derived from aerial photos (NZTM). (2) Shear vane calibration due 10/8/12. (3) Backfilled with in-situ soil.

Co-ordinates:

5183086.50mN

1570851.10mE

Inclination: -90°

See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

12. Appendix 3 – CERA Standardised Report Form

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name: St Albans Creche
Unit / No: / Street
Building Address: 3 Thames ST
Legal Description:
Degrees / Min / Sec
GPS south:
GPS east:
Building Unique Identifier (CCC):

Reviewer: NM Calvert
CPEng No: 242062
Company: SKM
Company project number: ZB01276.01
Company phone number: 03 940 4900
Date of submission: 28-Nov
Inspection Date: 31/08/2012
Revision: B
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):
Soil Profile (if available):
If Ground improvement on site, describe:
Approx site elevation (m):

Building

No. of storeys above ground: 1 — single storey = 1
Ground floor split? no
Storeys below ground 0
Foundation type: strip footings
Building height (m): 4.10
Floor footprint area (approx): 144
Age of Building (years): 52

Ground floor elevation (Absolute) (m):
Ground floor elevation above ground (m): 0.30
if Foundation type is other, describe: perimater strip footing with internal concrete piles
height from ground to level of uppermost seismic mass (for IEP only) (m):
Date of design: 1935-1965

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

Use (ground floor): educational
Use (upper floors):
Use notes (if required): Creche
Importance level (to NZS1170.5): IL2

Gravity Structure

Gravity System: load bearing walls
Roof: timber framed — rafter type, purlin type and cladding: Rafter depth 100x 50 Purlins 75x25 Galv corrugated iron cladding from April 1991 alteration drawings
Floors: timber — joist depth and spacing (mm): 250mm x 100mm and 200mm x 100mm in main room roof
Beams: timber — type
Columns:
Walls: — **Walls are load bearing timber frame**

Lateral load resisting structure

Note: Define along and across in detailed report!

Lateral system along: lightweight timber framed walls — note typical wall length (m)
Ductility assumed, μ: 1.00
Period along: 0.20 — 0.00 — estimate or calculation? estimated
Total deflection (ULS) (mm): 30 — estimate or calculation? estimated
maximum interstorey deflection (ULS) (mm): 0 — estimate or calculation? estimated

Lateral system across: lightweight timber framed walls — note typical wall length (m)
Ductility assumed, μ: 1.00
Period across: 0.20 — 0.00 — estimate or calculation? estimated
Total deflection (ULS) (mm): 30 — estimate or calculation? estimated
maximum interstorey deflection (ULS) (mm): 0 — estimate or calculation? estimated

Separations:

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

Non-structural elements

Stairs:
Wall cladding: plaster system — describe Lathe and Plaster
Roof Cladding: Metal — describe Lightweight corrugated steel cladding
Glazing: timber frames
Ceilings: plaster, fixed
Services(list):

Available documentation

Architectural	none	original designer name/date	
Structural	partial	original designer name/date	Harding Consulting Engineers LTD
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	partial	original designer name/date	SKM 2012

Damage

Site:
(refer DEE Table 4-2)

Site performance: — Describe damage:

Settlement:	none observed	notes (if applicable):	
Differential settlement:	1:150 or more	notes (if applicable):	1:50 at worst
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:	slight	notes (if applicable):	

Building:

Current Placard Status: yellow

Along — Damage ratio: 0% — Describe how damage ratio arrived at: Observed damage does not alter building strength
Describe (summary):

Across — Damage ratio: 0%
Describe (summary):

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

Diaphragms	Damage?: no	Describe:	
CSWs:	Damage?: no	Describe:	
Pounding:	Damage?: no	Describe:	
Non-structural:	Damage?: no	Describe:	

Recommendations

Level of repair/strengthening required: minor structural — Describe: Floor re-levelling
Building Consent required: yes — Describe: Building consent may be required to re level the floor
Interim occupancy recommendations: full occupancy — Describe: Green

Along — Assessed %NBS before: 61% — %NBS from IEP below — If IEP not used, please detail assessment methodology: SKM - Calculations
Assessed %NBS after: 55%

Across — Assessed %NBS before: 61% — %NBS from IEP below
Assessed %NBS after: 55%