CUPOLEX TECHNICAL MANUAL

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CUPOLEX®

CONTENTS

1.0 INTRODUCTION

This document contains design information.

For installation, please refer to the installation of Cupolex®. *www.cupolex.co.nz/installation*

A variation to any of the information given here will require a specific engineering design (SED) which makes it beyond the scope of this document. SED manual is also available through our CodeMark.

The Cupolex floor system can be constructed for all slab-on-ground floors for domestic or residential buildings that fall within the scope of NZS 3604:2011 “Timber Framed Buildings”.

The design details in this Manual are to be used to design a Cupolex foundation.

The Cupolex flooring system is covered by the BRANZ™ CodeMark.

Note that a BRANZ CodeMark means that if this Manual along with the Installation of Cupolex manual is followed, the relevant Building Control Authority will automatically provide a building permit without the need for producer statements (PS). To comply with this, certified concrete must be used.

Cupolex® = Cupolex | CodeMark® = CodeMark | BRANZ™ = Branz

Please note these registered marks are not required to be used throughout the document.

2.0 SCOPE

This clause sets out the limitations that apply to the use of the Cupolex system to ensure that specific engineering design (SED) is **not** required. The concrete floor slab for buildings or ground conditions that **do not meet this scope must be subject to SED** to comply with the requirements of the New Zealand Building Code (NZBC).

2.1 Structural limitations

SED input shall not be required only where the structure supported by the Cupolex system complies with all of the following:

- The structure supported by Cupolex is constructed in Earthquake Zone up to and including Zone 3 as defined within NZS3604:2011.
- Cupolex laid level or has a maximum step of 600mm detailed in accordance with this Manual.
- The structure supported by Cupolex has no basement, part basement or foundation walls.
- The total height from the lowest ground level to the highest point of the roof does not exceed 10m.
- The structure supported by Cupolex has a roof pitch limited to 60 degrees maximum from the horizontal.
- The maximum height of a single storey is 4.8m.
- Only ground floor walls of the structure supported by the Cupolex to be “heavy external walls” (as defined in Section 2.4 of this Manual).
- The roof truss span shall be less than or equal to 12m when the roof and ceiling loads are supported entirely by the external walls. Where internal support of the roof truss is used the footings below point loads identified by the truss designer shall comply with this Manual.
- Where internal load bearing walls are used to support the roof and floor, the loaded dimensions stated in Tables 8.2 and 14.10 of NZS 3604:2011 shall apply. These load bearing walls shall be supported by a 300mm wide load bearing rib as detailed in this Manual.
- Floors may be of unlimited size provided that the maximum dimension between free joints shall not exceed 29m. Where free joints are **required** they should be detailed in accordance with this Manual.

2.2 Live loading

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

- 1.5kPa and up to 2.5kPa Floor loading.
- 13kN concentrated load in garage over area of 0.3 x0.3m (vehicle limited to 2500kg gross).

2.3 Snow loading

Open ground snow loading as defined within NZS 3604:2011 section 15 of up to 1.5kPa.

2.4 Dead loading for use with this Manual

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

- Light external walls with total mass not exceeding 60kg/m^2.
  Example: Timber framing with weather boards and interior wall linings.
- Heavy external walls with a total mass greater than 60kg/m^2 but not exceeding 290kg/m^2.
  Example: Timber framing with masonry veneer or partially filled 20 Series masonry blocks.
- Internal walls with total mass not exceeding 45kg/m^2.
  Example: Timber framing and linings.
- Light roofs with total mass not exceeding 45kg/m^2.
  Example: Ceiling linings and metal roof, including framing.
- Heavy internal walls and/or load bearing internal walls supported on a load bearing rib.

2.5 Foundation requirement for different building types

The designs given in this Manual are limited to where the system supports building types as described in Table 2. The classification of wall and roof weights are as detailed in Section 2.4 of this Manual.

Table 2

Foundation Type (A – C) Classification

Number of storey	Roof	Ground floor external walls	1.5kPa live load and up to 1kPa snow load	2.5kPa live load and up to 1.5kPa snow load
Single storey	Light	Light	A	A
Single storey	Light	Heavy	B	C

2.6 Foundation soils

The Cupolex may be used when the supporting ground meets the definitions of "good ground" given in Section 3 NZS 3604:2011 (as modified by B1 of the Building Compliance Documents). In addition, the Cupolex system shall not be used on damp sites i.e. where it can be reasonably expected that the ground water level could come within 600mm of the underside of the system. The acceptability of the ground shall be verified in accordance with Clause 3.1.3 of NZS 3604:2011. Lower bearing capacity than required by NZS 3604:2011 are possible, in fact Cupolex foundation compliance with Table 3 allows ultimate bearing capacities of less than 300kPa. However, with the exception of bearing capacity all other requirements in NZS 3604:2011 need to be complied with.

Solutions for soils prone to liquefaction or expansive soils are also available using Cupolex, however these are outside the scope of this Manual and require an SED.

Where the ultimate bearing capacity required of the supporting ground is verified by Scala Penetrometer testing in accordance with Clause 3.3 of NZS 3604:2011 or for cohesive soils using a calibrated shear vane in accordance with NZGS Guideline for Hand-Held Shear Vane Test. The bearing capacity shall exceed the values in Table 3 for the proposed building type. For Scala Penetrometer Testing the bearing capacity shall be considered adequate when the blows per 300mm depth of penetration below the underside of the system at each test site exceeds the values given in Table 3 below.

Table 3

Ultimate bearing capacity

Foundation type	Ultimate bearing capacity (kPa)	Min. blows for 300mm depth for scala testing
A	200	6
B	240	7
C	275	8
D	Good ground	As defined in NZS 3604:2011

2.7 Flow diagrams

The flow diagrams on the following pages (adapted from NZS 3604:2011) will help in determining whether the non-specific details for the Cupolex system can be used for the purpose of the concrete floor slab. There are two checks in the process. The first is to determine whether the proposed building complies with the requirements set out in this Manual (Building Check) and the second is to determine whether the site complies with the requirements set out in this Manual (Site Check)

(Note: NZS 3604:2011 provides for parts of buildings to be considered as individual buildings. These flow diagrams apply to those parts of the building where slab-on-ground is being considered and where the part of the building can be considered as an individual building under NZS 3604:2011.)

BUILDING CHECK

Importance level 1 or 2 building?	YES
Max 2.5kPa floor loads?	YES
Wind zone L,M,H,VH or EH?	YES
Snow loadings <=1.5kPa?	YES
Lowest ground level to roof apex <=10m?	YES
Max roof slope <=60°?	YES
Max wall slope <=20° to vertical?	YES
Max truss span <=12m?	YES
Trussed roof supported on external walls only?	YES
Roof support is external and internal load bearing?	YES
Loaded dimensions complying with NZS 3604:2011?	YES
External walls meet mass limitations of foundation types A-C?	YES
Internal non-load bearing wall mass <=45kg/m^2?	YES
Single storey studs <= 4.8m?	YES

IF YOU ANSWERED NO TO ANY OF THESE SED IS REQUIRED

BUILDING OK?
PROCEED TO SITE CHECK

Are there any issues with surrounding buildings? (e.g. piping, proximity, easements etc)	NO
Is the groundwater level within 600mm of the underside of the Cupolex?	NO
Is there services from other buildings running beneath the building platform?	NO
Is there any organic topsoil/peat etc. present?	NO
Is there uncontrolled fill present on the building platform?	NO
Is the building platform on expansive soils?	NO
Is the building platform prone to liquefaction?	NO
Is the ultimate bearing capacity less then the values specified in table 3 for the appropriate foundation type?	NO

IF YOU ANSWERED YES TO ANY OF THESE SED IS REQUIRED

CUPOLEX SYSTEM OK

3.0 TECHNICAL INFORMATION

3.1 Overview

The Cupolex floor system is a reinforced concrete raft floor for slab-on-ground applications. Typically, it consists of a minimum 60mm thick slab supported upon Cupolex pods. Cupolex pods are provided between edge beams, stiffening beams or slab thickenings beneath where load bearing or bracing walls are provided. The overall slab depth is 320mm compromising 260mm Cupolex pod and minimum 60mm concrete topping.

Where underfloor heating coils are installed, the minimum topping thickness shall be increased to accommodate the pipe size. i.e. 16mm-19mm pipe shall increase the topping thickness by 20mm. In this instance, the minimum topping thickness shall be 80mm. Similarly, where a polished floor is specified, the topping thickness shall be increased to account for the concrete depth required to achieve the polished surface. Refer to section 3.5.

Figure 1

Cupolex with steel reforcing

A Cupolex pod

B Mesh reinforcing

C Steel reinforcing

D Edge beam

3.2 Pods

Cupolex Pods are 550mm x 550mm and stand 260mm high. They are placed directly on top of the DPM on levelled ground and arranged in formation to form a reinforced concrete slab. The Cupolex pods are provided as an "infill" between the edge beams, stiffening beams or slab thickenings at load bearing or bracing walls. This provides a grid of reinforced concrete beams or thickenings. The Beton is used for adjustments in 55mm increments. There is no need for cutting Cupolex pods. Betons are also used to accommodate services. 350mm and 200mm high pods are also available for deeper Edge beams and internal beams or recessed showers.

3.3 Reinforcing Steel

Reinforcing steel in the slab shall consist of welded reinforcing mesh complying with AS/NZS 4671:2019 and NZS 3101:2006. The topping mesh reinforcement shall be a minimum of SE62 for a 60mm topping, SE72 for topping slab up to 90mm thick and will need to be specified by a structural engineer for thicker slabs. The reinforcing mesh sits directly on the high point of the Cupolex pods. Mesh chairs should be used for topping slabs greater than 80mm. Conventional timber or steel form work is used to form the edge of the slab/foundation.

The reinforcing bars in the edge beams and in the slab thickenings beneath where load bearing and bracing walls are provided shall conform to AS/NZS 4671:2019 and NZS 3101:2006 and be Grade 500E. All reinforcement lap, bent and tie shall be in accordance with NZS 3109:1997.

Specifically designed Cupolex spacers (C100) are used to create either a 300mm or 180mm Rib and Edge beam that secure the reinforcing steel bars whilst also providing the correct clearance and concrete cover until the concrete is placed and set.

3.4 Concrete

Certified concrete must be used for Cupolex foundations

1) Raftmix or Pump mix: 20MPa 100mm slump mix suitable for 100mm pump line. Up to 20mm Max nominal aggregate, or as a structural (non-pump) mix.
2) Raftmix or Pump mix: 25MPa 100mm slump mix suitable for 100mm pump line. Up to 20mm Max nominal aggregate, or as a structural (non-pump) mix. This mix is specified for buildings constructed in the “Sea Spray Zone” i.e. within 500m of the sea including harbours, or within 100m of tidal estuaries or inlets, or offshore islands and elsewhere defined as exposure Zone D in NZS 3604:2011 4.2.3.3.

3.5 Polished floor allowance

For polished floors, good ground slabs can be achieved by increasing the mesh size to match the requirement expressed in Table 1. A concrete thickness equivalent to the grinding amount shall be added to the standard Cupolex floor when pouring to achieve the 60mm finished thickness at the apex of the pod post grinding. Slab must be cured for a minimum 7 days, curing to be by either fully flooding the slab, or alternatively specialist support shall be sort from Markham, Aquron or Inforce and their design team to ascertain that a curing agent such as “Aquron 2000” or similar product is a feasible alternative for the project. Concrete supplier shall be made aware of the polished floors and provide an adequate mix to minimise plastic shrinkage. Where slab length exceeds 18m and ratio between the long and short side is greater than 2, saw cuts at maximum 6m spacing should be allowed. Saw cuts to be provided to the boundary of the polished areas irrespective of the size of the slab.

Table 1

Polished concrete floor mesh selection table:

	MESH REQUIRED FOR POLISHED CONCRETE FLOOR																						
	BUILDING LENGTH (L) [m]																						
BUILDING WIDTH (W) [m]	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7
17													SE82										
16												SE82	SE82	SE82									
15										SE92	SE92	SE82	SE82	SE82	SE82								
14									SE92	SE92	SE92	SE82	SE82	SE82	SE82	SE82							
13							SE92	SE92	SE92	SE92	SE92	SE82	SE82	SE82	SE82	SE82	SE72						
12					SED	SED	SE92	SE92	SE92	SE92	SE92	SE92	SE82	SE82	SE82	SE82	SE72	SE72					
11			SED	SED	SED	SED	SE92	SE92	SE92	SE92	SE92	SE92	SE82	SE82	SE82	SE82	SE72	SE72	SE72				
10	SED	SED	SED	SED	SED	SED	SED	SE92	SE92	SE92	SE92	SE92	SE82	SE82	SE82	SE82	SE72	SE72	SE72	SE72			
9	SED	SED	SED	SED	SED	SED	SED	SE92	SE92	SE92	SE92	SE92	SE82	SE82	SE82	SE82	SE72	SE72	SE72	SE72	SE62		
8	SED	SED	SED	SED	SED	SED	SED	SE92	SE92	SE92	SE92	SE92	SE82	SE82	SE82	SE82	SE82	SE72	SE72	SE72	SE62	SE62	
7	SED	SED	SED	SED	SED	SED	SED	SE92	SE92	SE92	SE92	SE92	SE82	SE82	SE82	SE82	SE82	SE72	SE72	SE72	SE62	SE62	SE62

SED = Mesh must be designed by a suitably qualified structural engineer.

Where the slab length exceeds 18m and the ratio between the long and short side is greater than 2, saw cut at a maximum of 6m spacing should be adopted. Saw cuts to be provided to the boundary of the polished areas irrespective of the slab size.

If the floor is not polished then slabs up to a length of 21m may use SE62 mesh. Slabs of greater length shall use SE72 mesh.

4.0 CONSTRUCTION DETAILS

Standard construction details for Cupolex are provided here for buildings within the scope of Section 2.0 Scope.

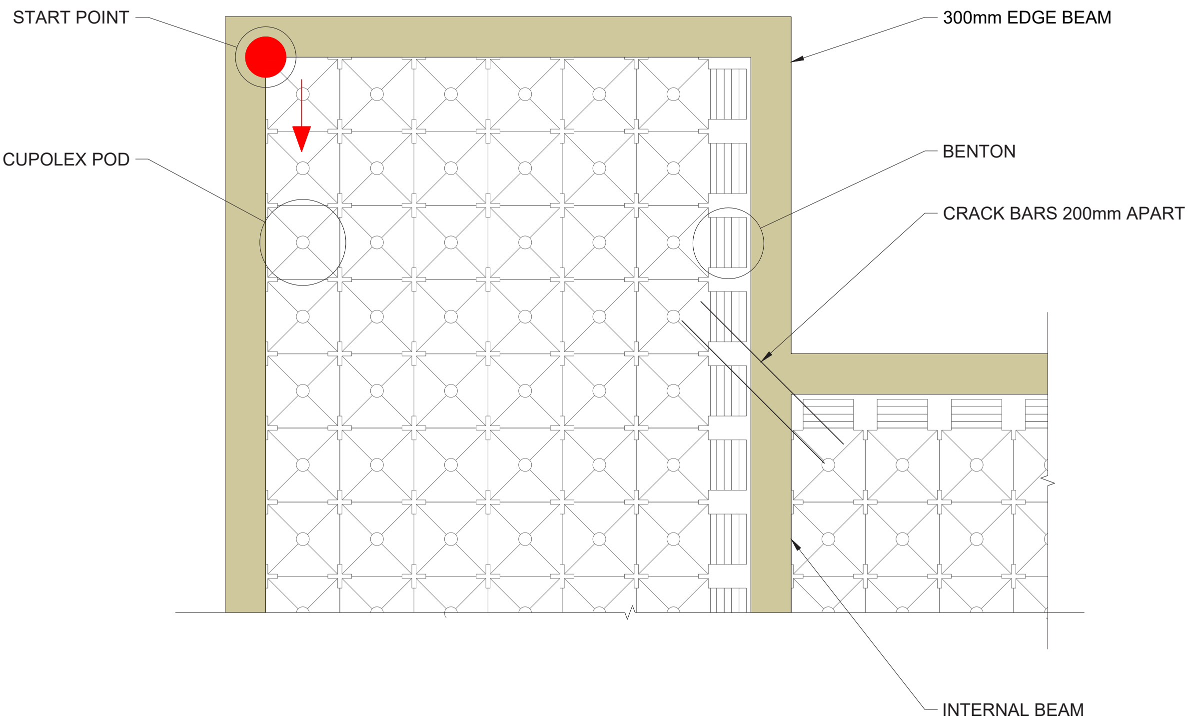
4.1 Pod layout

Cupolex pods shall be placed on levelled ground and arranged in clusters to suit the edge beams and load bearing wall slab thickenings. The pods are used as a sacrificial formwork (Void Formers) while the concrete is curing. These are an integral component of the system and shall not be substituted.

Pods shall be placed so as to provide the necessary spacing between the edge beam and internal beams. The edge beam shall have a minimum 300mm clearance to the first Cupolex component whether it be a Cupolex pod or Beton stop. The cluster is then formed by working from left to right and top to bottom (just like reading a book).

Figure 2

Example of a typical Cupolex layout



4.2 Edge beam width and reinforcement

Edge beams around the perimeter of the floor slab shall be 300mm to provide capacity for external load bearing walls and contain 2-HD12 bars (Grade 500E) as bottom and 2HD12 bar(s) (Grade 500E) around the top. This top bar shall be tied to the underside of the reinforcement mesh. See Figure 3 for construction details. If the edge beam is rebated for brick veneers refer to Figure 3 (C).

4.3 Internal beams for non-load bearing bracing walls

Due to the limited thickness of the slab 60mm (minimum) at its thinnest point, a 150mm wide full construction depth beam is required under all braced walls with hold-down connections; otherwise, the hold-downs will not achieve sufficient concrete embedment.

If the bracing line does not comprise of hold-downs (e.g. Gib GS1-N and GS2-N or other proprietary system for which the bottom plate is connected to the floor slab with shot fired nails) and the wall is not a load bearing wall, no thickening or beam is required below those lines. To minimise the use of concrete beams, it would be advisable to use, for internal non loading bearing walls, bracing system that allow for the use of shot fired nails to fix their bottom plate e.g. GS1 and GS2 GIB bracing system.

When initiating a 150mm or 300mm wide beam this is to be continued to any orthogonal beam, this helps with regularising the layout of the pods.

See Figure 3 E 150mm beam detail.

4.4 Internal beams for load bearing walls

300mm wide beams shall be provided under all load bearing walls and/or to regularise the layout (e.g. continuing the 300mm beam to the next orthogonal 300mm beam). Refer Figure 3 (D) for construction details under internal load bearing walls. Where load bearing beams meet and terminate at the edge beam or with another load bearing wall, the bottom reinforcement from the load bearing rib shall be bent into the edge beam or adjacent load bearing rib and tied together. The reinforcement shall lap at least 600mm and be tied.

Notes

1. Internal beam as per standard details (full depth to ground) reinforced using 3HD12 top and bottom and minimum SE62 mesh.

4.5 Point loads and uniformally distributed loads

For dwelling class activity A1:

- Live distributed load: 1.5kPa
- Live point load: 1.8kN
- For garages class activity F
- Garage live distributed load: 2.5kPa
- Garage live point load: 13kN

Snow zone up to ground snow load of 1.5 kPa with roof pitch >3 degrees, in accordance with NZS 3604:2011 Section 15.

Wind, no restriction to the wind zone as long as truss manufacturer loads (uplift) or NZS 3604:2011 connection requirement (uplift) do not exceed:

- 5.1kN/m for any external beam (300mm wide)
- 8.1kN/m for any internal load bearing beam (300mm wide)

A maximum ULS point load of 23kN may be applied to 300mm wide edge or loading bearing beams.

Multiple point loads on TC1 and Good Ground design to be not closer than:

- 4.5m if applied to exterior beam (300mm wide)
- 2.9m if applied to an internal beam (300mm wide)

Bracing systems are to be limited to 150BU/m or 7.5kN/m capacity.

Notes

1. If the point loads and line loads are equal to or less than the stated above, no shear link reinforcement is required in the main foundation beams. If shear links are required this is outside the scope of this document and is subject to Specific Engineering Design.

4.6 Mesh reinforcement

The entire floor area must be reinforced with a minimum SE62 for a 60mm to 70mm topping; SE72 is required for slabs over 70mm and less than a maximum of 90mm topping.

In the 60mm-70mm slab the mesh shall sit directly on top of the Cupolex pods see Figure 3a and be tied at overlaps; 90mm topping slabs the mesh will sit on 40mm chairs. For slab length that exceed 21m the standard mesh size shall increase to SE72.

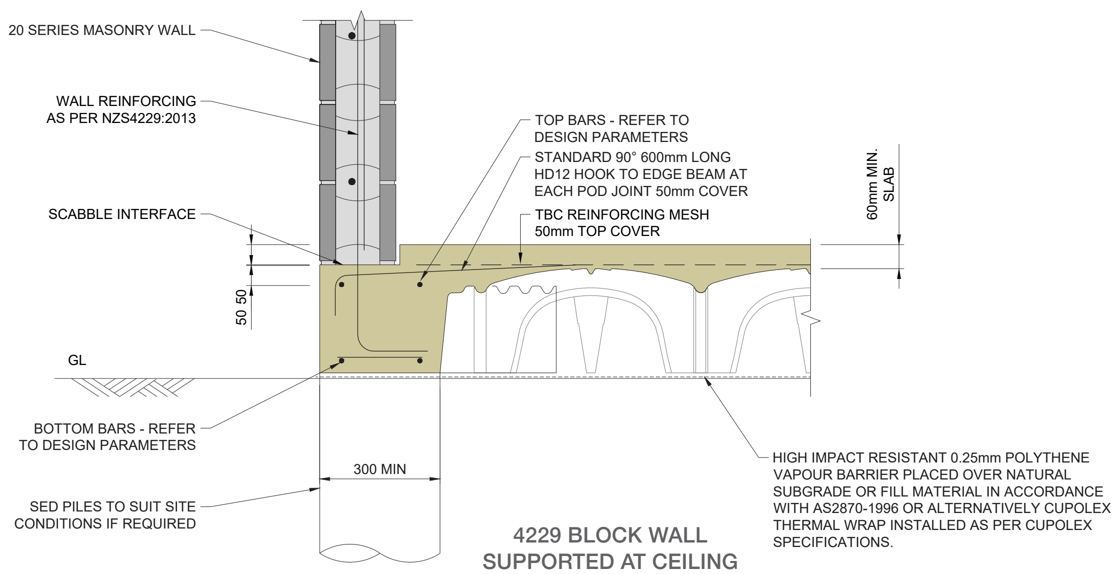
4.7 Re-entrant corners

In order to limit the risk of cracking on internal or re-entrant corners, an additional 2xHD12 (grade 500E) be placed on top of the mesh. These bars are to be 1200mm long and be place 200mm apart. See figure 1 Typical Cupolex layout.

Figure 3

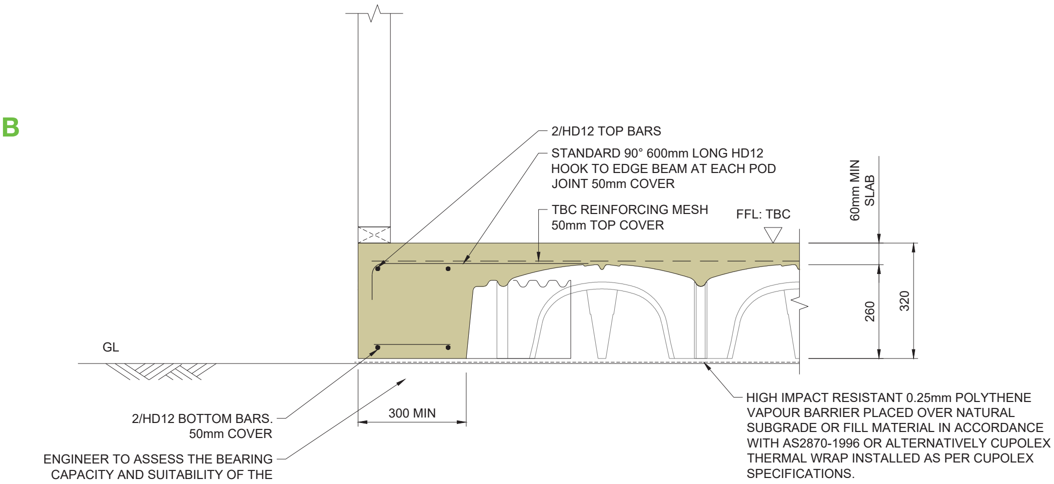
Standard Cupolex construction details

A



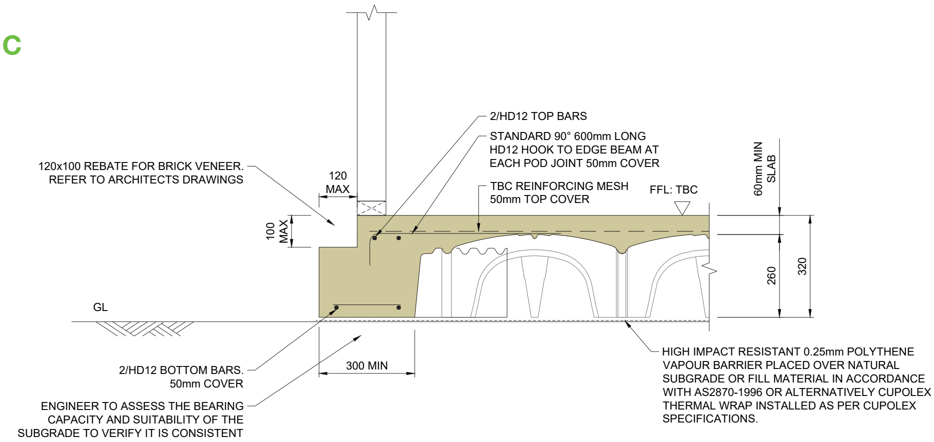
4229 BLOCK WALL SUPPORTED AT CEILING

B



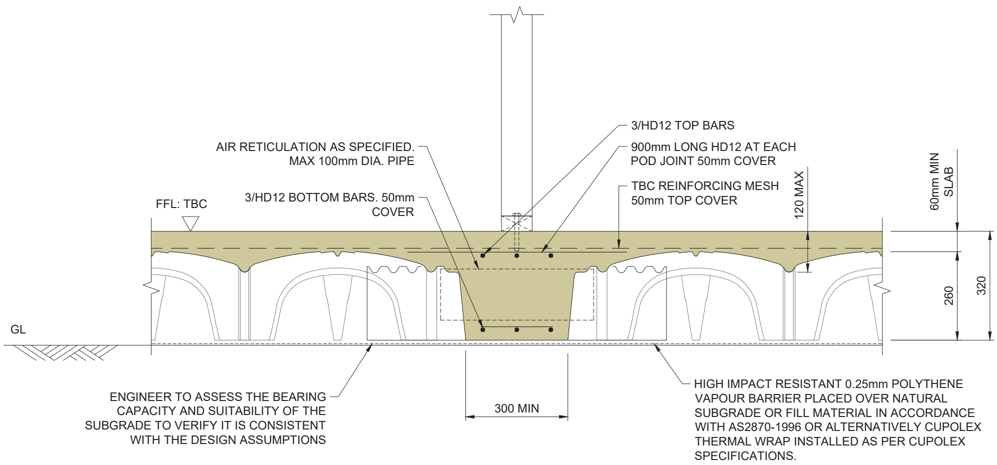
STANDARD EDGE DETAIL

C



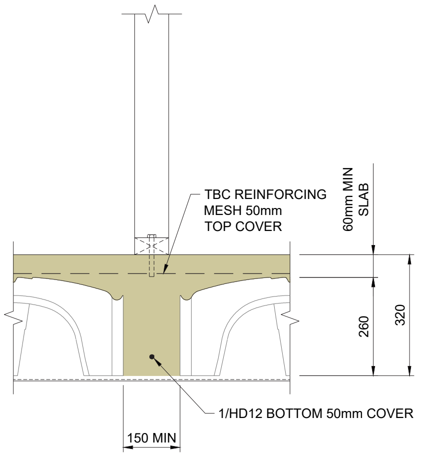
BRICK REBATE EDGE DETAIL

D



300MM INTERNAL BEAM DETAIL

E



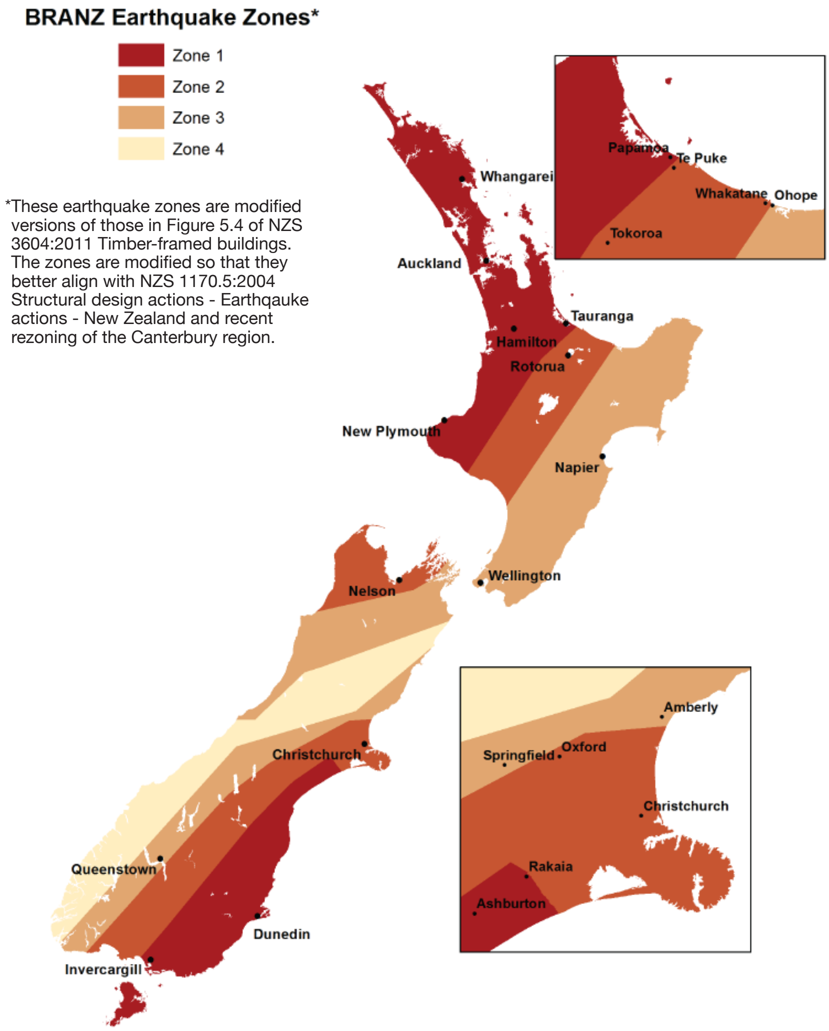
150MM BEAM INTERNAL DETAIL

5.0 LATERAL RESISTANCE

5.1 Earthquake resistance

Unlike conventional (Ring) foundations, Cupolex is not entrenched or embedded into the ground, instead a “raft” is created for a suitable building platform. The horizontal sliding resistance to seismic loads is provided by the frictional contact with the platform beneath. In areas and locations where the Seismic Hazard Factor (Z) is greater than Earthquake zone 3 as defined in NZS 3604:2011, SED is required as these may require shear keys and so is outside the scope of this document. Refer to Figure 4.

Figure 4



Earthquake zone map as per NZS 3604:2011 from the BRANZ website

5.2 Sliding

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

Cupolex bracing capacity is determined by the sliding capacity from the frictional resistance (i.e. Cupolex and the ground), where exceeded in Table 4 SED is required.

Table 4

Bracing capacity

Bracing capacity provided by frictional resistance per $100m^2$ of ground floor area:

Building type	Roof type	Ground floor external walls	BU's provided per $100m^2$
Single storey	Light	Light	2000
Single storey	Light	Heavy	2300

5.3 Design example for lateral resistance calculation

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

A single storey home with light roof located in a VH wind zone as defined in NZS 3604. The building height is 6m with 3m above the eves. i.e. the across-wind (length) is 15m and the along-wind (width) is 12m ($180m^2$).

For seismic zones 1 to 3, as required for the use of this manual, shear keys are not required for earthquake resistance.

However, with wind loadings shown in Table 5.5 of NZS 3604 requires 95 Bracing Units per metre (BU/m) across the building and 90 BU/m along. For this we have used a VH (Very High) wind zone, these figures need to be increased by a factor of 1.3:

- 95 x 1.3 x 15m = 1853 BU across
- 90 x1.3 x 12m = 1404 BU along

From Table 4 for a single storey light weight roof with lightweight ground floor external walls the capacity is 2000BU per $100m^2$. So at $180m^2$ the capacity is 3600BU. The capacity (3600) is higher than that of the demand (1853), so no shear keys are required.

If the demand had exceeded the **capacity** then SED is required.

6.0 OTHER DESIGN DETAILS

6.1 R-value

The insulation performance of a building element is by the R-value. The Schedule Method is the simplest method to achieve compliance with Clause H1 of the Building Code.

By calculating R-values to meet the minimum Building Code requirement for floors. For light timber frame construction the minimum is R1.3 and R1.5 for masonry construction. R1.3 can be used on masonry however glazing with greater insulation must be used (see NZBC, Clause H1). Where under floor heating is being used the R-value is increased to R1.9 and the resistance to thermal movement into the room must be one tenth (1/10) of that to the outside environment.

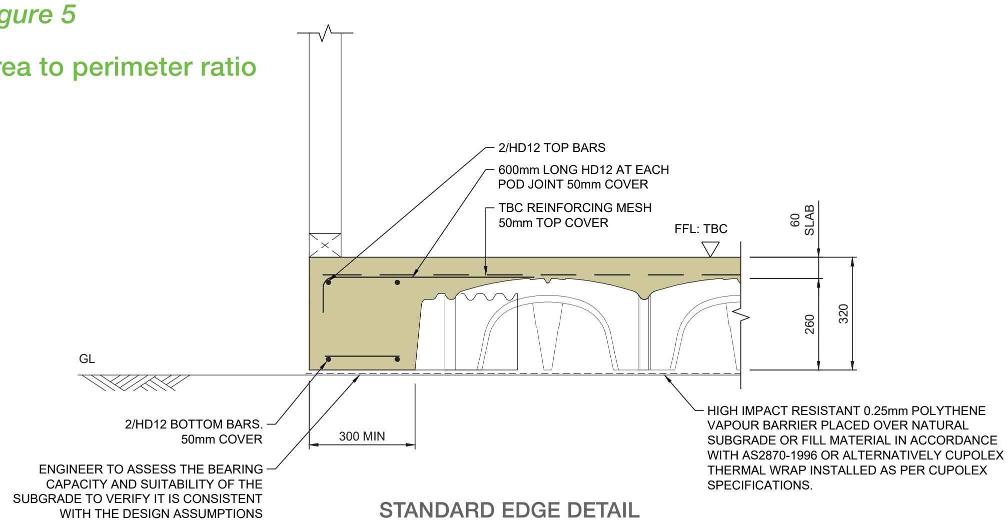
The fourth edition of H1 (Amendment 3, January 2017) states “Concrete Slab-on-Ground are deemed to achieve a construction-value of 1.3, unless a higher R-value is justified in the H1 Calculation, or physical testing is carried out”.

Cupolex is therefore a “deemed to comply” solution. In some instances a designer may wish to determine a more exact R-value for their particular project. There are many different methods to calculate R-values for slabs-on-ground with many different outcomes. The NZBC Clause H1 prescribed that “acceptable methods” for determining the thermal resistance (R-values) of building elements are contained in NZS 4214 Method. The R-value calculation is required to demonstrate compliance with the Building Code, then the NZS 4214 Methodology is probably the best alternative due to its reference in H1. However more technically robust calculations exist, and where a greater R-value is required e.g. heated floors, it is recommended the use of edge insulation. For more information about this the BRANZ Home Insulation Guide is a great resource.

The R-value of a concrete foundation is easily calculated using the Area to Perimeter ratio (A/P) see Figure 5. The R-values have been calculated using the NZS 4214:2006 “Methods of Determining the Total Thermal Resistance of Parts of Buildings”.

Figure 5

Area to perimeter ratio



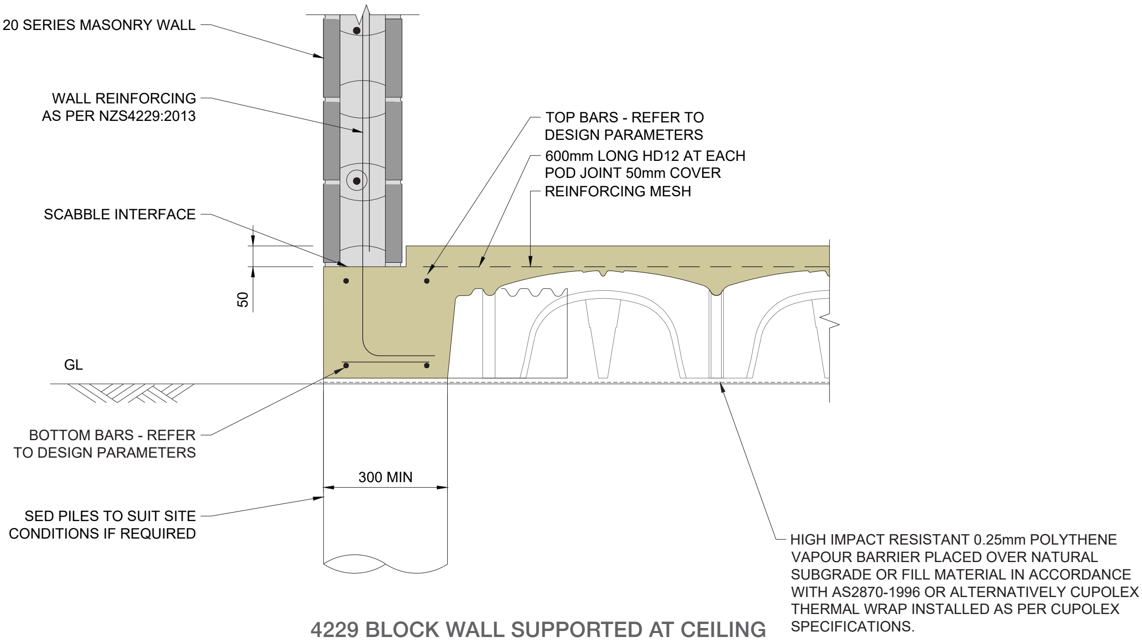
STANDARD EDGE DETAIL

R-values for 701-90mm thick veneer, cavity and 90mm walls

	FLOOR AREA TO PERIMETER RATIO M²/M									
	1.25	1.5	1.75	2.00	2.25	2.5	2.75	3.0	3.5	4.00
R-value m² °C/W	1.54	1.67	1.80	1.93	2.05	2.17	2.28	2.40	2.62	2.84

Figure 5A

Area to perimeter ratio



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R-values for various thicknesses of masonry walls

	BLOCK	FLOOR AREA TO PERIMETER RATIO M²/M									
		1.25	1.5	1.75	2.00	2.25	2.5	2.75	3.0	3.5	4.00
R-value m² °C/W	15 SERIES	1.48	1.60	1.73	1.85	1.96	2.08	2.19	2.30	2.51	2.72
	20 SERIES	1.54	1.67	1.80	1.93	2.05	2.17	2.28	2.40	2.62	2.84
	25 SERIES	1.59	1.73	1.86	1.99	2.12	2.24	2.37	2.49	2.72	2.95

R-values for 70-90mm thick veneer, cavity and various thickness masonry walls

	BLOCK	FLOOR AREA TO PERIMETER RATIO M²/M									
		1.25	1.50	1.75	2.00	2.25	2.5	2.75	3.0	3.5	4.00
R-value m² °C/W	15 SERIES	1.59	1.73	1.86	1.99	2.12	2.24	2.37	2.49	2.72	2.95
	20 SERIES	1.64	1.78	1.92	2.06	2.19	2.32	2.44	2.56	2.81	3.04
	25 SERIES	1.69	1.83	1.98	2.11	2.25	2.38	2.51	2.64	2.88	3.12

6.2 Shrinkage control

Shrinkage control joints reduce the risk of cracks, and their placement needs to be considered where uncontrolled cracking may become unacceptable. There are two acceptable solutions for shrinkage control - saw cuts and free joints.

6.2.1 Saw cuts

Saw cuts are located where the concrete is most likely to crack. Because of the design around Cupolex and positioning of the reinforcing, cracks have no structural implications. Saw cuts location should be selected to be in accordance with the prescription in NZS 3604:2011. Please refer to this standard to get more guidance on the placement of the saw cuts.

Things to consider:

- Does the floor have under floor heating?
- Is the floor a polished finish?
- Where are the ground beams running?
- Are there shear keys?

Cuts should either be done on the day of pouring using a “soft cut” or within 24 hours in summer or 48 hours in winter, using a diamond blade and should be to a depth of 25mm. Saw cuts location should be selected to be in accordance with the prescription in NZS 3604:2011. Please refer to this standard to get more guidance on the placement of the saw cuts. if no saw cuts are requested, SED is required.

6.2.2 Free joints

Where the length of the floor exceeds 29m a free joint shall be provided as detailed in Figure 6. Any movement, shrinkage or thermal will occur over this joint, so is positioned to minimise the impact on floor coverings and walls.

If the bottom of the Cupolex is not flat i.e. the floor incorporates a step-down, then a joint shall be provided if the distance from the step-down to the edge of the slab exceeds 15m.

Figure 6

Free joint detail

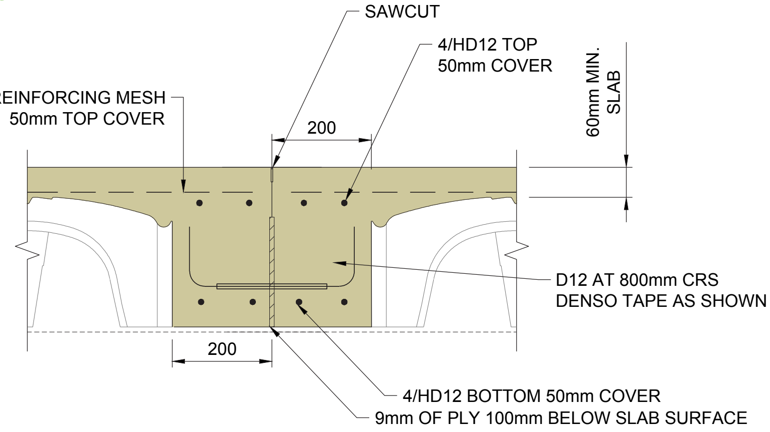
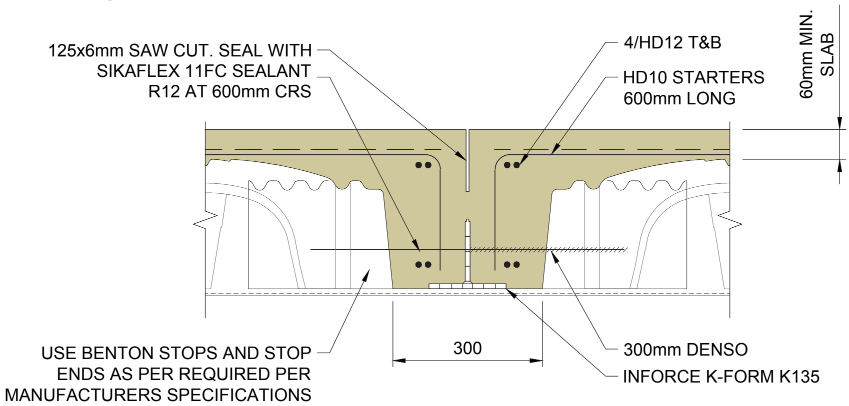


Figure 7

Control joint detail



6.3 Services detailing

There are two options available for running services through a Cupolex foundation. Both are acceptable solutions **however**, some Regional Building Authorities and Builders have preferences. The two options are in-slab or under-slab.

6.3.1 In-slab

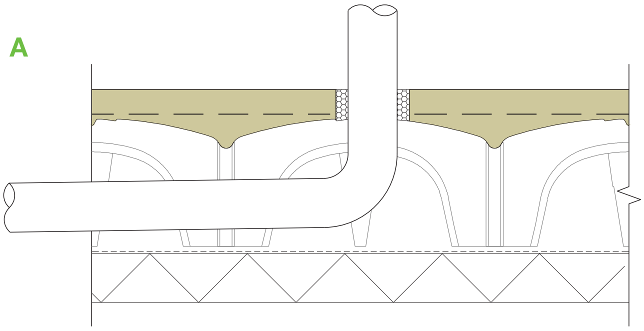
Pipes can run within the plane of the pods, either exiting out the side of the perimeter or out under the edge beam. Pipes must be laid and have the sufficient fall that complies with NZBC G13/AS1. For pipes up to 65mm diameter, the minimum gradient is 1:40, for 100mm it is 1:60. Greater falls may be necessary depending on the required number of discharge units. See Table 5 for distances from the pipe surface to the edge of the slab. A 350mm Cupolex pod is also available where the minimum required fall cannot be achieved. If gradients cannot be achieved using the 350mm pods, then services will be required to run under the slab.

To create the space for services a row of pods shall be removed and replaced using a Beton(s) to reduce the concrete usage and adjusted accordingly. See Figure 8.

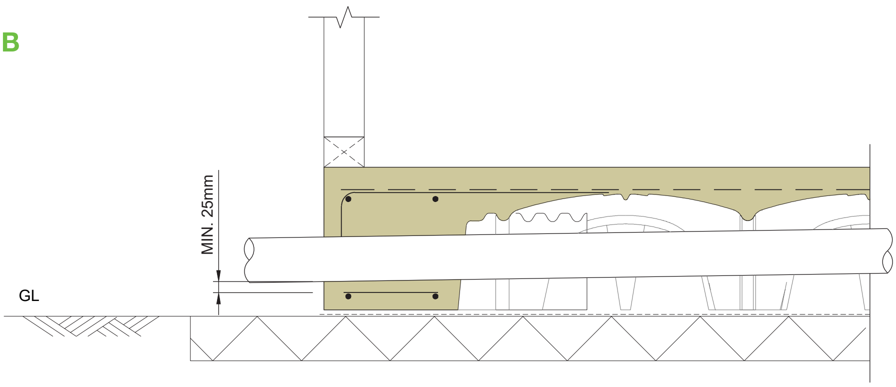
Figure 8

In-slab plumbing

A



B



C

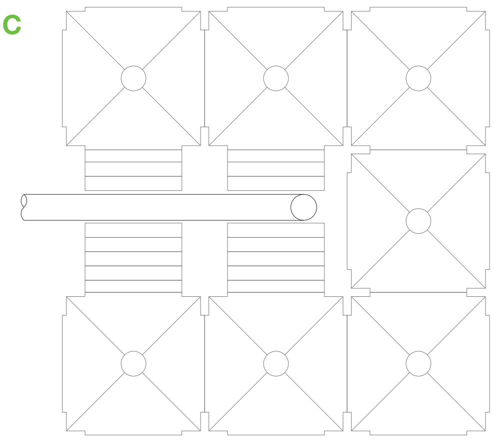


Table 5

Maximum distance from exterior to entrance point of plumbing pipes

Pipe diameter (ID mm)	Gradient	Max distance to edge using 260mm pod (100mm)	Max distance to edge using 350mm pod (100mm)
40mm	1:40	3400	6600
50mm	1:40	3000	6200
65mm	1:40	2400	5600
100mm	1:60	1200	4400

6.3.2 Under-slab running of services

For service ducts conveyed underground to the plan location then brought up through the Cupolex pod and concrete floor slab, within the limitation imposed by Table 5. Services shall not be placed within any concrete except to cross that section of concrete i.e. services must not run along beams or edge beams. In accordance with AS/NZS 3500.4:2015 “Pipe Penetrating Through Concrete”:

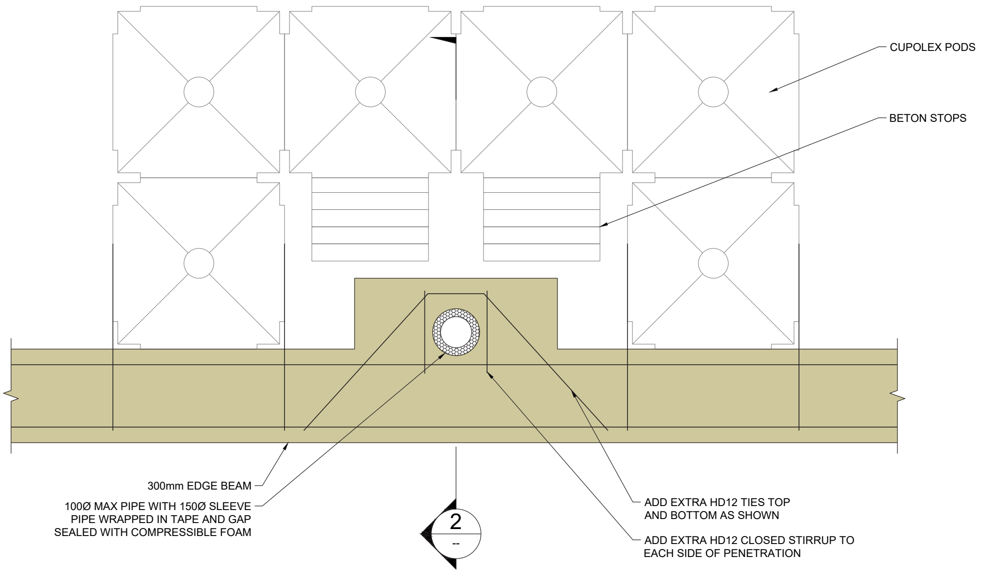
- Installed at right angles.
- Lagged with an impermeable material for the full depth of the concrete penetration.
- Lagging must be at least 6mm thick.

In Figure 9 at no stage should any reinforcement bars be relocated or cut to allow for the services (other than the mesh).

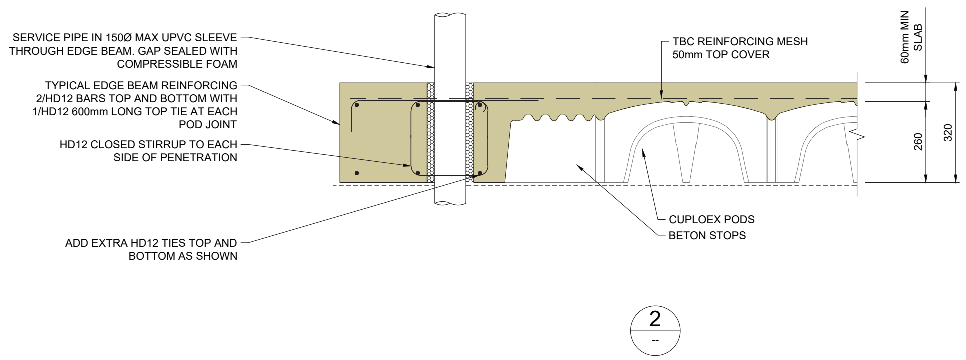
Figure 9

Service detailing requirements

A



EDGE BEAM PIPE PENETRATIONS B



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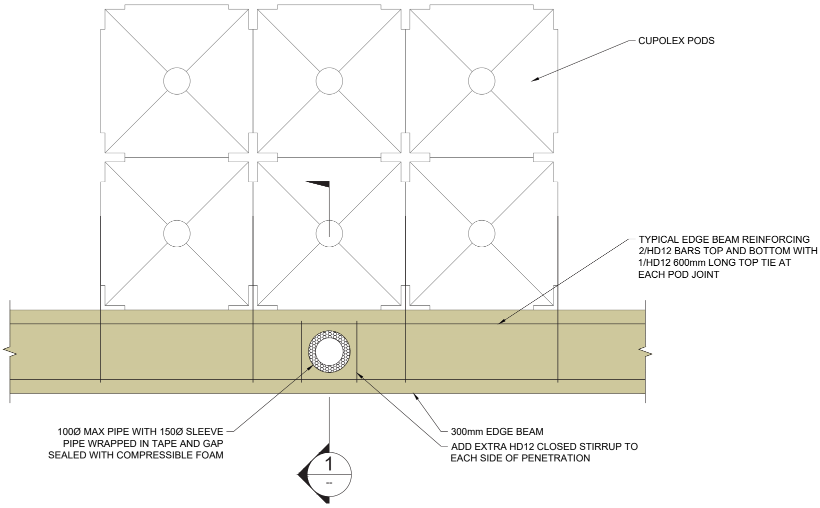
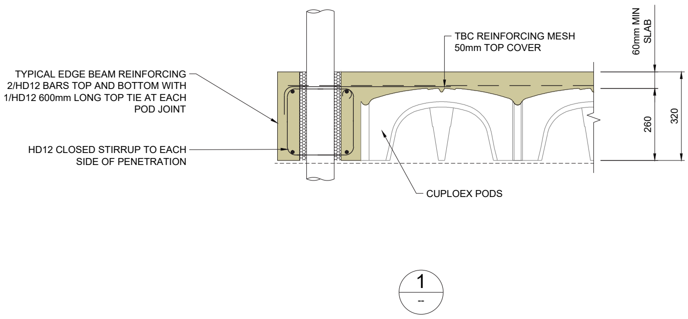


EDGE BEAM PIPE PENETRATIONS A

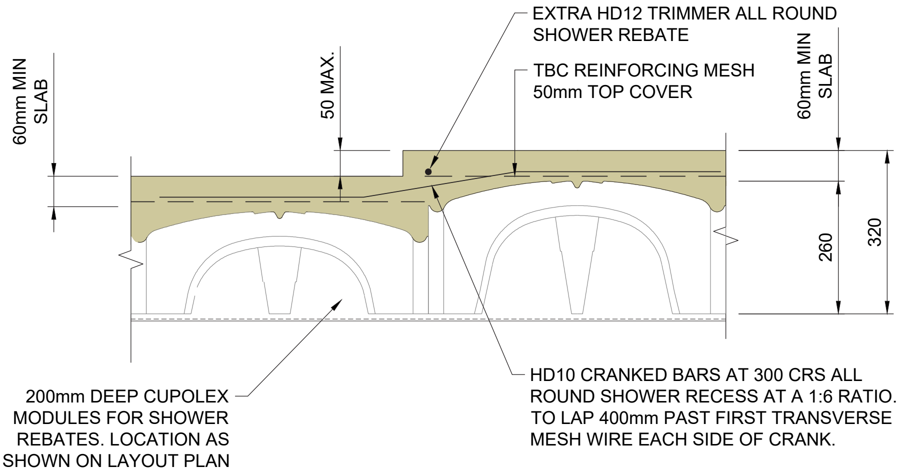


6.3.3 Recesses for showers

Where showers are recessed (Rebated) up to 50mm into the Cupolex slab topping, the details specified are to be in accordance with Figure 10.

Figure 10

Details where recesses up to 50mm for showers



SHOWER RECESS DETAIL

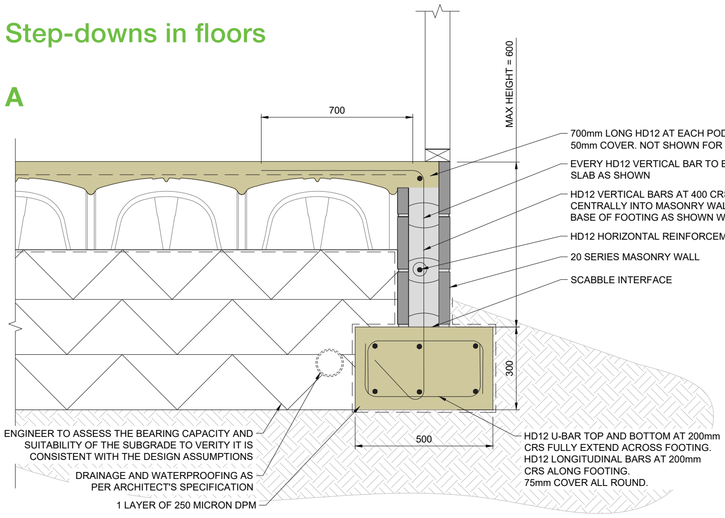
6.3.4 Step down of up to 600mm in Cupolex foundations

Not all sites are flat and sometimes a step down may be required. Steps of up to 600mm can be accommodated using one of the details in Figure 11. A step-down in a Cupolex foundation anchors the floor in that location with respect to the volume associated with drying shrinkage. As required by 6.2.2 a free joint should be provided if the distance from the step-down to the slab edge exceeds 15m.

Figure 11

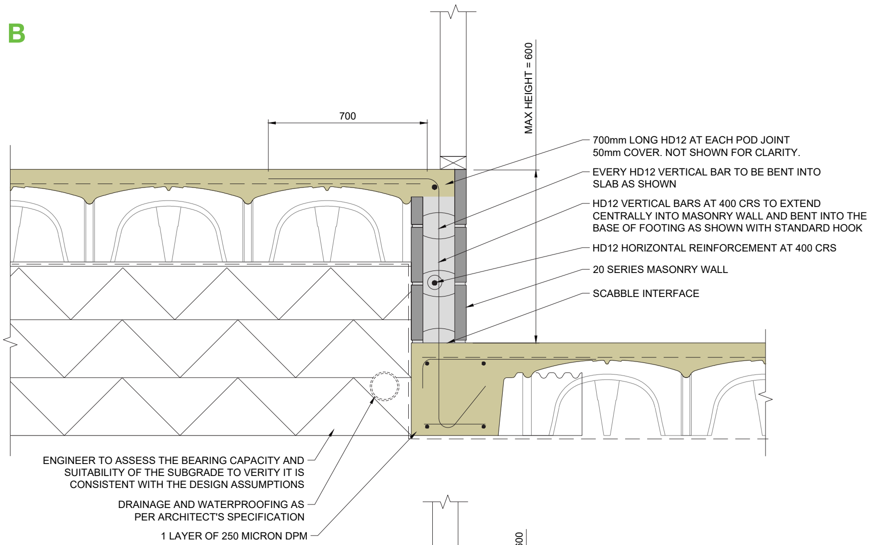
Step-downs in floors

A

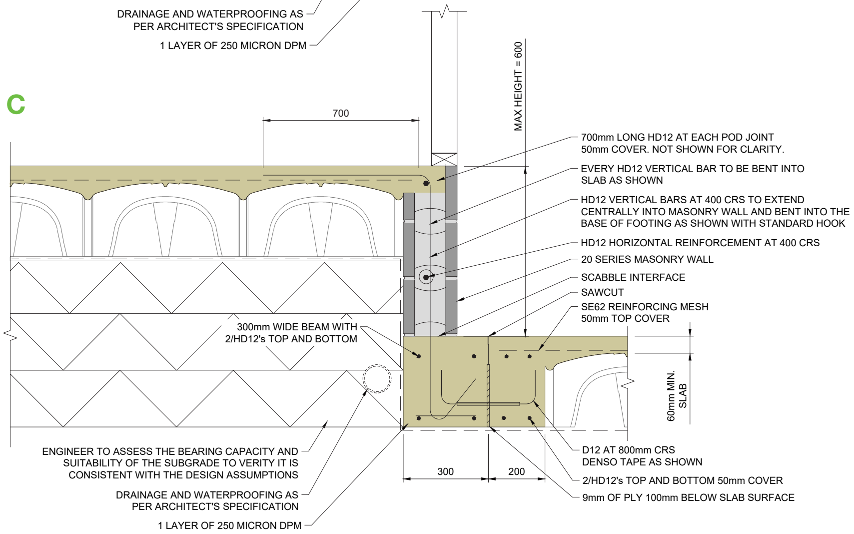


BLOCKING FOOTING DETAIL

B



C



BLOCK STEP DOWN & CONTROL JOINT DETAIL

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