

07 November 2022

1227064462

1002249



Raewyn Pamela Stockman  
27 County Drive  
Hawera 4610



Dear Sir/Madam

**Notification of Code Compliance Certificate (CCC) Decision**  
**Re: Building Consent No. BC200394, Relocate New Dwelling**

We have emailed/written to you on a previous occasion explaining the requirements for Council's Building Consent Authority to make a decision to issue a Code Compliance Certificate in respect of the above building consent.

As we have not received all the evidence required to conclude that the building work covered by this consent has been completed, we have decided **to refuse to issue a Code Compliance Certificate (CCC)** for the above building consent at this time.

Should you require a final inspection in the future, please contact our Customer Service team to request one.

Please note: Any further inspections or processing of any amendments to your consent may incur additional fees.

Should you wish to discuss this matter further, please contact me on 0800 111 323.

Yours sincerely

Heather Clarke  
Technical Support Officer



CCC

1227064462

1002249



Te Kaunihera o Taranaki ki Te Tonga  
**South Taranaki**  
District Council

5 July 2022

Raewyn P Stockman  
27 County Drive  
Hawera 4610

Dear Sir/Madam

**Application for Code Compliance Certificate**

**Re: Building Consent No. BC200394, Relocate New Dwelling**

**Location: 27 County Drive, Hawera**

Under the Building Act 2004, the building owner must apply for a Code Compliance Certificate (CCC) after all building work to be carried out under a building consent is completed.

If the building work to which the above consent relates is **complete**, please ring the South Taranaki District Council on 0800 111 323 and book a final inspection. If the building work is **nearly complete**, and will be completed by the two year anniversary date, please ring and book a final inspection once the work is completed.

Section 93 of the Building Act 2004 requires a Building Consent Authority to decide whether to issue a Code Compliance Certificate (CCC) in respect of a building consent in the event that an application for a CCC is not received from the building owner. This decision must be made within 20 working days of the two year anniversary of the granting of the consent, or within 20 working days of a later date agreed by the Building Consent Authority and the owner.

If you would like to discuss this matter further please contact me on 0800 111 323.

Yours sincerely

Heather Clarke  
**Building Control Administration Officer**

heather.clarke@stdc.govt.nz



# BUILDING CONSENT

Form 5, Section 51 New Zealand Building Act 2004



CONS

**Application No:** **BC200394**

**Description of Project:** **Relocate New Dwelling**

**Consent Issue Date:** 05 November 2020

## The Building

Street Address: 27 County Drive Hawera 4610

Legal Description: Lot 42 DP 412125

Valuation Number: 1227064462

Location of building within site: As Shown on Plans

Building Name:

Level/Unit Number: 1

## The Owner

Name: R P Stockman

Contact Person: R P Stockman

Mailing Address: 27 County Drive Hawera 4610

Street Address/Registered Office: 65 Egmont Street Hawera 4610

Business Phone: Mobile: 027 446 8006

Home Phone: 06 278 7353 Email: hamish@seselectrical.co.nz

## First point of contact for communications with the building consent authority

Name: H Hendra

Mailing Address: C/- Central Housemovers Ltd 86 Bridge Street Bulls 4818

Street Address/Registered Office: C/- Central Housemovers Ltd 86 Bridge Street Bulls 4818

Business Phone: 06 322 1860 Mobile:

Home Phone: Email: helena@centralhousemovers.co.nz

**Building Work:**

The following building work is authorised by this building consent and any associated amendments:

**RELOCATE NEW DWELLING**

This building consent is issued under section 51 of the Building Act 2004. This building consent does not relieve the owner of the building (or proposed building) of any duty or responsibility under any other Act relating to or affecting the building (or proposed building).

This building consent also does not permit the construction, alteration, demolition, or removal of the building (or proposed building) if that construction, alteration, demolition or removal would be in breach of any other Act.

**Subject to the following conditions:**

- (a) Under section 90 of the Building Act 2004, agents authorised by the Council (acting as the Building Consent Authority) are entitled, at all times during normal working hours or while building work is being undertaken, to inspect -
- i. land on which work is being or is proposed to be carried out; and
  - ii. building work that has been or is being carried out on or off the building site; and
  - iii. any building.

**Compliance Schedule:**

A Compliance Schedule is not required for this building project.

**Attachments:**

Copies of the following documents are attached to this building consent:

- Advice Notes for Building Consent
- Stamped Approved Consented Plans

**Signature:** .....



**Date:** .....

05/11/2020

**Position:** Building Control Officer

On behalf of **The South Taranaki District Council**



# BUILDING CONSENT ADVICE NOTES

Application No:

**BC200394**

Description of Project:

**Relocate New Dwelling**

---

## **Commencement of Work**

The Owner or person undertaking the building work shall give at least 2 working day's notice of the intended commencement of building work.

## **Restricted Building Work Requirements**

As per Section 87 of the Building Act 2004 prior to the commencement of any building work the owner/agent must provide in writing to the Building Consent Authority the name and licence number of all practitioners engaged to carry out the work within this consent if not already stated on the application.

The owner/agent must notify the Building Consent Authority of any changes to Licensed Building Practitioners that may be engaged during the course of the building project.

## **Inspection Notification**

The request for inspections is to be made at least 24 hours before any inspection is required.

**The contact person is to ensure that someone is on site at the time of the inspection.**

## **Compliance**

This building consent confirms compliance with the New Zealand Building Code. It does not give approval to commence building work until all other approvals have been obtained.

## **Completion Advice**

The owner shall as soon as practical after completion of the building work, notify the Hawera Administration Office that the work has been completed in accordance with this building consent by completing and returning the attached Application for Code Compliance Certificate (Form 6).

## **Lapsing of Consent**

This Consent shall lapse and be of no effect if the building work has not started within 12 months from date of issue.

### **Required Inspections**

24hrs notice is required for all inspection bookings

---

#### **DRAINAGE:**

All waste pipework outside the building line/envelope, inground pipework prior to covering or filling pipe trench, sewer connection, septic tank installation, effluent bed/field, effluent disposal system.

#### **FINAL INSPECTION:**

Final inspection on completion of all project work.

### **Required Documents**

The following documents are to be supplied to the building authority (STDC) on completion of building work.

---

- **Application form for CCC**
- **Electrical certificate**
- **Gas certificate**
- **"As built" drainage plan**
- **LBP Records of Building Work**
- **PS4 - Pile driving and supervision**



# APPLICATION FOR CODE COMPLIANCE CERTIFICATE (CCC)

Form 6, Section 92 of the Building Act 2004

Application No:

**BC200394**

Issued By:

**South Taranaki District Council**

Private Bag 902  
HAWERA 4610

Phone: 0800 111 323 or 06 278 0555

Facsimile No: 06 278 8757

Email: [contact@stdc.govt.nz](mailto:contact@stdc.govt.nz)

## The Owner

Name of Owner: R P Stockman.....

Contact Person: R P Stockman.....

Postal Address: 27 County Drive Hawera 4610 .....

Home Phone: 06 278 7353p..... Business Phone: .....

Mobile Phone: 027 446 8006.....

Email address: hamish@seselectrical.co.nz.....

The following evidence of ownership is attached to this application:

.....  
(copy of certificate of title, lease, agreement for sale and purchase,  
or other document showing full name of legal owners(s) of the building)

## The Agent (only required if application is being made on behalf of the owner)

Name of Agent: .....

Contact Person: .....

Postal Address: .....

Home Phone: ..... Business Phone: .....

Mobile Phone: .....

Email Address: .....

Website: .....

Relationship to owner:

First point of contact for communications with the building consent authority:

.....  
(state full name, mailing address, phone and fax numbers, email addresses)

## The Application

All building work to be carried out under the above building consent was completed on:

..... (insert date)

The licensed building practitioner(s) who carried out or supervised the restricted building work is/are as follows:

| Name | Licensing Class | Licensed building practitioner number* | Particular work carried out or supervised |
|------|-----------------|--|---|
|      |                 |  |   |
|      |                 |  |   |
|      |                 |  |   |
|      |                 |  |   |

\*(or registration number if treated as being licensed under section 291 of Building Act 2004)

The personnel who carried out building work other than restricted building work are as follows:

.....  
.....  
.....

[list names, addresses, telephone nos. and (where relevant and if not provided above) licensed building practitioner nos. or Plumbers, Gasfitters, and Drainlayers Board registration numbers]

If a Compliance Schedule is required, the following specified systems are contained on the compliance schedule for the building and, in the opinion of the personnel who installed them, are capable of performing to the performance standards set out in the building consent:

.....  
.....  
.....

I request you issue a Code Compliance Certificate (CCC) for this work under Section 95 of the Building Act 2004. The Code Compliance Certificate should be sent to:

.....  
.....  
.....

**Signature of Owner/agent on behalf of and with the authority of the:**

Owner:: .....

Name of person signing and signature: .....

Date: .....



**Attachments:**

The following documents are attached to this application:

- ☐ Memoranda (Records of Building Work) from licensed building practitioner(s) stating what restricted building work they carried out or supervised
- ☐ Other documents from the personnel who carried out the work
- ☐ Evidence that specified systems are capable of performing to the performance standards set out in the building consent
- ☐ Energy works certificates

**FOR OFFICE USE ONLY: BC200394**

Inspector:

Booked by:

Date:

Time:

Confirmed:

Event updated:

Site Plan prepared for Raewyn Stockman

27 County Drive, Hawera

Scale 1:250



PLAN

County Drive

29



South Taranaki District Council  
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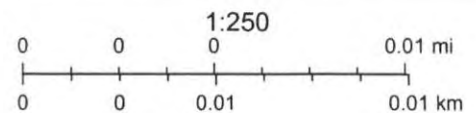
**F5 – Site Safe**

Safety Fencing to be erected  
to keep children and  
unauthorised persons out  
of the construction area

25

August 12, 2020

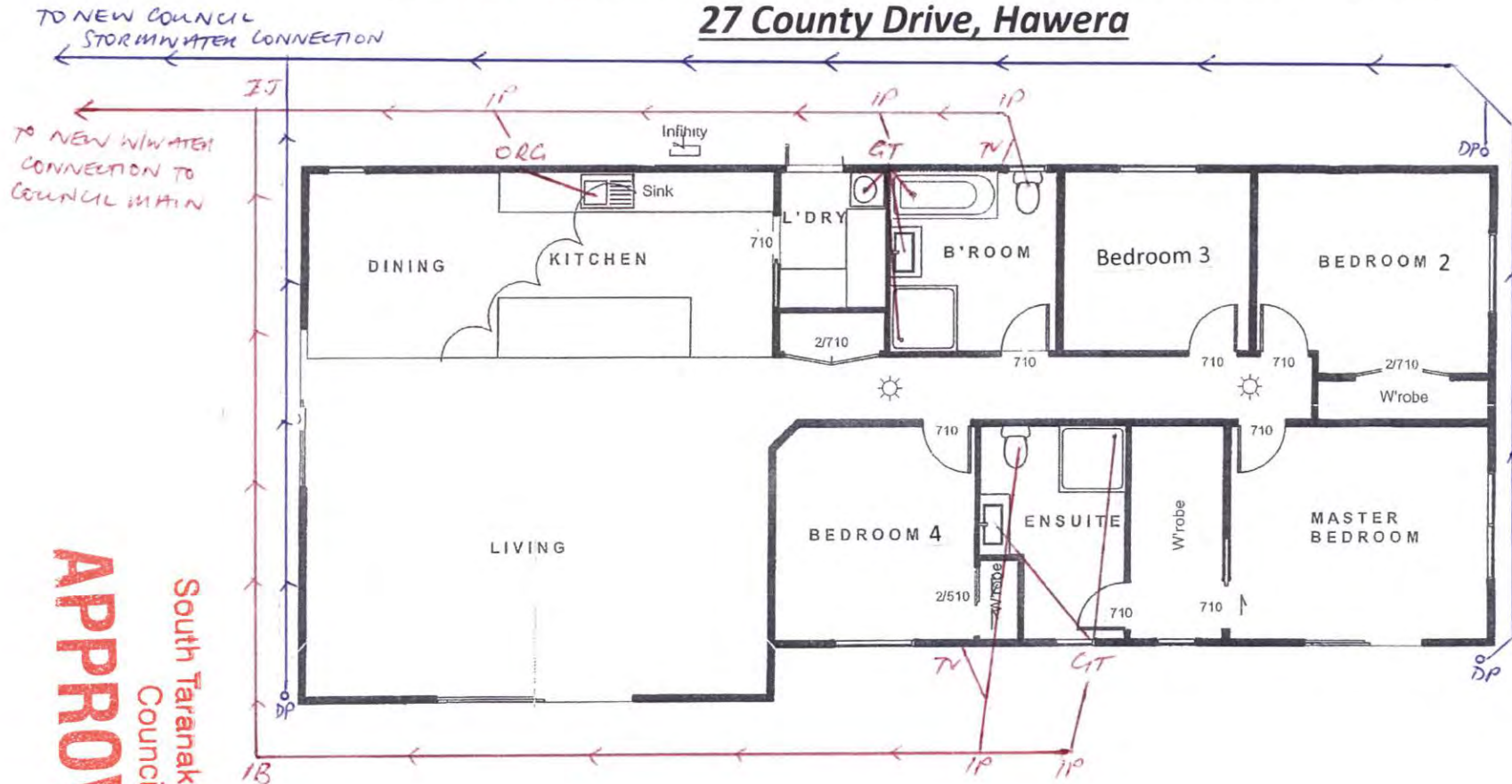
- Addresses
- ☐ Taranaki Regional boundary
- Road Names
- Railway
- ☐ Property Rating & Valuation
- Image
- ☐ Red: Red
- ☐ Green: Green
- ☐ Blue: Blue



LINZ, CORAX, LINZ



**Plumbing and drainage plan prepared for Raewyn Stockman**  
**27 County Drive, Hawera**



**APPROVED**  
 South Taranaki District  
 Council

**Plumbing and Drainage**

TV = 80mm terminal vent  
 GT = Gully Trap  
 ORG = Overflow relief gully  
 IP = Inspection Point  
 IB = Inspection Bend  
 IJ = Inspection Junction  
 DP = Downpipes 80mm

Foul water to comply  
 With G13/AS1 & G13/AS2

All waste sizes and drains  
 To comply with G13/AS1

Stormwater pipe to be  
 100mm PVC Fall 1:100

Wastewater pipe from  
 100mm PVC Fall 1:60

Water Line 25mm UPVC  
 Blue line to comply with G12/AS1

All fittings with branch drains  
 Exceeding 3.5m shall be fitted  
 With air admittance valves

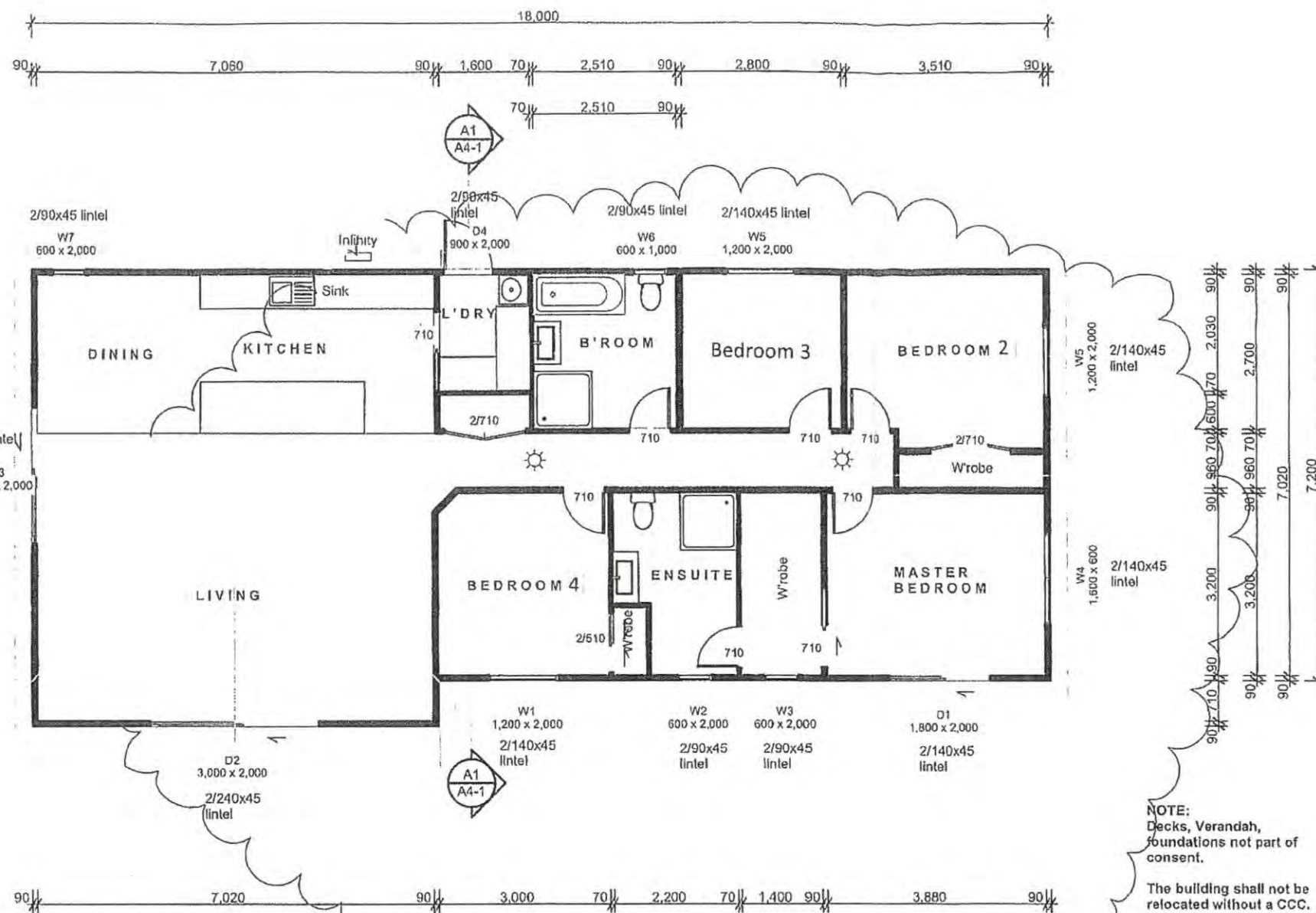
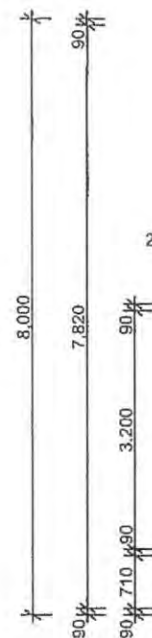
**Waste pipes and gradients:**

|                      |            |         |
|----------------------|------------|---------|
| WC                   | 100mm dia. | 1 in 60 |
| Bath/tub/shower/sink | 50mm dia.  | 1 in 40 |
| Basin                | 40mm dia.  | 1 in 20 |





ELEVATION KEY



FLOOR PLAN  
Scale 1:100

| Fixture    | Pipe size<br>(above floor) | Pipe size<br>(below floor) | Min. Grade |
|------------|----------------------------|----------------------------|------------|
| Basin      | 40Ø                        | 65Ø                        | 2.5%       |
| Dishwasher | 40Ø                        | 65Ø                        | 2.5%       |
| Shower     | 40Ø                        | 65Ø                        | 2.5%       |
| Bath       | 40Ø                        | 65Ø                        | 2.5%       |
| Sink       | 40Ø                        | 65Ø                        | 2.5%       |
| Toilet     | 100Ø                       | 100Ø                       | 1.65%      |
| Tub        | 40Ø                        | 65Ø                        | 2.5%       |

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| BUILDING ENVELOPE RISK MATRIX |                |            |
|-------------------------------|----------------|------------|
| All Elevations                |                |            |
| Risk Factor                   | Risk Severity  | Risk Score |
| Wind zone (per NZS 3604)      | Very high risk | 2          |
| Number of storeys             | Low risk       | 0          |
| Roof/wall intersection design | Low            | 0          |
| Eaves width                   | Medium risk    | 1          |
| Envelope complexity           | Low risk       | 0          |
| Deck design                   | Low            | 0          |
| Total Risk Score:             |                | 3          |

| BUILDING COMPONENT   | Product used                          | Minimum Insulation required | Insulation Achieved |
|--|---------------------------------------|-----------------------------|---------------------|
| Roof   | R3.2 Balts                            | R2.9                        | R3.1                |
| Walls  | Board, & R2.2 batts (studs @ 400 crs) | R1.9                        | R1.9                |
| Floor  | Timber floor with R1.4 Batt           | R1.3                        | R1.4                |
| Glazing  | Double Glazing                        | R0.26                       | R0.26               |
| Total Wall Area (North, South, East, West) = 142 Sqm           |                                       |                             |                     |
| Total Glazing Area (North, South, East, West) = 31 Sqm         |                                       |                             |                     |
| Total Glazing Area Allowed = 30% of Total wall area = 42.6 Sqm |                                       |                             |                     |

NPDC Approved for

19 JUL 2020

Building Consent

KEY:

— = New Timber framed wall

Whb = Wash hand basin

WC = Toilet

Shr = Shower

☀ = Battery operated  
Smoke Alarm

NOTE:

- Trusses as per plan attached  
- Lintels to be fixed as per detail on Sheet A6-2

- Use 2/90x45 MS8 timber top plates fix as per  
MITEK fixing schedule "B" Type

Line all wet areas with Gib Aquafine,

-10mm walls  
-13mm ceilings

Bathroom & ensuite shower to be tiled with  
wetseal waterproofing system

Kitchen / Laundry / bathroom to be selected  
vinyl or tile flooring

- All downlights to be NZCEP54  
Classification CA

Mechanically vent showers & Dryer  
directly to the outside with a proprietary  
ventilation ducting system and inline  
fan run through roof framing space out  
through wall or soffit

GENERAL NOTES:

1. All new construction where not specifically  
designed shall comply with the NZ Building  
Code Handbook and shall conform to NZS 3604:2011

2. Builder to check all dimensions prior to  
construction, manufacture or fixing in of any  
part and shall allow to adjust for fitting tolerances.

3. Dimensional errors shall not be the  
responsibility of the designer or the design  
firm or his agents

4. All exposed metal fasteners and plates shall  
be Stainless steel

5. All timber in near contact to concrete,  
steel or cement based products shall be  
separated with a nailhold strip DPC of  
sufficient width to prevent contact between the  
two.

6. Bottom plate to be fixed as per table on  
sheet A8-2.

8. All timber to be SG8 Grade

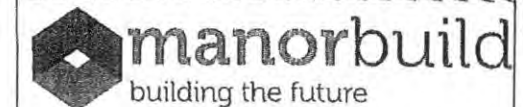
9. Stud sizing (Very High wind zone)

As per Designit calcs. no notching of studs  
allowed

Internal framing to be 70x45 @ 400 crs (non  
load bearing)

10. External lighting to comply with G8 and  
Access to D1 for future access.

visibility of all treads, internal light switch near  
the door and motion sensor for the light fitting



NEW PLYMOUTH  
40 Ocean View Parade | New Plymouth  
t: + 64 6 757 5842  
FREECALL: 0800 MANORGROUP  
www.manorbuild.co.nz | e: sales@manorbuild.co.nz

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Manor Build. All site dimensions are to be verified  
and confirmed by the client prior to the  
commencement of works.

#Notes

client:

project:  
STOCKMAN

design by: Manor Build

scale: As Noted

date: 8/07/2020

Floor Plan

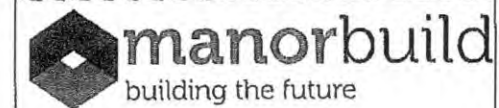
job no:

MG217

sheet no:

A2-1





NEW PLYMOUTH  
40 Ocean View Parade | New Plymouth  
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#Notes

NPDG Approved for  
09 JUL 2020  
Building Consent

client:

project:  
STOCKMAN

design by: Manor Build

scale: As Noted

date: 8/07/2020

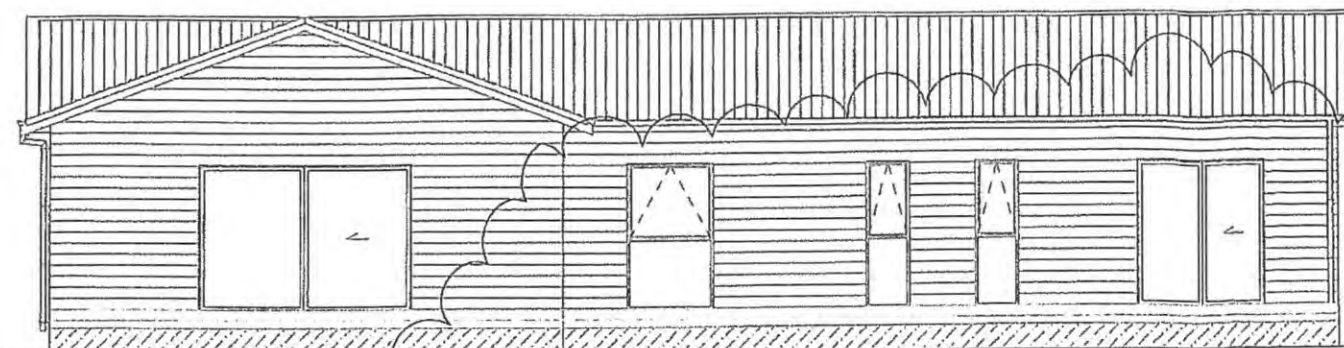
Elevations

job no:

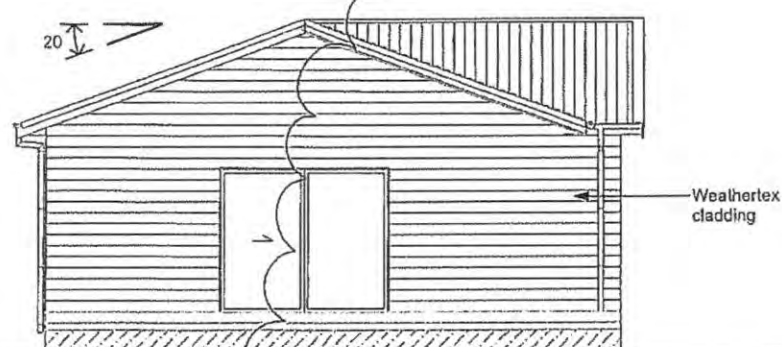
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sheet no:

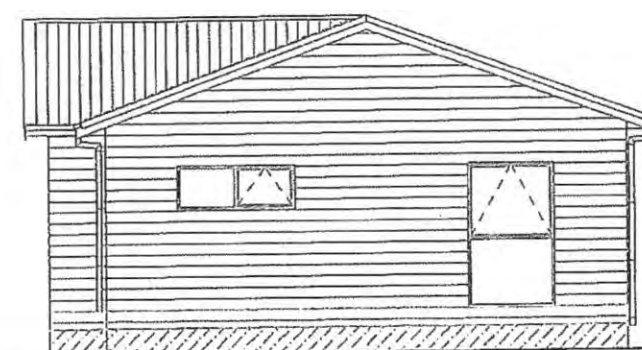
A3-1



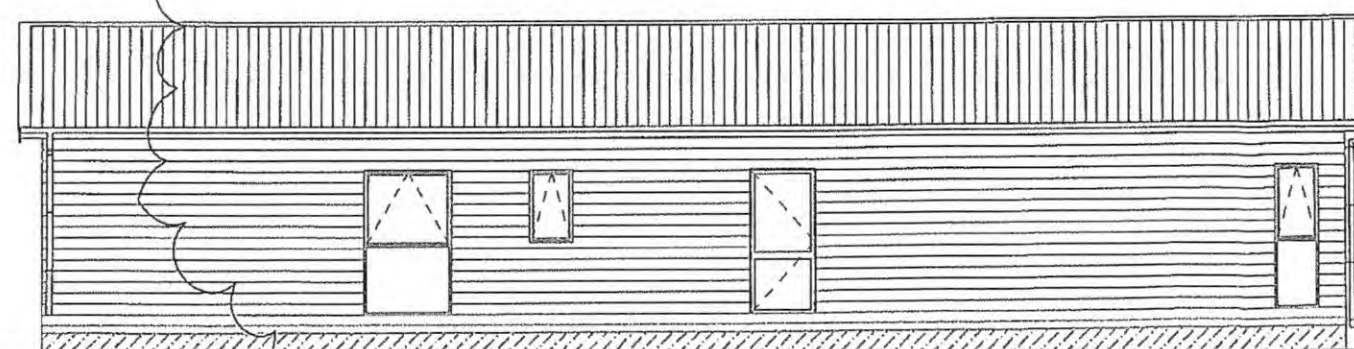
ELEVATION E1  
Scale 1:100



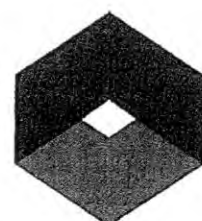
ELEVATION E2  
Scale 1:100



ELEVATION E3  
Scale 1:100



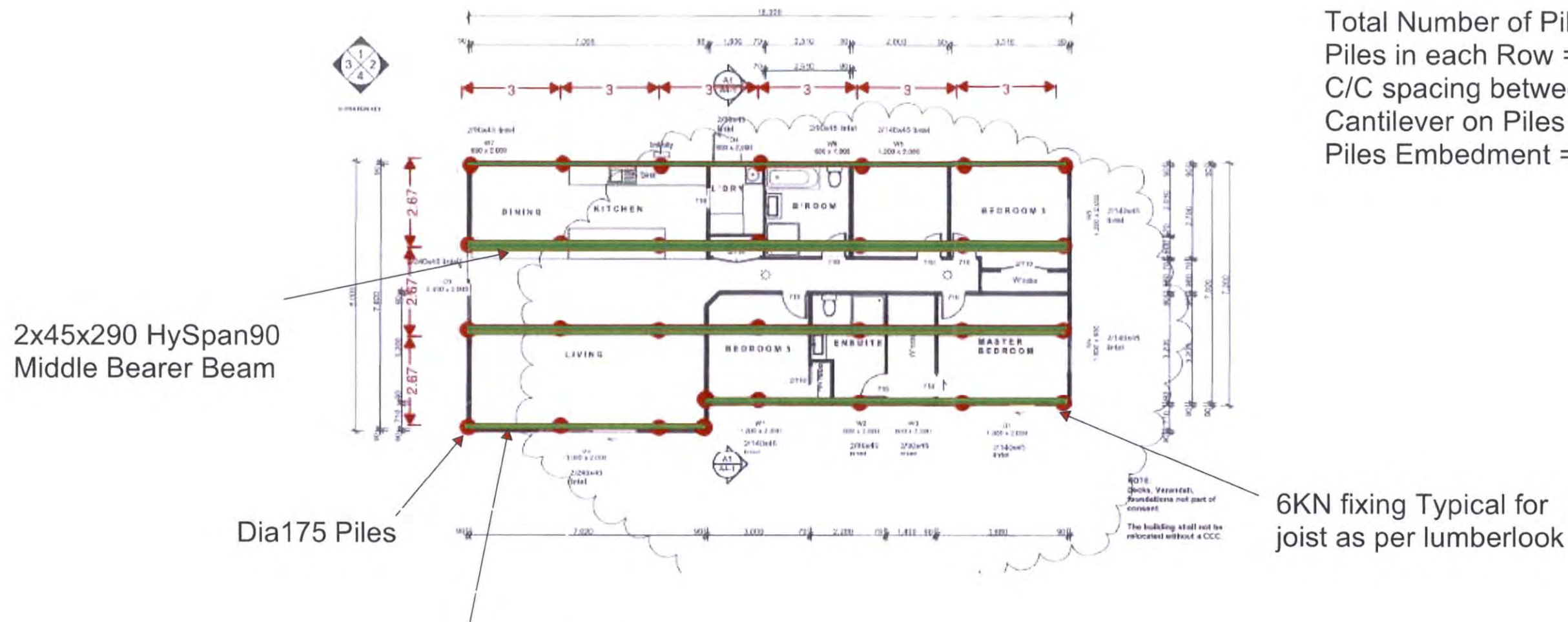
ELEVATION E4  
Scale 1:100



South Taranaki District  
Council  
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# Pile Layout Plan



Total Number of Piles = 30Nos.  
 Piles in each Row = 7Nos.  
 C/C spacing between piles = 3m longitudinal  
 Cantilever on Piles = 0.5m to 0.6m Maximum  
 Piles Embedment = 4m

45x290 HySpan90 End  
 Bearer Beam

## NOTES:

- Drive Dia175 SED Timber piles (H5) Tanapoles Using hammer listed below for required set.
- 500kg Hammer with 1m drop and pile final set of 32mm
- Treat the cut tops of the Tanapoles with generous three coats of Metalx.
- All sub floor fixing shall be stainless steel.
- Bearer to bearer connections used suitable joist hangers.
- All joist to bearer fixing shall be a 6KN connection.
- Provide solid blocking between joist over bearer lines @1.8m max centres and continuous solid blocking at mid-span of joist.
- All pile sizes are indicated on drawing.

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SKETCH -1

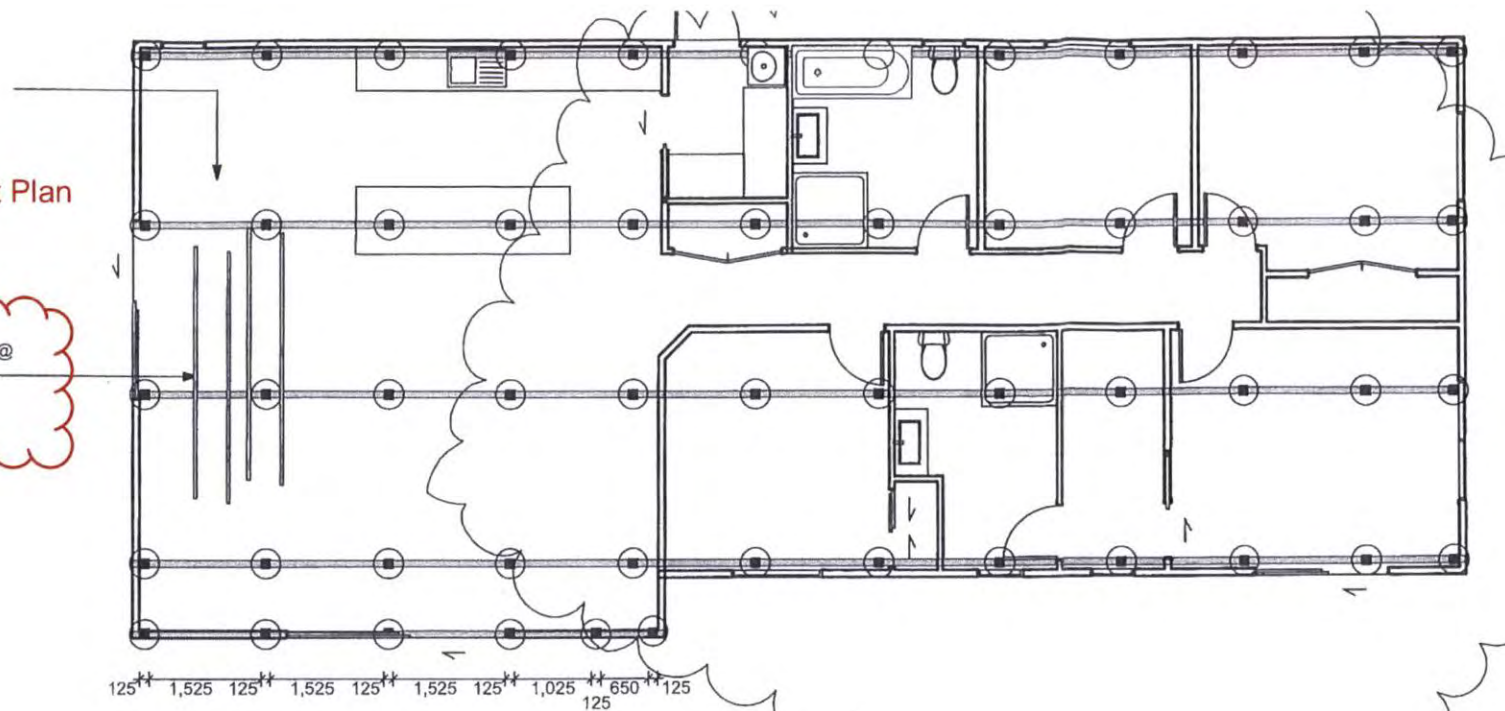


ACE CONSULTANTS LTD



Indicative only for subfloor Joist Plan  
for pile layout see sketch 1

140x45 timber floor joists @  
450mm crs, Nog along  
bearer lines @ 1.8m crs



FLOOR FRAMING PLAN  
Scale 1:150



Table 7.5 – Nailing schedule for hand-driven and power-driven nails (see 7.6)

| Joint   | Hand-driven nails                    |                              | Power-driven nails                   |                              |
|---|--------------------------------------|------------------------------|--------------------------------------|------------------------------|
|   | Length (mm) x diameter (mm) and type | Number/ Location             | Length (mm) x diameter (mm) and type | Number/ Location             |
| <b>Floor framing</b>                                      |                                      |                              |                                      |                              |
| Boundary joist to end of each joist                       | 100 x 3.75                           | 2 (end nailed)               | 90 x 3.15                            | 2 (end nailed)               |
| Curtailed joist not exceeding 3 m long to trimmer         | 100 x 3.75                           | 3 (end nailed)               | 90 x 3.15                            | 5 (end nailed)               |
| Curtailed joist to trimmer when half housed               | 100 x 3.75                           | 2 (end nailed)               | 90 x 3.15                            | 3 (end nailed)               |
| Flitched joint in joist                                   | 100 x 3.75                           | 4 (each end)                 | 90 x 3.15                            | 6 (each end)                 |
| Herringbone strutting to joist                            | 60 x 2.8                             | 2 (skewed)                   | 60 x 2.8                             | 2 (skewed)                   |
| Joist to plate on foundation walls                        | 100 x 3.75                           | 12 (skewed) per 1.5 m length | 90 x 3.15                            | 18 (skewed) per 1.5 m length |
| Joist to plate or bearer                                  | 100 x 3.75                           | 2 (skewed)                   | 90 x 3.15                            | 3 (skewed)                   |
| Lapped joint in joist                                     | 100 x 3.75                           | 2 (each side)                | 90 x 3.15                            | 3 (each side)                |
| Solid blocking between joists to plate bearer or stringer | 100 x 3.75                           | 4 (skewed)                   | 90 x 3.15                            | 6 (skewed)                   |
| Solid blocking to joist                                   | 100 x 3.75 or 75 x 3.15              | 2 (end nailed)<br>4 (skewed) | 90 x 3.15                            | 2 (end nailed)               |

| <b>Flooring</b>  |  |                |                             |                |
|--|--|----------------|-----------------------------|----------------|
| Sheet decking (not exceeding 21 mm thick):<br>(a) Supports at sheet edges<br>(b) Intermediate supports | 60 x 3.06 ring shanked galv. or 60 x 2.8 | 150 mm centres | 60 x 2.8 ring shanked galv. | 150 mm centres |
|  |  | 300 mm centres |                             | 300 mm centres |
| Strip flooring not exceeding 75 mm wide to floor joist   | 2½ x finished thickness                  | 1              | –                           | 1              |
| Strip flooring not exceeding 100 mm wide to floor joist  | 2½ x finished thickness                  | 2              | –                           | 2              |

NOTE –  
(1) Nail lengths and diameters are the minimum required.  
(2) See 4.4 for required protective coatings for metal fasteners.

South Taranaki District  
Council  
**APPROVED**



APPLICATION NO: BC 200394

PRE-VET No: BCPV 0240-20

PROPERTY NO: 1002249

VALUATION NO: 12270/644/62

VALUE OF WORK: \$ 27,000

REG #:

## Central house movers

REG #:

PLUMBER/DRAINLAYER:

REG #:

**DESCRIPTION OF PROPOSED WORK:**

Relocate yard build New Dwelling



PROC

# RESTRICTED BUILDING

# WADIV

\$

NTF

Marcus London

CONSENTS OFFICER

OKAY TO INVOICE ☒

GRANTED ☒

OFFICER'S NAME

(BLG)

## SEWER AND WATER

(PLNG)



File Contents

BC 200394

| Description                              | Req'd<br>(Y N) | Date<br>Added | Init'l | Description                 | Req'd<br>(Y/N) | Date<br>Added | Init'l |
|--|----------------|---------------|--------|-----------------------------|----------------|---------------|--------|
| Application Form                         | Y              | 11/9          | JL     | Records of Bldg Work        |                |               |        |
| Plans & Specs                            | Y              | 11/9          | JL     | Application for CCC<br>(F6) | Y              |               |        |
| Categorisation and Allocation<br>Form    | Y              | 11/9          | JL     | CCC Checksheet              | Y              |               |        |
| Certificate of Design Work               |                |               |        | Signed CCC                  | Y              |               |        |
| Producer Statements &<br>Supporting Docs |                |               |        |                             |                |               |        |
| Peer Reviews                             |                |               |        |                             |                |               |        |
| Fire Design Docs                         |                |               |        |                             |                |               |        |
| Requests for Further Info                |                |               |        | Producer Statements         |                |               |        |
| Requested Info Received                  |                |               |        | Warranties                  |                |               |        |
| Signed Building Consent &<br>Attachments | Y              | 05/11         | M      | Installation Certs          |                |               |        |
|  |                |               |        | Energy Work Certs           |                |               |        |
|  |                |               |        | As-built Drainage Plan      |                |               |        |
| Amendments 1                             |                |               |        | Notices to Fix              |                |               |        |
| Amendments 3                             |                |               |        | Rescind Notice to Fix       |                |               |        |
| Linking Certificate                      |                |               |        | Amendments 2                |                |               |        |
| Owner/Builder Declaration                |                |               |        | Amendments 4                |                |               |        |
|  |                |               |        |                             |                |               |        |
| OTHER (List as Appropriate)              |                |               |        |                             |                |               |        |
|  |                |               |        |                             |                |               |        |
|  |                |               |        |                             |                |               |        |
|  |                |               |        |                             |                |               |        |
|  |                |               |        |                             |                |               |        |

BUILDING:

HAZARDOUS SECTION CHECKED

CHECKED AGAINST STDC REGISTER

NOT APPLICABLE

Compliance Schedule No.  
CS

Is a new or amended Compliance Schedule required?

YES

NO

HERITAGE STATUS CHECK

NA



## PROJECT NOTES

OWNER: R Stockman

APPLICATION NO: BC 200394 - - -

CONTACT PERSON:

VALUATION NO: 12270 - / 644 - / 62

ADDRESS OF WORK:

27 County Drive Hawera

PROPOSED USE:

BUILDER:

**RESTRICTED BUILDING**

DESCRIPTION OF WORK:

Relocate Yard built Dwelling**WARI**

| DATE            | ACTIVITY           | OFFICER   | HOURS       | RATE         | AMOUNT       |
|-----------------|--------------------|-----------|-------------|--------------|--------------|
| <u>14/09/20</u> | <u>Planning</u>    | <u>MH</u> | <u>0.25</u> | <u>150-</u>  | <u>37.50</u> |
| <u>15/09/20</u> | <u>Engineering</u> | <u>PS</u> | <u>0.5</u>  | <u>150/-</u> | <u>87.50</u> |
|                 |                    |           |             |              |              |
|                 |                    |           |             |              |              |
|                 |                    |           |             | TOTAL        |              |
|                 |                    |           |             | PAID         |              |
|                 |                    |           |             | BALANCE      |              |

## PROPERTY INFORMATION MEMORANDUM PROCESSING

|                  | Date Placed in Tray | Date Completed    |
|------------------|---------------------|-------------------|
| Planning         | <u>11/9/20</u>      | <u>14/09/2020</u> |
| Water and Sewer  |                     |                   |
| Vehicle Crossing |                     |                   |

- ☒ Compliance Check with District Plan rules Residential Zone
- ☒ PIM Note Suspect Section note. - Engineered foundations
- ☒ Compliance Check with Resource Consent number RM  
granted 1 1
- ☒ Designations/Protected Trees/Historic sites etc.
- ☒ Site Plan required. Date

Please indicate on the enclosed map the distances from the proposed  
to all boundaries

Complies: Yes/No MHDate 14/09/2020**SEWER AND WATER**

Officers' Names

MARIA H



SERVICES

WATER MAIN

APPLICATION FORM SENT .....

SIZE .....mm LOCATION .....

CONNECTION REQUIRED YES/NO FEE PAYABLE \$..... SIZE..... mm

SEWER MAIN

APPLICATION FORM SENT .....

SIZE .....mm LOCATION .....

CONNECTION REQUIRED YES/NO FEE PAYABLE \$..... SIZE..... mm

STORMWATER

APPLICATION FORM SENT .....

MAIN SIZE .....mm LOCATION .....

CONNECTION REQUIRED YES/NO FEE PAYABLE \$..... SIZE..... mm

DISCONNECTION AND RECONNECTION FEES (DEMOLITION & REMOVALS)

WATER

SEWER

SIGNATURE

DATE

OTHER (e.g. HEALTH/STRUCTURAL etc)

LICENCES REQUIRED (Health/Dangerous Goods etc)

SIGNATURE

DATE

## Lindsey MacPhail

---

**From:** Lindsey MacPhail  
**Sent:** Tuesday, 20 October 2020 4:23 pm  
**To:** hamish@seselectrical.co.nz  
**Cc:** Building Control  
**Subject:** BC200394 - 27 County Drive, Hawera

Good Afternoon Hamish,

As discussed, we agree to the piles being driven and placed at 27 County Drive only. The building can be relocated as planned but no further work is to take place until a Building Consent is issued.

We will require a PS3 and possibly a PS4 for the piles as soon as possible after the building consent is issued and before a CCC can be issued.

Kind Regards

**Lindsey MacPhail**

**Kaihautū Ture Whare | Building Control Manager**



Te Kaunihera o Taranaki ki Te Tonga  
**South Taranaki**  
District Council

Te Kaunihera o Taranaki ki Te Tonga | South Taranaki District Council  
105-111 Albion Street | Private Bag 902, Hāwera 4640, NZ  
Waea/Phone: +64 6 278 0555 | 0800 111 323 | [www.southtaranaki.com](http://www.southtaranaki.com)

## Tax Invoice: 18721

GST Reg. No: 52-769-477

Invoice Date: 04 November 2020

R P Stockman  
27 County Drive  
Hawera 4610

Address: Private Bag 902  
Hawera  
Phone: 06 278 0555  
Free Phone: 0800 111 323  
Facsimile: 06 278 8757  
Email: [contact@stdc.govt.nz](mailto:contact@stdc.govt.nz)  
Website: [www.southtaranaki.com](http://www.southtaranaki.com)

**Application Number:** BC200394  
**Description:** Relocate New Dwelling  
**Location Address:** 27 County Drive Hawera 4610

| Charge Description                        | Charge     | GST      | Amount     |
|---|------------|----------|------------|
| Building Consent Administration Fee       | \$131.30   | \$19.70  | \$151.00   |
| Dept Building & Housing Levy              | \$39.85    | \$5.98   | \$45.83    |
| Dept Building & Housing STDC commission   | \$1.23     | \$0.19   | \$1.42     |
| BRANZ Levy                                | \$26.19    | \$0.00   | \$26.19    |
| BRANZ STDC Commission                     | \$0.70     | \$0.11   | \$0.81     |
| Code Compliance Certificate Fee           | \$110.43   | \$16.57  | \$127.00   |
| Inspection Fee*                           | \$292.17   | \$43.83  | \$336.00   |
| Building Consent Peer Review              | \$136.52   | \$20.48  | \$157.00   |
| Building Consent Processing/Plan Checking | \$219.13   | \$32.87  | \$252.00   |
| Engineering Assessment                    | \$32.61    | \$4.89   | \$37.50    |
| Planning Assessment                       | \$32.61    | \$4.89   | \$37.50    |
| Total                                     | \$1,022.74 | \$149.51 | \$1,172.25 |

*The consent will be granted and issued after the invoice is paid.*

*\*Inspection fee calculated @ \$168.00 x 2 inspections*

E-MAILED 4/11

## Remittance Advice

**Please email to [payments@stdc.govt.nz](mailto:payments@stdc.govt.nz)**

**Or post to:**

South Taranaki District Council  
Private Bag 902  
Hawera 4640

If you wish to pay online details are as follows – 03-0647-0220100-03

Please quote the Application Number as the reference

**Application Number:** BC200394

**Applicant:** R P Stockman

**Amount Due:** \$1,172.25

**Due Date:**

*We reserve the right to charge overdue fees and collection costs on all accounts not paid by their due date.*



BC Number: 200394

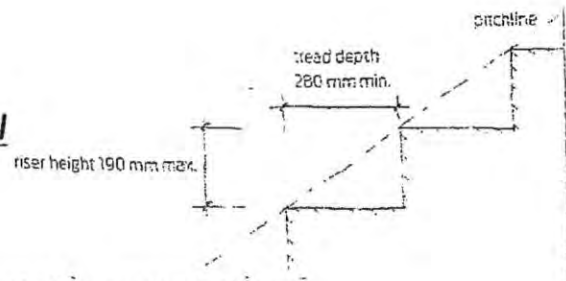
| RESIDENTIAL  |  |  |
|--|--|--|
| Category   | Description  | Examples of work   |
| Res 1  | Residential buildings and ancillary buildings as defined by the Building Regulations 1992. Detached dwellings (SH) designed to a common standard (e.g. NZS3604, NZS4229, NASH3405) that are single storey, including RAFT floor systems and have an E2/AS1 risk matrix score less than or equal to 6.          | Drain alteration, fences over 2.5 metres high, marquees, retaining walls (not retaining surcharge) internal non-load-bearing walls, garden sheds, pergolas, swimming pool fencing, residential solid fuel heating, residential decking over 1.5 metres, carports, garages, pole type buildings.  |
| Res 2  | Detached dwellings (SH) designed to a common standard (e.g. NZS6304, NZS4229, NASH3405) that are less than or equal to two storeys, including RAFT floor systems and have an ES/AS1 risk matrix score less than or equal to 12.  | Silos, New or Additions and Alterations to: one or two storey brick veneer or weatherboard clad detached residential dwellings with 600mm soffits or more.   |
| Res 3  | Detached dwellings (SH) or other dwellings (SR) that are less than or equal to three storeys but limited to vertical plane fire separation and direct egress to the outside. E2/AS1 risk matrix score of 13-20.  | New or Additions and Alterations to: Complex single or two storey solid plaster, monolithic, profiled metal and/or weatherboard clad residential dwellings with enclosed decks.  |
| COMMERCIAL   |  |  |
| Category   | Description  | Examples of work   |
| Com 1  | Commercial, industrial and communal non-residential buildings and their associated outbuildings and ancillary buildings equal to or less than two storeys and an occupancy load of equal to or less than 100 people or SR or SA residential buildings up to two storeys and with a horizontal fire separation. | New or Additions and Alterations to: Light industrial or small commercial buildings up to two storeys and with an occupant load up to 100 people (CL or WL) e.g. workshops, warehouse, factory, retail shop, hairdresser, office/s, New Public/group assembly buildings up to two storeys with an occupant load up to 100 people, e.g. school, college, university, bank, halls stadiums, restaurants, nightclubs/bars, shopping complexes.  |
| Com 2  | Commercial, industrial, communal residential and communal non-residential buildings equal to or less than four storey and an occupancy load of equal to or less than 500 people or SC or SD that are single storey.  | Alterations and Additions to: public/group assembly buildings up to two storey with an occupant load up to 500 people, e.g. school, college, university, bank, halls, stadiums, restaurants, nightclubs/bars, shopping complexes. New or Additions and Alterations to: Buildings containing sleeping purpose groups other than SR and SH, buildings up to three storeys, or buildings with an occupant load up to 100 people e.g. hotel, motel, boarding house, rest home, flats, apartments, commune/marae, hospital etc. |
| Com 3  | All uses of buildings that are over four storeys, or are designed to have more than 500 occupants or SC and SD buildings that are higher than a single storey.   | High rise office and apartment buildings, multi-levelled hospitals, care institutions and detention centres.   |
| <b>NOTES:</b> <div style="text-align: right; border: 1px solid red; padding: 5px; width: fit-content; margin: 10px auto;"> <b>RECEIVED</b><br/> <b>11 SEP 2020</b><br/> <b>BUILDING CONTROL</b> </div> |  |  |
| Processed by: .....  |  | Categorised by: Julie Date: 11/9/20  |



SPEC

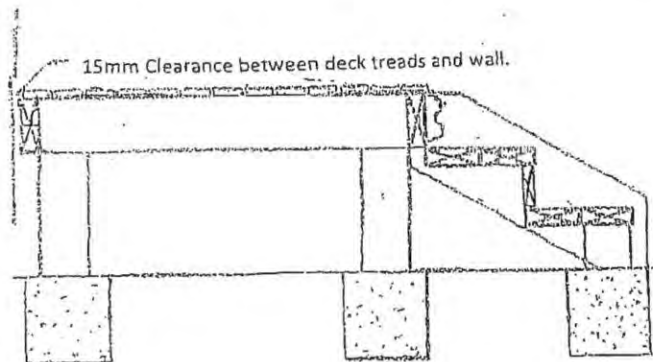
### Stair detail

- Riser Height Max 190mm
- Tread Depth minimum 280mm
- Pitch line 37°
- Finish on steps to be slip resistant decking timber – groove side up



### Landing/deck details for external opening doors

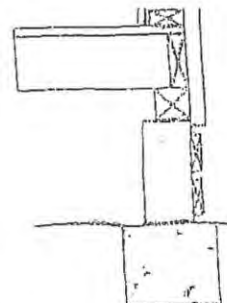
- Pile footings 300x300. Piles to be H5 125 x 125. Concrete strength 20mpa
- Bearers to be H3.2 2/140 x 45 spanned @ min 1.2m . Max loaded dimension of 2m
- Joists to be H3.2 140 x 45 spanned @ 450mm Centers
- All fixings within 600mm of ground level to be stainless steel
- M12 coach bolts @ max 800mm centers max to be used to fix the landing to house
- Fixings from house to deck/landing to be stainless steel
- Finish on deck/landing to be slip resistant decking timber - groove side up



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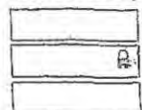
### Subfloor Ventilation

- 100 x 25 or 150 x 25 H3.2 boards
- Spacing between the boards to be 25mm



### Subfloor Access

- To be a minimum of 450mm x 600mm
- To have a slide bolt at minimum to keep the access closed at all times







JANUARY 2020

South Taranaki District  
Council

**+RibRaft®**

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TECHNICAL  
MANUAL







This document contains design and installation information. A variation to any of the information given requires specific engineering design and is hence beyond the scope of this document.

The Firth RibRaft® Floor System can be constructed for all slab-on-ground concrete floors for domestic or residential buildings that fall within the scope of NZS 3604:2011 "Timber Framed Buildings" and Clause 3 "Scope" of Section 1 of this Manual. The design and installation details in this Manual shall be used to design and construct such a floor.

The Firth RibRaft® Floor System is covered by the MBIE Codemark®. This is conditional on the system being used as described in CertMark Australasia certification decision, which in turn requires design in accordance with Section 1 and installation in accordance with Section 2 of this Manual and on site verification in accordance with Section 3.

Note that a MBIE Codemark® means that if this Manual is rigidly followed the relevant Building Control Authority will automatically provide a building permit without the need for producer statements. To comply with the Manual does mean that Firth Certified Concrete® must be used.

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**THIS  
MANUAL  
CONSISTS  
OF 3  
SECTIONS:**

**SECTION**

**1 DESIGN  
INFORMATION**

Contains information  
principally useful for  
the specifier or  
building designer

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**SECTION**

**2 INSTALLATION  
INFORMATION**

Primarily aimed at the  
person on site installing  
the Firth RibRaft®  
Floor system

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**SECTION**

**3 VERIFICATION**

Describes the required  
verification checks

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## SECTION: DESIGN INFORMATION

# 1

1.0 THIS SECTION OF THIS MANUAL CONTAINS DESIGN INFORMATION NOT REQUIRING SPECIFIC ENGINEERING INPUT FOR THE FIRTH RIBRAFT® FLOOR SYSTEM (THE SYSTEM). FULL INFORMATION ON THE INSTALLATION PROCEDURES IS DESCRIBED IN SECTION 2 OF THIS MANUAL (INSTALLATION INFORMATION). WHERE STANDARDS ARE REFERENCED IN THIS MANUAL, THESE SHALL INCLUDE THE LATEST AMENDMENTS.

## 2.0 TECHNICAL INFORMATION

### 2.1 Overview

The Firth RibRaft® Floor System is a reinforced concrete waffle raft floor slab-on-ground. Typically it consists of an 85mm thick slab supported by a grid of ribs normally 100mm wide at 1200mm x 1200mm centres. The overall depth is 305mm. Edge beams and ribs under load bearing walls are 300mm wide to provide for the extra load carried by these members. Where heating coils of less than 25mm diameter are embedded in the topping, the slab concrete thickness shall be 110mm meaning the overall thickness is 330mm. Where the top floor surface is honed to provide a decorative finish, a slab thickness of 100mm (before honing) should be specified.

### 2.2 Pods

Firth RibRaft® polystyrene pods 1100mm square and 220mm thick are placed directly on levelled ground and are arranged in such a way as to form a reinforced concrete floor slab with a grid of reinforced concrete ribs and edge beams when concrete is placed onto them. Pods may be cut to suit specific architecture layout and also to accommodate services. 300mm thick pods are available if needed for deeper edge beams and internal ribs.

### 2.3 Steel

Reinforcing steel in the slab shall consist of Welded Reinforcing Mesh complying with AS/NZS 4671:2001 with a minimum weight of 2.27kg/m<sup>2</sup>, a lower characteristic stress of 500MPa, square configuration of orthogonal bars between 150 to 200mm centres, and ductility class L or E, hereafter referred to "mesh". The presence of Class E reinforcing bars in the ribs and beams provides adequate ductility of the system which allows the use of class L mesh. Typically the topping mesh reinforcement will be 665 mesh (class L) or SE62 ductile mesh, each being equally applicable. The reinforcing bars in the ribs and edge beams shall conform to AS/NZS 4671:2001 "Steel Reinforcing Materials". Specifically designed spacers are used to position the polystyrene pods and the rib and edge beam reinforcing steel bars in a secure manner until the concrete is placed. The reinforcing mesh is held in place by mesh chairs. Conventional timber or steel formwork is used to form the edge of the slab.

### 2.4 Concrete

One of the following Firth concrete products shall be used in the system:

- 1) Raftmix: a 20MPa 100mm slump mix available as a pump mix suitable for 100mm pump lines available in either a 13mm or more usually a 19mm nominal aggregate size, or as a structural (non-pump) mix.
- 2) Raftmix25: a 25MPa 100mm slump mix available as a pump mix suitable for 100mm pump lines available in either a 13mm or more usually a 19mm nominal aggregate size, or as a structural (non-pump) mix. This mix shall be specified for buildings constructed in the 'sea spray zone' (i.e. within 500m of the sea including harbours, within 100m of tidal estuaries or inlets, on offshore islands and elsewhere defined as exposure zone D in 4.2.3.3 of NZS3604).

Note: Additional admixtures to standard RibRaft® mixes to be approved by the Firth Plant Engineer.

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### 3.0 SCOPE

This Clause sets out the limitations that apply to the use of the system to ensure that specific engineering input is not required. The concrete floor slab for buildings or ground conditions that do not meet this scope must be subjected to specific engineering design to comply with the requirements of the New Zealand Building Code.

#### 3.1 Structure Limitations

Specific engineering input shall not be required only where the structure supported by the system complies with the following criteria:

- > The structure supported by the system is constructed in a location where the Seismic Hazard Factor Z (defined in NZ1170.5) is less than or equal to 0.45 (refer to Figure 6).
- > The system is laid level, or has a maximum step of 600mm detailed in accordance with this Manual.
- > The structure supported by the system has no basement, part basement or foundation walls.
- > The total height from the lowest ground level to the highest point of the roof shall not exceed 10m.
- > The structure supported by the system has a roof pitch limited to 60 degrees maximum from the horizontal.
- > The maximum height of a single or top storey is 4.8m and any other storey is 3m.
- > Only ground floor walls of the structure supported by the system are permitted to be "heavy external walls" (as defined in Clause 3.3).
- > The roof truss span shall be less than or equal to 12m when the roof and ceiling loads are supported entirely by the external walls. Where internal support of roof trusses is used the footings below point loads identified by the truss designer shall comply with this Manual.
- > Where internal load bearing walls are used to support the roof and floor, the loaded dimensions stated in tables 8.2 and 14.10 of NZ3604:2011 shall apply, and these load bearing walls shall be supported on a 300mm wide load bearing rib as detailed in this manual.
- > Floors may be of unlimited size provided that the maximum dimension between free joints shall not exceed 30m. Where free joints are required they should be detailed in accordance with this Manual.

#### 3.2 Live Loading

The live loading cases of structures covered by these designs are:

- > 1.5kPa and 3.0kPa as per NZS3604 "Timber Framed Buildings".
- > 13kN concentrated load in garage over area of 0.3 x 0.3m (vehicle limited to 2500kg gross).

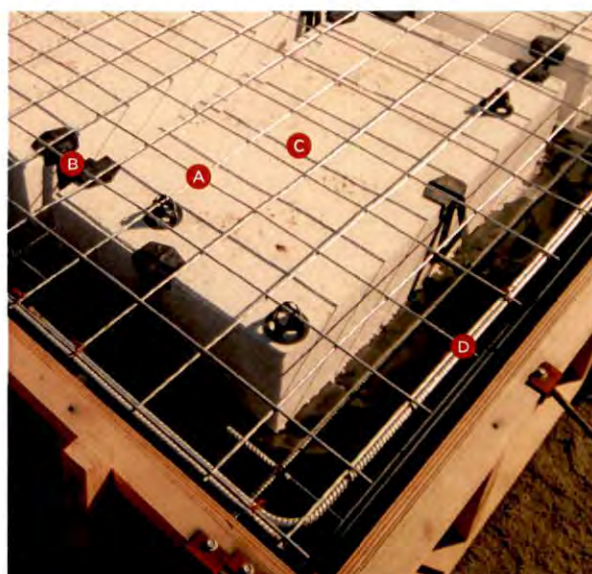
#### 3.3 Snow Loading

Open ground snow loading as defined in NZS3604 of up to 2kPa.

#### 3.4 Dead Loading for Use with This Manual

The dead load cases of structures covered by these designs are:

- > Light external walls with total mass not exceeding 60kg/m<sup>2</sup> – e.g. timber framing with weather boards and interior wall linings.
- > Heavy external walls with total mass greater than 60kg/m<sup>2</sup> but not exceeding 290kg/m<sup>2</sup> – e.g. timber framing with masonry veneer or partially filled 20 series masonry blocks.
- > Internal walls with total mass not exceeding 45kg/m<sup>2</sup> – e.g. timber framing and linings.
- > Light roofs with total mass not exceeding 45kg/m<sup>2</sup> – e.g. ceiling linings and metal roof, including framing.
- > Heavy roofs with total mass greater than 45kg/m<sup>2</sup> but not exceeding 85kg/m<sup>2</sup> – e.g. ceiling lining and concrete tiles or slates, including framing.
- > Mid-floors with total mass not exceeding 60kg/m<sup>2</sup> – e.g. timber framing and flooring, including ceiling linings.
- > Heavy internal walls and/or load bearing internal walls supported on a load bearing rib.



The RibRaft® System

- A** Steel mesh reinforcing    **B** Firth 100mm spacer
- C** Firth RibRaft® polystyrene pods    **D** Steel reinforcing



### 3.5 Foundation Requirement for Different Building Types

The designs given in this Manual are limited to where the system supports Building Types as described in Table 1. The classification of wall and roof weights are as detailed in Clause 3.4 of this Section. Single and two storey shall be as defined in NZS 3604:2011.

Table 1 Foundation Type Identifier

| NUMBER OF STORIES | ROOF  | GROUND FLOOR EXTERNAL WALLS | SECOND STOREY EXTERNAL WALLS | 1.5KPA LIVE LOAD & UP TO 1KPA SNOW LOAD | 3KPA LIVE LOAD & /OR 2KPA SNOW LOAD |
|-------------------|-------|-----------------------------|------------------------------|---|-------------------------------------|
| SINGLE STOREY     | Light | Light                       |                              | A                                       | A                                   |
|                   | Heavy | Light                       |                              | A                                       | B                                   |
|                   | Light | Heavy                       |                              | B                                       | B                                   |
|                   | Heavy | Heavy                       |                              | C                                       | C                                   |
| DOUBLE STOREY     | Light | Light                       | Light                        | C                                       | D                                   |
|                   | Heavy | Light                       | Light                        | D                                       | E                                   |
|                   | Light | Heavy                       | Light                        | D                                       | E                                   |
|                   | Heavy | Heavy                       | Light                        | E                                       | G                                   |

### 3.6 Foundation Soils

The system may be used when the supporting ground meets the definitions of "good ground" given in Section 3 of NZS 3604:2011 (as modified by B1 of the Building Compliance Documents). In addition, the system shall not be used for damp sites i.e. where it can be reasonably expected that the ground water level could come within 600mm of the underside of the system. The acceptability of the ground shall be verified in accordance with Clause 3.1.3 of NZS 3604:2011.

Solutions for soils prone to liquefaction or expansive soils are available using the Firth RibRaft<sup>®</sup> technology, however these are outside the scope of this Manual and require specific engineering design.

Where the ultimate bearing capacity required of the supporting ground is verified by Scala Penetrometer testing in accordance with Clause 3.3 of NZS3604:2011 or for cohesive soils using a calibrated shear vane in accordance with the NZGS Guideline for Hand Held Shear Vane Test, the bearing capacity shall exceed the values in Table 2 for the proposed building type. For scala penetrometer testing, the bearing capacity shall be considered adequate when the number of blows per 300mm depth of penetration below the underside of the system at each test site exceeds the values given in Table 2 below.

For RibRaft<sup>®</sup> foundations compliance with Table 2 allows ultimate bearing capacities of less than 300kPa. However, with the exception of bearing capacity all other requirements in NZS3604:2011 for "good ground" shall be complied with.

Table 2 Scala Penetrometer Blows Required and Ultimate Bearing Capacity

| FOUNDATION TYPE | ULTIMATE BEARING CAPACITY (KPA) | MIN. BLOWS PER 300MM DEPTH FOR SCALA TESTING |
|-----------------|---------------------------------|--|
| A               | 140                             | 4  |
| B               | 175                             | 5  |
| C               | 210                             | 6  |
| D               | 240                             | 7  |
| E               | 275                             | 8  |
| G               | Good ground                     |  |

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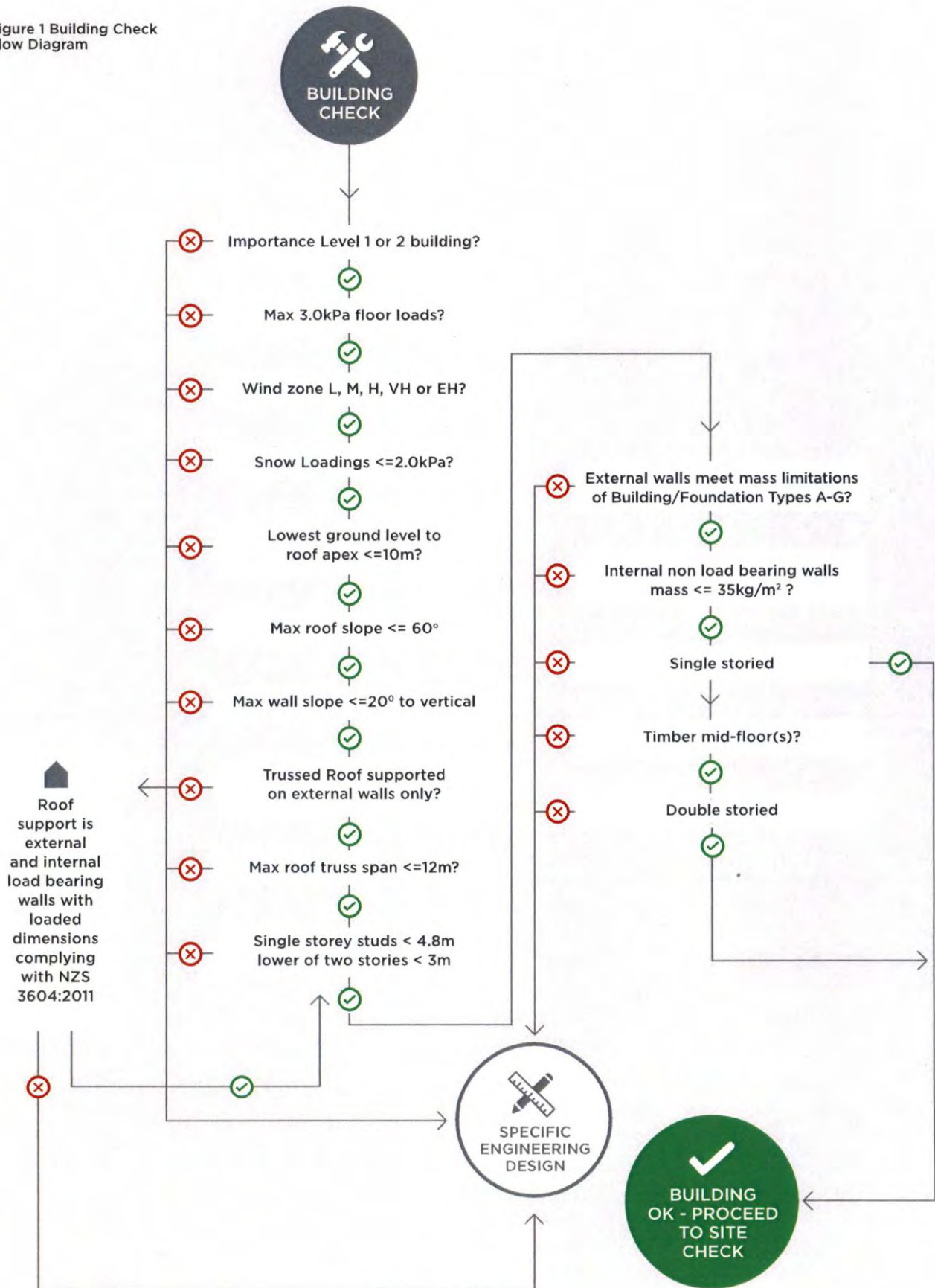
### 3.7 Flow Diagrams

The flow diagrams on the following pages (adapted from NZS3604:2011) will help in determining whether the non-specific details for the system can be used for the purposes of the concrete floor slab construction. There are two checks in the process. The first is to determine whether the proposed building complies with the requirements set out in this Manual (Building Check), and the second is to determine whether the site complies with the requirements set out in this Manual (Site Check).

(Note: NZS3604:2011 provides for parts of buildings to be considered as individual buildings. These flow diagrams apply to those parts of the building where slab-on-ground is being considered and where the part of the building can be considered as an individual building under NZS3604:2011).

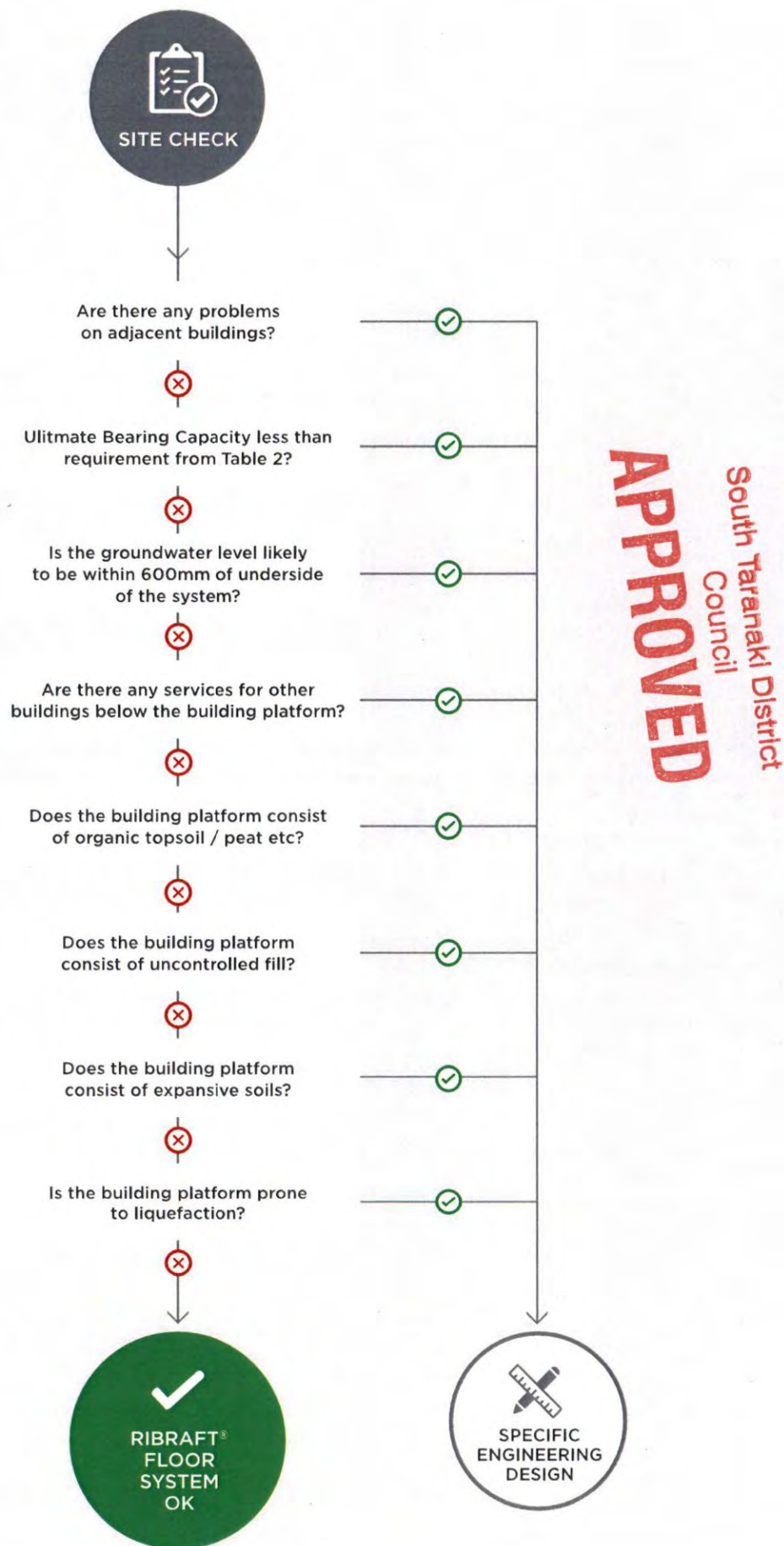


Figure 1 Building Check Flow Diagram



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Figure 2 Building Check  
Flow Diagram





## 4.0 CONSTRUCTION DETAILS

Standard construction details for the system are provided here for buildings that fall within the below scope.

### 4.1 Pod Layout

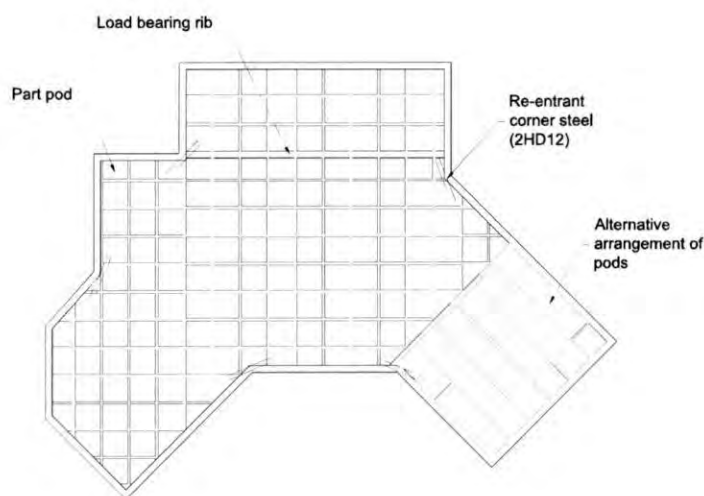
RibRaft® polystyrene pods supplied by Firth (1100 x 1100 x 220mm thick) shall be placed on levelled ground and arranged in a waffle pattern. The pods are used as void formers while the concrete is curing. These pods are an integral component of the system and shall not be substituted.

Pods shall be placed so as to provide the necessary spacing between the edge beams and ribs as described below. The first rib out from the edge beam shall have a maximum clear separation of 1100mm however in all other cases the centre to centre distance between the ribs, whether they are 100mm or 300mm wide, shall be 1200mm. In the case of 100mm ribs this centre to centre spacing is achieved by the 1100mm square pods however between 100mm and 300mm ribs, or between two 300mm ribs, the pods shall be cut down to suit. Pods may be cut down to size but shall not be added to, where this is necessary to suit the building layout, penetrations or orientation of beams and ribs.

**Figure 3** shows a typical layout of the pods and ribs. Note the part pods around the edge, where the building shape dictates, and adjacent to the 300mm rib.

Firth suggests that when drawing the building plan, a generic RibRaft® grid (100mm wide ribs at 1200mm centres) is set out using the corner of the building as a starting point. The location of any load bearing ribs, or point loads greater than 10kN, are identified and pods cut to establish 300mm wide ribs or foundation pads as described in this Manual. The most cost effective solution being a simple grid layout which requires minimum cutting of the pods. Ribs can be used at less than 1200mm centres, however it is more cost effective to use the 1200mm centres wherever practicable.

Figure 3 Typical RibRaft® Plan



### 4.2 Edge Beam Width and Reinforcement

Edge beams around the perimeter of the floor slab shall be 300mm to provide bearing capacity for external load bearing walls, and contain 2-HD12 bars (Grade 500E) as bottom steel and 1-HD12 bar (Grade 500E) in the top. This top bar shall be tied to the underside of the reinforcement mesh. Refer Figure 5, below for construction details. The edge beam shall be rebated for brick veneers where necessary as shown in Figure 5(C).

### 4.3 Internal Ribs (non load bearing) Width and Reinforcement

Each standard internal rib shall be 100mm wide and shall contain 1-HD12 steel bar (Grade 500E) held in place at the bottom of the rib by a Firth spacer. Refer Figure 5E for construction details.

### 4.4 Internal Ribs (load bearing) Width and Reinforcement

For load bearing walls that support the roof and floors and heavy internal walls, the pods shall be cut to create a 300mm wide rib directly under the load bearing wall. Refer Figure 5(D) for construction details under load bearing walls. Where the load bearing ribs meet and terminate at an edge beam or internal rib the bottom reinforcement from the load bearing rib shall be bent into the adjacent rib and tied together. The reinforcement shall lap for at least 720mm.

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4.5 Point Loads

Truss manufacturers often support the roof trusses internally on posts or studs within a wall, which are described on the truss manufacturer's drawings as falling into various ultimate limit state categories. Table 3 summaries when individual footings are required below the reactions, and the form these should take.

Table 3 Foundation Requirements for Individual Point Loads

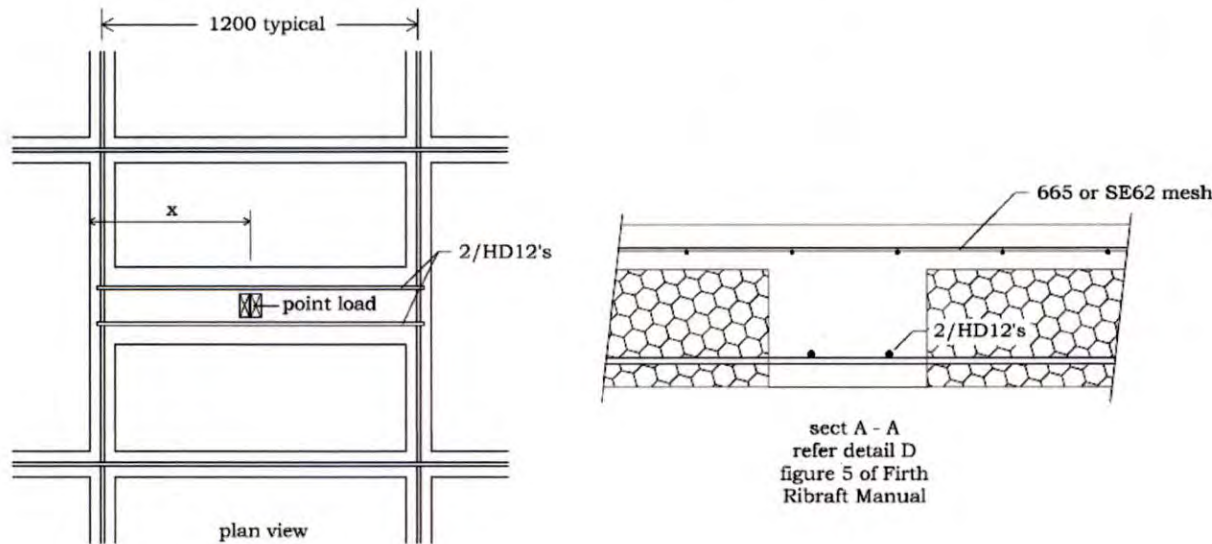
| FOUNDATION OPTIONS BELOW POINT LOAD: |                            |  |
|--------------------------------------|----------------------------|--|
| ULTIMATE LIMIT POINT LOAD REACTION   | PAD OPTION, GOOD GROUND    | BEAM OPTION, BEARING CAPACITY GREATER THAN 140KPA <sup>(3)</sup> |
| Up to 10kN                           | No thickening required     | No thickening required   |
| Up to 20 kN                          | 375x375 pad <sup>(1)</sup> | 300mm wide load under point load as detailed in Figure 5         |
| Up to 30kN                           | 450x450 pad <sup>(2)</sup> | 300mm wide load under point load as detailed in Figure 5         |

Notes  
(1) Pad thickness to match depth of pods plus topping (bears on ground not polystyrene) and reinforced with 2 x D12 Bars both ways  
(2) Pad thickness to match depth of pods plus topping (bears on ground not polystyrene) and reinforced with 3 x D12 Bars both ways  
(3) Refer section 3.6 for confirmation of bearing capacity. With exception of bearing capacity all other requirements in NZS3604 for good ground shall be complied with.

Figure 4 Details for Beam Option Thickening Under Point Loads

| ULTIMATE LIMIT LOAD P FROM TRUSS DESIGNER | MINIMUM EDGE DISTANCE X IN MM |
|---|-------------------------------|
| 20kN                                      | 200 *                         |
| 30 kN                                     | 400 *                         |

\* If minimum edge distances cannot be achieved extend thickening to next 100mm ribs





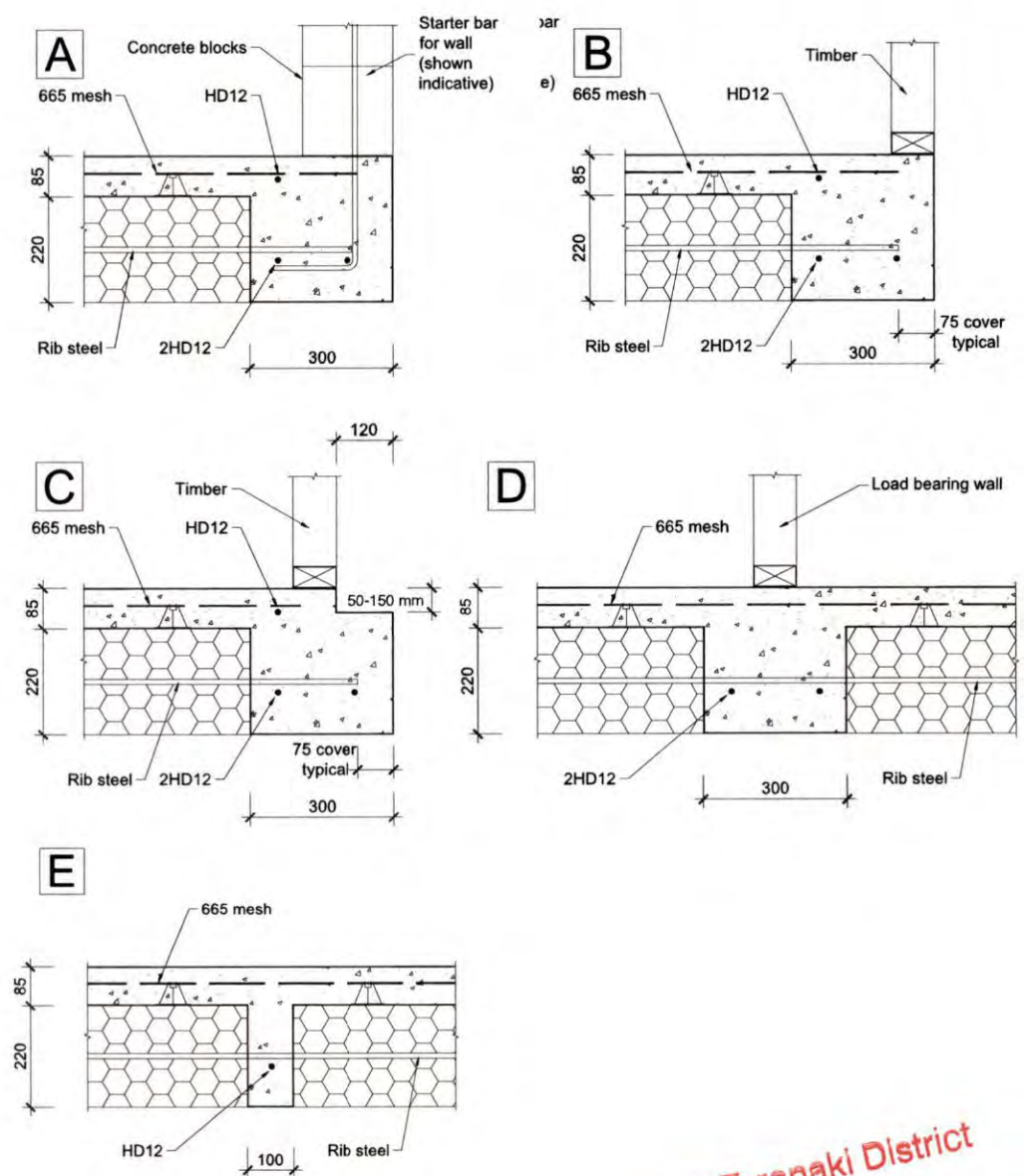
#### 4.6 Mesh Reinforcement

The entire floor slab shall be reinforced with 665 mesh supported on 40mm mesh chairs sitting on the polystyrene pods.

#### 4.7 Re-entrant Corners

In order to limit the width of cracking at the re-entrant, or internal corners, extra steel shall be placed on top of the mesh. These shall be 2-HD12 bars (Grade 500E), 1200mm long tied to the top of the mesh at 200mm centres, with 50mm cover from the internal corner - refer Figure 3.

Figure 5  
Standard RibRaft®  
Construction Details



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## 5.0 LATERAL RESISTANCE

### 5.1 Earthquake Resistance

Unlike conventional foundation systems, the Firth RibRaft® system is not embedded into the ground. Sliding resistance to horizontal seismic loads is provided by frictional contact with the soil. In locations where the Seismic Hazard Factor  $Z$  is greater than 0.45, shear keys may be required to resist seismic loads. Such buildings require specific engineering design and are outside the scope of this document. Refer to Figure 6.

Depending on the wind zone and the weight of the building elements this frictional resistance may not be sufficient to provide sliding resistance to wind loads, and specific shear keys may be required, as detailed in Clause 5.2.

Figure 6  
Seismic Hazard  
Factor  $Z$  to  
NZS 1170.5



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## 5.2 Wind Resistance

The building's bracing demand from wind loading shall be assessed from Section 5 of NZS 3604:2011 for both directions (i.e. along and across the building). The bracing capacity of the system must exceed the greater of the bracing demands determined.

The bracing capacity of the system shall be determined as the sum of the bracing capacity provided by frictional resistance (i.e. friction between the system and the ground) and the bracing capacity provided by the shear keys (if any) necessary to meet the requirements of Clause 5.2.

The bracing capacity provided by frictional resistance shall be determined from Table 4 depending on the building type, roof weight, and floor live loading. The bracing capacity provided by the shear keys shall be the sum of the bracing capacity of the individual shear keys determined as follows. If the shear key is in clay, each shear key shall be considered to contribute 170 BU's. If the shear key is in sand, each shear key shall be considered to contribute 200 BU's. If the bracing capacity of the system, determined from the frictional resistance and the shear keys as described above, is less than the bracing demand further shear keys shall be added until the bracing demand is met.

| BUILDING TYPE | ROOF TYPE | GROUND FLOOR EXTERNAL WALLS | SECOND STOREY EXTERNAL WALLS | BU's PROVIDED PER 100M <sup>2</sup> 1.5KPA | FOR LIVE LOADING OF: 3.0KPA |
|---------------|-----------|-----------------------------|------------------------------|--|-----------------------------|
| Single Storey | Light     | Light                       |                              | 1630                                       | 1746                        |
| Single Storey | Heavy     | Light                       |                              | 1737                                       | 1857                        |
| Single Storey | Light     | Heavy                       |                              | 1802                                       | 1922                        |
| Single Storey | Heavy     | Heavy                       |                              | 1909                                       | 2029                        |
| Double Storey | Light     | Light                       | Light                        | 2163                                       | 2403                        |
| Double Storey | Heavy     | Light                       | Light                        | 2270                                       | 2510                        |
| Double Storey | Light     | Heavy                       | Light                        | 2335                                       | 2575                        |
| Double Storey | Heavy     | Heavy                       | Light                        | 2442                                       | 2682                        |

Table 4 Bracing Capacity Provided By Frictional Resistance Per 100m<sup>2</sup> Of Ground Floor Area

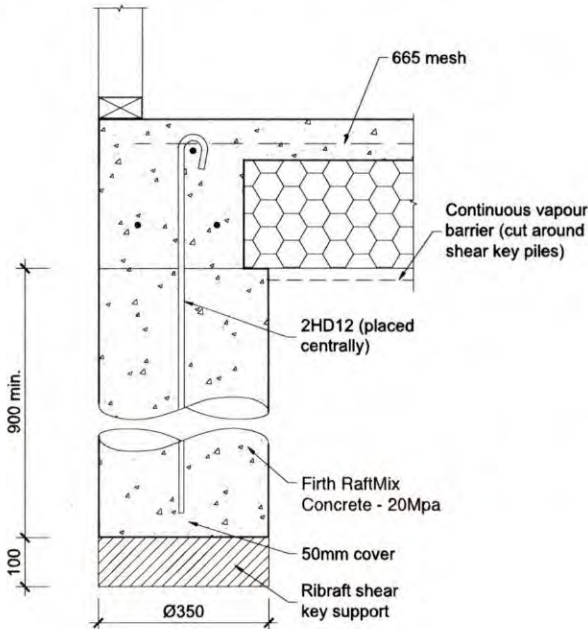
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## 5.3 Shear Keys

Shear key piles required by Clause 5.2 must be uniformly distributed around the perimeter of the building, and be located at the edge beam/internal rib junction. Where a shear key is required, the minimum number of shear keys shall be two per floor plan. Where two shear keys are used they shall be placed at diagonally opposite ends of the floor plan.

Construction details of the shear keys shall be as shown on Figure 7. Shear keys shall be a minimum of 900mm long. The holes shall be over-drilled at least 100mm and a polystyrene RibRaft® Shear Key Support placed into the bottom of each hole. This will support only the plastic (wet) concrete and then allow movement of the shear key if settlement of the supporting ground occurs. The effective end bearing of the shear keys is therefore eliminated.

Figure 7 RibRaft® Shear Key



## 5.4 Design Example For Lateral Resistance Calculation

The following is a short example to demonstrate the process of determining whether shear piles are required.

Consider a 180m<sup>2</sup> single storey home with a light roof located in Palmerston North in a VH wind zone as defined by NZS3604. Assume the building height is 6m with 3m above the eaves. The length for across wind considerations is 15m and the width (along wind) is 12m.

First consider seismic actions. From Figure 6 the seismic hazard factor is 0.4. Since this is less than 0.45 shear keys will not be required for earthquake resistance.

Now consider wind loading. Table 5.5 of NZS3604 requires 95 bracing units per meter (BU/m) across the building and 90 BU/m along. As it's a very high wind zone these figures need to be increased by a factor of 1.3.

The BU demand for across building wind is therefore =  $95 \times 1.3 \times 15 = 1853\text{BU}$

The BU demand along the building =  $90 \times 1.3 \times 12 = 1404\text{BU}$

From Table 4 for a single storey light weight roof with 1.5kPa live load the capacity is 1630BU per 100m<sup>2</sup>. Therefore for 180m<sup>2</sup> the capacity is 2934BU. As the capacity (2934) is greater than the demand (1853) no shear keys are required.

If the demand had exceeded the capacity then any shortfall can be provided by supplying shear keys in accordance with Section 5.3 with each shear key providing the BU specified in Section 5.2.

## 6.0 OTHER DESIGN DETAILS

### 6.1 R-Values

The insulation performance of a building element is measured by the "R-Value". The schedule method is the simplest method to achieve compliance with Clause H1 of the Building Code. Using this method the minimum R-Values required for floors are R1.3 for light timber frame construction, and typically R1.5 for masonry construction. R-values of R1.3 can be used for masonry construction if glazing with greater insulation is used (refer NZBC, Clause H1). If in-floor heating is used the minimum required R-Value is increased to R1.9, and the resistance to thermal movement into the room must be one tenth of that to the outside environment.

The fourth edition of H1 (amendment 3, January 2017) states that "Concrete slab-on-ground floors are deemed to achieve a construction R-value of 1.3, unless a higher R-value is justified by calculation or physical testing". RibRaft® is therefore a deemed to comply solution however in some instances designers may wish to determine the R-value as part of the design process. There are numerous methods for calculating R-values for slabs on ground, with many of the processes giving quite different R-values. NZBC clause H1 prescribed that an "Acceptable methods for determining the thermal resistance (R-values) of building elements are contained in NZS 4214."

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The R-values provided in this Manual use the NZS4214 methodology.

If the R-value calculation is required to demonstrate compliance with the Building Code, then the NZS4214 methodology is probably the best alternative due to its reference in H1. However, more technically robust calculation methodologies exist and where the R-values are important, for example heated floors, use can be made of the BRANZ Home Insulation Guide. For these instances edge insulation is also recommended.

When slab edge insulation is specified, it is recommended that Firth HotEdge® is used as it has been designed to be compatible with Firth RibRaft®.

The R-Value of a concrete floor is dependent on the floor area to perimeter ratio, and the details of the floor perimeter. The R-Value for various solutions are illustrated below. The R-Values have been independently calculated using NZS4214:2006 "Methods of Determining the Total Thermal Resistance of Parts of Buildings," though modified for perimeter heat loss using recommendations from the Building Research Establishment.



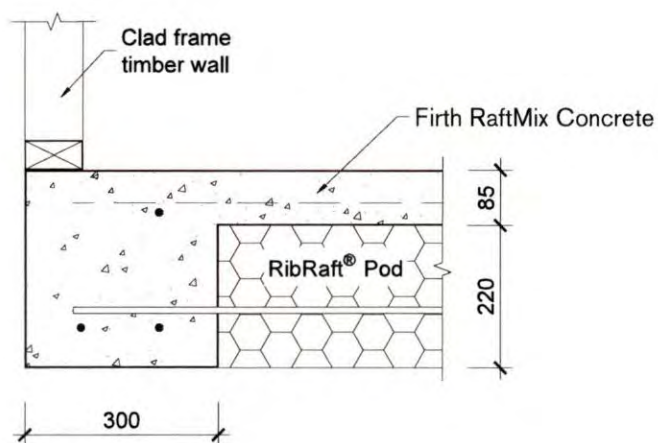


Figure 8  
RibRaft® R Values  
For 90mm Thick  
Walls On The  
Floor Edge

|                             | FLOOR AREA TO PERIMETER RATIO M <sup>2</sup> /M |      |      |      |      |      |      |      |      |      |      |
|-----------------------------|---|------|------|------|------|------|------|------|------|------|------|
|                             | 1.00  | 1.25 | 1.50 | 1.75 | 2.00 | 2.25 | 2.5  | 2.75 | 3.0  | 3.5  | 4.00 |
| R-Value m <sup>2</sup> °C/W | 1.28  | 1.40 | 1.52 | 1.64 | 1.75 | 1.86 | 1.97 | 2.07 | 2.17 | 2.38 | 2.57 |

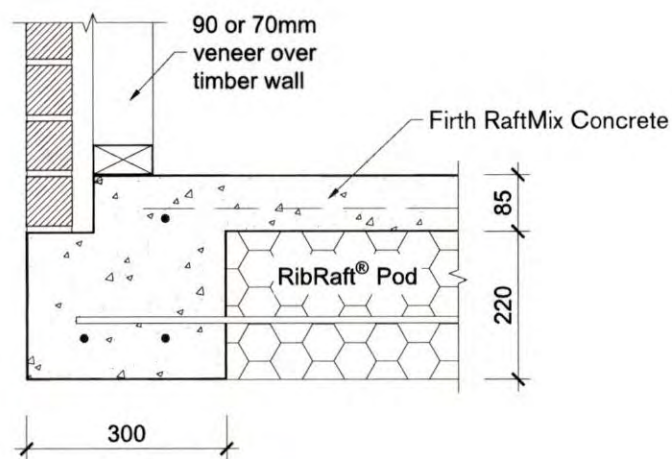


Figure 9  
RibRaft® R Values  
For 70-90mm  
Thick Veneer,  
Cavity, and  
90mm Walls.

|                             | FLOOR AREA TO PERIMETER RATIO M <sup>2</sup> /M |      |      |      |      |      |      |      |      |      |
|-----------------------------|---|------|------|------|------|------|------|------|------|------|
|                             | 1.25  | 1.50 | 1.75 | 2.00 | 2.25 | 2.5  | 2.75 | 3.0  | 3.5  | 4.00 |
| R-Value m <sup>2</sup> °C/W | 1.54  | 1.67 | 1.80 | 1.93 | 2.05 | 2.17 | 2.28 | 2.40 | 2.62 | 2.84 |

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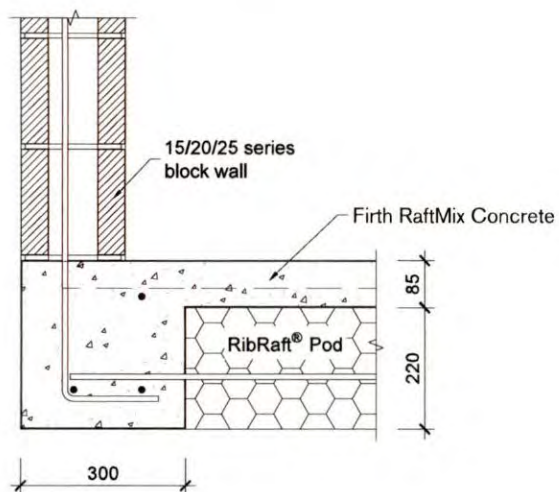


Figure 10  
RibRaft® R Values  
For Various  
Thicknesses  
Of Masonry Walls

|                                | BLOCK        | FLOOR AREA TO PERIMETER RATIO M <sup>2</sup> /M |      |      |      |      |      |      |      |      |      |
|--------------------------------|--------------|---|------|------|------|------|------|------|------|------|------|
|                                |              | 1.25  | 1.50 | 1.75 | 2.00 | 2.25 | 2.5  | 2.75 | 3.0  | 3.5  | 4.00 |
| R-Value<br>m <sup>2</sup> °C/W | 15<br>SERIES | 1.48  | 1.60 | 1.73 | 1.85 | 1.96 | 2.08 | 2.19 | 2.30 | 2.51 | 2.72 |
|                                | 20<br>SERIES | 1.54  | 1.67 | 1.80 | 1.93 | 2.05 | 2.17 | 2.28 | 2.40 | 2.62 | 2.84 |
|                                | 25<br>SERIES | 1.59  | 1.73 | 1.86 | 1.99 | 2.12 | 2.24 | 2.37 | 2.49 | 2.72 | 2.95 |

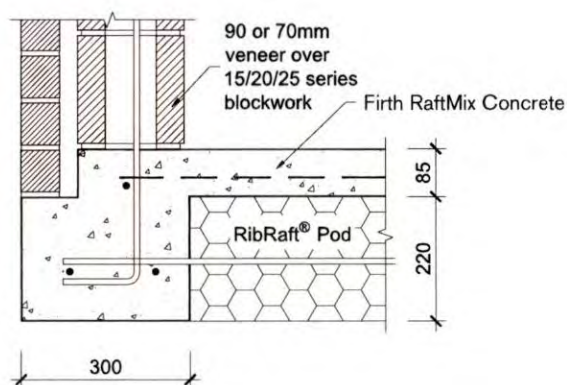


Figure 11  
RibRaft® R-Values  
For 70-90mm Thick  
Veneer, Cavity, And  
Various Thickness  
Masonry Walls

|                                | BLOCK        | FLOOR AREA TO PERIMETER RATIO M <sup>2</sup> /M |      |      |      |      |      |      |      |      |      |
|--------------------------------|--------------|---|------|------|------|------|------|------|------|------|------|
|                                |              | 1.25  | 1.50 | 1.75 | 2.00 | 2.25 | 2.0  | 2.75 | 3.0  | 3.5  | 4.00 |
| R-Value<br>m <sup>2</sup> °C/W | 15<br>SERIES | 1.59  | 1.73 | 1.86 | 1.99 | 2.12 | 2.24 | 2.37 | 2.49 | 2.72 | 2.95 |
|                                | 20<br>SERIES | 1.64  | 1.78 | 1.92 | 2.06 | 2.19 | 2.32 | 2.44 | 2.56 | 2.81 | 3.04 |
|                                | 25<br>SERIES | 1.69  | 1.83 | 1.98 | 2.11 | 2.25 | 2.38 | 2.51 | 2.64 | 2.88 | 3.12 |

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## 6.2 Shrinkage Control

Shrinkage control joints reduce the risk of unwanted cracks, and their placement needs to be carefully considered where uncontrolled cracking could be unacceptable. Two types are described here: saw cut joints (which are tied joints), and free joints.

### 6.2.1 Saw Cut Joints

Saw cuts are located at positions in which the concrete is likely to crack due to stresses induced by restrained shrinkage. The aim of providing them is for the concrete to crack at the bottom of the saw cut thus minimizing the potential for a visible crack wandering over the surface. The level of reinforcement provided in a RibRaft® mean that cracks have no structural implications being only an aesthetics issue. Factors to consider are the type of floor finish, the location of ribs and ground beams, underfloor heating, and the effect of piles restraining shrinkage.

Preference should be given to using early entry saws which are used immediately after finishing. Shrinkage control joints cut using diamond blades shall be cut as early as possible which is typically within 24 hours of hardening in summer, and 48 hours in winter. They shall be cut to a depth of 25mm. Shrinkage control joints do not guarantee elimination of all visible or unwanted cracks but should minimise number.

Joints shall be positioned to coincide with major changes in floor plan. Where concrete is to be exposed, for example in a garage, or brittle covering placed over, the maximum intermediate bay sizes shall be limited to 5m. Bay dimensions formed by shrinkage control joints shall be limited to a maximum ratio of length:width of 1.5:1. Shrinkage control joints shall be placed over 100mm wide internal ribs wherever possible. Where a shrinkage control joint runs along the line of a 300mm wide load bearing rib, then the joint shall be located directly above one edge of that rib.

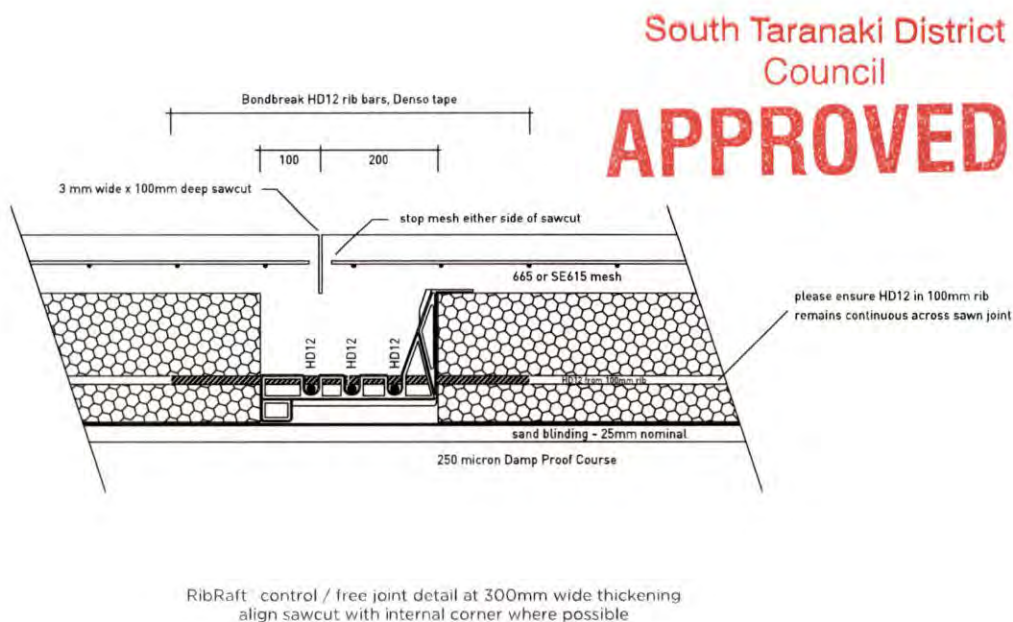
In order to limit the width of cracks at re-entrant, or internal corners, extra steel shall be placed on top of the mesh. These shall be 2-HD12 bars (Grade 500E), 1200mm long tied to the top of the mesh at 200mm centres, with 50mm cover to the internal corner – refer Figure 3.

### 6.2.2 Free Joints

Where the length of the floor exceeds 30m a free joint shall be provided as detailed in Figure 12. Movement, shrinkage and thermal, will occur over this joint so it shall be positioned to minimize the impact of this movement on floor coverings and wall elements.

Where the bottom of the RibRaft® is not flat (for example the floor incorporates a step down), free joints shall be provided if the distance from the step down to edge of slab exceeds 15m.

Figure 12  
Free Joint  
Details



### 6.3 Services Detailing

Two options exist for running services, both of which are appropriate, however some regional Building Control Authorities and Builders have clear preferences. The options being within slab, or under slab. Experience from the Christchurch earthquakes shows that the most seismically robust solution is for services to run within the plane of the pods (within slab).

#### 6.3.1 Within Slab Running of Services

Pipes services can be run within the plane of the pods either exiting out of the side of the perimeter ring beam or going underground at the edge beam. Pipes shall be laid at a fall to comply with NZBC G13/AS1. For pipe up to 65mm diameter the minimum gradient is typically 1 in 40, while for 100mm pipes it's 1 in 60, however greater falls may be required dependent upon the required number of discharge units. Table 5 provides distances from the edge of the slab to pipe surface penetration to achieve minimum pipe gradients. A 300mm pod alternative is often used where the proposed positioning of the service means minimum required gradients cannot be achieved. Where gradients cannot be achieved with a 300mm pod, then service will require to be run under the slab.

Pipes shall be located to pass perpendicular to the ribs and beams and shall not be laid along the length of ribs or beams. Pods are cut as required to achieve the required fall and position. Pipes shall be laid to ensure 15mm concrete cover between pipe and reinforcement in the perimeter beam. All pipes in contact with concrete shall be lagged with an impermeable material of at least 6mm thickness.

Table 5 Maximum Distance From Exterior To Entrance Point Of Plumbing Pipes

| PIPE DIAMETER (ID)MM | GRADIENT | MAXIMUM DISTANCE TO EDGE WITH 220MM THICK POD | MAXIMUM DISTANCE TO EDGE WITH 300MM THICK POD |
|----------------------|----------|---|---|
| 40                   | 1 in 40  | 3400  | 6600  |
| 50                   | 1 in 40  | 3000  | 6200  |
| 65                   | 1 in 40  | 2400  | 5600  |
| 100                  | 1 in 60  | 1200  | 4400  |

#### 6.3.2 Under Slab Running Of Services

For this option, services ducts shall be conveyed underground to their plan location then brought up through the polystyrene pod and the concrete floor slab, within the limitation imposed by Table 8. Services shall not be placed within any concrete except to cross that section of concrete i.e. services shall not run along ribs or edge beams. In accordance with AS/NZS3500.4:2015 pipes penetrating through concrete shall be:

- > Installed at right angles to the slab surface.
- > Lagged with an impermeable material for the full depth of the concrete penetration.
- > Lagging must be at least 6mm thick.

The maximum diameter of the services shall be as outlined in Table 6.

Any services crossing ribs or the edge beam horizontally shall be placed only within the middle third of the member. Except as noted in Figure 13, services crossing the ribs vertically shall also be constrained to the middle third of the width of the edge or internal load bearing rib. Except as noted in Figure 15 at no stage shall any of the reinforcement bars be relocated or cut to allow for the services (it is acceptable, however to cut the mesh). In some instances this will dictate the location of the ribs. The pods shall be cut to allow for this and if necessary, the spacing of the ribs shall be decreased locally. There shall be 600mm minimum clear spacing in each direction between penetrations through the system.

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Table 6 Maximum Diameter Of Pipe Services

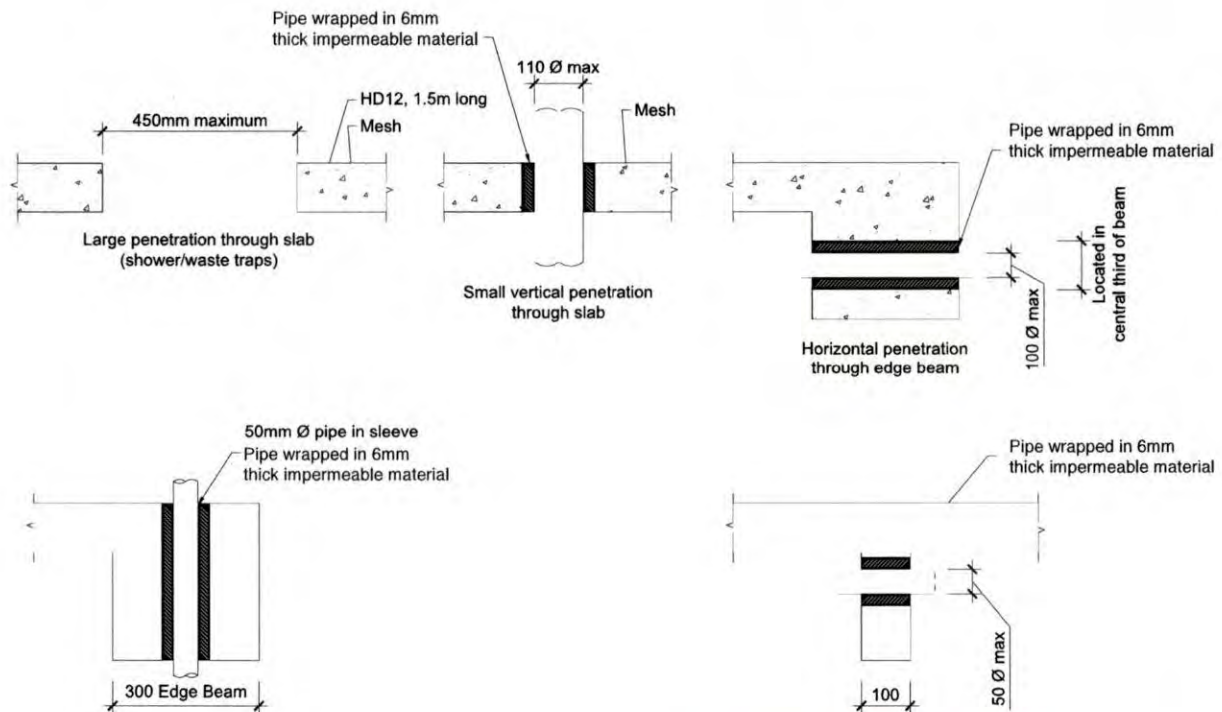
| ELEMENT                              | VERTICAL SERVICE   | HORIZONTAL SERVICE |
|--------------------------------------|--|--------------------|
| 300mm wide edge beam                 | 50mm nominal bore pipe   | 100mm NB pipe      |
| 500mm localized wide edge beam (1)   | 100mm NB pipe  | 100mm NB pipe      |
| 300mm wide internal load bearing rib | 50 NB pipe   | 100mm NB pipe      |
| 100mm wide internal rib              | Nil  | 100mm NB pipe      |
| Slab                                 | 100 NB pipe, or for large services<br>450mm square see also Note 3 | Nil                |

Notes:

- (1) For situations where a 100mm diameter pipe is required to pass vertically through the edge beam, the edge beam shall be locally increased in width to a minimum of 500mm wide. This shall be achieved by keeping flush the outside face of the edge beam and removing 200mm from the pod. The width shall remain at 500mm for a distance of 600mm beyond the service pipe. Refer to figure 14 for details for pipes passing vertically through edge beam and internal rib.
- (2) Where a gas pipe line runs through the RibRaft® floor system, in addition to the requirements above, the pipeline shall enter the building through the outside face of the perimeter foundation beam and be located in the plane of the pods. The aim being to ensure that damage to the gas pipe will most likely occur outside the building envelope should movement occur between the ground and RibRaft® in a large earthquake.
- (3) Larger penetrations or voids up to 450mm square (e.g. for shower waste/traps) are permitted through the slab provided all the conditions of this paragraph are met. These openings shall be trimmed with 1 HD12 (Grade 500E) bar 1500mm long placed along each side of the opening, tied to the mesh. One set of parallel bars shall be placed on top of the mesh and the other set placed under the mesh. These openings shall not be placed over a rib or edge beam. If necessary, the rib spacing shall be reduced or the pod layout altered to ensure that the opening occurs solely in the slab above a polystyrene pod. Penetrations such as these shall not be installed in garages or other areas where large (>3kN) point loads could be present. Only one penetration greater than 110mm is permitted in the slab above any single pod or part pod. Where two large openings are required to be in close proximity, an internal rib shall separate them. For these large penetrations/voids in the slab, the services shall not be within 25mm of the edges of the void through which they pass, and the opening shall be sealed to prevent materials entering the subfloor cavities. (This type of opening is normally only required for a shower waste/trap and the installation of the shower will ensure that the void is sealed/covered).

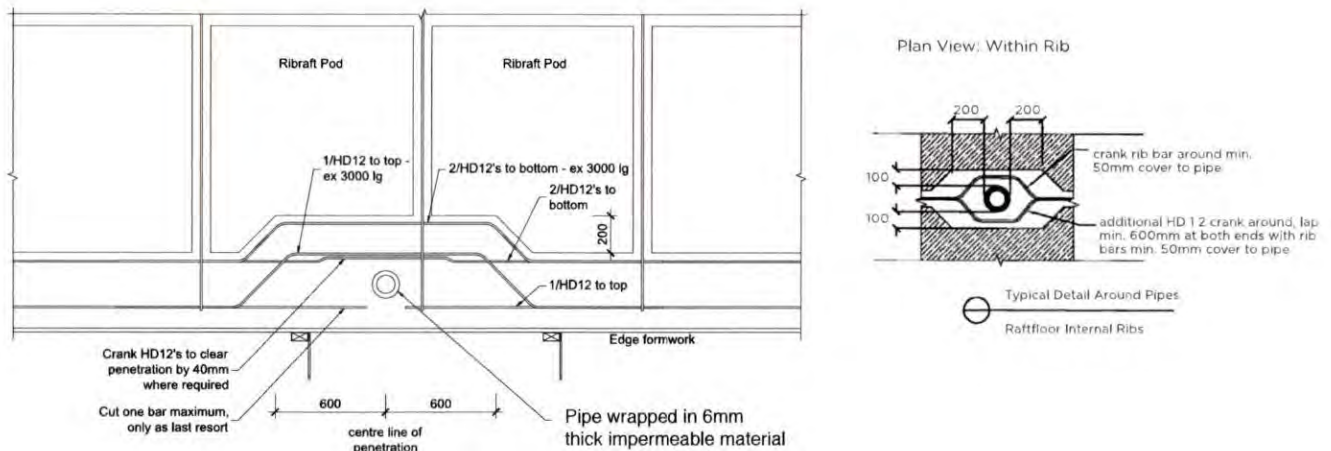
A pictorial of some of the above requirements is illustrated in Figure 13 and 14.

Figure 13 Example of Detailing Requirements For Services



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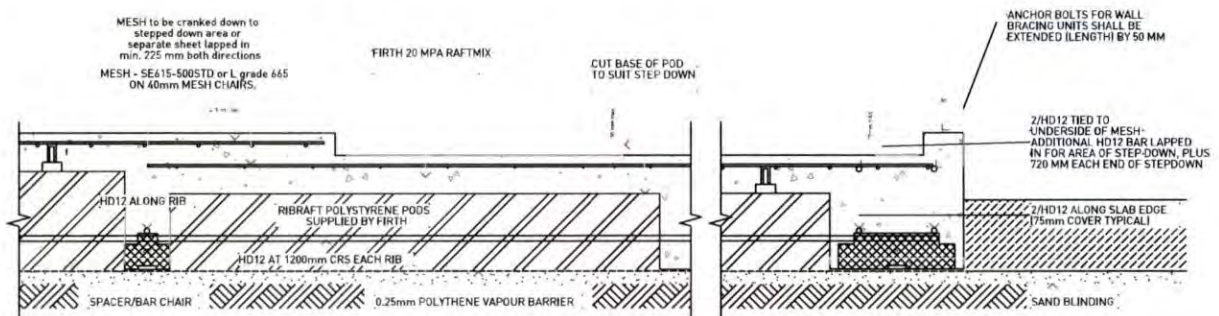
Figure 14  
Localised Increase In Width At Edge Beam Where Vertical Service Up To 100mm Diameter Are Required



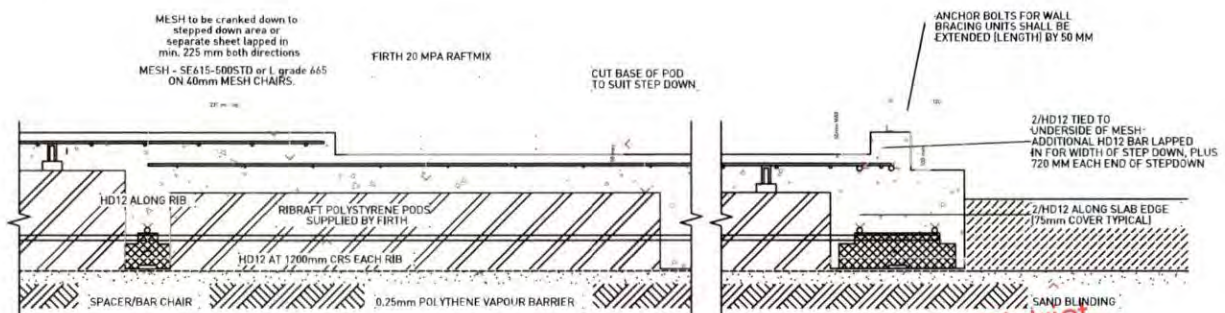
### 6.3.3 Recesses for Showers

Where showers are rebated up to 50mm into the RibRaft® concrete topping, the details specified shall be in accordance with Figure 15.

Figure 15 Details where recesses of up to 50mm are required for rebated showers



**RIB RAFT FLOOR - SET-DOWN DETAIL FOR MAX. 50mm REBATED SHOWER**

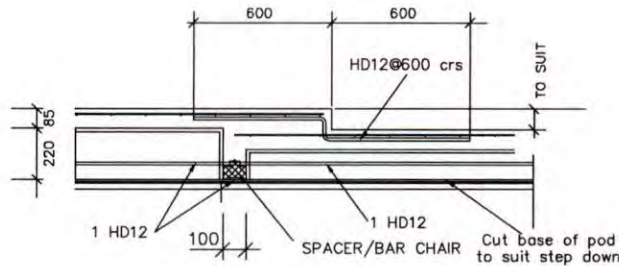


**RIB RAFT FLOOR - SET-DOWN DETAIL FOR MAX. 50mm REBATED SHOWER**

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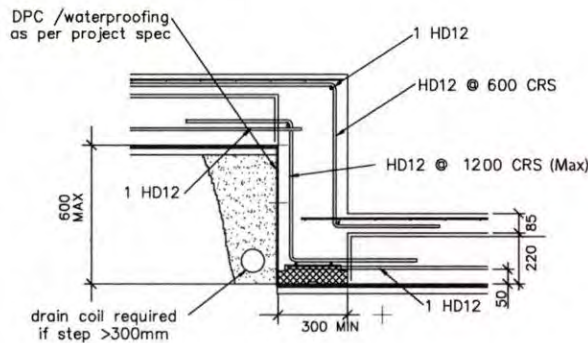


Figure 16 Details where step downs are required in the floor



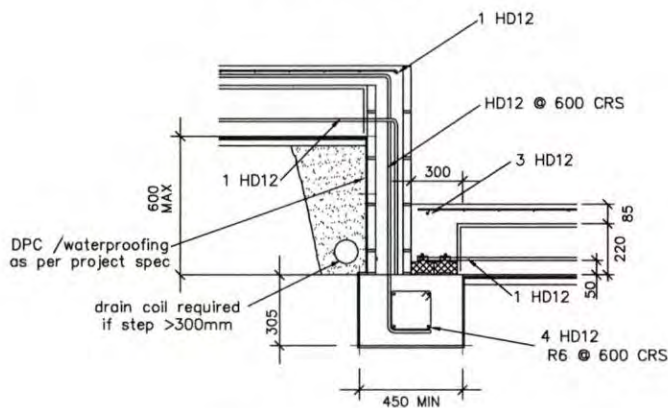
7  
S2  
SET-DOWN  
DETAIL FOR STEP  
UP TO 100mm

1: 20



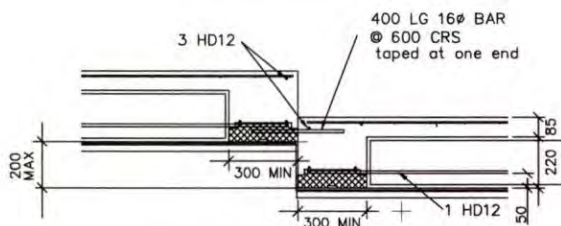
9  
S2  
SET-DOWN DETAIL  
IN CONCRETE  
FOR STEP LESS  
THAN 600mm

1: 20



8  
S2  
SET-DOWN DETAIL  
IN MASONRY  
FOR STEP LESS  
THAN 600mm

1: 20



10  
S2  
SET-DOWN  
DETAIL FOR STEP  
100 TO 200mm  
FOR SEPARATELY  
POURED SLABS

1: 20

### 6.3.4 Step Down Of Up To 600mm In The RibRaft® Floor

Where the site topography requires a step down in the slab, steps of up to 600mm can be accommodated using one of the details provided in Figure 16. A step down in the RibRaft® floor system anchors the floor in that location with respect to volume changes associated with drying shrinkage. As required by 6.2.2, a free joint shall be provided if the distance from the step down to the slab edge exceeds 15m.

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## SECTION: INSTALLATION INFORMATION

# 2

1.0 THIS SECTION DETAILS THE INSTALLATION INFORMATION REQUIRED FOR THE FIRTH RIBRAFT® FLOOR SYSTEM (THE SYSTEM). FULL INFORMATION ON THE DESIGN PROCEDURES NOT REQUIRING SPECIFIC ENGINEERING INPUT, AND REQUIREMENTS FOR THE SITE ASSESSMENT ARE DESCRIBED IN SECTION 1 OF THIS MANUAL (DESIGN INFORMATION). WHERE STANDARDS ARE REFERENCED IN THIS MANUAL THESE SHALL INCLUDE THE LATEST AMENDMENTS.



### 2.0 SITE REQUIREMENTS

#### 2.1 General

The site requirements of this Manual are concerned solely with the soil conditions under or immediately adjacent to the system. If a site does not comply with this Manual, the system shall be subject to specific engineering design.

This Section shall only apply for building sites such that:

- > The ground is as specified in Section 1 of this Manual;
- > Any system erected at the top of a slope (whether fill compacted in accordance with NZS4431, or natural ground) shall be located as shown in Figure 1 so that the finished ground is always outside the dashed line shown. (The vertical distance, V, shall be measured to 50mm below the underside of the slab).

Where the finished ground does not comply with Figure 1, the slope shall be retained by a specifically designed retaining wall.

#### 2.2 Temporary Excavations

No excavation shall take place at a location or in a manner where the stability of the foundation material is likely to be compromised. The backfilled material shall match the compaction and strength of, and have similar properties to, the surrounding material. The sides of the excavation shall be propped as necessary.

Temporary excavations shall be open for no longer than 48 hours and shall take place only above the critical depth line as shown on Figure 2. Should temporary excavations be required below this line, specific engineering design is required.

#### 2.3 Surface Water

Surface water from the site shall not flow across the slab platform. For example, on cut and fill sites the ground uphill from the system shall be graded to direct any surface run-off away from the system as shown in Figure 3.

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Figure 1  
Relationship  
Of RibRaft®  
To Sloping  
Ground Surface

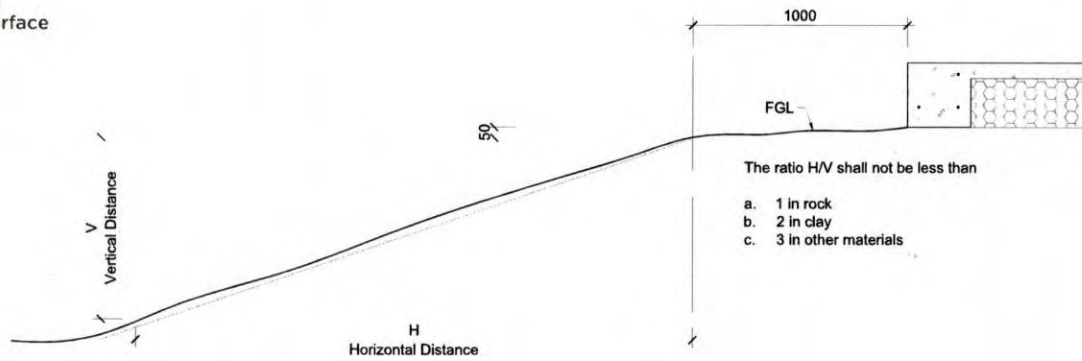


Figure 2  
Temporary  
Excavation  
Limited

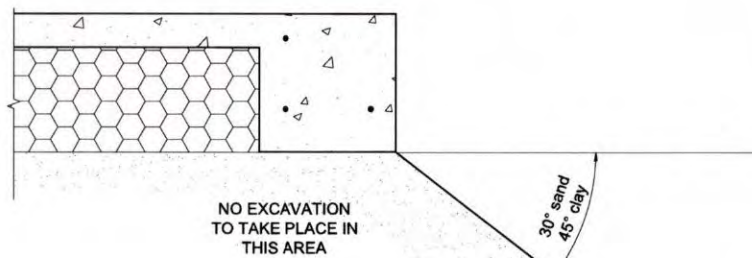
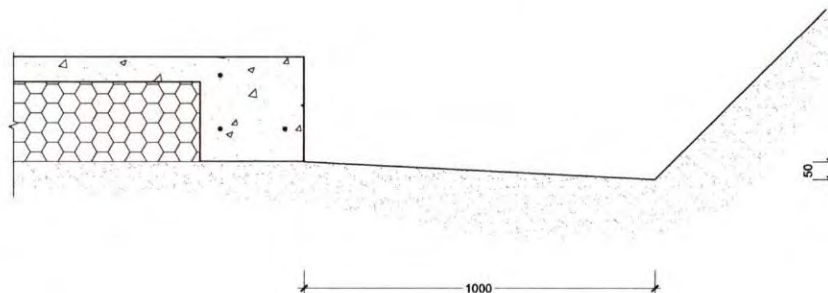


Figure 3  
Site Grading



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### 3.0 INSTALLATION PROCEDURE

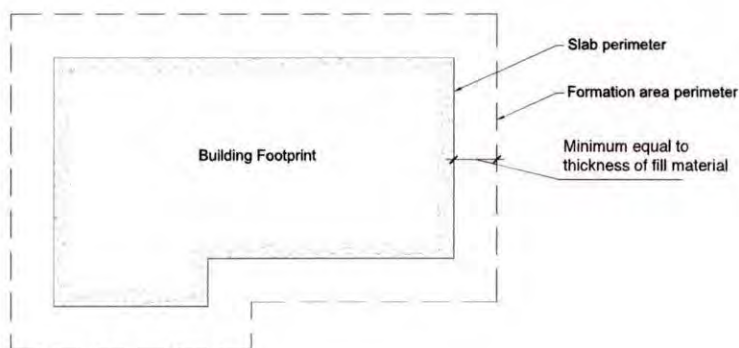
#### 3.1 Site Preparation

All vegetation, topsoil and other organic or deleterious material shall be removed from the area to be covered by the building (formation area) prior to commencing construction of the system.

#### 3.2 Earthworks

The formation area shall be cut or filled to a level approximately 330mm below finished floor level. Where fill is required to achieve this level, the fill shall be certified by a geotechnical engineer (outside the scope of this Manual) or shall be granular fill in accordance with Clause 7.5.3 of NZS 3604:2011 "Timber Framed Buildings". The formation area shall also extend a distance equal to the thickness of the fill material beyond the slab perimeter as shown in Figure 4. The installer shall confirm the acceptability of the ground over the entire building platform before proceeding with the construction. Refer to Clause 3.5 of Section 1 (Design Information) for requirements.

Figure 4 Plan of Formation Area



#### 3.3 Shear Keys

Where shear keys are required, the holes shall be drilled following the site clearing and earthworks, in accordance with Clause 4 in this section, and prior to the construction of the system commencing.

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#### 3.4 Plumbing and Services

Plumbing and services required beneath the system should preferably be conveyed underground to their plan location then brought up through the system.

The trenching, placing, and bedding of the pipes/ducts and the backfilling of the trenches shall conform to the requirements of the consent documentation. Services shall not run along ribs or edge beams. The maximum diameters of the services shall be as dictated in Clause 6.3 of Section 1.

Where required, the services can be installed by removing unnecessary polystyrene and placing pipes within the pod depth. All pipes shall be held firmly in place and have temporary end covers. Any services crossing ribs or the edge beam horizontally shall be placed only within the middle third of the member. Except as noted in Figure 14 (Section 1) services crossing the ribs vertically shall also be constrained to the middle third of the width of the edge or internal load bearing rib. Except as noted in Figure 13 (section 1) at no stage shall any of the reinforcement bars be relocated or cut to allow for the services (it is acceptable, however to cut the mesh). In some instances this will dictate the location of the ribs. The pods shall be cut to allow for this and if necessary, the spacing of the ribs shall be decreased locally. There shall be 600mm minimum clear spacing in each direction between penetrations through the system.

Where the services pass through the top of the pods, the opening shall be sealed to prevent materials entering the

subfloor cavities. (This can be achieved with Denso tape and a type of easily compressible foam.)

Larger penetrations or voids that are required, up to 450mm square (e.g. for shower waste/traps), shall be installed in accordance with all the conditions of this paragraph. These openings shall be trimmed with 1 HD12 bar (Grade 500E) 1500mm long placed along each side of the opening, tied to the mesh. One set of parallel bars shall be placed on top of the mesh and the other set placed under the mesh. These openings shall not be placed over a rib or edge beam. If necessary, the rib spacing shall be reduced or the pod layout altered to ensure that the opening occurs solely in the slab above a polystyrene pod. Penetrations such as these shall not be installed in garages or other areas where large (>3kN) point loads could be present. Only one penetration greater than 110mm is permitted in the slab above any single pod or part pod. Where two large openings are required to be in close proximity, an internal rib shall separate them. For these large penetrations/voids in the slab, the services shall not be within 25mm of the edges of the void through which they pass, and the opening shall be sealed to prevent materials entering the subfloor cavities. (This type of opening is normally only required for a shower waste/trap and the installation of the shower ensure that the void is sealed/covered).

Where a recess of up to 50mm is required in the topping to provide a rebate for a shower, the construction details shall be as shown in Figure 15 (Section 1).



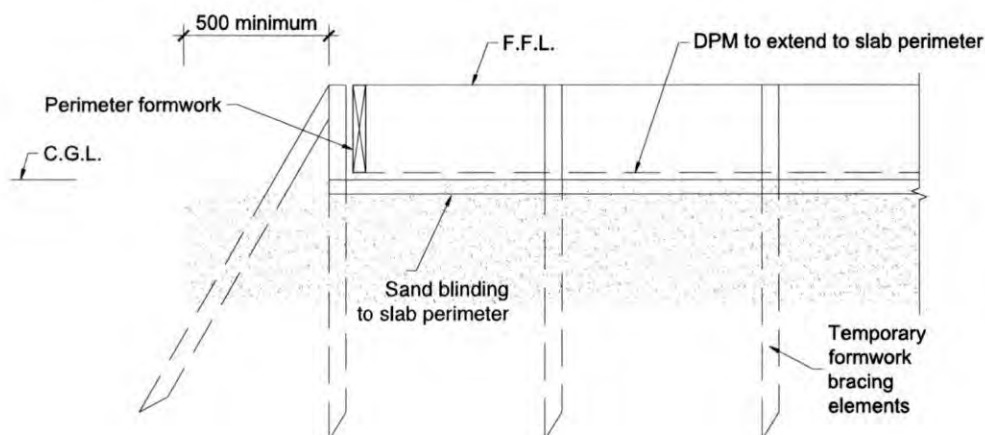
### 3.5 Sand Blinding

A layer of sand shall be placed, screeded and compacted over the building platform, extending to the outside edge of the perimeter foundation, refer Figure 5. The maximum thickness of this blinding layer shall be 50mm. The surface shall be level and a minimum of 305mm below finished floor level. A small plate compactor, vibrating roller or similar, should be used to compact the sand blinding layer. When the building platform is clay, it is essential that the blinding sand is compacted onto a clay surface that has not been softened by construction activities. If the clay has been softened (i.e. has a muddy surface layer due to construction activities), remove the softened material from under the RibRaft® ribs before placing the sand. If excavation lowers the clay surface to more than 50mm below the underside of the RibRaft®, fill shall be placed in accordance with Clause 7.5.3 of NZS 3604:2011 "Timber Framed Buildings". The sand is required to be level to ensure that pods remain stable throughout the installation of the system.

### 3.6 Damp Proof Membrane

The damp proof membrane (DPM) material shall be polyethylene sheet in accordance with NZS 3604:2011. The DPM shall be laid over the entire building platform directly on top of the sand blinding layer, extending to the outside of the edge beam – refer Figure 5 below. The joints shall be lapped not less than 150mm and sealed with pressure sensitive tape not less than 50mm wide. All penetrations of the DPM by plumbing and services or punctures during construction shall also be sealed with pressure sensitive tape. The DPM may extend beyond the edge of the slab i.e. underneath the formwork, or may be folded and stapled up the inside of the formwork. The minimum requirement is that the DPM extends to the outside of the edge beam. It is very important that the DPM is not bunched up at the formwork. The installer shall ensure a square and tidy finish at the underside and at all corners of the edge beam.

Figure 5 Sand blinding / DPM / Formwork Details



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### 3.7 Edge Formwork

The edge formwork shall be constructed ensuring that the requirements of NZS 3109:1997 "Concrete Construction" are adhered to. The formwork shall be adequately supported and braced to prevent any buckling or warping. If the wall is to be constructed in masonry veneer, formwork for a masonry veneer rebate should be adequately fixed to the perimeter formwork.

Thorough cleaning of re-useable formwork and the use of release agents enhances the life and performance of formwork and maintains a quality surface finish.

### 3.8 Laying the Pods and Spacers

The Firth RibRaft® polystyrene pods shall be laid out over the DPM in a regular waffle pattern ensuring direct contact with the ground across the entire pod. The edge beam shall be formed using the Firth approved 300mm spacers (refer Figure 9). These shall be placed at a maximum of 1200mm centres along the perimeter of the slab and one per pod or part pod. Ribs supporting a load bearing wall shall be formed using a minimum of one Firth approved 300mm spacer along the edge of each pod or part pod.

Except where a 300mm wide rib is required, each pod or part pod shall always be separated by 100mm using a minimum of one Firth approved 100mm spacer along each edge of each pod or part pod. The ribs in both directions shall form a waffle pattern throughout the slab. It is essential that the ribs and edge beams are straight when the concrete is poured, i.e. the pods need to be lined up. Figure 6 shows a detailed layout of the pods and spacers.

Figure 6  
Detailed layout  
of Pods and  
spacers (mesh  
and top steel omitted for clarity)

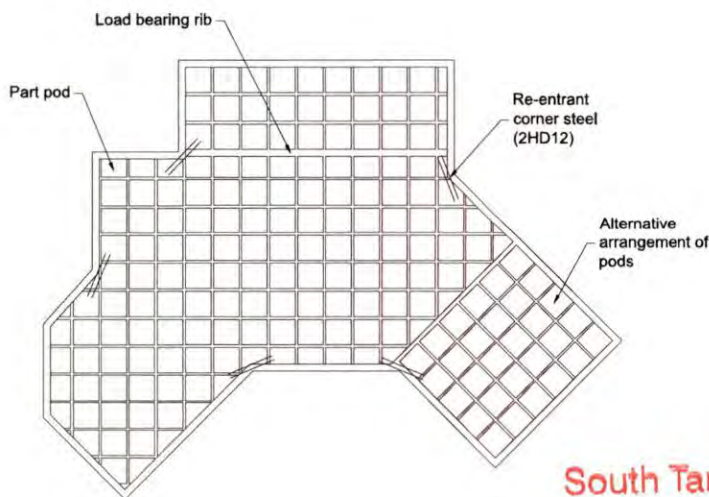
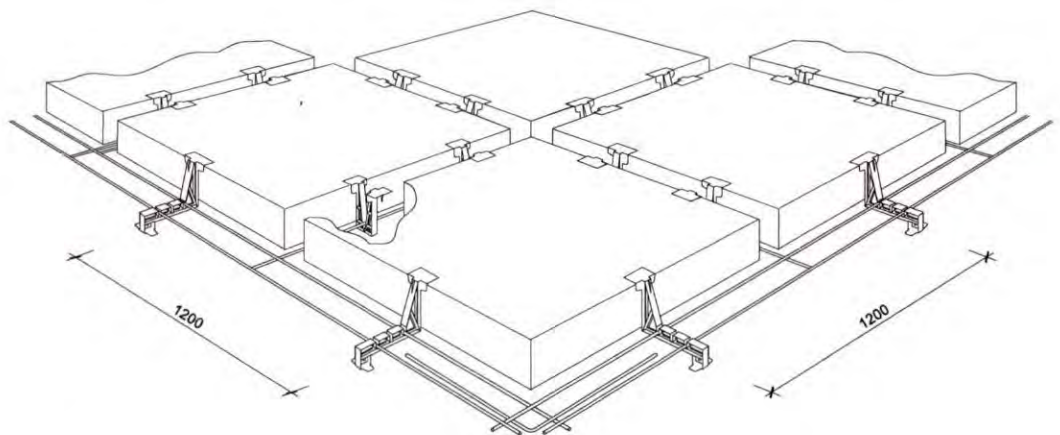


Figure 7 Typical Pod And Rib Layout

Where the shape of the house plan dictates, it may be more practical to consider the floor to be made up of different segments. The pods in each segment shall be in a regular waffle pattern – refer right hand side of Figure 7. Where these segments meet, the pods shall be cut to suit and the ribs made to join. The non right-angle rib junctions created by this approach are acceptable.

Alternatively, it is also acceptable to keep the orientation of the pods constant throughout the plan and have non right-angle junctions between the ribs and edge beam – refer left hand side of Figure 7.

As can be seen from Figure 7, it is not necessary for the pods to line up perfectly with the edge beam. It is acceptable to cut the pods (i.e. use part pods).

### 3.9 Reinforcing Steel

Reinforcing bars shall conform to NZS 4671:2001 "Steel Reinforcing Materials". All bars shall be of deformed type (Grade 500E). All bends shall be made cold without fracture and in accordance with the bend diameters given in NZS 3109 "Concrete Construction". Welded lap joints are not permitted.

Reinforcing steel in the slab shall consist of Welded Reinforcing Mesh complying with AS/NZS 4671:2001 with a minimum weight of 2.27kg/m, a lower characteristic stress of 500MPa, square configuration of orthogonal bars between 150 to 200mm centres, and ductility class L or E, hereafter referred to as "mesh". The presence of Class E reinforcing bars in the ribs and beams provides adequate ductility of the system which allow the use of class L mesh. Typically the topping mesh reinforcement will be 665 mesh (class L) or SE62 ductile mesh, each being equally applicable.

Figure 10 shows the detailed layout of the spacers and the steel in the edge beam and the standard ribs.

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### 3.9.1 Edge Beam Steel

Two edge beam reinforcing bars shall be placed in the bottom of the edge beam and supported in the correct position by the Firth spacers, as shown in Figure 10. One edge beam bar shall be tied below the mesh at the perimeter of the area covered by the polystyrene pods as shown in Figure 10.

All steel shall be lapped a minimum of 60 bar diameters (720mm for 12mm steel). Tying of the edge beam steel is only required at corners. Figure 8 shows the layout for the edge beam bottom steel bars at the corner. The inner bottom bars and the top bars shall cross each other and extend to 75mm from the outside face of the edge beam as shown. These bars shall be tied together where they cross. For solutions using veneer rebates the top bars shall terminate 50mm from the inside face of the rebate and be tied where they cross.

### 3.9.2 Rib Steel

Rib reinforcing steel shall be placed in the bottom of the internal ribs and supported in the correct position by the Firth or Wilton Joubert spacers (WJ). Figure 9 shows the detail of the Firth and WJ spacers, and Figure 10 shows a detailed section identifying how the steel is located in the spacers. The 300mm spacer shall be used for the 300mm wide internal ribs. These spacers ensure that cover to DPM below the base is greater than 45mm and cover to the exterior perimeter is 75mm.

All steel shall be lapped a minimum of 60 bar diameters (720mm for 12mm steel). At junctions with the edge beam, each rib steel bar shall sit on top of the edge beam bars, and extend to the outermost bar. The 75mm cover to the edge of the beam shall still be allowed for. One HD12 bar (Grade 500E) shall be placed in the bottom of each 300mm wide rib. For perimeter 300mm ribs a HD12 bar is also required in the top at the beam.

### 3.9.3 Mesh Reinforcing

Mesh reinforcing shall be placed over the pods and supported on 40mm mesh chairs spaced at a minimum of 1200mm centres, with at least two mesh chairs placed per pod and at least one per part pod. At laps the overlap of the outermost cross wires of the sheets shall be the spacing of the wires plus 50mm.

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### 3.9.4 Re-entrant Corner Steel

Two HD12 bars (Grade 500E), 1200mm long tied to the top of the mesh at 200mm centres, with 50mm cover to the internal corner as detailed in Figure 7 (this steel is to help reduce the width of cracks that may develop at this location)

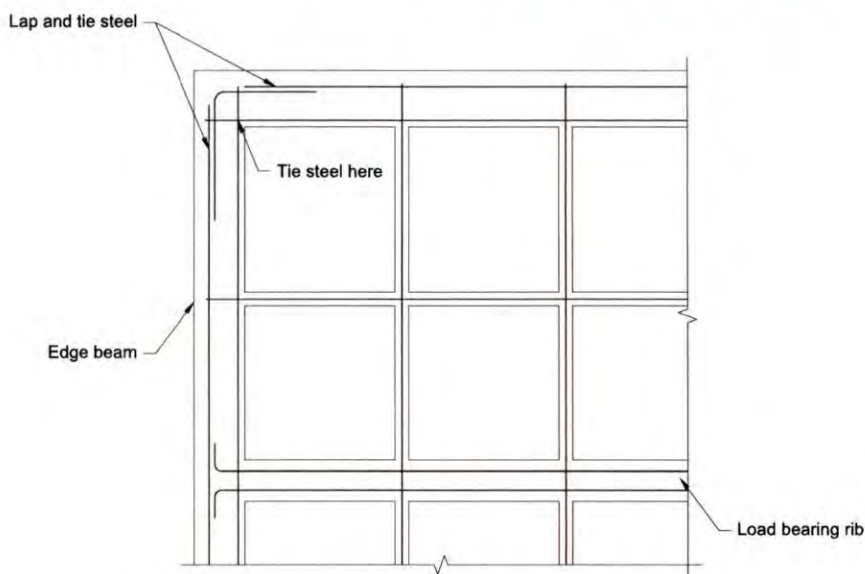


Figure 8 Corner steel layout

### 3.10 Concrete Installation

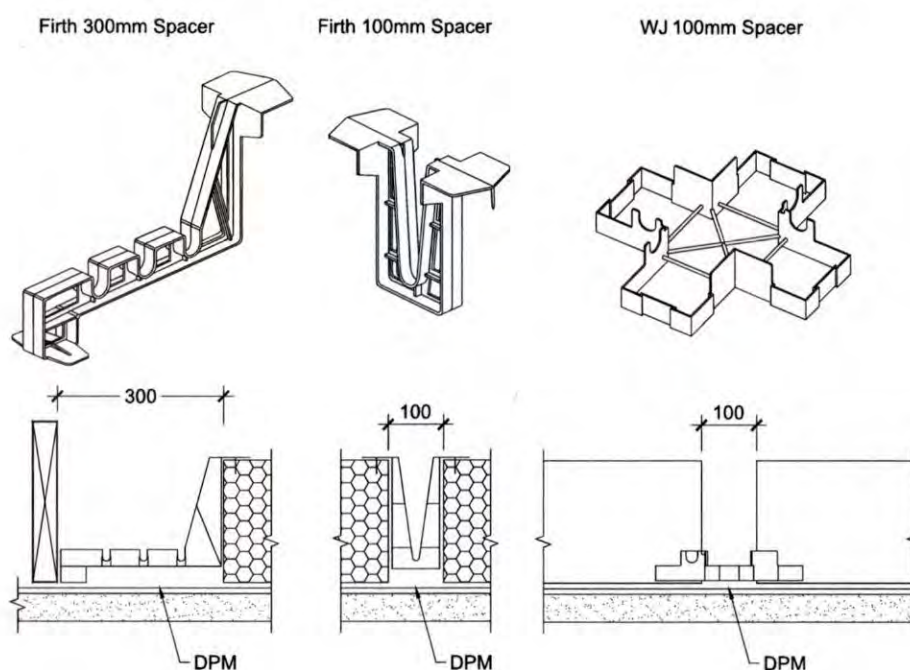
To comply with this manual, Firth Certified Concrete® must be used. Concrete placing, finishing and curing shall be in accordance with NZS 3109:1997, Clause 7.

#### 3.10.1 Placing

Only Raftmix or Raftmix25 concrete supplied by Firth Industries, shall be used in the floor. These two different concrete mixes shall be used in the following instances:

- > Raftmix – a 20MPa 100mm slump mix available as a pump mix suitable for 100mm pump lines available in either a 13mm or more usually a 19mm nominal aggregate size, or as a structural (non-pump) mix
- > Raftmix25 – a 25MPa 100mm slump mix available as a pump mix suitable for 100mm pump lines available in either a 13mm or more usually a 19mm nominal aggregate size, or as a structural (non-pump) mix. This mix shall be specified for buildings constructed in the 'sea spray zone' (i.e. within 500m of the sea including harbors, within 100m of tidal estuaries or inlets, on offshore islands and elsewhere defined as exposure Zone D in 4.2.3.3 of NZS3604).

Figure 9  
Spacer  
Details



The concrete supplied by Firth shall be poured in such a way to ensure that the pods remain in position during placing (Firth recommends that small amounts of concrete be placed on top of the pods prior to the ribs being filled). The concrete shall be compacted with the use of an immersion vibrator around all steel and into all corners of the formwork.

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### 3.10.2 Finishing

Screeding with the aid of a level shall commence immediately after compaction. Unless specifically installed as a screeding datum, the top of the formwork shall not be assumed as level and thus shall not be used for screeding purposes. Final finishing with a trowel shall take place after all the bleed water has evaporated. The edge of the slab and rebates shall be tooled to prevent chipping of the top of the slab.

Early age care of the slab shall be in accordance with good trade practice appropriate for the weather conditions – refer CCANZ website sections if further guidance is required:

[www.ccanz.org.nz/page/Early-Age-Crack-Control.aspx](http://www.ccanz.org.nz/page/Early-Age-Crack-Control.aspx)  
[www.ccanz.org.nz/page/Hot-and-Cold-Weather-Concreting.aspx](http://www.ccanz.org.nz/page/Hot-and-Cold-Weather-Concreting.aspx)

Early Age Crack Control  
Hot and Cold Weather Concreting

The surface shall be a blemish-free surface to class U3 finish (Refer NZS 3114:1987 "Specification for Concrete Finishes").

### 3.10.3 Curing

Proper curing of the concrete must take place immediately after finishing the concrete. One of the following methods of curing is recommended:

- > Ponding or continuous sprinkling of water.
- > Placing a wet covering or plastic membrane over the slab.
- > The use of liquid membrane curing compounds. However if these are used, they must be compatible with any subsequent applied surfacing.

### 3.11 Shrinkage Control Joints

Shrinkage control joints reduce the risk of unwanted cracks, and their placement needs to be carefully considered where uncontrolled cracking could be unacceptable. Two types are described here: saw cut joints (which are tied joints), and free joints.

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#### 3.11.1 Saw Cut Joints

Saw cuts are located at positions in which the concrete is likely to crack due to stresses induced by restrained shrinkage. The aim of providing them is for the concrete to crack at the bottom of the saw cut thus minimizing the potential for a visible crack wandering over the surface. The level of reinforcement provided in a RibRaft® mean that cracks have no structural implications being only an aesthetics issue. Factors to consider are the type of floor finish, the location of ribs and ground beams, underfloor heating and the effect of piles restraining shrinkage.

When warm sunny days are followed by cool nights, the change in temperature can cause cracking. Hence preference should be given to using early entry saws which are used immediately after finishing. Shrinkage control joints cut using diamond blades shall be cut as early as possible which is typically within 24 hours of hardening in summer, and 48 hours in winter. They shall be cut to a depth of 25mm. Shrinkage control joints do not guarantee to eliminate all visible or unwanted cracks.

Joints shall be positioned to coincide with major changes in floor plan. Where concrete is to be exposed, for example in a garage, or brittle covering placed over, the maximum intermediate bay sizes shall be limited to 5m. Bay dimensions formed by shrinkage control joints shall be limited to a maximum ratio of length:width of 1.5:1. Shrinkage control joints shall be placed over 100mm wide internal ribs wherever possible. Where a shrinkage control joint runs along the line of a 300mm wide load bearing rib, then the joint shall be located directly above one edge of that rib.

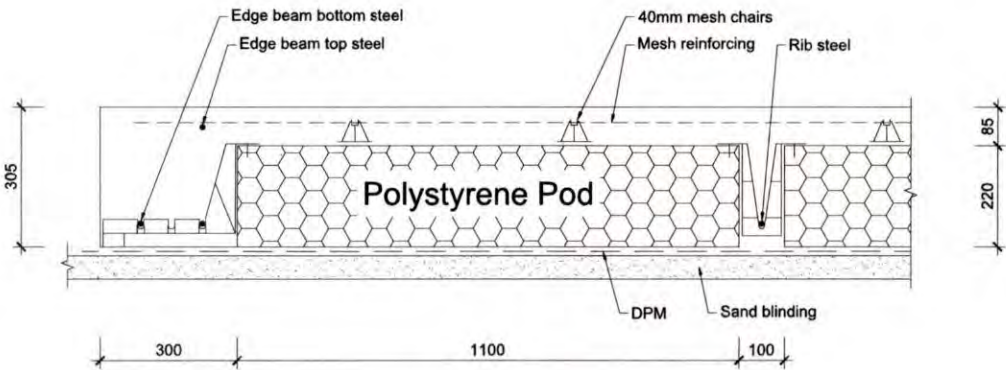
In order to limit the width of cracks at re-entrant, or internal corners, extra steel shall be placed on top of the mesh. These shall be 2-HD12 bars (grade 500E), 1200mm long tied to the top of the mesh at 200mm centres, with 50mm cover to the internal corner – refer Figure 7.

3.11.2 Free Joints

Where the length of the floor exceeds 30m a free joint shall be provided as detailed in Section 1, Figure 12. Movement, shrinkage and thermal, will occur over this joint so it shall be positioned to minimize the impact of this movement on floor coverings and wall elements.

Where the bottom of the RibRaft® is not flat (for example the floor incorporates a step down), free joints shall be provided if the distance from the step down to edge of slab exceeds 15m.

Figure 10 Detailed Section



3.12 Removal of Formwork

The formwork shall not be removed prior to 12 hours after the slab has been finished. No installation loads are to be placed on the system before adequate curing has taken place.

3.13 Masonry Veneer

Where the building is to be clad with masonry veneer, the rebate in the edge beam shall be waterproofed with a bituminous sealer due to the possibility of ponding of water. Firth recommends a Flintcote® or equivalent coating on both the vertical and horizontal faces of the rebate.

3.14 Landscaping/Paving

Landscaping and/or paving adjacent to the slab shall be kept as a minimum the specified distance below finished floor level as required by NZS 3604:2011. The landscaping shall allow for large trees to be kept sufficiently away from the edge of the slab. This is to prevent the tree roots from disturbing the soil moisture conditions under the slab. As a guide, trees should be as far away from the edge of the slab as they are tall when fully grown.

3.15 Ongoing Maintenance

The building owner shall ensure that the ground surrounding the system be maintained so that the integrity of the system is not jeopardised. In other words, at no time shall the ground immediately adjacent to the system be allowed to settle away to expose the underside of the slab.

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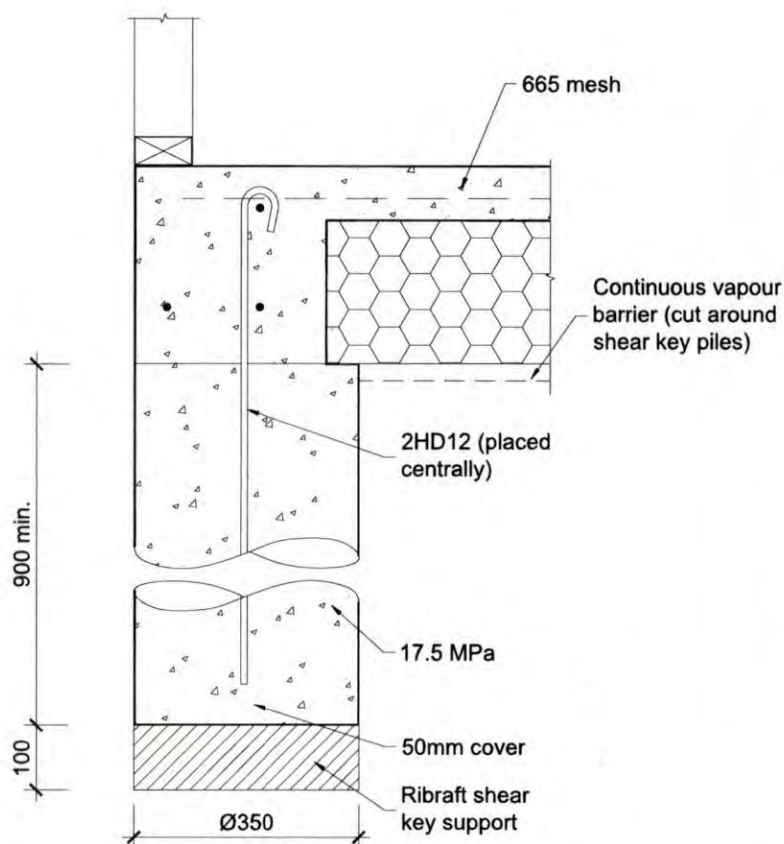


#### 4.0 SHEAR KEYS

Shear keys, if required, shall be provided to conform to the requirements of Section 1 of this Manual. Holes for the shear keys shall be drilled at least 1000mm deep. Into the bottom of each hole a RibRaft® Shear Key Support shall be placed. Every precaution shall be taken to ensure that the shear key support is laid level and at the base of the hole. The minimum depth of concrete placed on the support shall be 900mm. Refer to Figure 11 for construction details.

The connection steel (2HD12 Grade 500E) shall be secured in place and held during pouring to ensure the bars are correctly located. The concrete for the shear keys can be placed separately to the rest of the floor and shall be finished level to the top of the sand blinding layer, or poured in one pour with the RibRaft® floor. If poured separately the top surface of the shear key shall be finished rough to ensure a good join to the Firth Raftmix concrete in the system and the DPM shall be neatly cut around the shear keys.

Figure 11 Shear Pile Construction Detail



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SECTION: VERIFICATION

3

1.0 DESIGN

Verification that the design complies with the structural limitation outlined in this Manual is the responsibility of the designer, and shall be confirmed by the Building Control Authority issuing the Building Consent. Solutions outside the limitations outlined in this Manual will require specific engineering design.

2.0 CONSTRUCTION

The RibRaft® foundation system has been designed to accommodate structures complying with the non specific design standards NZS3604 or NZS4229. With these types of structures the Building Control Authority specifies the inspections required and often conducts these. A similar construction verification process shall be applied to the RibRaft® system.

To assist inspection the following check list has been prepared for structures complying with the limitation:

PRE-POUR INSPECTION CHECK LIST

GOOD GROUND CONFIRMED AS PER NZS3604, CLAUSE 3.1.3. OR SCALA OR SHEAR VANES TESTS CONFIRM ADEQUATE BEARING CAPACITY.

VEGETATION, TOPSOIL, ORGANIC OR DELETERIOUS MATERIAL REMOVED.

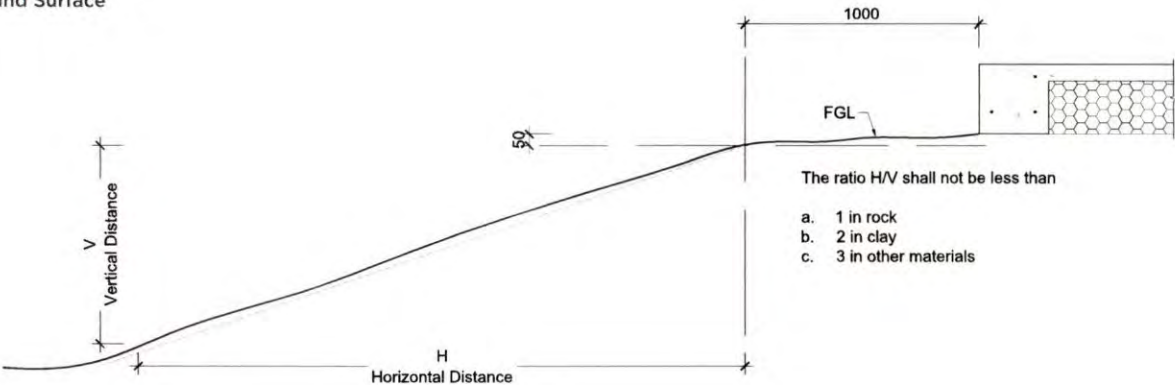
PROXIMITY TO SLOPE-GROUND SURFACE IS ALWAYS ABOVE DASH LINE SHOWN IN FIGURE 1.

SHEAR PILES (WHERE REQUIRED) IN PLACE AND REINFORCEMENT PROTRUDING.

FORMATION AREA EXTENDS AT LEAST THE DEPTH OF GRANULAR FILL BEYOND BUILDING FOOTPRINT.

STEPS IN THE FORMATION ARE DETAILED IN ACCORDANCE WITH THIS MANUAL.

Figure 1  
Relationship of  
RibRaft® To Sloping  
Ground Surface





## PRE-LAYOUT INSPECTION CHECK LIST: DAMP PROOF MEMBRANE IN PLACE

|                      |   |
|----------------------|---|
| PERIMETER FOUNDATION | WIDTH 300MM <sup>(1)</sup><br>REINFORCEMENT 2 X HD12 BOTTOM, 1 X HD12 TOP<br>FIRTH SUPPLIED SPACER USED AT 1.2M MAXIMUM CENTRES   |
| INTERNAL RIBS        | WIDTH 100MM<br>REINFORCEMENT 1 X HD12<br>FIRTH SUPPLIED SPACER, MAX SPACING OF ONE PER POD OR PART POD  |
| LOAD BEARING RIBS    | WIDTH 300MM<br>REINFORCEMENT 2 X HD12 BOTTOM<br>FIRTH SUPPLIED SPACER, MAX SPACING OF ONE PER POD OR PART POD   |
| PODS                 | FIRTH SUPPLIED RIBRAFT® POD   |
| MESH                 | 40MM CHAIRS, 1.2M MAX CENTRES, MIN TWO PER POD OR ONE PER PART POD<br>MESH IN PLACE AND 665 OR SE62<br>MESH LAPS OVERLAP OF OUTERMOST CROSSWIRE = MESH SPACING + 50MM   |
| REINFORCEMENT        | 2 X HD12 BARS 1.2M LONG PROVIDED AT RE-ENTRANT CORNERS<br>LAPS FOR 12MM REINFORCEMENT MINIMUM OF 720MM  |
| CONCRETE             | COVER TO PODS MINIMUM OF 85MM OR 110MM IF INFLOOR HEATING USED.<br>FIRTH RAFTMIX ORDERED  |
| SERVICE PENETRATIONS | NO REINFORCEMENT (WITH EXCEPTION OF MESH) CUT TO ALLOW PASSAGE<br>OF SERVICE PIPES. REFER CLAUSE 6.3 OF SECTION 1 FOR EXCEPTIONS<br>PIPES WRAPPED WITH MINIMUM 6MM THICKNESS OF IMPERMEABLE<br>COMPRESSIBLE MATERIAL WHERE IN CONTACT WITH CONCRETE<br>DIAMETER/SIZE OF PENETRATIONS AS PER TABLE 6, SECTION 1 OF THIS MANUAL |

(1) At locations of service penetrations the width of the perimeter foundation maybe locally increased. Refer Figure 14 Section 1 for details.

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## CONCRETE & MASONRY PRODUCTS: A SUSTAINABLE BUILDING OPTION & SOLUTION

- ✓ Environmentally compliant manufacturing plants
- ✓ Surplus water and some aggregates recycled
- ✓ Low transport impacts
- ✓ Leftover concrete returned from construction sites
- ✓ Passive solar heated thermal mass makes completed buildings more energy-efficient
- ✓ Most wash water returned from construction sites
- ✓ Highly durable, low maintenance buildings and no rot
- ✓ High degree of noise control
- ✓ Inherent fire resistance
- ✓ Overall longer effective building life
- ✓ Demolished concrete can be recycled as hard fill or aggregate

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**0800 FIRTH 1** (347841)  
**FIRTH.CO.NZ**



## **APPENDIX D - DESIGN STATEMENT PS1**

## PRODUCER STATEMENT – PS1 – DESIGN

(Guidance on use of Producer Statements (formerly page 2) is available at [www.engineeringnz.org](http://www.engineeringnz.org))

**ISSUED BY:** All Civil Engineering (ACE) Ltd  
(Design Firm)

**TO:** Hamish Scott  
(Owner/Developer)

**TO BE SUPPLIED TO:** South Taranaki District Council  
(Building Consent Authority)

**IN RESPECT OF:** Design of foundations and piles for relocatable house  
(Description of Building Work)

**AT:** 27 County Drive, Hawera  
(Address)

Town/City: Hawera (Address) **LOT** 42 **DP** 412125 **SO**

We have been engaged by the owner/developer referred to above to provide:  
Design of foundations and piles

(Extent of Engagement)

services in respect of the requirements of Clause(s) **B1** of the Building Code for:

☐ All or ☒ Part only (as specified in the attachment to this statement), of the proposed building work.

The design carried out by us has been prepared in accordance with:

☒ Compliance Documents issued by the Ministry of Business, Innovation & Employment **B1** or  
(verification method/acceptable solution)

☐ Alternative solution as per the attached schedule.

The proposed building work covered by this producer statement is described on the drawings titled:

Design of foundations and piles for relocatable house, 27 County Dr and numbered ACE Sheets 1 to 4  
together with the specification, and other documents set out in the schedule attached to this statement.

**On behalf of the Design Firm, and subject to:**

(i) Site verification of the following design assumptions: Ground conditions and embedment as specified in the design

(ii) All proprietary products meeting their performance specification requirements;

**I believe on reasonable grounds** that a) the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of the Building Code and that b), the persons who have undertaken the design have the necessary competency to do so. I also recommend the following level of construction monitoring/observation:

☐ CM1 ☒ CM2 ☐ CM3 ☐ CM4 ☐ CM5 (Engineering Categories) or ☐ as per agreement with owner/developer (Architectural)

I, Martin Donald Cockitt am: ☒ CPEng 173183 # ☐ Reg Arch #  
(Name of Design Professional)

I am a member of: ☒ Engineering New Zealand ☐ NZIA and hold the following qualifications: BEng, CEng, CPEng, IntPE

The Design Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than \$200,000\*.

The Design Firm is a member of ACENZ: ☐

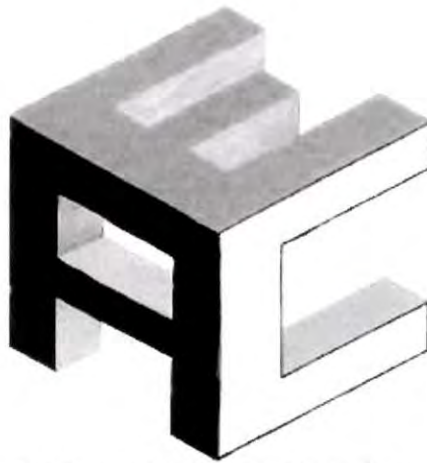
**SIGNED BY** Martin Donald Cockitt (Signature)  
(Name of Design Professional)

**ON BEHALF OF** All Civil Engineering (ACE) Ltd Date 14/9/20  
(Design Firm)

*Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of \$200,000\*.*

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.  
**THIS FORM AND ITS CONDITIONS ARE COPYRIGHT TO ACENZ, ENGINEERING NEW ZEALAND AND NZIA**





**ACE CONSULTANTS LTD**

# **Structural Calculations**

Pile Foundation and Garage Raft  
27 Country Drive, Hawera

Chk: MC  
Rev 0

South Taranaki District  
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# GRAVITY LOADING, IMPOSED LOADING (AS/NZS 1170.1:2002)

|               |        |   |      |
|---------------|--------|---|------|
| Building Size | Length | = | 18 m |
|               | Width  | = | 8 m  |

## ROOF

|                                 |         |             |
|---------------------------------|---------|-------------|
| Structure                       | =       | 0.17 kPa    |
| Services SDL (insulation incl.) | =       | 0.12 kPa    |
| Ceiling Lining                  | =       | 0.05 kPa    |
| Roof PL (Imposed)               | =       | 1.10 kN IL2 |
| Roof LL (Imposed)               | =       | 0.25 kPa    |
| lining description              | plywood |             |

Max DL  
Min DL

| G               | Q               |
|-----------------|-----------------|
| 0.17            |                 |
| 0.12            |                 |
| 0.05            |                 |
| 0.10            |                 |
|                 | 0.25            |
| <b>0.44 kPa</b> | <b>0.25 kPa</b> |
| 0.17 kPa        |                 |

## FLOOR

|                                   |   |                        |
|-----------------------------------|---|------------------------|
| Floor Live load                   | = | 2.00 kN/m <sup>2</sup> |
| Joist Loads                       | = | 45x240 Assumed         |
| Plywood                           | = | 0.20 kN/m <sup>2</sup> |
| Flooring                          | = | 0.15 kN/m <sup>2</sup> |
| Ceiling Lining (Insulation incl.) | = | 0.05 kN/m <sup>2</sup> |

| G               | Q               |
|-----------------|-----------------|
|                 | 0.05            |
|                 | 2.00 kPa        |
| 0.20            |                 |
| 0.15            |                 |
| 0.05            |                 |
| <b>0.45 kPa</b> | <b>2.00 kPa</b> |

## WALLS

|                   |   |          |
|-------------------|---|----------|
| Structure         | = | 0.10 kPa |
| Services          | = | 0.10 kPa |
| Extra Lining      | = | 0.05 kPa |
|                   | = |          |
| Wall LL (Imposed) | = | 0.25 kPa |

| G               | Q               |
|-----------------|-----------------|
| 0.10            |                 |
| 0.10            |                 |
| 0.05            |                 |
|                 | 0.25            |
| <b>0.25 kPa</b> | <b>0.25 kPa</b> |

# BUILDING SHELL WEIGHTS

## ROOF

| Item                      | Centres (m)     | Loading (kPa)  |
|---------------------------|-----------------|----------------|
| Roofing BMT and type      | 0.40 Corrugated | 0.04           |
| Building paper Type       | Standard        | 0.002          |
| Purlins type              | 360x45 @ 0.9    | 0.10 (assumed) |
| Portal Rafter Section     | 360x45 @ 9.00   | 0.01 (assumed) |
| Fixings (10% of total DL) |                 | 0.02           |
| SUM ROOF DL (kPa)         |                 | <b>0.17</b>    |

## WALL

|                        |                     |             |
|------------------------|---------------------|-------------|
| Wall Cladding          | 0.4 Plumdek Assumed | 0.04        |
| Building Paper         | Standard            | 0.002       |
| Girts                  | 140x45 @ 1.00       | 0.04        |
| Portal Leg section     | 90x45 @ 9.00        | 0.00        |
| Fixings (10% total DL) |                     | 0.01        |
| SUM WALL DL (kPa)      |                     | <b>0.09</b> |

## Applied Frame Loads

## FLOOR

|   |   |          |
|---|---|----------|
| G | = | 0.45 kPa |
| Q | = | 2.00 kPa |

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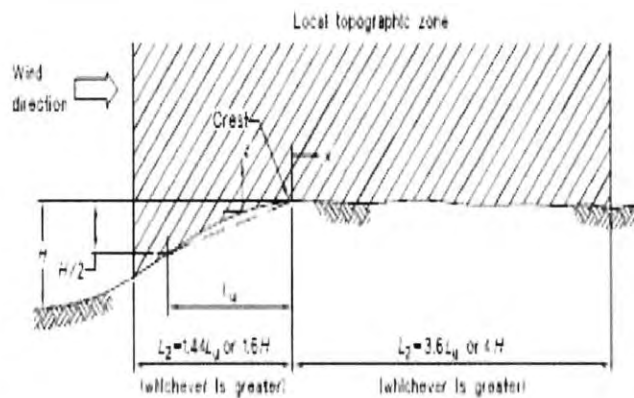
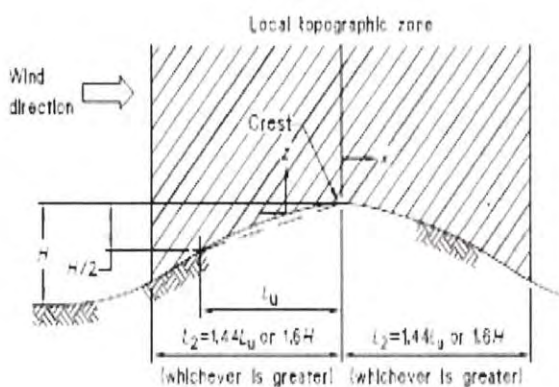


WIND LOADINGS: (AS/NZS 1170.2:2011)

STRUCTURE PARAMETERS

|                            |       |     |     |
|----------------------------|-------|-----|-----|
| Manual Wind Speed Override | High  |     |     |
|                            | 44.00 | m/s | ULS |
|                            | 37.30 | m/s | SLS |

Table 3.1



Check H and  $L_u$  in all directions, and use worst one for A.D.

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|                     |          |
|---------------------|----------|
| Max $p_{uls}$ =     | 1.16 kPa |
| $p_{sls}$ =         | 0.83 kPa |
| $p_{sls}/p_{uls}$ = | 71.9%    |

For design use Any Direction wind coefficients.  
Aerodynamic Shape Factor,  $C_{fig}$

Sect 5.3

| Cardinal Directions                                     | 1 (N) | 2 (E) | 3 (S) | 4 (W) |
|---|-------|-------|-------|-------|
| Or for AD   | 0°    | 90°   | 180°  | 270°  |
| Internal Pressures, $C_{fig} = C_{p,i} K_c$             |       |       |       |       |
| $C_{p,i}$   | 0     | -0.65 | -0.3  | -0.65 |
|   | 0.3   | 0     | 0     | 0     |
| External Pressures, $C_{fig} = C_{p,e} K_a K_c K_l K_p$ |       |       |       |       |
| Worst Cases given below                                 |       |       |       |       |
| Windward W, $C_{p,e}$                                   | 0.70  | 0.70  | 0.70  | 0.70  |
| Leeward L, $C_{p,e}$                                    | -0.3  | -0.38 | -0.3  | -0.38 |
| Side S, $C_l$   | -0.65 | -0.65 | -0.65 | -0.65 |
|   | -0.50 | -0.50 | -0.50 | -0.50 |
|   | -0.30 | -0.30 | -0.30 | -0.30 |
|   | -0.20 | -0.20 | -0.20 | -0.20 |

Table 5.1(A)&(B)

Eq 5.2(4)

$\alpha = 15^\circ$

Table 5.2(A)

(d/b= 0.625)

Table 5.2(B)

(b/d= 1.6)

Table 5.2(C)

$h = 4.60$  m

$h/d = 0.38 \quad 0.24 \quad 0.38 \quad 0.24$

Note:

Interpolated  
if need to be.

|                   |          |       |       |       |       |     |         |
|-------------------|----------|-------|-------|-------|-------|-----|---------|
| Roof R, $C_{p,e}$ | 0 - 0.5h | -0.90 | -0.40 | -0.90 | -0.40 | Max | (h/d=   |
|                   | 0.5 - 1h | -0.90 | -0.40 | -0.90 | -0.40 |     |         |
|                   | h - 2h   | -0.50 | 0.00  | -0.50 | 0.00  |     |         |
|                   | 2h - 3h  | -0.30 | 0.10  | -0.30 | 0.10  |     |         |
|                   | > 3h     | -0.20 | 0.20  | -0.20 | 0.20  | Min | 0.2396) |
| Roof U, $C_{p,e}$ | -0.61    |       | -0.61 |       |       | Max | (h/d=   |
|                   | -0.16    |       | -0.16 |       |       | Min | 0.3833) |
| Roof D, $C_{p,e}$ | -0.50    |       | -0.50 |       |       | Max | (h/d=   |
|                   | -0.50    |       | -0.50 |       |       | Min | 0.3833) |

Table 5.3(A) Gable Roof

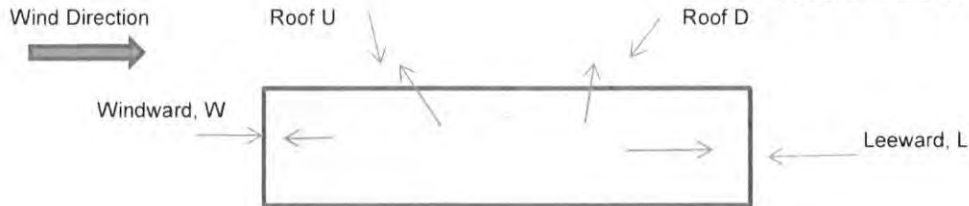
$\alpha > 10$  Table 5.3(B)

$\alpha > 10$  Table 5.3(B)



$$K_s K_c = 0.8$$

NOTE: INWARD LOADS POSITIVE



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Wind Across N / 0°

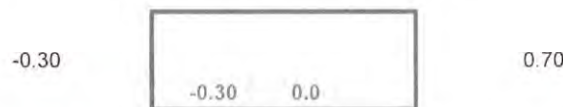
Sketching and Cfig values  
-0.61 -0.16 -0.50 -0.50



|   | Cpe-Cpi | p <sub>ULS</sub> | p <sub>SLS</sub> | K <sub>s</sub> K <sub>c</sub> | crs  | = | w <sub>ULS</sub> | w <sub>SLS</sub> |             |
|---|---------|------------------|------------------|-------------------------------|------|---|------------------|------------------|-------------|
| W | 0.70    | 1.16             | 0.83             | 0.8                           | 4.80 | = | 3.12 kN/m        | 2.24 kN/m        | Load Case 5 |
| U | -0.61   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -2.71 kN/m       | -1.94 kN/m       | Wacross1    |
| D | -0.50   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -2.23 kN/m       | -1.60 kN/m       |             |
| L | -0.30   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -1.34 kN/m       | -0.96 kN/m       |             |
| W | 0.70    | 1.16             | 0.83             | 0.8                           | 4.80 | = | 3.12 kN/m        | 2.24 kN/m        | Load Case 6 |
| U | -0.61   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -2.71 kN/m       | -1.94 kN/m       | Wacross2    |
| D | -0.50   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -2.23 kN/m       | -1.60 kN/m       |             |
| L | -0.30   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -1.34 kN/m       | -0.96 kN/m       |             |
| W | 0.70    | 1.16             | 0.83             | 0.8                           | 4.80 | = | 3.12 kN/m        | 2.24 kN/m        | Load Case 7 |
| U | -0.16   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -0.71 kN/m       | -0.51 kN/m       | Wacross3    |
| D | -0.50   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -2.23 kN/m       | -1.60 kN/m       |             |
| L | -0.30   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -1.34 kN/m       | -0.96 kN/m       |             |
| W | 0.70    | 1.16             | 0.83             | 0.8                           | 4.80 | = | 3.12 kN/m        | 2.24 kN/m        | Load Case 8 |
| U | -0.46   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -2.05 kN/m       | -1.47 kN/m       | Wacross4    |
| D | -0.50   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -2.23 kN/m       | -1.60 kN/m       |             |
| L | -0.60   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -2.68 kN/m       | -1.92 kN/m       |             |

Wind Across N / 180°

-0.50 -0.50 -0.61 -0.16



|   | Cpe-Cpi | p <sub>ULS</sub> | p <sub>SLS</sub> | K <sub>s</sub> K <sub>c</sub> | crs  | = | w <sub>ULS</sub> | w <sub>SLS</sub> |  |
|---|---------|------------------|------------------|-------------------------------|------|---|------------------|------------------|--|
| W | -0.30   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -1.34 kN/m       | -0.96 kN/m       |  |
| U | -0.20   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -0.89 kN/m       | -0.64 kN/m       |  |
| D | -0.31   | 1.16             | 0.83             | 0.8                           | 4.80 | = | -1.37 kN/m       | -0.98 kN/m       |  |
| L | 1.00    | 1.16             | 0.83             | 0.8                           | 4.80 | = | 4.46 kN/m        | 3.21 kN/m        |  |



|          |       |      |      |     |      |   |                   |                   |
|----------|-------|------|------|-----|------|---|-------------------|-------------------|
| <b>W</b> | -0.30 | 1.16 | 0.83 | 0.8 | 4.80 | = | <b>-1.34 kN/m</b> | <b>-0.96 kN/m</b> |
| <b>U</b> | -0.50 | 1.16 | 0.83 | 0.8 | 4.80 | = | <b>-2.23 kN/m</b> | <b>-1.60 kN/m</b> |
| <b>D</b> | -0.61 | 1.16 | 0.83 | 0.8 | 4.80 | = | <b>-2.71 kN/m</b> | <b>-1.94 kN/m</b> |
| <b>L</b> | 0.70  | 1.16 | 0.83 | 0.8 | 4.80 | = | <b>3.12 kN/m</b>  | <b>2.24 kN/m</b>  |
| <b>W</b> | 0.00  | 1.16 | 0.83 | 0.8 | 4.80 | = | <b>0.00 kN/m</b>  | <b>0.00 kN/m</b>  |
| <b>U</b> | -0.20 | 1.16 | 0.83 | 0.8 | 4.80 | = | <b>-0.89 kN/m</b> | <b>-0.64 kN/m</b> |
| <b>D</b> | 0.14  | 1.16 | 0.83 | 0.8 | 4.80 | = | <b>0.62 kN/m</b>  | <b>0.45 kN/m</b>  |
| <b>L</b> | 1.00  | 1.16 | 0.83 | 0.8 | 4.80 | = | <b>4.46 kN/m</b>  | <b>3.21 kN/m</b>  |
| <b>W</b> | -0.30 | 1.16 | 0.83 | 0.8 | 4.80 | = | <b>-1.34 kN/m</b> | <b>-0.96 kN/m</b> |
| <b>U</b> | -0.50 | 1.16 | 0.83 | 0.8 | 4.80 | = | <b>-2.23 kN/m</b> | <b>-1.60 kN/m</b> |
| <b>D</b> | -0.16 | 1.16 | 0.83 | 0.8 | 4.80 | = | <b>-0.71 kN/m</b> | <b>-0.51 kN/m</b> |
| <b>L</b> | 0.70  | 1.16 | 0.83 | 0.8 | 4.80 | = | <b>3.12 kN/m</b>  | <b>2.24 kN/m</b>  |

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## SEISMIC LOADING (AS/NZS 1170.5:2004)

### STRUCTURE PARAMETERS

Building Importance Level 2 Design Life 50 years  
Location New Plymouth (Hawera)

Elastic Site Hazard Spect  $C(T) = C_h Z R N(T, D)$

|                           | ULS                     | SLS               |                     |
|---------------------------|-------------------------|-------------------|---------------------|
| Period Estimate           | $T_1 = 0.4$ secs        | $T_1 = 0.40$ secs |                     |
| Ductility                 | $\mu = 1$               | $\mu = 1.00$      | Section 4.3.1       |
| Site Soil Class           | D Shallow Soil Site     |                   | Section 4.3.2       |
| Spectral Shape Factor     | $C_h(T_1) = 3.00$       | $C_h(T_1) = 3.00$ | Table 3.1           |
| Hazard Factor             | $Z = 0.18$ New Plymouth | $Z = 0.18$        | Table 3.3 & 3.4     |
| Return Period Factor      | $R_u = 1.00$ 1/500      | $R_s = 0.25$ 1/25 | Table 3.5 & NZBC B1 |
| Near-fault Factor         | $N(T, D) = 1.00$        | $N(T, D) = 1.00$  | Table 3.7 & 3.3     |
| Elastic Site Hazard Spect | $C(T_1) = 0.54$         | $C(T_1) = 0.14$   | Eq 3.1(1)           |

### Seismic Horizontal Design Action

$$C_d(T_1) = C(T_1) S_p / k_m$$

|                                     |                              |                              |                |
|-------------------------------------|------------------------------|------------------------------|----------------|
| Structural Performance factor       | $S_p = 1.00$<br>$k_m = 1.00$ | $S_p = 0.70$<br>$k_m = 1.00$ | Section 4.4.2  |
| Seismic Horizontal<br>Design Action | $C_d(T_1) = 0.540$ ULS       | $= 0.095$ SLS                | Section 5.2(1) |

SLS = 20% ULS

Structural Performance factor

$$\begin{aligned} S_p (\text{ULS}) &= 0.7 \text{ for } \mu \geq 2 \\ S_p (\text{ULS}) &= (1.3 - 0.3\mu) \text{ if } \mu \geq 1 \text{ and } < 2 \\ S_p (\text{SLS}) &= 0.7 \end{aligned}$$

For soil classes A, B, C and  $k_m = \mu$  for  $T \geq 0.7$ s

$$k_\mu = \frac{(\mu - 1) T_1}{0.7} + 1 \text{ for } T < 0.7 \text{s}$$

Section 5.2.1.1

For soil class E

$$\begin{aligned} k_\mu &= \mu \text{ for } T \geq 1 \text{s or } \mu < 1.5 \\ k_\mu &= (\mu - 1.5) T + 1.5 \text{ for } T < 1 \text{s and } \mu \geq 1.5 \end{aligned}$$

Wind Loads Will Govern As Light Weight structure

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## STRUCTURE LOADINGS

### Load Combination

#### Floor

|     |               |        |          |
|-----|---------------|--------|----------|
| ULS | $1.2G + 1.5Q$ | Wuls = | 3.84 kPa |
| SLS | $G + 0.7Q$    | Wsls=  | 2.1 kPa  |

#### Walls

|     |        |        |          |
|-----|--------|--------|----------|
| ULS | $1.2G$ | Wuls = | 0.3 kPa  |
| SLS | $G$    | Wsls=  | 0.25 kPa |

|          |              |        |          |
|----------|--------------|--------|----------|
| Wind ULS | $1.2G + W_u$ | Wwind= | 1.46 kPa |
| Wind SLS | $0.9G + W_u$ | Wwind= | 1.39 kPa |

### Floor Loads

|     |               |        |           |
|-----|---------------|--------|-----------|
| ULS | $1.2G + 1.5Q$ | Wuls = | 3.54 kN/m |
| SLS | $G + 0.7Q$    | Wsls=  | 1.85 kN/m |

|  |        |
|--|--------|
| Pile Spacing in transverse direction =   | 2.18 m |
| Pile Spacing in Longitudinal direction = | 3 m    |
| Number of Piles =                        | 28 Nos |

This is a relocation home and the existing floor bearers (45-140@450c/c) which can span 2.67m in transverse dir. (see attached calc sheet)

So the bearers are required along the longitudinal direction.

End blocking joist will be installed at the end of piles

Nogging will be installed between the floor joist at bearer beams.

### Load on floor Joist

|                               |            |     |
|-------------------------------|------------|-----|
| Spacing between Floor Joist = | 450 mm     |     |
| Udl load on Floor Joist =     | 1.728 KN/m | ULS |
| Udl load on Floor Joist =     | 0.945 KN/m | SLS |

### Piles and Sub Floor

Dia175 timber piles are proposed to be used for the Subfloor.

2x45x290 bearer beams for the mid row

1x45x290 bearer beams for the edge rows of piles.

4 rows of piles with 2.67mc/c in transverse direction and 3m c/c between each pile in longitudinal direction.

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Seismic Shear for piles

#### BUILDING GEOMETRY

|                       |   |      |                |  |
|-----------------------|---|------|----------------|--|
| Building Width        | = | 8.0  | m              |  |
| Building Lower Height | = | 3.00 | m              | (worst case)   |
| Building Upper Height | = | 3.60 | m              | (worst case)   |
| Area                  | = | 26.4 | m <sup>2</sup> | Calculated cross sectional area (standard shape) insert area if required |
| Wind area             | = | 26.4 | m <sup>2</sup> | Area transferring load to foundation via wind posts                      |

#### WIND LOADS ON BRACING

|                                       |   |        |                |  |
|---------------------------------------|---|--------|----------------|--|
| Base wind pressures                   | = | 1.46   | kPa ULS        |  |
|                                       | = | 1.39   | kPa SLS        |  |
| C <sub>fig</sub> (Windward + Leeward) | = | 1.1    | -              |  |
| k <sub>a</sub> k <sub>c</sub>         | = | 0.9    | -              |  |
| Direct Wind Load                      | = | 37.51  | kN             | base wind speed * half cross section area * C <sub>fig</sub> * k <sub>a</sub> * k <sub>c</sub> |
| Check for drag:                       | = | NA     |                |  |
| h                                     | = | 3.40   | m              |  |
| b                                     | = | 18.0   | m              |  |
| d                                     | = | 8.0    | m              |  |
| C <sub>f</sub> =                      | = | 0.02   |                | Corrugations across wind direction   |
| d/h =                                 | = | 2.35   | -              |  |
| d/b =                                 | = | 0.44   | -              |  |
| Affected Area                         | = | -138.9 | m <sup>2</sup> |  |
| Drag force                            | = | 0.00   | kN             |  |
| Wind along taken by braces            | = | 37.51  | kN             |  |

#### SEISMIC LOADS ON BRACING

|                                |   |       |                |  |
|--------------------------------|---|-------|----------------|--|
| Roof Area                      | = | 180.0 | m <sup>2</sup> |  |
| Roof Dead Weight               | = | 78.8  | kN             |  |
| Top Half Wall Area             | = | 78.0  | m <sup>2</sup> |  |
| Top Half Wall Weight           | = | 19.5  | kN             |  |
| Seismic Horizontal Load        | = | 53.06 | kN             | With horizontal coefficient of 0.206           |
| Number of piles provide        | = | 28.02 |                | Wind load Governs the Horizontal shear of pile |
| Horizontal Shear Load per pile | = | 1.339 | kN             |  |

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## Subfloor Bracing Demand

NZS 3603:1993

### Wind Bracing Demand

|                         |   |          |
|-------------------------|---|----------|
| Building Length         | = | 18 m     |
| Building Width          | = | 8 m      |
| Roof Height above Eave  | = | 0.8 m    |
| Wall height             | = | 2.4 m    |
| Subfloor Height         | = | 0.6 m    |
| Building Height to eave | = | 3.00 m   |
| Building Height         | = | 3.80 m   |
| ULS Wind Pressure       | = | 1.16 kPa |

|                                       |   |          |        |
|---------------------------------------|---|----------|--------|
| Wind Subfloor Bracing Demand - Along  | = | 37.51 kN | 750 BU |
| Wind Subfloor Bracing Demand - Across | = | 34.3 kN  | 685 BU |

### Earthquake Bracing Demand

|                       |   |        |        |
|-----------------------|---|--------|--------|
| Seismic Weight        | = | G      | Q      |
| Roof Load             | = | 79 kN  |        |
| Wall Load (External)  | = | 39 kN  |        |
| Wall Load (Internal)  | = | 20 kN  |        |
| Floor Load + Subfloor | = | 65 kN  | 134 kN |
|                       |   | 202 kN |        |

$$W = G + 0.3Q = 242 \text{ kN}$$

|                            |   |        |         |
|----------------------------|---|--------|---------|
| Seismic Coefficient        | = | 0.54   |         |
| Subfloor EQ Bracing Demand | = | 131 kN | 2616 BU |

|                        |   |        |
|------------------------|---|--------|
| Subfloor Height        | = | 0.6 m  |
| Floor Thickness        | = | 0.02 m |
| Floor Joist Depth      | = | 0.14 m |
| Bearer Depth           | = | 0.14 m |
| Pile Cantilever Height | = | 0.5 m  |

For 0.5 m cantilever height, driven pile bracing capacity = 160 BU Max (Wind)  
95 BU (EQ)

#### Along BU Check

| Pile along     |             | NO | Min BU Req. | Wind Rating | EQ Rating | Wind BU Provided | EQ BU Provided |
|----------------|-------------|----|-------------|-------------|-----------|------------------|----------------|
| Line 1         | Driven pile | 7  | 188         | 160         | 95        | 1120             | 665            |
| Line 2         | Driven pile | 7  | 188         | 160         | 95        | 1120             | 665            |
| Line 3         | Driven pile | 7  | 188         | 160         | 95        | 1120             | 665            |
| Line 4         | Driven pile | 7  | 188         | 160         | 95        | 1120             | 665            |
| Total provided |             |    |             |             |           | 4480             | 2660           |
| Required       |             |    |             |             |           | 750              | 2616           |
| Check          |             |    |             |             |           | OK               | OK             |

#### Across BU Check

| Pile Across    |             | No | Min BU Req. | Wind Rating | EQ Rating | Wind BU Provided | EQ BU Provided |
|----------------|-------------|----|-------------|-------------|-----------|------------------|----------------|
| Line A         | Driven pile | 4  | 114.1899    | 160         | 95        | 640              | 380            |
| Line B         | Driven pile | 4  | 114.1899    | 160         | 95        | 640              | 380            |
| Line C         | Driven pile | 4  | 114.1899    | 160         | 95        | 640              | 380            |
| Line D         | Driven pile | 4  | 114.1899    | 160         | 95        | 640              | 380            |
| Line E         | Driven pile | 4  | 114.1899    | 160         | 95        | 640              | 380            |
| Line F         | Driven pile | 4  | 114.1899    | 160         | 95        | 640              | 380            |
| Line G         | Driven pile | 4  | 114.1899    | 160         | 95        | 640              | 380            |
| Total provided |             |    |             |             |           | 4480             | 2660           |
| Required       |             |    |             |             |           | 685              | 2616           |
| Check          |             |    |             |             |           | OK               | OK             |

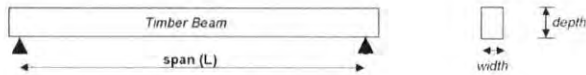
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## Pile Head Bearer Beam

NZS 3603:1993



Number of Beams = 2 Mid Span  
1 End Span

Beam Size = 45 x 290 mm

Z = 630750 mm<sup>3</sup>

Span of Beam (L) = 3.00 m  
Effective Span (L<sub>eff</sub>) = 3.00 m  
W<sub>uls</sub> = 1.77 kN/m  
W<sub>sls</sub> = 4.03 kN/m  
W<sub>wind</sub> = 3.02 kN/m  
Bending Moment (M\*) = 8.68 kNm (ULS)  
Bending Moment (M\*) = 3.40 kNm (wind)  
Shear Force (V\*) = 11.58 kN (ULS)

Loaded Form UDL

Centre Span Loading  
8.68 kNm (ULS)  
3.4 kNm (wind)  
11.58 kN (SLS)

End Span Loadings  
4.34 kNm (ULS)  
1.7 kNm (wind)  
5.79 kN (SLS)

Load Duration

Permanent  
Permanent

k<sub>1</sub> = 0.6  
k<sub>1</sub> = 0.6

ULS  
Wind

Table 2.4

Timber Grade

SG8  
dry

Bending strength f<sub>b</sub> = 14 MPa  
Compressive Strength f<sub>c</sub> = 18 MPa  
Tension Strength f<sub>t</sub> = 6 MPa  
Stress in Shear f<sub>v</sub> = 3 MPa  
Modulus of Elasticity E = 8000 MPa  
Lower Bound Mod of E E<sub>low</sub> = 5600 MPa  
F = 0.8

Number of Parallel Supports

2

k<sub>4</sub> = 1.14

Table 2.7

Assume no Grid system

k<sub>5</sub> = 1

Cl 2.9.2

max of

$$S = 1.35 \times \frac{(L_{eff} \times (d/b)^2 \cdot 1)^{0.5}}{b} = 0.9$$

$$\text{or } 3 \times d/b = 19.33$$

Yes

k<sub>6</sub> = 1.00

Beam fully restrained on tension face only

Cl 3.2.5.2

Table 2.8

### BENDING CAPACITY (ULS)

$$M_n = k_1 k_4 k_5 k_6 f_b Z = 6.04 \text{ kNm}$$

Cl 3.2.4

Mid Span

FM<sub>n</sub> = 9.66 kNm

O.K.

End Span

FM<sub>n</sub> = 4.83 kNm

O.K.

### BENDING CAPACITY (wind)

$$M_n = k_1 k_4 k_5 k_6 f_b Z = 6.04 \text{ kNm}$$

Cl 3.2.4

Mid Span

FM<sub>n</sub> = 13.77 kNm

O.K.

End Span

FM<sub>n</sub> = 6.89 kNm

O.K.

### SHEAR CAPACITY

$$V_n = k_1 k_4 k_5 f_v A_v = 17.85 \text{ kN}$$

$$A_v = (2bd)/3 = 8700 \text{ mm}^2$$

Cl 3.2.3.1

FV<sub>n</sub> = 28.56 kN

O.K.

### DEFLECTION

(Beam is supported by Purlins so effective span will be reduced)

Flexural deflection = 2.0 mm  
Shear Deflection = 0.3 mm

d<sub>2</sub> = 2

Table 2.5

NZ Timber Design Guide 2001

Total Deflection = 1.1 mm

Deflection = 1  
Span = 2658

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# Pile Carrying Lateral and Vertical Loads (Abutment 1)

1. Piles carrying vertical and horizontal loads.
2. The length of the pile to a soil depth fo+gc is considered to resist of the horizontal loads and the remainder is considered to carry the vertical loads.



## Soil Properties

Undrained shear strength su 35 kPa Assumed Lateral resistance reduction factor Ø 0.85

## Applied Loads

Horizontal Load H\* = 1.3386 kN Max Vertical Load N\* = 23 kN  
Vertical Load N\* (under H\*) = 23.152 kN

## Horizontal Pile Capacity

### Pile Dimensions

Diameter of the embedded part of the pile shaft D = 0.175 m  
Length of the pile shaft L = 4 m  
Above ground dist. at which H\* is applied e = 0.6 m  
Pile shaft assumed to be unsupported in cohesive soil eo = 0.2 m ≥ 0.6m  
Centre to centre spacing between embedded piles 3 m no interaction between piles, isolated pile case

## Ultimate Lateral Capacity for Isolated and Continuous Piles

Horizontal Load H\* = 1.3386 kN H\* = 1.3386166 kN

Ø Hu = Ø.9.su.D.[√((L+2e+eo)<sup>2</sup> + (L-eo)<sup>2</sup>) - (L+2e+eo)] Ø Hu = 56.4 kN (for isolated piles)

Ø Hu = Ø.2.su.D.[√((L+2e+eo)<sup>2</sup> + (L-eo)<sup>2</sup>) - (L+2e+eo)] Ø Hu = 12.5 kN (for continuous piles)

## Spacing factor

Spacing factor SF =  $\frac{\text{centre to centre pile spacing} - D}{3 \times D}$  = 1.00

## Ultimate Lateral Capacity of Spaced Piles

Ø Hu spaced = Ø Hu continuous + spacing factor(Ø Hu isolated - Ø Hu continuous) = 56.369 kN  
Total pile length = 4.20 m

## Pile Bending

Dist. from good ground to maximum pile shaft moment gc =  $\frac{H^*}{\text{Ø} \cdot [2 + SF(9-2)] \cdot su \cdot D} + eo = 0.23 \text{ m}$  Maximum Pile Shaft Moment  
Mmax =  $\frac{H^* \cdot (e + eo + (gc - eo))}{2} = 1.1 \text{ kN-m}$

## Vertical Pile Capacity

Vertical load N\* = 23.152 kN (ultimate limit state) N\* = 23.1516 kN

V\* ≤ Ø(Vsu + Vbu) - 1.2W Where Vsu = pile shaft resistance Vbu = pile base resistance W = pile selfweight Ø = 0.5

## Pile Dimensions

Pile diameter 0.175 m Soil Properties  
Pile length carrying vertical load 3.77 m Soil undrained shear strength su = 35 kPa  
Timber unit weight 16 kN/m<sup>3</sup> Adhesion factor α = 0.25

## Pile Shaft Resistance

Vsu = C.ca C = pile shaft area into rock socket ca = rock socket adhesion Vsu = 41.23 kN  
= 0.27 m<sup>2</sup> = 150 kPa  
Lr = Rock Socket  
= 1.5 m

## Pile Base Resistance

Vbu = su.pile base area su = pile end bearing capacity area = Pile base area Vbu = 0.84 kN  
su = 35 kPa area = 0.0240528 m<sup>2</sup>

## Pile Self Weight + weight of Abutment

W = pile volume.concrete unit weight pile volume = 0.10 m<sup>3</sup> W = 1.54 kN  
Ø1 = ULS Strength reduction Factor  
= 0.5 Ø(Vsu + Vbu) - 1.2W = 464.10 kN  
Ø1 = Skin Friction in Conjunction with End Bearing  
= 0.85

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# HILEY FORMULA FOR DETERMINING PILE SET

## Pile

### Standards Used

There are no applicable standards, this is an alternative solution in terms of the building code.

### Assumptions

Soil types are assumed with parameters taken from standard tables.

A factor of safety of 4 is used unless pile load tests have been undertaken and this can be reduced to 3.

### Description

The sheet calculates the pile set for a maximum pile load and specifies the parameters for the testing.

The achieved set is the average set recorded for 10 drops of the hammer over the specified fall.

|  |        |     |           |           |
|--|--------|-----|-----------|-----------|
| Critical Pile Set Design Load =            | 17.36  | kN  | SLS Load  |           |
| Pile Size =                                | 175.00 | Dia |           |           |
| Pile length =                              | 4.00   | m   | Pile wt = | 461.81 kg |
| Weight of pile, anvil, helmet and follower | 486.8  | kg  |           |           |

### Pile Sets

Hiley Pile Driving Formula; 
$$R = \frac{W \cdot h \cdot \eta}{S + C/2}$$
 Phi= 0.5  
R= 46.3

Where, PhiR = 23.15 kN, ultimate driving resistance

W = 500 kg, weight of the hammer = 4.9 kN

h = 1000 mm, free-fall height of hammer. Hammer type = Winch operated hammer

Trigger drop hammer 1 0.8

Winch operated hammer 0.8

Single acting hammer 0.9

= 800 mm, allowing for hammer free fall efficiency

Soil is assumed to be medium driving ;

$$C = C_c + C_p + C_q; \quad C_c = 1 \text{ mm, elastic compression of pile head or dolly}$$
$$C_p = 4 \times 10^{-4} \text{ mm/mm, elastic compression of the pile itself}$$
$$C_q = 4 \text{ mm, quake of the ground beneath the pile}$$

C = 6.60 mm

n = 0.59 , efficiency of blow

Factor of Safety = 3

S = 32 mm, final set or penetration per blow (mean of 10 blows)

### Adopt -

A final set of 32 mm per blow (mean of 10 blows) using a 500kg hammer with a drop of 1000mm

Minimum embedment depth 4m

If driven pile fails to reach required pile set, inform design engineer immediately.

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## Garage Slab and Footing

|                           |   |           |     |
|---------------------------|---|-----------|-----|
| Wall loading              | = | 3.5 kN/m  | ULS |
|                           | = | 1.85 kN/m | SLS |
| Wall frame width          | = | 150 mm    |     |
| Pressure under wall frame | = | 24 kPa    |     |

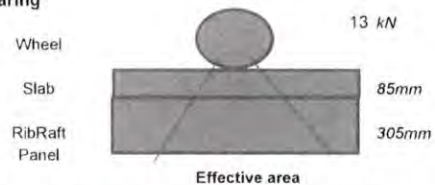
Ok for ground Bearing

### Garage Slab Size

|         |   |       |              |       |
|---------|---|-------|--------------|-------|
| Length  | = | 8 m   | Width=       | 4.5 m |
| Loading | = | 13 kN | (Point Load) |       |

|                      |   |            |              |  |
|----------------------|---|------------|--------------|--|
| Wheel Size           | = | 200x500 mm | Contact Area |  |
| Pressure under wheel | = | 22 kPa     |              |  |

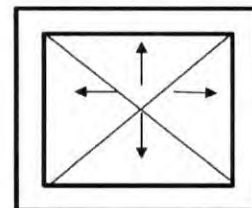
OK for Ground Bearing



Using the Rib Raft footing supported on timber piles as the ground has uncontrolled fill upto 1m. So the piles are proposed to be drilled into the ground to support the RibRaft footing.

|                              |   |             |            |
|------------------------------|---|-------------|------------|
| Slab Thickness proposed      | = | 85 mm       |            |
| External Rib DL              | = | 0.3*0.22*24 | 1.584 kN/m |
| Internal Rib DL              | = | 0.1*0.22*24 | 0.528 kN/m |
| Internal Load Bearing Rib DL | = |             | 1.584 kN/m |

|                 |   |         |                  |
|-----------------|---|---------|------------------|
| Floor Slab LL   | = | 2.5 kPa | (Garage Loading) |
| Slab Point Load | = | 13 kN   | (Garage Loading) |



85mm thick slab to span between 305mm deep ribs @ 1200mm Centers each way

|                             |   |                      |             |
|-----------------------------|---|----------------------|-------------|
| M*(1.2G)                    | = | 0.18 kNm             |             |
| M*(1.5Q)                    | = | 0.225 kNm            |             |
| M*(1.5P)                    | = | 1.22 kNm             | (per 1.2m)  |
| M*Max(1.2G+1.5P)            | = | 1.40 kNm             |             |
| Ast (area of steel req)     | = | 81.3 mm <sup>2</sup> | < Min Steel |
| Ast (Min.area of steel req) | = | 123 mm <sup>2</sup>  |             |

|           |   |                     |   |                     |         |
|-----------|---|---------------------|---|---------------------|---------|
| SE62 Mesh | = | 142 mm <sup>2</sup> | > | 123 mm <sup>2</sup> | So Okay |
|-----------|---|---------------------|---|---------------------|---------|

### Wall Footing

For simplicity, the slab load on external rib is UDL

|           |   |           |
|-----------|---|-----------|
| Wall Load | = | 3.5 kN/m  |
| Wall Load | = | 1.85 kN/m |
| PG        | = | 5.31 kN   |
| PQ        | = | 2.775 kN  |

|               |   |         |
|---------------|---|---------|
| W (1.2G+1.5Q) | = | 11 kN/m |
| P (1.2G+1.5Q) | = | 7 kN    |

|                             |   |                         |
|-----------------------------|---|-------------------------|
| M*ULS                       | = | 16.1 kNm                |
| Ast (area of steel req)     | = | 172.465 mm <sup>2</sup> |
| Ast (Min.area of steel req) | = | 193.2 mm <sup>2</sup>   |

|                             |   |                          |
|-----------------------------|---|--------------------------|
| 2/H12=226mm <sup>2</sup> /m | > | 193.2 mm <sup>2</sup> /m |
|-----------------------------|---|--------------------------|

### Internal Ribs for Garage

|    |   |          |
|----|---|----------|
| G  | = | 2.2 kN/m |
| PG | = | 3.056 kN |
| PQ | = | 13 kN    |

Governing

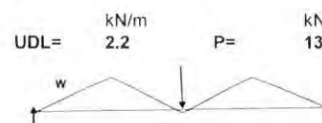
|                             |   |                            |
|-----------------------------|---|----------------------------|
| M*max                       | = | 17.6 kNm                   |
| V*Max                       | = | 13.71 kN                   |
| Ast (area of steel req)     | = | 189 mm <sup>2</sup>        |
| Ast (Min.area of steel req) | = | 69 mm <sup>2</sup>         |
| 1/H12                       | = | 113mm <sup>2</sup> is Okay |

### Shear Check

|    |   |                      |
|----|---|----------------------|
| V* | = | 19.31 kN             |
| pw | = | 0.003275 steel ratio |
| Vc | = | 0.52 Mpa             |
| Vi | = | 0.47 Mpa             |
|    | < | 0.52 Mpa             |

So Ok

No Stirrups Required



### Shear Check

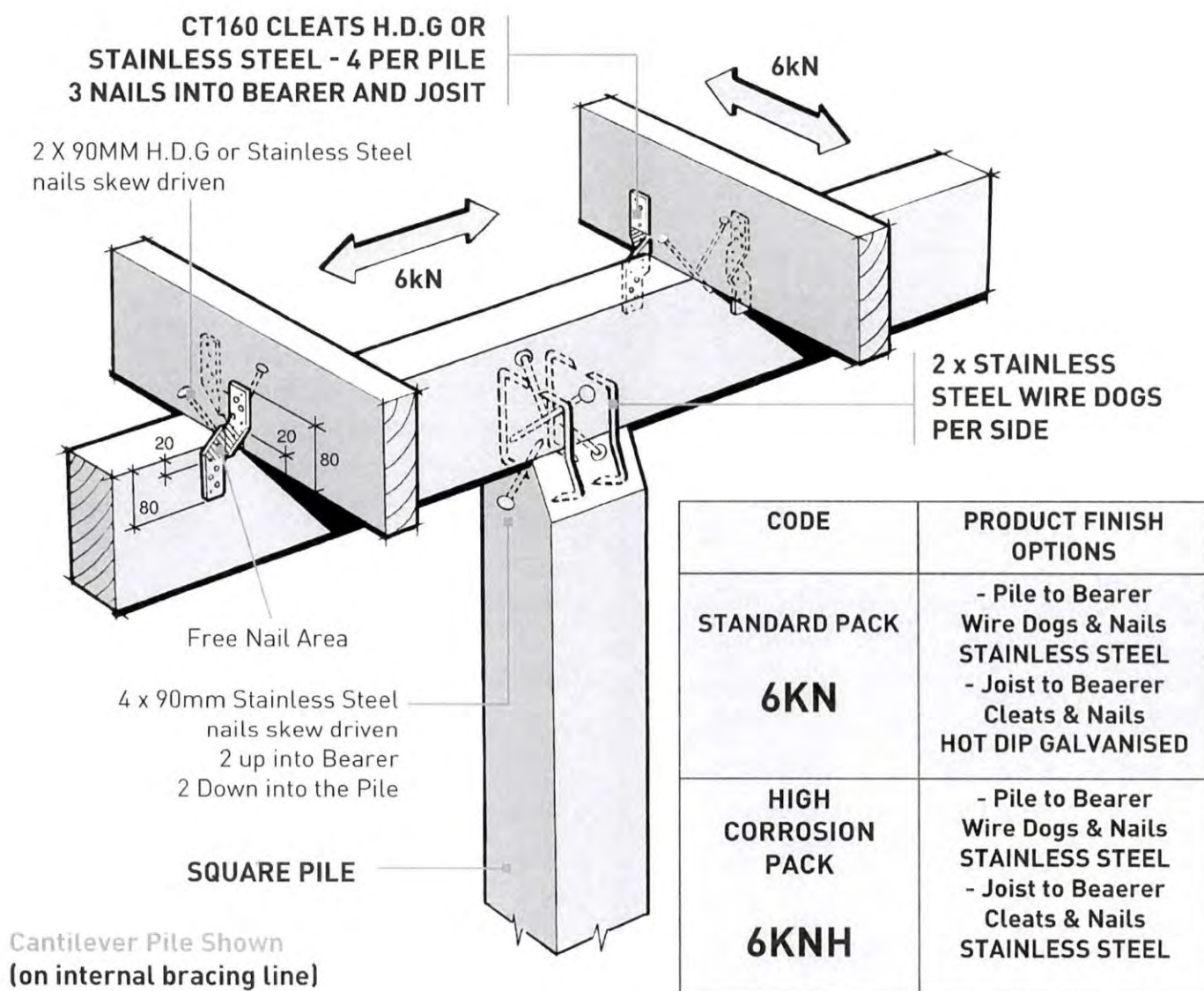
|    |   |                      |
|----|---|----------------------|
| V* | = | 13.71 kN             |
| pw | = | 0.003767 steel ratio |
| Vc | = | 0.54 Mpa             |
| Vi | = | 0.79 Mpa             |
| Av | = | 32 mm <sup>2</sup>   |
|    | > | 0.54 Mpa             |

So Ok

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# 6kN PILE FIXING FOR CANTILEVER PILES

- The 6kN Pile Fixing must be installed in accordance with this brochure
- Auckland University Tested Ref. 4613
- All Subfloor construction must be in accordance with NZS 3604:2011
- NZS 3604 requires lines of lateral support to floor joists within 300mm of bearer or bracing lines, refer clause 7.1.2
- Joists deeper than 150mm require solid nogging over cantilever pile



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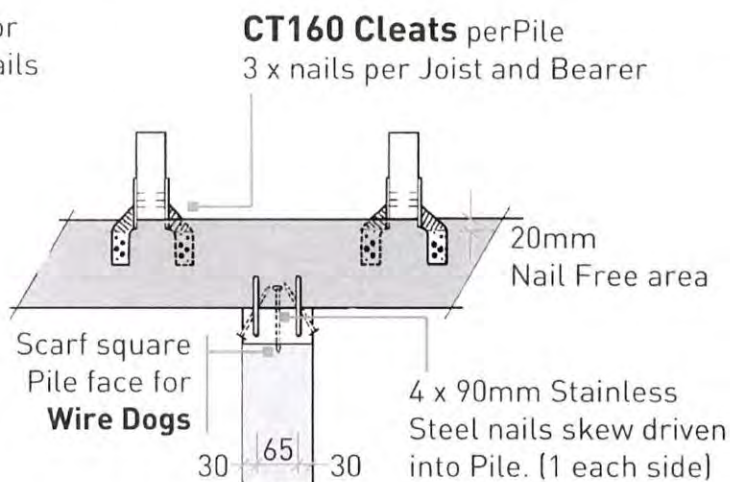
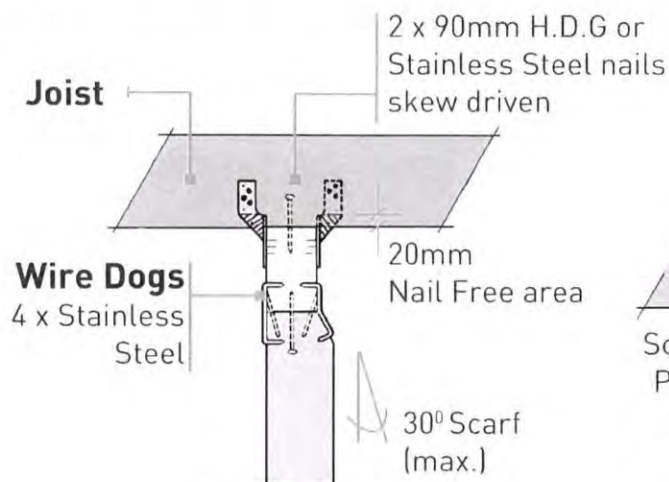
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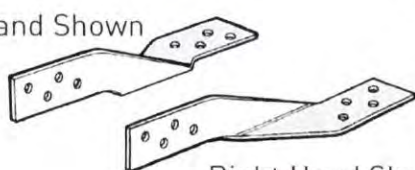


## 6KN PILE FIXING



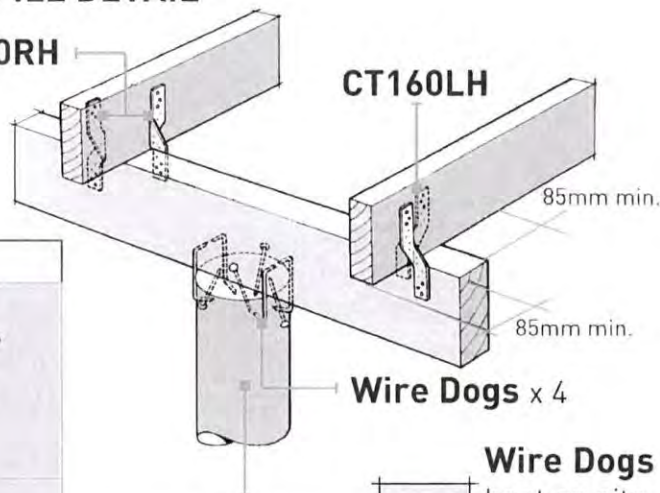
### SQUARE PILE DETAIL

Left Hand Shown



Right Hand Shown

CT160RH



#### CORROSION HAZARD USE TABLE

Standard Pack 6KN

- Zones B & C
- If Joist to Bearer fixing ABOVE 600mm from ground level

Pile to Bearer fixings Stainless Steel (304).  
Joist to Bearer fixings Hot Dip Galvanised

High corrosion pack 6KNH

- Zone D
- All fixings BELOW 600mm from ground level

All items Stainless Steel (304).

#### 6KN Joint Fixing Schedule

PILE to BEARER - Wire Dog Staple (4 per joint) Stainless Steel  
- 4 x 90mm skew nails (1 per face) Stainless Steel

JOIST to BEARER - CT160 Cleats (4 per pile) 160mm long  
- 3 nails per Cleat into Joist  
- 3 nails per Cleat in Bearer  
- 2 skew nails 90mm (1 per side)

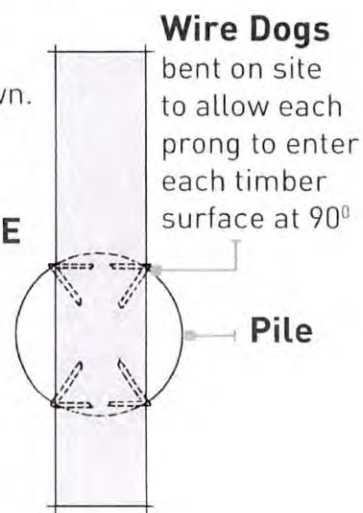
NAILS - 24 x 45mm 3.55 dia. spiral nails.  
- 4 x 90mm x 4 dia. St nails (6KN pack only)  
- 8 x 90mm x 4 dia. St nails (6KNH pack only)

#### 6KN Pile Set Contents

4 x Stainless Steel Wire Dogs  
4 x CT160 Cleats  
24 x 45mm 3.55 dia Spiral Nails  
90mm Stainless Steel nails to suit (4-6KN pack / 8-6KNH pack)

Round Pile Shown.  
(140mm min.)

#### EXTERNAL BRACING LINE



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# SED POLE

NZS 3603:1993

## POLE CAPACITY TABLES - SUMMARY

### BENDING

$$\phi M_n = \phi k_1 k_{21} k_{22} k_{23} \pi d^3 f_y / 32 \text{ (kNm)}$$

$$\phi = 0.8$$

$$k_{21} = 1.0$$

$$k_1 = 1.0$$

$$f_y = 380 \text{ MPa}$$

$$k_{22} = 0.85$$

$$E = 1.12 \times 10^5 \text{ GPa}$$

$$k_{23} = 0.85$$

| Pole Height<br>(m) | $\phi M_n$ (kNm) |       |       |       |       |       |       |
|--------------------|------------------|-------|-------|-------|-------|-------|-------|
|                    | 1500             | 1750  | 2000  | 2250  | 2500  | 2750  | 3000  |
| 2.40               | 8.58             | 14.65 | 21.25 | 29.59 | 39.65 | 52.26 | 67.01 |
| 3.00               | 10.22            | 15.50 | 22.34 | 30.94 | 41.51 | 54.24 | 69.34 |
| 3.60               | 10.90            | 16.38 | 23.47 | 32.34 | 43.20 | 56.28 | 71.72 |
| 4.20               | 11.60            | 17.30 | 24.63 | 33.77 | 44.94 | 58.34 | 74.16 |
| 4.80               | 12.33            | 18.25 | 25.83 | 35.25 | 46.73 | 60.46 | 76.65 |
| 5.40               | 13.09            | 19.24 | 27.07 | 36.77 | 48.56 | 62.64 | 79.19 |
| 6.00               | 13.86            | 20.26 | 28.34 | 38.34 | 50.44 | 64.88 | 81.80 |
| 6.60               | 14.70            | 21.31 | 29.66 | 39.95 | 52.37 | 67.14 | 84.45 |
| 7.20               | 15.55            | 22.40 | 31.02 | 41.60 | 54.35 | 69.47 | 87.17 |

### AXIAL

$$\phi N_c = \phi k_1 k_2 k_{21} k_{22} k_{23} A \text{ (kN)}$$

$$A = \pi d_p^2 / 4$$

$$S = k_{11} 1.33 L / d$$

$$\phi = 0.8$$

$$k_{21} = 0.8$$

$$d_p = \text{SED}$$

$$k_{11} = 1.5$$

$$k_1 = 1.0$$

$$k_{22} = 1.25$$

$$d \text{ at } 0.4L \text{ from SED}$$

$$k_2 = \text{derived from } S$$

$$f_y = 380 \text{ MPa}$$

$$k_{23} = 1.0$$

| Pole Height<br>(m) | $\phi N_c$ (kN) |       |       |       |       |       |       |
|--------------------|-----------------|-------|-------|-------|-------|-------|-------|
|                    | 1500            | 1750  | 2000  | 2250  | 2500  | 2750  | 3000  |
| 2.40               | 81.2            | 145.8 | 242.5 | 367.0 | 516.0 | 691.1 | 887.8 |
| 3.00               | 54.2            | 98.4  | 162.4 | 251.4 | 375.3 | 530.3 | 705.4 |
| 3.60               | 37.4            | 69.3  | 115.7 | 181.5 | 273.8 | 384.9 | 540.5 |
| 4.20               | 29.0            | 51.3  | 86.4  | 138.8 | 208.5 | 295.9 | 398.6 |
| 4.80               | 22.1            | 39.5  | 67.0  | 105.9 | 162.6 | 234.4 | 322.7 |
| 5.40               | 17.0            | 32.2  | 53.4  | 84.7  | 126.6 | 180.0 | 234.6 |
| 6.00               | 14.0            | 26.3  | 43.8  | 68.7  | 104.6 | 153.1 | 216.8 |
| 6.60               | 12.0            | 22.5  | 36.8  | 57.8  | 86.9  | 126.8 | 179.1 |
| 7.20               | 10.5            | 19.4  | 31.7  | 49.6  | 74.2  | 108.5 | 150.0 |

$$S > 50$$

$$S > 65 \text{ (included for interpolation only)}$$

Note:  $S < 65$  for Wind and Earthquake,  $S \leq 50$  All other load cases.

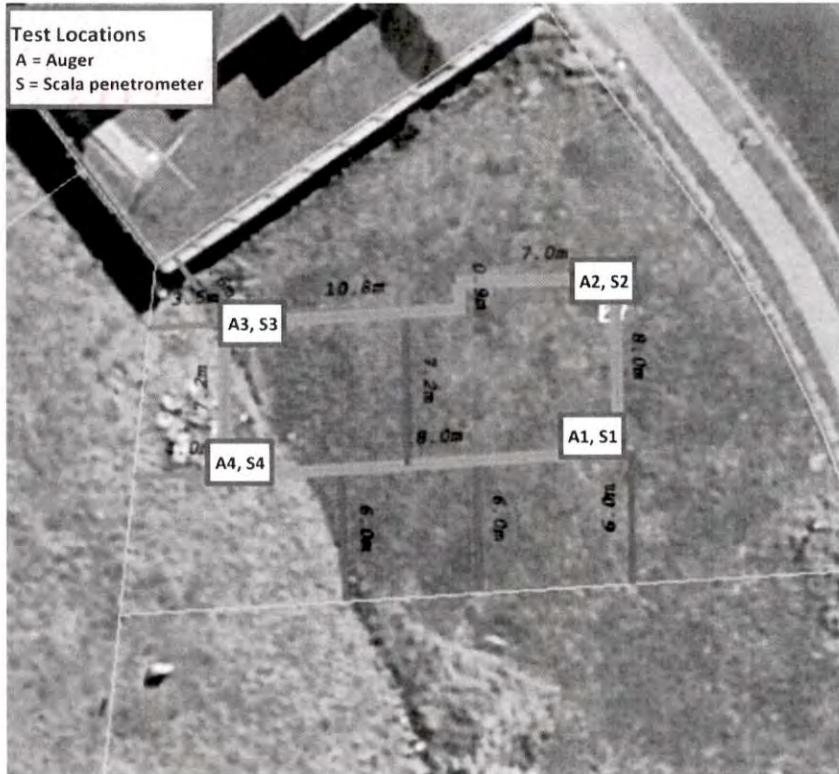
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### SCALA PENETROMETER, AUGER & SHEAR VANE TEST SHEET

Client: Hamish Scott  
Client Contact:  
Location: 27 County Drive, Hawera  
Test Date: 14/08/20

Job No: 20123  
Tested By: Jabe Radich



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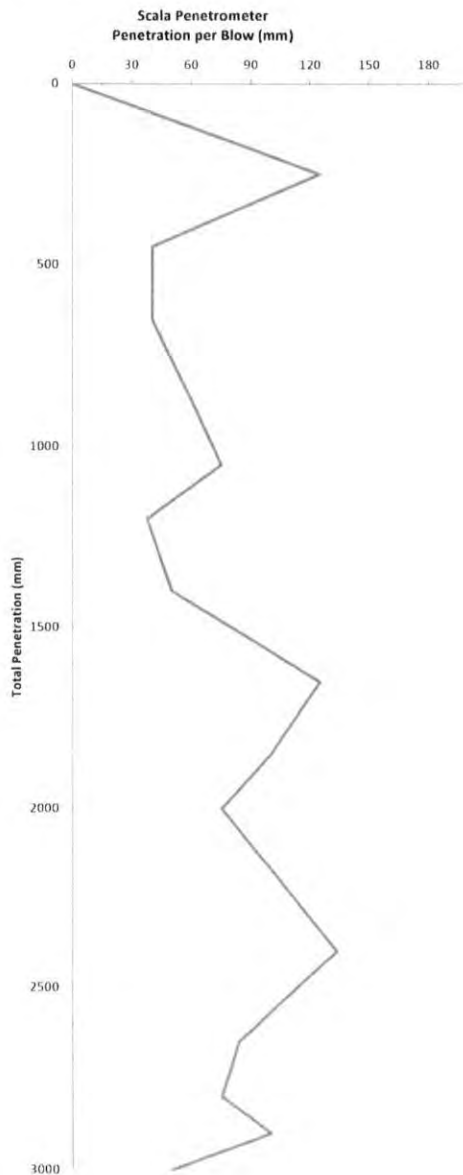
**SCALA PENETROMETER, AUGER & SHEAR VANE TEST SHEET**

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**Scala 1**



**Auger 1**

| Depth (mm) | Description   | Log | Shear Strength (kPa) |
|------------|---|-----|----------------------|
| 0          | Topsoil   |     |                      |
| 300        |   |     |                      |
| 500        | Moist, low plasticity, brown clayey silt loam with a trace of coarse sand |     | 98                   |
| 1000       | Water Content increase  |     | 79                   |
| 1500       |   |     | 81                   |
| 1800       | Soil becomes light brown  |     |                      |
| 2000       |   |     | 54                   |
| EOH        |   |     |                      |



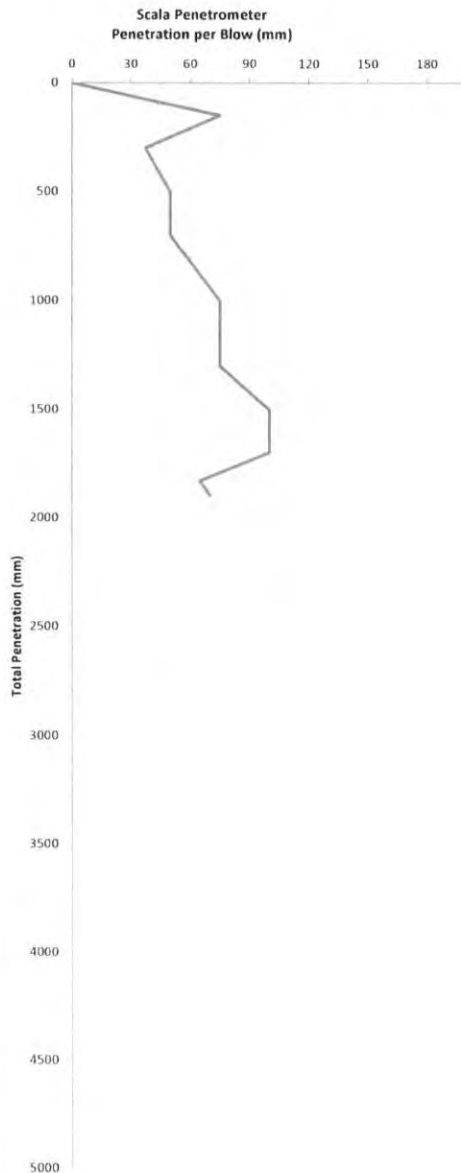
**SCALA PENETROMETER, AUGER & SHEAR VANE TEST SHEET**

Client: Hamish Scott  
Client Contact:  
Location: 27 County Drive, Hawera  
Test Date: 14/08/20

Job No: 20123  
Tested By: Jabe Radich

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**Scala 2**



**Auger 2**

| Depth (mm) | Description   | Log | Shear Strength (kPa) |
|------------|---|-----|----------------------|
| 0          | Topsoil   |     |                      |
| 200        |   |     |                      |
| 500        | Moist, low plasticity, brown clayey silt loam with a trace of coarse sand |     | 109                  |
| 1000       | Red medium gravels (100 mm layer)   |     | 62                   |
| 1500       | Water Content increase  |     | 84                   |
| 2000       | Soil becomes light brown  |     | 57                   |
| 2200       | Soil becomes stickier   |     |                      |
| 2500       |   |     |                      |
| 3000       |   |     | 54                   |
| 3500       |   |     |                      |
| 4000       |   |     | 68                   |
| 4500       | Black peat  |     |                      |
| 5000       |   |     |                      |

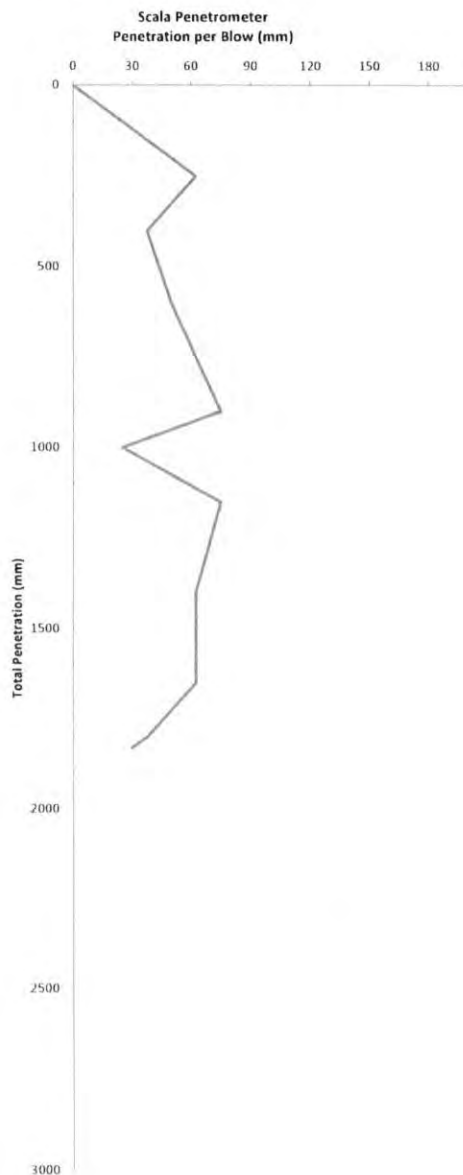
EOH

**SCALA PENETROMETER, AUGER & SHEAR VANE TEST SHEET**

Client: Hamish Scott  
Client Contact:  
Location: 27 County Drive, Hawera  
Test Date: 14/08/20

Job No: 20123  
Tested By: Jabe Radich

**Scala 3**



**Auger 3**

| Depth (mm) | Description   | Log | Shear Strength (kPa) |
|------------|---|-----|----------------------|
| 0          | Topsoil   |     |                      |
| 300        | Moist, low plasticity, brown clayey silt loam with a trace of coarse sand |     |                      |
| 500        |   |     | 109                  |
| 1000       |   |     | 75                   |
| 1500       | Water Content increase  |     |                      |
| 1500       | Soil becomes light brown  |     | 114                  |
| 1900       | Water table   |     |                      |
| 2000       |   |     | 117                  |

EOH

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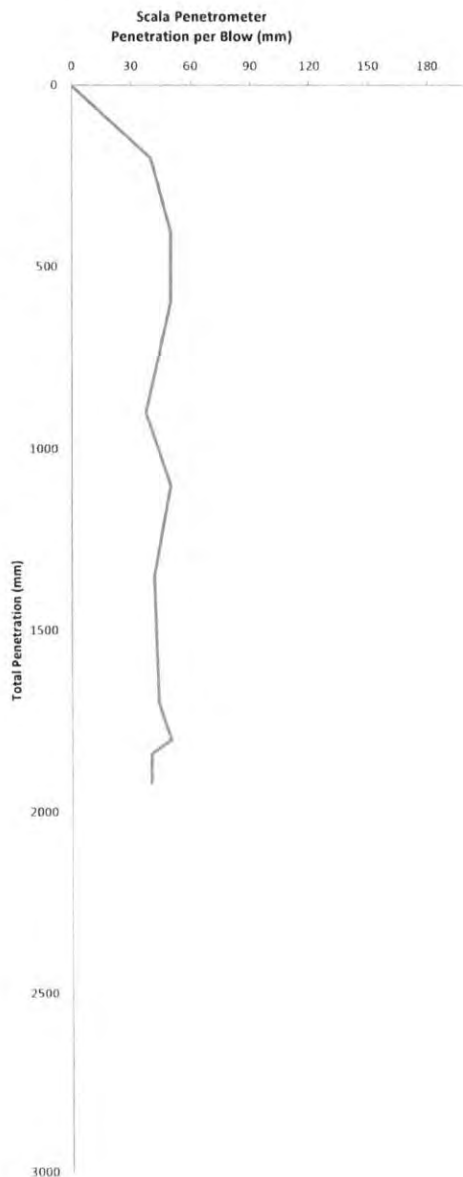


SCALA PENETROMETER, AUGER & SHEAR VANE TEST SHEET




Client: Hamish Scott  
 Client Contact:  
 Location: 27 County Drive, Hawera  
 Test Date: 14/08/20

Job No: 20123  
 Tested By: Jabe Radich

Scala 4



Auger 4

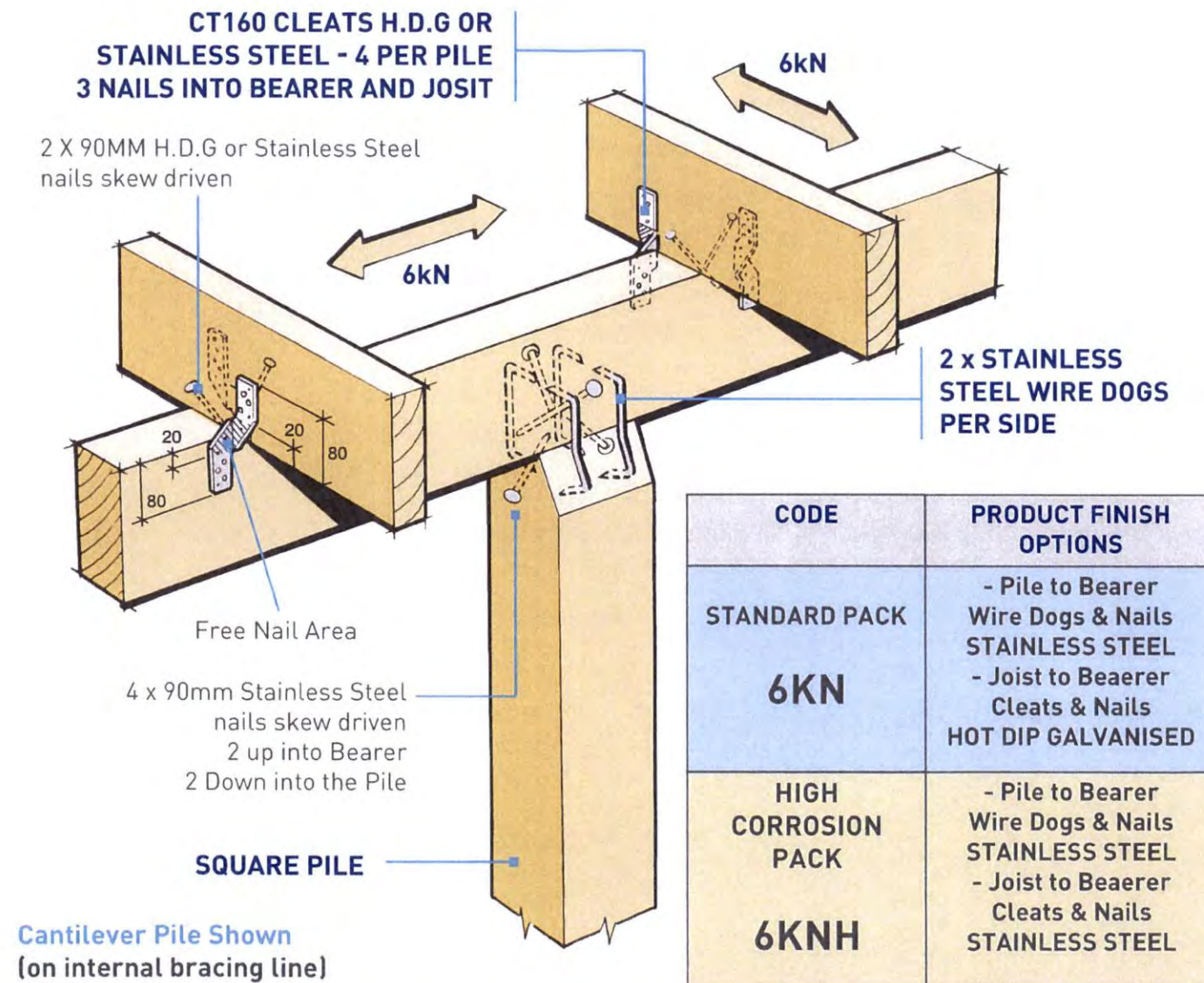
| Depth (mm) | Description   | Log   | Shear Strength (kPa) |
|------------|---|---|----------------------|
| 0          | Topsoil   |  |                      |
| 300        | Moist, low plasticity, brown clayey silt loam with a trace of coarse sand |  | 163                  |
| 500        |   |   |                      |
| 1000       | Water Content increase  |  | 120                  |
| 1500       | Soil becomes light brown  |   | 98                   |
| 2000       | Water table EOH   |   | 79                   |

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17/08/2020

# 6kN PILE FIXING FOR CANTILEVER PILES

- The 6kN Pile Fixing must be installed in accordance with this brochure
- Auckland University Tested Ref. 4613
- All Subfloor construction must be in accordance with NZS 3604:2011
- NZS 3604 requires lines of lateral support to floor joists within 300mm of bearer or bracing lines, refer clause 7.1.2
- Joists deeper than 150mm require solid nogging over cantilever pile



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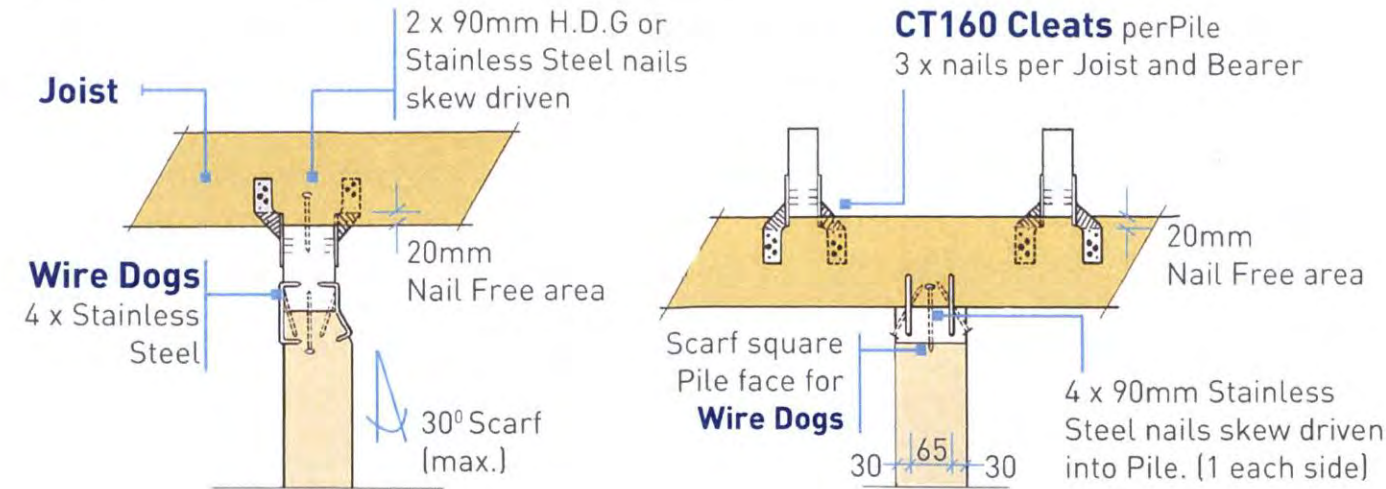
[www.mitek.nz.co.nz](http://www.mitek.nz.co.nz)



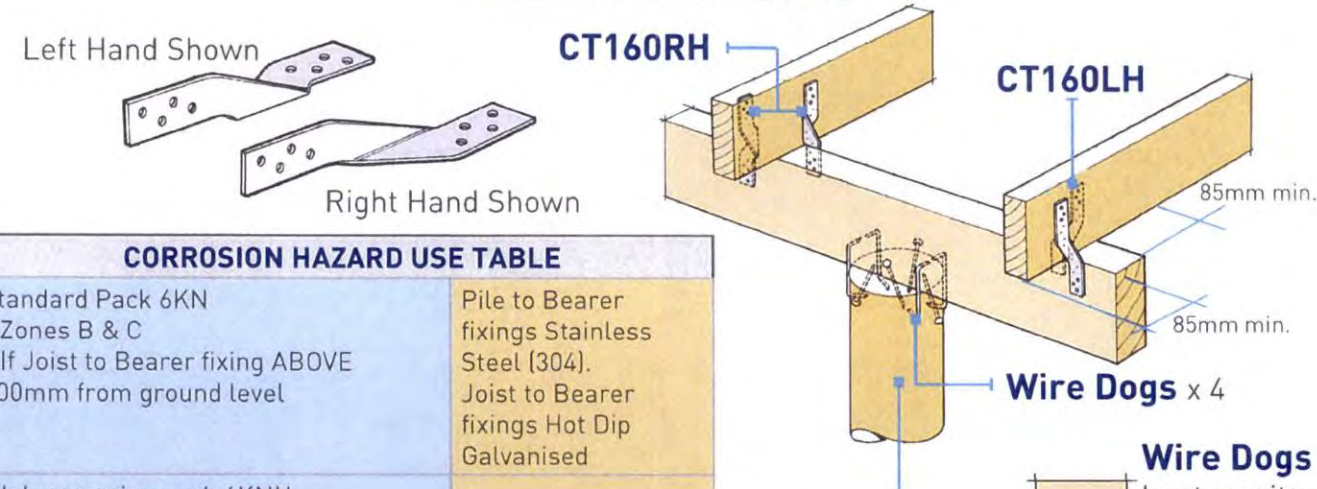
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## 6KN PILE FIXING



### SQUARE PILE DETAIL



#### CORROSION HAZARD USE TABLE

|   |   |
|---|---|
| Standard Pack 6KN<br>- Zones B & C<br>- If Joist to Bearer fixing ABOVE 600mm from ground level | Pile to Bearer fixings Stainless Steel (304).<br>Joist to Bearer fixings Hot Dip Galvanised |
| High corrosion pack 6KNH<br>- Zone D<br>- All fixings BELOW 600mm from ground level             | All items Stainless Steel (304).  |

#### 6kN Joint Fixing Schedule

- PILE to BEARER** - Wire Dog Staple (4 per joint) Stainless Steel  
- 4 x 90mm skew nails (1 per face) Stainless Steel
- JOIST to BEARER** - CT160 Cleats (4 per pile) 160mm long  
- 3 nails per Cleat into Joist  
- 3 nails per Cleat in Bearer  
- 2 skew nails 90mm (1 per side)
- NAILS** - 24 x 45mm 3.55 dia. spiral nails.  
- 4 x 90mm x 4 dia. St nails (6KN pack only)  
- 8 x 90mm x 4 dia. St nails (6KNH pack only)

#### 6kN Pile Set Contents

- 4 x Stainless Steel Wire Dogs  
4 x CT160 Cleats  
24 x 45mm 3.55 dia Spiral Nails  
90mm Stainless Steel nails to suit (4-6KN pack / 8-6KNH pack)

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