THE QPOD
EARTH-FRIENDLY FOUNDATIONS

DESIGN MANUAL

For continous and raft applications

VERSION 1.7

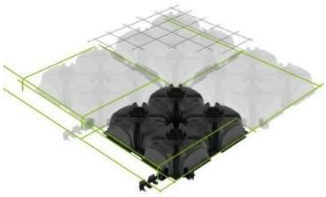
1.0 Overview

1.1 QPOD™ Configurations

The QPOD Foundation System can be configured in two ways; as RAFT or CONTINUOUS. A reinforced concrete floor slab-on-ground, with an overall depth of 305mm and typical 85mm thick topping supported by a grid of QPOD forming arched legs typically at 550mm centers. For RAFT there is the addition of 100mm ribs at 1200mm centers achieving greater load performance. Edge beams and ribs under load bearing walls are typically 300mm wide to provide for the extra load carried by these members.

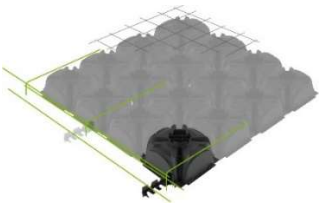
QPOD RAFT

QPOD can be configured as laid in a 'RAFT' format with 100mm ribs at 1200mm centers. 2 closed sides QPOD are supplied as a group of 4 pre-assembled to represent a 1100mm x 1100mm pod. The rib structure delivers a greater load spread and can be optimised in SED foundation designs.



QPOD CONTINUOUS

QPOD CONTINUOUS can be configured as laid continuously omitting the need for ribs and offering savings in concrete and steel for lightweight home designs with reduced loading demands.



SLABTANK™ WATER ATTENUATION

SlabTank can be included in the QPOD foundation design for the purpose of water attenuation, supplied in two sizes 220 and 300mm height. Designed to the same profile as QPOD, and offering the same structural integrity as the QPOD Continuous system.

1.2 Pods

The QPOD pods are 550mm square and 220mm high with an inbuilt 40mm mesh spacer and are placed directly on levelled ground and arranged to form a reinforced concrete floor slab with a grid of arched legs and edge beams when concrete is placed onto them. In the case of RAFT 100mm ribs are formed at 1200mm centers using the clip-on QPOD Rib spacers. QPOD Extenders are used in conjunction with open sided QPOD to suit specific architecture layout and also to accommodate services. 220mm or 300mm deep QPOD are allowable following the detailing and installation described in this document or by alternative SED methods.

1.3 Steel

Reinforcing steel in the slab's 85mm topping shall consist of welded reinforcing mesh, seismic grade SE62 Grade 500E with a minimum weight of 2.29kg/m2. The reinforcing in the ribs, edge beams and hockey stick bars shall be deformed 12mm bar. QPOD System spacers are used to position the rib and edge beam reinforcing steel bars to maintain minimum requirement covers. All bending of bars shall be carried out in accordance with NZS 3101. Minimum bend diameters for main reinforcing bars (between 6-20mm dia.) shall be 5 x diameter of the bar measured to the inside face of the bend. All bar laps shall be 600mm or greater.

1.4 Concrete

Certified concrete is to be used for all QPOD foundations with reference to the Zone exposure categories outlined in 4.2.3.3 of NZS3604-2011. For Exposure Zones B-C, Foundations are to be 20 MPa minimum. For Zones D (sites within 500m from the sea or within 100m from tidal estuaries and sheltered inlets), foundations are to be 25 MPa minimum.

1.5 Slabtank™

The SlabTank water attenuation tank is 3290mm x 1090mm and either 220 or 300mm thick depending on capacity, with an inbuilt 40mm mesh spacer. They are placed directly on levelled ground and arranged to form a reinforced concrete floor slab with a grid of legs and edge beams when concrete is placed onto them for the purpose of water attenuation. In the case of driveway applications 100mm topping is formed with 100mm reinforced rib surrounding. The SlabTank Distribution Chamber is used in conjunction with SlabTank to complete the attenuation handling of retained and detained waters. SlabTanks are allowable in conjunction with the QPOD System, under driveways and under decks following the detailing and installation described in this document or by alternative SED methods.

1.6 User Pathway

Resources required to design QPOD™ Foundation

1) Geotechnical Report
2) Working plan drawings
3) Roof truss design

Verify house and site conditions meet limitations

Foundation designer to verify house and site conditions, following the guidance in this manual. **Refer 2.0 Scope of Use.**

Foundation designer to create detailed drawings.

Foundation designer to design slab in accordance with **3.0 Installation and Construction Detail** and determine site R-Value referring to **4.0 Insulation Guidance.**

If outside the scope of this manual SED by chartered professional must be obtained for consent

Final plans and design submitted to local building authority

Final plans and design submitted to local building authority to verify and grant building consent, no PS1 is required for foundation designs within the scope of this document.

Site contractor/installer to install QPOD™ components

Site contractor/installer to install QPOD™ components, steel and other materials to pre-pour stage according to design.

Site inspection

Local building authority to inspect detail to be in accordance with the submitted design. If SED; chartered professional engineer to inspect detail to be in accordance with the details in the design submitted or local building authority if outlined in the PS1 provided with the design.

Concrete pour

Contractor/installer is to follow the specific guidance in concrete specification, placing, curing and saw cuts as outlined in this manual 3.14-3.15 before proceeding with other structural elements of the build.

2.0 Scope of Use

QPOD Foundations RAFT & CONTINUOUS concrete foundation systems are designed to support residential and light commercial buildings within the design scope of NZS3604-2011, or the NASH Standard for lightweight steel framing. Including exceptions and limitations outlined in this design manual.

2.1 Structural Limitations

1) The structure supported by the system is constructed in a location where the Seismic Hazard Factor Z is less than 0.45 (see 2.4 Lateral Resistance)
2) The structure supported by the system has no basement, part basement or foundation walls.
3) The structure supported by the system has a roof pitch limited to 60 degrees maximum from the horizontal.
4) Up to 2 levels high with a maximum height to apex of 10m.
5) Only ground floor walls of the structure supported by the system are permitted to be heavy cladding.
6) The roof truss clear span shall be less than or equal to 12m.
7) Where internal load bearing walls are used to support the roof or floors, the loaded dimensions stated in Tables 8.2 and 14.10 of NZS3604-2011 shall apply, and the load bearing wall shall be supported on a 300mm wide load bearing rib as detailed in this Manual.
8) Supported on good ground and allowed reduction in minimum ultimate bearing capacities of 200kPa. See 2.3 Ground Conditions.
9) Supported on a level platform with a maximum step of 600mm as detailed in the manual.
10) SlabTank in driveway application is suitable for light vehicle traffic restricted to cars, light vans etc, not exceeding 2500kg gross mass.

QPOD Foundations outside of these limitations and scope including TC2 and expansive ground conditions can be designed by Specific Engineered Design.

2.2 Weights and Loads

The live loading cases of structures covered by these designs are up to 2.5kPa floor loading and 13kN concentrated load in garage over area of 0.3m x 0.3m (vehicle limited to 2500kg gross)

2.2.1 Dead or Permanent Loads

QPOD CONTINUOUS allows for standard residential and garage loading as per NZS3604, NZS1170 and maximum loading as per the below.

1) Heavy roof loading 1.0 kPa – including cladding, roof framing, insulation, and ceiling.
2) Light roof loading 0.5 kPa – including cladding, roof framing, insulation and ceiling.
3) First floor (timber) – 0.6 kPa – Including joists, nogs and services, flooring and lower-level ceiling.
4) Lower-level heavy cladding - 2.2 kPa (220 kg/m2).
5) Upper/lower-level light cladding - 0.6 kPa (60 kg/m2).

2.2.2 Live or Imposed Loads

1) First floor loading 2 kPa.
2) Slab loading 3 kPa with 2.7 kN point load.
3) Slab loading of 2.5 kPa with 13 kN point load applied over an area of 300mm x 300mm.
4) Max vehicle weight of 25 kN or 2500 kg.
5) Max snow loading as per sections 15 of NZS3604 – (2kPa, refer figure 15.1 of NZS3604).

2.2.3 Load Bearing Walls and Point Loads

	RAFT Configuration	CONTINUOUS Configuration
Loads up to 5kn	No thickening required	No thickening required
Loads exceeding 5kN up to 10kN	No thickening required	Requires thickening 300 x 400mm terminating at nearest rib, See figure 18.
Loads exceeding 10kN up to 20kN	Requires thickening 300 x 400mm terminating at nearest rib, See figure 18.	Requires thickening 300 x 800mm terminating at nearest rib, See figure 19.
Loads exceeding 20kN up to 30kN	Requires thickening 300 x 800mm terminating at nearest rib, See figure 19.	Requires thickening 300 x 800mm terminating at nearest rib, See figure 19.
Load Walls Supporting 1st Floor	Internal thickening beam 300mm wide	Internal thickening beam 300mm wide
Load Exceeding 30kN	To be designed by CPEng	To be designed by CPEng

TABLE 1 - LOAD THICKENING GUIDE

2.2.4 Internal Bracing Wall Hold-down Fixings.

Internal proprietary bracing walls that have hold-down fixings (up to 15kN characteristic loading) require a minimum slab thickness of 100mm or a thickening pad as per Figure 18 of this design manual.

It is the responsibility of the designer to check that the foundation complies with the hold-down fixing requirements.

2.3 Ground Conditions

1. Consistent bearing capacities of the building platform and underlying soils as per NZS3604:2011 clause 3.1.3. and allowed reduction in minimum ultimate bearing capacity as per Table 2 for given building types A-E.
2. Stable platform, free from any instability or settlement from any scenario where vertical movement greater than 25mm over the 50-year design life is expected.
3. Slightly expansive soils are allowed, with a maximum characteristic movement (Ys) of 22mm as per NZS3604.
4. Filled platform consisting of well graded compacted hard fill or suitable fill material approved by a geotechnical engineer. Cut and fill batters to be completed in accordance with NZS3604-2011 and see Figure 2 - Slope Setback.

Building Type	Levels	Level 1 Wall Cladding	Level 2 Wall Cladding	Roof Type	Minimum Ultimate Bearing Capacity
A	1	Light	_	Light	200kPa
B	1	Heavy	_	Light	200kPa
C	1	Heavy	_	Heavy	200kPa
D	2	Light	Light	Light	200kPa
E	2	Heavy	Light	Light	300kPa

Minimum Ultimate Bearing for SlabTank in driveways is 200kPa

TABLE 2 – MINIMUM ULTIMATE BEARING CAPACITY

Beyond these limitations QPOD RAFT can be designed by a Chartered Professional Engineer to combat greater vertical and horizontal movements and UBC limits as low as 150kPa if required.

2.4 Lateral Resistance

Lateral resistance to sliding under seismic actions is generally resisted by friction between the slab and the ground surface.

Seismic action generally governs the design for sliding rather than wind loading. The scope of this design manual includes earthquake zones up to and including zone 3 ($Z \leq 0.45$) as defined by NZS3604:2011.

The wind load demand is calculated according to Section 5 of NZS3604:2011. The design wind load is the greater of the along and across directions. The foundation lateral resistance is calculated based on the slab area using the capacity values from the table below. QPOD Design parameters includes allowance for up to and including 'extra high' wind zone loading.

Building Type	Roof Type	Ground Floor External Walls	BU's for resistance per m2
Single Storey	Light	Light	20
Single Storey	Light	Heavy	23

FIGURE 1 – Bracing units for resistance

Specific shear keys may be designed by a suitably qualified engineer in SED situations outside the scope of this document.

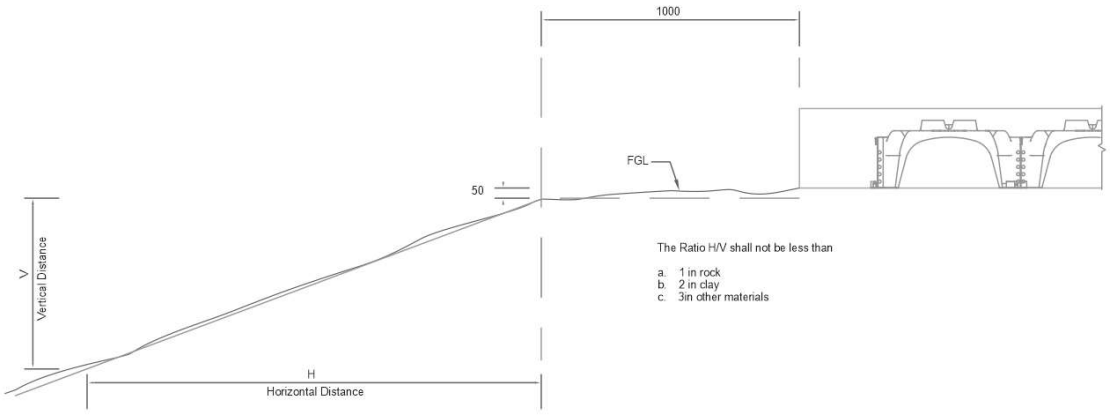
3.0 Installation and Construction Detail

The following installation and construction guidance are to be followed solely with the site conditions within the Scope of The QPOD Design Manual as outlined in section 2.0.

When foundation design is conducted as SED all construction and detail will be in accordance with details as specified by the chartered professional engineer.

3.1 Site Preparation

Any system erected at the top of a slope (whether fill compacted in accordance with NZS4431, or natural ground) shall be located as shown below so that the finished ground is always outside the dashed line shown (the vertical distance, V, shall be measured to 50mm below the underside of the slab). Where the finished ground does not comply with Figure 2, the slope shall be retained by a specifically designed retaining wall by a CPEng or following the compliance pathway B1/VM4 (Verification Method) or "Module 6: Earthquake resistant retaining wall design" by MBIE (Alternative Solution).



FIGUR<u>E 2 - SLOPE SETBACK</u>

As per section 2.3 Ground Conditions, all topsoil, organic material and any soft soil (below design bearing strength) shall be removed from the building platform in accordance with the provided geotech specification and as per section 2.0 - Scope of Use. The formation area shall be cut or filled to a level approximately 305mm below the finished floor level. Where additional fill is required to achieve this level, the fill shall be certified by a geotechnical engineer or shall be granular fill in accordance with Clause 7.5.3 of NZS 3604:2011. Granular fill shall extend from the slab edge extent equal measure to excavation depth with a Bater of 1H:2V. Any isolated soft spots shall be excavated to a depth where adequate bearing is achieved. Compacted hard fill (well graded AP40) or engineered fill in accordance with NZS 4431:1989 ('Code of practice for earth fill for residential development') may be required to achieve the finished floor levels. The geotechnical engineer shall also confirm the building platform meets all the requirements of section 2.3 (Ground Conditions) of this manual. A clean sand blinding layer (10mm minimum, 20mm maximum) shall be installed on the cut ground level or on top of the certified subgrade layer. The blinding layer will create a level platform, reduce shrinkage forces in the floor slab and protect the DPM from being punctured by sharp aggregates.

3.2 Pipe Penetrations

There are two options for installing the plumbing services in combination with QPOD Foundations. The pipes can either be installed within the subgrade beneath the concrete foundation to their plan location then brought up through the system, as per AS/NZS 3500.2:2021 “Plumbing and drainage, Part 2: Sanitary plumbing and drainage”. Alternatively, services can be conveyed within the depth of the slab itself. Referring to MBIE guideline section A figure S14 & S15 and building code clause G13. All pipes shall be laid at a fall to comply with NZBC G13/AS1

All steel is to maintain covers and positionings as set out in later sections 3.6, 3.7, 3.8, thickening and perimeters may be adjusted in standard dimensions following the guidance for appropriate covers and steel detailing set out in the following demonstrations.

In all cases of services passing through concrete a clearance around the pipe must be maintained for the full course of the concrete penetration adopting flexible lagging around the pipes (25mm minimum or recommended 50mm as per MBIE Guidance Part A Figure 5.14).

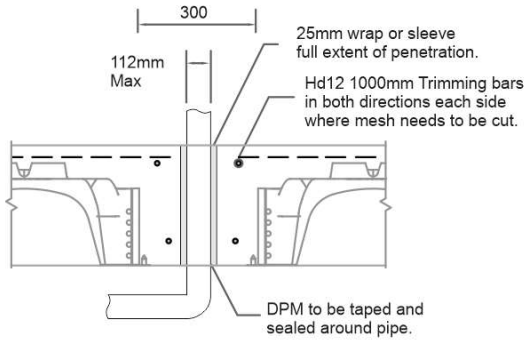


FIGURE 3 - VERT PENETRATION

Pipes up to 112mm may penetrate a thickening vertically without adjusting the 300mm width demonstrated in figure 3 & figure 7.

For penetrations offset from centre of thickening as demonstrated in figure 4 and figure 7, A & B dimensions must equal or exceed 300mm.

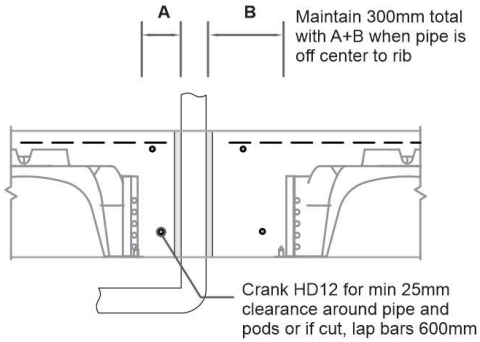


FIGURE 4 - VERT PENETRATION OFFSET

Pipes are not permitted to run along or within ribs and footings.

Pipes are permitted to cross perpendicular through a rib or footing providing they are located with the middle third of the depth of the slab and are 112mm diameter or less.

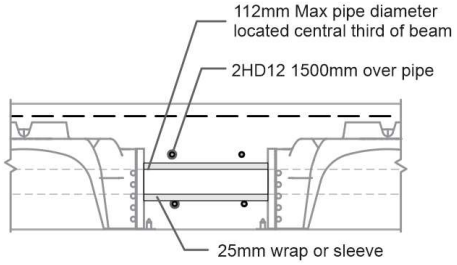


FIGURE 5 - THICKENING HORIZ PENETRATION

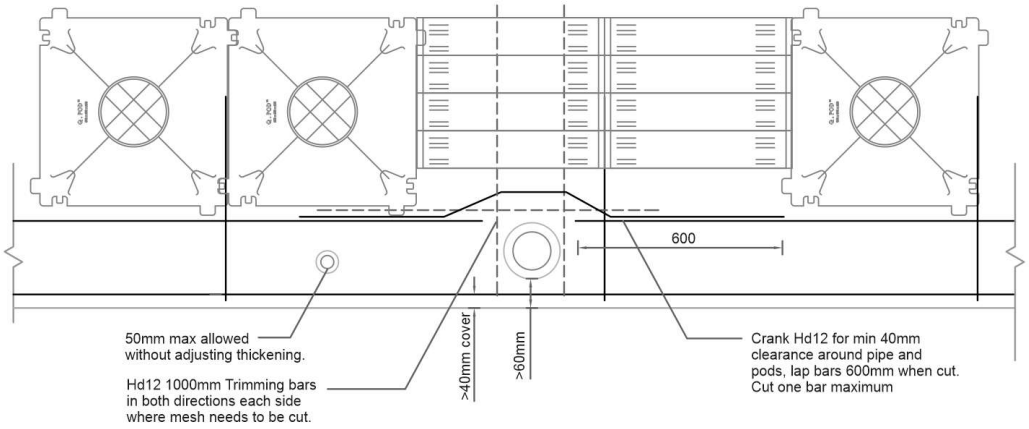


FIGURE 6 - PERIMETER PENETRATION

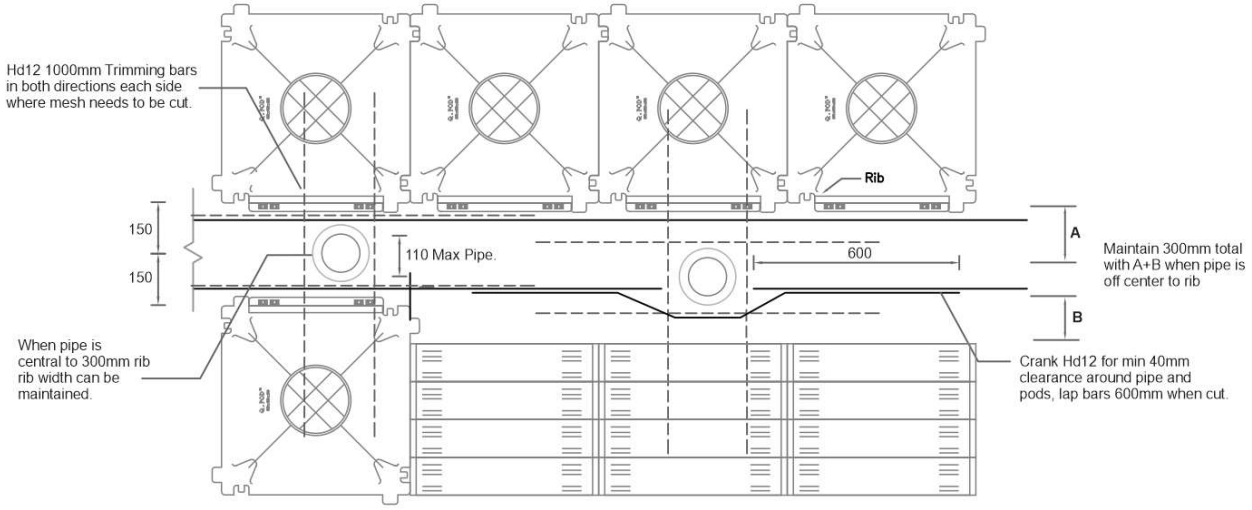


FIGURE 7 - THICKENING PENETRATION

Where the services pass through the top or side of the QPOD, the plastic opening shall be sealed to prevent materials entering the subfloor cavities using tapes or self-expanding foam.

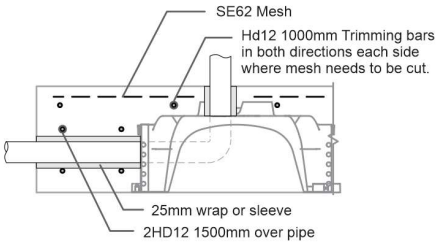


FIGURE 8 - PERIMETER PENETRATION A

Perimeter penetrations can be conducted vertical or horizontal following minimum steel covers and total A+B measurement of >300mm demonstrated in Figure 6 & Figure 9.

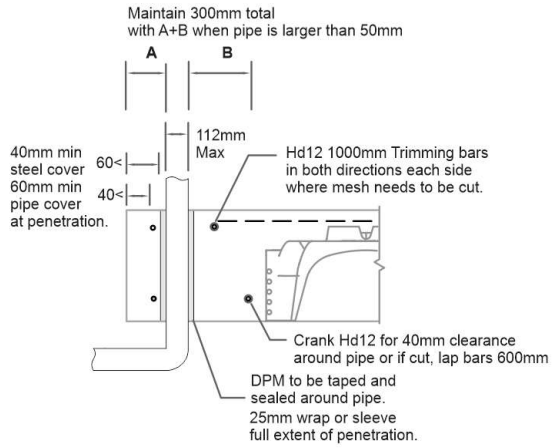


FIGURE 9 - PERIMETER PENETRATION B

Where steel cover cannot be achieved such as with SlabTank or pipes exiting below a brick rebate demonstrated in Figure 10 a deepened footing may be required as demonstrated in Figure 11.

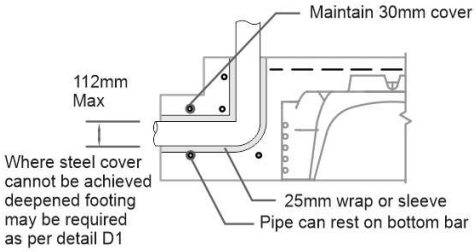
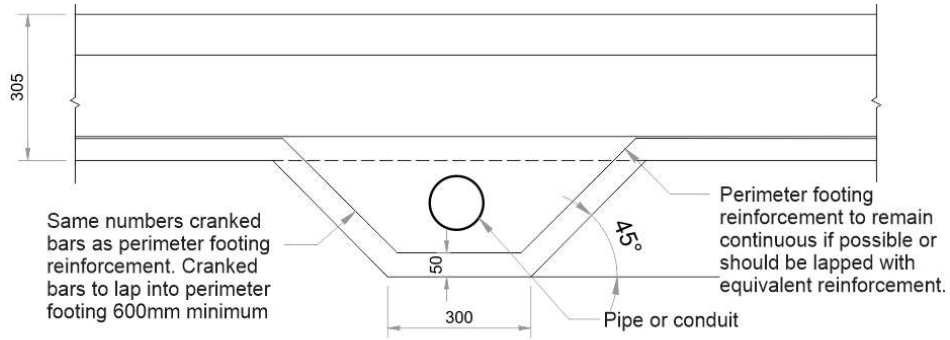


FIGURE 10 - PERIMETER PENETRATION C



Typical deepened edge penetration detail where cover cannot be achieved for bottom reinforcement.

FIGURE 11 - DEEPENED PERIMETER PENETRATION

3.3 Damp Proof Membrane (DPM)

A continuous damp proof membrane shall be placed on top of the sand blinding layer over the entire slab area in accordance with NZS3604. Polythene sheet shall be not less than 0.25mm thick, lapping the joints not less than 150mm wide and sealing the joint with >50mm pressure sensitive plastic tape. DPM should lap up the perimeter boxing to a height of 50mm.

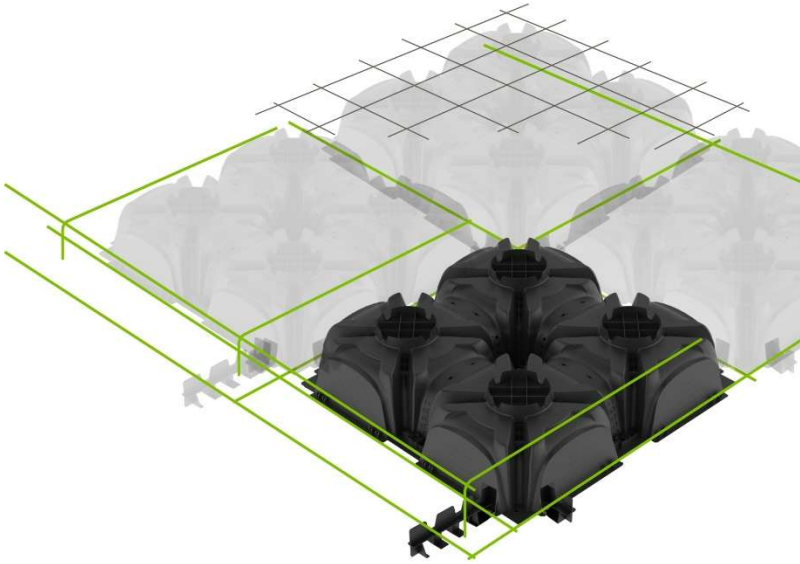
3.4 Setout and Boxing

Site profiles, levels, and positions onsite shall be determined by the builder and/or surveyor to form FFL of 305-320mm.

3.5 QPOD and SLABTANK Layouts

3.5.1 QPOD RAFT Layout

The QPOD RAFT pods and extender components shall be laid out over the DPM in a RAFT configuration with 100mm ribs at 1200mm centres. The edge beams & internal load beams shall be formed using the QPOD 300mm Spacer clipped directly to the QPOD component system. These shall be placed at a maximum of 1200mm centres or one per QPOD.

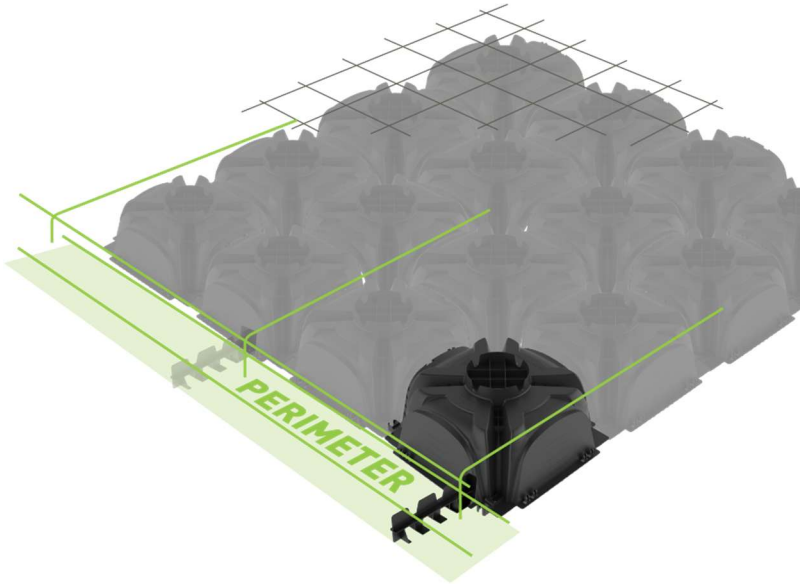


3.5.2 QPOD CONTINUOUS Layout

The QPOD CONTINUOUS pods and extender components shall be laid out over the DPM in a continuous configuration. The edge beams & internal load beams shall be formed using the QPOD 300mm Spacer clipped directly to the QPOD component system. These shall be placed at a maximum of 1100mm centres or one per QPOD.

Where the QPOD segments meet irregular dimensions the QPOD Extender is attached to create 100mm-500mm adjustment in 100mm

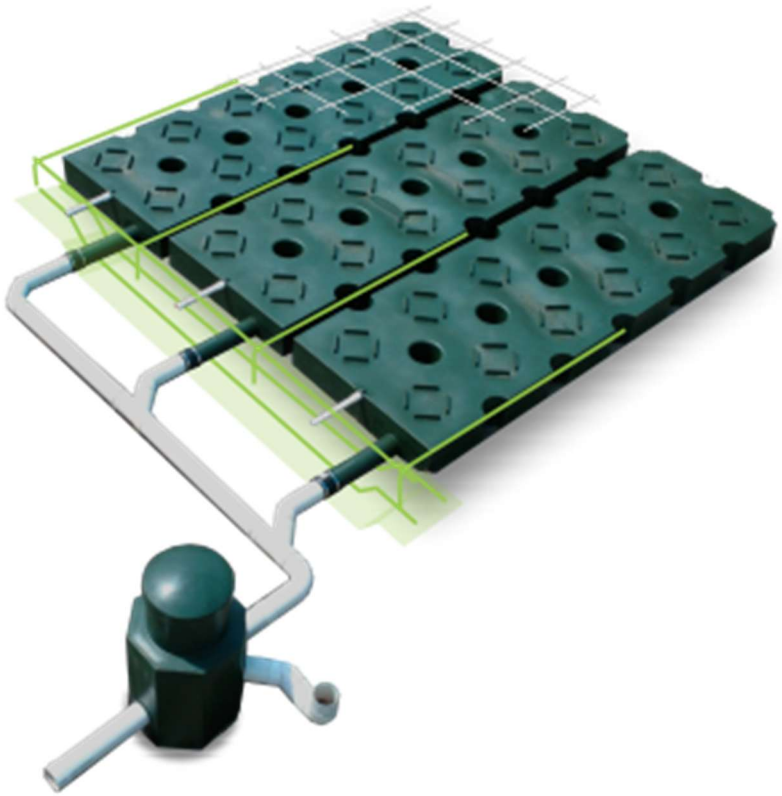
increments. Non-right-angle layout terminations can be created by the modular assembly of adding removing individual QPOD 550x550mm components and adopting the QPOD Extender. All open sides and voids of QPOD are to be closed off using the QPOD End Cap.



3.5.3 SLABTANK Layout

SlabTank is designed for both in-slab and on-ground applications including in concrete foundations, beneath driveways, under decks, and beneath piled homes. Standard detailing has been provided for a number of these scenarios. A Chartered Professional Engineer can be contracted for specific applications.

The SlabTank water attenuation pods shall be laid out over the DPM in a continuous configuration with 100mm inlet/outlet spigots extending to the outside of the perimeter foundation. No ribs are required between SlabTank tanks due to the patented built-in pillar structure. Design for loads over 5kN must consider load thickenings and placement of SlabTank see Table 1.



Where multiple SlabTanks are installed in sequence connections are made using a flexible pipe coupler into a multi-branch connection stack. The spigot moulded into the one-piece design can be cut to length as required. All piping and connections are laid level to allow flow both ways and coupled up to the SlabTank Distribution chamber. No onsite testing is required for standard SlabTank installations as tanks are pressure tested at point of manufacture. A deepened footing is required to accommodate the 100mm SlabTank spigot on perimeter, see Figure 11.

Connections between tanks within the concrete foundation are beyond the scope of this document unless outside the habitable space such as driveways, see Figure 35.

All SlabTank tanks must be fitted with a top level breather to allow the water storage to fill and empty. SlabTank is supplied fitted with a 25mm BSP threaded fitting to attach a 20mm breather to the outside of the perimeter foundation. Breather must be fitted with vermin-proof breather, alternatively return continuously back to the distribution chamber, see Figure 33.

For in-slab and driveway applications it is recommended to fill the tanks completely with water, prior to pouring concrete to eliminate floatation risk.

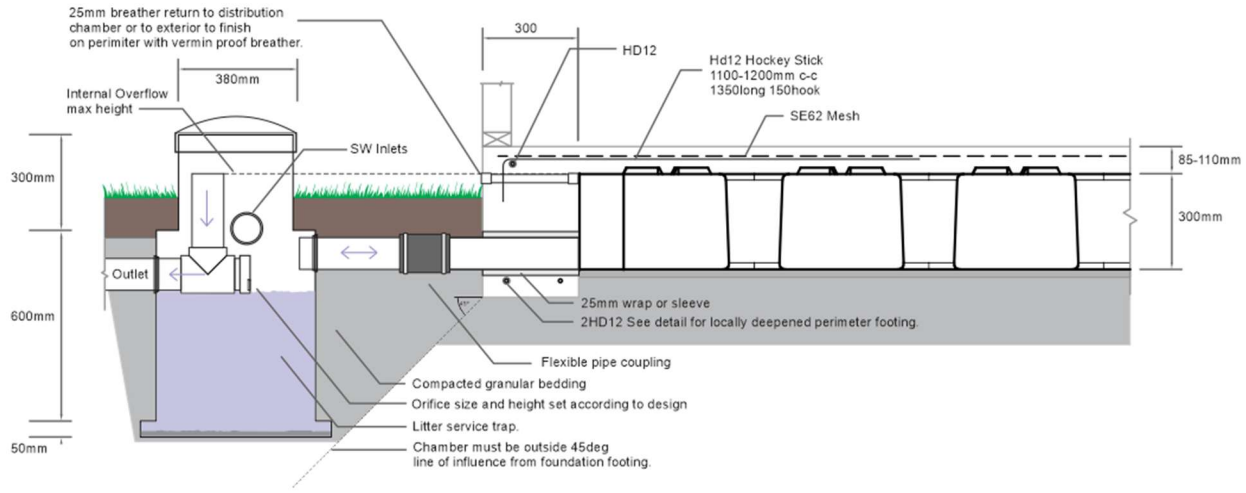


FIGURE 33 - PERIMETER DETAIL - SLABTANK & DISTRIBUTION CHAMBER

The SlabTank Distribution chamber serves three or more connections including stormwater & downpipe inlets, SlabTank storage tanks supply and return, and discharge orifice with overflow. All connections to the chamber must be made with flexible 'Wallace Seal' pipe penetrations or similar.

Suitable depth hole must be excavated to accommodate distribution chamber considering maximum tank levels and internal overflow design. Backfill around distribution chamber with compacted granular bedding. See Figure 33.

The distribution chamber can also be a draw-point for a rainwater harvesting pump, submersible pump, and/or level switches such as SlabTank Rainharvester Auto.

Depending on the applications and surroundings, service requirements will differ. The distribution chamber lid can be removed for maintenance and removal of settled fines in the chamber sump. If mesh steel or diaphragm is fitted to outlet, inspect for blockages following manufacturers guidance for longevity of your SlabTank. Marley curve leaf diverter or similar should be installed on all downpipes and be your first point of debris diversion. These must be maintained following supplier guidance. Adhering to these guidelines minimises maintenance of the distribution chamber.

Setting the discharge orifice height determines percentage of retention or detention that is required for the application. Orifice diameter is dependent on local requirement calculations.

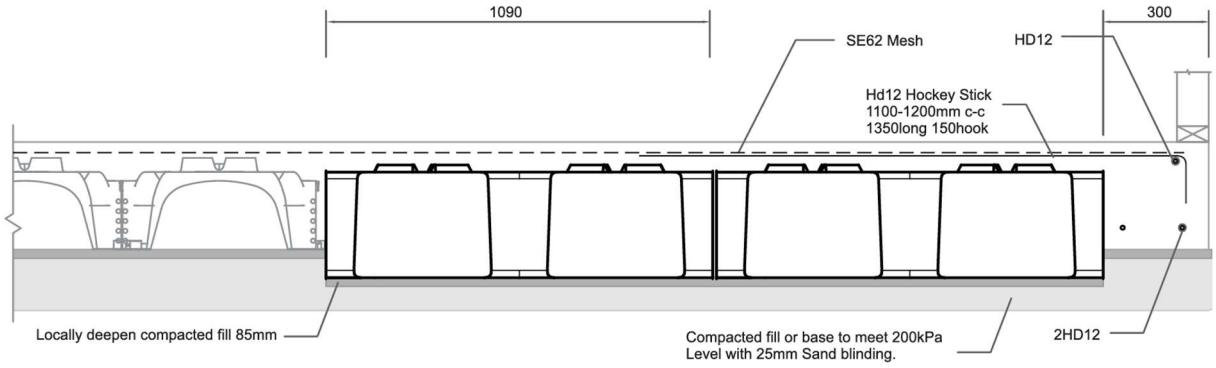


FIGURE 34 - PERIMETER DETAIL - SLABTANK™ LOCALLY DEEPENED EXCAVATION

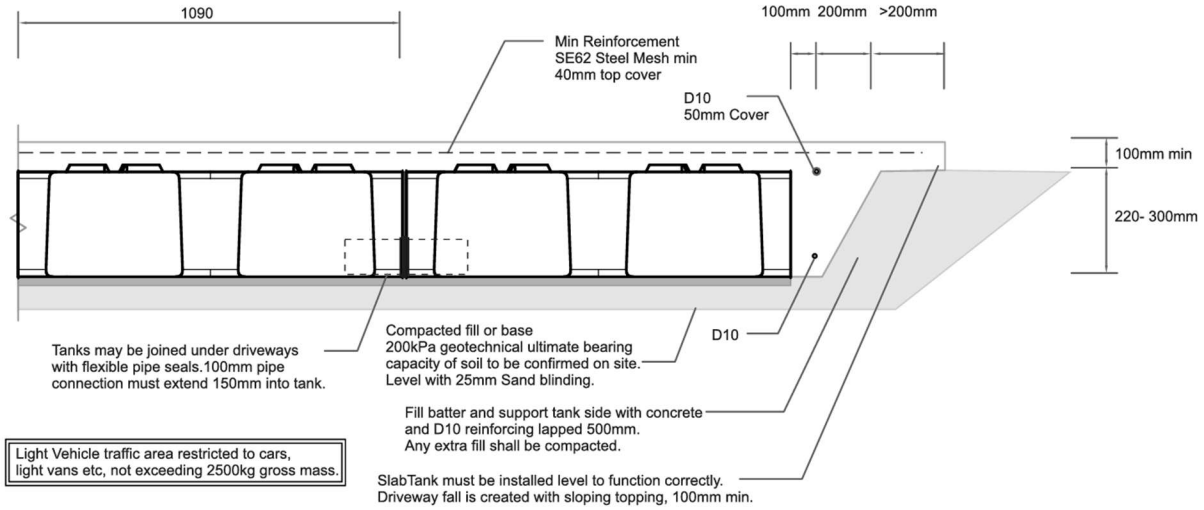


FIGURE 35 - PERIMETER DETAIL - SLABTANK™ DRIVEWAY

3.6 Perimeter Foundations

The perimeter edge beam is typically 300mm wide however larger widths could be specified when ground conditions or edge detailing of cladding dictate this in the specific design. Typically, 2 x HD12 bars (Grade 500E deformed bars) are used for bottom steel in the footing and 1 x HD12 used as top reinforcement.

The bottom bars shall be placed onto QPOD 300mm spacers to achieve a 50mm bottom and side cover. HD12 starter bars (hockey stick bars) are used at 1100-1200mm centres (or at the junction of every 2nd QPOD). These are 1350mm long with a 150mm hook anchoring the footing to the floor slab. Hockey stick bars shall be tied underneath the mesh to ensure 30mm minimum top cover to all the reinforcement. The top HD12 longitudinal bar is tied perpendicular to the underside of the hockey stick bars.

Optimising the patented QPOD built-in chair reinforcement mesh maintains consistent 30mm top cover and all reinforcement maintains 50mm side cover.

The perimeter footing may have rebates to accommodate exterior cladding details such as bricks, garage door rebates, and full height joinery rebates. The rebates shall be coordinated and set out in accordance with the architect's drawings. The maximum permitted rebates are 150mm wide by 120mm deep or 200mm wide and 25mm deep.

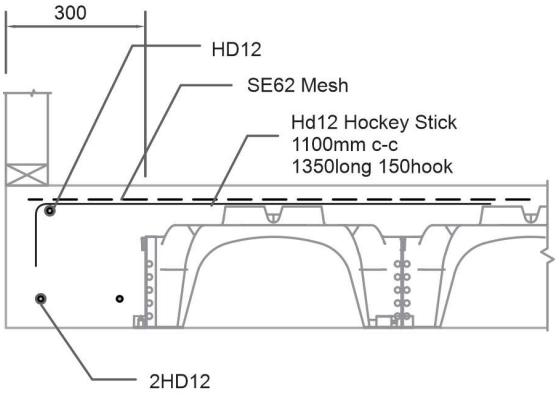


FIGURE 12 - LIGHTWEIGHT CLADDING

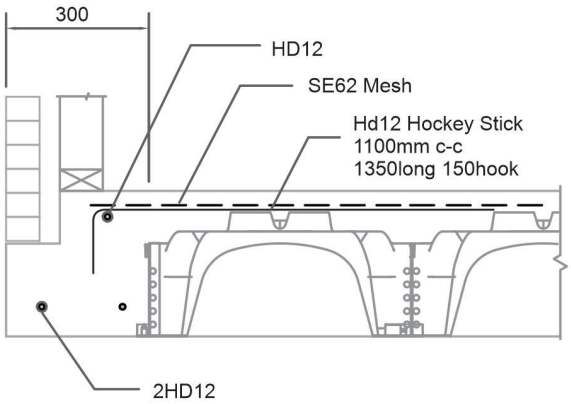


FIGURE 13 - HEAVY CLADDING

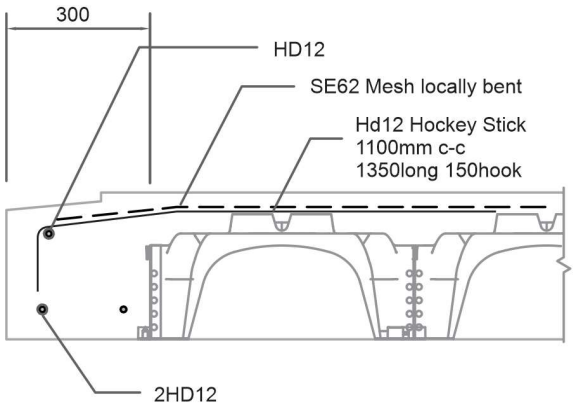


FIGURE 14 - GARAGE REBATE

3.7 Ribs, Internal Load Bearing Thickenings and Pads

A standard internal thickening is 300mm wide and has 2 x HD12 bars located in the bottom of the rib with 50mm cover to the DPM. Bars are secured in location using the QPOD 300mm Spacer.

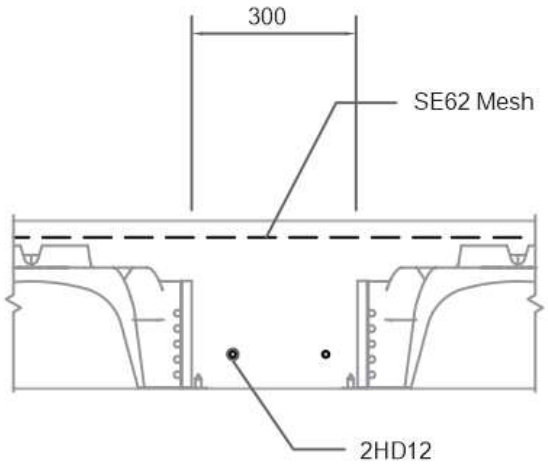


FIGURE 15 - THICKENING 300mm

Where slab thickening meets perimeter, terminating rib bars shall be anchored into the 300mm perimeter with a 150mm hook to outside bar. All HD12 bars shall be lapped (600mm minimum) where required.

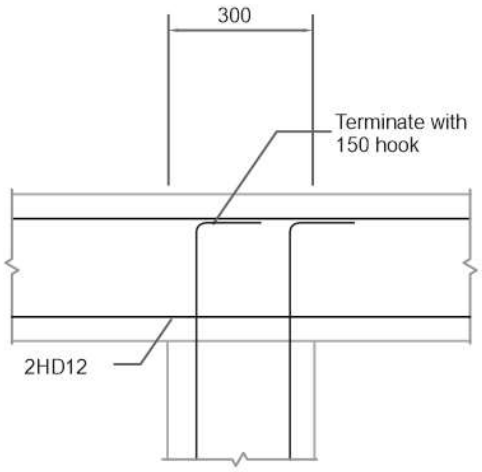


FIGURE 16 - THICKENING MEETS PERIMETER

For RAFT configuration 1 x HD12 reinforcing bar is placed in the foot of each rib with 50mm cover to the DPM.

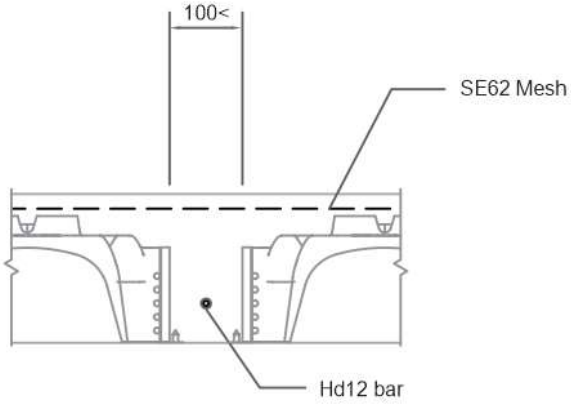


FIGURE 17 - RIB 100mm

Internal and external point loads exceeding minimum loads as outlined in 2.2 - Weights and Loadings shall be detailed in accordance with Figure 18: 300mm x 400mm MIN.

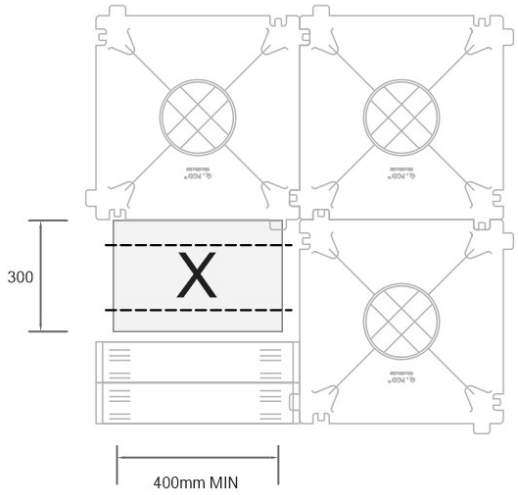


FIGURE 18 - LOAD POINT

Internal and external point loads exceeding 20kN Loads as outlined in 2.2 - Weights and Loads shall be detailed in accordance with Figure 19: 300mm x 800mm MIN extending to nearest rib.

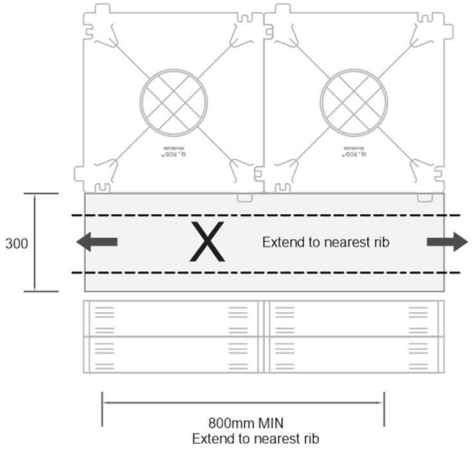


FIGURE 19 - LOAD POINT

For any thickenings or mass concrete other than outlined above where pods have been removed. HD12 'U' bars with 150mm hook at 300mm centers should be located each way as foot reinforcement adjacent to any already present reinforcing, see detail in Figure 20.

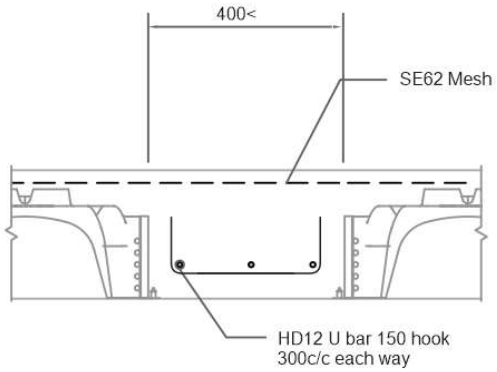


FIGURE 20 - MASS THICKENING

3.8 Mesh and Topping Thickness

The mesh used in the 85mm topping is SE62 grade 500. The mesh shall be supported on the patented QPOD built-in 40mm chair. Top covering on mesh shall be 45mm maximum and 30mm as a minimum. The reinforcing mesh sheets must be lapped at sheet joins by the greater of a minimum 225mm lap or in accordance with the manufacturer's specifications. It must extend to within 75mm of the outside edge of the floor slab (including foundation walls).

Where underfloor heating or polished concrete is specified, the topping may be increased up to and including 110mm. Depending on the finish and depth of grind additional topping can be added to the minimum 85mm topping. Underfloor heating pipes shall be no larger than 16mm diameter. It is recommended the underfloor heating pipes are tied to the top of the mesh. It is advised to dip the pipes below the mesh at saw cut locations to avoid the risk of damaging the heating. Increasing the mesh top cover would increase the risk of shrinkage cracking and as such shall be avoided.

Toppings greater than 110mm thick are beyond the scope of this document and must be designed by a chartered professional engineer.

3.9 Shower Rebates

A 50mm deep shower rebate is allowed. All pods in contact with the shower rebate are cut down by 50mm or supplied as 170mm high QPOD. Mesh is lowered to maintain correct cover and 300mm lap between cuts. Trimming bars are required 50mm from around the shower required to extend 600mm beyond rebate. See Figure 21.

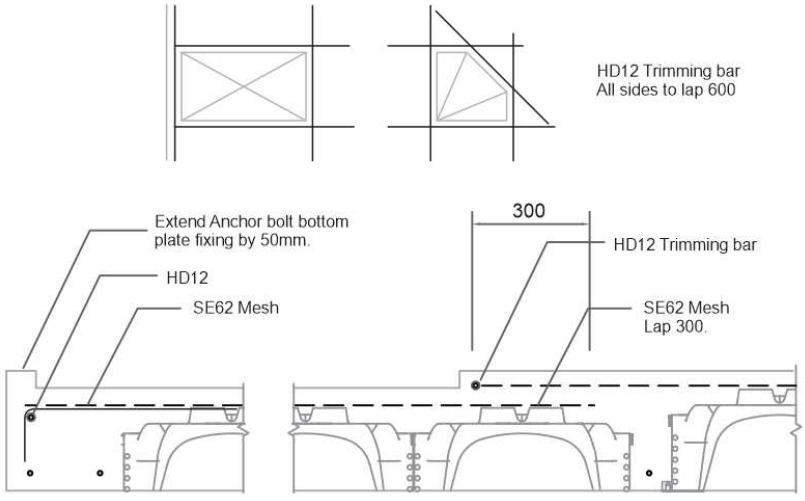


FIGURE 21 - SHOWER REBATE

Larger penetrations or voids up to 450mm square (e.g. for shower waste/traps) are permitted through the slab. These openings shall be trimmed with 1 x HD12 (Grade 500E) 1500mm bar placed along each side of the opening, tied to the mesh. One set of parallel bars shall be placed on top of the mesh and the other set placed under the mesh. Any situation of the reinforcing mesh being cut to accommodate services should apply this additional reinforcing. See Figure 22.

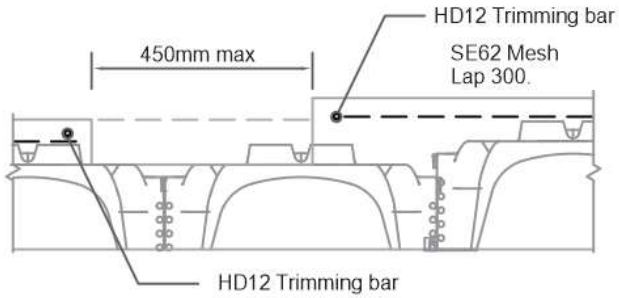


FIGURE 22 - LARGER PENETRATION

3.10 Split Levels and Raised Block Perimeters

Steps of up to 600mm can be designed within the slab envelope or to create a raised perimeter on undulating sites. Refer to Figures 23-25 Step Down detailing options. For masonry block options, a minimum of 15 Series block (150mm) is required.

A free joint is detailed when the distance from the step-down to the slab edge is in excess of 15m following the detail in Figures 30-32.

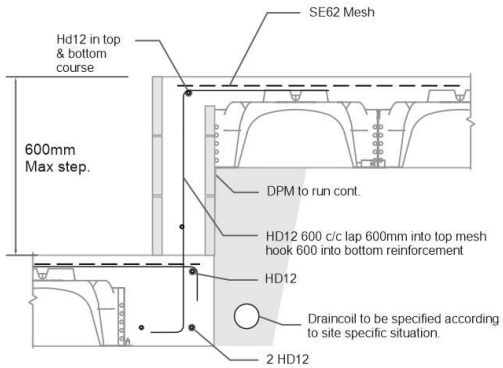


FIGURE 23 - INTERNAL STEP DOWN BLOCK

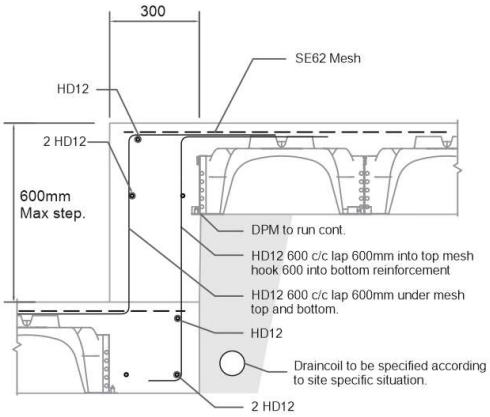


FIGURE 24 - INTERNAL STEP DOWN CONCRETE

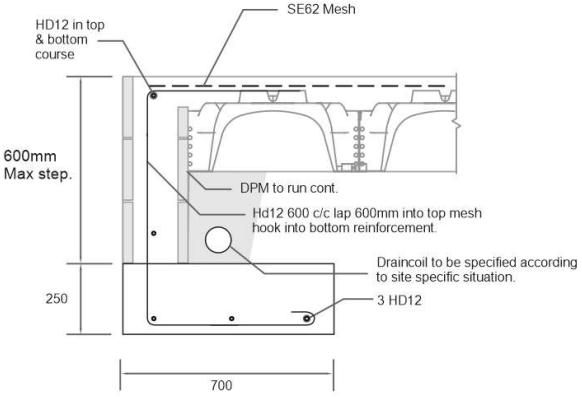


FIGURE 25 - EXTERNAL STEP DOWN BLOCK

3.11 Wing Walls

Small wing wall projections are permitted to a maximum projection from the slab of 1200mm with a minimum width of 140mm, lightweight cladding is allowed for, whilst heavy cladding would require SED. Refer to Figure 26. Where wing wall designs fall outside of this scope a supporting PS1 is required to cover this element only.

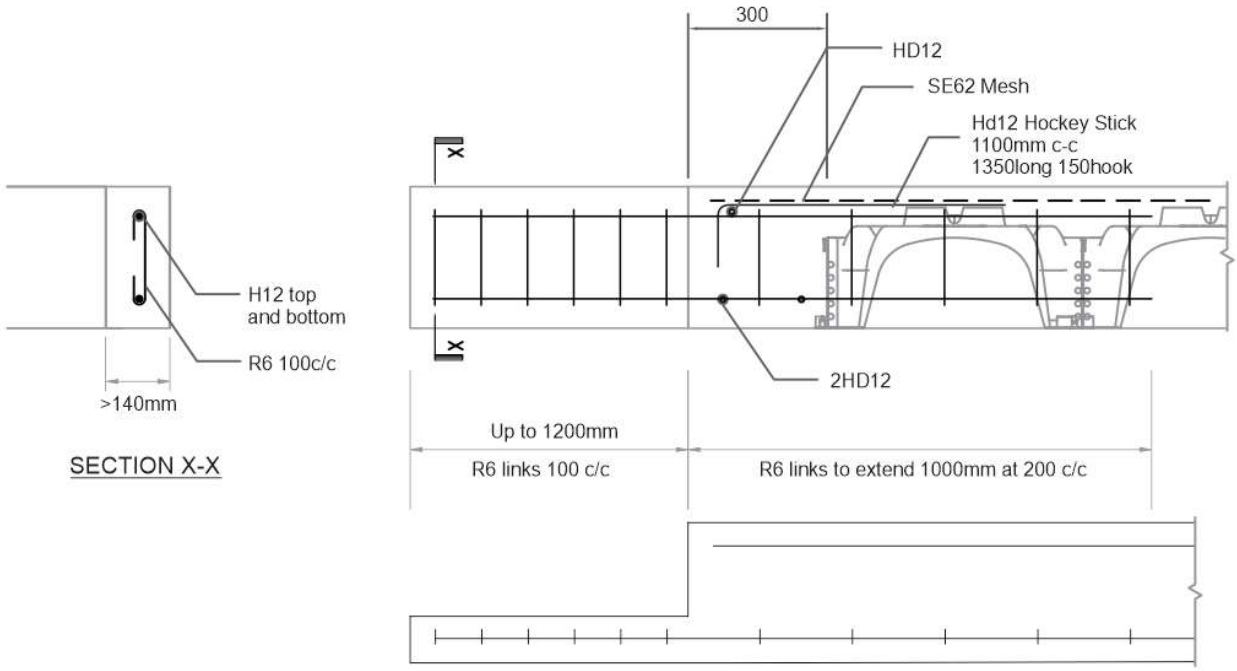


FIGURE 26 - WING WALL

3.12 Corners

2 x Corner bars shall be placed on the bottom extending into one outside bar. The bottom bars shall lap these 600mm minimum each direction extending from two bottom bars into the one outside bar maintaining 50mm cover. These bars shall be tied together where they cross. The single top bars shall adopt the same corner bar lap maintaining covers 50mm from the inside edge and 30mm top cover. See Figure 27.

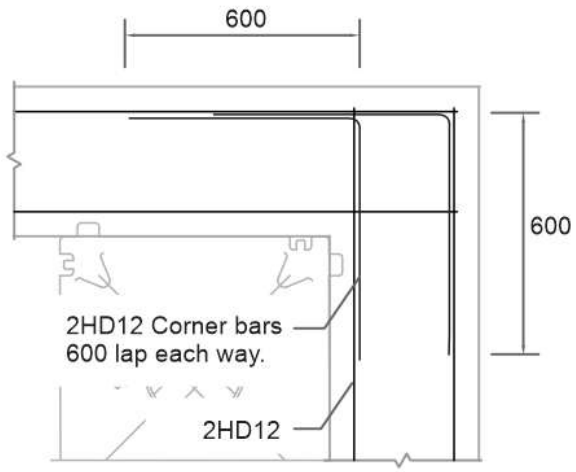


FIGURE 27 - CORNER

3.13 Re-Entrant Corners

Additional steel is required to reduce the risk of cracking this consists of 2 x 2000mm HD12 bars, placed diagonally across the re-entrant corners. Spaced 100mm apart with the first being located with 50mm side cover to the corner.

Re-entrant corner steel can be omitted if fibre concrete is used or sawcut is located at the given corner.

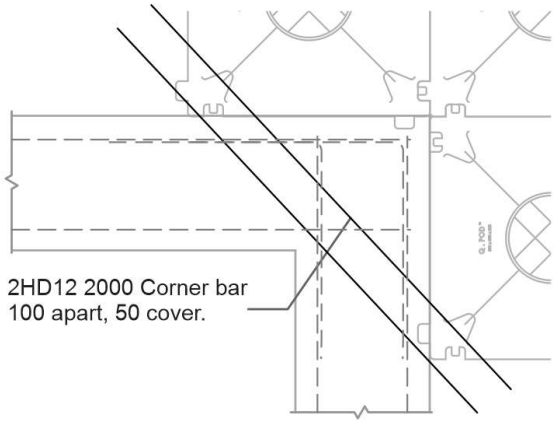


FIGURE 28 - RE-ENTRANT CORNER

3.14 Concrete Placing, Finishing and Curing

Concrete placing shall be carried out in accordance with NZS3109. Truck, Barrow and Slump pumps used with either 13mm or 19mm aggregate are all acceptable methods.

The top surface of the slab shall be screeded immediately after placing/vibration has been completed.

Screeding shall be carried out with a level as a reference to ensure the top surface is finished within tolerance.

The surface shall be a blemish-free surface to class U3 finish in accordance with NZS3114.

Foundations shall be cured for at least 7 days in accordance with NZS3109:1997.

3.15 Shrinkage Control Joints

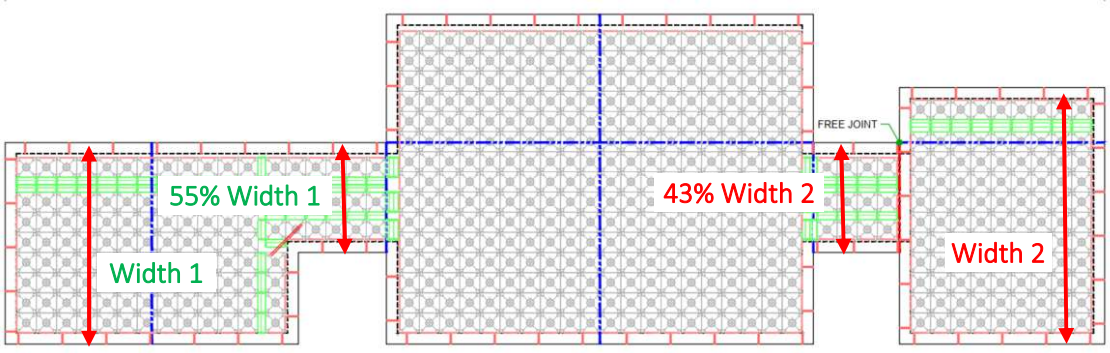
Shrinkage control joints reduce the risk of unwanted cracks, and their placement needs to be carefully considered where uncontrolled cracking could be unacceptable. Two types are described here: saw cut joints (which are tied joints), and free joints.

Saw cuts shall be 20-25mm deep (for the standard 85mm topping). For thicker toppings deeper saw cuts will be required of approximately one quarter of the topping thickness. Saw cuts shall be made where indicated on the drawings.

Re-entrant corners are at higher risk of cracking due to differential stresses developing in the slab with different rates of curing on the exposed edges than compared with the internal slab.

Saw cuts shall be installed where possible at re-entrant corners and at 6m x 6m (maximum).

Slabs longer than 30m or with an irregular shape and narrow corridor* as demonstrated in Figure 29 will require a free joint, demonstrated in Figures 30-32. Cladding and floor coverings in particular which cross the free joint need to be detailed appropriately to tolerate the horizontal movement which could occur. Where the floor incorporates a step down free joints shall be required if the distance from the step down to edge of the slab exceeds 15m.



*Narrow corridors are defined as a width less than 6m AND has a width less than 50% of the smaller adjacent slab.

FIGURE 29 – HOUSE SHAPE

For **CONTINUOUS**, an 80mm crack inducer shall be located directly above the pod edge (thickening edge). Mesh stops either side of the crack inducer and 600mm HD12 dowels shall be threaded through at 550mm centres debonded on one side. Extra HD12 reinforcing to be placed under mesh either side of joint. The bottom reinforcement at the perimeter shall run CONTINUOUS, debonded on one side of the crack inducer for a length of 300mm as per Figures 30-31 Free Joint CONTINUOUS Type.

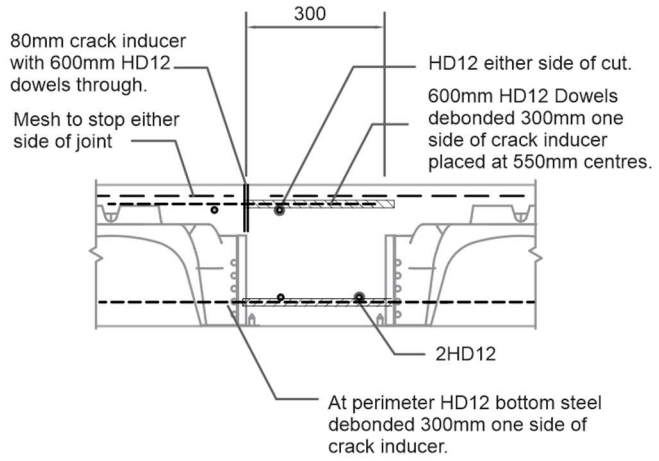


FIGURE 30 - FREE JOINT CONTINUOUS TYPE

Note for free joints in garages

Free joints that pass through a central point in a garage (<300mm from a wall) must feature a 300mm rib both sides of the free joint or crack inducer to ensure sufficient wheel support from vehicle loads.

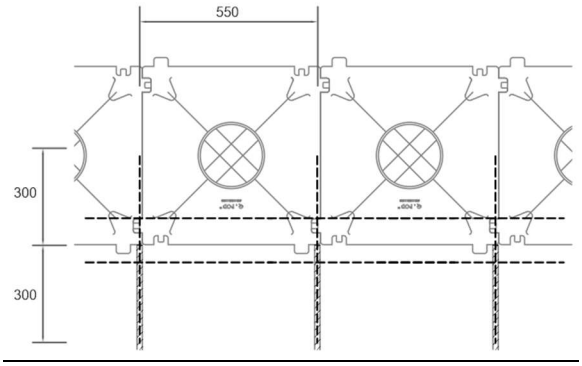


FIGURE 31 - FREE JOINT CONTINUOUS TYPE TOP

For **RAFT**, 80mm x 6mm green cut or crack inducer shall be located directly above pod edge (thickening edge). Top reinforcement stops either side of the sawcut or crack inducer. Extra HD12 reinforcing to be placed under mesh either side of joint. The bottom reinforcement must extend perpendicular to the free joint at a minimum of 1200mm either side of the joint and be debonded for a length of 300mm on one side as per Figure 32 – Free Joint RAFT Type

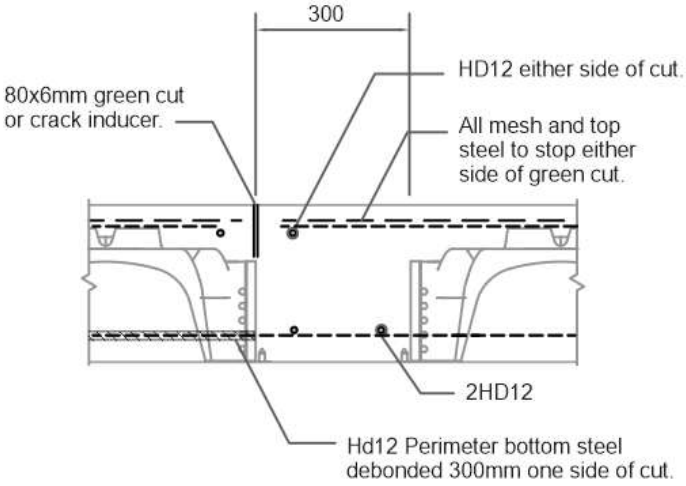


FIGURE 32 - FREE JOINT RAFT TYPE

4.0 Insulation Guidance

4.1 R-Value Requirements

Compliance with H1.3.1(a) and H1.3.2E for buildings incorporating a concrete floor shall be established by specific design using the Schedule Method in H1/AS1 and H1/AS2, or the Calculation Method in H1/AS1 and H1/AS2, using construction R-values from the performance tables described in Acceptable Solution H1/AS1 Section F.1.2 or H1/AS2 Section F.1.2 or by the method in Verification Method H1/VM1 Appendix F Section F.1.2 or Verification Method H1/VM2 Appendix F Section F.1.2.

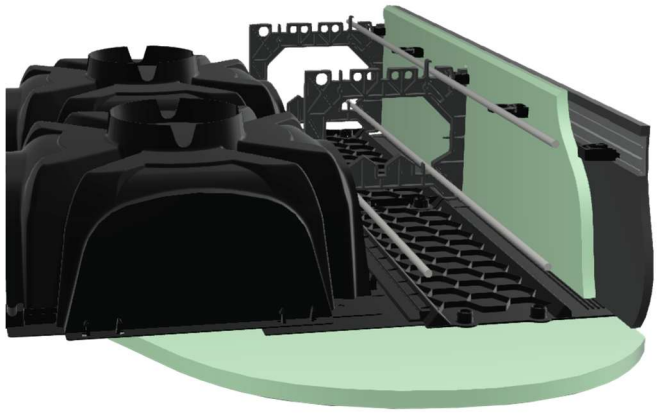
The establishing of R-Values for QPOD has been achieved using calculations as per the NZBC H1 standard Verification Method H1/VM1 Appendix F, effective 4 August 2022, for the configurations summarised in the report(s) produced by Sustainable Engineering Ltd

For specific R-Values relating to your building design, please refer to our latest online R-Value Calculators on the QPOD website. Here we reference results based on the calculation method in Verification Method.

4.2 Insulation Systems

Side Insulation

Approved side Insulation systems such as QuickSet Formwork can be incorporated in the QPOD foundation in accordance with manufacturers specification and specific hold down fastening guidance. All perimeter steel detailing and steel cover shall be in accordance with the guidance in this manual; 3.6 Perimeter Foundations. All bottom plate hold-down fixings must be in accordance with NZS3604-2011.



QuickSet Insulated formwork system has had HILTI carry out verification of the hold-downs to meet the NZS3604 loading requirements as follows:

Standard bottom plate fixing: HILTI screw anchor – HUS3-H 10mm diameter (130mm long), 85mm minimum embedment @ 800c/c – installed as per manufacturers specifications.

15kN brace wall: HILTI chemical anchor – HIT-RE 500 V4 + HAS 8.8HDG M10 (190mm long), 110mm minimum embedment – installed as per manufacturers specifications.

Under Slab Insulation

Under slab insulation can be used under QPOD and SlabTank optimising available XPS & EPS insulation options where compressive strengths shall meet minimum requirements of 200kPa @10% deformation allowed for thicknesses up to 100mm or maximum deformation of <10mm for thicknesses up to 150mm thick.

Supplier must provide certification of meeting the minimum compressive strength to thickness requirements. R-values for the relevant tested products can be calculated on the QPOD R-value calculator provided online.