

Site Classification & Footing Construction Report – Revision 1

Date: 18 July 2019

Job reference no.: 19106

Site: 14 Baker Avenue, Morphettville SA

Project: Proposed Residences

Client: Jessica Carter

Enclosures:

Surface Soil Borelog
Borehole Location Plan

Drawings

Sheet 19106-F01-B : Footing Layout Plan & Details
Sheet 19106-C01-D : Site Plan & Details

Typical Standard Details

Sheets RSF1–RFS3 : General Details for Raft Footing Slab Systems
Sheet FD3 : Typical Sewer & Stormwater Pipe Penetration Details
Sheet FD4 : Concrete Paving Details for Residential Sites
Sheet SW1 : General Drainage Details

Footing Construction Report Specifications

Sheet GFS-1 : General Specification for Footing & Slab Construction.
Sheet GNSP-1 : General notes on siteworks and building construction.
Sheet GNE-1 : General conditions of use, performance, soil borelogs and site inspections.

Structural Design and Documentation

Pages 1 – 3 : Footing design calculations

Soil Reactivity and Site Classification

GENERAL

The owner/agent must notify the engineer of any changes to the overall site conditions which may impact on the overall site classification.

For all sites (in particular sites with reactive soils) drainage and soil moisture conditions around the building need to be managed to maintain “normal” moisture conditions as defined in AS2870-2011.

The owner/agent must also reference the CSIRO BTF 18 document titled “Foundation Maintenance and Footing Performance: A Homeowners Guide”, please refer to the following link to purchase a copy (<http://www.publish.csiro.au/pid/7076.htm>)

The site has been classified in accordance with the techniques and principals outlined in AS2870-2011 The “Residential Slabs and Footings” code.

Refer to the Surface Soil Borelogs for a detailed description of the soil encountered in sampling at the site.

SOIL REACTIVITY ASSESSMENT

The natural foundation for this site was assessed predominately as being a ‘highly reactive’ soil profile with deep seated moisture change characteristics - refer AS 2870-2011.

SITE CLASSIFICATION

This site is classified as being a ‘Class P’ – Problem Site.

The soils on this site may be subjected to differential soil moisture conditions beyond those for a “normal” site due to the effects of existing trees and existing structures.

Fill material of undetermined origin and compaction in depth from 0.3m was identified at the location of boreholes 3 and 4.

The tree effect parameters used in our footing system design are as follows:

| | |
|-----------------------|--------------------|
| Basis of design: | Tree group effects |
| Design tree height: | 10m |
| Distance to building: | 5m |

It is recommended that the above parameters be independently verified by both the owner and owner employed qualified arborist prior to construction. The assessment shall apply to all trees which may influence the building and shall include existing trees and proposed future tree planting or removal. This office should be contacted immediately for further advice if the parameters are independently assessed to differ to the design parameters given above.

Please also note that current design practice attempts to account for tree effects by designing for a greater soil movement than would otherwise occur, however, due to the complex tree root geometry, variable moisture extraction by the tree and the difficulty in predicting future tree growth, a precise design for the effects of trees is outside current knowledge. The owner must be aware that although precautions have been taken for the effects of the trees in our design, some distortion must be accepted. Engineers are not experts in tree growth and cannot be expected to know the anticipated growth and mature height of trees.

BOREHOLE LOG - 654-BH1

Client: GAMA Consulting
Client Job No: 19106
Job No: DBA-0654
Location: 14 Baker Ave, Morphetville
Driller: JR Soil Sampling



Sheet 1 of 1

Logged by: DBA Position: (MGA 54) Plant Used:
 Date Logged: 16/06/2019 Date Drilled: 13/06/2019

| Groundwater | Depth (m) | Graphic Log | Material Description Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components | Moisture Condition | Consistency/ Relative Density | Bearing Strength | Estimated Ips (%) | Structure & other observations |
|-------------|-----------|--------------------------------|--|-----------------------|----------------------------------|------------------|-------------------|-----------------------------------|
| | | | SM: SILTY SAND: fine to medium grained, brown, low plasticity | M | L | L | 0 | |
| | | | CH: CLAY: high plasticity, brown | <PL | St | M | 2 | |
| | 1 | | CI: CALCAREOUS CLAY: medium plasticity, pale brown | <PL | St | M | 1.8 | |
| | 2 | | CH: CLAY: high plasticity, brown to pale brown | >PL | F | L-M | 2 | |
| | 3 | Borehole terminated at 3.000 m | | | | | | |

Termination reason: Target Depth Reached

This Borehole has been logged in accordance with AS1726-1993 and the above instability indices (Ips %) are in accordance with Cl2.3.2 (iii) of AS2870-2011

This report must be read in conjunction with accompanying notes and abbreviations.

BOREHOLE LOG - 654-BH2

Client: GAMA Consulting
Client Job No: 19106
Job No: DBA-0654
Location: 14 Baker Ave, Morphetville
Driller: JR Soil Sampling



Sheet 1 of 1

Logged by: DBA Position: (MGA 54) Plant Used:
 Date Logged: 16/06/2019 Date Drilled: 13/06/2019

| Groundwater | Depth (m) | Graphic Log | Material Description Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components | Moisture Condition | Consistency/ Relative Density | Bearing Strength | Estimated Ips (%) | Structure & other observations |
|-------------|-----------|--------------------------------|--|-----------------------|----------------------------------|------------------|-------------------|-----------------------------------|
| | | | SM: SILTY SAND: fine to medium grained, brown, low plasticity | M | L | L | 0 | |
| | | | CH: CLAY: high plasticity, brown | <PL | St | M | 2 | |
| | 1 | | CI: CALCAREOUS CLAY: medium plasticity, pale brown | <PL | St | M | 1.8 | |
| | 2 | | CH: CLAY: high plasticity, brown to pale brown | >PL | F | L-M | 2 | |
| | 3 | Borehole terminated at 3.000 m | | | | | | |

Termination reason: Target Depth Reached

This Borehole has been logged in accordance with AS1726-1993 and the above instability indices (Ips %) are in accordance with Cl2.3.2 (iii) of AS2870-2011

This report must be read in conjunction with accompanying notes and abbreviations.

BOREHOLE LOG - 654-BH3

Client: GAMA Consulting
Client Job No: 19106
Job No: DBA-0654
Location: 14 Baker Ave, Morphetville
Driller: JR Soil Sampling



Sheet 1 of 2

Logged by: DBA Position: (MGA 54) Plant Used:
 Date Logged: 16/06/2019 Date Drilled: 13/06/2019

| Groundwater | Depth (m) | Graphic Log | Material Description Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components | Moisture Condition | Consistency/ Relative Density | Bearing Strength | Estimated Ips (%) | Structure & other observations |
|-------------|-----------|-------------|--|-----------------------|----------------------------------|------------------|-------------------|-----------------------------------|
| | | | FILL: SAND: fine to coarse grained, brown | M | | - | - | |
| | | | SM: SILTY SAND: fine to medium grained, brown, low plasticity | M | L | L | 0 | |
| | | | CH: CLAY: high plasticity, brown | <PL | St | M | 2 | |
| | 1 | | CI: CALCAREOUS CLAY: medium plasticity, pale brown | <PL | St | M | 1.8 | |
| | 2 | | CH: CLAY: high plasticity, brown to pale brown | >PL | F | L-M | 2 | |
| | 3 | | | | | | | |

Termination reason: Target Depth Reached

This Borehole has been logged in accordance with AS1726-1993 and the above instability indices (Ips %) are in accordance with Cl2.3.2 (iii) of AS2870-2011

This report must be read in conjunction with accompanying notes and abbreviations.

BOREHOLE LOG - 654-BH4

Client: GAMA Consulting
Client Job No: 19106
Job No: DBA-0654
Location: 14 Baker Ave, Morphetville
Driller: JR Soil Sampling



Sheet 1 of 1

Logged by: DBA Position: (MGA 54) Plant Used:
 Date Logged: 16/06/2019 Date Drilled: 13/06/2019

| Groundwater | Depth (m) | Graphic Log | Material Description Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components | Moisture Condition | Consistency/ Relative Density | Bearing Strength | Estimated Ips (%) | Structure & other observations |
|-------------|-----------|-------------|--|-----------------------|----------------------------------|------------------|-------------------|-----------------------------------|
| | | | FILL: SAND: fine to coarse grained, brown | <M | | - | - | |
| | | | CH: CLAY: high plasticity, brown | <PL | St | M | 2 | |
| | 1 | | CI: CALCAREOUS CLAY: medium plasticity, pale brown | <PL | St | M | 1.8 | |
| | 2 | | CH: CLAY: high plasticity, brown to pale brown | >PL | F | L-M | 2 | |
| | 3 | | Borehole terminated at 3.000 m | | | | | |

Termination reason: Target Depth Reached

This Borehole has been logged in accordance with AS1726-1993 and the above instability indices (Ips %) are in accordance with Cl2.3.2 (iii) of AS2870-2011

This report must be read in conjunction with accompanying notes and abbreviations.

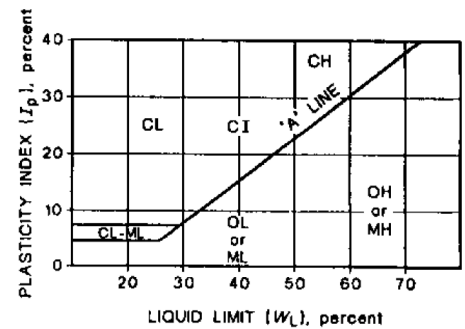
Explanatory Notes – Soil Description

| | | | | | |
|--|---------------|--|---------------|--|--------------------|
| | GRAVEL | | CLAY | | FILL |
| | Silty GRAVEL | | Gravelly CLAY | | TOPSOIL |
| | Clayey GRAVEL | | Sandy CLAY | | PEAT |
| | SAND | | SILT | | COBBLES & BOULDERS |
| | Silty SAND | | Gravelly SILT | | CONCRETE |
| | Clayey SAND | | Sandy SILT | | NO CORE |

WATER

| | |
|--|--------------|
| | Water Level |
| | Water Inflow |

Plasticity Properties



| | | | | | |
|----|----------------------|----|------------------------|----|----------------------|
| GP | Poorly Graded Gravel | SM | Silty Sand | CH | High Plasticity Clay |
| GW | Well Graded Gravel | SC | Clayey Sand | OL | Organic Soils (LP) |
| GM | Silty Gravel | ML | Low Plasticity Silt | OH | Organic Soils (HP) |
| GC | Clayey Gravel | MH | High Plasticity Silt | PT | Peat |
| SP | Poorly Graded Sand | CL | Low Plasticity Clay | | Cobbles & Boulders |
| SW | Well Graded Sand | CI | Medium Plasticity Clay | | Fill |

CLASSIFICATION AND INFERRED STRATIGRAPHY (with reference to AS1726-1993, Table A1)

| Particle Size | | |
|----------------|--------------|-------------------|
| Major Division | Sub Division | Particle Size |
| Boulders | | > 200 mm |
| Cobbles | | 63 to 200 mm |
| Gravel | Coarse | 20 to 63 mm |
| | Medium | 6.0 to 20 mm |
| | Fine | 2.36 to 6.0 mm |
| Sand | Coarse | 0.6 to 2.36 mm |
| | Medium | 0.2 to 0.6 mm |
| | Fine | 0.075 to 0.2 mm |
| Silt | | 0.002 to 0.075 mm |
| Clay | | < 0.002 mm |

The methods of description and classification of soils in the attached logs are based on AS1726-1993. They present an engineering and/or geological interpretation of the subsurface conditions at the specific investigation location. Subsurface conditions between boreholes may vary significantly.

The presence of fill materials is usually regarded with caution as the possible variation in density, strength, and material type is much greater than with natural soil deposits. Reference to AS2870 should be made in determining the site classification.

The instability index (I_{ps}) values provided in the attached logs are in accordance with AS2870-2011, CI 2.3.2 (iii).

Fill Descriptors

| Generalized terms | Typical descriptions |
|----------------------|--|
| Organic matter | Fibrous peat |
| | Charcoal |
| | Wood fragments |
| | Roots (greater than 2 mm diameter) |
| | Root fibres (less than 2 mm diameter) |
| Artificial materials | Oil, bitumen |
| | Masonry |
| | Concrete rubble |
| | Fibrous plaster, plasterboard |
| | Timber pieces, wood shavings, sawdust |
| | Iron filings, drums, steel bars, steel scrap |
| | Bottles, broken glass |
| | Leather |
| | Slag |
| | Chitter, ash, tailings |
| | Asbestos, fibre cement |
| | Rubber tyres |

MOISTURE CONDITION

| Symbol | Term | Description | Symbol | Term | Description |
|--------|-------|---|--------|--------------------------------------|---|
| D | Dry | Non-cohesive and free running | <PL | Less than plastic limit | Hard and friable, powdery |
| M | Moist | Soil feels cool, darkened in colour. Granular soils tend to stick together | ≈PL | Approximately equal to plastic limit | Soils can be moulded at a moisture content approximately equal to the plastic limit |
| W | Wet | Soil feels cool, darkened in colour. Granular soils tend to stick together, free water forms when handling. | >PL | Greater than plastic limit | Soils usually weakened and free water forms on hands when handling |

CONSISTENCY AND DENSITY (AS1726 - 1993, Table A4)

| Sym. | Term | Undrained Shear Strength |
|------|------------|--------------------------|
| VS | Very Soft | 0 to 12 kPa |
| S | Soft | 12 to 25 kPa |
| F | Firm | 25 to 50 kPa |
| St | Stiff | 50 to 100 kPa |
| VSt | Very Stiff | 100 to 200 kPa |

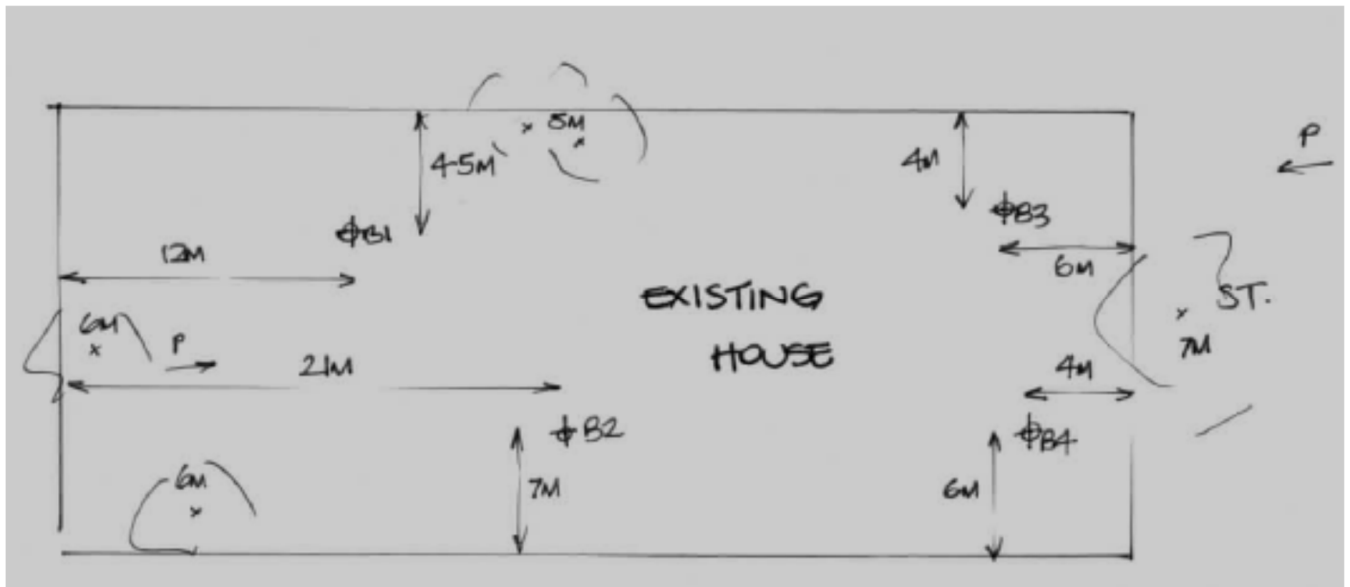
| Sym. | Term | Density Index % |
|------|--------------|-----------------|
| VL | Very Loose | Less than 15 |
| L | Loose | 15 to 35 |
| MD | Medium Dense | 35 to 65 |
| D | Dense | 65 to 85 |
| VD | Very Dense | Above 85 |

Bore Hole Location Plan

Project No. : 19106

Date Sampled : 13/6/19

Site Address : 14 Baker Avenue, Morphettville



Footing Construction Details (Report)

GENERAL

This report must be read in conjunction with all listed attachments. The owner and or his/her Agent* will comply and procure compliance in all respects and at all times with all terms and conditions and recommendations contained in or attached to this Footing Construction Report. Should the owner prefer to have the conditions and obligations contained within this Footing Construction Report personally explained, it is then recommended that the owner make an appointment with our office to facilitate such proceedings. Our fee for this service will be \$200.00 + gst.

All construction shall comply with AS 2870-2011 "Residential Slabs and Footings".

PROPOSED BUILDING CONSTRUCTION DETAILS

The footing system has been designed for the following construction:

| | |
|---------------------|--------------------------|
| Building Type: | Single storey dwelling |
| Wall Construction: | Articulated brick veneer |
| Roof Construction: | Lightweight cladding |
| Floor Construction: | Concrete |

FOOTING SYSTEM TYPE

Recommended Footing System: RC Raft Footing

The footing system has been designed for tree effects –refer "Site Classification". Should the owner wish to consider alternative tree effects in the design please contact this office. Additional fees may apply for requested amendments to the footing system design.

If the owner/agent requires a different type of footing to the one recommended, then this office shall be contacted accordingly. Additional fees may apply for requested amendments to the footing system design.

FOOTING SYSTEM DETAILS

The Specification for Materials and Workmanship and Standard Details for the footings are given in the attachments to this report.

REFER TO DRAWING 19106-F01 FOR FOOTING BEAM AND SLAB SIZES AND REINFORCEMENT.

Founding Note:

The founding depth of footing beams shall be a minimum of 100mm into firm natural soil.

SITE PREPARATION

Refer to Standard Notes GNSP-for general information

Remove surface soil containing grass, roots and organic matter from the building area and level as required.

Care should be exercised during demolition works to reduce soil disturbance. All disturbed soil and fill material on this site must be compacted in accordance with Section 6.4.2 of AS 2870-2011 and AS3798. Where the material is assessed and certified as “controlled fill” in accordance with AS 3798 by a NATA registered geotechnical consultant then;

- a) the footings may be founded in the controlled fill
- b) a 100mm thick slab reinforced with a single layer of SL82 top may be used throughout.

Where certification of the fill material is not provided then;

- a) where the fill depth is less than or equal to 400mm, part b) above may apply
- b) where the fill depth is greater than 400mm the slab design shall comply with the information contained in the General Comments & Requirements given below.

If the existing residence is of timber floor construction, then the soils under the floor will be naturally desiccated. Construction of the new raft slab footing shall not commence on these desiccated soils until the soils are left exposed for a sufficient period of time to enable them to achieve a moisture content similar to the surrounding previously exposed soils. This process may be accelerated by pre-wetting the site in accordance with Section 3 of Sheet GNSP-1.

SITE INSPECTIONS

Site inspection must be carried out at the following stages:

1. After trenching and before the plastic membrane is placed
2. After placement of all reinforcement
3. As requested by the client/contractor/engineer

Please note:

Each inspection will incur an additional charge in accordance with our current fee scales for inspections.

Travel charges are applicable outside a 30km radius from the G.P.O (Adelaide, 5000)

GENERAL COMMENTS & REQUIREMENTS

The slab thickness shall be increased to 125mm and be reinforced with an additional layer of SL72 mesh bottom to slab panels constructed over more than 300mm of rolled fill (600mm for sand fill).

Use SL92 top in-lieu of the specified top slab mesh where brittle floor coverings such as tiles or slate are to be used, except where the slab is left to cure for three (3) months, or a flexible adhesive such as 'Resaflex' is used. Refer section 5.3.7 of AS 2870-2011.

Ensure adequate drainage as per General Notes GNSP-1.

Provide full height control joints in walls at the locations shown on Sheet F01 and elsewhere as required for the material type and by the material manufacturer's specifications.

Flexible connection to sewer and stormwater pipes are required for this site. Sewer pipes shall be lagged with 40mm closed cell polyethylene, or similar lagging material, through external footing beams and 20mm through internal footing beams.

COPYRIGHT STATEMENT

The site investigation and footing construction report has been prepared expressly for the property owner for the sole purposed of constructing the building described in the plans and specifications. This report is copyright to Gama Consulting. No part of this report shall be used for any other purpose nor by any third party without prior written consent of Gama Consulting.

The owner is defined as the person or persons named in this report or the person or persons as for whom the named building company is acting as agent.

*The agent is defined as the person or persons who is authorised to act on behalf of the owner/owners and agrees to act on behalf of the owner/owners.

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| | | | | |
|-----|----------|------------------------------------|-----|-------|
| B | 18/07/19 | GARAGE SD AND ALFRESCO RCP REVISED | IB | PC |
| A | 01/07/19 | ISSUED FOR BUILDING APPROVAL | IB | MM |
| REV | DATE | DESCRIPTION | DRN | APP'D |



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PROJECT

PROPOSED RESIDENCES

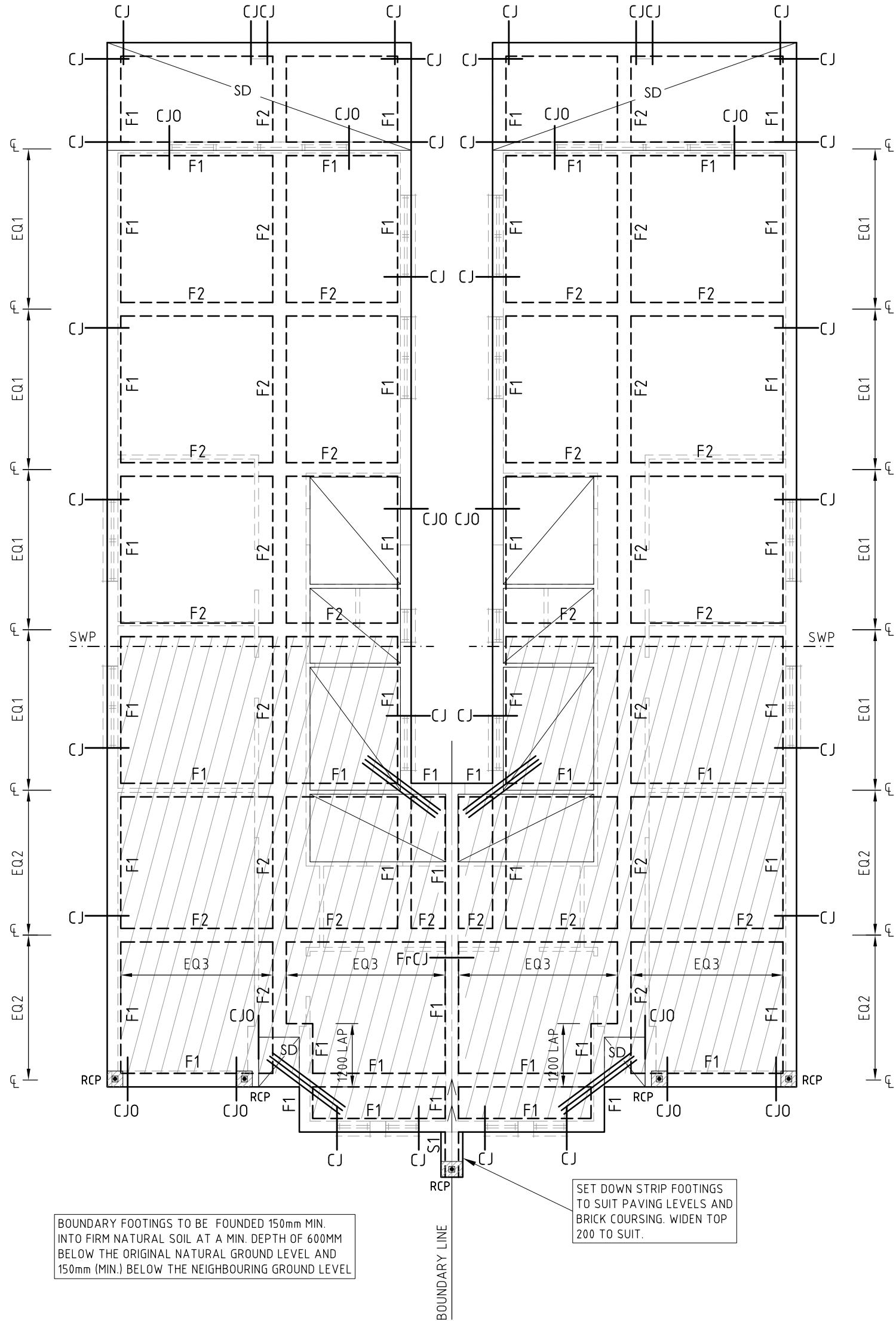
14 BAKER AVENUE
MORPHETTVILLE, SA 5043

CLIENT

JESSICA CARTER

| | |
|-------------|-----------------------------|
| STATUS | APPROVAL |
| COUNCIL | MARION COUNCIL |
| DESCRIPTION | FOOTING PLAN AND DETAILS |

| | |
|-------------------|--------------------|
| DRAWN IB | DESIGN PC |
| DRAFT CHECK PC | DESIGN CHECK PC |
| DRAWING No. | 19106-F01 |
| SHEET SIZE A2 | REVISION B |



FOOTING PLAN – RESIDENCE 1 & 2
SCALE 1:100

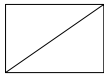
| FOOTING SCHEDULE | | | |
|--|--|------------------|----------------|
| MARK | SIZE (WxD) | REINFORCEMENT | LIGATURES |
| F1 | 300x600 | 3-N16-T, 3-N16-B | L6 AT 1200 CTS |
| F2 | 300x600 | 2-N16-T, 3-N16-B | L6 AT 1200 CTS |
| S1 | 300x600 | 3-N16-T, 3-N16-B | L6 AT 600 CTS |
| SLAB | 100mm THICK REINFORCED WITH SL82 MESH -TOP (U.N.O) | | |
| CONCRETE GRADE: N20 (EXTERNAL EXPOSED AREAS TO BE SUITABLY PROTECTED TO SUIT THE SITE ENVIRONMENT) | | | |

- GENERAL NOTES:
- THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE INFORMATION CONTAINED IN THE FOOTING CONSTRUCTION REPORT
 - BASE OF FOOTING TRENCHES SHALL BE FOUNDED 100mm MINIMUM INTO FIRM NATURAL GROUND OR ON TRENCHED PIERS FOUNDED 100mm INTO FIRM NATURAL GROUND

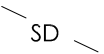
- FOOTING SYSTEM DESIGN PARAMETERS:
- SITE CLASSIFICATION TO AS 2810-2011 - CLASS P
 - EVALUATED $Y_s = 43\text{mm}$
 - WITH CONSIDERATION THE FOOTING SYSTEM DESIGN HAS INCORPORATED TREE EFFECTS, EVALUATED $Y_t = 17\text{mm}$

- PLUMBING NOTES
- FLEXIBLE PLUMBING CONNECTIONS TO SEWER AND STORMWATER DRAINS ARE REQUIRED FOR THIS SITE FLEXIBLE CONNECTIONS SHALL BE CARRIED OUT BY A SUITABLY QUALIFIED REGISTERED PLUMBER AND SHALL COMPLY WITH SECTION 5.6.4 OF AS 2870-2011 AND SHALL BE DESIGNED TO ACCOMMODATE A TOTAL RANGE OF DIFFERENTIAL MOVEMENT IN ANY DIRECTION OF NOT LESS THAN 60mm
 - PIPES SHALL BE LAGGED WITH 40mm CLOSED CELL POLYETHYLENE, OR SIMILAR LAGGING MATERIAL
 - WHERE A PLUMBING CONDUIT (OR CONDUIT LAGGING) IS LOCATED WITHIN 100mm OF THE BASE OF THE TRENCH, THE TRENCH MUST BE DEEPEMED LOCALLY TO PROVIDE A MINIMUM OF 100mm CLEARANCE BETWEEN THE CONDUIT (OR LAGGING) AND THE BASE OF THE TRENCH.THE DEEPEMED SECTION SHALL EXTEND FOR A DISTANCE OF NOT LESS THAN 1.0m EACH SIDE OF THE CONDUIT. REFER SHEET FOR DETAILS FD3

LEGEND




WET AREA – SET DOWN 25mm
GENERALLY, 50mm TO SHOWER.




SD

SET DOWN SLAB TO ARCHITECTS DETAILS, MESH
TO BE CONTINUOUS (LAPPED OR Z-MESH) AT STEP




RCP

FULL HEIGHT CONCRETE FILLED BRICK PIER
REINFORCED WITH 1 N16 VERTICAL ROD CENTRAL.
PROVIDE CORRESPONDING STARTER BAR AT BASE
1000 LONG, 400 INTO FOOTING




FrCJ

FIRE RATED CONTROL JOINT




CJ

FULL HEIGHT CONTROL JOINTS TO BRICKWORK

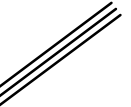


CJO


CONTROL JOINTS ABOVE OPENING ONLY



125mm THICK SLAB TO AREAS SHOWN SHADED
REINFORCE WITH 2 LAYERS OF MESH; SL82-TOP,
SL72-BOTTOM

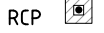


3-N12-100 x 2000 LONG BARS TIED UNDER
THE SLAB MESH TO RE-ENTRANT CORNERS
CRANK BARS AT STEPS TO SUIT




SWP

STORMWATER PIPE

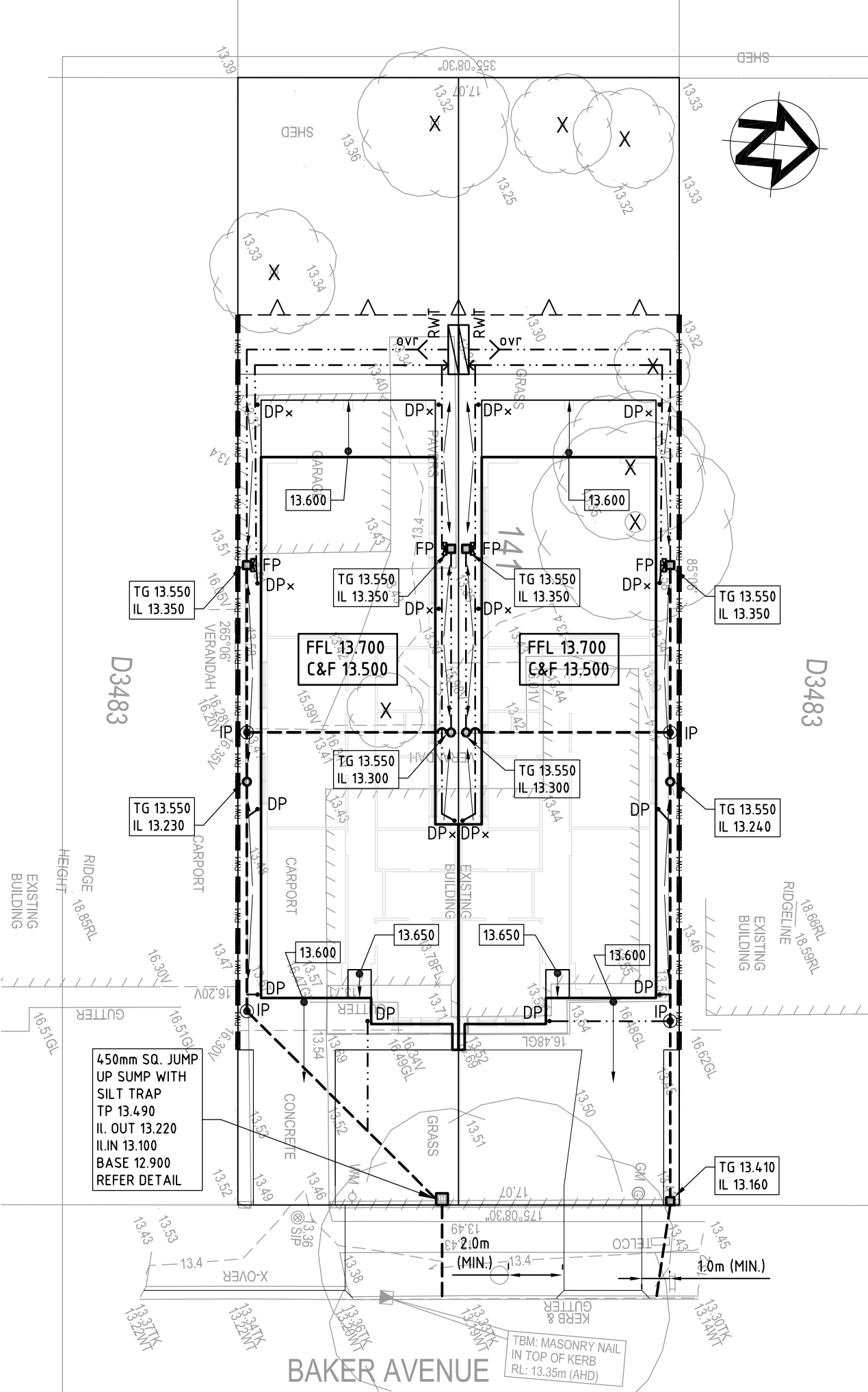


RCP

FULL HEIGHT CONCRETE FILLED BRICK PIER
REINFORCED WITH 1 N16 VERTICAL ROD CENTRAL.
PROVIDE CORRESPONDING STARTER BAR AT BASE
1000 LONG, 400 INTO FOOTING



Strip footing reinforcement to continue
1000mm MIN. INTO RAFT SLAB AT LOCATIONS
SHOWN



SITE PLAN
1:200

DETENTION EVALUATION

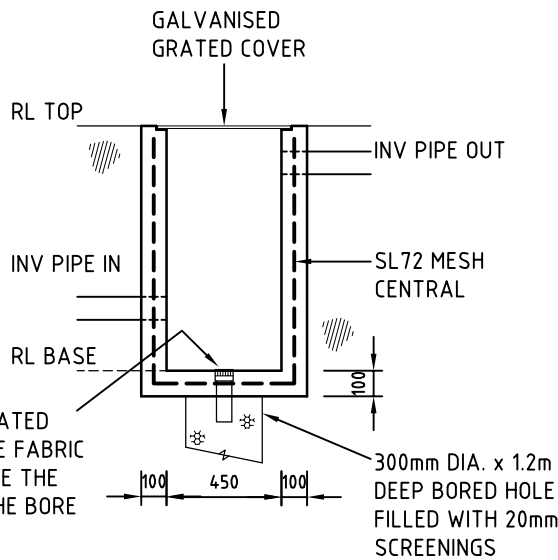
ROOF AREA/SITE AREA
= 165/372 = 44%

DETENTION REQUIRED ≈ 660
LITRES (MINIMUM)

ROOF TO TANK ≈ 70%

NOTE:
NEW CROSSOVER AND ALTERATIONS TO
EXISTING TO BE IN ACCORDANCE WITH
COUNCIL SPECIFICATIONS

60mm DIA. RISER WITH GRATED
COVER. WRAP GEOTEXTILE FABRIC
AROUND GRATE TO REDUCE THE
INGRESS OF SILTS INTO THE BORE
HOLE



JUMP UP SUMP DETAIL

GENERAL NOTES

- THIS IS AN ENGINEERING SURVEY PLAN, AND SHOULD NOT BE TAKEN AS A CADASTRAL OR IDENTIFICATION SURVEY. BOUNDARY DATA SHOWN IS TO BE TAKEN AS A GUIDE ONLY.
- SURVEYED BY OTHERS.
- ALL SITE LEVELS AND DETAILS MUST BE CHECKED AND APPROVED BY THE OWNER/BUILDER PRIOR TO COMMENCEMENT OF ANY WORK.
- INSTALLATION OF STORMWATER SYSTEMS TO COMPLY WITH AS3500.5 'NATIONAL PLUMBING AND DRAINAGE CODE'.
- REFER TO ARCHITECTURAL SITE PLAN FOR SET OUT DIMENSIONS.
- THE FINISHED GROUND LEVEL ADJACENT TO EXTERNAL FOOTING SHALL BE SET DOWN TO SUIT REQUIRED PAVING LEVELS AND FALLS. REFER TO ENGINEERING REPORT FOR PAVING DETAILS.
- COVER TO PIPES SHALL COMPLY WITH AS 3500.5. PIPES LESS THAN 200mm BELOW THE FINISHED SURFACE UNDER THE DRIVEWAYS SHALL BE ENCASED IN 100mm OF CONCRETE.
- PROVIDE SUITABLE PROPRIETARY FIRST FLUSH SYSTEM TO RAINWATER TANK INLETS, INCLUDING LEAF SCREENS ETC.
- THE STORMWATER DRAINAGE SYSTEM SHALL BE INSTALLED AS SHOWN. ALTERATIONS TO THE SYSTEM MUST BE APPROVED BY THIS OFFICE TO ENSURE THAT THE INTEGRITY OF THE DESIGN IS MAINTAINED.
- SITE CLASSIFICATION TO AS2870-2011 : CLASS P
- TREE REMOVAL TO BE CONFIRMED WITH OWNER PRIOR TO COMMENCEMENT OF ANY WORK ON SITE ANY CHANGES TO THE EXTENT SHOWN ON THIS DRAWING MUST BE CONFIRMED WITH THIS OFFICE
- THE RETAINING WALL/PLINTH INFORMATION SHOWN IS SPECIFIC TO THE EXTEND OF CUT AND FILL CARRIED OUT ON THIS SITE ONLY. THE DESIGN OF ALL BOUNDARY RETAINING/PLINTH SHALL BE CARRIED OUT TO REFLECT THE INFLUENCE OF ALL EXISTING EARTHWORKS, RETAINING WALL AND STRUCTURES.

LEGEND

- DN90 STORMWATER PIPE
- DN100 STORMWATER PIPE
- DOWNPIPES
- DOWNPIPES DRAINING INTO THE RAINWATER TANKS (SHOWN DPx) SHALL BE SEALED TO THE UNDERGROUND STORMWATER SYSTEM GRADE ALL SEALED SYSTEM STORMWATER TO FLUSH POINT
- FLUSH POINT IN SUMP
PROVIDE REMOVABLE SCREW CAP TO END OF PIPE IN SUMP TO ALLOW FOR PERIODIC CLEANING OF SEALED SYSTEM
- 150 PVC RISER + GRATE
- SUMP
(CLASS A GRATED COVER, U.N.O)
- INSPECTION POINT
- 2000 LITRE RAINWATER TANK/TANKS WITH 1000 LITRES DESIGNATED FOR ON SITE DETENTION.
ARRANGED IN ACCORDANCE WITH LOCAL COUNCIL SPECIFICATIONS AND DETAILS
REFER BROCHURE <https://www.marion.sa.gov.au/webdata/resources/files/Stormwater-Defention-Brochure.pdf>
- OVERFLOW AND RESTRICTED DISCHARGE ORIFICE
- FINISHED DESIGN LEVELS
- SURFACE FALL
- RETAINING WALL/CONCRETE PLINTH (0.2m MAX. HEIGHT) BY OWNER
- REMOVE EXISTING TREE
- DESIGN LEVEL:
TG- TOP OF GRATE
IL- INVERT LEVEL

| | | | |
|-----|------------------------------|------------|---------|
| D | DP LOCATIONS REVISED | 18/07/2019 | MM |
| C | ISSUED FOR BUILDING APPROVAL | 01/07/2019 | MM |
| B | CROSSOVERS AMENDED | 27/05/2019 | MM |
| A | ISSUED FOR PLANNING APPROVAL | 18/03/2019 | MM |
| REV | DESCRIPTION | DATE | CHECKED |

| | | | |
|-------------|-----------|----------------|-----------------|
| STATUS | APPROVAL | DRAWN NR | DESIGN NR |
| COUNCIL | MARION | DRAFT CHECK MM | DESIGN CHECK MM |
| DESCRIPTION | SITE PLAN | DRAWING No. | 19106-C01 |
| | | SHEET SIZE | A3 |
| | | REVISION | D |

T:\2019\19106\ACAD\CURRENT\19106-C01-REV.D.DWG



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PROJECT CARTER DEVELOPMENT
14 BAKER AVENUE,
MORPHETTVILLE, SA
CLIENT M&J CARTER

GENERAL DETAILS FOR RAFT FOOTING SLAB SYSTEM

SHEET NO: RSF1

SCALE: 1:20(A4)

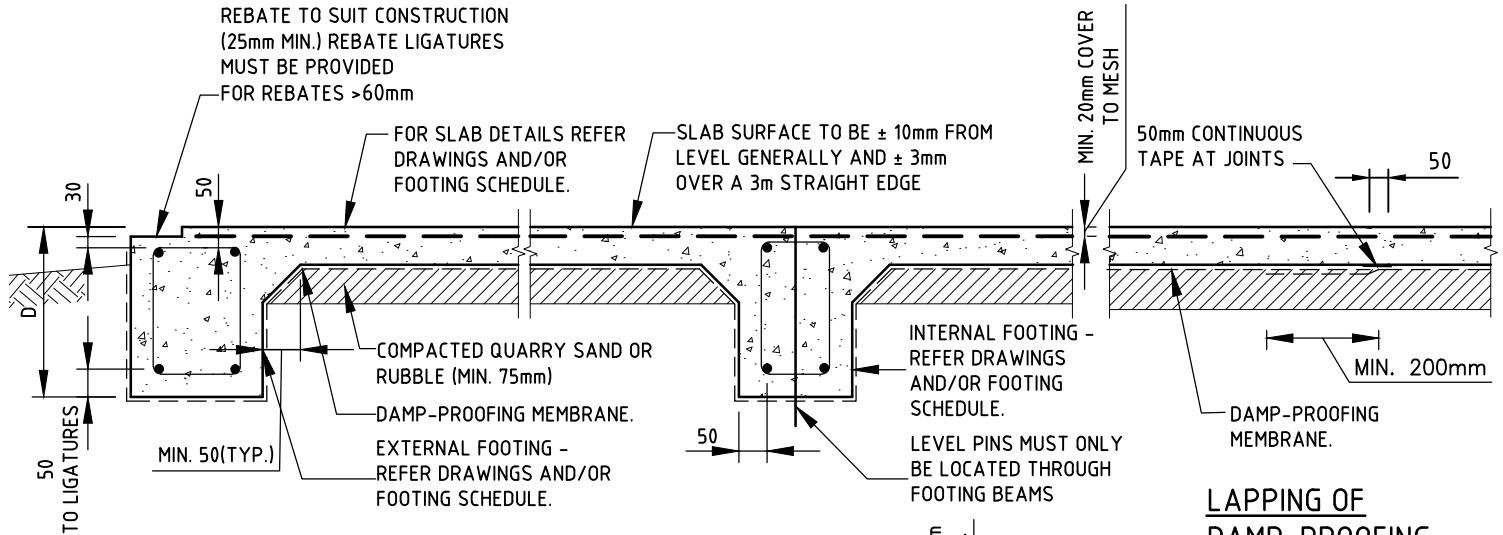
DATE: Jul-18

GENERAL REQUIREMENTS

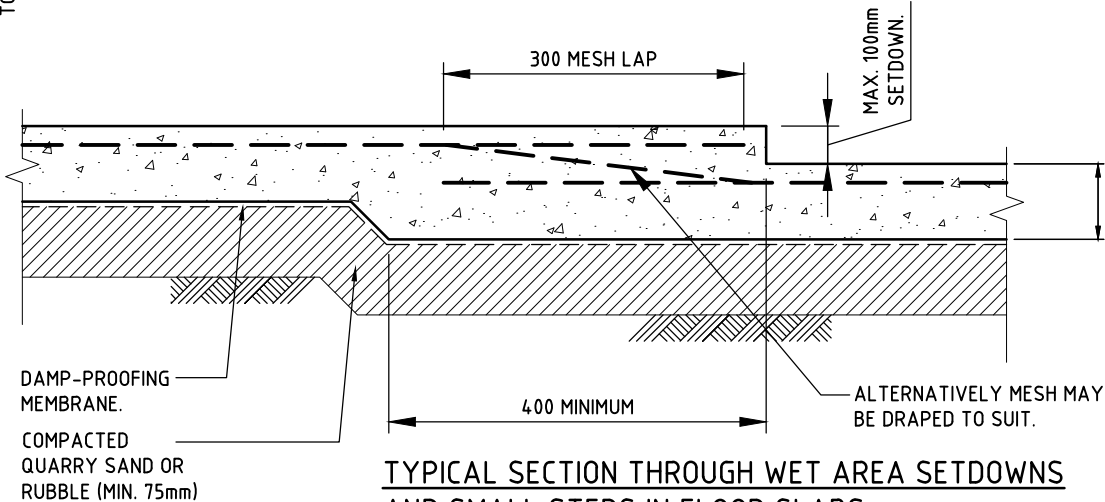
NOTE: DIMENSIONS SHOWN ARE FROM EXTERNAL FACE OF FOOTING TO HANGERS

ENSURE COLLAPSED TRENCHES ON EXTERNAL FOOTING BEAMS ARE LINED WITH FRC SHEETING ON THE EXTERNAL FACE (OR SIMILAR) BEHIND DAMP-PROOFING MEMBRANE TO PREVENT OVERPOUR ON THE EXTERNAL FACE OF FOOTING BEAM.

IT IS RECOMMENDED THAT SECTION C5.5 OF AS2870-2011 BE REFERRED IN RELATION TO REMEDIATION MEASURES THAT SHOULD BE CONSIDERED FOR ANY RESULTING OVER-POUR UNDER FORM BOARDS.



LAPPING OF DAMP-PROOFING MEMBRANES

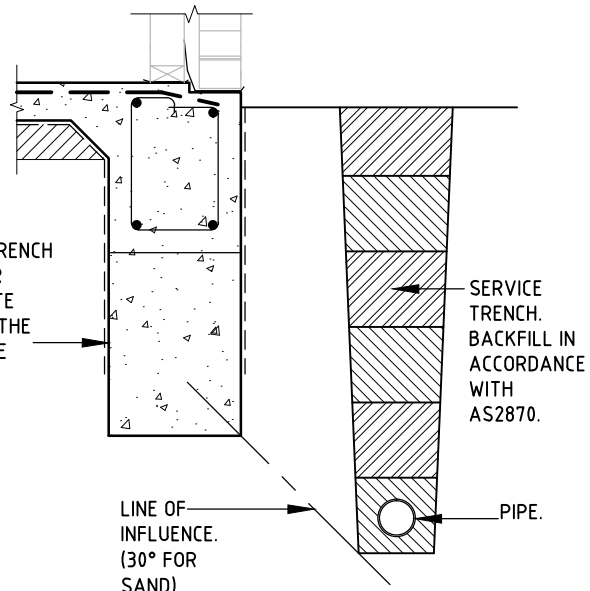


TYPICAL SECTION THROUGH WET AREA SETDOWNS AND SMALL STEPS IN FLOOR SLABS

FOOTING DETAIL ADJACENT TO SERVICES TRENCHES AND SIMILAR EXCAVATIONS

NOTE: UNLESS SHOWN OTHERWISE ON DRAWINGS PIERS SHALL BE MIN. 1000mm LONG WITH CLEAR SPACING NOT EXCEEDING 1500mm. PIERS SHALL NOT BE USED WHERE SOILS HAVE BEEN DESCRIBED AS HAVING COLLAPSE POTENTIAL OR ARE OF LOW BEARING STRENGTH. REFER TO SURFACE SOIL BORELOG.

CONTINUOUSLY TRENCH FOOTING BEAM OR PROVIDE CONCRETE PIERS TO BELOW THE LINE OF INFLUENCE SHOWN.

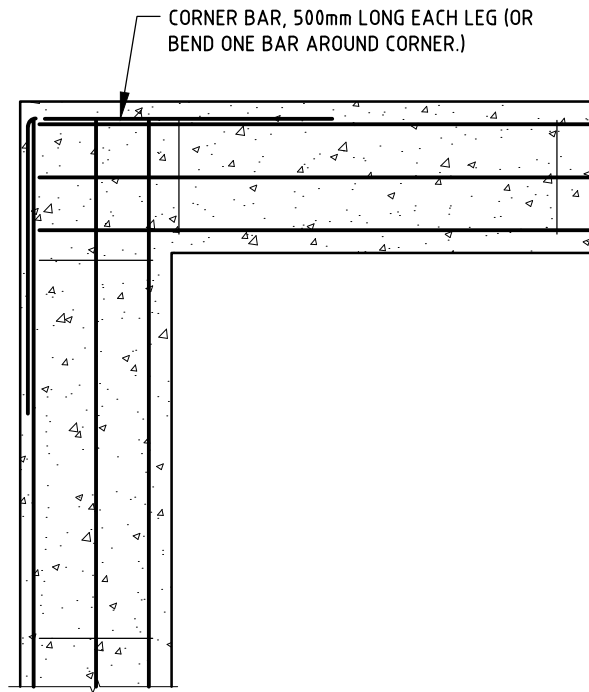


GENERAL DETAILS FOR RAFT FOOTING SLAB SYSTEM

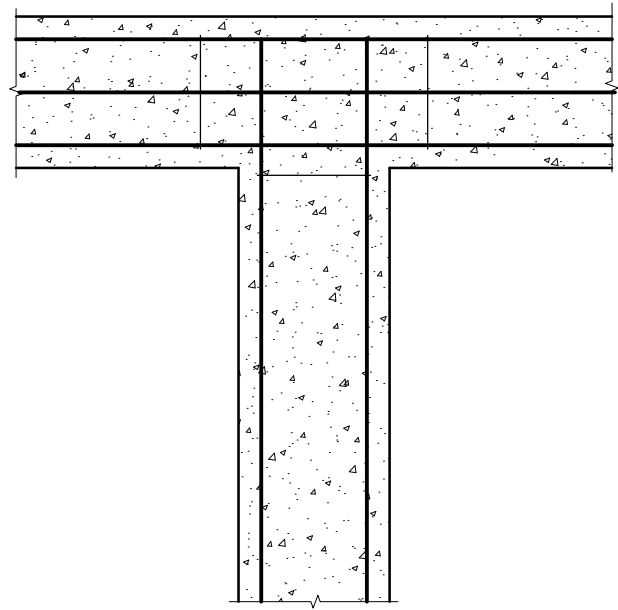
SHEET NO: RSF2

SCALE: 1:20(A4)

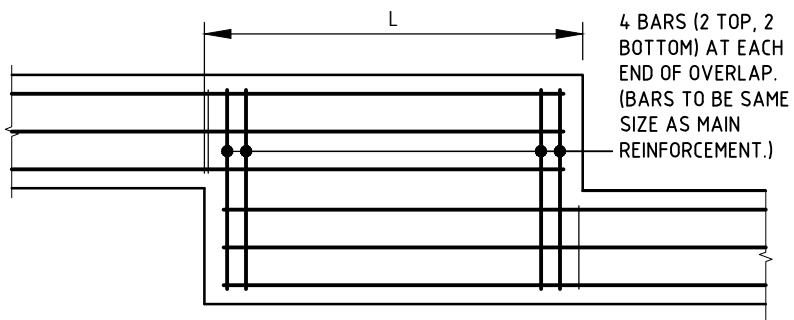
DATE: Jul-18



PLAN AT 'L' INTERSECTIONS

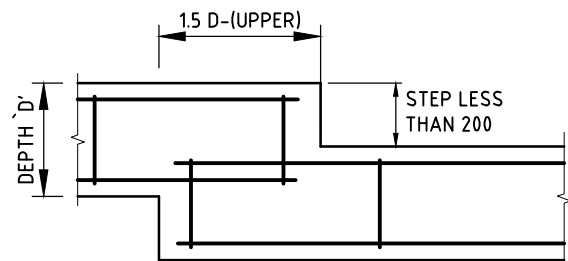


PLAN AT 'T' INTERSECTIONS



TYPICAL PLAN DETAIL OF 'OVERLAP' IN BEAMS

NOTE: DIMENSION 'L' SHALL BE AS SPECIFIED ON THE DRAWINGS BUT NOT LESS THAN 60 BAR DIAMETERS.



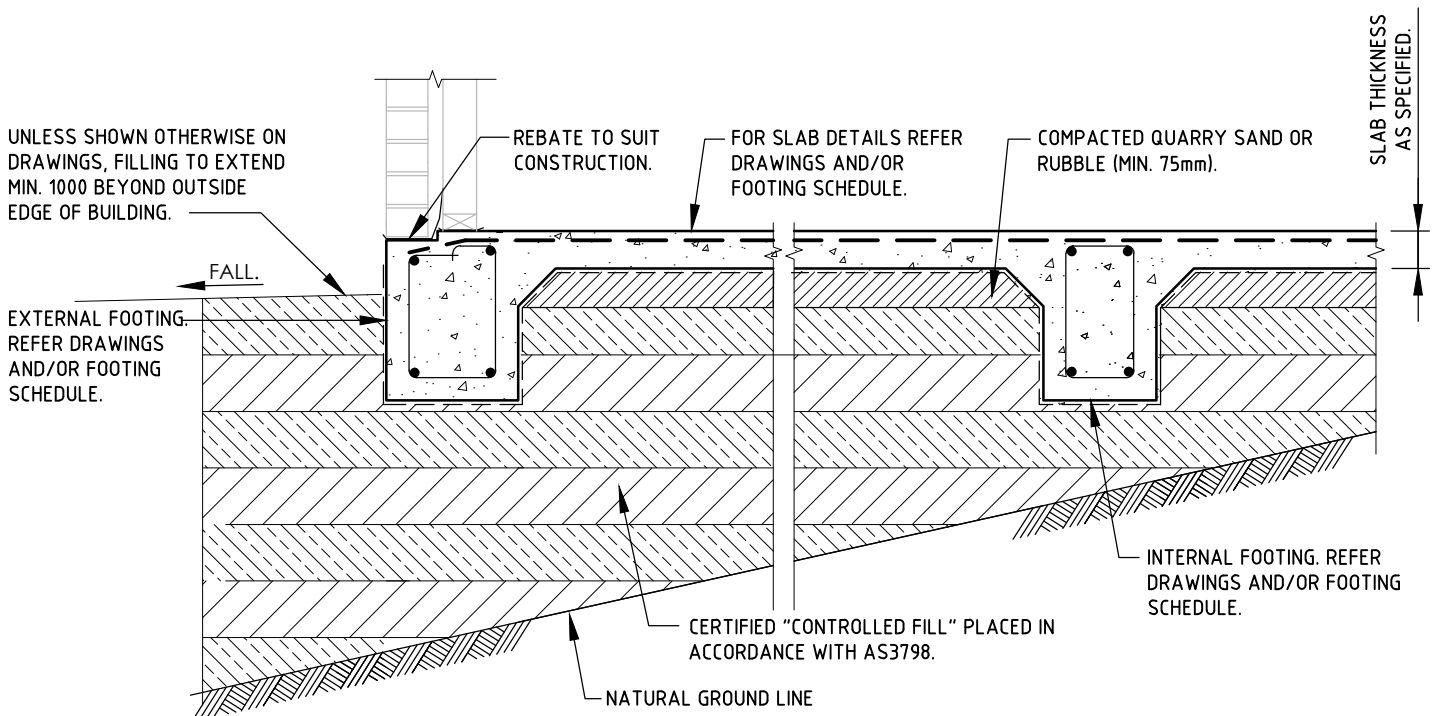
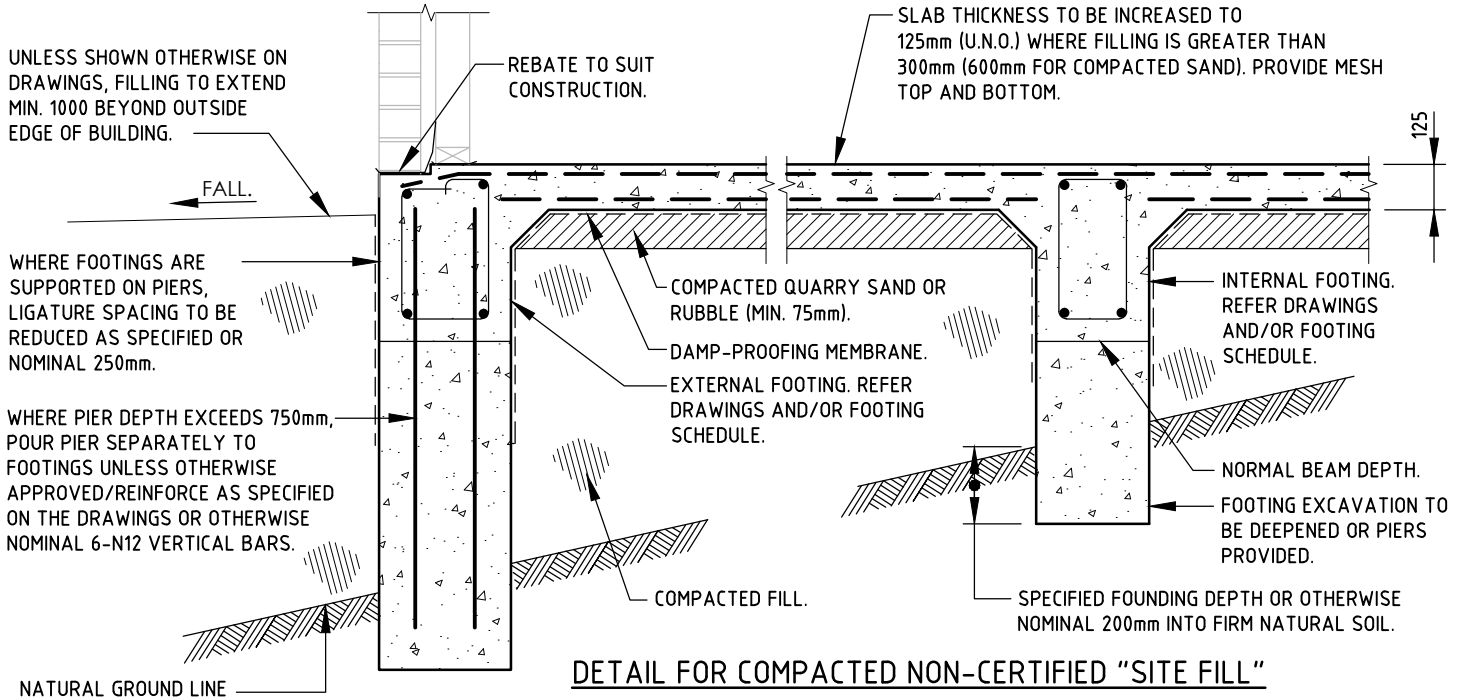
TYPICAL SECTION THROUGH FOOTING BEAM STEP DETAILS FOR STEPS LESS 200

GENERAL DETAILS FOR RAFT FOOTING SLAB SYSTEM

SHEET NO: RSF3

SCALE: 1:20(A4)

DATE: Jul-18

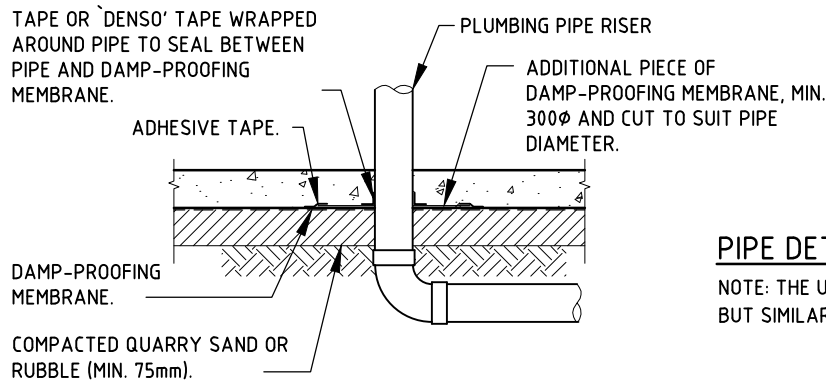


FOOTING SYSTEM TYPICAL SEWER & STORMWATER PIPE PENETRATIONS DETAILS

SHEET NO: FD3

SCALE: 1:20(A4)

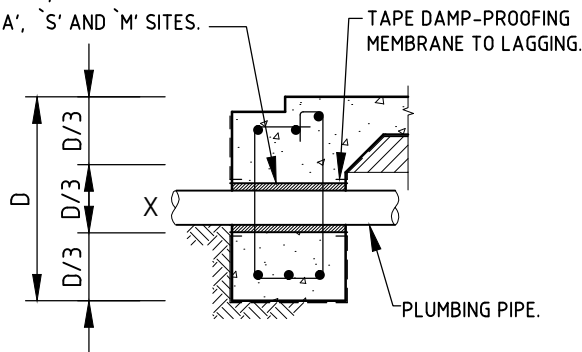
DATE: Jul-18



PIPE DETAIL THROUGH SLAB

NOTE: THE USE OF 'DENSO' TAPE IS RECOMMENDED, BUT SIMILAR EQUIVALENT IS ACCEPTED.

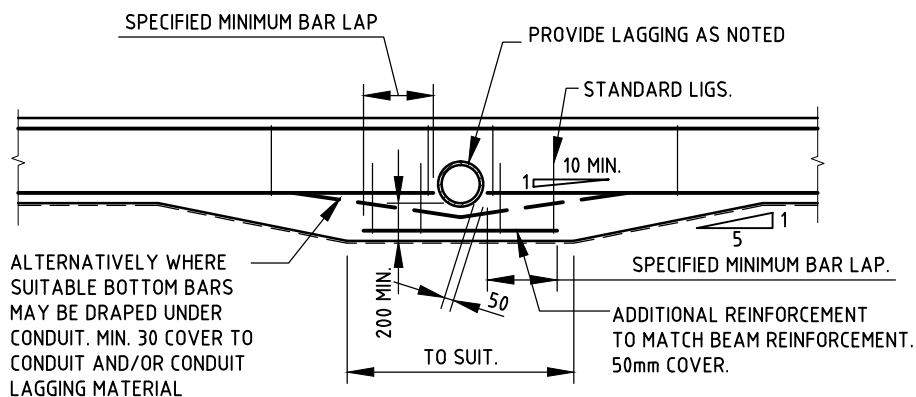
PROVIDE 40mm. CLOSED CELL POLYETHYLENE LAGGING (OR SIMILAR) ALL ROUND FOR CLASS 'H', 'E' & 'P' (U.N.O.) SITES, 20mm. LAGGING FOR CLASS 'A', 'S' AND 'M' SITES.



PIPE DETAIL THROUGH EXTERNAL FOOTING BEAM (STRIP FOOTING DETAIL SIMILAR)

NOTE: IT IS PREFERABLE TO PASS PIPES UNDER FOOTING, BUT IF IT IS NOT POSSIBLE, THEN ONLY IN ZONE MARKED 'X'

TYPICAL SECTION THROUGH INTERNAL FOOTING BEAM



TYPICAL SERVICE PENETRATION ELEVATION WHERE PIPE PASSES BELOW MID THIRD OF BEAM SCALE N.T.S.

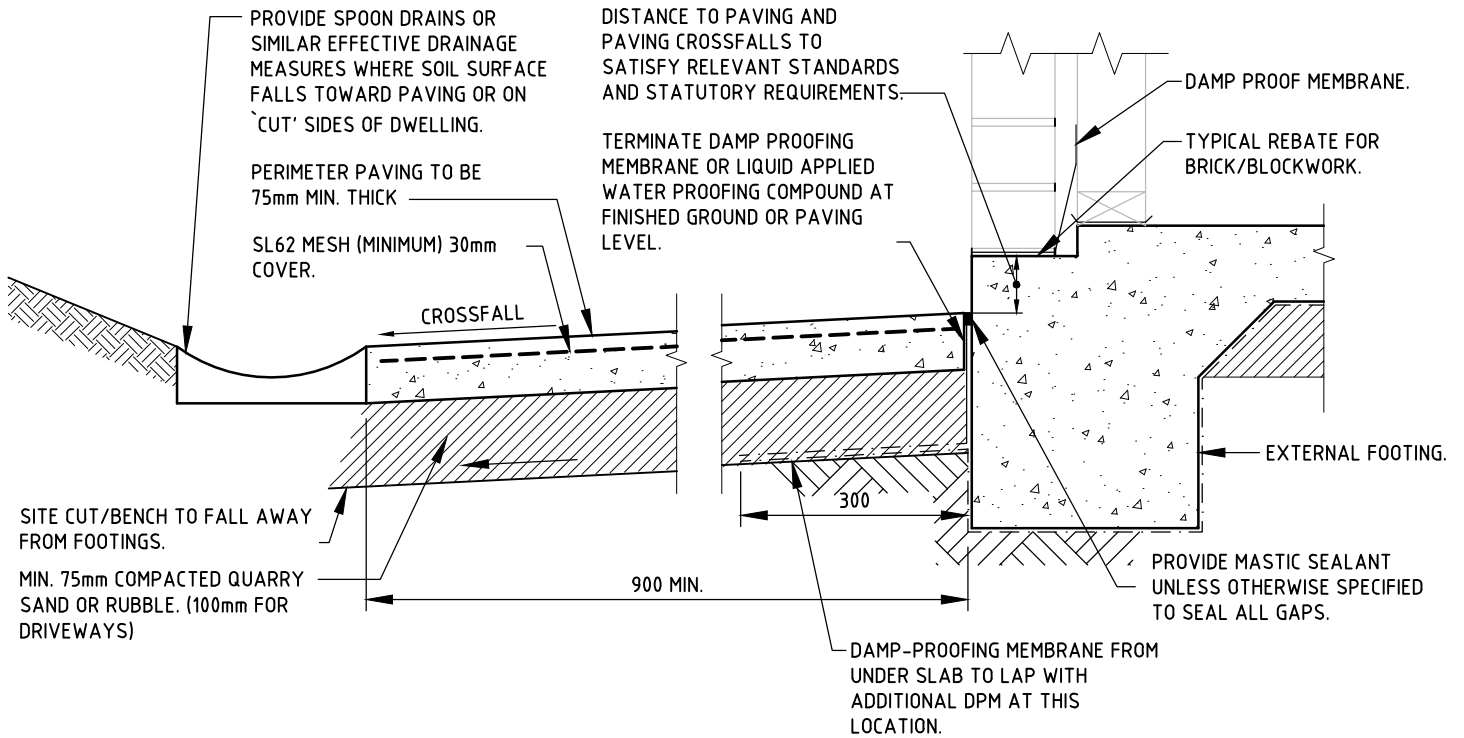
NOTE: REMOVE LIGATURES AS NECESSARY TO MAINTAIN HORIZONTAL ALIGNMENT OF TOP BARS

CONCRETE PAVING DETAILS FOR RESIDENTIAL SITES

SHEET NO: FD4

SCALE: 1:20(A4)

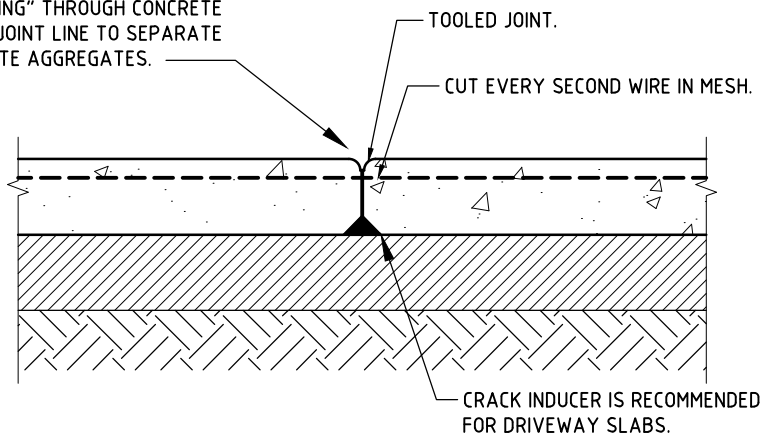
DATE: Jul-18



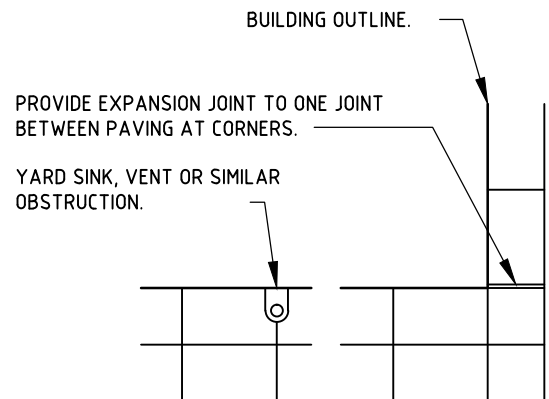
TYPICAL SECTION THROUGH EXTERNAL PAVING

NOTE: REFER TO AS3660 FOR PAVING SETDOWN REQUIREMENTS IN REGARD TO VISIBLE TERMITE INSPECTION ZONES AND TERMITE PROTECTION.

PROVIDE WEAKNESS PLATE
ALONG LINE OF JOINT BY
"CHOPPING" THROUGH CONCRETE
ALONG JOINT LINE TO SEPARATE
CONCRETE AGGREGATES.



TYPICAL TOOLED JOINT DETAIL



TYPICAL PAVING INTERSECTION DETAIL

NOTES:

1. MESH TO BE CONTINUOUS THROUGH JOINTS, WITH EVERY 2ND WIRE TO BE CUT.
2. ALL CONCRETE TO BE 20MPa UNLESS NOTED OTHERWISE.
3. JOINTS ARE RECOMMENDED AT BETWEEN 2.0M & 3.0M CENTRES TO ALL CONCRETE SURFACES, SUBJECT TO SLAB GEOMETRY
4. INSTALL CONNELLY KEY JOINTS OR SIMILAR WHERE SLAB SPANS EXCEED 20.0M
5. REINFORCEMENT MUST BE TAKEN TO WITHIN 50MM. OF EDGES AND CORNERS TO REDUCE DIAGONAL CRACKING ACROSS CORNERS.
6. PAVEMENTS FOR DRIVEWAYS AND OTHER AREAS SUBJECT TO VEHICULAR TRAFFIC SHALL BE MINIMUM 100mm THICK AND REINFORCED WITH MIN. SL72 MESH.
7. PROVIDE MASTIC SEALANT TO ALL GAPS BETWEEN PAVING SLAB AND THE EXTERNAL FACE OF THE FOOTING.

TYPICAL SEALED SYSTEM FLUSH POINT DETAIL

1. GENERAL

- 1.1 The specific type of building construction is stated in the Footing Construction Details specified in the Footing Construction Report.
- 1.2 The standard details shown are typical only, and specific items (e.g. footing dimensions, number of bars) are to be noted as in the Footing Construction Report.
- 1.3 Where specific requirements or details provided in the Footing Construction Report or on the drawings, conflict with these general specifications, the report and / or drawings shall take precedence. Some details may not be applicable to the site. Only appropriate details need be incorporated.
- 1.4 The specifications below shall apply unless noted otherwise.

2. DAMP-PROOFING MEMBRANE

- 2.1 The damp-proofing membrane shall be branded continuously 'AS 2870 Concrete Underlay, 0.2 mm High Impact Resistance' together with the manufacturer's or distributor's name.
- 2.2 The damp-proofing membrane shall be provided throughout the underside of all habitable areas and shall be continuous under all beams and slabs as depicted on the appropriate typical detail sheets.
- 2.3 All joints shall be lapped a minimum of 200 mm and sealed with a 50 mm wide strip of pressure-sensitive waterproof tape.
- 2.4 All service penetrations shall be securely flashed and taped. Perforation of the damp-proofing membrane shall be sealed before placing concrete.
- 2.5 Where the depth of the footing trench exceeds 800 mm, the damp-proofing membrane shall extend down the sides of the trench only.
- 2.6 Where the depth of the footing trench exceeds 1000 mm, provide two layers of damp-proofing membrane to full depth each side of the trench.
- 2.7 Where strip footings are continuous beyond the slab (e.g. carports, footings), the sides and base of the strip footings shall be lined with a damp-proofing membrane for a distance of not less than 600 mm beyond the edge of the slab, unless Clause 2.5 prevails.
- 2.8 The damp-proofing membrane is not mandatory under exposed slabs (carports, verandas, etc) where they are poured separately to the footing beams. Where future enclosure of carport or similar structure is proposed, then it is a requirement to provide the damp-proofing membrane.

3. LEVEL PINS

- 3.1 Level pins puncturing the damp-proofing membrane may be used in the footing trenches but must not be used in the area of the floor slab.
- 3.2 Level pins shall have 30 mm cover to all reinforcement.
- 3.3 Any pins used to support service pipes must be driven to a minimum of 30 mm below the finished floor level, and be fully taped to the pipe.

4. SERVICE PENETRATIONS AND FLEXIBLE CONNECTIONS

Service penetrations are permitted through footings subject to the following requirements:

- 4.1 A minimum of 50 mm cover shall be provided between the pipe and any reinforcement.
- 4.2 Pipes shall be placed through the middle third of the footing beam depth. Penetrations outside this area may require additional concrete depth or reinforcement. Where any reinforcement is cut to suit the location of pipes, additional reinforcement shall be provided, correctly placed and lapped with the main reinforcement. Such reinforcement shall be in accordance with standard detail sheet SD3 "General sewer and stormwater pipe penetration details through footing beams and slab" and / or to the direction of the Engineer inspecting the work.

- 4.3 Where the pipe is close to the bottom bars and adequate cover is not available, additional excavation must occur below the pipe and the bottom rods placed and lapped so as to provide the correct cover.
- 4.4 Pipes embedded within the floor slab shall generally have 100 mm of cover over the pipe. Where this cannot be achieved the minimum cover may be reduced to 40 mm provided that the reinforcing fabric is continuous over the pipe, and the sand/ rubble base is excavated to provide 100 mm of concrete all around the remainder of the pipe.
- 4.5 Holes provided for service penetrations through the floor slab shall not exceed 600 mm square without approval from the Engineer.

5. CONCRETE

- 5.1 Construction methods, materials, tolerances and finishes are to comply with AS 3600 Concrete Structures Code and all other relevant Australian Standards, the National Code Construction Series (Building Code of Australia) and any specific requirements of the Local Council.
- 5.2 Unless otherwise specified, concrete shall be as follows:
 - Grade N20 (i.e. 20 MPa) to slab on ground, footings protected by damp-proofing membrane and residential strip / pad footings;
 - Grade N25 to suspended slabs, beams and columns and non-residential footings unprotected by damp-proofing membrane;
 - Grade N32 to members in exposed exterior environments or where concrete is to have a polished finish;
 - Maximum aggregate 20 mm; Slump 100 mm in accordance AS1379.
- 5.3 For sites within 100m of the shoreline of large expanses of salt water (1km for areas subjected to breaking surf) or heavy industrial areas where surfaces (e.g. verandahs, balconies, carports) are exposed, the surface shall be protected with suitable approved topping, sealer, tiles etc or the concrete grade shall be not less than N32 (N40 for high permeability soils in groundwater).
- 5.4 For sites containing high sulphate or highly saline soils (or in heavy industrial areas), the concrete surface is to be protected from the aggressive soil by a 0.2 mm branded and certified damp-proofing membrane. Alternatively, use a concrete grade of N32 or greater (N40 for high permeability soils in groundwater).
- 5.5 Concrete shall be supplied in accordance with AS 1379-2007 The specification and supply of concrete. Site mixed concrete shall not be used without written approval from this office.
- 5.6 Project control testing is not required, unless specifically noted elsewhere in the contract documents.
- 5.7 Sulphate-resisting cement (Type SR - AS 3972-2010 General purpose and blended cements) shall be used when specified, or when it is known by the owner, builder, local council, or concrete supplier that this cement should be used at the site.
- 5.8 Chemical admixtures may be used, provided the concrete supplier accepts responsibility for their use.

Placement of Concrete

- 5.9 The concrete shall be placed as close as possible to its final position, and the pour shall proceed in one continuous operation, ensuring that no more than 45 minutes elapse before placing fresh concrete against previously placed, in order to eliminate 'cold joints'.
- 5.10 To ensure that the concrete is thoroughly, all concrete shall be mechanically vibrated and all excess air voids removed. Care shall be taken to ensure that the concrete does not become segregated by local over-vibration.
- 5.11 Construction joints will not be permitted in the footings without approval from the Engineer, with the only exception where noted on the detail drawings. If a raft footing system is specified it is required that the footing be poured integrally with the floor slab. If it is necessary to pour the footing beams separately to the floor slab, the beams shall be poured to a level exposing the top reinforcement by approximately 100 mm. Where construction joints are used, the concrete surface shall be formed up vertically and the hardened surface of the first pour shall be thoroughly cleaned of all laitance, dirt, loose aggregate etc. The hardened concrete shall be thoroughly wetted and neat slurry shall be applied to its surfaces in a thin layer cement immediately prior to pouring fresh concrete.
- 5.12 The construction of a slab shall achieve the following dimensional tolerances:
- The cover to the reinforcement from the surface in contact with the ground shall be within +40 mm and -10mm of the specified cover, except that the bottom cover to beams may be increased where the beams are deeper than specified;
 - The cover to the reinforcement from the internal surface shall be within +20 mm and -10 mm of the specified cover;
 - The surface level to be within +10 mm of the specified finished floor level (for levelness);
 - In the absence of any specification, a steel trowel finish with a tolerance of +/-5 mm from a 3 m straightedge shall be used (for flatness);
 - The thickness of the slab and the width and depth of the beam shall not be less than the specified Dimension in the Footing Construction Report;
 - More stringent tolerances may be required for some applications such as polished concrete floors where the reflection from the surface may highlight slight undulations.

Curing

- 5.13 Curing of the slab shall commence as soon as possible after the pour and no later than 3 hours.
- 5.14 Curing may be achieved by covering with polythene sheeting for a minimum of 7 days, or by spraying with an approved curing compound, subject to compatibility with the proposed surface finishes and providing the concrete is sprayed immediately following the final finishing of the slab surface.

Hot Weather Concreting

- 5.15 Concrete shall not be poured when the forecast temperature exceeds 36° Celsius, without specific approval from the Engineer.
- 5.16 When the forecast temperature is between 32° Celsius and 36° Celsius pouring will only be permitted under the following conditions:
- When pouring can be completed prior to the air temperature reaching 32° Celsius.
 - When the site is protected from hot drying winds.
 - When the slab surface can be covered with plastic sheeting, or hessian (kept wet), within 2 hours of finishing.

6. REINFORCEMENT

- 6.1 In accordance with AS/NZS 4671-2001 Steel reinforcing materials, reinforcement designations are:
- | | |
|---------------------------------|---------------------------------|
| - R: Plain round structural bar | - N: Hot rolled deformed bar |
| - F: Hard drawn wire fabric | - SL: Square ribbed fabric |
| - W: Hard drawn wire bar | - RL: Rectangular ribbed fabric |
- 6.2 Reinforcement shall be supported on concrete blocks or bar chairs, or suspended from formwork.

- 6.3 Reinforcement shall be placed evenly throughout the footing system, the reinforcement must be straight and adequately wire-tied to prevent any movement and to hold it in the correct position during pouring of concrete.
- 6.4 Fabric shall be supported on concrete blocks or bar chairs, placed under the intersection of cross wires at 800 mm x 800mm (maximum centres). Where the base for the slab is soft, provide spreader pans for bar chairs and / or close up the support centres as necessary.
- 6.5 Where rod reinforcement is spliced, the minimum lap lengths shall be:

| Bar Size | N12 | N16 | N20 | N24 | N28 | N32 | N36 |
|-----------------|-----|-----|------|------|------|------|------|
| Lap Length (mm) | 500 | 750 | 1000 | 1450 | 1800 | 2150 | 2600 |

- 6.6 Fabric shall be lapped one full square plus 25 mm at all joins.
- 6.7 Where brittle floor coverings are to be used (e.g. tiled areas), additional measures are required to control the effect of shrinkage cracking.

Such measures shall include one or more of the following:

- A flexible grout bed shall be provided, 'Resaflex' or similar.
- The placement of floor coverings shall be delayed.
Note: A minimum of 6 months drying of the concrete is usually required before the placement of brittle floor covering.
- Installation of control joints within the brittle floor coverings where the area exceeds 20 m².
- 2 layers of SL72T (or 1 layer of SL92T).

Cover

- 6.8 Clear concrete cover to reinforcement, (including fitments and wire ties) shall be:
- Internal slab on fill (excludes carports): 30 mm bottom and sides, 20 mm top.
 - Footings protected by damp-proofing membrane: 40 mm bottom and sides, 20 mm top.
 - Residential footings unprotected by damp-proofing membrane: 40 mm top, 50 mm bottom and sides.
 - Non-residential footings unprotected by damp-proof membrane: 50 mm top, bottom and sides.
- 6.9 If footing beams are over-excavated, the reinforcing 'cage' must be positioned such that the steel cage is to be kept towards the top of the footing beam.

7. EDGE REBATES

- 7.1 Edge rebates shall be provided to all masonry cavity or veneer walls.
- 7.2 The minimum rebate depth shall be 25 mm, but may be increased to suit masonry coursing. The maximum rebate depth shall be 100 mm.
- 7.3 Rebates are not required for single leaf masonry walls, timber frame clad walls or walls on strip footings.

8. HEATING CABLES AND PIPES

- 8.1 Electric heating cables may be embedded in the slab without any increase in thickness.
- 8.2 Hydronic heating pipes may be embedded in the slab provided the slab thickness is increased by 25 mm. An additional layer of fabric (SL42 or larger) shall be provided under the pipes. The main fabric shall be placed with 20 mm cover to the top face.

9. SLABS ON FILL

- 9.1 Filling used under a slab, (whether existing on site or placed during site works) except where the slab has been designed as suspended, shall consist of controlled fill or rolled fill.

9.1.1 Controlled fill is material that has been placed and compacted within a defined moisture range, in layers by compaction equipment to a defined density requirement. Except as provided below, controlled fill shall be placed in accordance with engineering principles. One test for each 100 m² of building area (or 3 tests minimum per visit - whichever is greater) is required for every 600 mm thickness of compacted material.

Sand fill, well compacted in not more than 300 mm layers by a vibrating plate or vibrating roller, shall be deemed to comply with this requirement. This will need to be verified using acceptable testing methods.

Non-sand fill well compacted in not more than 150 mm layers by a mechanical roller, shall be deemed to comply with this requirement. In accordance with AS 1289 .5.1.1-2003 (Standard compactive effort), non-sand fill shall be compacted to 95% maximum dry density when tested.

9.1.2 Rolled fill consists of material compacted in layers of repeated rolling by an excavator. Rolled fill shall not exceed 300 mm compacted in layers of not more than 150 mm.

- 9.2 The fill shall be tested to ensure that it has been compacted to the specified density, OR

- The slab shall be increased in thickness by 25 mm, and reinforced with an additional layer of fabric (of the same size as the top fabric), placed with 30 mm cover to the damp-proofing membrane. The thicker slab, and additional fabric, shall be provided to the full area of any floor panel (maximum panel size of 20 m²) (i.e. from beam-to-beam) over the deep fill, OR
- Piers 600 mm (minimum) square shall be provided under the slab panel, extending to the specified minimum footing founding depth. Piers shall be located such that the distance between adjacent piers, or between a pier and a footing beam, does not exceed 1.8 m.
- The above requirements may be waived when the Engineer is satisfied that the design / proposed construction is adequate.

10. TERMITE PROTECTION

- 10.1 Termite protection systems shall be in accordance with AS 3660.1-2000 Termite management – New building work.

1. **EARTHWORKS**

- 1.1 Statutory requirements giving the relationship between finished floor level, road levels, external paving and/or the sewer flood gully, and paving requirements, must be adhered to with any discrepancies reported immediately to an engineer in our office prior to any works being commenced.
- 1.2 Unless otherwise specified in the footing construction report, selected approved site materials, excluding topsoil or organic-bearing soil, may be used for compacted filling. Where site materials are unsuitable because of their nature or moisture content or environmental impact, quarry rubble or other approved filling material may be used.
- 1.3 Where the surface slope of an area which is to receive filling is steeper than the ratio 1 (vertical) in 8 (horizontal), a series of berms (level benches) must be excavated along the contour over the whole of the area which will receive filling. This will stabilize the fill against downhill slip.
- 1.4 Care must be taken when using vibrating rollers/machinery. If there are buildings close to the area being compacted and there is concern regarding potential damage to surrounding structures our office should be contacted immediately.
- 1.5 The footings specified in the footing construction report have been proportioned assuming that the builder will achieve the specified compaction. No footing beam shall be founded in the filling unless the Engineer has checked its compaction standard and given his written acceptance of its compliance with the specifications.
- 1.6 If the builder chooses to place shallow filling without the use of appropriate compaction equipment, the filling will be assumed to be incapable of supporting any building loads, and any concrete slab over such filling will be have increased thickness and reinforcement (refer to the standard details for the specified footing type which shows these additional requirements). The Engineer may waive this requirement if his inspection and/or checking of the filling shows it will be able to support floor slabs or other loads. Note that settlement of loose fill can lead to damage to pavements, services etc.

2. **EXCAVATOR**

- 2.1 It is imperative that sufficient supervision of the cut and fill operation is provided in order to ensure that satisfactory completion of the siteworks and drainage scheme proposal are adhered to.
- 2.2 Vegetation and roots must be scraped off and removed from the building area at the commencement of cutting and filling. Unless otherwise noted, or determined on site during excavation, unsuitable topsoil may be taken as the top 100mm of the natural soil profile.
- 2.3 Where trees and large shrubs are removed from reactive clay soils, the surrounding soils, where desiccated, must be watered for a suitably sufficient period to raise the moisture content to that of the other soils unaffected by the desiccating effect of the trees and shrubs (Also refer Clause 3.4).
- 2.4 Filling under a slab (except where the slab is suspended) shall consist of controlled fill or rolled fill as follows:
 - Controlled fill is material that has been placed and compacted within a defined moisture range in layers by compaction equipment to a defined density requirement. Except as provided below, controlled fill shall be placed in accordance with engineering principles.
 - Sand fill up to 800mm deep, well compacted in not more than 300mm layers by a vibrating plate or vibrating roller, shall be deemed to comply with this requirement. Sand fill shall achieve a blow count of 7+ per 300mm using a penetrometer to AS 1289 6.3.3.
 - Non-sand fill up to 400mm deep, well compacted in not more than 150mm layers by a mechanical roller, shall be deemed to comply with this requirement. Clay fill shall be at near equilibrium moisture condition during compaction. Non-sand fill shall be compacted to 95% max. dry density when tested in accordance with AS 1289 5.1.1.
 - Rolled fill consists of material compacted in layers by repeated rolling by an excavator. Rolled fill shall not exceed 600mm compacted in layers not more than 300mm for sand material or 300mm compacted in layers not more than 150mm for other material.
 - Any existing fill shall be considered as uncompacted unless the fill is certified as controlled fill.

- 2.5 The extent of the cut and fill outside the building line shall comply with the following requirements:
- Cut or fill on the boundaries should not exceed 600mm (unless a suitable retaining wall is specified in the site plan), and shall not undermine any structure that exists on an adjacent property.
 - Generally cut or fill within the property (i.e. not on boundary) should not exceed 800mm (unless a suitable retaining wall is specified in the site plan).
- 2.6 Where bank heights do not exceed 1.5m and the natural slope of the site does not exceed a ratio of 1 in 5, the batter slopes recommended below may be used.

| Material | Surface slope (Max.) |
|---|------------------------------|
| Stiff clays | 1 vertical to 1 horizontal |
| Sands/cohesionless soils | 1 vertical to 2 horizontal |
| Stiff sandy clays and silty clays | 1 vertical to 1.5 horizontal |
| Weathered rock in good condition (Visual assessment can be provided by this office upon request.) | 1 vertical to 0.5 horizontal |
| Rock in very good condition (Sound Rock) | Nearly vertical |

- 2.7 If a retaining wall has been specified, the cut/fill must not exceed the design height of the wall.
- 2.8 Slopes and grades of the cut bench or platform shown on the site plan are to be strictly adhered to, this is to allow for the site to be drained. In particular, a temporary toe may need to be cut in the ground at the base of cut banks to provide a drain, with a fall sufficiently to the low side so that water does not pond. On sites where erosion may be a critical problem (eg. Sand sites), provision of trench drains above the cut bank may be required to prevent erosion during the construction phase.

3. **SITE PREPARATION**

- 3.1 Upon completion of primary earthworks the site must be prepared for footing construction. Ideally, for raft construction, or strip footings where the soil surface under the floors is sealed, soils beneath the building area should be kept in as moist a condition as possible. For strip footings where the soil surface under the floors is not sealed, the building area should be kept as dry as possible.
- 3.2 For concrete floors provide a working surface of a minimum compacted thickness of 75mm of quarry sand or rubble or other approved material. The surface must be free of any sharp aggregate which could damage or penetrate the vapour barrier. Blinding sand shall be provided where necessary.
- 3.3 On sites where the overall soil profile is defined in the footing construction report as Highly Reactive or Extremely Reactive, pre-wetting of soil under slabs is most advantageous, especially if construction occurs in summer or autumn. In some cases, pre-wetting of the site will be mandatory, but in all cases it is a desirable procedure to reduce the future heave of reactive clays. Pre-wetting is to be carried out by watering the site before under-floor fill is placed, using garden sprinklers for a minimum of 2 hours continuous daily for up to 14 days immediately prior to commencement of construction. The amount of pre-wetting will vary considerably depending on seasonal and soil conditions, and it may be possible to eliminate watering if construction commences after prolonged rain. Care must be taken to ensure that the soil does not become too saturated, otherwise siteworks/excavation may be difficult. Once the site has been pre-wet, the under-floor filling must be placed within a period of not more than 2 days.

- 3.4 The soils in the vicinity of trees/shrubs will be naturally desiccated. Where existing trees/shrubs are removed from Highly reactive and Extremely reactive soil sites, the resultant excavation of the removal of the tree(s)/shrub(s) shall be widened to approximately 1.5m to 2.0m in diameter. The resultant hole from the tree(s)/shrub(s) removal shall be kept filled with water for a period of at least 2 weeks. After this period the excavation shall be backfilled in layers with a moist clayey soil, and compacted as specified in Section 6.4.2 of AS 2870 – 2011. The above process must be completed prior to the construction of the footings. It may be possible to eliminate watering where the trees are removed prior to prolonged periods of rain before the footings are constructed, this must be confirmed with an engineer from our office.
- 3.5 If an existing residence on the property is removed and the residence is of timber floor construction, then the soils under the floor will be naturally desiccated. Construction of the new footings shall not commence on these desiccated soils until the soils are left exposed for a sufficient period of time to enable them to achieve a moisture content similar to the surrounding previously exposed soils. We strongly recommend that the site is pre-wet in accordance with section 3.3.
4. **SITE DRAINAGE**
- 4.1 Moisture variation (i.e. wetting or drying) is one of the main cause of movement in clay soils. Site drainage is an important factor in the life of the building as it reduces the chance of footings having to cope with extremes of soil movement.
- Common causes of moisture variation are given below.
- Wetting up**
- 4.2 Sloping sites and inadequate drainage causing water to pond or collect close to the building.
- 4.3 Leaking sewer, water or stormwater pipes.
- 4.4 Over-watering of gardens and lawns.
- 4.5 Downpipes discharging adjacent to the building.
- 4.6 Seepage on sloping sites caused by water travelling on the topsoil-clay, or soil-rock, interface. Cut-off drains are required in this situation.
- 4.7 Gardens or lawn watering immediately adjacent to the footings. As a general rule this is not acceptable and must not be done without approval of an Engineer from our office.
- 4.8 Inadequate soakage trenches to septic tanks, stormwater drains.
- 4.9 Flooding during, and after, building construction.

Drying out

- 4.10 The non-provision of paving, particularly on the north and west sides of the building, coupled with the non-establishment of a garden.
- 4.11 A change from an established garden situation to a native garden coupled with a substantially reduced level of watering.
- 4.12 Trees and large shrubs require substantial amounts of water, and if the soil near the tree dries out, the roots will extend in search of soil moisture. Clays will shrink as they dry, and the building may settle. Removal of large trees creates the opposite problem. As soil moisture is gradually restored, clays swell and may lift shallow footings.

Many factors determine the extent of clay-drying by trees, mainly the soil type, the size and number of trees, and their species. Trees obtain moisture from roots that spread sideways and the drying zone is influenced by the extent of these roots. For single trees, the drying zone is usually one-half to twice the tree height, but the zone may be larger for groups or rows of trees. Although it is known that the species can influence the extent and severity of the drying zone, little definite information is currently available. Some Australian trees are particularly efficient in extracting water from very dry soils and can be more dangerous than non-Australian species that use large amounts of water in normal conditions. The effect of tree drying on the amount of movement is also related to the reactivity of the clay. To minimize the risk of damage, trees (especially groups of trees) should not be planted near the house on a reactive clay site, and the distance of the tree from the building should be at least 0.75 "h" for Moderately reactive soil sites, 1.0 "h" for Highly reactive soil sites, and 1.5 "h" for Extremely reactive soil sites, where "h" is the eventual mature height of the tree. These values should be increased by 50% if the trees are in a dense group. If larger trees are desired, it may be practical to adopt a specially designed footing system, e.g. piled footings.

- 4.13 To minimize the detrimental effects of the above factors the following work must be carried out:
- Establish lawns and gardens around the building as soon as possible, within a maximum of 6 months of occupation of the building.
 - Ensure all roof storm water is discharged to the street where possible or alternatively discharged on the low side of the site not less than 7m from the building, ensuring that the flow of water is not concentrated onto the neighbouring property. Stormwater pipes shall be of a size to suit the design flow, and shall have a grade of not less than 1 in 100 away from the building. All trenches for pipes shall have a grade of the same magnitude and direction as the pipe.
 - Large garden beds should not be located near the building. This will avoid the possibility of introducing too much moisture to the foundation soil by over watering. The zone near the building should be planned for paths or covered with gravel and plastic sheeting.
 - After constructing footings, the surface adjacent to the footings shall be graded by cutting and/or filling to provide a fall away from the building for a distance of not less than 1.0m. Any channel formed must be graded to discharge runoff away from the building area. Generally, any cut area shall be drained via a surface drain at the base of the cut embankment discharging to the low side of the site. On sites where significant catchment area is present uphill from the building, a surface drain must also be constructed across the top of the embankment.
 - Water must not pond within surface footing beams or adjacent to footings. If this occurs water must be pumped out immediately and the above grading and drainage implemented.
- 4.14 Where specified in the recommendations or shown on the site plan, sub-surface drainage shall be installed in accordance with details provided.

Note: Potential seepage or sub-surface drainage problems cannot always be recognised from the results of the site investigation. All the potential problems with respect to sub-surface water flow or seepage may not be evident at the time of the investigation, or even at the time of construction.

- 4.15 Due to constraints of site and building levels, the cover to underground pipes may be less than the manufacturer's specifications. This is necessary to prevent very significant cost increases in site works which would otherwise be required. Some damage (which must be repaired immediately) may occur to pipes if trenching for other services is undertaken, or if vehicles travel over garden areas. Modifications to site levels can be made if the owner does not accept these conditions.
- 4.16 Where site drainage designs are not included with this report, they shall be prepared by others experienced in site drainage, and shall comply with the details and requirements of this Report.
- 4.17 The following table, and attached drawings, show typical details for drainage away from the building; refer to site works plan to determine which details are appropriate.

| Site Class | Comments on perimeter paving | Min slope 1 in | | | |
|--------------------|---|----------------|----------|-------------|---------|
| | | Paving | | Open Drains | |
| | | sealed | unsealed | lined | unlined |
| A or S | Paving not mandatory, provided surface sheds water away from building for a minimum of 1.2m. | 40 | 20 | 200 | 100 |
| M | Paving desirable but not mandatory, provided surface sheds water away from building for a minimum of 1.8m. | 30 | 20 | 100 | 75 |
| H1, H2 or P | Paving mandatory on uphill side, and desirable, but not mandatory, on side slopes and downhill side, provided surface sheds water away from building for a minimum of 1.8m. | 25 | 15 | 75 | 50 |
| E | Paving mandatory | 20 | 10 | 50 | 30 |

5. **PAVING REQUIREMENTS**

- 5.1 Concrete pavements shall comply with the following table:

| Site Class | Minimum Cross Fall: 1 in | For Foot Traffic Only | | For Light Vehicle Traffic | |
|--------------------|--------------------------|-----------------------|---------------|---------------------------|---------------|
| | | Thickness (mm) | Reinforcement | Thickness (mm) | Reinforcement |
| A or S | 50 | 75 | * | 100 | SL72 |
| M | 30 | 75 | * | 100 | SL72 |
| H1, H2 or P | 25 | 75 | SL62 | 110 | SL72 |
| E | 20 | 100 | SL62 | 120 | SL72 |

* SL62 mesh is not mandatory, but is recommended to limit shrinkage cracking.

- 5.2 Control joints shall be provided in concrete pavements in accordance with the enclosed standard details or otherwise in accordance with the recommendations of the Cement and Concrete Association of Australia.
- 5.3 Alternative pavements may be provided, e.g. brick or block pavers, hotmix etc. Construction must be in accordance with the manufacturers' or suppliers' specifications.

- 5.4 Perimeter pavements shall not be less than 900mm in width (unless noted elsewhere on the site plan).
- 5.5 Paving shall be constructed on a firm clean ground base. Ensure that all building debris is removed from under paving areas. Provide a compacted quarry rubble base if necessary to elevate paving and achieve the necessary falls.
- 5.6 The paving shall not be constructed above any damp-proof course or built-in damp-proof membrane, unless other adequate damp-proofing measures are taken. (Refer to the standard detail for the appropriate footing type for a typical detail of the junction between the pavement and the footing).
- 5.7 On reactive soil sites it may be found that paving separates horizontally from the perimeter of the building. It is important that any gaps between the building and paving be immediately sealed with a flexible mastic sealant.

6. **GRADIENTS OF DOMESTIC DRIVEWAYS**

- 6.1 The maximum gradients of driveways at domestic properties shall be as follows, unless specifically required or permitted otherwise by the local regulatory authority (e.g. local council):
 - Across footpath i.e. between edge of the front roadway and the property line; 1 in 40 (2.5%)
 - Within the property; 1 in 5 (20%)
- 6.2 Grade changes shall ensure that vehicles will not scrape when negotiating them. Changes in grades in excess of 12.5% (ratio: 1 in 8) will require the introduction of transitions between the main grade lines. Grade change is computed by subtracting one grade expressed as a percentage, from the adjacent grade (Note: uphill is positive grade, downhill is negative grade).

Transitions of 2.0m in length will usually be sufficient to correct bottoming or scraping. They may be in the form of a simple chord with grade calculated as half the algebraic sum of the two adjacent grades, but for vehicle occupant comfort are desirably constructed as short vertical curves. Grade changes greater than 12.5%, or the need to cater for vehicles with unusually small ground clearances, may require longer transitions.
- 6.3 Grade changes should be checked by use of the method and template contained within Australian Standard AS/NZS 2890.1:2004 Parking facilities—Off-street car parking.

7. **BUILDING CONSTRUCTION AND ARTICULATION**

- 7.1 It should be realised that there are many factors which affect the performance of the building. Visible cracking can be caused by shrinkage and warping of timbers, crazing of plaster, expansion of brickwork (brick growth) and shrinkage of concrete, as well as the most commonly attributed cause, viz. footing distortion.
- 7.2 It is generally recommended that masonry walls be articulated at some or all openings. Articulation involves the incorporation of control joints at doors and windows. The provision of all control joints at locations specified in the footing construction report, or on the control joint marking plan, is mandatory.
- 7.3 Control joints detailed in the footing construction report are specified for compliance with footing movement criteria – additional joints may be required to comply with the requirements of the manufacturer's specifications or the relevant Australian Standards. The detailing of joints for other than footing movements is not part of our brief.
- 7.4 Where no control joints are specified for footing movement requirements, expansion joints must be provided in walls longer than 10m.

Note: significant economies in footing costs may be achieved by using an articulated structure

8. **SERVICES**

- 8.1 On Class H1, H2, E or Class P sites, special care must be taken to ensure that flexible service connections are used so as to allow for differential soil movement. Drains attached to or emerging from underneath the building shall incorporate flexible joints immediately outside the footing and commencing within 1 m of the building perimeter to accommodate a total range of differential movement in any direction equal to the estimated characteristic surface movement of the site (y_s). In the absence of specific design requirements, the fittings or other devices that are provided to allow for the movement shall be set at the mid position of their range of possible movement at the time of installation, so as to allow for movement equal to $0.5y_s$ in any direction from the initial setting. This requirement applies to all stormwater and sanitary plumbing drains and discharge pipes and the design of such systems shall be carried out by a suitably qualified plumber. Additional statutory requirements or recommendations must also be adhered to.
- 8.2 Unless approved otherwise service trenches must be positioned so that the distance between the trench and the edge of the footing is not less than the depth of the trench below the base of the footing. If this cannot be achieved the Engineer must be notified before footing construction commences so that appropriate alternatives can be made to the footing design.
- 8.3 Service penetrations are permitted through footings subject to the requirements detailed in the footing construction specifications.
- 8.4 All sewer trenches both inside and outside the perimeter of the building must be carefully backfilled with approved material, and compacted. On reactive clay sites the trenches should be sloped away from the building, and should be backfilled with clay in the top 300mm within 1.5m of the building, and where pipes pass under the footings, the trench should be backfilled with clay or concrete to prevent the ingress of water beneath the footing.

1. **GENERAL CONDITIONS OF USE**

- 1.1 This construction report has been prepared at the request of the Owner or such person or persons that act on the owners behalf (his or her agent). It is a condition of the use of this report that the Owner accepts the basis on which the footing design has been prepared (as outlined in clause 2 below), and that the Owner ensures that the Engineer is advised of the times he should attend for each of the mandatory site inspection.
- 1.1.1 It is essential that the owner/agent reads the entire Footing Construction Report, as it contains important information relating not only to the construction of the footings, but also to the obligations, liabilities and requirements for site management.
- 1.2 This report contains advice designed to minimise risk to the building. It is an important document and should be kept in a safe place. It is essential that this report be supplied to subsequent owners so that they are aware of the consequences of making changes to the building, garden, and surrounding areas. Without this information, they may institute changes to site management that could jeopardise the long term serviceability of the building.
- 1.3 The Engineer may (and the Owner hereby authorises the Engineer to):
 - 1.3.1 make such modifications to the report as the Engineer may deem necessary during the course of construction of the building;
 - 1.3.2 issue instructions (including an instruction to cease construction) on behalf of the Owner to any person engaged in the construction of the building or any part thereof to ensure construction of the building in accordance with this report and any modification thereof, provided that if any modification as aforesaid would be likely to result in additional construction costs exceeding \$3,000.00. The Engineer may only issue an instruction to cease construction in order to obtain the approval of the Owner to such modification.
- 1.4 The Owner shall be responsible for, and indemnify the Engineer against, all and any costs and charges and all claims and demands made for any additional costs incurred by reason of any act, requirement or instruction of the Engineer made or given pursuant to clause 1.3.
- 1.5 The Owner will comply and procure compliance in all respects and at all times with all terms, conditions and recommendations contained in, or attached to, this report.
- 1.6 The Engineer shall not be liable for any defect in or damage to the building (which includes the footing) arising from footing inadequacy or movement of the building, including its footing, caused by or contributed to by any breach of the terms, conditions and recommendations committed, permitted or allowed by the Owner.
- 1.7 Where more than one person is named as the Owner, all these terms, conditions and recommendations shall bind all such persons jointly and each such person severally, and any instruction or information given to the Engineer by any one such person shall be deemed to be given by all other such persons.
- 1.8 For the purposes of these conditions any builder or supervisor (and any of their respective servants or agents) engaged in the construction of the building shall be deemed to be an agent of the Owner.
- 1.9 It is imperative that the owner is aware of his/her responsibilities with regard to site management. Gama Consulting Pty Ltd will not be liable for any problems on site that may arise on site as a result of non-compliance or negligence by the owner (or agent).

2. **FOOTING PERFORMANCE**

- The following information represents the basis on which the report has been prepared.
- 2.1 The intent of the AS 2870-2011 "Residential slabs and footings", on which the design of the footing systems are based, is for the economical design of footings and slabs. Limits on the expected performance of engineered footings are set out in tables C1 and C2 of AS2870-2011, reproduced below. While occasional Category 2 behaviour may occur, Category 0 and 1 should be the limit for most situations.

- 2.2 AS2870-2011 adopts an accepted probability of category 3 damage occurring in the life of the building, which may be 50 years, is 5%. This equates to the probability that 1 in 20 buildings will experience a crack of 5mm width some time during the 50year design life and is a level of risk adopted in AS2870.
- 2.3 If the owner requires a different type of footing to that recommended, or stronger footings to reduce any possible movement, the Owner must notify our office prior to the commencement of construction, and we will advise accordingly.
- 2.4 The owner should appreciate that on reactive clays it is impossible to design an economical footing system that will totally prevent movement. Some minor aesthetically undesirable cracking may also occur as a result of movements associated with the properties of modern day building materials.
- 2.5 Limits of performance are detailed in the CSIRO BTF 18 document titled "Foundation Maintenance and Footing Performance: A Homeowners Guide" and while occasional Category 2 behaviour may occur, for most situations Categories 0 and 1 should be the limit. Even significant masonry cracking with widths over 5mm (Category 3) usually has no influence on the function of the wall and only presents an aesthetic problem.
- 2.6 It is important for owners to understand that reactive clays move because of moisture changes and even relatively stable clays will move significantly if subjected to extreme moisture changes (e.g. too much or too little garden watering). It is neither possible nor economical to design for extreme conditions. The Owner is the only person who can maintain reasonable moisture conditions at the site.
- 2.7 The Owner should appreciate it is impossible to design a footing system that will totally prevent movement. Some minor aesthetic (non-structural) cracking, whilst undesirable, will occur in a significant proportion of buildings. Limits of performance are set out in Tables A1 & A2 and while occasional Category 2 behaviour may occur, for most situations Category 0 and 1 should be the limit. Even significant wall cracking with widths over 5mm (Category 3) usually has not influence on the function of the wall and only presents and aesthetic problem.
- 2.8 Just as it is impossible to design an immovable footing system, it is almost impossible to provide remedial measures that will prevent further movements if distress does occur. Consequently, extreme remedial measures should not be undertaken for minor problems.
- 2.9 Buildings constructed on sites subject to abnormal moisture conditions have a higher probability of damage. For protection against the possibility of damage and where the feature is sufficiently close to affect the ground moisture under the building and/or the event was sufficiently recent that the following examples of abnormal moisture conditions shall be avoided:
 - (a) The effect of trees too close to a footing.
 - (b) Excessive or irregular watering of gardens adjacent to the building.
 - (c) Failure to maintain site drainage.
 - (d) Failure to repair plumbing leaks.
 - (e) Loss of vegetation from near the building.
- 2.10 The owner shall be aware that normal sites can be expected to be adversely impacted by irregular climatic effects – this could include prolonged drought.
- 2.11 It has been assumed that aspects of site drainage, paving and landscaping which are described in this report have been, or will be, implemented. Where all of these aspects do not form part of the building contract, it is a mandatory requirement that they be carried out within a period of 3 months from date of completion, provided always that adequate temporary drainage is provided.
- 2.12 For protection against the possibility of damage, the planting of trees should be avoided on reactive clay sites. This is not normally practicable but the planting of trees must accord with recommendations set out elsewhere in these notes.

- 2.13 When additions are made to an existing building, special conditions will apply. The footings of the existing building and the footings of the addition are always separate structures. Even though some connection may be made between the footings, the footings will move differentially, meaning that cracking may occur at the junction of the two footings and control joints will open and/or close. The presence of the addition should not be expected to stabilise any pre-existing movements in the existing building.
- 2.14 Attachment of floor surfacing to concrete slabs that have not fully dried can cause problems via shrinkage or moisture reactions with glues. Drying times up to 6 months may be required. Recommendations given in Martin et al (1983) should be followed. Concrete shrinks as it dries and this results in some cracking, often of the order of 1mm wide. This has little effect on structural performance or watertightness of the slab but could affect some brittle floor coverings if installed too soon.

| TABLE C1: CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS | | |
|--|---|-------------------------------|
| Description of typical damage and required repair | Approximate crack width limit | Category and degree of damage |
| Hairline cracks. | < 0.1 mm | 0 – Negligible |
| Fine cracks which do not need repair. | < 1 mm | 1 - Very slight |
| Cracks noticeable but easily filled. Doors and windows may stick slightly. | < 5 mm | 2 – Slight |
| Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weather-tightness often impaired. | 5 mm to 15 mm (or a number of cracks 3 mm to 5 mm in one group) | 3 – Moderate |
| Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably. Service pipes disrupted | 15 mm to 25 mm but also depends on number of cracks | 4 – Severe |

NOTES:

- 1 Where the cracking occurs in easily repaired plasterboard or similar clad-framed partitions, the crack width limits may be increased by 50% for each damage category.
- 2 Crack width is the main factor by which damage to walls is categorized. The width may be supplemented by other factors, including serviceability, in assessing category of damage.
- 3 In assessing the degree of damage, account shall be taken of the location in the building or structure where it occurs, and also of the function of the building or structure.

TABLE C2: CLASSIFICATION OF DAMAGE WITH REFERENCE TO CONCRETE FLOORS

| Description of typical damage | Approx. crack width limit in floor | Change in offset from a 3m straight edge centered over defect ⁽⁵⁾ | Category and degree of damage |
|---|------------------------------------|--|-------------------------------|
| Hairline cracks, insignificant movement of slabs from level. | <0.3 mm | < 8 mm | 0 - Negligible |
| Fine but noticeable cracks. Slab reasonably level. | < 1.0 mm | < 10 mm | 1 - Very slight |
| Distinct cracks. Slabs noticeably curved or changed in level. | < 2.0 mm | < 15 mm | 2 – Slight |
| Wide cracks. Obvious curvature or change in level. | 2 mm to 4 mm | 15 mm to 25 mm | 3 - Moderate |
| Gaps in slab. Disturbing curvature or change in level. | 4 mm to 10 mm | > 25 mm | 4 – Severe |

NOTES:

- 1 The straightedge is centred over the defect, usually, and supported at its ends by equal height spacers. The change in offset is then measured relative to this straightedge, which is not necessarily horizontal.
- 2 Local deviation of slope, from the horizontal or vertical, of more than 1:100 will normally be clearly visible. Overall deviations in excess of 1:150 is undesirable.
- 3 Account should be taken of the past history of damage in order to assess whether it is stable or likely to increase.

3. **SOIL BORELOGS**

- 3.1 The soil profiles as indicated by the test bores, form the basis of the footing recommendations contained within this report. The Owner should appreciate that soil samples obtained at the site may not disclose all types of soil existing at the site.
- 3.2 The footings have been selected on the basis of the recognised characteristics of the soil profile. Unless otherwise stated these characteristics have been visually assessed and related to known performance of the soils under optimum conditions of site development and uses.
- 3.3 It is not economically possible or practical to determine every sub surface feature on a site. Because of this any variations or discrepancies in soil type, colour, or horizon depth which come to the attention of the Owner or his agents must be referred to the Engineer immediately.
- 3.4 The soil sampling investigation carried out on your site follows recommendations in AS2870. Most times be this will be sufficient to determine the average soil characteristics. If the owner and/or the agent are or become aware of any unusual soil properties, our office must be informed immediately.

4. **SITE INSPECTIONS**

4.1 The intention of the inspections is that the work is being carried out substantially in accordance with the requirements of the report. The inspections shall not be of a detailed supervisory nature, and it shall remain the clients or agents responsibility to ensure the overall adequacy. Inspections specifically exclude the particular architectural details, checking of levels, layout dimensions, squareness, relationship to boundaries and matters which will not affect the structural performance of the building.

4.2 The Owner (or appointed Builder) shall ensure that the Engineer is advised at least 24 hours in advance of the time he should attend for each of the mandatory inspections, and shall ensure that construction of the building is not allowed to proceed beyond any stage at which an inspection is required, unless the Engineer has approved the work at that stage.

4.3 Fees for site inspections have not been included in the initial design fees, and will be charged in accordance with current fee scales.

Please see below for a list of possible inspections. Please note that the inspections listed below are strongly recommended with some inspections possibly optional, and can be carried out at the discretion of the Owner; however it is stressed that incorrect construction, detected at a later stage, may result in increased costs for remedial work.

4.4 **Stages for Inspections:-**

4.4.1 Upon completion of primary earthworks, where the depth of excavation exceeds 600mm. Alternatively, this inspection may be carried out at the same time as later inspections, provided the Owner accepts the consequences of any changes to the footing construction that may be required, as a result of the primary earthworks. The inspection shall be limited to a visual assessment of the earthworks, and any approval shall be conditional upon the Owner completing the final earthworks to the correct levels and slopes at a later stage. Where the Engineer considers that additional testing or investigation is required as a result of the earthworks, work shall not proceed until the additional services have been completed. Any such additional testing, investigation and reporting shall incur additional fees.

4.4.2 Upon completion of excavation for footings and prior to the placement of any damp-proofing membrane or reinforcement. Where footing construction is completed in stages (e.g. pier-and-beam construction, split-level buildings) an inspection must be carried out at each stage. If inspection 4.1 has not been carried out, the earthworks will be checked at this stage.

4.4.3 Upon completion of fixing of reinforcement and at, or prior to, the commencement of the concrete pour. The following items shall be checked during this inspection, but it shall remain the Client's responsibility to ensure that the correct cover to reinforcement, concrete quality and quality of workmanship are maintained, damp-proofing membrane are not punctured, and that the concrete is finished to the correct levels.

4.4.4 Upon completion of excavation for main sewers to ensure that the trenches, as constructed, do not contravene the original plans. Checking sewers for compliance with the requirements of statutory authorities is excluded. This inspection is only mandatory when the depth of any sewer trench exceeds the distance from the trench to the building. (This does not apply to trenches up to 900mm deep perpendicular to the building).

4.4.5 Upon completion of any masonry (where it is specified to be articulated) to ensure that the control joints have been provided at the specified locations. Checking joint details which are not visible is excluded and no responsibility is taken for any problem arising from such joint details. Alternatively, this inspection may be carried out at the same time as 4.5.6, provided the Owner accepts the consequences of any remedial works required as a result of incorrect joint construction.

- 4.4.6 Upon completion of the installation of paving, stormwater drains, pipes and structures, to check their compliance with drainage requirements. The checking of sections which are not visible is excluded and no responsibility is taken for any problem arising from such sections. Maintenance of ground slopes to ensure continued proper drainage will be required subsequent to the inspection, and shall remain the Owner's responsibility. If inspection 4.4.5 has not been carried out, any control joints will be checked at this stage.

This work must have been completed, and inspected, within 3 months of the date of practical completion.

5. **TERMS OF ENGAGEMENTS**

- 5.1 All work will be carried in accordance with Gama Consulting's "Terms and Conditions of Engagement for Consulting Services"

GROUND MOVEMENT COMPUTATION

| | | |
|---|--|---|
| SITE LOCATION: 14 Baker Avenue MORPHETTVILLE | Tree Parameters Single tree Design height of tree HT = 10.0m Dist. of tree to building Dt = 5.0m Max. Des. Drying Depth Ht = 4.0m Influence Distance Di = 10.0m Δu_{base} 0.43pF | Location Adelaide Δu 1.20pF H_s 4.0 m |
|---|--|---|

| REFER TO THE SURFACE SOIL BORELOGS FOR THE DESCRIPTION OF THE SOIL HORIZONS | α | | lpt % | | Depth (m) | | | | | | | |
|---|----------|--|-------|--|-------------|---|-------------|---|-------------|---|--|--|
| | | | | | BORE 1 | R | BORE 2 | R | BORE 3 | R | | |
| | 1 | | 0.0 | | 0.00 - 0.50 | | 0.00 - 0.20 | | 0.00 - 0.30 | | | |
| | 1 | | 2.0 | | 0.50 - 0.80 | | 0.20 - 0.80 | | | | | |
| | 1 | | 1.8 | | 0.80 - 2.00 | | 0.80 - 1.60 | | | | | |
| | 1 | | 2.0 | | 2.00 - 3.00 | | 1.60 - 3.00 | | | | | |
| | 1 | | 0.0 | | | | | | 0.30 - 0.60 | | | |
| | 1 | | 2.0 | | | | | | 0.60 - 0.80 | | | |
| | 1 | | 1.8 | | | | | | 0.80 - 1.30 | | | |
| | 1 | | 2.0 | | | | | | 1.30 - 3.00 | | | |

| | | | | | | | |
|--|--------------------------------|--------|------|--------|------|--------|------|
| <div><div><div>SITE CLASSIFICATION:</div><div>CLASS - P</div></div><div><div>PROBLEM FACTORS</div><div>See Footing Construction Report</div></div><div><div>OVERALL SOIL REACTIVITY:</div><div>Highly Reactive</div></div></div> | | | | | | | |
| | | BORE 1 | | BORE 2 | | BORE 3 | |
| | y _s | 35.8 | | 42.9 | | 34.7 | |
| | y _t | 16.6 | | 17.0 | | 16.7 | |
| | y _s +y _t | 52.3 | | 59.8 | | 51.4 | |
| | | c/h | e/h | c/h | e/h | c/h | e/h |
| | y _m | 41.6 | 25.0 | 47.0 | 30.0 | 41.0 | 24.3 |
| | D _{cr} | 2.2 | 1.6 | 2.4 | 1.8 | 2.2 | 1.5 |
| | | | | | | | |

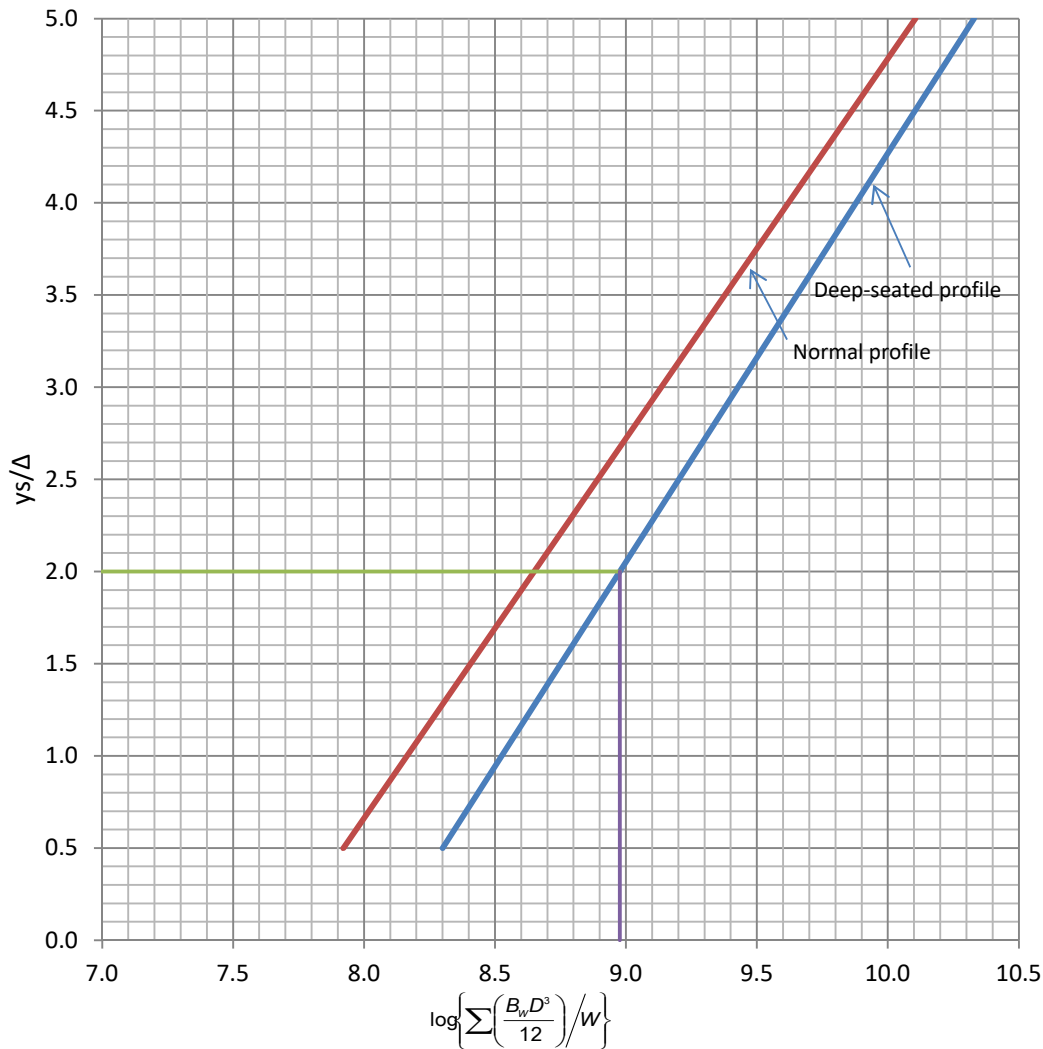
FOOTING DESIGN - Movement Ratio vs Unit Stiffness

To AS2870

Movement profile

Deep-seated, $H_s > 3$

With Tree Effects



| Beam Type (L & T) | Type L | Type T |
|---------------------------------|--------|--------|
| B_w width of beam web (mm) | 300 mm | 300 mm |
| D overall depth of beam (mm) | 600 mm | 550 mm |
| Number of each beam type | 2 | 5 |
| Top bars | 2-N16 | 2-N16 |
| Bottom bars | 3-N16 | 3-N16 |
| Slab thickness (mm) | 100 | 100 |
| Slab mesh (SL) | 82 | 82 |
| Slab width | 2000 | 4000 |
| μ_u/μ_{cr} - Centre Heave | 1.96 | 1.87 |
| μ_u/μ_{cr} - Edge Heave | 2.25 | 2.25 |

W overall width of slab (m) 21.0 m

$\sum(B_w D^3/12) = 3.16E+10 \text{ mm}^4$

y_s 60 mm maximum characteristic surface movement

Δ 30 mm maximum differential movement (see Table 4.1, Column 3 for class of construction)

y_s/Δ 2.00

$$\log\left\{\sum\left(\frac{B_w D^3}{12}\right)/W\right\} = 9.18 > 8.98 \rightarrow \text{OK}$$