

16 July 2016

Our Ref: 437433

Suburban Estates
PO BOX 13349
City East
Christchurch, 8013

Attention: Kim Sanders

Pre-Purchase Geotechnical and Foundation Report - Lot 6, Prèvelles Subdivision, Prebbleton

1 Introduction

This report describes the ground conditions encountered at the above site and provides guidance on likely foundation design and construction requirements for a new residential dwelling.

2 Geology

The site is surfaced with silty topsoil over fine sandy silts and silts that extend to between 1.6 to 3.5m below ground level (bgl) where medium dense to very dense sandy gravels are present. Groundwater is typically located between 2 to 3m bgl.

There is generally a low risk of liquefaction occurring across the site in a future design-level earthquake and the site can be considered equivalent to **Technical Category 1 (TC1)**.

Extensive earthworks were carried out as part of subdivision construction to raise ground levels and achieve adequate falls for surface drainage. This required the original topsoil layer to be stripped, before placing compacted silt fill in accordance with the requirements of *NZS 4431:1989* before resurfacing with lightly compacted silty topsoil and revegetating with grass. The extent and depth of controlled filling carried out for subdivision construction is documented in Eliot Sinclair's Inspecting Engineer's Report.

3 Site Specific Testing

Following the completion of subdivision construction earthworks, Eliot Sinclair's geotechnical staff carried out one shallow spade hole and two Scala penetrometer tests on each lot in order to determine the typical depth of topsoil that is present and to estimate the ultimate bearing capacity of the underlying silty soils. Please refer to the attached site investigation record/s.

Scala penetrometer resistances at this Lot and nearby areas typically exceeded 5 blows per 100mm in the upper silts, and at least 3 blows per 100mm within the deeper silts. These results indicate the silts provide an 'index' ultimate bearing capacity of at least $q_u=300\text{kPa}$.

Given the silt fill and insitu silts are relatively uniform across the site, the Scala penetrometer resistances and the low risk of liquefaction, we are satisfied that the silts present 0.3m bgl satisfy the definition of 'good ground', as defined by *NZS 3604:2011*.

Eliot Sinclair

surveying | engineering | planning | landscape architecture | urban design

www.eliotstinclair.com

4 Recommendations

The foundations and floor slab for any new dwelling will need to be designed and constructed to comply with the relevant provisions of *NZS 3604:2011 'Timber Framed Buildings'* and to satisfy the minimum requirements for Technical Category One that are set out in Section 5 of MBIE's guidelines³.

4.1 Shallow Foundation Design

The foundations for any new dwelling should comply with one of the following options;

a. Standard foundations

As the site is underlain by sandy silts and silts that satisfy the definition of 'good ground', *NZS 3604:2011 "Standard Foundations"* may be used for buildings that are designed within the scope of *NZS 3604:2011*.

b. Eliot Sinclair foundation detail

An alternative to *NZS3604* standard perimeter foundations which is **easier to construct**, is to use Eliot Sinclair's 2xD16 perimeter foundation detail. Eliot Sinclair's detail requires the perimeter foundation trench to be excavated 300mm wide and the upper part of the foundation boxed to 240mm wide at the top and reinforced with two D16 rods, one top and one bottom and spaced 300mm apart, with D10 slab ties at 600mm centres extending at least 600mm into the floor slab. Please refer to the attached detail.

Upon request, Eliot Sinclair can provide a '*Producer Statement – Design*' for the 2xD16 foundation detail which is suitable for either a brick veneer or light/medium weight sheet cladding and a '*Memorandum of Design of Restricted Building Work*' (LBP) to the Selwyn District Council.

Please contact Eliot Sinclair prior to submitting your application for Building Consent if you would like to use Eliot Sinclair's 2xD16 foundation detail so that we can be engaged to review the drawings of the proposed dwelling to confirm there are no other foundation requirements.

c. TC1 Waffle Slab Foundation

Another alternative to *NZS3604* standard foundations would be a *TC1 waffle slab*, which will require specific engineering design.

A *TC1 waffle slab* can be designed assuming the prepared subgrade (refer below) will be stiff, inorganic and will provide an ultimate bearing capacity of $q_u=200\text{kPa}$ and by adopting a geotechnical strength reduction factor of $\Phi_{bc}=0.5$.

d. Specific foundation design

Dwellings outside the scope of *NZS 3604:2011* will require specific foundation design.

4.2 Floor Slab Design

Floor slabs shall be reinforced with a minimum of 2.27kg/m^2 welded reinforcing mesh sheets and the reinforcing is to be Ductility Class E in accordance with *NZS 4671*.

The 100mm thickness of the floor slab and the mesh reinforcing shall be continuous through any step or recesses in the floor slab, such as a shower recess. If it is impractical to continue the mesh through the step or recess, then use H10 bars at 300mm centres each way and lapped at least 600mm with the floor slab mesh. A D12 trim bar shall also be provided around the edge of the recess and extend at least 600mm past the edge of the recess.

³ Ministry for Business, Innovation & Employment. December 2012. Version 3. "*Guidance. Repairing and rebuilding houses affected by the Canterbury earthquakes*".

4.3 Excavation Requirements

a. Foundations

All perimeter foundations shall be excavated through the topsoil layer, to *at least* 300mm bgl, and shall bear into firm silt that provides an ultimate bearing capacity of at least $q_u=300\text{kPa}$.

Internal floor slab thickenings and any other pads that are to support concentrations of weight from roof trusses or columns shall be supported on, or be replaced with, mass concrete filled pads of the same area that are excavated through the topsoil and bear onto firm silt that provides an ultimate bearing capacity of at least $q_u=300\text{kPa}$.

b. Floor and Waffle Slab

The ground under any lightly loaded floor slab, or waffle slab, should be prepared by removing all turf and at least the upper 100mm of topsoil, along with any deeper areas of soft or organic rich topsoil before proof-rolling or compacting to achieve a firm uniform surface.

If a waffle slab is to be used, the prepared subgrade shall comprise uniform soil type and strength, be stiff, dry and well-compacted, must not contain any significant concentrations of organic and provide an ultimate bearing capacity of at least $q_u=200\text{kPa}$.

The geotechnical technician or engineer shall inspect the prepared surface and confirm in writing that there are no deeper organic-rich, soft or unsuitable soils remaining and that the prepared surface is firm, well-compacted, and uniform.

4.4 Placement of compacted hardfill

Where required, the stripped floor slab area should be reinstated by placing and compacting AP40 sandy gravels in 200mm thick layers so that the dry density of each layer of compacted gravel fill will be *at least* 2150kg/m^3 up to the underside of the floor slab.

4.5 Construction Inspections

Where NZS 3604:2011 "*standard foundations*" are to be used, the Council building inspector may agree to inspect and verify the presence of "*good ground*", the stripped floor slab area and the compaction of the hardfill that will support the floor slab.

Alternatively a geotechnical engineer or experienced technician shall inspect all excavated foundations, the stripped floor slab area, and the standard of compaction of any backfill that is to support floor slabs in order to verify the recommendations of this report have been followed.

Please arrange for the builder to contact Eliot Sinclair at least 48 hours prior to excavation if you would like our geotechnical team to inspect the excavated foundations, floor slab area and reinforcing.

The geotechnical technician should also review nuclear density test records of the compacted AP40 hardfill to verify it has been placed and compacted to a satisfactory standard, before providing approval in writing for construction of the floor slab to proceed.

Where Eliot Sinclair's geotechnical team inspect and verify the exposed foundation bearing conditions and the compaction of any hardfill is consistent with the recommendations of this report, then we will issue a '*Producer Statement – Construction Review*' for the foundation and floor slab bearing conditions.

5 Disclaimer

This 'Pre-Purchase Geotechnical and Foundation Report' is intended to be used as technical supporting document for foundation design.

This report may be used to support an application for Building Consent where NZS3604:2011 standard foundation are specified.

Where Eliot Sinclair's 2xD16 perimeter foundation is to be used, a Producer Statement-Design shall be provided by Eliot Sinclair & Partners Ltd to confirm the suitability of the foundations for the proposed dwelling, before an application is submitted for Building Consent.

Comments made in this pre-purchase geotechnical and foundation report are based on Eliot Sinclair's previous assessment of the deeper geotechnical conditions, observations during subdivision construction filling earthworks in early 2020, and shallow penetrometer testing carried out in May and June 2020.

Whilst every care was taken during our investigation and interpretation of subsurface conditions, there is a very small risk there could be subsoil strata or features at depth that we are unaware of.

At time of foundation excavation, should the exposed soil conditions vary from those described in this report then Eliot Sinclair & Partners Ltd should be contacted to advise if the recommendations of this report remain valid. Further, should the requirements of MBIE's guidelines, NZ Standards or the NZBC that relate to for foundations and floors be updated, then Eliot Sinclair should be contacted to advise if the recommendations of this report remain valid.

This report has been prepared for the benefit of Suburban Estates Ltd, the initial purchaser of the land from Suburban Estates Ltd, and the Selwyn District Council.

No liability is accepted by this company, or any employee of this company, with respect to the use of this report by any other party or for any purpose other than what is described in Section 1 of this report.

Yours sincerely
ELIOT SINCLAIR & PARTNERS LTD



Chris O'Connell
BE(Hons) Civil
Geotechnical Engineer



John Aramowicz BEng(Hons) Mining
CMEngNZ IntPE(NZ) CPEng (1008112)
Geotechnical Engineer
Director

Enclosed:

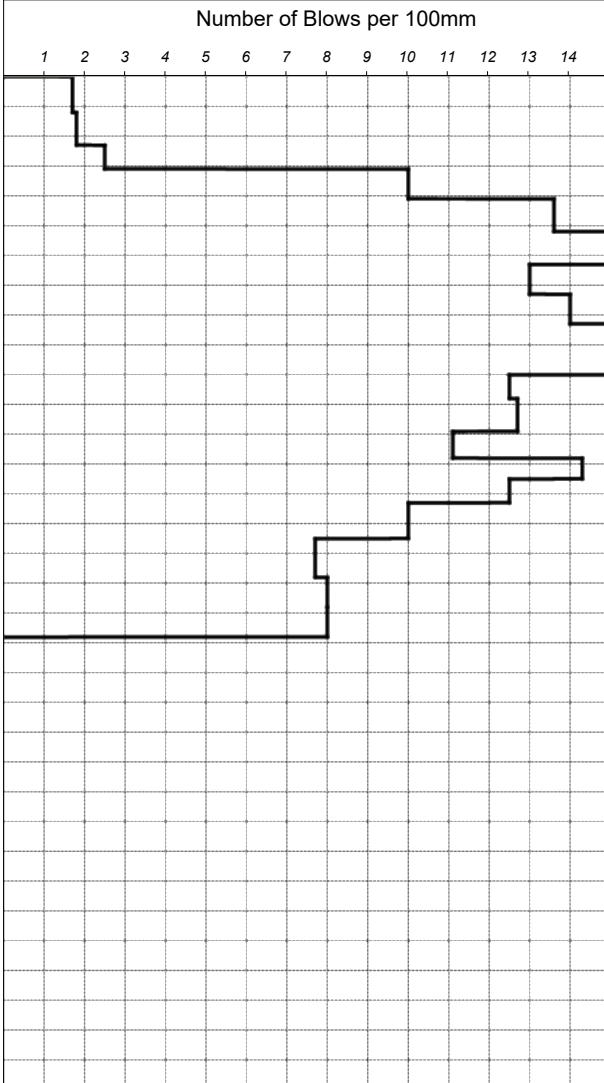
- Eliot Sinclair Site Investigation Records, 2 pages
- Eliot Sinclair 2xD16 Perimeter Foundation Detail

SITE INVESTIGATION RECORD

Client **Suburban Estates Limited**

Site **53-93 Tosswill Road, Prebbleton (Site Specific Testing)**

SCALA PENETROMETER TEST RESULTS



Depth (m)

SOIL PROFILE

Water

— Lot 6 01

COMMENTS

SITE PLAN (Not to Scale)



Field Staff:

CAO

Prepared By:

CAO

Investigation Type

☐ Hand Auger

☐ Spade Hole

☐ Test Pit

Job Manager:

BES

Approved By:

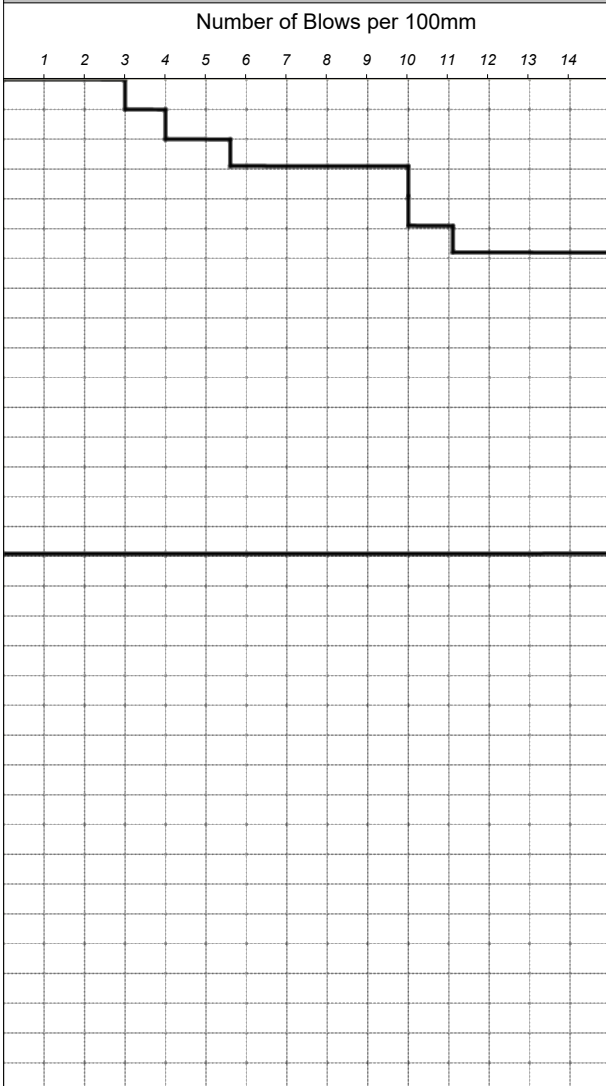
JTA

SITE INVESTIGATION RECORD

Client **Suburban Estates Limited**

Site **53-93 Tosswill Road, Prebbleton (Site Specific Testing)**

SCALA PENETROMETER TEST RESULTS



Depth (m)

SOIL PROFILE

Water

— Lot 6 02

COMMENTS

SITE PLAN (Not to Scale)



Field Staff:

CAO

Prepared By:

CAO

Investigation Type

☐ Hand Auger

☐ Spade Hole

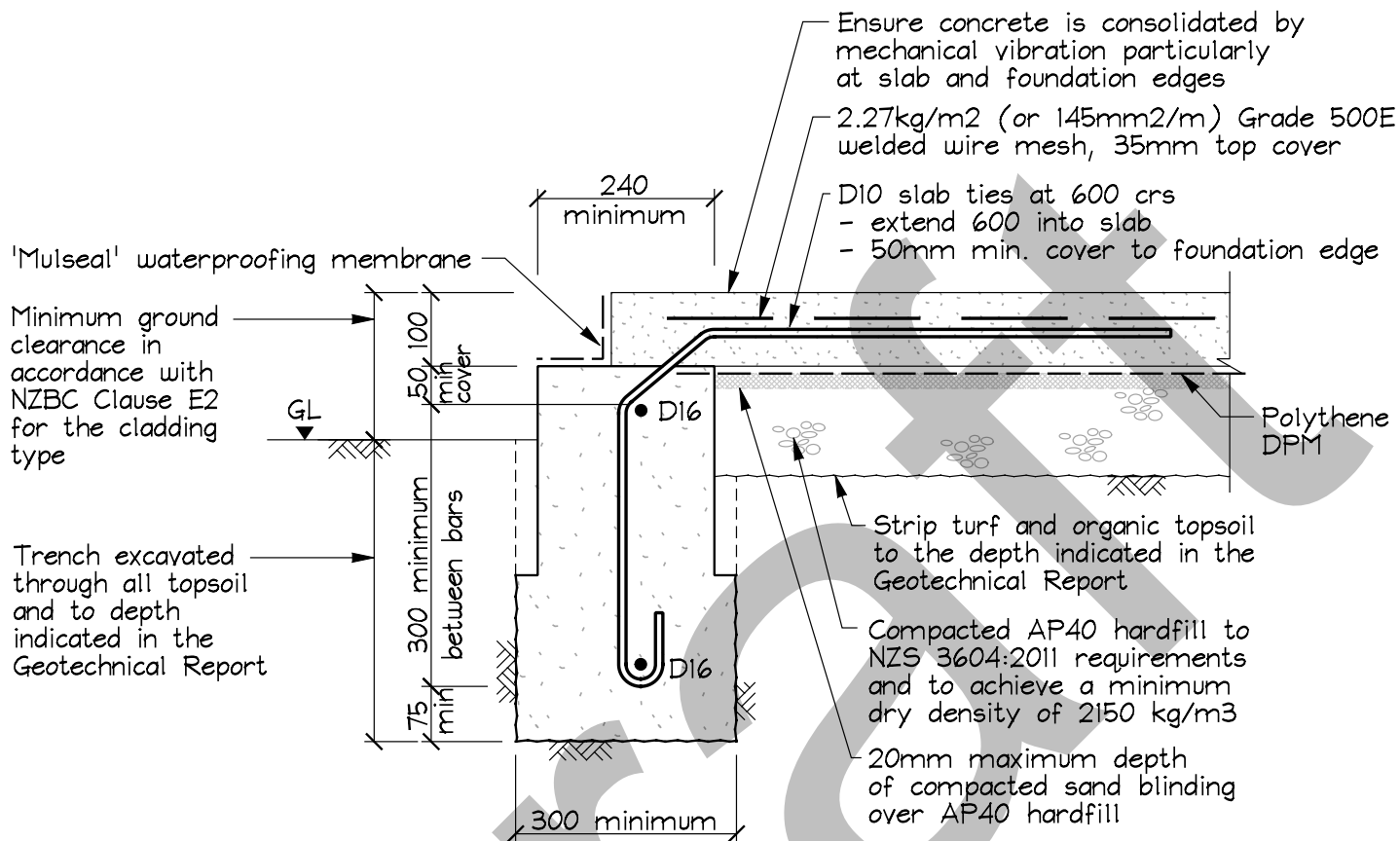
☐ Test Pit

Job Manager:

BES

Approved By:

JTA



NOTES

- This foundation detail is to be read in conjunction with the Geotechnical and Foundation Report prepared by Eliot Sinclair.
- All reinforcing is to be Ductility Class E in accordance with NZS 4671.
- 50mm cover to reinforcing for concrete placed against formwork
- 75mm cover to reinforcing for concrete cast against ground
- The minimum 28 day concrete strength, complying with NZS 3104 and NZS 3109 shall be in accordance with NZS 3604:2011 Section 4-Durability, clause 4.5.2 for the exposure zone (refer fig. 4.2 of NZS 3604) that the building site is located within.

2-D16 FOUNDATION DETAIL - BRICK VENEER

Scale 1:10

Scale: As Shown (A4)

Date: 02/06/2020

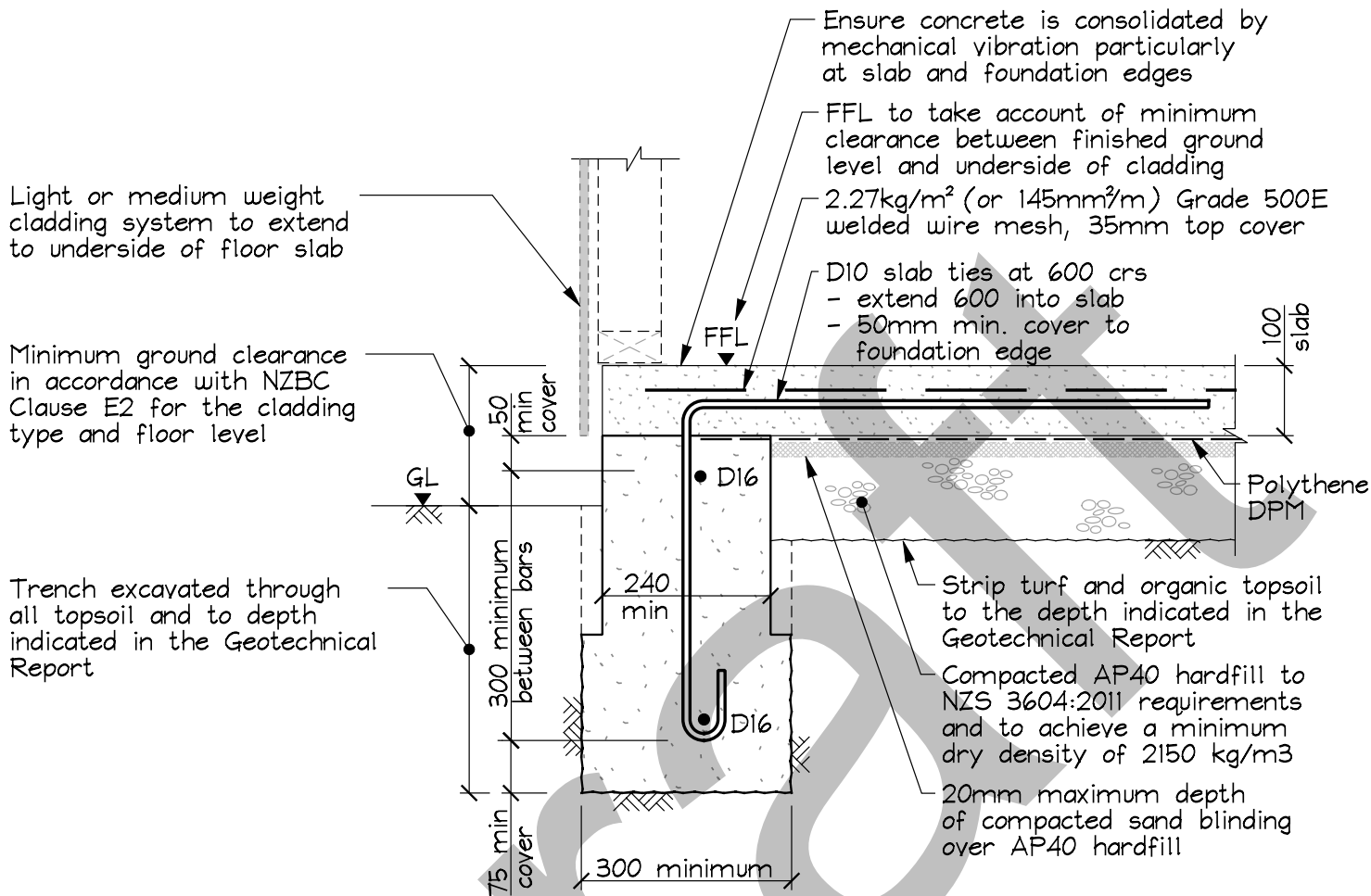
checked	JTA	origin of levels	
designed	RHJM	surveyed	
drawn	NMS	surv.date	
manager	RHJM	Cad No.	
			datum

Eliot Sinclair
surveyors | engineers | planners

Drawing Set

Sheet 1 of 1

rev.



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2-D16 FOUNDATION DETAIL LIGHT or MEDIUM WEIGHT CLADDING

Scale 1:10

Scale: As Shown
(A4)

Date: 02/06/2020

checked	JTA			origin of levels
designed	RHJW	surveyed		
drawn	NMS	surv.date		
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Drawing Set

Sheet 1 of 1
rev.