CHRISTCHURCH CITY COUNCIL

PRO_0862
Maurice Carter Court Owner/Occupier
16 Dundee Place, Spreydon

QUANTITATIVE ASSESSMENT REPORT

FINAL

- Rev D
- February 2014

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Contents

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	Signature	Date	Name	Title
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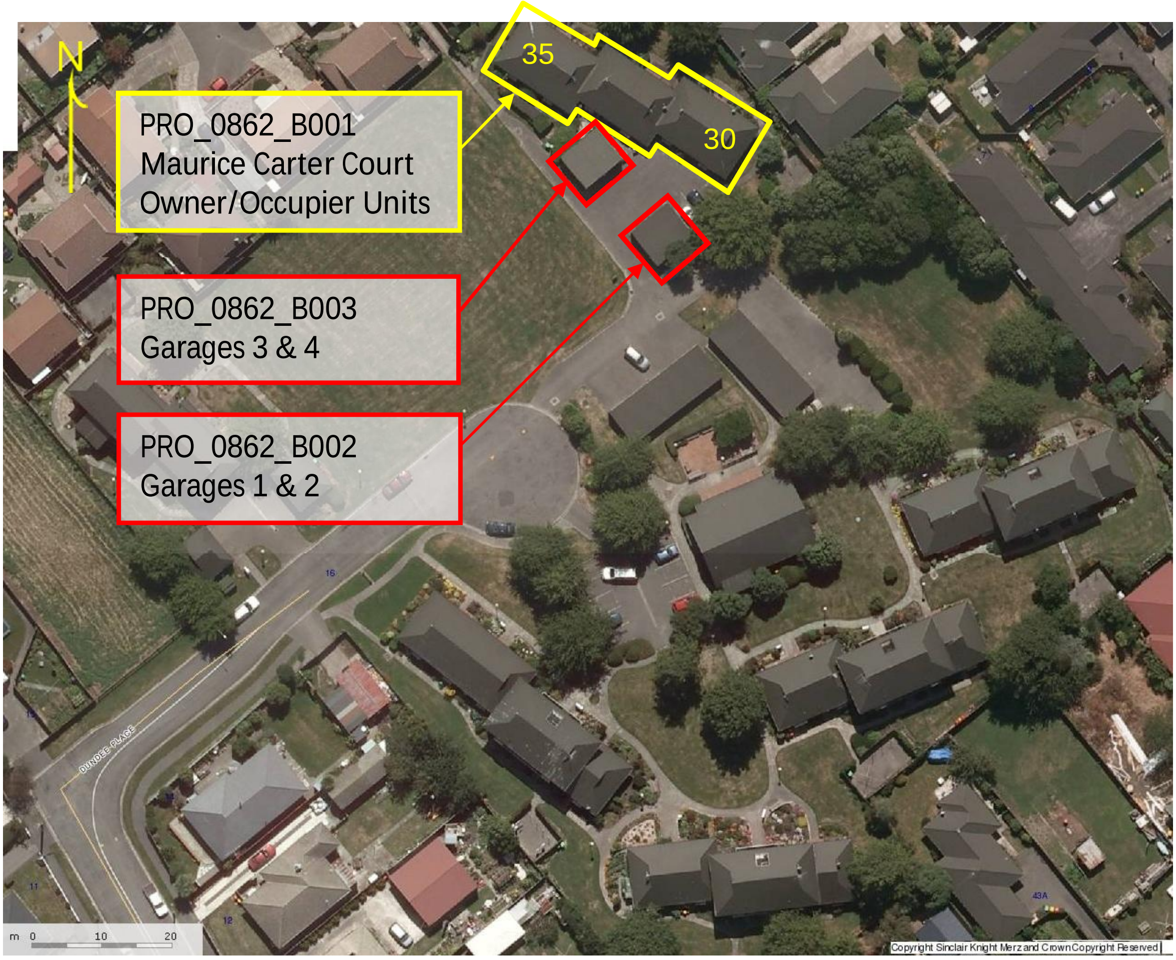
1. Executive Summary

1.1. Background

A Quantitative Assessment was carried out on the three Owner/Occupier buildings located at Maurice Carter Court, 16 Dundee Place, Spreydon; known as Maurice Carter Court Owner/Occupier Units, Maurice Carter Court Owner/Occupier Garages 1 & 2 and Maurice Carter Court Garages 3 & 4. An aerial photograph illustrating the area is shown below in Figure 1. Detailed descriptions outlining the buildings and construction types are given in Section 5 of this report.

- **Figure 1 Aerial Photograph of Maurice Carter Court**



This report for the building structures is based on the Engineering Advisory Group's "Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings" (from July 2011) visual inspection on 26/07/2013 and limited available existing drawings by Christchurch City Council dated November 1989. Strengthening of the garages has been carried out as proposed in Appendix D and Appendix E except that

7mm ecoply board has been installed in lieu of the proposed 10mm gib board. The 7mm Ecoply has a higher capacity. The new %NBS to incorporate the strengthening has been reflected in this report.

1.2. Key Damage Observed

Hairline cracking and non-structural damage was noted to elements in Maurice Carter Court Owner/Occupier Units. Refer to Section 6 Building Damage for a detailed account of the damage.

1.3. Critical Structural Weaknesses

No critical structural weaknesses have been discovered.

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 capacity of the building using the quantitative method. Our assessment included consideration of geotechnical conditions, existing earthquake damage to the buildings 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.
- Architectural drawings of some of the buildings produced by CCC in 1989. See section 5 and Appendix B for details.
- Qualitative assessment of critical structural weaknesses (CSWs) based on review of available structural drawings and inspection where drawings were not available.
- Geotechnical Interpretative Report produced by SKM in December 2012. This report was primarily issued to provide recommendations for proposed new build residential units located in the vicinity of the existing buildings in subject. See Appendix C for details.

Maurice Carter Court Owner/Occupier Garages 1-4 were deemed to be Earthquake Prone before the installation of strengthening. Strengthening of the garages has been carried out as proposed in Appendix D and Appendix E, therefore it is classed as low risk. The completed strengthening works have been inspected and photos are included as PHOTO 28 – 29.

STRUCTURE NAME	ESTIMATED %NBS STRENGTH	LIMITING ACTION
PRO_0862_B002 Maurice Carter Court Owner/Occupier Garages 1 & 2 PRO_0862_B003 Maurice Carter Court Owner/Occupier Garages 3 & 4	100% NBS	Longitudinal wall bracing under in Plane Shear
PRO_0862_B001 Maurice Carter Court Owner/Occupier Units	67% NBS	Longitudinal Gib wall under in Plane Shear

1.5. Conclusions and Recommendations

It is recommended that:

a) There is no damage to the buildings that would cause them to be unsafe to occupy.

b) Barriers around the building are not necessary.

2. Introduction

Sinclair Knight Merz was engaged by Christchurch City Council to carry out a Quantitative Assessment of the seismic performance of the apartment houses (Unit 30-35) and adjacent garages at Maurice Carter Court located at 16 Dundee Place, Spreydon.

The scope of this quantitative analysis includes the following:

- Analysis of the seismic load carrying capacity of the buildings 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

The recommendations from the Engineering Advisory Group's "Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings" (from July 2011)[*] 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[†].

At the time of this report, only architectural drawings by Christchurch City Council dated August 1989 were made available for two buildings. These have been used in our evaluation of the building. The building description below is based on a review of the drawings and our visual inspections.

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[*] EAG 2011, *Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury - Draft*, p 10

[†] 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),

c) 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.

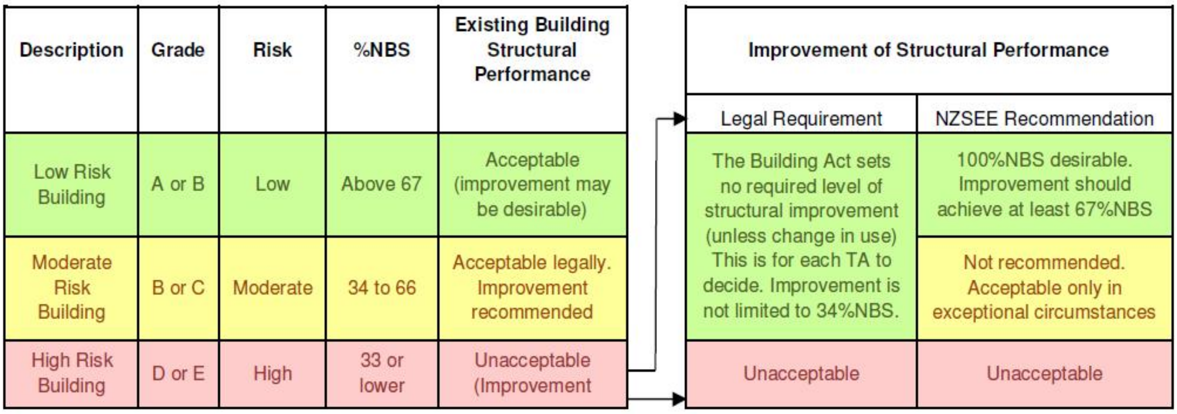
4. Earthquake Resistance Standards

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 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.

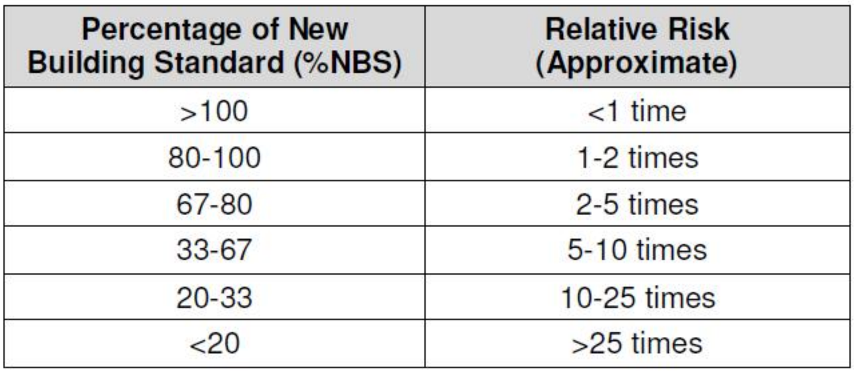
- **Figure 2: NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE Guidelines**



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

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

The complex under consideration consists of a block of residential buildings and garages as shown on the aerial view in Figure 1. For the purpose of this report; Table 2 shows the notations adopted (in line with CCC notations):

- **Table 2 - Building notations**

CCC notation	Local notation	Purpose	Available Drawings
PRO_0862_B001	Maurice Carter Court Owner/Occupier Units	Block of flats	Original architectural /structural drawings (CCC 1989)
PRO_0862_B002	Maurice Carter Court Owner/Occupier Garages 1&2	Garage	Original architectural /structural drawings (CCC 1989)
PRO_0862_B003	Maurice Carter Court Owner/Occupier Garage 3&4	Garage	Original architectural /structural drawings (CCC 1989)

The building descriptions and our evaluation is based on the visual inspection of external surfaces and the original architectural drawings (by CCC in 1989 – contained in Appendix C).

5.1. Design Criteria and Assumptions

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

- The buildings were built according to the drawings and according to good practice at the time. We have reviewed the buildings and from our visual inspection the structures appears to be built in accordance with the drawings.
- The associated strengthening work to the Maurice Carter Court Owner/Occupier Garages 1-4 has been completed. Refer to PHOTO 28 – 29 for the photos of the completed strengthening works.
- The soil on site is class D as described in AS/NZS1170.5:2004, Clause 3.1.3, Soft Soil. This is a conservative assumption based on the desktop study.
- Standard design assumptions for residential type buildings as described in AS/NZS 1170.0 :2002:
- 50 year 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.
- Site hazard factor, Z = 0.3, NZBC, Clause B1 Structure, Amendment 11 effective from 1 August 2011.

- The following material properties were estimated and used in the analyses:

- **Table 3: Material Properties**

Material	Nominal Strength
Structural Steel	f_y = 250MPa
Concrete	f_c’ = 30MPa
Timber – No 1 Framing	f_b’ = 10MPa
Masonry	f_m’ = 12MPa
Steel Reinforcement	f_y = 300MPa

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.

5.2. Maurice Carter Court Owner/Occupier Units

The building is a single storey block of 6 residential units constructed of timber frame walls clad with brick veneer or weatherboard externally and with plasterboard or particleboard internally. Each unit is separated by a reinforced concrete masonry wall, 190mm thick.

The hipped roof is constructed of series of timber trusses spanning in the transverse direction, supporting timber purlins with ply sarking and corrugated metal sheeting. The plasterboard ceiling is attached to the underside of the roof trusses.

The building is founded on strip footings with a ground bearing slab.

Refer to PHOTOS 1-15 for general images of Maurice Carter Court Owner/Occupier Units.

5.2.1.Gravity load resisting system

The weight of the roof is transferred to the perimeter walls (typically timber framed) through the timber trusses. The ground floor is a slab on grade.

The weight of the walls and applied loads are transferred into the concrete strip footing and then directly into the ground below.

5.2.2. Seismic load resisting system

Lateral loads at roof level are distributed to the supporting walls through the gib diaphragm attached to the underside of the roof trusses.

Horizontal forces are transferred to foundation level by means of combination of concrete masonry walls and timber stud walls with plasterboard linings, acting as shear walls.

Horizontal forces at foundation level are resisted by friction and ground pressures between the surrounding soil and the foundations.

5.2.3. Analysis Assumptions

- Period T < 0.4seconds
- Ductility, μ=2
- The concrete walls were assumed to be singly reinforced with:
    - 12 mm bars at 600 mm centres vertically

- It is assumed that all the concrete walls are connected to the diaphragm and therefore contribute to the transverse and longitudinal capacity of the building. This will need to be confirmed during the detailed design of strengthening works.

5.3. Maurice Carter Court Owner/Occupier Garages 1&2, 3&4

The buildings are identical, single storey garages (Two garages per building divided by a plasterboard partition), constructed of timber frame walls clad with brick veneer (sides and rear) or weatherboard (front) externally and exposed internally (PHOTOS 16-28) The mono pitch roof is constructed of timber rafters and corrugated metal sheeting. The building is founded on strip footings and a ground bearing slab.

5.3.1. Gravity load resisting system

The weight of the roof is transferred to the perimeter walls (typically timber framework) through the timber rafters. The weight of the walls and applied loads are transferred into the concrete strip footing and then directly into the ground below.

5.3.2. Seismic load resisting system

Lateral loads at roof level are distributed to the supporting walls through the timber roof.

Horizontal forces are primarily transferred to the foundation level by means of timber stud walls with either angle braces (22 x 22 x 1.2 to sides and rear) or weatherboards (front).

Horizontal forces at foundation level are resisted by friction and ground pressures between the surrounding soil and foundations.

5.3.3. Design Assumptions

- Period T < 0.4 seconds
- Ductility, $\mu = 2$

6. Building Damage

The list of damage items observed during the time of inspection is as follows:

6.1. Maurice Carter Court Owner/Occupier Units

Structural damage	
-	None observed
Non-structural damage	
E-1	Superficial cracking to plasterboard lining in the living room in the Unit 35 (PHOTO 8)

6.2. Maurice Carter Court Owner/Occupier Garages 1 & 2

Structural damage	
-	None observed
Non-structural damage	
E-2	Door frame to the Garage 1 has broken – doesn`t appear to be earthquake damage (PHOTO 23)

6.3. Maurice Carter Court Owner/Occupier Garages 3 & 4

Structural damage	
-	None observed
Non-structural damage	
E-3	Weatherboard to the bottom of the front elevation of Garage 4 has been damaged (PHOTO 28)

7. Results and Discussion

7.1. Critical Structural Weaknesses

These buildings have no critical structural weaknesses.

7.2. Analysis Results

The equivalent static force method was used to analyse the demands or loads applied to these buildings. These were then compared to the capacities of the structural elements to assess the seismic capacity of the buildings. The results of the analysis are reported in the following table as %NBS. The %NBS of the garages has been revised to reflect the completion of strengthening works in accordance with Appendix D and Appendix E.

- **Table 4: DEE Results**

Building	**Seismic Resisting Element**	**Action**	**Seismic Rating %NBS**
PRO_0862_B001 Maurice Carter Court Owner/Occupier Units	Longitudinal	In Plane Shear	67%
	Transverse	In Plane Shear	>100%
	Concrete Masonry Wall	Capacity	>100%
	Brick Veneer	Tie layout	>100%
	Timber Wall Studs	Flexural Capacity	>100%
PRO_0862_B002 Maurice Carter Court Owner/Occupier Garages 1 & 2 PRO_0862_B003 Maurice Carter Court Owner/Occupier Garages 3 & 4	Longitudinal	In Plane Shear	100%
	Transverse	In Plane Shear	>100%
	Timber Wall Studs	Flexural Capacity	>100%

7.3. Discussion

The buildings at Maurice Court were built in the late 1980's, therefore it is assumed they were designed prior to NZS 3604:1990, *Timber framed buildings*. The building mass was assessed by normal structural engineering methods with seismic live load in accordance with AS/NZS1170.0:2002 *Structural Design Actions: General Principles* and AS/NZS 1170.1:2002 *Structural Design Actions: Permanent, Imposed and Other Actions*. These were converted to seismic lateral load for each orthogonal direction using the Equivalent Static Procedure defined in NZS1170.5:2004 *Structural Design Actions: Earthquake Actions - New Zealand*.

Maurice Carter Court Owner/Occupier Units relies on the concrete masonry party walls in the transverse direction and their connection to the diaphragms to provide sufficient capacity. An assumption of the connection between the diaphragm and the party wall limits the %NBS in this direction. In the longitudinal direction they rely on the out of plane capacity of the concrete masonry party walls and on the number and lengths of available timber walls to provide bracing capacity to the building. There are relatively few internal walls in the longitudinal direction where the space is largely used for open plan living. The external walls have a number of windows and doors that shortens the available wall length for bracing.

Maurice Carter Court Owner/Occupier Garages 1 - 4 have large openings in the front wall that limits the wall length available for bracing to be placed in the longitudinal direction. Therefore bracing is only placed to the back wall. Strengthening works have been carried out and plywood linings have been installed onthe rear walls to increase the strength of the garages. The transverse direction relies on diagonal bracing on both walls and internal plasterboard lining between the garages to provide sufficient restraint.

8. Conclusions and Recommendations

SKM carried out a quantitative assessment on the buildings at Maurice Carter Court located at 16 Dundee Place, Spreydon.

This assessment concluded that Maurice Carter Court Owner/Occupier Garages 1-4 are classified as 'Low Risk' following the completion of strengthening works..

The Maurice Carter Court Owner/Occupier Units are 'Low Risk' having a capacity greater than or equal to 67% NBS.

- **Table 5: Quantitative assessment summary**

Description	**Grade**	**Risk**	**%NBS**
PRO_0862_B002 Maurice Carter Court Owner/Occupier Garages 1 & 2 PRO_0862_B003 Maurice Carter Court Owner/Occupier Garages 3 & 4	B	Low	100%
PRO_0862_B001 Maurice Carter Court Owner/Occupier Units	B	Moderate	67%

It is recommended that:

a) There is no damage to the buildings that would cause them to be unsafe to occupy.

b) Barriers around the building are not necessary.

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. Site Inspection Report Photos

PHOTO 1: Maurice Carter Court Owner/Occupier – Exterior front view of the property from south-west. Two garage buildings to the front, apartment units 30-35 (from right to left) to the rear.

PHOTO 2: Maurice Carter Court Owner/Occupier Units – Exterior rear view of the property from North-East. The apartment units 30-35 (from left to right).

	
PHOTO 3: Maurice Carter Court Owner/Occupier Units – Exterior view of the Unit 30 from the South	PHOTO 4: Maurice Carter Court Owner/Occupier Units – Exterior view of the Unit 30 from the East.
	
PHOTO 5: Maurice Carter Court Owner/Occupier Units – Exterior view of the Units 32-33 from the North	PHOTO 6: Maurice Carter Court Owner/Occupier Units – Exterior view of the Units 35 from the North.

PHOTO 7: Maurice Carter Court Owner/Occupier Units – Interior view of the Unit 30.

PHOTO 8: Maurice Carter Court Owner/Occupier Units – Interior view of the Unit 35. Hairline cracking in the gib lining above the rear entrance door.

PHOTO 9: Detail of previous photo (probably earthquake damage)

PHOTO 10: Maurice Carter Court Owner/Occupier Units – Interior view of the Unit 30.

<table>
<tr><td></td><td></td></tr>
<tr><td>PHOTO 11: Maurice Carter Court Owner/Occupier Units – Interior view of roof space above Unit 30 towards east</td><td>PHOTO 12: Maurice Carter Court Owner/Occupier Units – Interior view of roof space above Unit 30 towards east</td></tr>
<tr><td></td><td></td></tr>
<tr><td>PHOTO 13: Maurice Carter Court Owner/Occupier Units – Interior view of roof space above Unit 30 towards north</td><td>PHOTO 14: Maurice Carter Court Owner/Occupier Units – Interior view of roof space above Unit 30 towards north</td></tr>
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	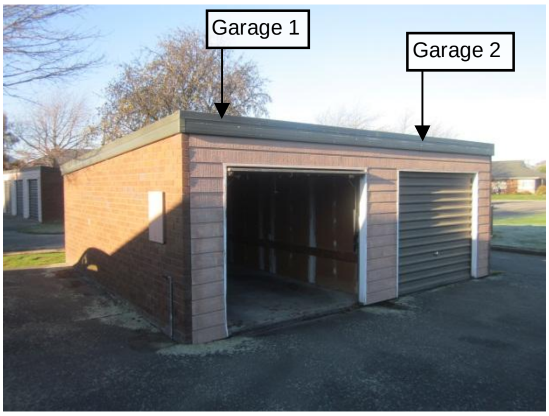
PHOTO 15: Maurice Carter Court Owner/Occupier Units – Interior view of roof space above Unit 30.	PHOTO 16: Garages 1&2 – Exterior view
	
PHOTO 17: Garage 1 – Exterior view	PHOTO 18: Garage 1 – Roof timber bracing

PHOTO 19: Garage 1 – Roof timber bracing

PHOTO 20: Garage 1 – Perimeter wall bracing

PHOTO 21: Garage 1 – Interior view

PHOTO 22: Garage 1 – Interior view (partition wall to the right)

PHOTO 23: Garage 1 – Damage to door frame (not earthquake related)

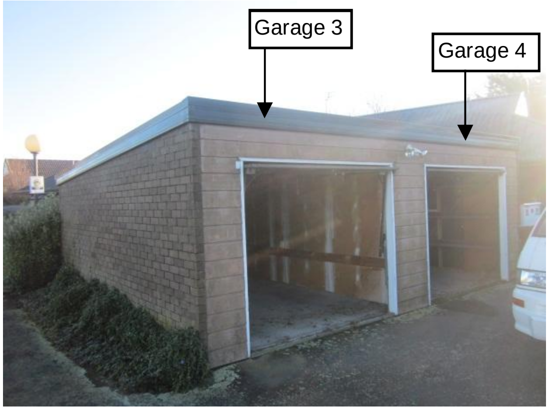

PHOTO 24: Garages 3&4 – Exterior view

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<tr><td></td><td></td></tr>
<tr><td>PHOTO 25: Garage 3 – Interior view</td><td>PHOTO 26: Garage 3 – Interior view (partition wall to the right)</td></tr>
<tr><td></td><td></td></tr>
<tr><td>PHOTO 27: Garage 3 – Roof timber bracing</td><td>PHOTO 28: Garage 4 – Cracked hardies to the bottom of the front elevation (possibly earthquake damage)</td></tr>
</table>

	
PHOTO 28: 7mm Ecoply installed at the rear of the garage wall	PHOTO 29: Close up view of the nail fasteners

Appendix A CERA Standardised Report Forms

Detailed Engineering Evaluation Summary Data V1.14

Location

Building Name: Maurice Carter Court Owner/Occupier Units
Building Address: Maurice Carter Court; Unit; No: 16; Street: Dundee Place
Legal Description:
GPS south: Degrees; Min; Sec
GPS east:
Building Unique Identifier (CCC): PRO_0862_B001

Reviewer: N Calvert
CPEng No: 242062
Company: Sinclair Knight Merz
Company project number: ZB01276.243
Company phone number: 03 940 4919
Date of submission: 3/02/2014
Inspection Date: 26/07/2013
Revision: D
Is there a full report with this summary? yes

Site

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

Max retaining height (m):
Soil Profile (if available):
If Ground improvement on site, describe:
Approx site elevation (m):

Building

No. of storeys above ground: 1 single storey = 1
Ground floor split? no
Storeys below ground 0
Foundation type: other (describe)
Building height (m): 2.50
Floor footprint area (approx): 280
Age of Building (years):

Ground floor elevation (Absolute) (m):
Ground floor elevation above ground (m):
if Foundation type is other, describe: Slab on grade with perimeter footings
height from ground to level of uppermost seismic mass (for IEP only) (m):
Date of design: 1976-1992

Strengthening present? no
Use (ground floor): multi-unit residential
Use (upper floors):
Use notes (if required):
Importance level (to NZS1170.5): IL2

If so, when (year)?
And what load level (%g)?
Brief strengthening description:

Gravity Structure

Gravity System: load bearing walls
Roof: timber framed
Floors: concrete flat slab
Beams:
Columns:
Walls: load bearing concrete

rafter type, purlin type and cladding Timber truses @ 1200crs, pulins @ 900crs
slab thickness (mm)
#N/A

Lateral load resisting structure

Lateral system along: lightweight timber framed walls
Ductility assumed, μ: 2.00
Period along: 0.40 0.00
Total deflection (ULS) (mm): 5
maximum interstorey deflection (ULS) (mm):

Note: Define along and across in detailed report!

note typical wall length (m) 2
estimate or calculation? estimated
estimate or calculation? estimated
estimate or calculation?

Lateral system across: partially filled CMU
Ductility assumed, μ: 1.25
Period across: 0.40 ##### enter height above at H31
Total deflection (ULS) (mm): 5
maximum interstorey deflection (ULS) (mm):

note total length of wall at ground (m): 190mm thick
estimate or calculation? estimated
estimate or calculation? estimated
estimate or calculation?

Separations:

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

Non-structural elements

Stairs:
Wall cladding: brick or tile
Roof Cladding: Metal
Glazing: timber frames
Ceilings: plaster, fixed
Services(list):

describe (note cavity if exists) 70mm clay brick and weatherboard
describe Lightweight roofing iron

Available documentation

Architectural partial
Structural partial
Mechanical none
Electrical none
Geotech report none

original designer name/date
original designer name/date
original designer name/date
original designer name/date
original designer name/date

Damage

Site:
(refer DEE Table 4-2)

Site performance:
Settlement: none observed
Differential settlement: none observed
Liquefaction: none apparent
Lateral Spread: none apparent
Differential lateral spread: none apparent
Ground cracks: none apparent
Damage to area: none apparent

Describe damage:
notes (if applicable):
notes (if applicable):
notes (if applicable):
notes (if applicable):
notes (if applicable):
notes (if applicable):
notes (if applicable):

Building:

Current Placard Status: green

Along Damage ratio: 0%
Describe (summary): refer to report for full outline
Describe how damage ratio arrived at:

Across Damage ratio: 0%
Describe (summary): refer to report for full outline

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

Diaphragms Damage?: no Describe:
CSWs: Damage?: no Describe:
Pounding: Damage?: no Describe:
Non-structural: Damage?: yes Describe: minor cracking

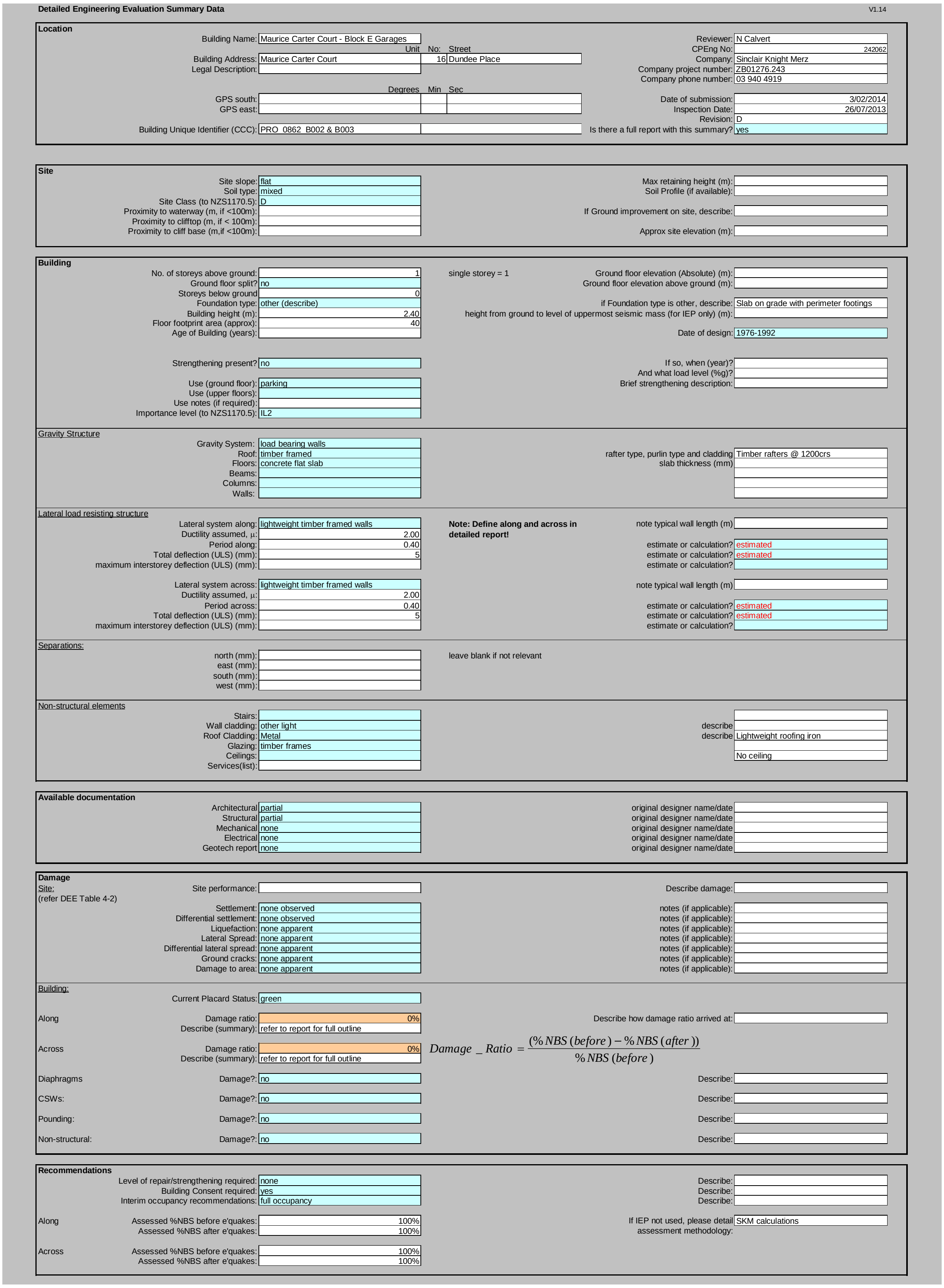
Recommendations

Level of repair/strengthening required: none Describe:
Building Consent required: no Describe:
Interim occupancy recommendations: full occupancy Describe:

Along Assessed %NBS before e'quakes: 67%
Assessed %NBS after e'quakes: 67%

If IEP not used, please detail assessment methodology: SKM calculations

Across Assessed %NBS before e'quakes: 100%
Assessed %NBS after e'quakes: 100%



Detailed Engineering Evaluation Summary Data V1.14

Location

Building Name: Maurice Carter Court - Block E Garages
Unit No: Street
Building Address: Maurice Carter Court | 16 | Dundee Place
Legal Description:
Degrees Min Sec
GPS south:
GPS east:
Building Unique Identifier (CCC): PRO_0862_B002 & B003

Reviewer: N Calvert
CPEng No: 242062
Company: Sinclair Knight Merz
Company project number: ZB01276.243
Company phone number: 03 940 4919
Date of submission: 3/02/2014
Inspection Date: 26/07/2013
Revision: D
Is there a full report with this summary? yes

Site

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

Max retaining height (m):
Soil Profile (if available):
If Ground improvement on site, describe:
Approx site elevation (m):

Building

No. of storeys above ground: 1 — single storey = 1
Ground floor split? no
Storeys below ground 0
Foundation type: other (describe)
Building height (m): 2.40
Floor footprint area (approx): 40
Age of Building (years):

Ground floor elevation (Absolute) (m):
Ground floor elevation above ground (m):
if Foundation type is other, describe: Slab on grade with perimeter footings
height from ground to level of uppermost seismic mass (for IEP only) (m):
Date of design: 1976-1992

Strengthening present? no
Use (ground floor): parking
Use (upper floors):
Use notes (if required):
Importance level (to NZS1170.5): IL2

If so, when (year)?
And what load level (%g)?
Brief strengthening description:

Gravity Structure

Gravity System: load bearing walls
Roof: timber framed
Floors: concrete flat slab
Beams:
Columns:
Walls:

rafter type, purlin type and cladding Timber rafters @ 1200crs
slab thickness (mm)

Lateral load resisting structure

Lateral system along: lightweight timber framed walls
Ductility assumed, μ: 2.00
Period along: 0.40
Total deflection (ULS) (mm): 5
maximum interstorey deflection (ULS) (mm):

Note: Define along and across in detailed report!

note typical wall length (m)
estimate or calculation? estimated
estimate or calculation? estimated
estimate or calculation?

Lateral system across: lightweight timber framed walls
Ductility assumed, μ: 2.00
Period across: 0.40
Total deflection (ULS) (mm): 5
maximum interstorey deflection (ULS) (mm):

note typical wall length (m)
estimate or calculation? estimated
estimate or calculation? estimated
estimate or calculation?

Separations:

north (mm):
east (mm):
south (mm):
west (mm):

leave blank if not relevant

Non-structural elements

Stairs:
Wall cladding: other light — describe
Roof Cladding: Metal — describe Lightweight roofing iron
Glazing: timber frames
Ceilings: No ceiling
Services(list):

Available documentation

Architectural partial — original designer name/date
Structural partial — original designer name/date
Mechanical none — original designer name/date
Electrical none — original designer name/date
Geotech report none — original designer name/date

Damage

Site:
(refer DEE Table 4-2)
Site performance: — Describe damage:
Settlement: none observed — notes (if applicable):
Differential settlement: none observed — notes (if applicable):
Liquefaction: none apparent — notes (if applicable):
Lateral Spread: none apparent — notes (if applicable):
Differential lateral spread: none apparent — notes (if applicable):
Ground cracks: none apparent — notes (if applicable):
Damage to area: none apparent — notes (if applicable):

Building:

Current Placard Status: green

Along Damage ratio: 0% — Describe how damage ratio arrived at:
Describe (summary): refer to report for full outline

Across Damage ratio: 0%
Describe (summary): refer to report for full outline

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

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

Recommendations

Level of repair/strengthening required: none — Describe:
Building Consent required: yes — Describe:
Interim occupancy recommendations: full occupancy — Describe:

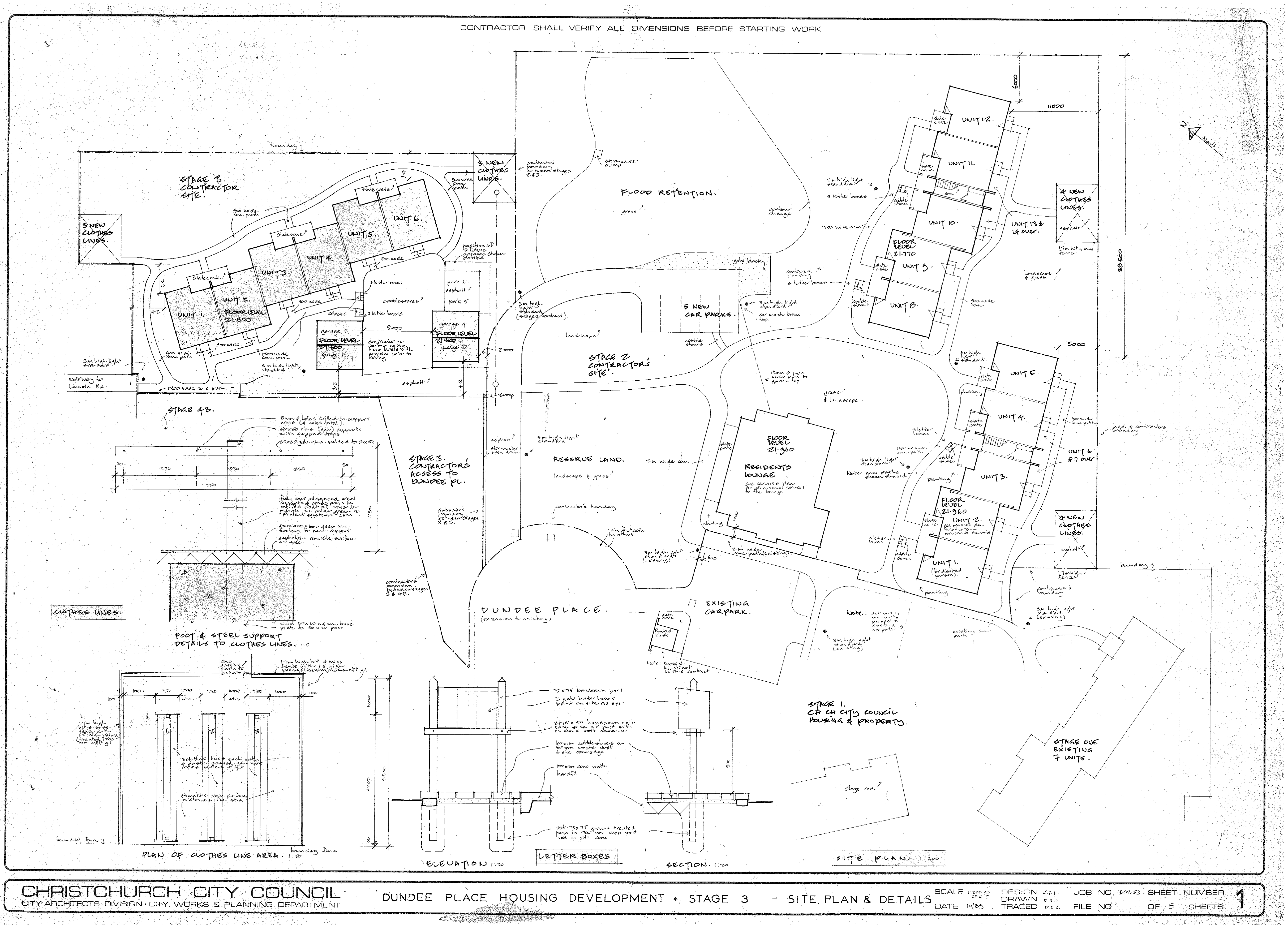
Along Assessed %NBS before e'quakes: 100%
Assessed %NBS after e'quakes: 100%

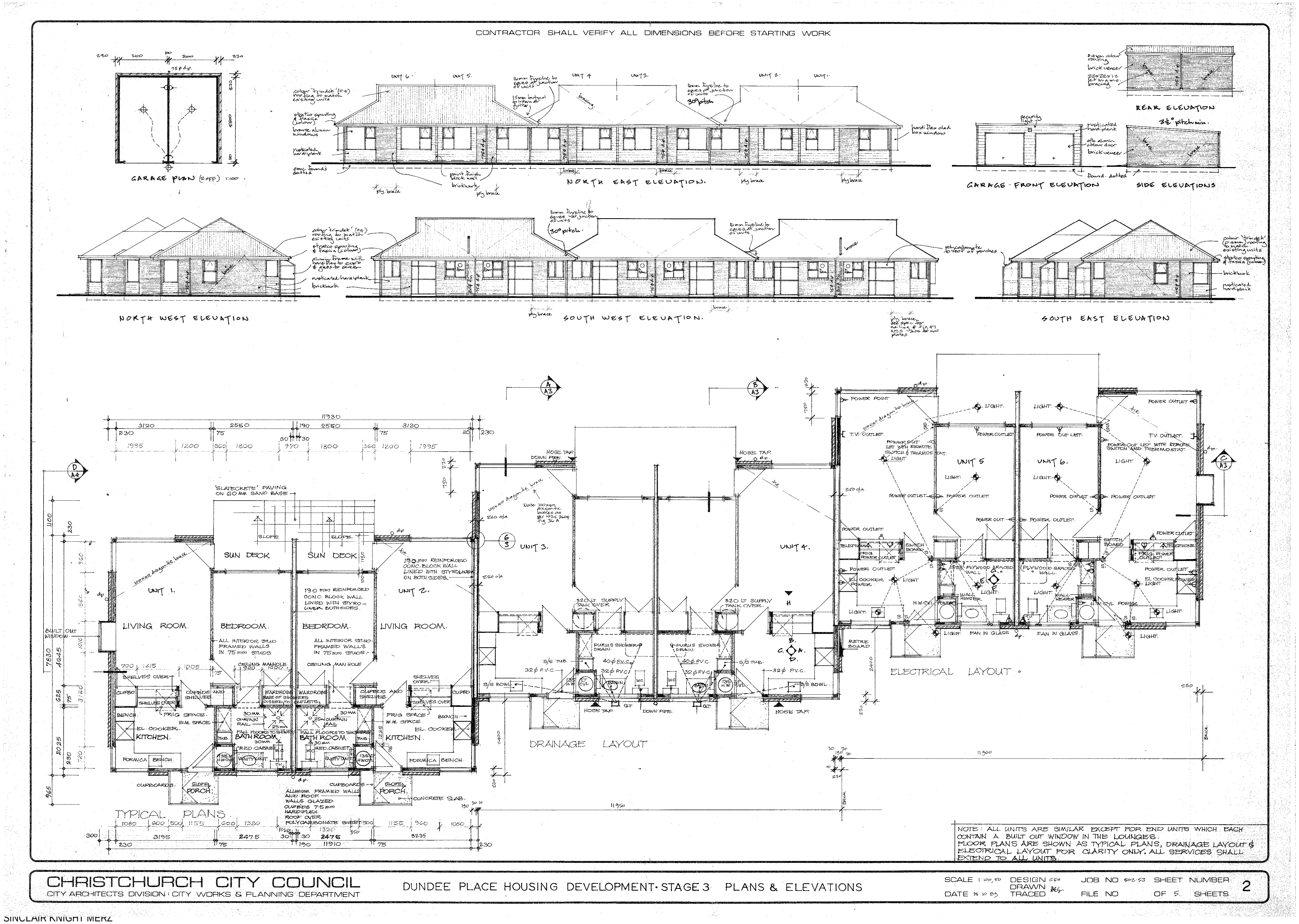
If IEP not used, please detail assessment methodology: SKM calculations

Across Assessed %NBS before e'quakes: 100%
Assessed %NBS after e'quakes: 100%

SINCLAIR KNIGHT MERZ

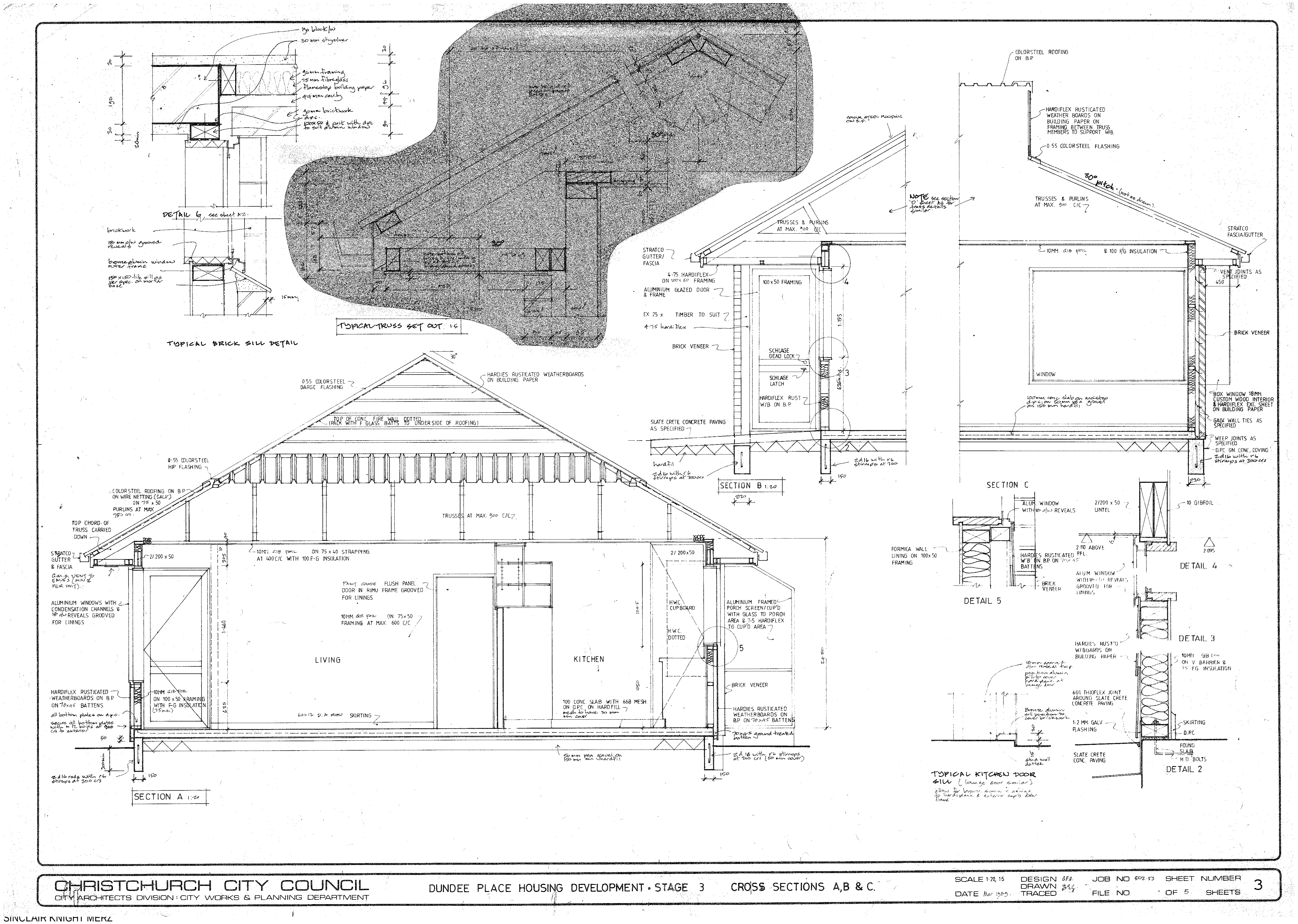
Appendix B Original drawings

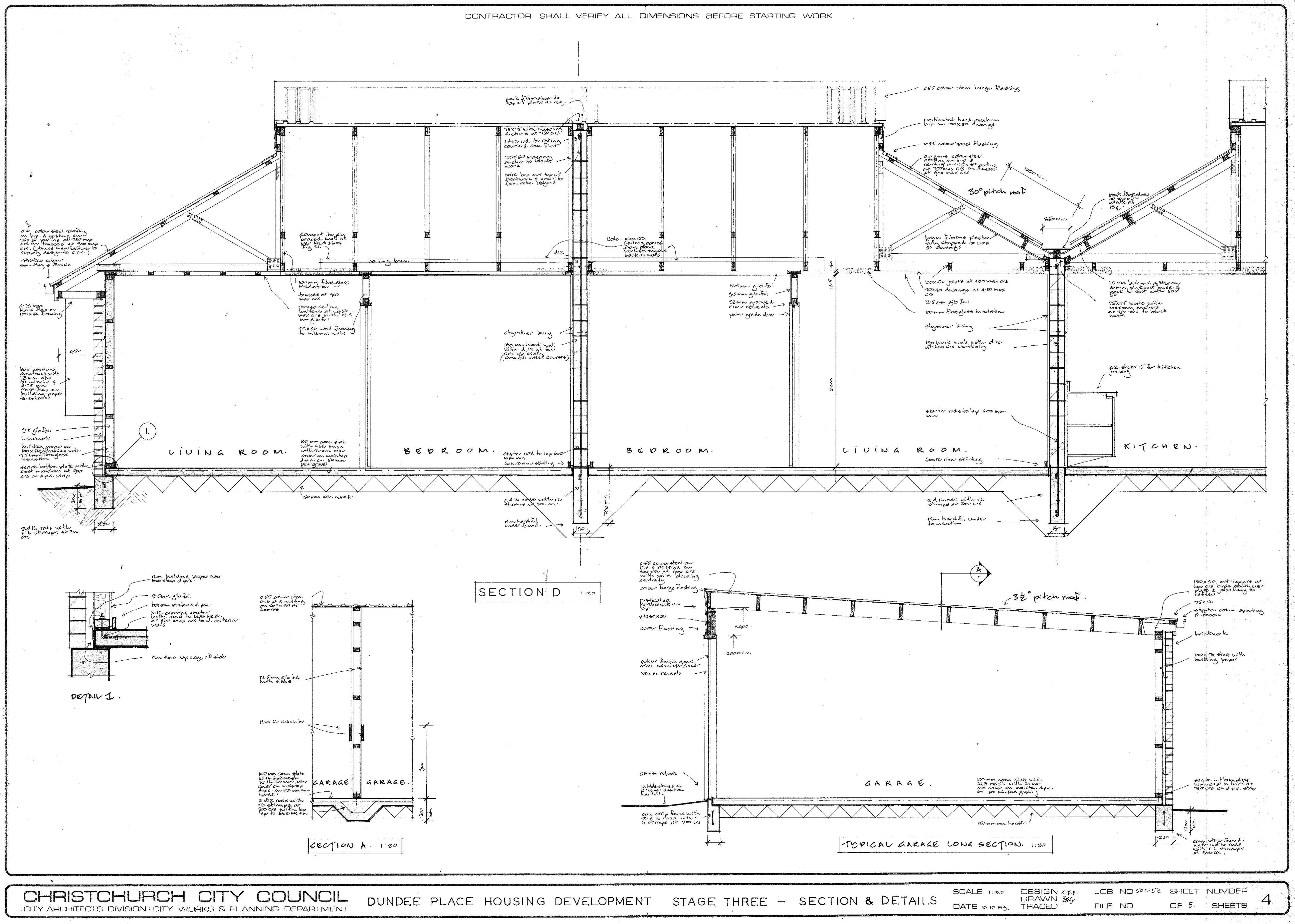

CONTRACTOR SHALL VERIFY ALL DIMENSIONS BEFORE STARTING WORK
boundary
STAGE 3. CONTRACTOR SITE.
3 NEW CLOTHES LINES.
900 wide conc path
slatecrete
UNIT 1.
UNIT 2.
FLOOR LEVEL 21.800
UNIT 3.
UNIT 4.
UNIT 5.
UNIT 6.
900 wide
1200 wide conc path
3m high light standard
walkway to Lincoln Rd.
3 letter boxes
cobblestones
cobbles
garage 2.
FLOOR LEVEL 21.600
garage 1.
garage 4
garage 3.
9.000
2.000
contractor to confirm garage floor levels with engineer prior to boxing
park 6
asphalt
park 5
position of 2 future garages shown dotted
sump
contractors boundary between stages 2 & 3.
stormwater sump
FLOOD RETENTION.
grass
contour change
gobi block
5 NEW CAR PARKS.
car wash brass tap
3m high light standard (stage 2 contract).
landscape
cobble stones
STAGE 2 CONTRACTOR'S SITE.
12mm ø p.v.c. water pipe to garden tap
grass & landscape
1200 wide conc
contoured planting
4 letter boxes
UNIT 8.
UNIT 9.
FLOOR LEVEL 21.770
UNIT 10.
UNIT 11.
UNIT 12.
UNIT 13 & 14 over.
4 NEW CLOTHES LINES.
1.7m hit & miss fence
landscape & grass
900 wide conc
6000
11000
38500
5000
North
UNIT 5.
UNIT 4.
UNIT 6 & 7 over
UNIT 3.
FLOOR LEVEL 21.960
UNIT 2.
see services plan for all external services to the units
UNIT 1. (for disabled person).
planting
legal & contractors boundary
boundary
1.7m high fence
contractor's boundary
3m high light standard (existing)
FLOOR LEVEL 21.960
RESIDENTS LOUNGE
see services plan for all external services to the lounge
Note: new paths shown shaded
2m wide conc
2m wide conc path (existing)
RESERVE LAND.
landscape & grass
asphalt
stormwater open drain
contractor's boundary
1.5m footpath by others
DUNDEE PLACE. (extension to existing).
EXISTING CARPARK.
Rubbish Kiosk
Note: Rubbish kiosk not in this contract
Note: set out 14 new units parallel to existing car park.
existing conc path
STAGE 1. CH CH CITY COUNCIL HOUSING & PROPERTY.
STAGE ONE EXISTING 7 UNITS.
stage one
STAGE 3. CONTRACTOR'S ACSESS TO DUNDEE PL.
contractors boundary between stages 3 & 4B.
STAGE 4B.
8mm ø holes drilled in support arms (4 holes total).
50x50 r.h.s. (galv) supports with capped tops
25x25 galv. r.h.s. welded to 50x50
30
230
750
1780
fully coat all exposed steel supports & cross arms in one full coat of crusader mastic s.1. colour green to "Protect systems" spec.
400x400x600 deep conc. footing for each support
asphaltic concrete surface as spec.
weld 80x80x4mm base plate to 50x50 post
CLOTHES LINES.
FOOT & STEEL SUPPORT DETAILS TO CLOTHES LINES. 1:5
conc access path to suit site plan
1.7m high hit & miss fence with 1.5 high palings (treated) 200mm off g.l.
1000
750
n.t.s.
100
1200
4000
5300
3 clothes lines each with 4 plastic coated galv wire cords pulled tight
asphaltic conc surface in clothes line area
boundary fence
PLAN OF CLOTHES LINE AREA. 1:50
75x75 bandsawn post
3 galv letter boxes paint on site as spec
2/75x50 bandsawn rails each side of post with 12mm ø bolt connector
60mm cobblestones on 50mm crusher dust & site conc edge
100mm conc path
hardfill
set 75x75 ground treated post in 700mm deep post hole in site conc.
900
ELEVATION 1:20
LETTER BOXES.
SECTION. 1:20
SITE PLAN. 1:200
CHRISTCHURCH CITY COUNCIL
CITY ARCHITECTS DIVISION: CITY WORKS & PLANNING DEPARTMENT
DUNDEE PLACE HOUSING DEVELOPMENT • STAGE 3 - SITE PLAN & DETAILS
SCALE 1:200 50 20 & 5
DATE 10/89
DESIGN
DRAWN
TRACED
JOB NO 502.53
FILE NO
SHEET NUMBER 1
OF 5 SHEETS

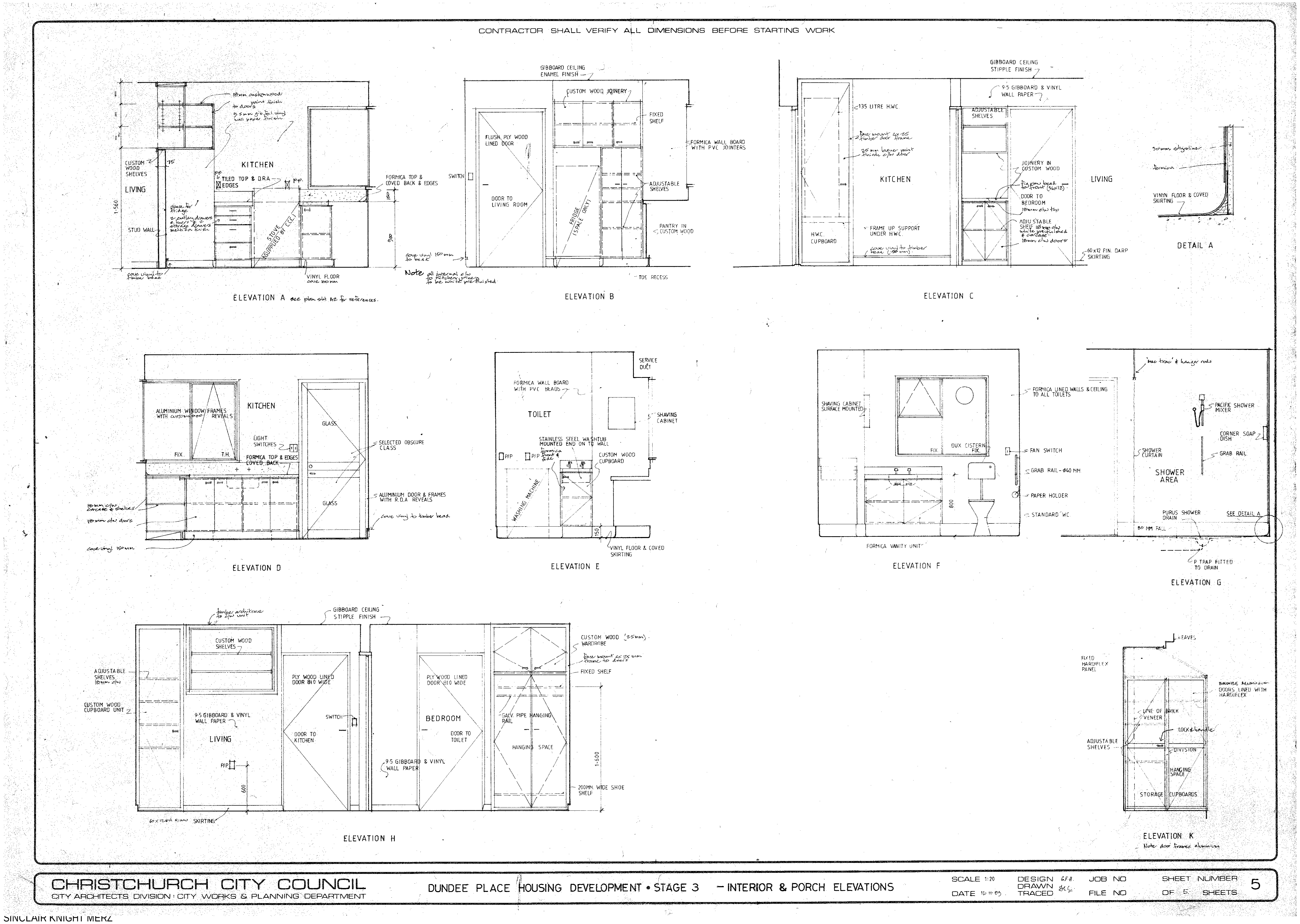


NOTE: ALL UNITS ARE SIMILAR EXCEPT FOR END UNITS WHICH EACH CONTAIN A BUILT OUT WINDOW IN THE LOUNGES. FLOOR PLANS ARE SHOWN AS TYPICAL PLANS, DRAINAGE LAYOUT & ELECTRICAL LAYOUT FOR CLARITY ONLY. ALL SERVICES SHALL EXTEND TO ALL UNITS.

CHRISTCHURCH CITY COUNCIL CITY ARCHITECTS DIVISION : CITY WORKS & PLANNING DEPARTMENT	DUNDEE PLACE HOUSING DEVELOPMENT · STAGE 3 PLANS & ELEVATIONS	SCALE 1:100, 50 DATE 15 10 83	DESIGN GFH DRAWN TRACED	JOB NO 502-53 FILE NO
				SHEET NUMBER 2 OF 5. SHEETS


DETAIL 6 see sheet no 2
TYPICAL BRICK SILL DETAIL
TYPICAL TRUSS SET OUT 1:5
0.55 COLORSTEEL BARGE FLASHING
HARDIES RUSTICATED WEATHERBOARDS ON BUILDING PAPER
TOP OF CONC. FIRE WALL DOTTED (PACK WITH F GLASS BATTS TO UNDERSIDE OF ROOFING)
0.55 COLORSTEEL HIP FLASHING
COLORSTEEL ROOFING ON B.P. ON WIRE NETTING (GALV) ON 75 x 50 PURLINS AT MAX 750 crs.
TOP CHORD OF TRUSS CARRIED DOWN
TRUSSES AT MAX. 900 C/C
STRATCO GUTTER & FASCIA
2/ 200 x 50
10MM GIB FOIL ON 75 x 40 STRAPPING AT 400 C/C WITH 100 F-G INSULATION
ALUMINIUM WINDOWS WITH CONDENSATION CHANNELS & 18 d/u REVEALS GROOVED FOR LININGS
PAINT GRADE FLUSH PANEL DOOR IN RIMU FRAME GROOVED FOR LININGS
10MM GIB FOIL ON 75 x 50 FRAMING AT MAX 600 C/C
LIVING
KITCHEN
HWC CUPBOARD
H.W.C. DOTTED
ALUMINIUM FRAMED PORCH SCREEN/CUP'D WITH GLASS TO PORCH AREA & 7.5 HARDIFLEX TO CUP'D AREA
BRICK VENEER
HARDIES RUSTICATED WEATHERBOARDS ON BP ON 70 x 45 BATTENS
HARDIFLEX RUSTICATED WEATHERBOARDS ON B.P. ON 70 x 45 BATTENS
10MM GIB FOIL ON 100 x 50 FRAMING WITH F-G INSULATION (75mm)
100 CONC SLAB WITH 668 MESH ON D.P.C. ON HARDFILL
SKIRTING
SECTION A 1:20
STRATCO GUTTER/ FASCIA
4.75 HARDIFLEX ON 100 x 50 FRAMING
ALUMINIUM GLAZED DOOR & FRAME
EX 75 x TIMBER TO SUIT
BRICK VENEER
SCHLAGE DEAD LOCK
SCHLAGE LATCH
HARDIFLEX RUST. W/B ON B.P.
SLATE CRETE CONCRETE PAVING AS SPECIFIED
TRUSSES & PURLINS AT MAX. 900 C/C
100 x 50 FRAMING
SECTION B 1:20
COLORSTEEL ROOFING ON B.P
HARDIFLEX RUSTICATED WEATHER BOARDS ON BUILDING PAPER ON FRAMING BETWEEN TRUSS MEMBERS TO SUPPORT W/B.
0.55 COLORSTEEL FLASHING
30° pitch
TRUSSES & PURLINS AT MAX. 900 C/C
10MM GIB FOIL & 100 F/G INSULATION
STRATCO FASCIA/GUTTER
VENT JOINTS AS SPECIFIED
450
BRICK VENEER
WINDOW
BOX WINDOW 18MM CUSTOM WOOD INTERIOR & HARDIFLEX EXT. SHEET ON BUILDING PAPER
GALV. WALL TIES AS SPECIFIED
WEEP JOINTS AS SPECIFIED
D.P.C ON CONC. COVING
SECTION C
ALUM WINDOW WITH 18 d/u REVEALS
2/200 x 50 LINTEL
10 GIBFOIL
FORMICA WALL LINING ON 100 x 50 FRAMING
HARDIES RUSTICATED W.B. ON BP ON 70 x 45 BATTENS
BRICK VENEER
DETAIL 5
DETAIL 4
DETAIL 3
HARDIES RUST'D W/BOARDS ON BUILDING PAPER
10MM GIB FOIL ON 'V' BARRIER & 75 FG INSULATION
600 THIOFLEX JOINT AROUND SLATE CRETE CONCRETE PAVING
1.2 MM GALV FLASHING
SLATE CRETE CONC. PAVING
SKIRTING
D.P.C
FOUND SLAB
H.D. BOLTS
DETAIL 2
TYPICAL KITCHEN DOOR SILL (lounge door similar)
CHRISTCHURCH CITY COUNCIL
CITY ARCHITECTS DIVISION : CITY WORKS & PLANNING DEPARTMENT
DUNDEE PLACE HOUSING DEVELOPMENT · STAGE 3
CROSS SECTIONS A,B & C.
SCALE 1:20, 1:5
DATE Mar 1989
DESIGN
DRAWN
TRACED
JOB NO
FILE NO
SHEET NUMBER 3
OF 5 SHEETS


CONTRACTOR SHALL VERIFY ALL DIMENSIONS BEFORE STARTING WORK
0.55 colour steel barge flashing
rusticated hardiplank on b.p. on 100x50 dwangs
0.55 colour steel flashing
0.4 g.m.s. colour steel roofing on b.p. & netting on 75x50 purlins at 750 max crs on trusses at 900 max crs
1000 min.
30° pitch roof
pack fibreglass to top of plate as req.
350 min
16mm fibrous plaster fully stopped to 100x50 dwangs
100x50 joists at 900 max crs
70x40 dwangs at 450 max crs
12.5mm gib foil
100mm fibreglass insulation
1.5mm butynol gutter on 18mm plywood base & pack to suit with 50x50
75x75 plate with masonry anchors at 750 crs to block work
styroliner lining
190 block wall with d12 at 600 crs vertically
see sheet 5 for kitchen joinery
LIVING ROOM.
BEDROOM.
BEDROOM.
LIVING ROOM.
KITCHEN.
SECTION D 1:20
DETAIL 1.
GARAGE
GARAGE.
SECTION A. 1:20
3½° pitch roof.
GARAGE.
TYPICAL GARAGE LONG SECTION. 1:20
CHRISTCHURCH CITY COUNCIL
CITY ARCHITECTS DIVISION : CITY WORKS & PLANNING DEPARTMENT
DUNDEE PLACE HOUSING DEVELOPMENT
STAGE THREE — SECTION & DETAILS
SCALE 1:20
DATE 10 10 89.
DESIGN G.F.H.
DRAWN
TRACED
JOB NO 502.53
FILE NO
SHEET NUMBER 4
OF 5 SHEETS


CONTRACTOR SHALL VERIFY ALL DIMENSIONS BEFORE STARTING WORK
18mm custom wood paint finish to doors
9.5mm gib foil vinyl wall paper finish
CUSTOM WOOD SHELVES
75
KITCHEN
LIVING
P.P.
TILED TOP & DRA
EDGES
p.p.
FORMICA TOP & COVED BACK & EDGES
space for fridge
2 cutlery drawers & liners & 2 storage drawers melteca finish
STUD WALL
1·560
STOVE (SUPPLIED BY C.C.C.)
150
900
cove vinyl to timber bead
VINYL FLOOR cove 100mm
ELEVATION A see plan sht A2 for references.
GIBBOARD CEILING ENAMEL FINISH
CUSTOM WOOD JOINERY
FIXED SHELF
FORMICA WALL BOARD WITH PVC JOINTERS
SWITCH
FLUSH PLY WOOD LINED DOOR
DOOR TO LIVING ROOM
FRIDGE (SPACE ONLY)
ADJUSTABLE SHELVES
PANTRY IN CUSTOM WOOD
cove vinyl 150mm to bead
Note all internal c/w to kitchen joinery to be white pre-finished
TOE RECESS
ELEVATION B
GIBBOARD CEILING STIPPLE FINISH
9·5 GIBBOARD & VINYL WALL PAPER
135 LITRE H.W.C.
face mount ex 25 timber door frame
25mm laquer paint finish c/w door
KITCHEN
H.W.C. CUPBOARD
FRAME UP SUPPORT UNDER H.W.C.
cove vinyl to timber bead (150mm)
ADJUSTABLE SHELVES
JOINERY IN CUSTOM WOOD
fig rimu bead to front (36x12)
DOOR TO BEDROOM
18mm c/w top
ADJUSTABLE SHELF 18mm c/w white prefinished & carcase
18mm c/w doors
LIVING
60 x 12 FIN. DARP SKIRTING
ELEVATION C
30mm styroliner
formica
VINYN FLOOR & COVED SKIRTING
DETAIL A
ALUMINIUM WINDOW FRAMES WITH customwood REVEALS
FIX.
T.H.
KITCHEN
LIGHT SWITCHES
FORMICA TOP & EDGES COVED BACK
GLASS
SELECTED OBSCURE CLASS
GLASS
ALUMINIUM DOOR & FRAMES WITH R.D.A REVEALS
18mm c/w carcase & shelves
18mm c/w doors
cove vinyl to timber bead
cove vinyl 150mm
ELEVATION D
SERVICE DUCT
FORMICA WALL BOARD WITH PVC BEADS
TOILET
SHAVING CABINET
STAINLESS STEEL WASHTUB MOUNTED END ON TO WALL
P/P
P/P
formica front & side
CUSTOM WOOD CUPBOARD
WASHING MACHINE
150
VINYL FLOOR & COVED SKIRTING
ELEVATION E
SHAVING CABINET SURFACE MOUNTED
FIX.
DUX CISTERN FIX.
FORMICA LINED WALLS & CEILING TO ALL TOILETS
FAN SWITCH
GRAB RAIL - Ø40 MM.
PAPER HOLDER
800
STANDARD WC.
FORMICA VANITY UNIT
ELEVATION F
'mac trac' & hanger rods
PACIFIC SHOWER MIXER
CORNER SOAP DISH
SHOWER CURTAIN
GRAB RAIL
SHOWER AREA
PURUS SHOWER DRAIN
SEE DETAIL A
50 MM FALL
P TRAP FITTED TO DRAIN
ELEVATION G
timber architrave to c/w unit
GIBBOARD CEILING STIPPLE FINISH
CUSTOM WOOD SHELVES
ADJUSTABLE SHELVES 18mm c/w
CUSTOM WOOD CUPBOARD UNIT
9·5 GIBBOARD & VINYL WALL PAPER
LIVING
P/P
600
PLY WOOD LINED DOOR 810 WIDE
SWITCH
DOOR TO KITCHEN
PLY WOOD LINED DOOR 810 WIDE
BEDROOM
DOOR TO TOILET
9·5 GIBBOARD & VINYL WALL PAPER
CUSTOM WOOD (25mm) WARDROBE
face mount ex 25 mm frame to doors
FIXED SHELF
GALV. PIPE HANGING RAIL
HANGING SPACE
1·600
200MM. WIDE SHOE SHELF
60 x 12 DA RIMU SKIRTING
ELEVATION H
EAVES
FIXED HARDIFLEX PANEL
bronze aluminium
DOORS LINED WITH HARDIFLEX
LINE OF BRICK VENEER
LOCK & handle
ADJUSTABLE SHELVES
DIVISION
HANGING SPACE
STORAGE CUPBOARDS
ELEVATION K
Note door frames aluminium
CHRISTCHURCH CITY COUNCIL
CITY ARCHITECTS DIVISION : CITY WORKS & PLANNING DEPARTMENT
DUNDEE PLACE HOUSING DEVELOPMENT • STAGE 3 – INTERIOR & PORCH ELEVATIONS
SCALE 1:20
DATE 16 10 89
DESIGN G.F.H.
DRAWN
TRACED
JOB NO
FILE NO
SHEET NUMBER 5
OF 5 SHEETS

Appendix C Geotechnical Interpretative report

Christchurch City Council

BE 1103 EQ2

Maurice Carter Courts

16 Dundee Place, Spreydon

GEOTECHNICAL INTERPRETATIVE REPORT

FINAL

- B
- 19 December 2012

Christchurch City Council
BE 1103 EQ2
Maurice Carter Courts
16 Dundee Place, Spreydon

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Contents

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Approval

	Signature	Date	Name	Title
Author		21/03/2013	Jon Rabey	Engineering Geologist
Approver		21/03/2013	Alex Martin	Project Manager

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1. Introduction

SKM has been commissioned by Christchurch City Council (CCC) to undertake a geotechnical investigation to provide foundation recommendations for the proposed new build residential units at 16 Dundee Place, Spreydon. It is understood that the findings from this report will be used in a quantitative Detailed Engineering Evaluation (DEE).

The scope of geotechnical works involved:

- Organising a drilling contractor to undertake the geotechnical investigation comprising 2 CPTs.
- Supervising the on-site investigation (CPTs), undertaking hand auger boreholes and Scala penetrometer tests, logging geotechnical data and soil sampling.
- Preliminary assessment of liquefaction potential and settlement at the site.
- Preparation of a geotechnical interpretative report identifying the ground related issues for consideration when building the proposed residential units.
- Recommendation for foundations for the purpose of cost estimating.

2. Site description

The site is located at 16 Dundee Place in Spreydon and comprises a topographically flat, undeveloped area of lawn (approximately 40 m by 50 m) in between residential properties.

- **Table 2.1 – Site Location**

Maurice Carter Courts has been classified as ‘urban non-residential’ by CERA. However, the site is surrounded by residential housing which has been classified as TC2 so it is suggested that Maurice Carter Courts falls under this category with respect to foundation construction. TC2 refers to the ‘Foundation Technical Category 2’ which is defined as:

Minor to moderate damage land from liquefaction is possible in future large earthquakes. Lightweight construction or enhanced foundations are likely to be required such as enhanced concrete raft foundations.

3. Existing geotechnical information

3.1. Investigation by third parties

Available map data shows that no boreholes or Cone Penetration Tests (CPTs) have been undertaken previously on the site or if they have, they are not publically available. No boreholes were found in close proximity to the site from a search of all available information. However, Project Orbit shows CPT logs (approximately 250 m away) which indicate silts and sands to at least 16 m below ground level (mbgl).

The liquefaction mapping exercise undertaken by Cubrinovski and Taylor following the 22 February 2011 earthquake found no evidence of liquefaction within or adjacent to the site. EQC interpretation of liquefaction from mapping shows no liquefaction after 22 February 2011 or 23 December 2011, but some minor liquefaction occurred in the nearby area following the 13 June earthquake. Discussions with local residents confirmed that no damage to the properties had occurred and that no liquefaction was observed in the immediate area of the site following any of the major earthquakes in the recent Canterbury earthquake sequence.

3.2. Regional geology

The 1:250,000 geological map of the Christchurch urban area (Brown and Weeber, 1992) indicates that the site is predominantly underlain by alluvial sand and silt deposits of the Springston Formation.

4. Geotechnical investigation

4.1. General

The geotechnical investigation included 2 CPT tests to a target depth of 20 mbgl as detailed in Table 4.1. Prior to commencing the CPTs, hand auger boreholes were excavated at each CPT position to check for the presence of underground services. The boreholes were terminated at 1.5 mbgl and then backfilled with arisings. In addition, 6 Scala penetrometer tests were undertaken to a maximum depth of 3.3 mbgl (see Table 4.3) and 4 further hand auger boreholes were put down to 3 mbgl (see Table 4.2). Please refer to the exploratory hole location plan showing all the test locations (Appendix A).

4.2. Methodology

4.2.1. Cone penetration tests

The CPTs were conducted using a truck mounted CPT rig in accordance with ASTM standard D-5778-07.

Table 4.1 summarises the CPT locations and probe depths. The CPT results are presented in Appendix B.

- **Table 4.1 – CPTs Summary**

CPT	Final depth, mbgl	Coordinates		Termination Remarks
		Eastings	Northings	
CPTu01	19.94	1567691	5177820	Target depth
CPTu02	20.00	1567664	5177793	Target depth

Note: Coordinates to NZTM, derived from aerial photography; CPTu = piezocone

4.2.2. Hand augers

The 4 hand auger boreholes referred to in Section 4.1 above are detailed in Table 4.2 below.

- **Table 4.2 – Hand augers summary**

Hand augerhole	Final depth, mbgl	Coordinates	
		Eastings	Northings
H1	3.2	1567704	5177801
H2	3.2	1567692	5177789
H3	3.0	1567661	5177796
H4	3.2	1567676	5177807

Note: Coordinates to NZTM, derived from aerial photography.

4.2.3. Scala penetrometer tests

The 6 Scala penetrometer tests referred to in Section 4.1 above are detailed in Table 4.3 below.

- **Table 4.3 – Scala penetrometer summary**

Scala penetrometer test	Final depth, mbgl	Coordinates	
		Eastings	Northings
S1	3.3	1567691	5177820
S2	3.3	1567704	5177801
S3	3.3	1567692	5177789
S4	3.3	1567677	5177780
S5	3.3	1567661	5177796
S6	3.3	1567676	5177807

4.3. Groundwater observations

The table below provides a summary of the groundwater levels observed during the investigation.

- **Table 4.4 – Groundwater levels summary**

Test ref.	Date	Groundwater Level (mbgl)
CPTu01	10/12/12	1.0
CPTu01	10/12/12	1.0
H1	11/12/12	1.3
H2	11/12/12	1.4
H3	12/12/12	1.2
H4	12/12/12	1.3

5. Geotechnical interpretation

5.1. Geological model

Based on the above data and the review of published geological information, the following ground model for the site can be inferred.

- **Table 5.1 – Geological ground model**

Depth range (mbgl)	Description	Formation
0.0 – 0.5	SILT / Clayey SILT with subordinate peat bands	Springston
0.5 – 13.0	Silty SAND / Sandy SILT/ Clayey SILT with subordinate peat bands	Springston
13.0 – 20.0	SAND / Silty SAND / SILT	Springston
20 >	Sandy GRAVEL	Riccarton Gravels

Note: Ground model based on CPT logs only

The CPT logs indicate the subsurface to comprise of silts and sands to 20 mbgl. The subsurface material becomes sandy at approximately 13 mbgl.

5.2. Geotechnical parameters

This section provides the geotechnical parameters adopted for use in foundation design. The parameters are based on in-situ test results with empirical correlations.

- **Table 5.2 – Summary of geotechnical parameters**

Unit	Depth (mbgl)	Cohesion (kPa)	Peak undrained shear strength (kPa) (1)	Effective friction Angle (Degrees) (2)	Relative Density (%) (3)
SILT / Clayey SILT	0.0 – 0.5	0	50	35	45
Silty SAND / Sandy SILT / Clayey SILT	0.5 – 13.0	5	80	30	30
SAND / Silty SAND / SILT	13.0 – 20.0	0	-	38	45
Sandy GRAVEL	20 >	0	-	38	65

1) Parameters estimated from CPT correlations – Lunne et al (1997), Scala penetrometer and shear vanes.
2) Parameters estimated from CPT results, shear vanes, published data (Meyerhof G.G. 1956) and experience (1956).
3) Parameters estimated from published data (NZGS guidelines, 2005) and CPT results.

These values are based on site conditions at the time of investigation and may change if the subgrade is disturbed prior to foundation construction, in which case further geotechnical assessment may be required.

It is suggested that the ground parameters listed above together with the seismic subsoil class and liquefaction assessment can be used to assess the existing residential units at 16 Dundee Place for the purposes of writing a quantitative DEE.

5.3. Seismicity

Canterbury is located in a wide zone of active earth deformation associated with collision between the Australian and Pacific plates. The nearest active fault to the site is the Greendale Fault, approximately 22 km west of central Christchurch based on the Institute of Geological and Nuclear Society (GNS) active fault database.

The design seismic actions have been evaluated in accordance with NZS1170.5:2004 considering upgraded Z factors as per recommendations by the Structural Engineering Society (SESOC) following the Canterbury Earthquakes (2010-2011).

The site has been evaluated as Class D due to the consistency and depth of the alluvial formations underlying this site. An Importance Level of 2 has been selected based on the current site use. SKM is not aware of any planned changes to the use of the site.

6. Geotechnical considerations

6.1. Liquefaction

The liquefaction potential of the site has been evaluated based on CPT results using the Modified Robertson Method published in the 1997 Proceedings of NCEER Workshop on Evaluation of Liquefaction Resistance of Soils (TL Youd, 2001).

Estimations of liquefaction-induced ground settlement have been determined using Ishihara & Yoshimine (1992) method. This is strictly an estimate due to limitations involved with the calculation, and the predicted settlements are generally regarded as conservative.

The following tables (Table 6.1 to 6.2) summarise the liquefaction potential of the site and its estimated ground settlement. A groundwater level of 1 mbgl has been used in the liquefaction analysis.

- **Table 6.1 – Evaluation of liquefaction potential from CPT results for a ULS design event (0.35g/M7.5)**

CPT	Sections that have potentially liquefiable layers (mbgl)	Potentially liquefiable thickness (m)	Estimated Ground Settlement (mm)
CPT01	1.5 – 15.2 16.2 – 19.2	16.7	670
CPT02	1.5 – 10.9 11.1 – 15.0 15.2 – 15.9 16.5 – 19.3	16.8	670

- **Table 6.2 – Evaluation of liquefaction potential from CPT results SLS design event 0.13g / M7.5**

CPT	Sections that have potentially liquefiable layers (mbgl)	Potentially liquefiable thickness (m)	Estimated Ground Settlement (mm)
CPT01	1.5 – 7.8 8.2 – 12.8 12.9 – 13.2 13.4 – 14.5 14.8 – 15.2 16.2 – 16.4 16.7 – 19.2	15.4	620
CPT02	1.5 – 10.9 11.1 – 14.8 15.5 – 15.8 16.5 – 17.2 18.0 – 18.2 18.4 – 19.1	15.0	600

Based on our recent investigation the site is unlikely to be susceptible to liquefaction in future earthquakes despite the high estimated ground settlements in the tables above. The estimates above are based upon the 1997 Proceedings of NCEER Workshop on Evaluation of Liquefaction Resistance of Soils (TL Youd, 2001). This procedure does not take into account the percentage of fines which has resulted in the high estimates of estimated ground settlement in the tables above. According to Project Orbit, aerial photography and discussions with local residents, there has been no evidence of liquefaction at the surface following the major earthquakes in the recent Canterbury earthquake sequence. No ejected material, sand boils or uneven ground was identified during the site visit.

Graphical outputs of liquefaction assessments from CPT results are provided in Appendix C for ULS and SLS design events. The results suggest that most of the material in the subsurface is cohesive in nature up to 13 mbgl and therefore does not have the potential to liquefy. It is suggested that the more silty layers (particularly at the ground surface) have confined any liquefiable material at depth preventing any material coming to the ground surface. The sand below 13 mbgl, although liquefiable, has not manifested at the surface due to the cohesive strata above preventing the upward movement of liquefied material.

6.2. Lateral spread

The site is not located near any free faces and is therefore considered to be at a negligible risk of lateral spread.

6.3. Bearing capacity

An assessment of the bearing capacity of the shallow soils can be carried out based on the findings of the Scala penetrometer results and in particular the plots of blow counts with depth. The majority

6.4. Foundations

6.4.1. General

Notwithstanding the findings of the liquefaction assessment and bearing in mind the nature of the proposed development, it is assumed that the recommendations contained within the Department of Building and Housing (DBH) guidance dated November 2011 can be adopted assuming single storey buildings with lightweight cladding and roofing.

The development comprises the construction of eight units (1-8) with associated garages, parking areas, footpaths and soft landscaping. The recommendations provided below relate to the units and any integral garages. In the case of detached garages, consideration could be given to a conventional strip footing and ground bearing slab assuming an ultimate rupture bearing capacity of 200 kPa as indicated by the Scala penetrometer test results.

As previously mentioned, the site is located within an area classified as TC2. The Scala penetrometer test results indicate an ultimate rupture bearing capacity of 200 kPa (i.e. blows counts of 2 or 3 for 100mm penetration). Based on this assessment of the ultimate rupture bearing capacity and referring to the above design guidance, it is recommended that the units are provided with foundations consisting of a TC2 compliant stiffened raft slab as outlined below.

It should be noted that all the below options require detailed consideration to be given to the service lines as they enter and travel within the slab. With careful design, provision could also be included in the design of the raft slabs for re-levelling following a major seismic event, if required.

6.4.2. Raft Options

A detailed description of the TC2 complaint raft slab options is provided in Section 5.3 of the DBH guidance. An overview is provided below.

6.4.2.1. Composite raft and gravel platform

This option involves removing the upper 800mm of soil from below the proposed raft followed by the reinstatement of the excavation to the underside of the raft with well graded and compacted granular fill with a basal geo-grid layer and possibly a further geo-grid layer at the mid-depth of the gravel platform and at least 100mm below the lowest point of the raft. The overlying raft should comprise a NZS3604 reinforced and tied slab foundation with edge beams and local thickenings beneath internal load bearing walls.

6.4.2.2. Thick slab raft

This option involves the construction of a 300mm thick reinforced slab raft with a minimum of two layers of mesh reinforcement (top and bottom). The guidance stipulates that for two storey, heavyweight structures, the thickness of the slab should be increased to 400mm.

6.4.2.3. Generic beam grid and slab formation

This option involves the construction of a 100mm thick reinforced slab supported on a 250mm thick layer of compacted gravel or polystyrene pods tied into external and internal, 600mm deep by 300mm wide, reinforced concrete beams with a maximum span between the beams of 3.5m.

6.4.2.4. Waffle slab raft

This option involves the construction of a 85mm thick slab raft supported on 300mm deep polystyrene pods and tied into 385mm deep by 300mm wide external, reinforced concrete beams and internal, 100mm wide reinforced concrete ribs at spacings not exceeding 1.2m.

6.4.3. Other foundation options

In addition to the above shallow solutions, consideration could be given to piles or ground improvement. However, both options are likely to prove more expensive than the raft slab solutions outlined above. It should be noted that detailed design of the slab rafts will be required by a qualified structural engineer using the information contained in this report.

7. Conclusions and recommendations

7.1. Conclusions

- The site is underlain by silts and sands of the Springston Formation overlying Riccarton Gravels. The subsurface strata are generally cohesive (silts/silty clays) in nature up to 13 mbgl. Sands are encountered between 13 and 20 mbgl.
- The groundwater level has been estimated to be between 1.0 and 1.4 mbgl. A conservative groundwater level of 1.0 mbgl has been used in the liquefaction assessment.
- The site has been evaluated as Class D due to the consistency and depth of the alluvial formations underlying this site.
- The liquefaction assessment indicates the potential for 670 mm of liquefaction induced total free field settlement at the site. However, this does not take into account the percentage of fines. As the subsurface mostly comprises materials with a high percentage of fines between the ground surface and 13 mbgl this material is expected to have a low susceptibility to liquefaction.
- Maurice Carter Courts are not located near any free surfaces and are therefore considered to be at negligible risk of lateral spread.
- It is suggested that the ground parameters listed in this report together with the seismic subsoil class and liquefaction assessment can be used to assess the existing residential units at 16 Dundee Place for the purposes of writing a quantitative DEE.

7.2. Recommendations

- Based on this assessment of the ultimate rupture bearing capacity and referring to the TC2 design guidance, it is recommended that the units and integral garages are provided with foundations consisting of a TC2 compliant stiffened raft slab as outlined in section 6.4.2.For the detached garages, a conventional strip footing and ground bearing floor slab should suffice.
- In addition to a shallow foundation solution, consideration could be given to piles or ground improvement. However, both options are likely to prove more expensive than the raft slab solutions outlined above.
- If significant modifications or relevelling of the existing units is required additional ground investigation is likely to be required.

8. Limitations

This report is project specific. It was prepared to address geotechnical issues relating to Maurice Carter Courts, 16 Dundee Place in accordance with the scope of works as defined in the contract between SKM and our Client. This report has been prepared on behalf of, and for the exclusive use of, our Client, and is subject to, and issued in accordance with, the provisions of the contract between SKM and our Client. The findings presented in this report should not be applied to another site or another development within the same site without consulting SKM.

Geotechnical conditions can change and will vary across any site and between investigation locations. The findings of this geotechnical report reflect the geotechnical conditions at the identified locations and at the time of the investigation. If this report is being referenced after some period of time has elapsed since it was drafted then it is recommended that SKM be consulted regarding the current validity of this report.

Not all of the ground conditions that exist at the site may have been identified in this report. All reports and conclusions that deal with sub-surface conditions are based on interpretation and judgement and as a result have uncertainty attached to them. You should be aware that this report contains interpretations and conclusions which are uncertain due to the nature of the investigations. Sampling techniques, by definition, cannot determine the conditions between the sample points and so this report cannot be taken to be a full representation of the sub-surface conditions. This report only provides an indication of the likely sub surface conditions. No study or investigation can eliminate every risk and conclusively identify all the ground conditions within a site.

This report is based on assumptions that the site conditions as revealed through sampling are indicative of conditions throughout the site. The findings are the result of standard assessment techniques used in accordance with normal practices and standards, and they represent a reasonable interpretation of the current conditions on the site.

This report should be read in full and no excerpts are to be taken as representative of the findings. It must not be copied in parts, have parts removed, redrawn or otherwise altered without the written consent of SKM.

9. 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.

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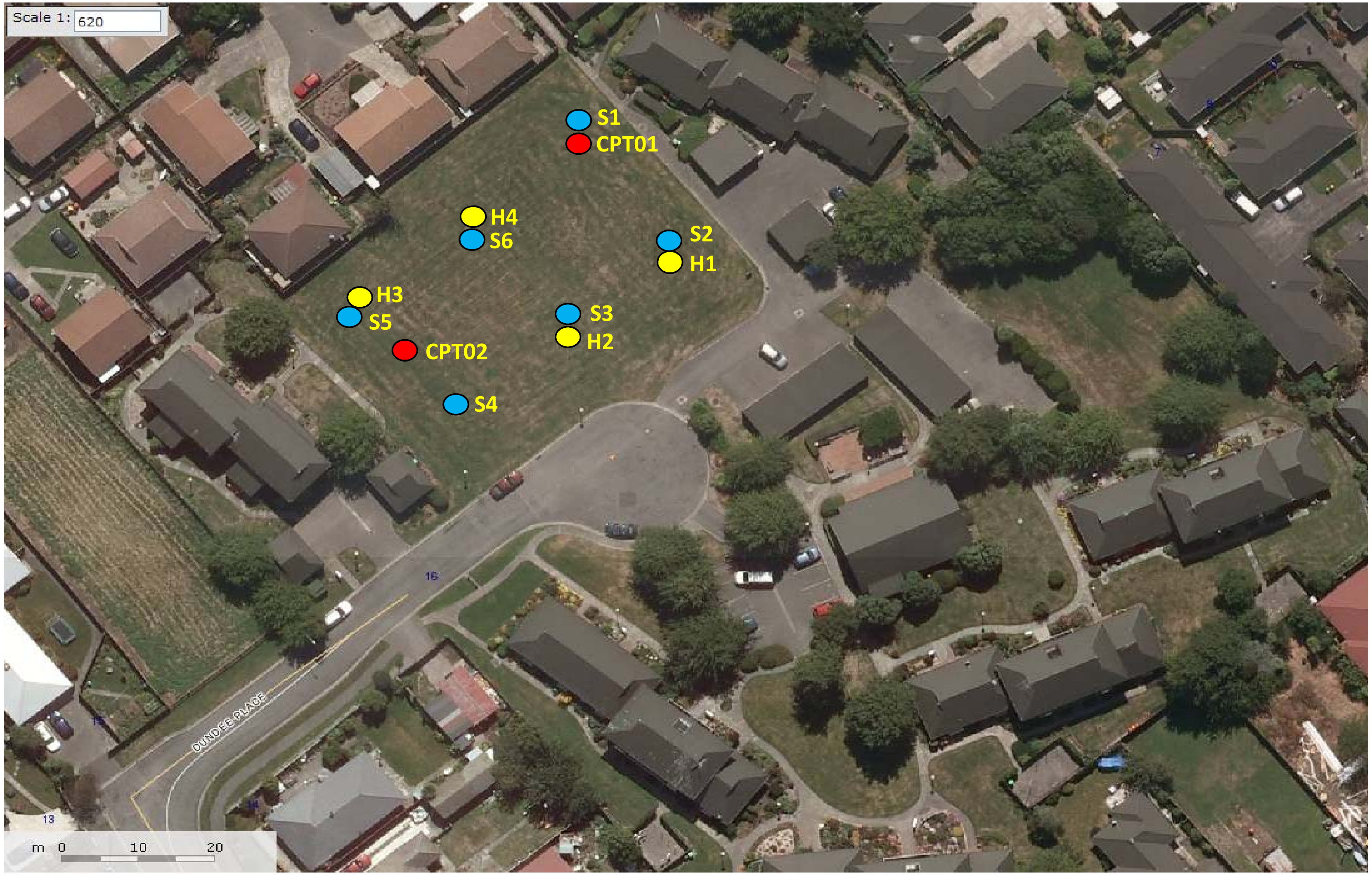
Robertson. 2010. Guide to Cone Penetration Testing, 4th Edition.

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

Youd, TL et al. 2001. Liquefaction Resistance of Soils: summary report from the 1996 NCEER and 1998 NCEER/NSE workshops on evaluation of liquefaction resistance of soils. Journal of Geotechnical and Geoenvironmental Engineering, ASCE, vol. 127, no. 10, Oct pp.817 – 833.

Appendix A – Site Plan



Legend:

🔴 CPT

🟡 Hand augerhole

🔵 Scala penetrometer

Note: scale and layout approximate only.

Client:	Christchurch City Council	Job No:	ZB01276.219
Project:	Maurice Carter Courts, 16 Dundee Place	Date:	19-Dec-12
		Scale:	N/A
Title:	Geotechnical Investigation Site Plan	By:	Jon Rabey
	SKM	Figure:	Appendix A

Appendix B – CPT logs

CPT ANALYSIS NOTES

Soil Type

Interpretation using chart of Robertson & Campanella (1983). This is a simple but well proven interpretation using cone tip resistance (q_C) and friction ratio (f_R) only. No normalisation for overburden stress is applied. Cone tip resistance measured with the piezocone is corrected with measured pore pressure (u_C).

- 🟥 sand (and gravel)
- 🟨 silt-sand
- 🟩 silt
- 🟦 clay-silt
- 🟦 clay
- ⬛ peat

Liquefaction Screening

The purpose of the screening is to highlight susceptible soils, that is sand and silt-sand in a relatively loose condition. This is not a full liquefaction risk assessment which requires knowledge of the particular earthquake risk at a site and additional analysis. The screening is based on the chart of Shibata and Teparaksa (1988).

- 🟥 high susceptibility
- 🟧 medium susceptibility
- 🟩 low susceptibility

High susceptibility is here defined as requiring a shear stress ratio of 0.2 to cause liquefaction with D_{50} for sands assumed to be 0.25 mm and for silty sands to be 0.05 mm.

Medium susceptibility is here defined as requiring a shear stress ratio of 0.4 to cause liquefaction with D_{50} for sands assumed to be 0.25 mm and for silty sands to be 0.05 mm.

Low susceptibility is all other cases.

Relative Density (D_R)

Based on the method of Baldi et. al. (1986) from data on normally consolidated sand.

Undrained Shear Strength (S_U)

Derived from the bearing capacity equation using $S_U = (q_C - \sigma_{VO})/15$.

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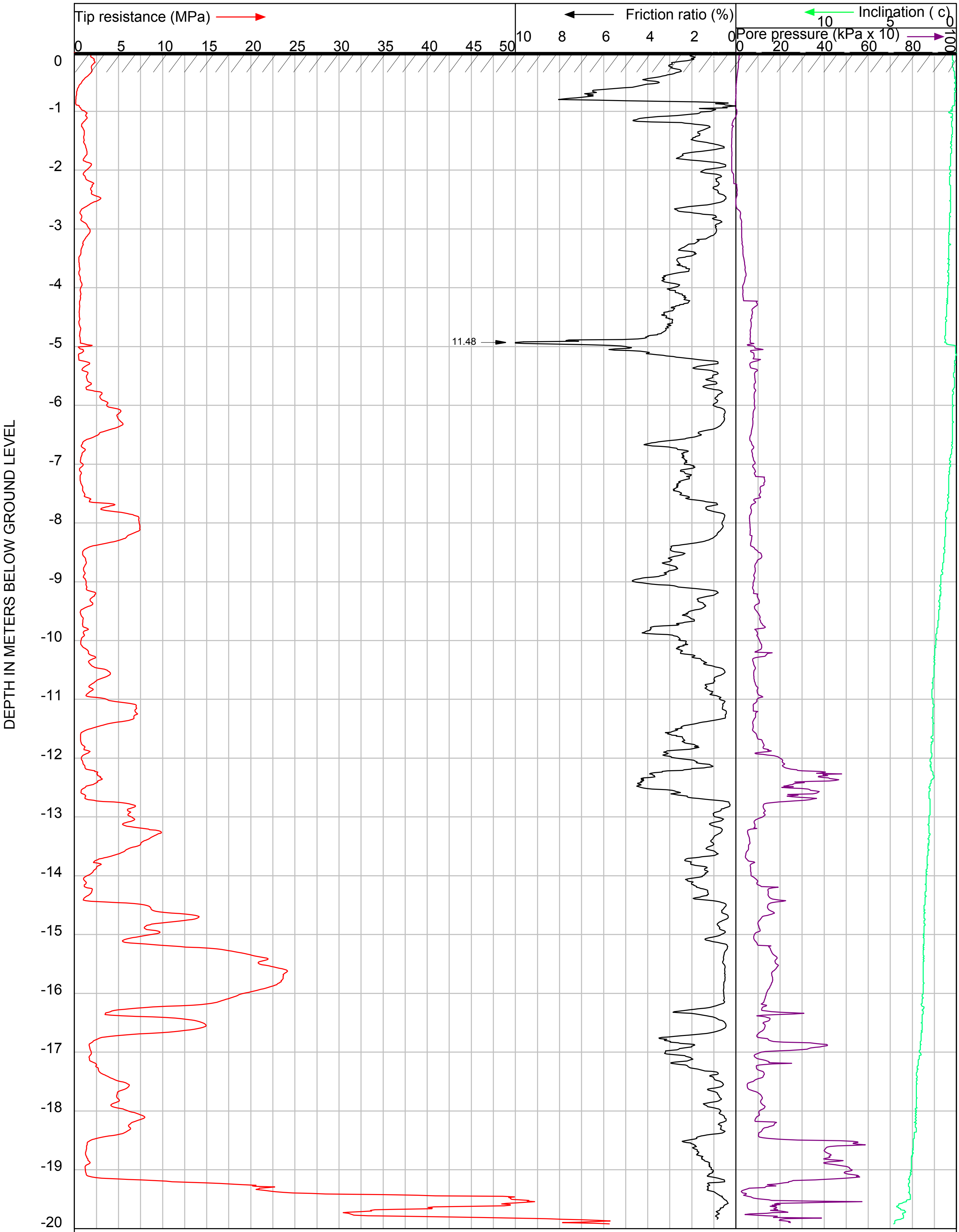

CLIENT : Sinclair Knight Merz
LOCATION : 16 Dundee Place, Christchurch
DATE : 10-12-2012
OPERATOR : S.Cardona
REMARK 1 : CPTu001
REMARK 2 : Effective Refusal

JOB # : 11448
TEST # : 1
CONE TYPE/SERIAL #: I-CFXYP20-10/ 120523T

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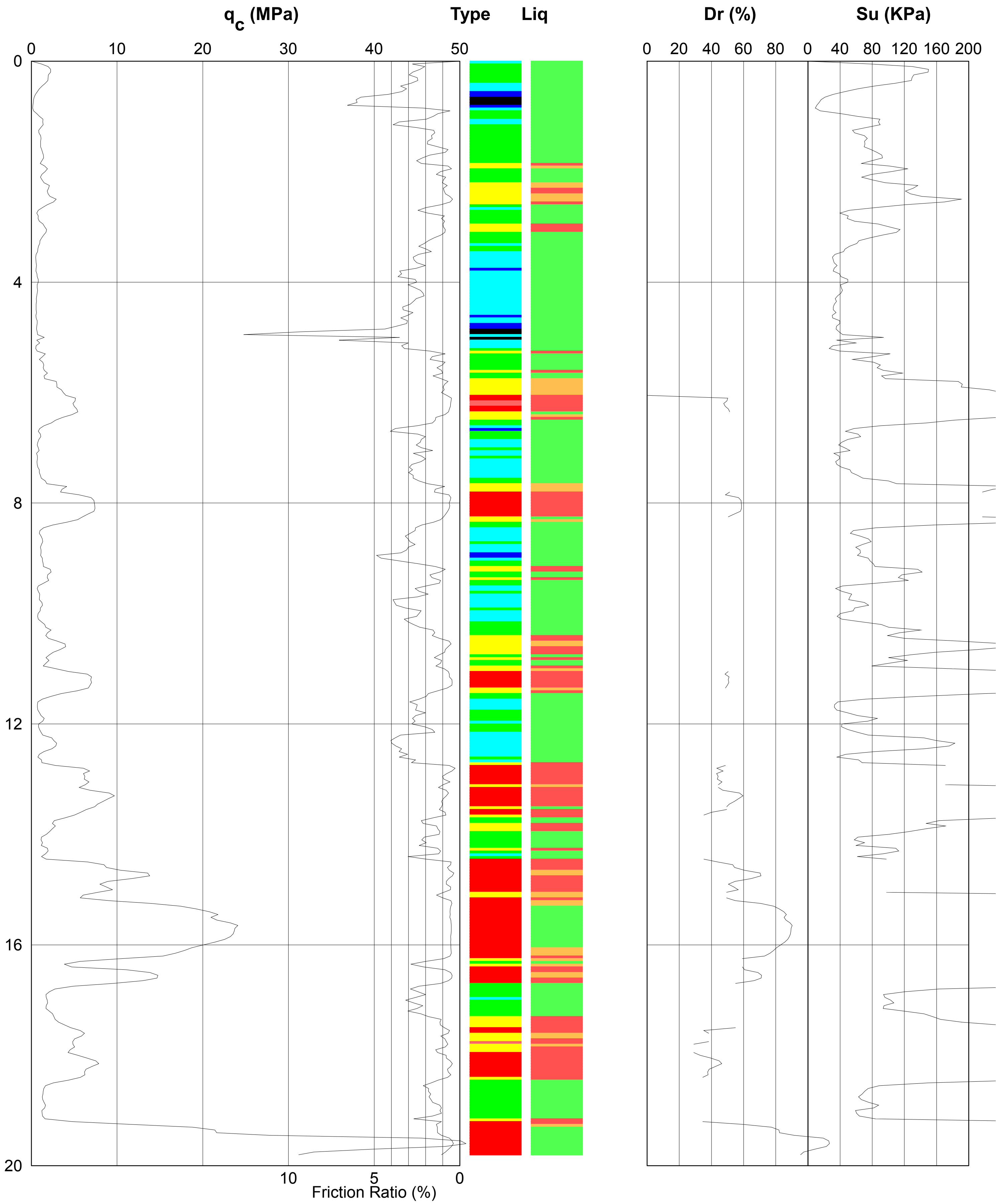
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



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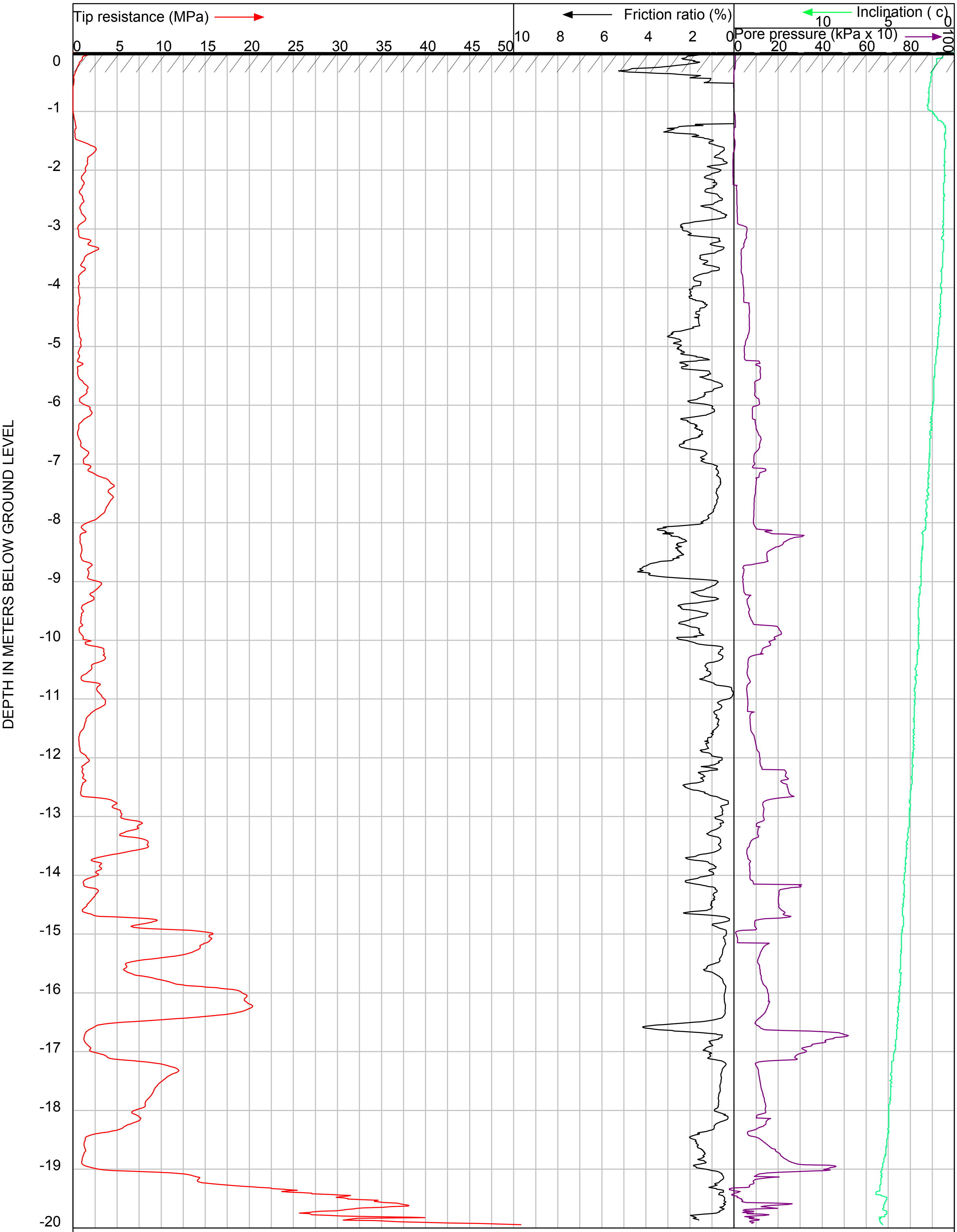
CPT No:	CPTu001	Operator:	S.Cardona
Project:	Sinclair Knight Merz	Remark:	Effective Refusal
Location:	16 Dundee Place, Christchurch		



CLIENT	:	Sinclair Knight Merz
LOCATION	:	16 Dundee Place, Christchurch
DATE	:	10-12-2012
OPERATOR	:	S.Cardona
REMARK 1	:	CPTu002
REMARK 2	:	Target Depth

JOB # : 11448

TEST # : 2

CONE TYPE/SERIAL #: I-CFXYP20-10/ 120523T

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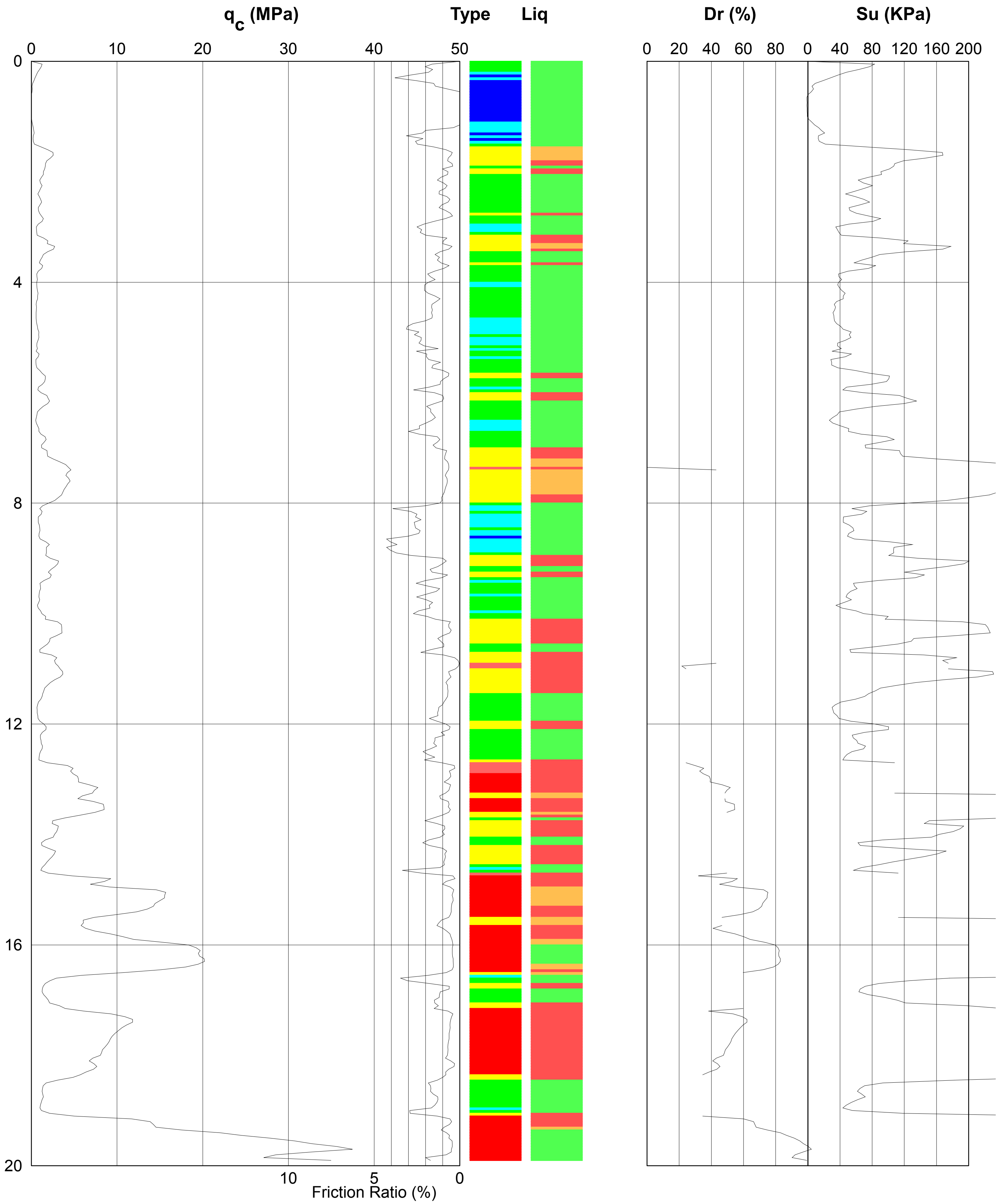
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No:	11448	Date:	10-12-2012
CPT No:	CPTu002	Operator:	S.Cardona
Project:	Sinclair Knight Merz	Remark:	Target Depth
Location:	16 Dundee Place, Christchurch		

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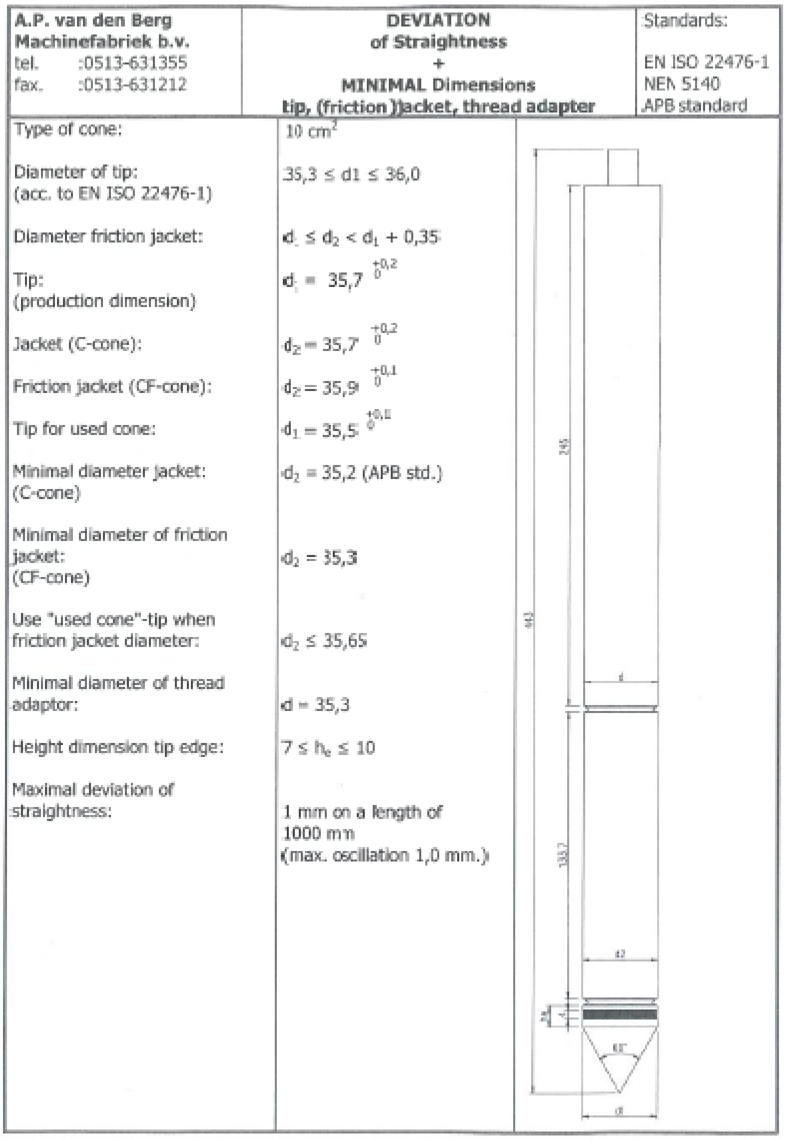
CPT CALIBRATION AND TECHNICAL NOTES

These notes describe the technical specifications and associated calibration references pertaining to the following cone types:

- ELCI-10CFXY measuring cone resistance, sleeve friction and inclination (standard cone);
- ELCI-CFXYP20-10 measuring cone resistance, sleeve friction, inclination and pore pressure (piezo cone).

Dimensions

Dimensional specifications for both cone types are detailed below. All tolerances are routinely checked prior to testing and measurements taken are manually recorded on CPT field sheets. All field sheets are kept on file and available on request.



A.P. van den Berg
Machinefabriek b.v.
tel. :0513-631355
fax. :0513-631212

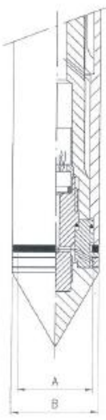
DEVIATION
of Straightness
+
MINIMAL Dimensions
tip, (friction)jacket, thread adapter

Standards:

EN ISO 22476-1
NEN 5140
APB standard

Type of cone:	10 cm^2
Diameter of tip: (acc. to EN ISO 22476-1)	$35,3 \le d1 \le 36,0$
Diameter friction jacket:	$d \le d_2 < d_1 + 0,35$
Tip: (production dimension)	$d = 35,7\ ^{+0,2}_{0}$
Jacket (C-cone):	$d_2 = 35,7\ ^{+0,2}_{0}$
Friction jacket (CF-cone):	$d_2 = 35,9\ ^{+0,1}_{0}$
Tip for used cone:	$d_1 = 35,5\ ^{+0,1}_{0}$
Minimal diameter jacket: (C-cone)	$d_2 = 35,2$ (APB std.)
Minimal diameter of friction jacket: (CF-cone)	$d_2 = 35,3$
Use "used cone"-tip when friction jacket diameter:	$d_2 \le 35,65$
Minimal diameter of thread adaptor:	$d = 35,3$
Height dimension tip edge:	$7 \le h_e \le 10$
Maximal deviation of straightness:	1 mm on a length of 1000 mm (max. oscillation 1,0 mm.)

Cone surface ratio



$A = 0,25 \times 3,14 \times 30,9 \times 30,9 = 750\ MM^2$
$B = 0,25 \times 3,14 \times 35,7 \times 35,7 = 1000\ MM^2$

$\alpha = A/B \qquad \beta = 1 - A/B$

$\alpha = 750/1000 = 0,75$
$\beta = 1 - 0,75 = 0,25$

Calibration

Each cone has a unique identification number that is electronically recorded and reported for each CPT test. The identification number enables the operator to compare 'zero-load offsets' to manufacturer calibrated zero-load offsets.

The recommended maximum zero-load offset for each sensor is determined as ± 10% of the maximum measuring range although the more conservative trigger point adopted by McMillan Drilling Services is ± 10% of the nominal range.

In addition to maximum zero-load offsets, McMillan Drilling Services also limits the difference in zero load offset before and after the test as ± 1% of the maximum measuring range. See table below:

	Tip (MPa)	Friction (MPa)	Pore Pressure (MPa)
Maximum Measuring Range:	150	1.50	3.00
Nominal Measuring Range:	100	1.00	2.00
Max. 'zero-load offset':	10	0.10	0.20
Max 'before and after test':	1.5	0.015	0.03

Note: The zero offsets are electronically recorded and reported for each test in the same units as that of each sensor.

TEST CERTIFICATE
Icone (all versions)

Supplier:	A.P. v.d. Berg Machinefabriek, Heerenveen The Netherlands
Production-order:	57152
Client:	McMillan
Cone-type:	ELCI-CFXYP20-10
Cone-number:	120523

To test / To check item	**Required value**	**Checked value**
Isolation-resistance	>0.5 G-Ohm	Gohm
Straightness	S=<0,2 mm	f mm
Zero-Value Tip	Good	-4,546 MPa
Zero-Value Local Friction	Good	-0,0696 MPa
Zero-Value Pore Pressure	Good	-233 kPa
Zero-Value Inclination X Zero-Value Inclination Y	-2°< X <+2° -2° < Y <+2°	-0,1 ° 0,1 °
Measurements Tip resistance OK?	[✓ Yes]	0-50 MPa
Influence of Tip on Local Friction and Pore Pressure? Tip: **Max Load**; Mantle free? 10cm2:**150 kN.** // 15 cm2:**225 kN.**	[✓ No influence]	
Measurements Local Friction OK?	[✓ Yes]	0-0,75 MPa
Local Friction: **Max Load**	[✓ O.K.]	
Measurements Pore Pressure OK?	[✓ Yes]	0-2000 kPa
Measurements Inclination OK?	[✓ Yes]	± 10°
Cone recognition on disconnecting and connecting Icone again?	[✓ Yes]	
Software version **1.8** installed? Check at opening screen. **Uitzondering: GEO LYNBY gebruikt v. 1.7 ! NOTEER versienr.**	Version:	1.8
Check alarm-settings Icone. Alarm values are set. (Kill Shutdown)	[✓ O.K.]	

Remarks:

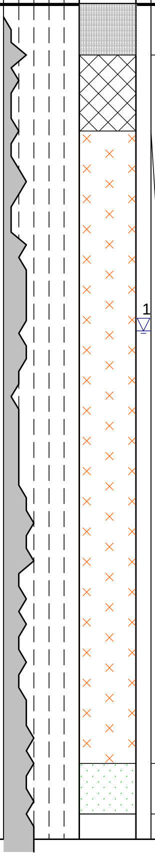
Calibrated by: J.E. Tenhage	Date: 14.05.12	Sign.:
Final check: C.J. Ouwejan	Date: 15.05.12	Sign.:

Appendix C – Hand auger logs

Preliminary Log of Investigation

Project: **Maurice Carter Courts**	
Location: **16 Dundee Place** Project No: **ZB01276.219**	Hole ID: **H1**
Client: **Christchurch City Council**	Date: **11/12/2012**

R.L. (m)	Depth (m)	Shift Details	Drilling Method	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
										SILT with trace sand, brown. Soft, dry, low plasticity **(Topsoil)**	R	
										SILT with gravel. Soft, dry, low plasticity. Gravel is fine to medium, subangular **(Fill)**	Q1nc	
					$I_{vp}65/I_{vr}26$					*0.20m: With subangular, fine to medium gravel (Fill)* *0.30m: Minor sand. Sand becomes coarse.* *0.40m: Absence of gravel*		
										SILT, grey mottled orange. Soft, dry, low plasticity **(Alluvium)**	Q1a	
	1.0				$I_{vp}207/I_{vr}207$				1	*0.60m: Becomes moist, moderate plasticity.* *0.90m: Becomes high plasticity* *1.00m: Becomes low plasticity, sandy.* *1.10m: Becomes firm, moderate plasticity.* *1.30m: Becomes high plasticity.* *1.80m: Becomes very soft, wet.*		
					$I_{vp}39/I_{vr}25$							
	2.0				$I_{vp}23/I_{vr}19$							
					$I_{vp}58/I_{vr}48$							
	3.0									SAND with silt, grey. Loose, wet **(Alluvium)**	Q1a	



H1 terminated at 3.30m. Target Depth

Started: 11/12/2012 Finished: 11/12/2012 Driller: N/A Plant: Logged: JR Checked: LAB	Depth Related Remarks *From* *Remarks*	Groundwater Observations *No.* *Struck (m)* *Date* *Observations* *Standing (m)* 1. 1.3m 11/12/2012	Co-ordinates: 5177801.00mN 1567704.00mE Inclination: -90°
	Remarks NZTM coordinates derived from aerial photography.		Page 1 of 1

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

SKM

Preliminary Log of Investigation

Project: **Maurice Carter Courts**

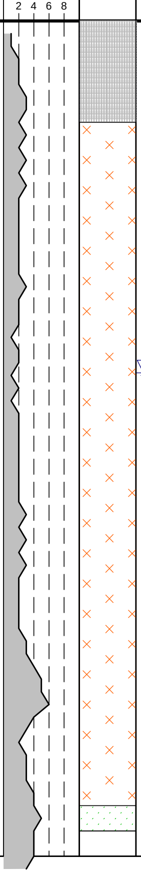
Location: **16 Dundee Place** Project No: **ZB01276.219**

Hole ID: **H2**

Client: **Christchurch City Council**

Date: **11/12/2012**

Description of Strata



R.L. (m)	Depth (m)	Drilling Method	In-Situ Testing	Sampling	GroundWater	Description of Strata	Geological Unit	Backfill / Installation
						SILT with trace sand, brown. Soft, dry, low plasticity. **(Topsoil)**	R	
						0.20m: Sand becomes fine to medium.		
			I_{vp}134/I_{vr}61			SILT with minor sand, grey mottled orange. Firm, dry, low plasticity. **(Alluvium)**	Q1a	
						0.60m: Becomes soft, moderate plasticity. Absence of sand.		
						0.70m: Becomes moist. Trace of sand		
	1.0		I_{vp}135/I_{vr}55			*0.90m: Becomes firm*		
					1 ▽	*1.15m: Becomes high plasticity. Absence of sand.*		
			I_{vp}104/I_{vr}30			*1.40m: Becomes wet.*		
	2.0		I_{vp}80/I_{vr}35			*1.80m: Becomes very soft. Trace of sand.*		
						2.40m: Becomes sandy, grey.		
						2.70m: Wood fragments.		
	3.0		I_{vp}90/I_{vr}84					
						SAND with silt. Loose, wet. **(Alluvium)**	Q1a	

H2 terminated at 3.30m. Target Depth

Started: 11/12/2012

Finished: 11/12/2012

Driller: N/A

Plant:

Logged: JR

Checked: LAB

Depth Related Remarks

From *Remarks*

Groundwater Observations

No.	*Struck (m)*	*Date*	*Observations*	*Standing (m)*
1.	1.4m	11/12/2012		

Remarks

NZTM coordinates derived from aerial photography.

Co-ordinates:

5177789.00mN

1567692.00mE

Inclination: -90°

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

Preliminary Log of Investigation

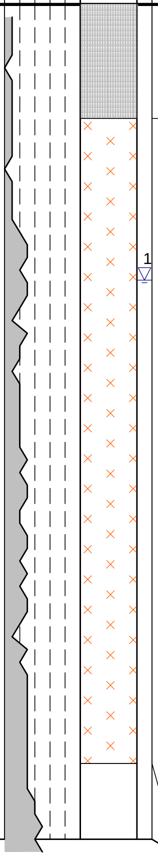
Project: **Maurice Carter Courts**

Location: **16 Dundee Place** Project No: **ZB01276.219**

Hole ID: **H3**

Client: **Christchurch City Council**

Date: **12/12/2012**



R.L. (m)	Depth (m)	Shift Details	Drilling Method	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
										SILT with trace sand, brown. Soft, dry, low plasticity.**(Topsoil)**	R	
					I_{vp}54/I_{vr}38					SILT with sand, grey mottled orange. Soft, moist, low plasticity.**(Alluvium)**	Q1a	
										0.50m: Becomes moderate plasticity. Trace of sand.		
	1.0				I_{vp}64/I_{vr}26				1 ▽			
										1.10m: Becomes wet.		
					I_{vp}57/I_{vr}39					*1.50m: Becomes sandy.*		
										1.60m: Becomes high plasticity.		
	2.0									*2.00m: Becomes sandy, low plasticity.*		
										2.30m: Becomes high plasticity, absence of sand.		
					I_{vp}26/I_{vr}26							
	3.0				I_{vp}62/I_{vr}46					*2.90m: Becomes sandy, low plasticity.*		
										3.00m: Becomes high plasticity. Absence of sand		

H3 terminated at 3.30m. Target Depth

Started: 12/12/2012

Finished: 12/12/2012

Driller: N/A

Plant:

Logged: JR

Checked: LAB

Depth Related Remarks

From	*Remarks*

Groundwater Observations

No.	*Struck (m)*	*Date*	*Observations*	*Standing (m)*
1.	1.1m	12/12/2012		

Remarks

NZTM coordinates derived from aerial photography.

Co-ordinates:
5177796.00mN
1567661.00mE

Inclination: -90°

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

SKM

Preliminary Log of Investigation

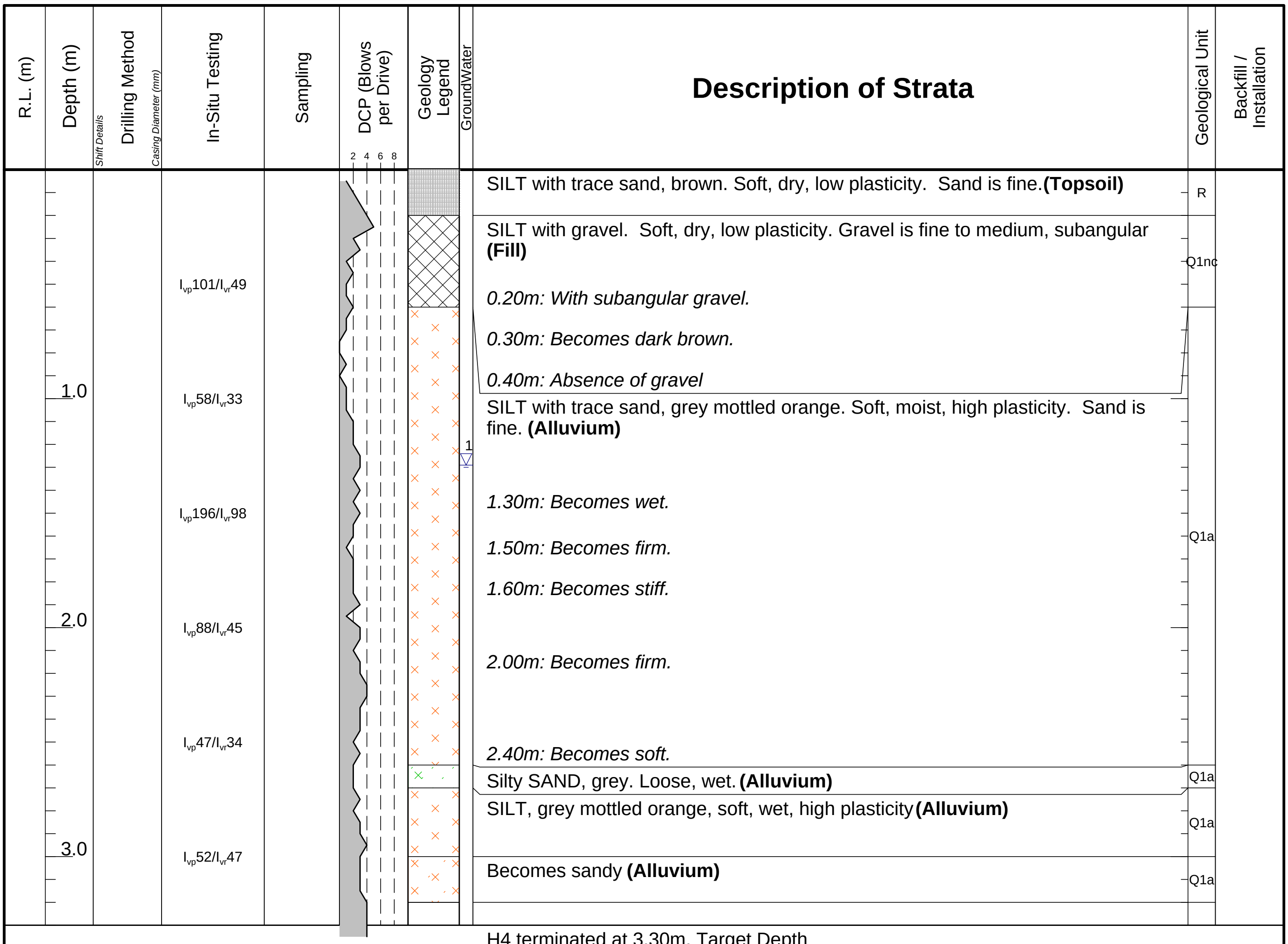
Project: **Maurice Carter Courts**

Location: **16 Dundee Place** Project No: **ZB01276.219**

Hole ID: **H4**

Client: **Christchurch City Council**

Date: **12/12/2012**



Description of Strata

Depth (m)	In-Situ Testing	Description of Strata	Geological Unit
		SILT with trace sand, brown. Soft, dry, low plasticity. Sand is fine. **(Topsoil)**	R
	$I_{vp}101/I_{vr}49$	SILT with gravel. Soft, dry, low plasticity. Gravel is fine to medium, subangular **(Fill)** *0.20m: With subangular gravel.* *0.30m: Becomes dark brown.* *0.40m: Absence of gravel*	Q1nc
1.0	$I_{vp}58/I_{vr}33$	SILT with trace sand, grey mottled orange. Soft, moist, high plasticity. Sand is fine. **(Alluvium)**	
	$I_{vp}196/I_{vr}98$	*1.30m: Becomes wet.* *1.50m: Becomes firm.* *1.60m: Becomes stiff.*	Q1a
2.0	$I_{vp}88/I_{vr}45$	*2.00m: Becomes firm.*	
	$I_{vp}47/I_{vr}34$	*2.40m: Becomes soft.*	
		Silty SAND, grey. Loose, wet. **(Alluvium)**	Q1a
		SILT, grey mottled orange, soft, wet, high plasticity **(Alluvium)**	Q1a
3.0	$I_{vp}52/I_{vr}47$	Becomes sandy **(Alluvium)**	Q1a

H4 terminated at 3.30m. Target Depth

Started:	12/12/2012
Finished:	12/12/2012
Driller:	N/A
Plant:	
Logged:	JR
Checked:	LAB

Depth Related Remarks

From *Remarks*

Groundwater Observations

No.	*Struck (m)*	*Date*	*Observations*	*Standing (m)*
1.	1.3m	12/12/2012		

Remarks

NZTM coordinates derived from aerial photography.

Co-ordinates:

5177807.00mN

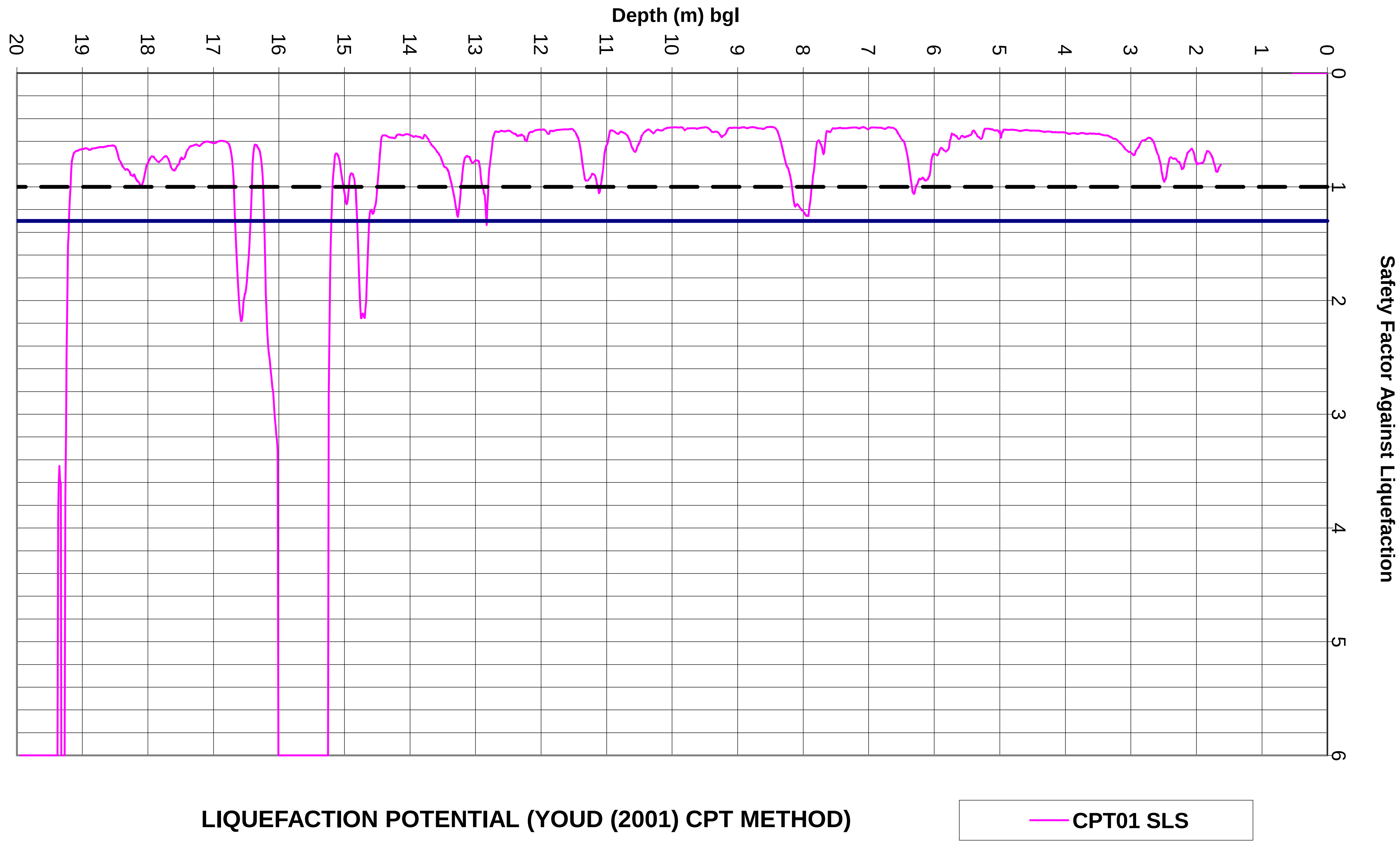
1567676.00mE

Inclination: -90°

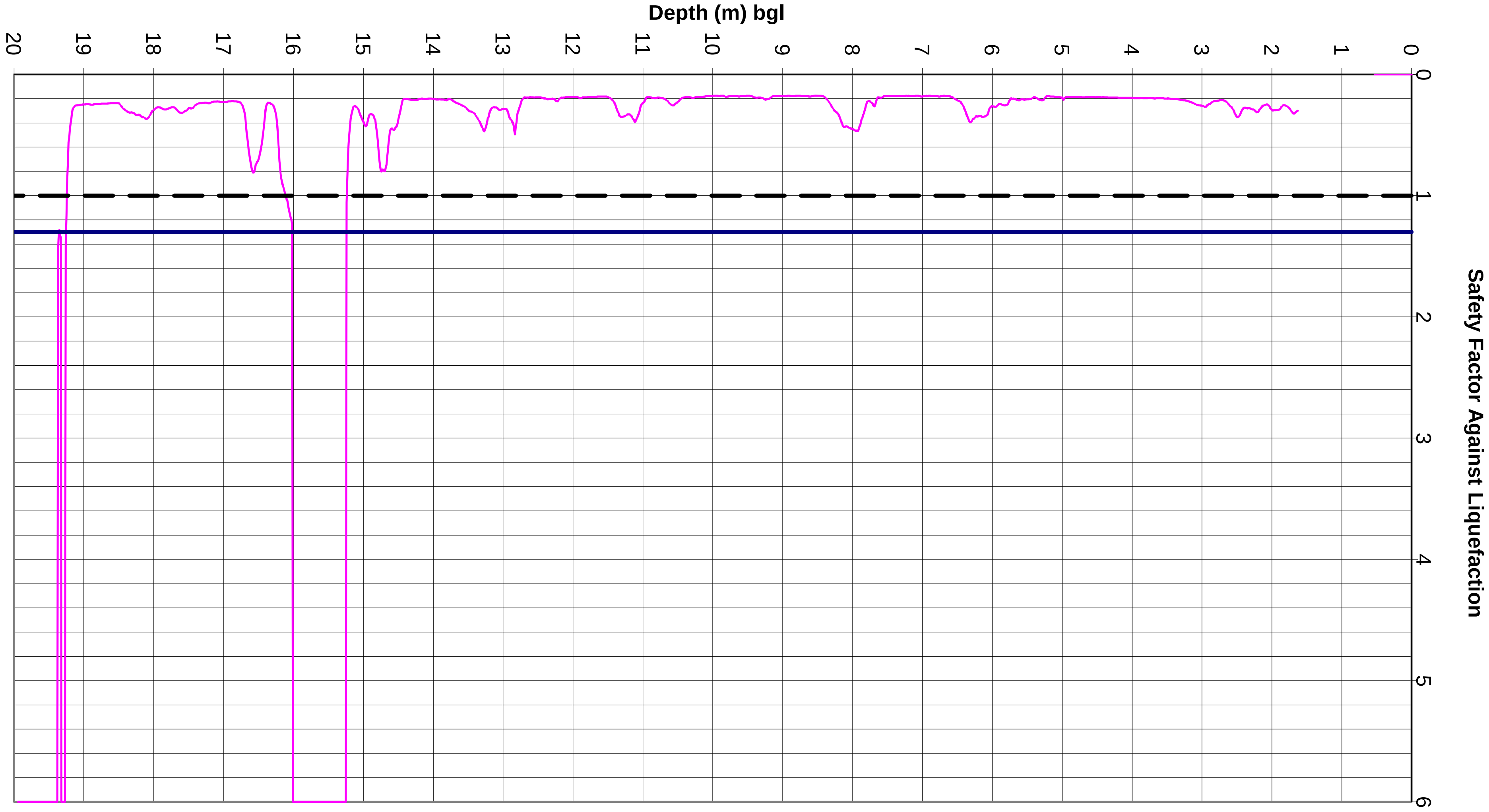
See key sheet for an explanation of symbols and abbreviations. Material descriptions as per NZGS Guidelines - December 2005.

Version 1.6 28/08/2006 - S.Humphreys

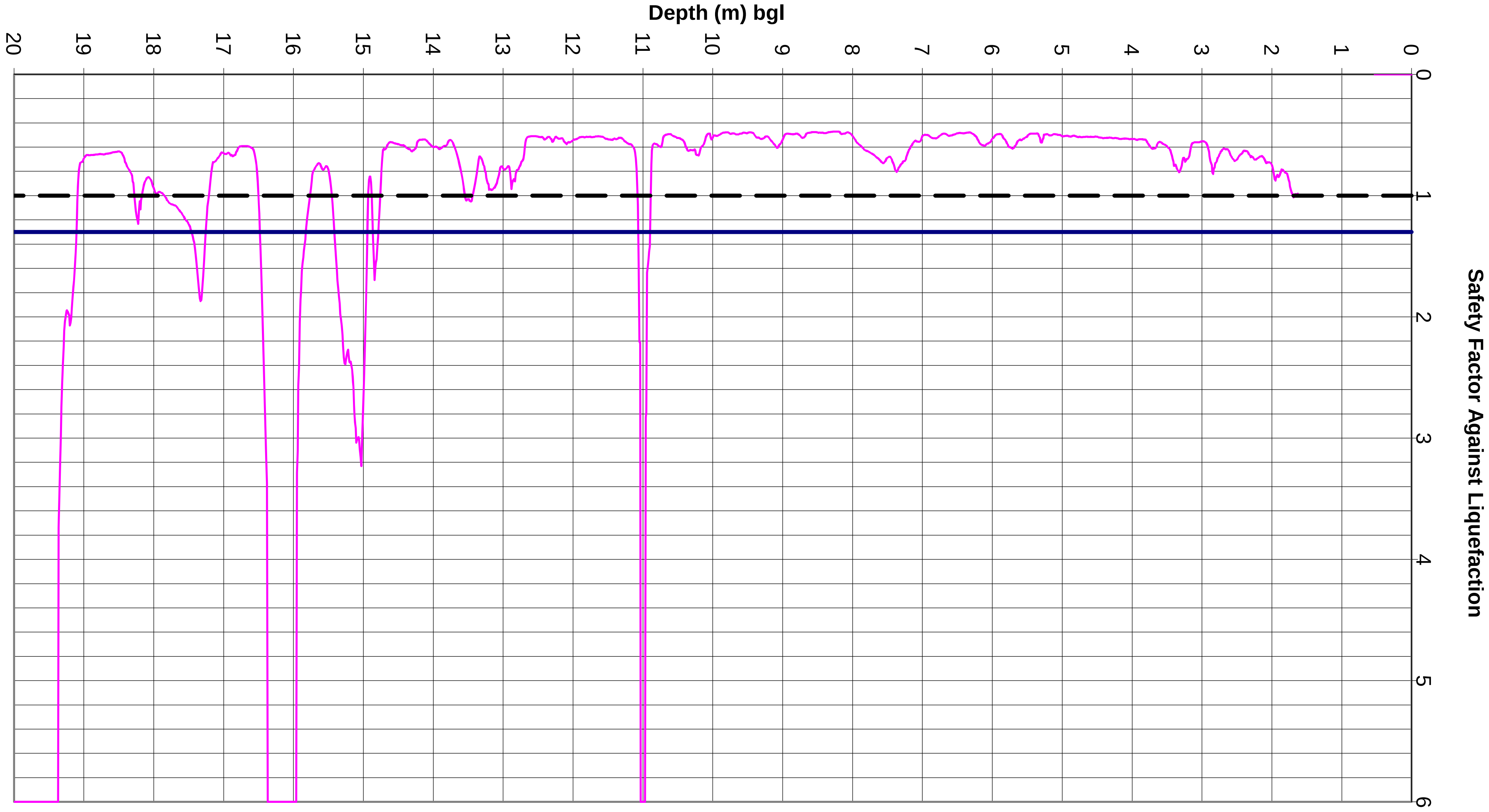
Appendix D – Liquefaction Analysis



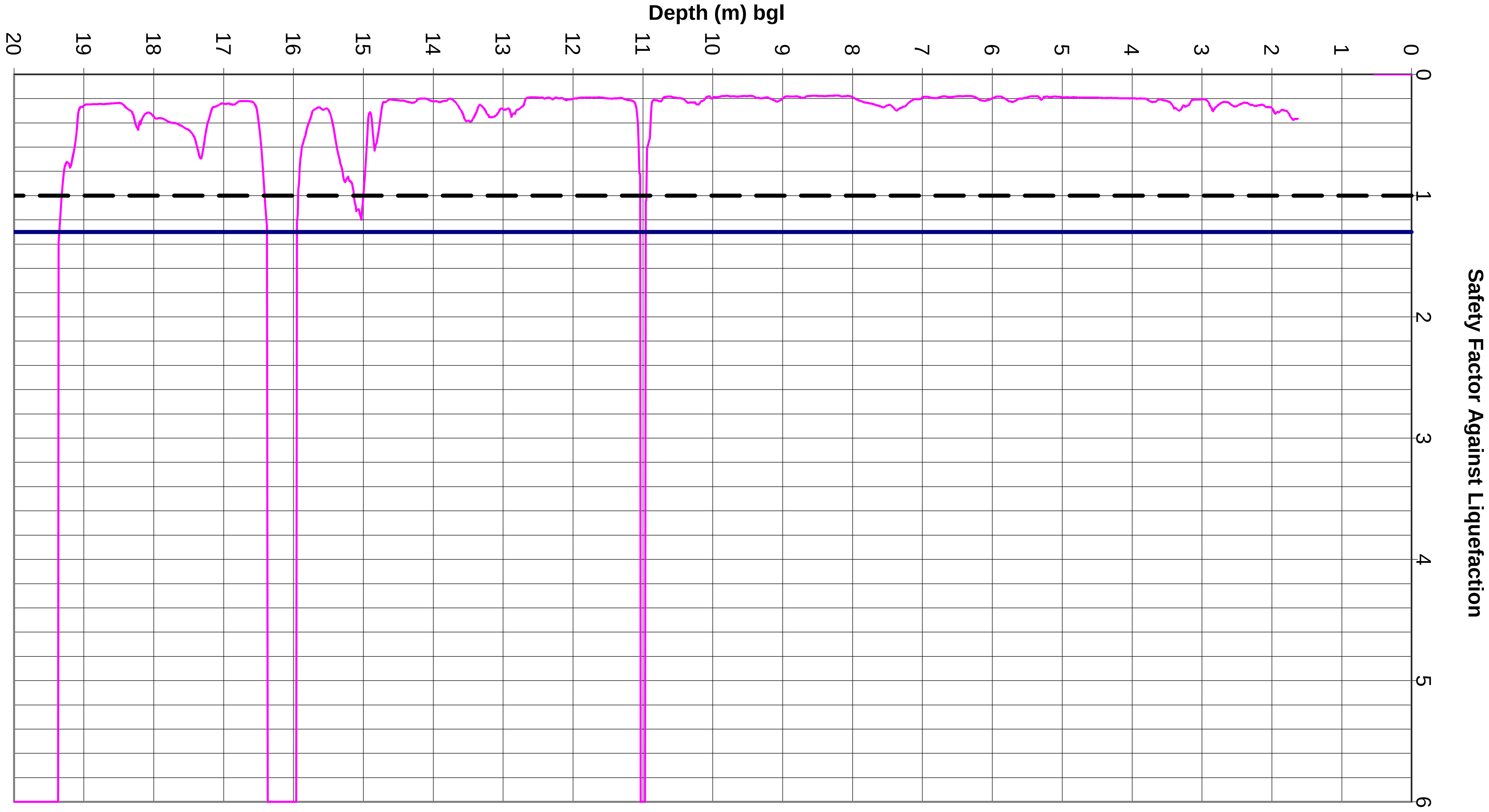
LIQUEFACTION POTENTIAL (YOUD (2001) CPT METHOD)



LIQUEFACTION POTENTIAL (YOUD (2001) CPT METHOD)



LIQUEFACTION POTENTIAL (YOUD (2001) CPT METHOD)



LIQUEFACTION POTENTIAL (YOUD (2001) CPT METHOD)

Appendix D Structural Strengthening Calculations

Job No. 3P01276.255

Calc. Series

Client

Page 01

Job Name Maurice Carter Courts - Garages

By TSW

Calcs Title Strengthening Calcs - Revised

Date

REVISED CHECK:

7mm ECOPLY = 130 BU/m. > 60 BU/m - 10mm GIB.
↑ PG 02 ↑ REFER TO PREVIOUS CALCS (ATTACHED)

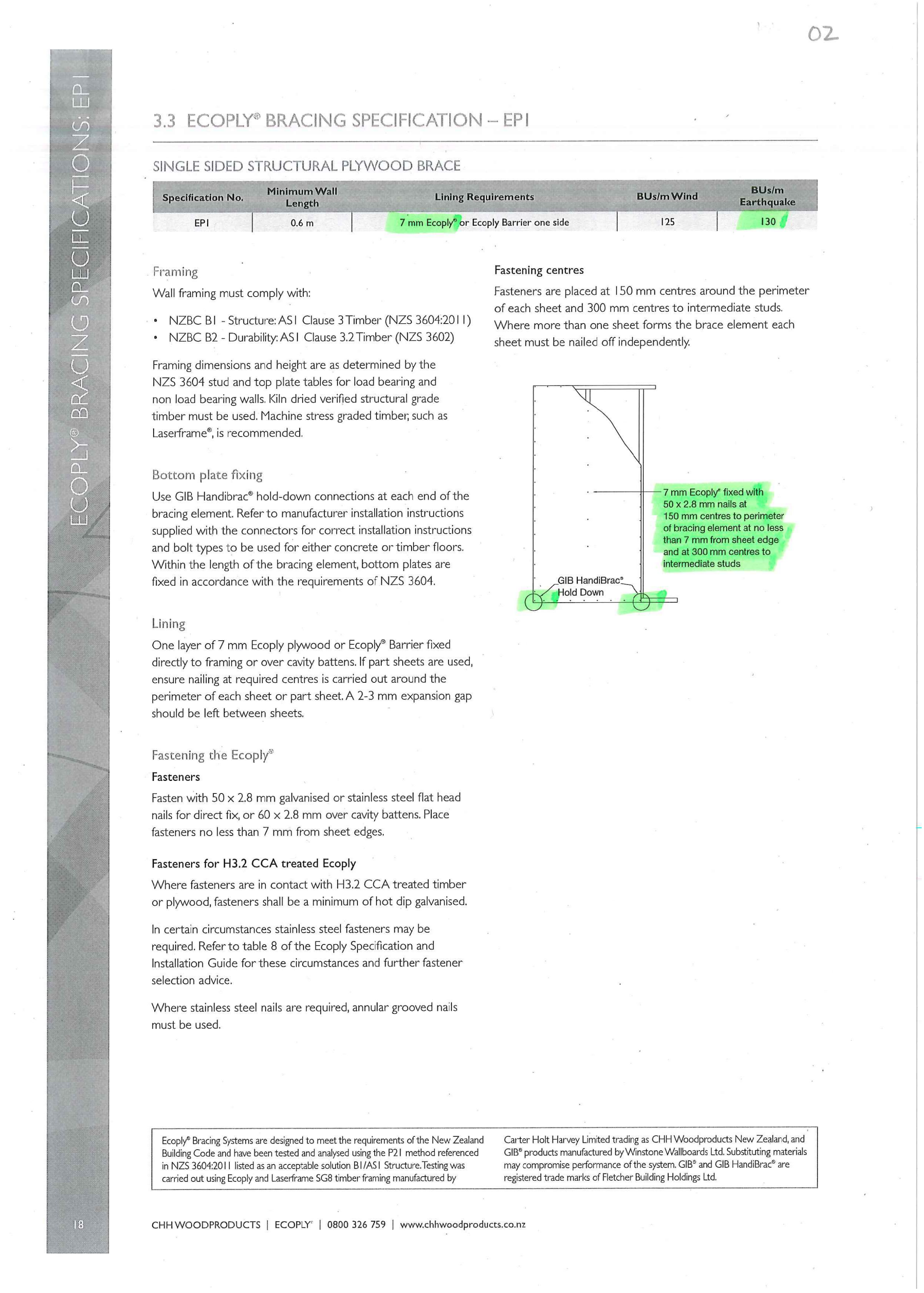
WALL LENGTH = 3.1 × 2 = 6.2 m.

BU = 130 × 6.2 = 806 BU

CAPACITY = 40 kN

DEMAND FROM PREVIOUS CALC = 20 kN ≤ CAPACITY. — 100% NBS

THEREFORE IT IS OK



02

ECOPLY® BRACING SPECIFICATIONS: EP1

3.3 ECOPLY® BRACING SPECIFICATION – EP1

SINGLE SIDED STRUCTURAL PLYWOOD BRACE

Specification No.	Minimum Wall Length	Lining Requirements	BUs/m Wind	BUs/m Earthquake
EP1	0.6 m	7 mm Ecoply® or Ecoply Barrier one side	125	130

Framing

Wall framing must comply with:

- NZBC B1 - Structure: AS1 Clause 3 Timber (NZS 3604:2011)
- NZBC B2 - Durability: AS1 Clause 3.2 Timber (NZS 3602)

Framing dimensions and height are as determined by the NZS 3604 stud and top plate tables for load bearing and non load bearing walls. Kiln dried verified structural grade timber must be used. Machine stress graded timber, such as Laserframe®, is recommended.

Bottom plate fixing

Use GIB Handibrac® hold-down connections at each end of the bracing element. Refer to manufacturer installation instructions supplied with the connectors for correct installation instructions and bolt types to be used for either concrete or timber floors. Within the length of the bracing element, bottom plates are fixed in accordance with the requirements of NZS 3604.

Lining

One layer of 7 mm Ecoply plywood or Ecoply® Barrier fixed directly to framing or over cavity battens. If part sheets are used, ensure nailing at required centres is carried out around the perimeter of each sheet or part sheet. A 2-3 mm expansion gap should be left between sheets.

Fastening the Ecoply®

Fasteners

Fasten with 50 x 2.8 mm galvanised or stainless steel flat head nails for direct fix, or 60 x 2.8 mm over cavity battens. Place fasteners no less than 7 mm from sheet edges.

Fasteners for H3.2 CCA treated Ecoply

Where fasteners are in contact with H3.2 CCA treated timber or plywood, fasteners shall be a minimum of hot dip galvanised.

In certain circumstances stainless steel fasteners may be required. Refer to table 8 of the Ecoply Specification and Installation Guide for these circumstances and further fastener selection advice.

Where stainless steel nails are required, annular grooved nails must be used.

Fastening centres

Fasteners are placed at 150 mm centres around the perimeter of each sheet and 300 mm centres to intermediate studs. Where more than one sheet forms the brace element each sheet must be nailed off independently.

Ecoply® Bracing Systems are designed to meet the requirements of the New Zealand Building Code and have been tested and analysed using the P21 method referenced in NZS 3604:2011 listed as an acceptable solution B1/AS1 Structure. Testing was carried out using Ecoply and Laserframe SG8 timber framing manufactured by Carter Holt Harvey Limited trading as CHH Woodproducts New Zealand, and GIB® products manufactured by Winstone Wallboards Ltd. Substituting materials may compromise performance of the system. GIB® and GIB HandiBrac® are registered trade marks of Fletcher Building Holdings Ltd.

18

CHH WOODPRODUCTS | ECOPLY® | 0800 326 759 | www.chhwoodproducts.co.nz

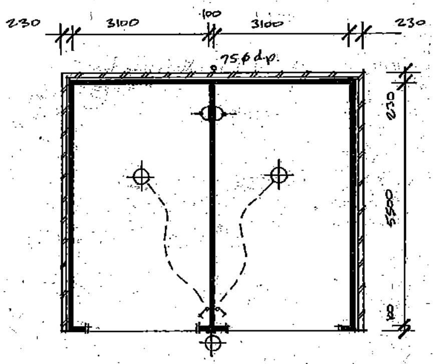
Job No. 2B01276.255
Calc. Series
Client
Page 1
Job Name Maurice Carter Courts - Garages E
By KS
Calcs Title Strengthening Calcs
Date 28/8/13

Maurice Carter Courts Garages

- SCOPE:
  - Drawings, Calculations, Specification for strengthening works to 34% NBS.
  - Update assessment Report.

- Refer to assessment calculations for original capacity.
  - Longitudinal direction % NBS = 25%

- Plan View: x 2 of



GARAGE PLAN (2OFF) 1:100

SINCLAIR KNIGHT MERZ

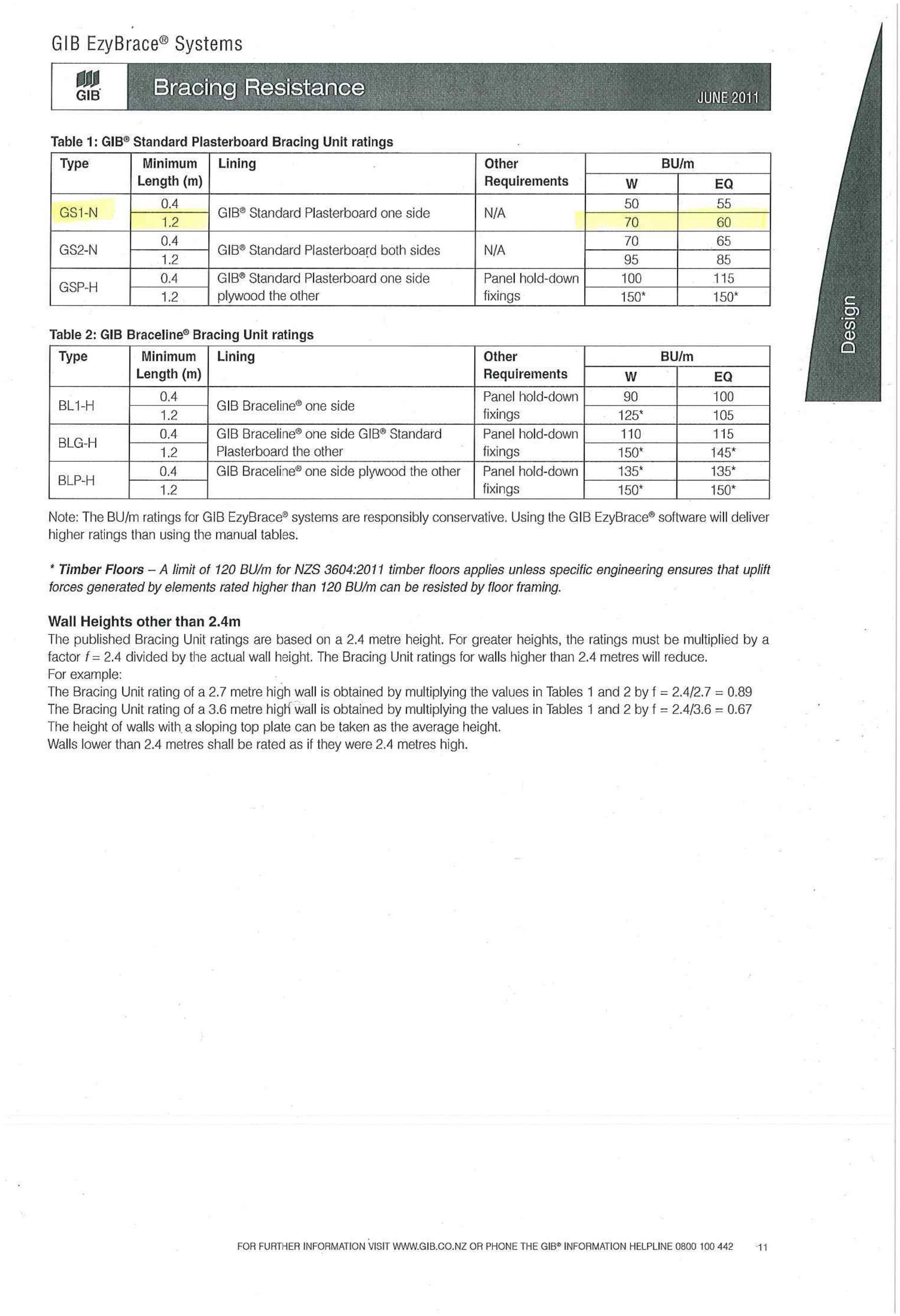
Job No. ZB01276.253
Calc. Series
Client
Page 2
Job Name Maurice Carter Courts - Garages E
By KS
Calcs Title Strengthening Calcs
Date 28/8/13

Strengthening:

- Line walls at the back with plasterboard as per Gib specifications.
- 10mm gib, one side with angle brace
  - 60 BU /m. (see page 3)
  - Wall length = 3.1 × 2 = 6.2m
  - BU = 60 × 6.2 = 372BU
  - Capacity = 19kN
  - Demand from previous calculations = 28 kN

New %NBS = 19/28 = 67% NBS.

Note: Additional weight of plasterboard is negligable.



GIB EzyBrace® Systems

Bracing Resistance

JUNE 2011

Table 1: GIB® Standard Plasterboard Bracing Unit ratings

Type	Minimum Length (m)	Lining	Other Requirements	BU/m	
				W	EQ
GS1-N	0.4	GIB® Standard Plasterboard one side	N/A	50	55
	1.2			70	60
GS2-N	0.4	GIB® Standard Plasterboard both sides	N/A	70	65
	1.2			95	85
GSP-H	0.4	GIB® Standard Plasterboard one side plywood the other	Panel hold-down fixings	100	115
	1.2			150*	150*

Table 2: GIB Braceline® Bracing Unit ratings

Type	Minimum Length (m)	Lining	Other Requirements	BU/m	
				W	EQ
BL1-H	0.4	GIB Braceline® one side	Panel hold-down fixings	90	100
	1.2			125*	105
BLG-H	0.4	GIB Braceline® one side GIB® Standard Plasterboard the other	Panel hold-down fixings	110	115
	1.2			150*	145*
BLP-H	0.4	GIB Braceline® one side plywood the other	Panel hold-down fixings	135*	135*
	1.2			150*	150*

Note: The BU/m ratings for GIB EzyBrace® systems are responsibly conservative. Using the GIB EzyBrace® software will deliver higher ratings than using the manual tables.

* ***Timber Floors** – A limit of 120 BU/m for NZS 3604:2011 timber floors applies unless specific engineering ensures that uplift forces generated by elements rated higher than 120 BU/m can be resisted by floor framing.*

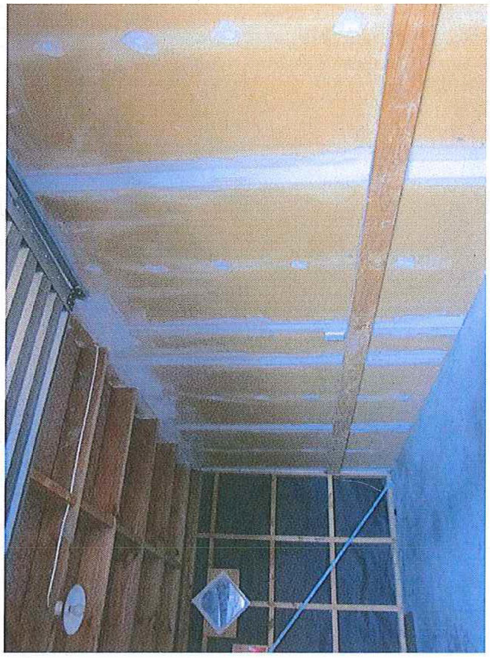
Wall Heights other than 2.4m

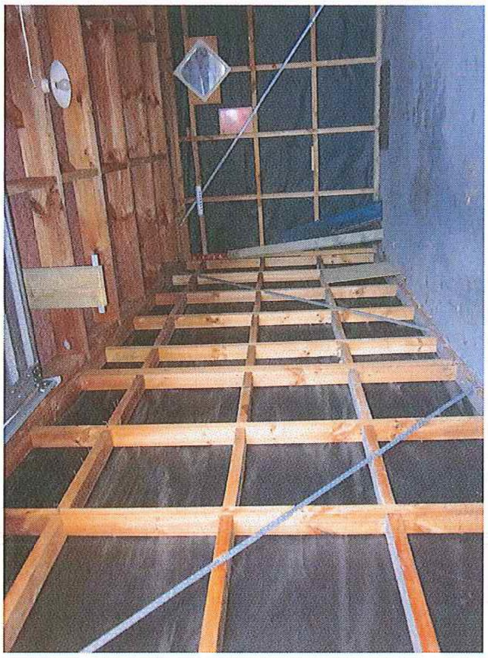
The published Bracing Unit ratings are based on a 2.4 metre height. For greater heights, the ratings must be multiplied by a factor *f* = 2.4 divided by the actual wall height. The Bracing Unit ratings for walls higher than 2.4 metres will reduce.
For example:
The Bracing Unit rating of a 2.7 metre high wall is obtained by multiplying the values in Tables 1 and 2 by f = 2.4/2.7 = 0.89
The Bracing Unit rating of a 3.6 metre high wall is obtained by multiplying the values in Tables 1 and 2 by f = 2.4/3.6 = 0.67
The height of walls with a sloping top plate can be taken as the average height.
Walls lower than 2.4 metres shall be rated as if they were 2.4 metres high.

FOR FURTHER INFORMATION VISIT WWW.GIB.CO.NZ OR PHONE THE GIB® INFORMATION HELPLINE 0800 100 442 11

Inspection photos
26-07-2013
TB-SKM

page 4


Maurice CC Block E Garages 004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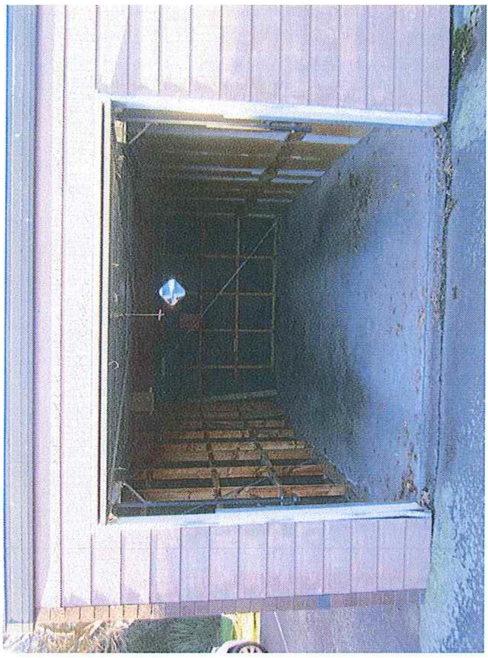
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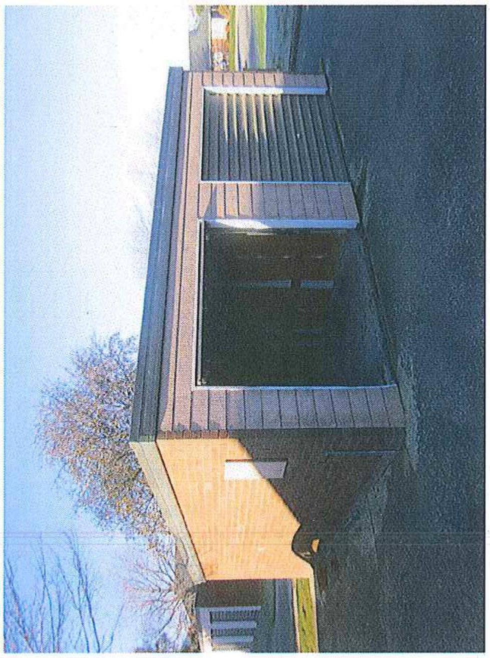
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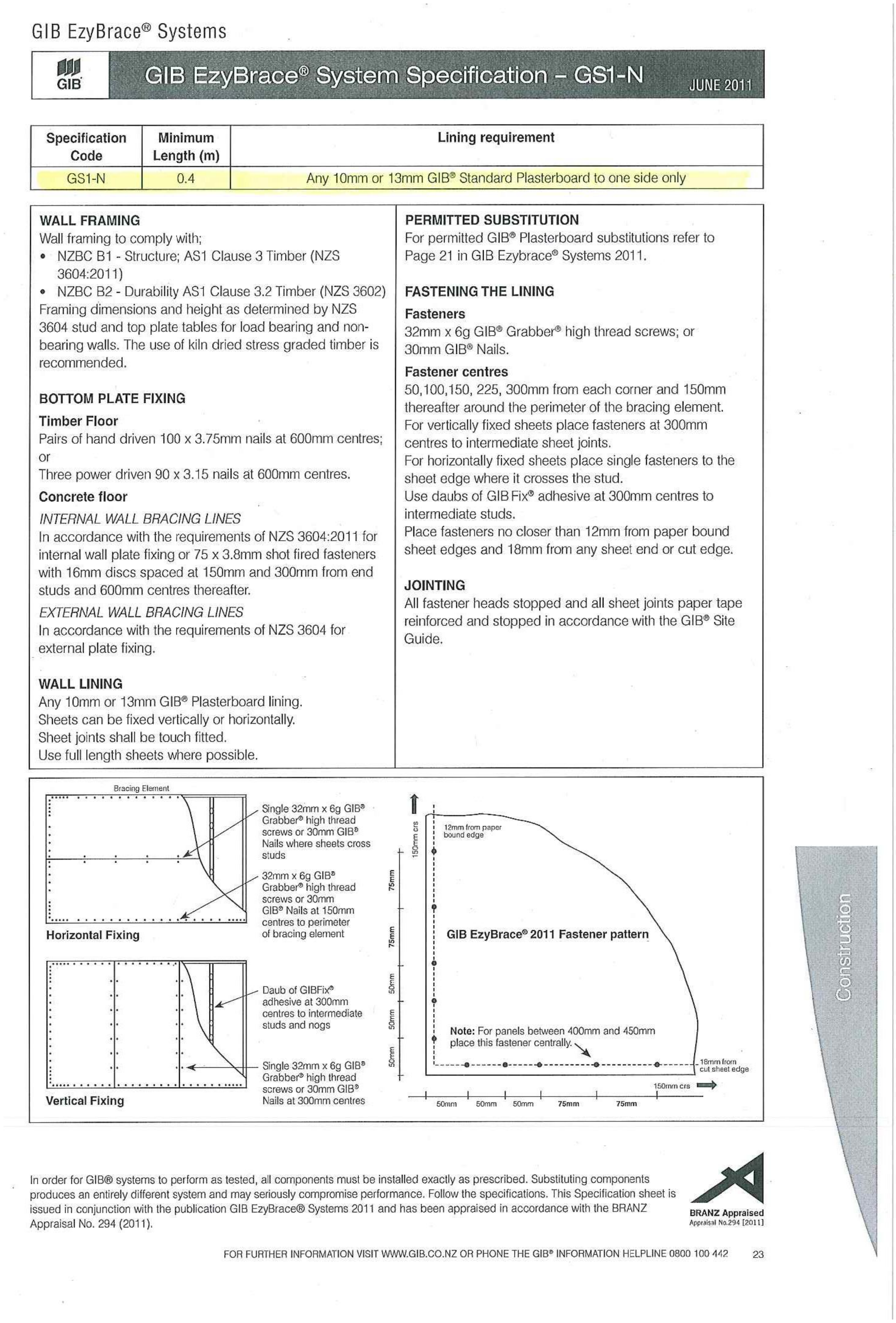


GIB EzyBrace® Systems

GIB EzyBrace® System Specification – GS1-N

JUNE 2011

Specification Code	Minimum Length (m)	Lining requirement
GS1-N	0.4	Any 10mm or 13mm GIB® Standard Plasterboard to one side only

WALL FRAMING

Wall framing to comply with;

- NZBC B1 - Structure; AS1 Clause 3 Timber (NZS 3604:2011)
- NZBC B2 - Durability AS1 Clause 3.2 Timber (NZS 3602)

Framing dimensions and height as determined by NZS 3604 stud and top plate tables for load bearing and non-bearing walls. The use of kiln dried stress graded timber is recommended.

BOTTOM PLATE FIXING

Timber Floor

Pairs of hand driven 100 x 3.75mm nails at 600mm centres; or

Three power driven 90 x 3.15 nails at 600mm centres.

Concrete floor

INTERNAL WALL BRACING LINES

In accordance with the requirements of NZS 3604:2011 for internal wall plate fixing or 75 x 3.8mm shot fired fasteners with 16mm discs spaced at 150mm and 300mm from end studs and 600mm centres thereafter.

EXTERNAL WALL BRACING LINES

In accordance with the requirements of NZS 3604 for external plate fixing.

WALL LINING

Any 10mm or 13mm GIB® Plasterboard lining.
Sheets can be fixed vertically or horizontally.
Sheet joints shall be touch fitted.
Use full length sheets where possible.

PERMITTED SUBSTITUTION

For permitted GIB® Plasterboard substitutions refer to Page 21 in GIB Ezybrace® Systems 2011.

FASTENING THE LINING

Fasteners

32mm x 6g GIB® Grabber® high thread screws; or 30mm GIB® Nails.

Fastener centres

50,100,150, 225, 300mm from each corner and 150mm thereafter around the perimeter of the bracing element.
For vertically fixed sheets place fasteners at 300mm centres to intermediate sheet joints.
For horizontally fixed sheets place single fasteners to the sheet edge where it crosses the stud.
Use daubs of GIB Fix® adhesive at 300mm centres to intermediate studs.
Place fasteners no closer than 12mm from paper bound sheet edges and 18mm from any sheet end or cut edge.

JOINTING

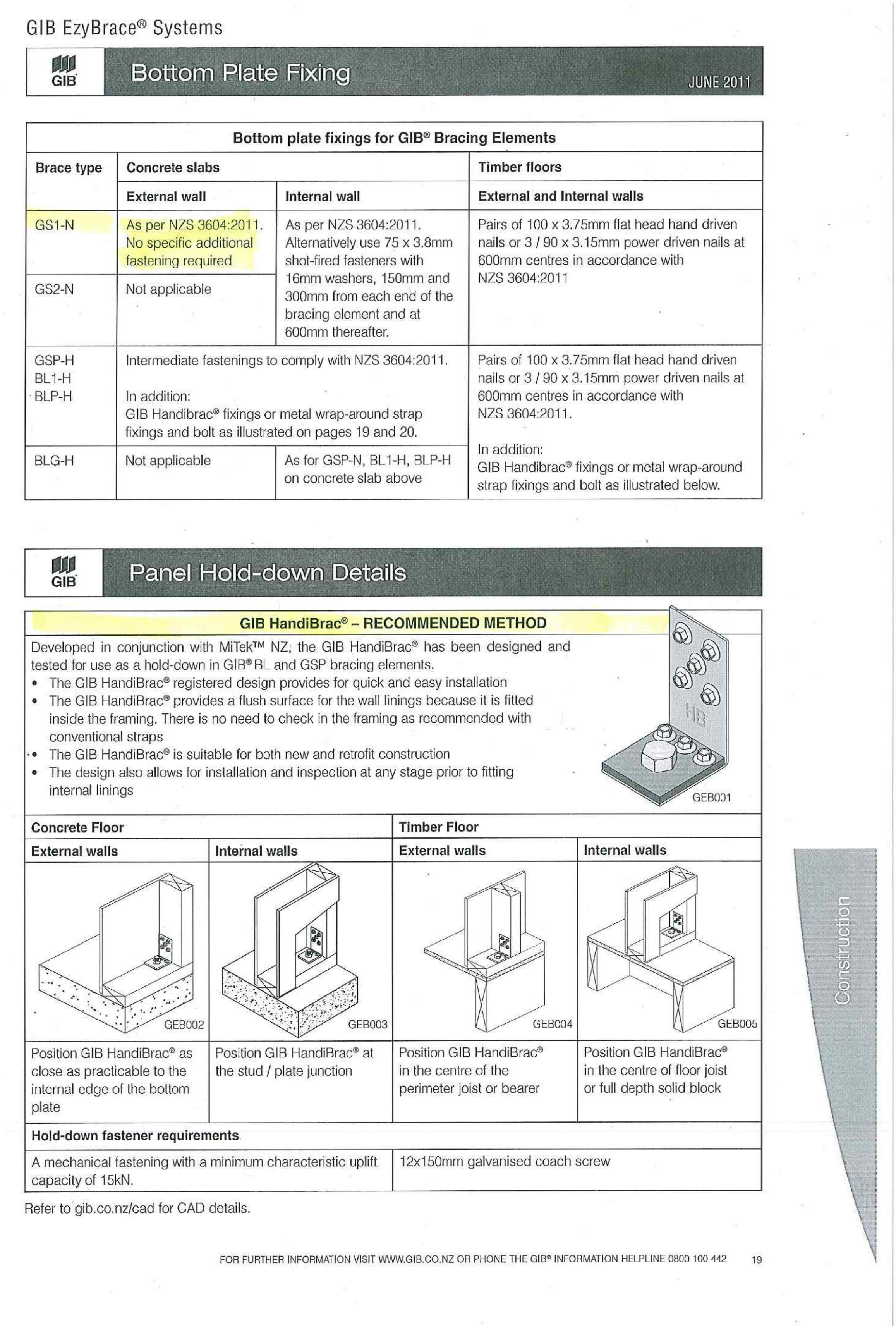
All fastener heads stopped and all sheet joints paper tape reinforced and stopped in accordance with the GIB® Site Guide.

In order for GIB® systems to perform as tested, all components must be installed exactly as prescribed. Substituting components produces an entirely different system and may seriously compromise performance. Follow the specifications. This Specification sheet is issued in conjunction with the publication GIB EzyBrace® Systems 2011 and has been appraised in accordance with the BRANZ Appraisal No. 294 (2011).

BRANZ Appraised
Appraisal No.294 [2011]

FOR FURTHER INFORMATION VISIT WWW.GIB.CO.NZ OR PHONE THE GIB® INFORMATION HELPLINE 0800 100 442 23

Construction



GIB EzyBrace® Systems

Bottom Plate Fixing

JUNE 2011

Bottom plate fixings for GIB® Bracing Elements

Brace type	**Concrete slabs**		**Timber floors**
	External wall	**Internal wall**	**External and Internal walls**
GS1-N	As per NZS 3604:2011. No specific additional fastening required	As per NZS 3604:2011. Alternatively use 75 x 3.8mm shot-fired fasteners with 16mm washers, 150mm and 300mm from each end of the bracing element and at 600mm thereafter.	Pairs of 100 x 3.75mm flat head hand driven nails or 3 / 90 x 3.15mm power driven nails at 600mm centres in accordance with NZS 3604:2011
GS2-N	Not applicable		
GSP-H BL1-H BLP-H	Intermediate fastenings to comply with NZS 3604:2011. In addition: GIB Handibrac® fixings or metal wrap-around strap fixings and bolt as illustrated on pages 19 and 20.		Pairs of 100 x 3.75mm flat head hand driven nails or 3 / 90 x 3.15mm power driven nails at 600mm centres in accordance with NZS 3604:2011. In addition: GIB Handibrac® fixings or metal wrap-around strap fixings and bolt as illustrated below.
BLG-H	Not applicable	As for GSP-N, BL1-H, BLP-H on concrete slab above	

Panel Hold-down Details

GIB HandiBrac® – RECOMMENDED METHOD

Developed in conjunction with MiTek™ NZ, the GIB HandiBrac® has been designed and tested for use as a hold-down in GIB® BL and GSP bracing elements.

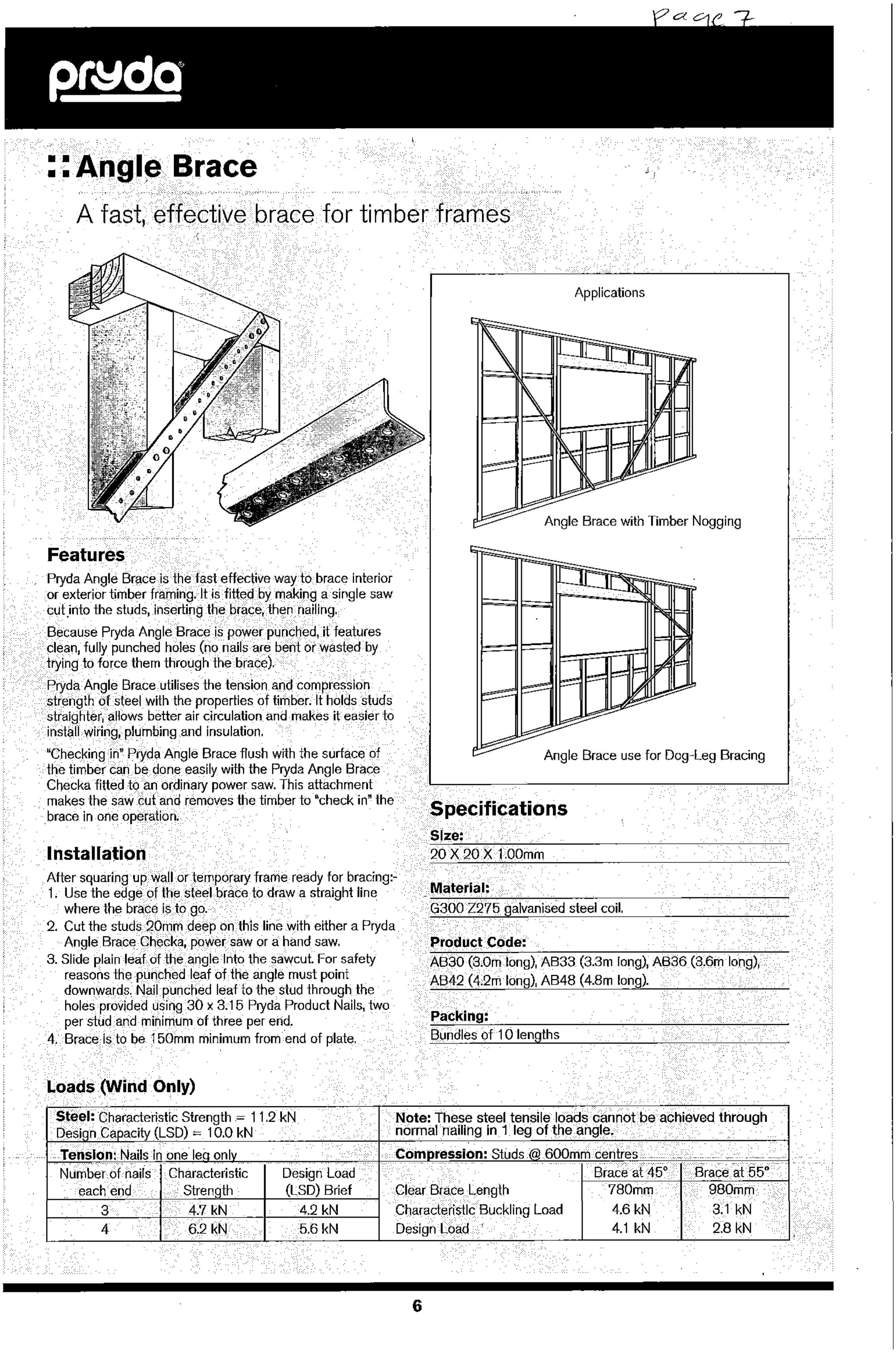
- The GIB HandiBrac® registered design provides for quick and easy installation
- The GIB HandiBrac® provides a flush surface for the wall linings because it is fitted inside the framing. There is no need to check in the framing as recommended with conventional straps
- The GIB HandiBrac® is suitable for both new and retrofit construction
- The design also allows for installation and inspection at any stage prior to fitting internal linings

GEB001

Concrete Floor		**Timber Floor**	
External walls	**Internal walls**	**External walls**	**Internal walls**
GEB002	GEB003	GEB004	GEB005
Position GIB HandiBrac® as close as practicable to the internal edge of the bottom plate	Position GIB HandiBrac® at the stud / plate junction	Position GIB HandiBrac® in the centre of the perimeter joist or bearer	Position GIB HandiBrac® in the centre of floor joist or full depth solid block
Hold-down fastener requirements			
A mechanical fastening with a minimum characteristic uplift capacity of 15kN.		12x150mm galvanised coach screw	

Refer to gib.co.nz/cad for CAD details.

FOR FURTHER INFORMATION VISIT WWW.GIB.CO.NZ OR PHONE THE GIB® INFORMATION HELPLINE 0800 100 442 19



Page 7

pryda

∷Angle Brace

A fast, effective brace for timber frames

Applications

Angle Brace with Timber Nogging

Angle Brace use for Dog-Leg Bracing

Features

Pryda Angle Brace is the fast effective way to brace interior or exterior timber framing. It is fitted by making a single saw cut into the studs, inserting the brace, then nailing.

Because Pryda Angle Brace is power punched, it features clean, fully punched holes (no nails are bent or wasted by trying to force them through the brace).

Pryda Angle Brace utilises the tension and compression strength of steel with the properties of timber. It holds studs straighter, allows better air circulation and makes it easier to install wiring, plumbing and insulation.

"Checking in" Pryda Angle Brace flush with the surface of the timber can be done easily with the Pryda Angle Brace Checka fitted to an ordinary power saw. This attachment makes the saw cut and removes the timber to "check in" the brace in one operation.

Installation

After squaring up wall or temporary frame ready for bracing:-

1. Use the edge of the steel brace to draw a straight line where the brace is to go.
2. Cut the studs 20mm deep on this line with either a Pryda Angle Brace Checka, power saw or a hand saw.
3. Slide plain leaf of the angle into the sawcut. For safety reasons the punched leaf of the angle must point downwards. Nail punched leaf to the stud through the holes provided using 30 x 3.15 Pryda Product Nails, two per stud and minimum of three per end.
4. Brace is to be 150mm minimum from end of plate.

Specifications

Size:
20 X 20 X 1.00mm

Material:
G300 Z275 galvanised steel coil.

Product Code:
AB30 (3.0m long), AB33 (3.3m long), AB36 (3.6m long), AB42 (4.2m long), AB48 (4.8m long).

Packing:
Bundles of 10 lengths

Loads (Wind Only)

Steel: Characteristic Strength = 11.2 kN
Design Capacity (LSD) = 10.0 kN

Note: These steel tensile loads cannot be achieved through normal nailing in 1 leg of the angle.

Tension: Nails in one leg only

Number of nails each end	Characteristic Strength	Design Load (LSD) Brief
3	4.7 kN	4.2 kN
4	6.2 kN	5.6 kN

Compression: Studs @ 600mm centres

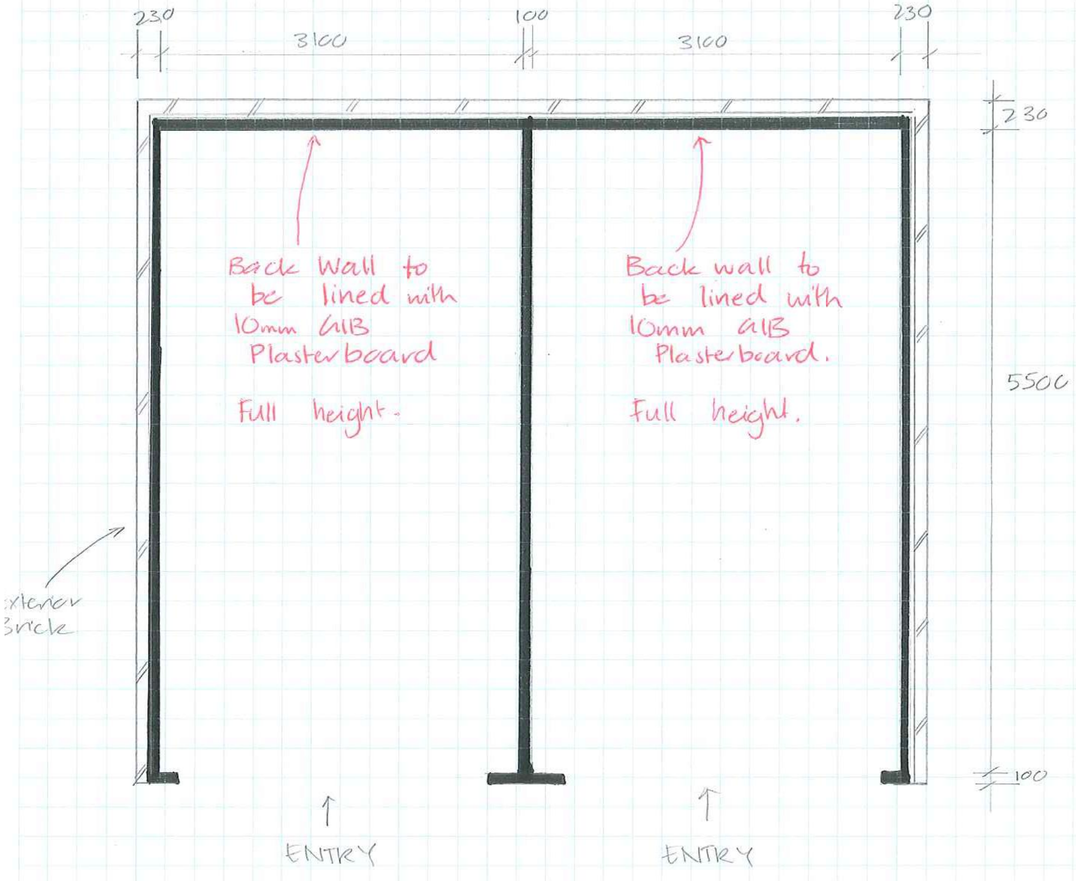
	Brace at 45°	Brace at 55°
Clear Brace Length	780mm	980mm
Characteristic Buckling Load	4.6 kN	3.1 kN
Design Load	4.1 kN	2.8 kN

6

Appendix E Structural Strengthening Sketches

Job No. ZB01276.255
Calc. Series
Client
Page SK01
Job Name
By KS
Calcs Title
Date 28/8/13

PLAN VIEW: x 2 of.
N.T.S.



NOTES:

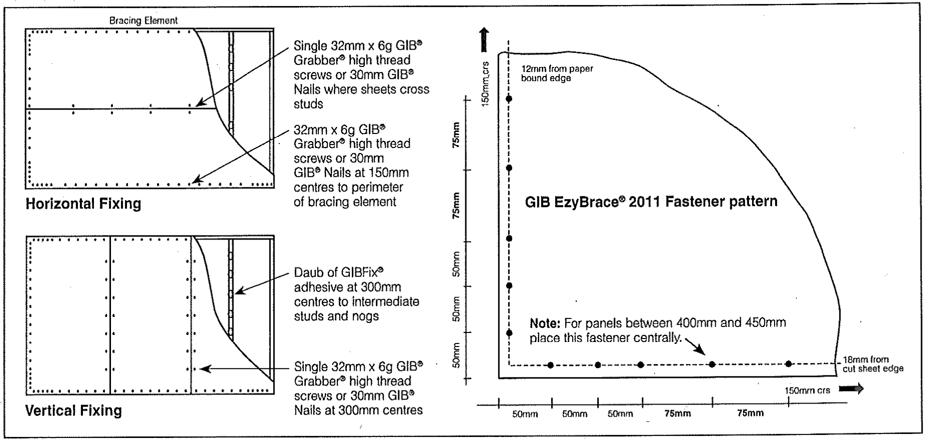
- Refer to SK02 for details
- Refer to SK03 for Notes

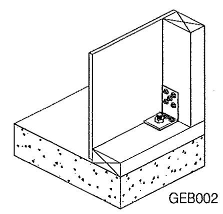
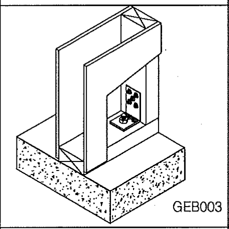
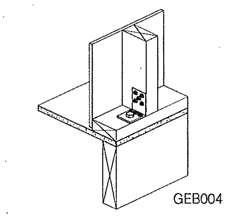
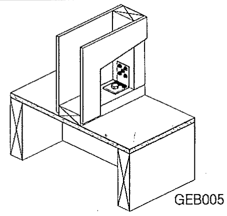
Job No. ZB01276.255
Calc. Series
Client
Page SK02
Job Name
By KS
Calcs Title
Date 28/8/13

DETAILS:

NTS.

Refer to manufacturers specifications for any further requirements and installation details.



Concrete Floor		Timber Floor	
External walls	**Internal walls**	**External walls**	**Internal walls**
 GEB002	 GEB003	 GEB004	 GEB005
Position GIB HandiBrac® as close as practicable to the internal edge of the bottom plate	Position GIB HandiBrac® at the stud / plate junction	Position GIB HandiBrac® in the centre of the perimeter joist or bearer	Position GIB HandiBrac® in the centre of floor joist or full depth solid block
Hold-down fastener requirements			
A mechanical fastening with a minimum characteristic uplift capacity of 15kN.		12x150mm galvanised coach screw	

Refer to gib.co.nz/cad for CAD details.

Job No. ZB01276.255
Calc. Series
Client
Page SK03
Job Name
By KCS
Calcs Title
Date 28/8/13

GENERAL NOTES:

1. SKETCHES TO BE READ IN CONJUNCTION WITH SPECIFICATION.
2. WALL LINING STRENGTHENING APPLIES TO THE FULL HEIGHT OF THE BACK WALL IN ALL FOUR GARAGES.
3. CONTRACTOR SHALL TAKE SITE MEASUREMENTS TO CONFIRM BUILDING LAYOUT AND DIMENSIONS PRIOR TO COMMENCING CONSTRUCTION. IF LAYOUT VARIES FROM THAT SHOWN ON THESE DRAWINGS, THE CONTRACTOR IS TO CONTACT ENGINEER FOR FURTHER INSTRUCTION.
4. ALL NEW WALL LININGS TO BE 10mm GIB STANDARD PLASTERBOARD. INSTALLED PER THE MANUFACTURER'S INSTRUCTIONS.
5. ENGINEER TO INSPECT FOLLOWING INSTALLATION OF NEW WALL FIXING AND LININGS PRIOR TO MAKING GOOD
6. ALL SURFACES TO BE MADE GOOD TO MATCH EXISTING..