University of Wales Trinity Saint David

Module: Construction Technology One

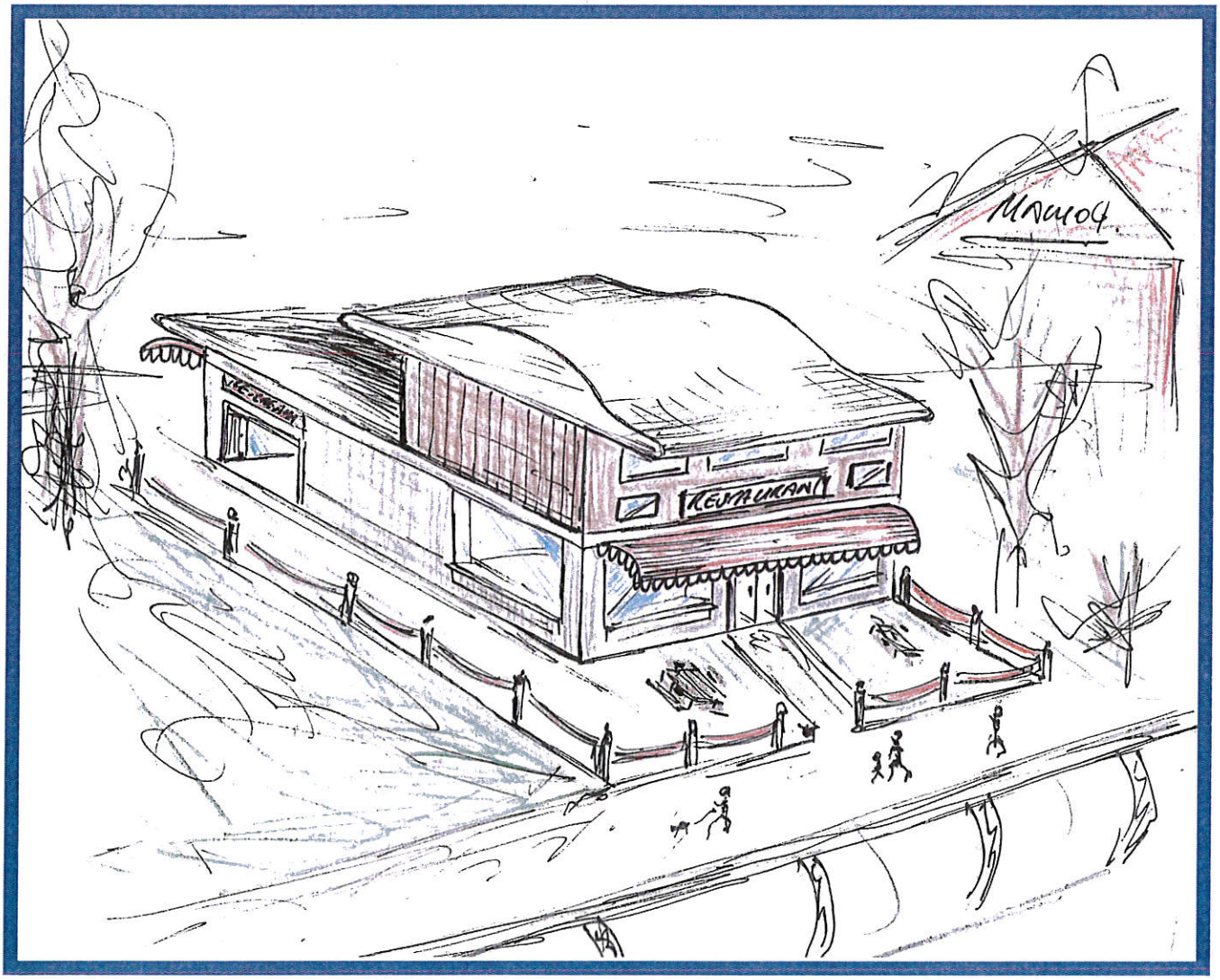
Module code: M4X01303

Assignment Title: Swansea Foreshore Ice-cream Parlour

Submission date: 24th April 2018

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Student Number: 1708489

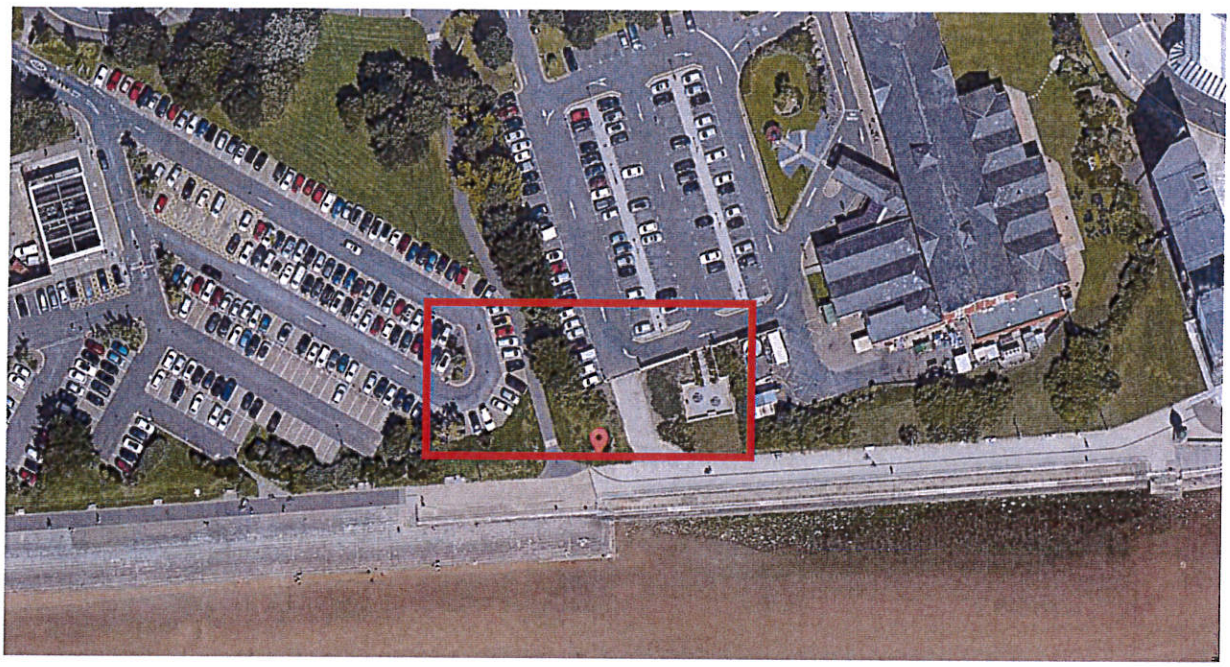


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Introduction:

The City and County of Swansea have chosen to enter in to a joint agreement with Marriot Hotels to create a new restaurant, ice-cream parlour and manager's apartment on Swansea foreshore. Plan view of the site below. Marked in red is the New Development site boundary.



This report presents historical and existing information of the grounds of the new proposed development.

This report will discuss the following topics:

- Details for further site investigation requirements.
- Recommendations for suitable foundation types and sub-structure detailed drawings.
- Building opening details for window, doors and roof structure.
- A site layout and set up plan.
- Choice of materials and required plant to expedite the work in a safe and controlled manner.
- Local supply chain.

Desk top study: Site investigation and Procedures:

Project Location – Swansea Foreshore

Postcode – SA1 3SA

Construction has many risks from pre-tender to building completion and maintaining the building for the future. To avoid risks financially and or health and safety related that may occur is why it is extremely important to carry out in depth thorough site examination reports. Recommendations and site procedures that would need to be considered are as detailed below.

Contamination to soil. What was there before. Are there any existing remains beneath ground that we cannot see? Full research is required.

Topography and geomorphological mapping.

Investigate ground conditions for water, any potential flooding risks, local water courses and springs.

Soil investigation and soil types. Samples are for identification, classification and ascertaining the subsoils characteristics and properties.

The purpose of soil investigation is to determine the suitability of the site for the proposed project. Determine suitable foundations. Determine the difficulties that may occur during the construction process and period. Determine the occurrence of any potential changes in the subsoil conditions.

Samples of the ground would be taken to establish the physical, chemical and general characteristics of the subsoil. The depth of soil investigations may vary based on: The foundation type, pressure bulb of proposed foundation and relationship of foundation to other foundations.

As a general guidance, suitable methods in terms of investigation depths are:

Foundations up to 3.000 deep – trial pits

Foundations up to 30.000 deep – Bore holes

Foundations over 30.000 deep – deep borings and in-situ examinations from tunnels and/or deep pits.

Plate loading testing.

Conduct in-situ subsoil tests.

Engineering risks – Ground subsidence, mining, old fuel tanks.

Borehole, trial pits - may also be used to establish the presence of any geological faults and the upper or lower limits of the water table. This would need to be considered as the new development is based on a beach with potentially soft ground.

Consult local utility providers for underground and overhead services, proximity to site and weather they cross the site boundary's.

Observation on cracks to the ground, sub subsidence due to mining and any other informalities to existing buildings.

Trees – Preservation orders would need to be checked and notified to the client.

Considerations to surrounding area, buildings and people.

Consider best layout of the new building, practical use and access, exposure to sun and prevailing conditions.

Access potential hazards to Health and Safety – Ensure perimeter of site is enclosed locked and secure.

Swansea Foreshore Historical maps – SA1 3SA:

Figure 1 taken in the late 1800's. Circled in red is a hospital stating "for contagious diseases". Even though this is a long time ago and the Hospital do not exist today, it must be taken into consideration for the new development. Soil contaminations may lay deep underground. There are also train tracks that run through the new site boundary marked in green. Although there are no train tracks here today further underground investigation is required.

Fig 1 - Glamorgan XXIV (includes: Coed Ffranc; Swansea.) https://maps.nls.uk/view/102342508#
Surveyed: 1876 to 1877 Published: 1884

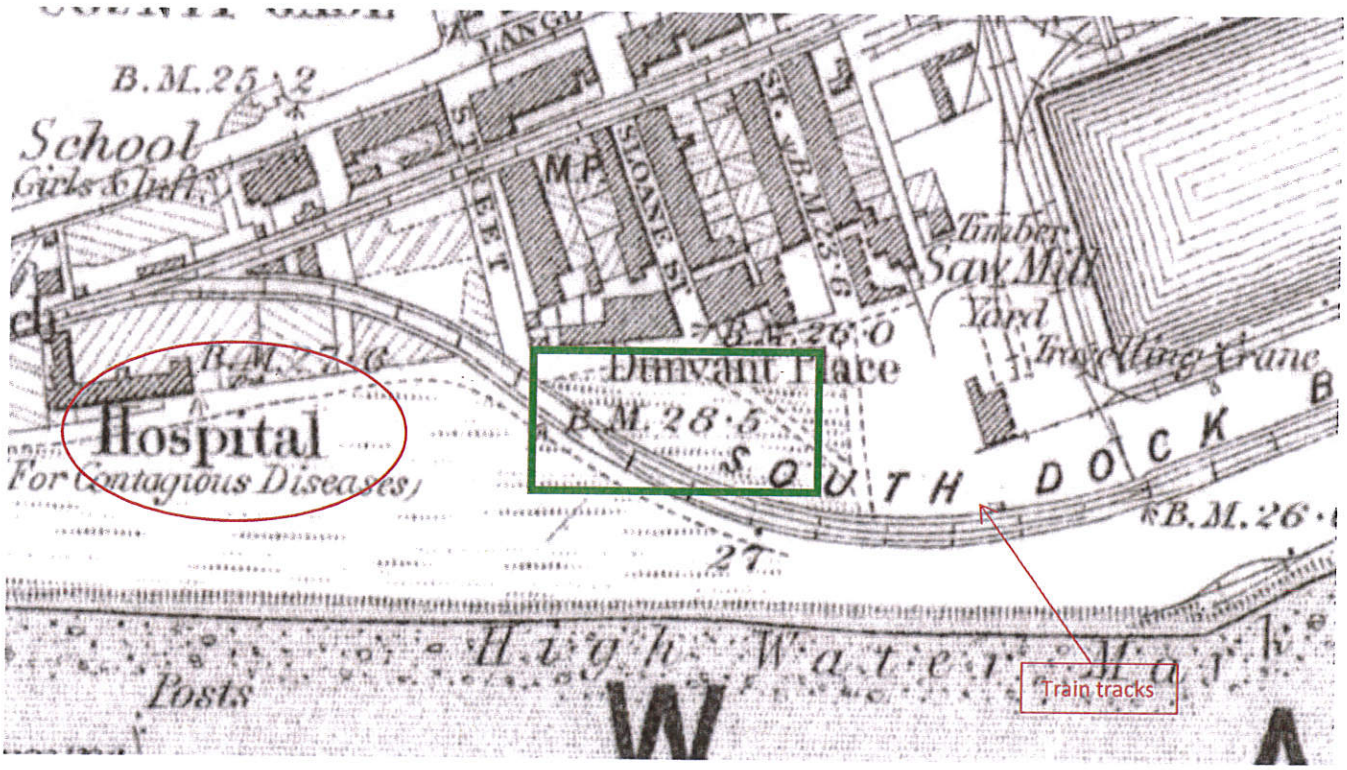


Figure 1

Figure 2 taken in the early 1900's. Marked in green is the new development boundary. Further changes and developments show canister works and an engine shed which looks like the main train station access point. Further soil and bore hole testing required to establish what lies beneath. The Hospital is no longer there but soil investigations would still be required.

Fig 2 - Glamorgan XXIV (includes: Coed Ffranc; Swansea.) https://maps.nls.uk/view/102342505

Revised: 1913 to 1914 Published: 1921

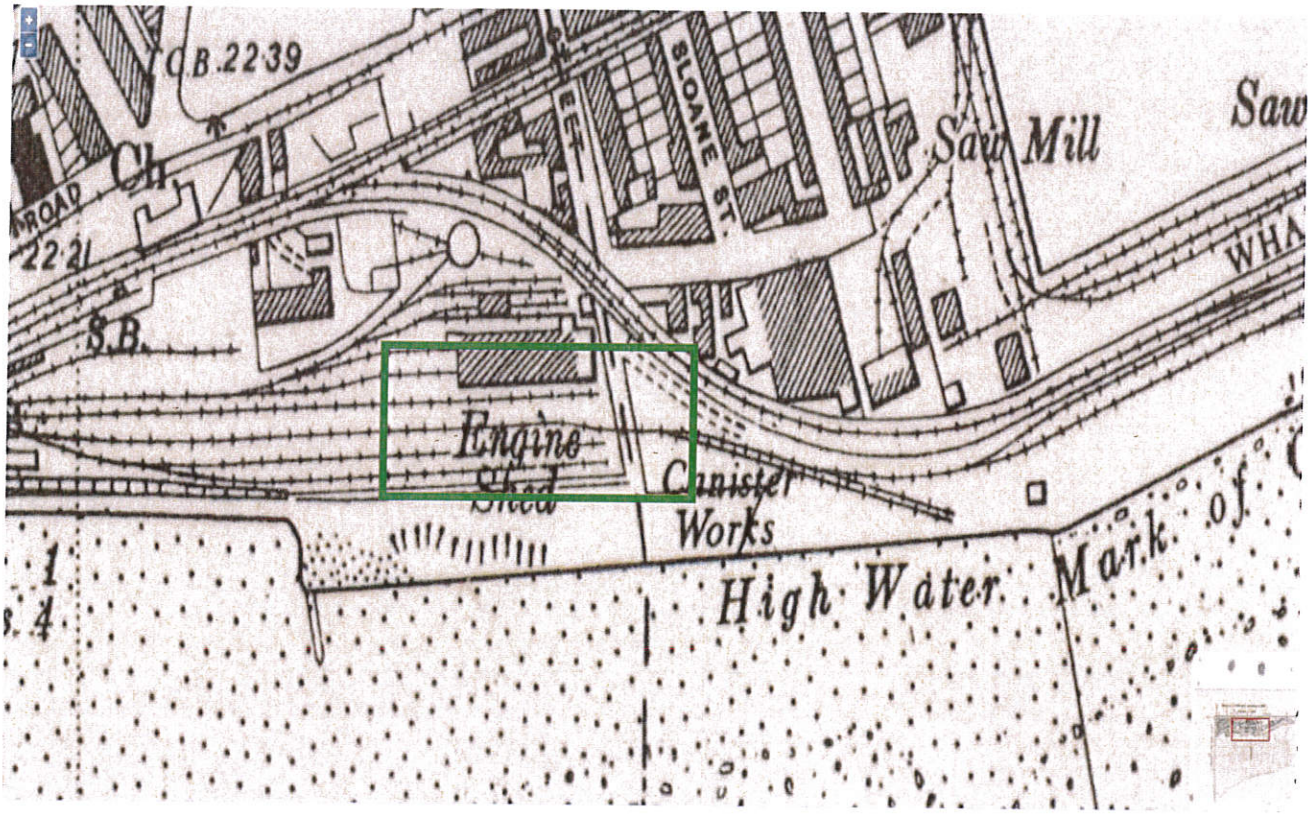


Figure 2

Figure 3 taken in the mid 1900's. They have been slight changes to the infrastructure, more roads have been constructed. Not a huge amount of change in the last 50 years but existing buildings and railway track and roads must be taken into consideration when choosing the suitable foundations for the new build.

Fig 3 - Glamorgan XXIV.SW (includes: Swansea.) https://maps.nls.uk/view/102183138

Revised: 1947 Published: 1951

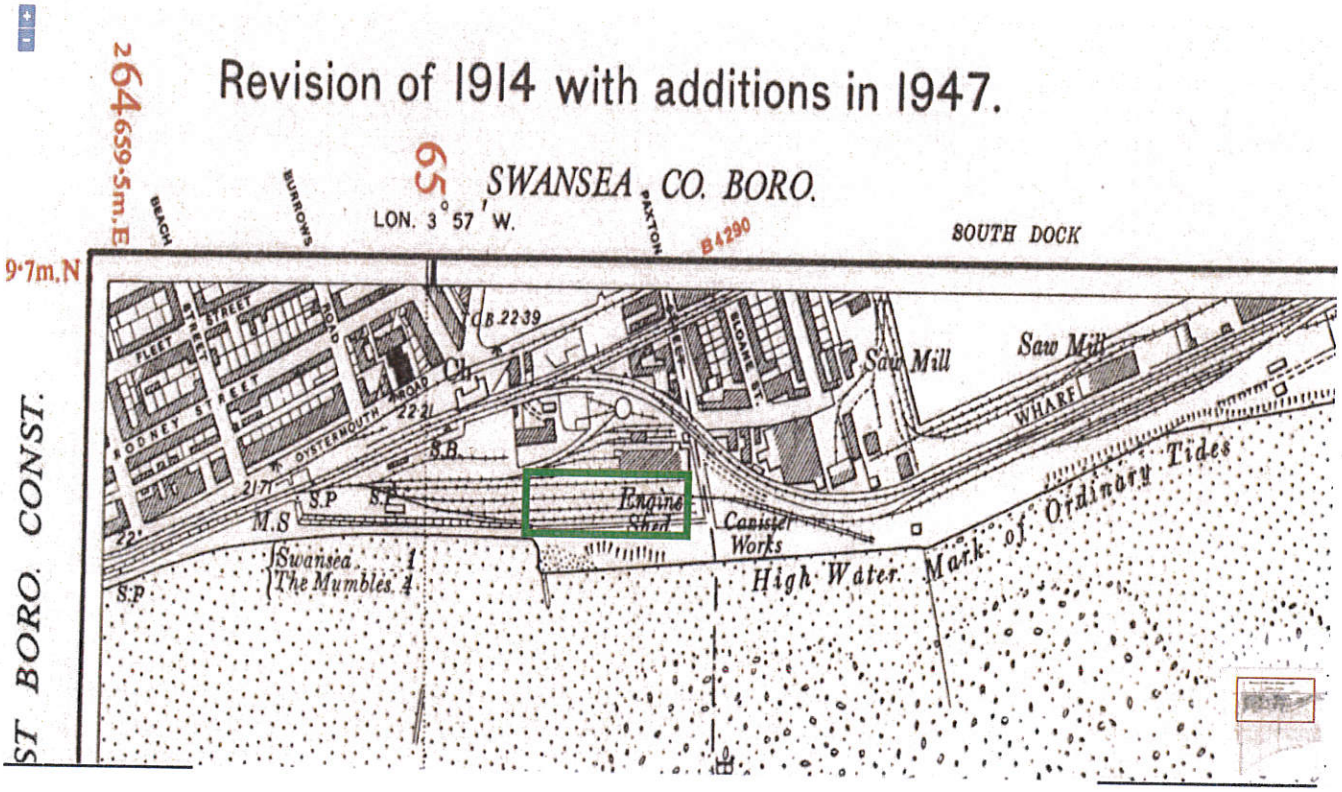


Figure 3

Figure 4 taken 2018. This is a plan view of Swansea sa1 3sa today. Huge amount of change to previous years. Marked in green is the new site boundary. Further site investigations to the sub soil is required. Even though the site looks like a clean open space, we need to establish what types of soil and ground is below ground level. New building (Marriot Hotel, Civic Centre) may have services etc. running underneath the site. When excavations are carried out contaminated soils may be exposed. A thorough soil examination is required. The site is also adjacent to the beach front and public pathway. This would also have an influence on the type of foundation required.

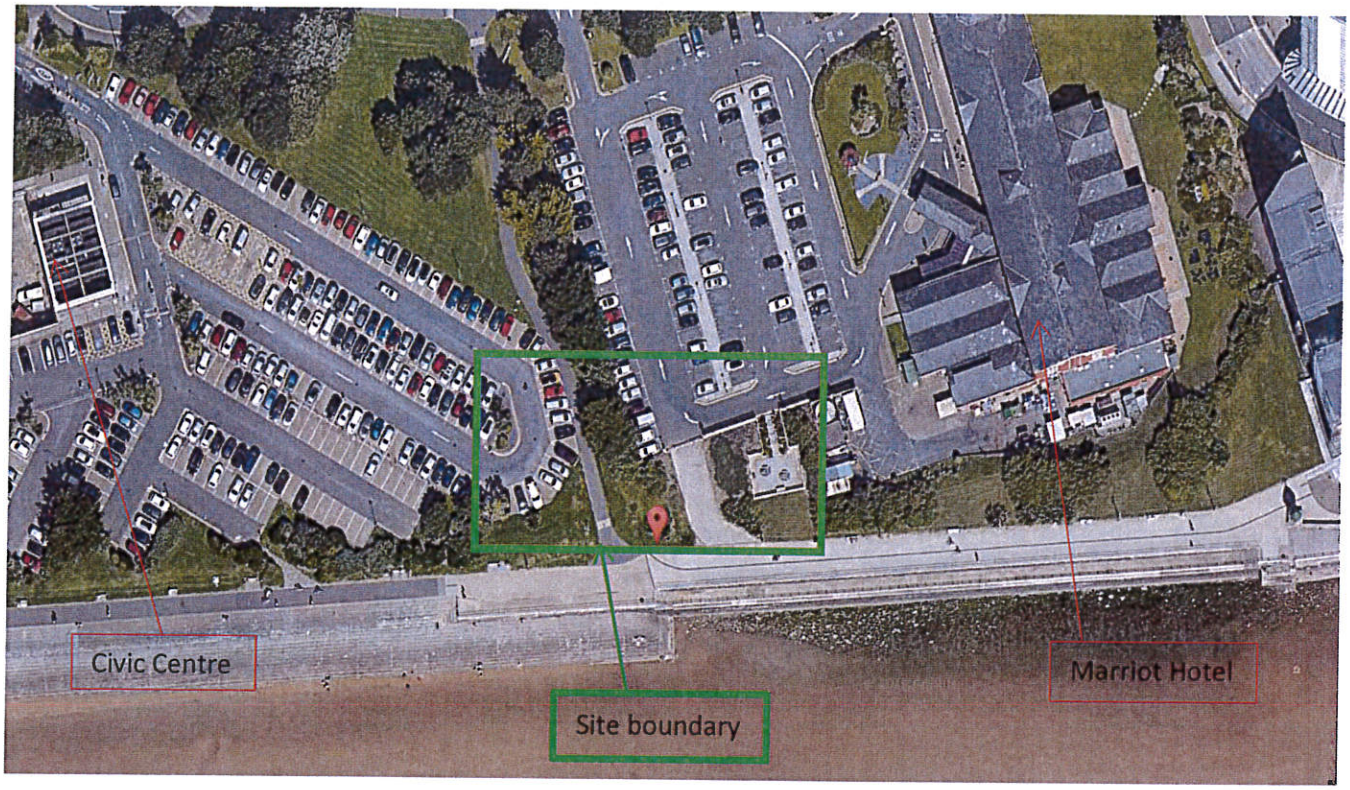
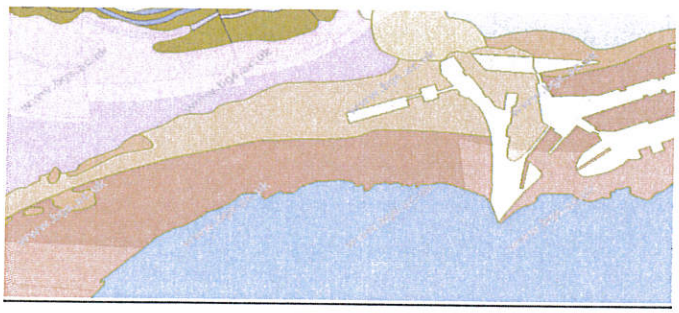


Figure 4

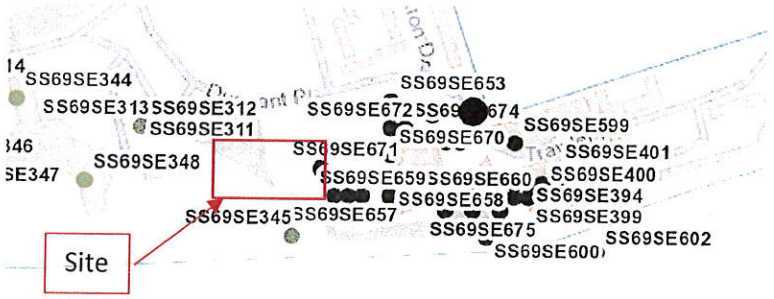
Swansea SA1 3SA: Bedrock geology and bore hole testing maps.

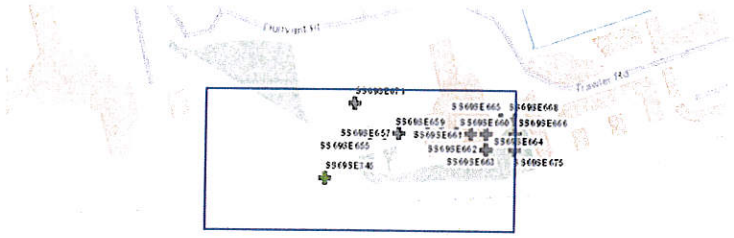
Below is maps and bore hole testing that have previously been carried out. The information is confidential, However bore hole testing would still need to be carried out within the site boundary.

Superficial deposits
1:50 000 scale bedrock geology description: South Wales Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone. Sedimentary Bedrock formed approximately 310 to 318 million years ago in the Carboniferous Period. Local environment previously dominated by swamps, estuaries and deltas.



Geoindex onshore report below showing results from bore holes testing.







Preliminary Desk top study – Site walk-over inspection:

Before starting any ground/earthworks it is essential that a thorough soil investigation is carry out. Any existing below structures and underground services (water, gas, electric) are identified prior to work commencing. Is there any contaminated soil? Everything must be addressed. Planning and co-ordination of operations should be scheduled and in place prior to any work commencing. You must consider the possible implications to Health, safety and the environmental impacts the works may impose. It is important to establish a clear picture of the ground conditions before excavations are carry out – (CEM2012). The engineer and contractor will review all information regarding the topography of the project.

The location of the site is based in between the Marriot Hotel and Swansea Civic Centre. As shown in *figure 5* below.



Figure 5

The red out line is the site perimeter. This will contain the New development which will have a ground floor space of approximately 300m2. Mobile welfare facilities/offices, storage of material/waste and operating plant will all be contained within the perimeter of the site boundary. Access in and out via *Dunvant place road* is accessible to the site location. The sea front has a public pedestrian footpath. This would need to be securely sectioned off with a solid temporary fence. The site must have no interference with pedestrians and must be secure so no pedestrians can trespass through the site.

When I carried out the site walk-over inspection on first observations, I noticed the great view of the beach front and open spaced area. This would be a key view of the building and where the restaurant would look out to. The area between The Marriott Hotel and Civic Centre has a lot of space and would not in crouch on these existing buildings. The new development boundary is located in the car park areas. There is a foot and cycle pathway leading onto the main pathway of the beachfront which would be blocked off as this goes through the site boundary. The photographs I have taken below of the site will give a more visual outline of the considerations that need to be addressed with regards to the public, services, site access and boundary's and any implications that will delay any progression of works.

Figure 6 and 7 below are taken from Dunvant Place road. Fig 6 shows the public pathway onto the beachfront. Fig 7 shows the exit route from the Marriott Hotel car park.



Figure 6



Figure 7

Figure 8 below is the Public Pathway which states "West Glamorgan County Council private right of way highways act 1980".



Figure 8

Figure 9 and 10 below is the Pathway which is directly positioned in the site boundary blocking the access onto the beach front pathway as shown in figure 11. A request would need to be made to the Council to obtain permission to provide an alternative route. The greenfield and trees in Figure 10 would also lie in the site boundary. Further permission would to need be granted before work commences. As the site includes trees which may need to be retained, these may draw a considerable amount of water during the growing season, causing the ground beneath (clay) to shrink, this may result in affecting the stability in the soil which may influence the chosen foundations.



Figure 9



Figure 10



Figure 11

Figure 12 and 13 below is the main car park for the Marriott Hotel. The vehicle access gate leads onto the beachfront. This area would lie on the site boundary and if in use would need to be re-positioned. The electrical feed from the lampposts either side of the access gate all would need to be identified and moved prior to the groundworks.



Figure 12



Figure 13

Figure 14 is the Marriott Hotel car park and the new site positon. The car park would provide a stable base for access in and out of the site and would also provide a base for the site welfare units along with storage of materials and skips for waste.

Figure 15 in red shows the site boundary line from the edge of the Public pathway. Heras fence or solid barriers would be essential for the safety of the public when work is carried out.



Figure 14



Figure 15

The photographs show the site area is an open space in between two car parks. There are no existing buildings thatwould need to take down or interfere with the new development. The car parks are flat tarmac with paved walkways.

Figure 16 below is a plan view of the site. This shows the layout and position of the new build and site set up.

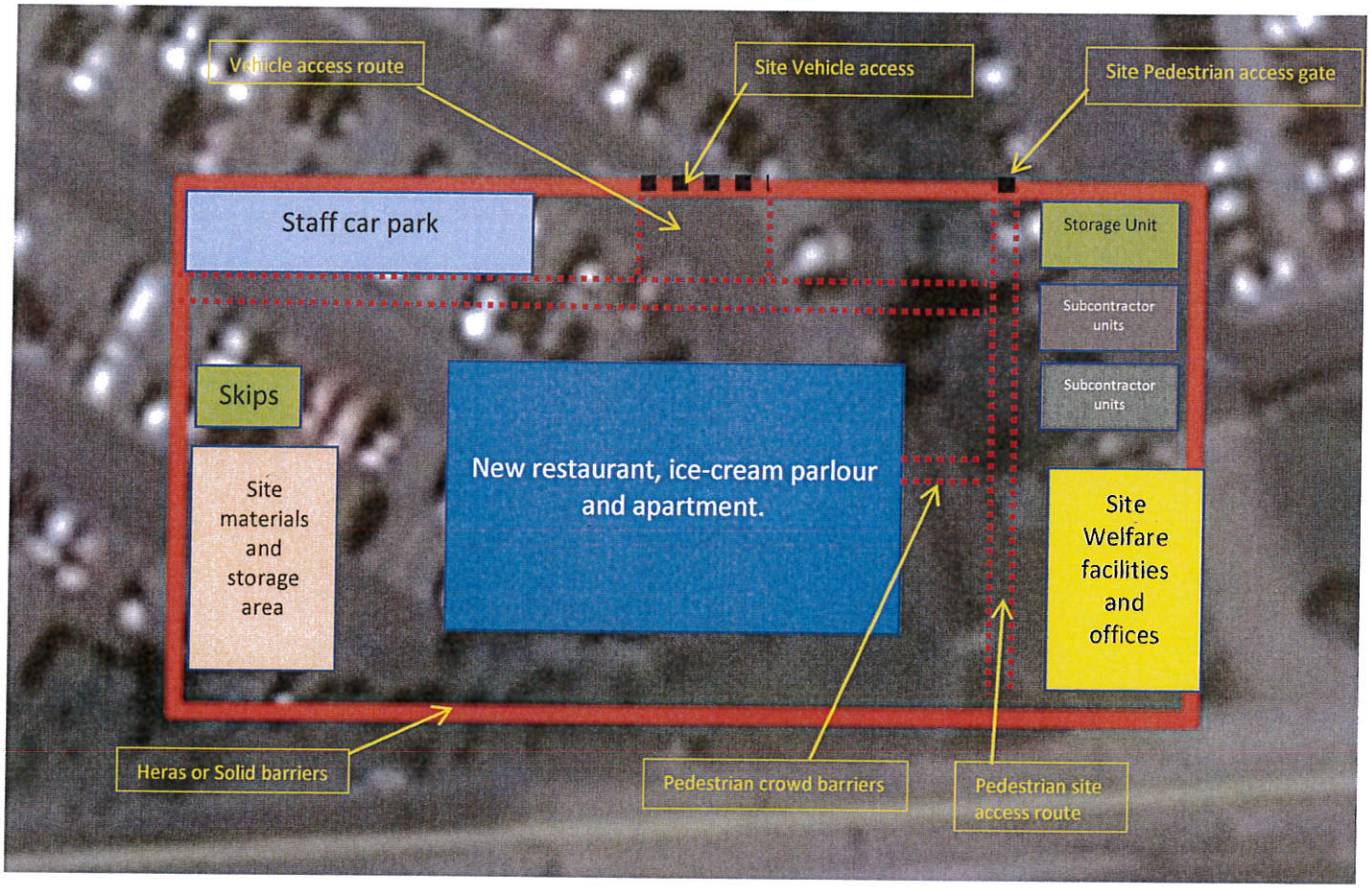


Figure 16

Site layout plan:

Accommodation requirements:

It will be the contractor's responsibility to make sure a minimum site set up is reached as per Building Health, safety and welfare regulations 1996. *"Welfare facilities, accommodation, sanitation, protective clothing, 1st aid equipment/personal, means to heat and prepare food must all be applied to the site set up.* The number of staff male and female and any disabilities to be anticipated for the duration of the project can be roughly worked out by the program of works, number of sub-contractors, site staff and the length of the Project. All this information will be discussed at pre-tender stage. This is a vital stage of the project and will depend on if the development is possible to achieve in the time scale and if it is affordable. All prelims from the start of the project will be forecast and put into a bar chart programme. This is very important as this programme of works will be what the construction of the building will work from to achieve the outcome.

The minimum requirements for welfare accommodation are governed by the offices, shops and railway premises act 1963 unless they are:

1. Mobile units in use for not more than six months.
2. Fixed units in use for not more than six weeks.
3. Any type of unit in use for not more than 21 man hours per week.
4. Office for exclusive use or self-employed person.
5. Office used by family-only staff.

Figure 17 is a site layout welfare plan which would be adequate for my site. The welfare units would be mobile and a Hiab would lift them into place. Fire rated mobile units would also be used if the building was within 6 metres of any existing buildings, in this case the units do not need to be fire rated.

Canteen space – To be provided for all staff and site operatives

Male / female and disable toilets – To be provide for all staff and site operatives - 2no toilets supplied would cover 6-25 people there after 1no WC and basin for every 25 persons.

Drying Room with heaters – This would be supplied for site operatives to store and dry their clothes in wet weather. Lockable lockers would be supplied.

The welfare facilities would comply with the Health and Safety at Work act 1974. Construction (Design and Management) Regulations 2015 (Incorporating the Construction (Health, Safety and Welfare) Regulations of 1996.

Health and Safety (First Aid) Regulations 1981. Workplace (Health, Safety and Welfare) Regulations 1992. Management of Health and Safety at Work Regulations 1999.

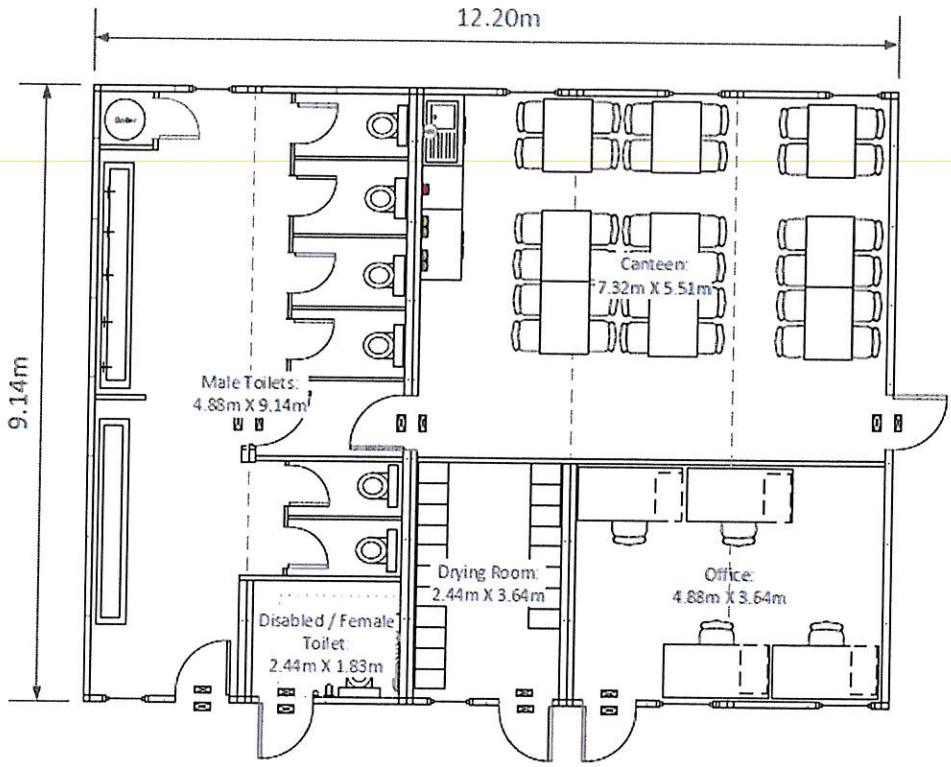


Figure 17

Foundations would be required as per examples below figure 18. As the site welfare set up is located on a tarmac base the units would still require pad foundation. This would consist of a 1m2 150mm deep concrete base. If the units were located on soft earth, then a deeper pad foundation would be required.

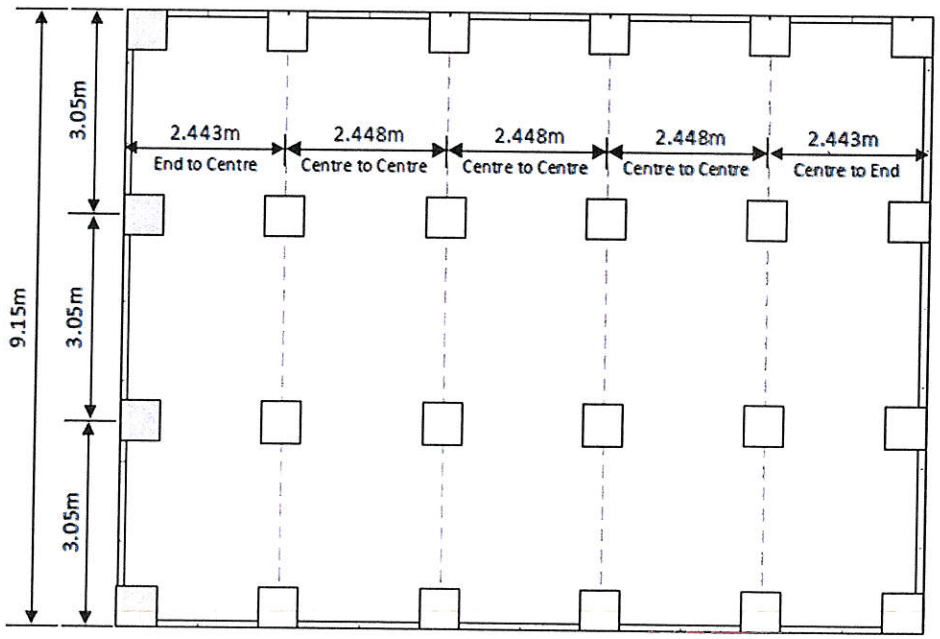


Figure 18

Considerations when using mobile site set up. If connection to mains sewage is not yet achievable then a waste tank would be required. This would then be pumped out a minimum once per week. Water supply if not able to connect to mains water supply then clean water tanks would be used.

Further to my investigation to the location of the site with regards to mains water supply and mains sewage.

The service drawing maps below from Welsh Water would help when constructing the New development. As shown in the maps there are no services which would hinder the construction of the new development. However, Connection to the mains water network and mains sewage lines and all surface/storm water would help when connection is required from the new building. This would be requested at pre-tender stage and authorised through the council.

Figure 19 – Is a Welsh water map 265398, 192360 showing the main waste network – Swansea SA1 3SA. **Complete map on next page.**

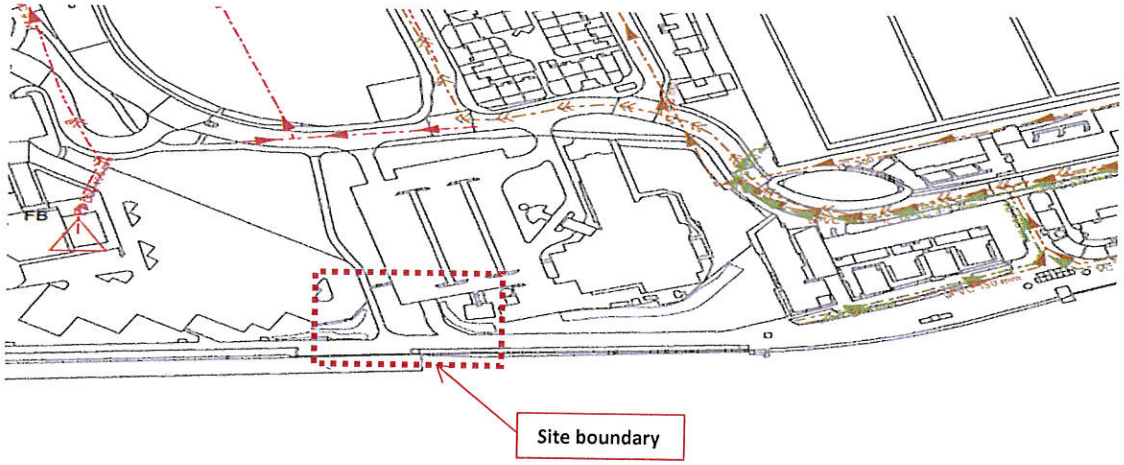


Figure 19

Figure 20 – Is the Welsh Water map 265398, 192360 showing the main clean water network – Swansea SA1 3SA. **Complete map on the next page.**

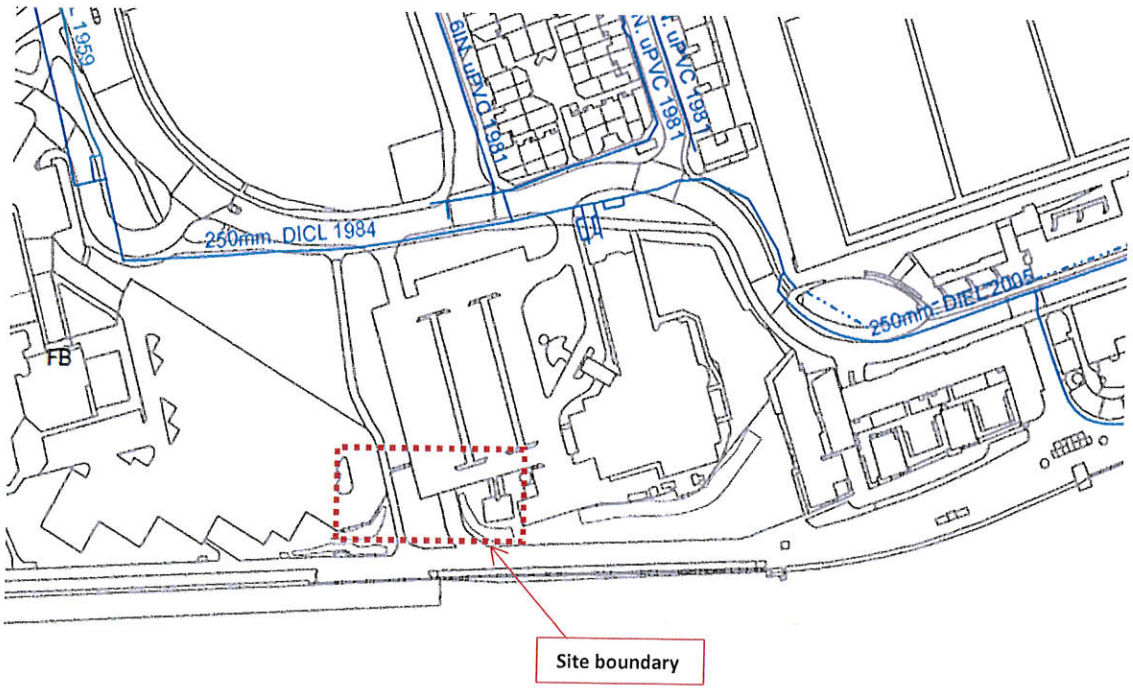


Figure 20



Dŵr Cymru
Welsh Water

Swansea, SA1 3SA

N
W E
S

LEGEND(Representative of most common features)

Waste network:

Foul chamber		Outfall	
Surface water chamber		Lamphole	
Combined chamber		Storm Overflow	
Combined sewer overflow		Rising main	
Special purpose chamber		Gravity sewer	
Treatment works		Private sewer	
Pumping station	S 104	Private sewer subject to Sect. 104 adoption agreement	
		Private Sewer Transfer	
		Lateral Drain	
		Inspection Chamber	

NB: Sewer symbol colour indicates the type:
RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

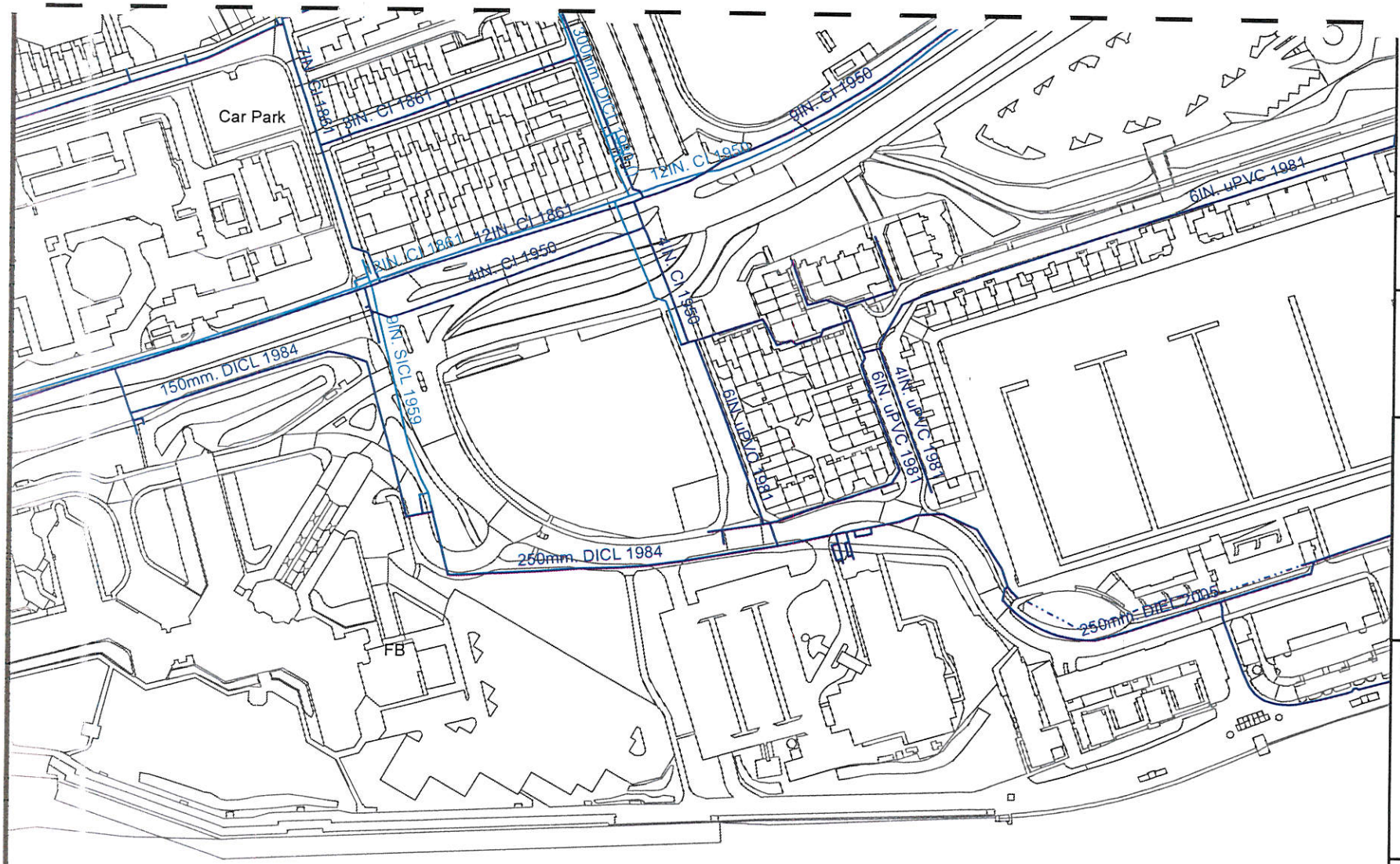
Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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Map Ref:	265398,192360
Map scale:	1:2500
Printed by:	Parker Amanda
Printed on:	06 Apr 2018



Dŵr Cymru
Welsh Water

Swansea, SA1 3SA

N
W E
S

LEGEND

Clean network:

- Sluice valve
- Pressure reducing valve
- Meter
- Bulk meter
- Hydrant
- Cap end
- Air valve
- Stop tap
- Water Treatment Works
- Water Pumping Station
- Existing main
- Non-operational main
- Raw Water

NB Water main symbol colour indicates the type.

LIGHT BLUE - Trunk
DARK BLUE - Distribution
YELLOW - Raw Water

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dŵr Cymru Cyfyngedig ('the Company') gives this information as to the position of its underground apparatus by way of general guidance only and on the strict understanding that it is based on the best information available and no warranty as to its correctness is raised upon in the event of excavations or other works made in the vicinity of the company's apparatus. The onus of locating apparatus before carrying out any excavations rests entirely on you. The information which is supplied by the Company is done so in accordance with statutory requirements of sections 198 and 199 of the Water Industry Act 1991 which is based upon the best information available and, in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not disclose the existence of a water main, service pipe, sewer, lateral drain, or disposal main and any associated apparatus laid before 1 September 1989, or if they do, the particulars (lines of including their position underground may not be accurate. It must be understood that the furnishing of this information is entirely without prejudice to the provisions of the New Roads and Street Works Act 1991 and the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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Map Ref:	265398,192360
Map scale:	1:2500
Printed by:	Parker Amanda
Printed on:	06 Apr 2018

Storage considerations – types of material to be stored on site. Security and weather protection. Allocating a space for material to maximise work space all need to be planned and considered.

Temporary IT services and power – Mains electric is always the best way to run a site but as a starting point until mains connections is sorted, generators would be used for power to the welfare units. All power to site would be 110v this is for health and safety risks. As a joint venture with Marriott hotels, mains electric and IT network connection may be an option to feed of the hotel next to the site set up. This would need to be requested pre-tender stage.

Solid and heras fencing british standards must be at least 2.0mtr high. A licence or permit must be obtained from the local authority before erection. – Solid/Heras fence panels are 3.5 metres wide and 2.0 metres high – To secure and barrier off site and keep pedestrians from trespassing. This would be the first step in the construction process. All health and safety signage would need to be visible and to keep people out. Weather would need to be taken into consideration. Heavy winds and in an open area to all elements may also be a hazard to the workers and public. Solid posts and or double couplers and back stays (stabilisers) would be necessary to avoid any risk of the boundary fence blowing over into the pedestrian footpath. This would also be security against theft and vandalism and to protect from innocent trespassers. Night security may be necessary.

Internal site crowd barriers would be used for pathways to and from the building site, access to welfare facilities and for safety of site operatives to exclude them from moving plant and lifting zone areas.

Vehicle gates for all deliveries into site and for skip exchanges.

Client may also want to use the site boundary fencing for advertisement to the local public.

All health and safety signed would need to be in place for all site operatives and for the local public to ensure all safety precautions and risks are seen, a no-go zone areas are clear. Signage on site for works to ensure all necessary personal protective equipment is used as a safety standard any further requirements such as hot works/dust control or any other requirements that may be necessary. All safety requirements and construction regulations must be met by the minimum work standard act 1974.

Plant requirements below that may typically be used for the new development:

PLANT	POWER SUPPLY	GENERAL USE	H&S REQUIREMENTS
Generators	N/A	Power supply to site offices / building during works	Integral drip trays / fume exhausts
Heras Fencing minimum 2.00m high	N/A	Site Boundary security and storage area delineation	Sufficient height ballast / connections to ensure site is secure
Pedestrian & Vehicle Gates	N/A	Secure access to site	Lockable, closed at all times when not in use and controlled
Timber Hoarding	N/A	Site Boundary security and storage area delineation	Sufficient height ballast / connections to ensure site is secure
Pedestrian Barriers	N/A	Segregation of walkways from vehicular movement	Sufficient ballast / connections to ensure walkways are secure
Pedestrian Cross Over Points	N/A	Stop point to ensure no pedestrian / vehicular movement	Sufficient signage to ensure all pedestrians aware of cross over
Silos	Electric 110v	Container for mortar for the works	Correct foundations / fixings Cleaning in vicinity
Forklifts	Diesel	Distribution of site materials	Certificated (every 6 months) daily visual inspections
2000kg Goods hoists	Electric 110v	Vertical distribution	Certified and regular inspection
500kg Brick Hoists	Electric 110v	Vertical distribution	Certified and regular inspection
150t Mobile Crane	N/A	Steelwork erection and metal deck loading	Lifting plans
Concrete Pumps	Diesel	Composite slab pumping at 1st 2nd floor	Certificated (every 6 months) daily visual inspections
Scaffold	N/A	Safe access to all areas where working at height required	To comply with Working at Height and NASC Regulations
Haki Stairs	N/A	Safe access to all areas where working at height required	To comply with Working at Height and NASC Regulations
Mobile Towers	N/A	Safe access to all areas where working at height required	To comply with Working at Height

MEWPS	Diesel	Access to working areas	Certificated (every 6 months) daily visual inspections
Skips	N/A	Disposal of waste	Waste Transfer notes to be logged
20 t Excavators	Diesel	Substructure works	Certificated (every 6 months) daily visual inspections
6t Dumper	Diesel	Substructure works	Certificated (every 6 months) daily visual inspections
1200 Roller	Diesel	Substructure works	Certificated (every 6 months) daily visual inspections
Whacker Plates	Diesel	Substructure works	Certificated (every 6 months) daily visual inspections
Concrete Vibrator	Diesel	Substructure works	Certificated (every 6 months) daily visual inspections
Power Floats	Diesel	Substructure works	Certificated (every 6 months) daily visual inspections
Disc Cutters	Diesel	Substructure works	Certificated (every 6 months) daily visual inspections
Drill	Battery		
Dumpy Level	N/A	Surveying / Setting out	Calibration certificates (every 6 months)
Total Station	N/A	Surveying / Setting out	Calibration certificates (every 6 months)
Coshh Store	N/A	Safe storage of Coshh items	Compliance with Coshh Regulations
Steel Store	N/A	Safe storage of material / plant items	
Tower Lights	Diesel	Site wide safety lighting	Sufficient LUX level
Bunded Fuel Tanks	N/A	Storage of fuel	Integrated drip trays and spill kit available
Drip Trays	N/A	Stop fuel spills	
Emergency Spill Kits	N/A	Clean up after spills	
Fire Extinguishers	N/A	Fire Safety	Located in all areas

Recommendations for Foundation types:

The required foundations for the new development would be based on the assessment of the site ground conditions and a more in depth site and soil investigation. Ground conditions change all the time and it is adequate that all through examinations are carried out before any earth works commence.

An estimated calculation of the structural loadings would determine the overall dimensions of the foundations. Two factors for basic sizing of foundations are:

1. Load being transmitted, max 70kn/m (dwelling up to three storeys).
2. Bearing capacity of subsoil under proposed foundation.

Soil conditions, type of structure, structural loadings, economic factors, time factors (contract period) and construction building problems would all need to be taken into consideration when choosing the suitable foundation.

The main objective of a foundation design is to ensure that the structural loads are transmitted to the subsoil safety. To ensure there is no movement during the construction period and throughout the anticipated life of the building or structure. If foundations fail the building will fail.

The following information and drawings are potential foundations that may be used when constructing the New development.

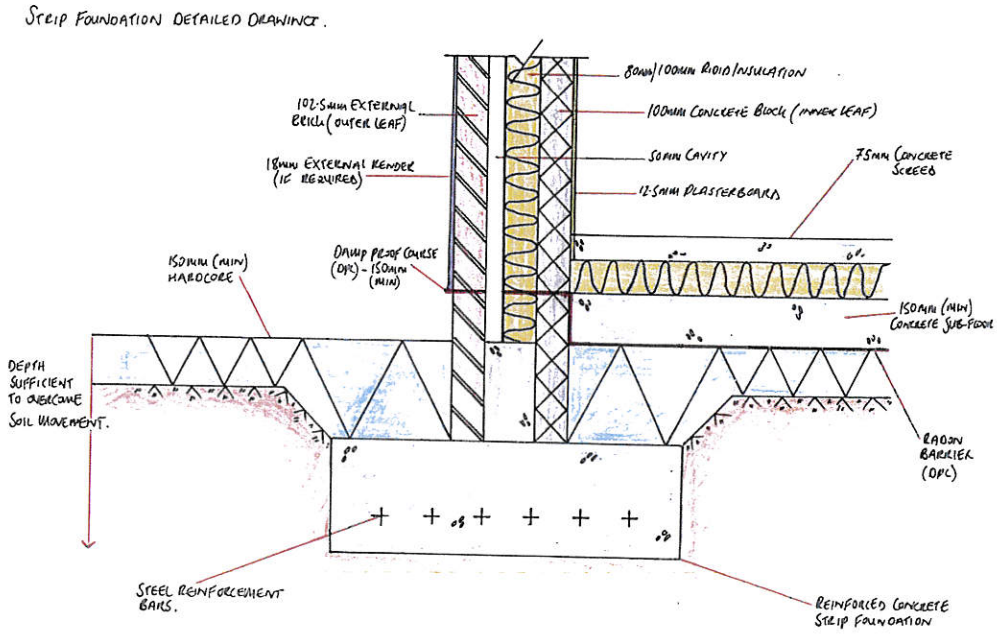
Strip foundations:

Strip foundations are basically a strip of concrete placed into a trench. The concrete must be a minimum of 150mm. The Building Regulations will give a list of standards and rules where strip foundations are suitable. For example, strip foundations, would not be used where there is made up ground from imported soils etc or weak soil areas where foundation are likely to fail. The width of a strip foundation must be in accordance with table 12 of approved documents A1/2 in section E1 of the building regulations. The strip must be no less than the same size of the thickness of the wall and never less than 150mm.

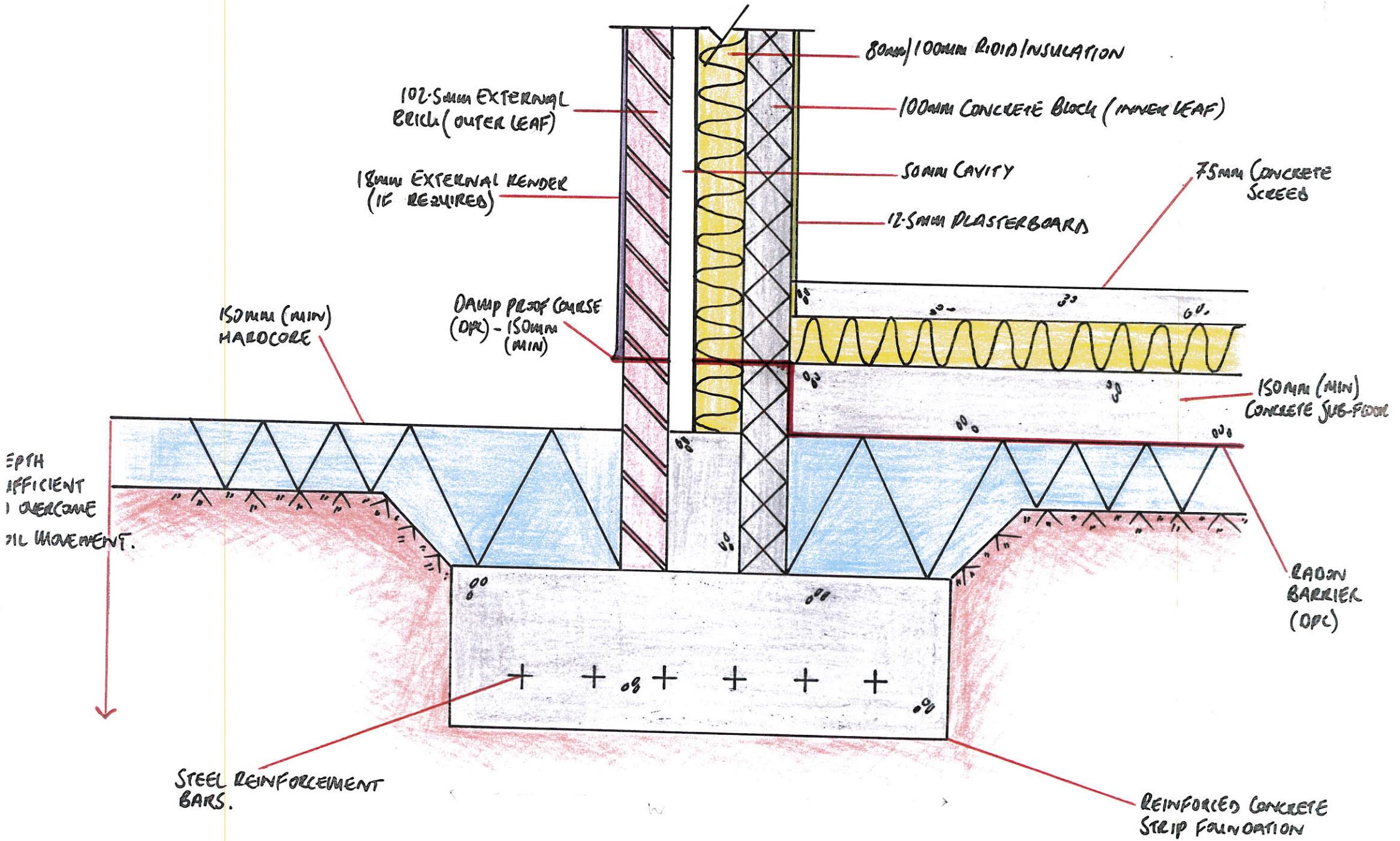
Considerations when using strip foundations are: Trees draw a lot of water from the ground. The ground will rise and fall without trees present and this would increase in clay soils. Trees will draw water even in warm weather which will continually shrink the ground. The ground can rise and fall up to 40mm around trees in winter and summer. Where trees may be cut down in clay conditions the ground could swell up to 150mm as roots no longer draw water from the ground. This will affect the foundations. it is required where possible that when using strip foundations where trees may be present that they are kept a tree length away from the foundations. British standard 5837 suggests that special precautions are taken when foundations are to be constructed near trees. Trees that are cut may also results in the roots underground rooting which will affect and weaken the load bearing of the building.

Strip foundations are used where the soil has a good bearing capacity and are suitable for most subsoils and relatively light loadings such as low to medium rise domestic buildings. Most cases reinforcement concrete would be used. This is where the strip foundation would have distribution bars included in the foundation strip make it a lot stronger with the amount of load bearing.

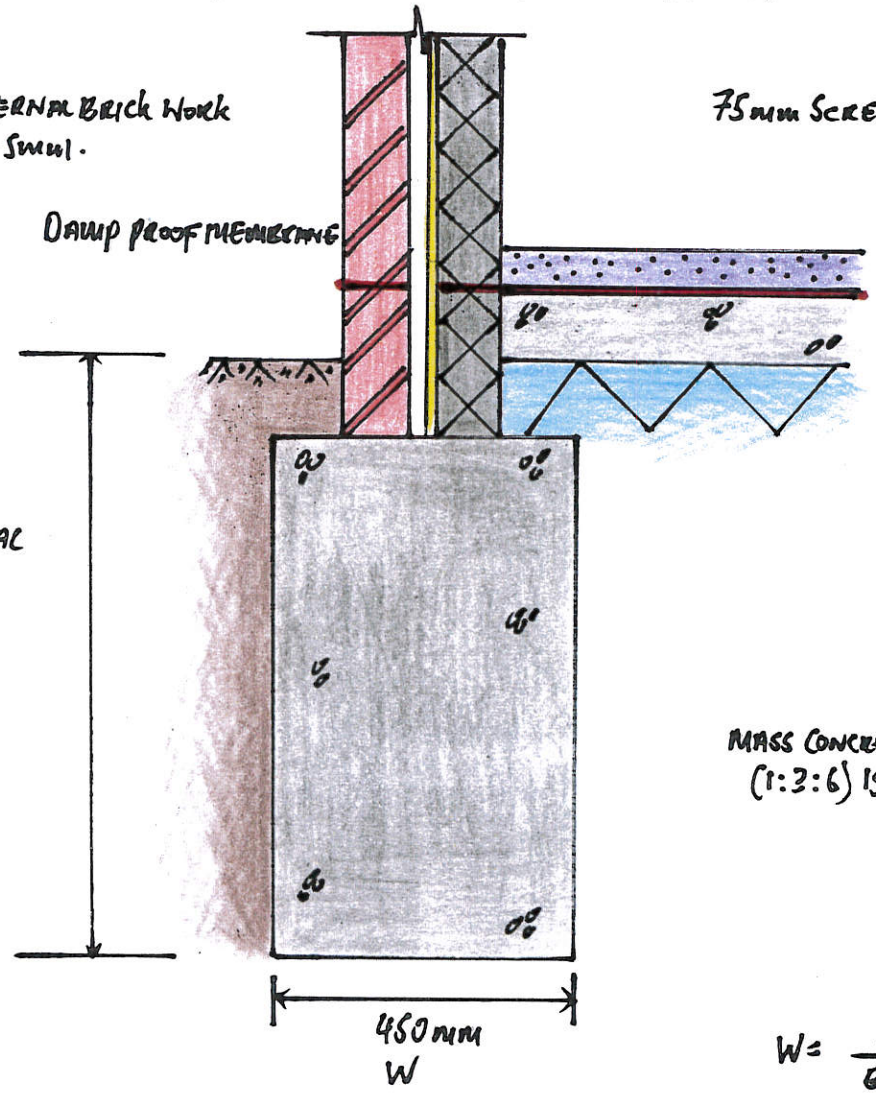
As per drawing below. Details of a suitable strip foundation could be used with reinforced concrete bars. The width of the strip foundation would be three times the size of the overall width of the wall. The load bearing is transmitted at 45 degrees from the base of the wall to the soil. The depth of a strip foundation must be a minimum size of the width of the wall. **(Full detailed drawing on next page)**



Strip Foundation Detailed Drawing.



DEEP STRIP - TRENCH FILL FOUNDATION.



$$W = \frac{\text{LOAD PER METRE}}{\text{BEARING CAPACITY OF SOIL}}$$

"THE WIDTH OF THE FOUNDATION MUST GIVE ADEQUATE WORKING SPACE WHICH IS USUALLY 450mm TO 600mm MINIMUM DEPENDING ON DEPTH OF EXCAVATION."

A minimum of 150mm compacted hardcore would be used as a base for the subfloor which would then be poured directly on top and for the subsequent loads of the dwelling. The concrete sub-floor minimum of 150mm would provide a strong platform for the insulation.

A radon membrane would be installed to form a seal on the entire base (footprint) of the building. This would act as a waterproof/damp membrane and stop any arising gases that may occur.

The damp proof membrane is installed at a minimum of 150mm above finished external ground level. This is vital and will repel any rising moisture. 100mm thick insulation boards can be installed below finished floor level, this would encourage minimal heat lost through the foundation. 75mm concrete screed then provides a smooth finished to the internal floor level.

Table below is a basic guide for strip foundation width. As per Building Regulations A.D: A – Structure.

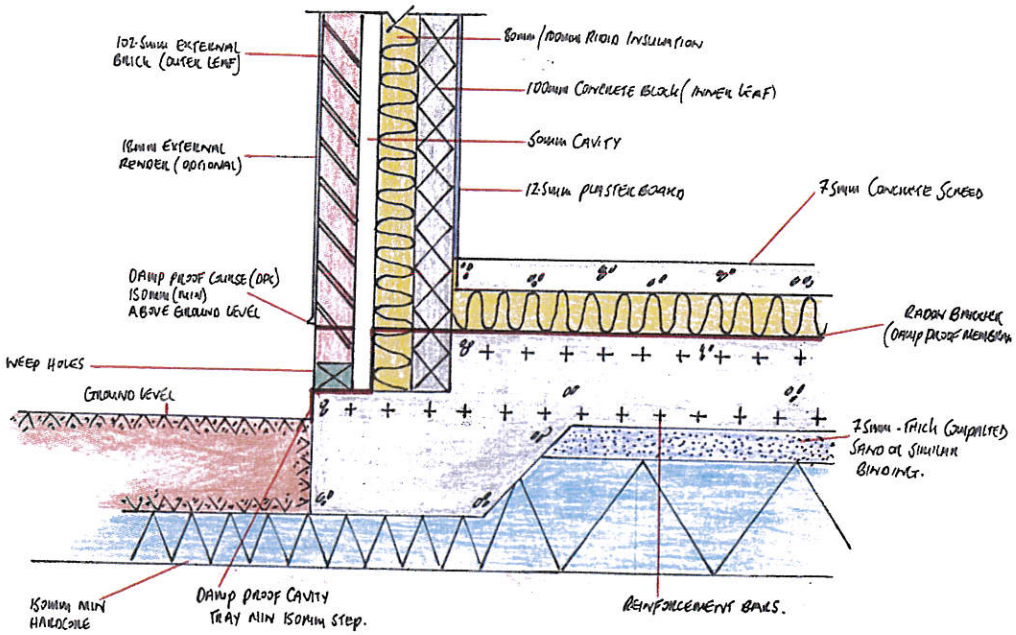
Ground type	Ground condition	Field test	Max. total load on load-bearing wall (Kn/M **Minimum width (mm) 20 30 40 50 60 70**
Rock	Not inferior to sandstone, limestone or firm chalk	Requires mechanical device to excavate	At least equal to width of the wall
Gravel Sand	Medium density compact	Pick required to excavate. 50mm peg hard to drive beyond 150mm	250 300 400 500 600 650
Clay **Sandy Clay**	Stiff Stiff	Requires mechanical device or pick to excavate. Can be indented slightly with thumb.	250 300 400 500 600 650
Clay **Sandy Clay**	Firm Firm	Can be moulded under substantial pressure by fingers	300 350 450 600 750 850
Sand **Silty sand** **Clayey sand**	Loose Loose Loose	Can be excavated by spade. 50mm square peg easily driven into ground.	400 600 Conventional strip foundation unsuitable for loads exceeding 30kN/m
Silt **Clay** **Sandy Clay** **Silty Clay**	Soft Soft Soft Soft	Finger pushed in up to 10mm. Easily moulded with fingers	450 600
Silt **Clay** **Sandy Clay** **Silty Clay**	Very soft Very soft Very soft Very soft	Finger easily pushed in up to 25mm. Wet and easily squeezed between fingers.	Strip foundation inappropriate. Steel-reinforced wide strip, deep strip or piled foundations required.

Raft Foundations:

Raft foundations (also known as mat foundations) are basically a large concrete slab which supports several steel columns and walls. The slab will cover the entire building footprint which will ultimately lower the pressure compared to other foundations like strip or trench footings. After the 2nd world war raft foundations were widely used because of the speed and volume of houses required. Also, being cheap and easy to install they did not require deep excavations. When Building, Regulations were introduced in 1965 raft foundations were less used as this meant they had to be designed and approved by the building control. This made the construction process a lot more difficult and time consuming.

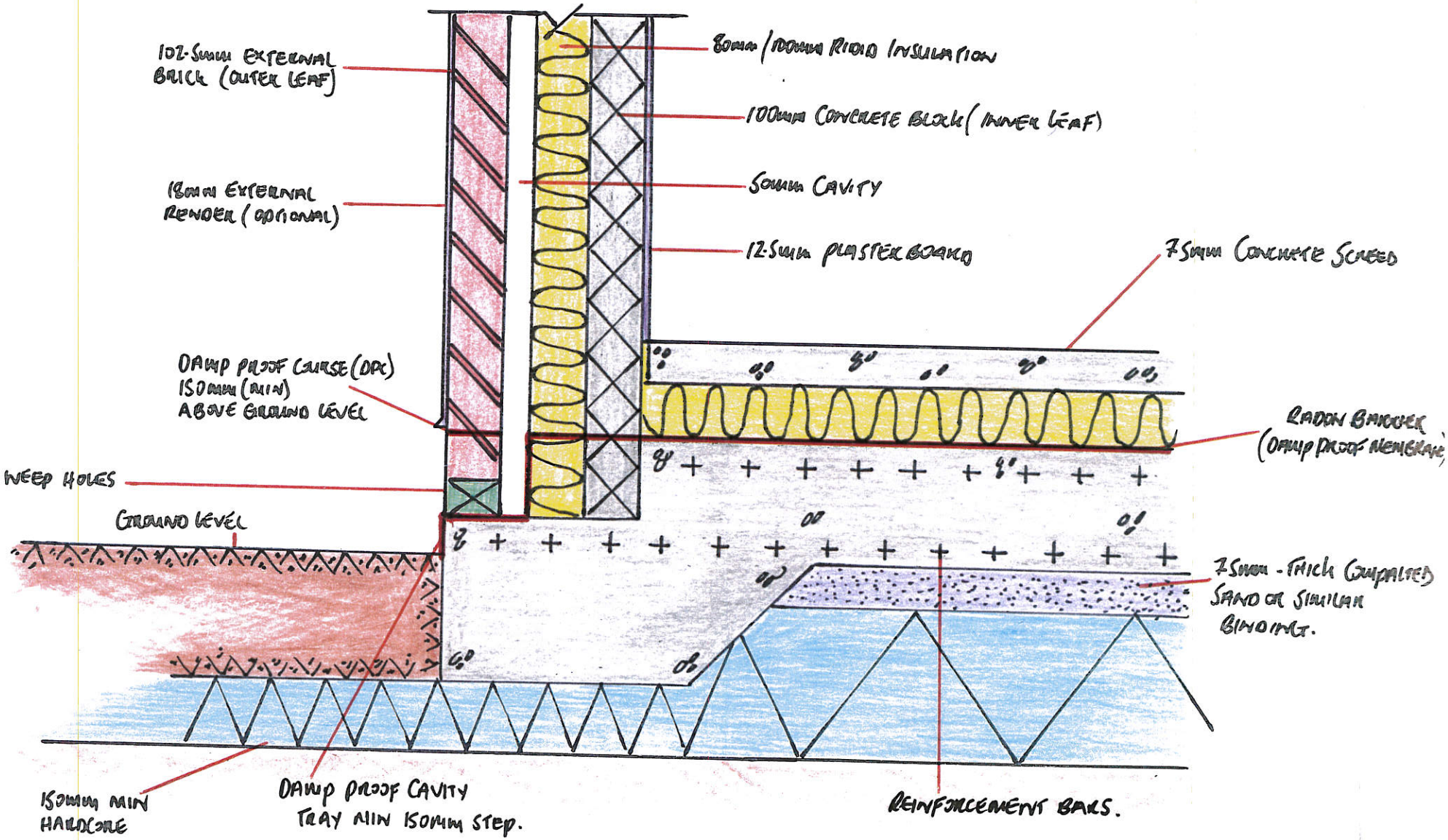
Raft foundations are very successful and more commonly used in commercial buildings rather than houses. Rafts are used when the strata are unstable/areas of movement in the strata or because a strip foundation would take up most the floor space. **(Full detailed drawing on next page)**

RAFT FOUNDATION DETAILED DRAWING.

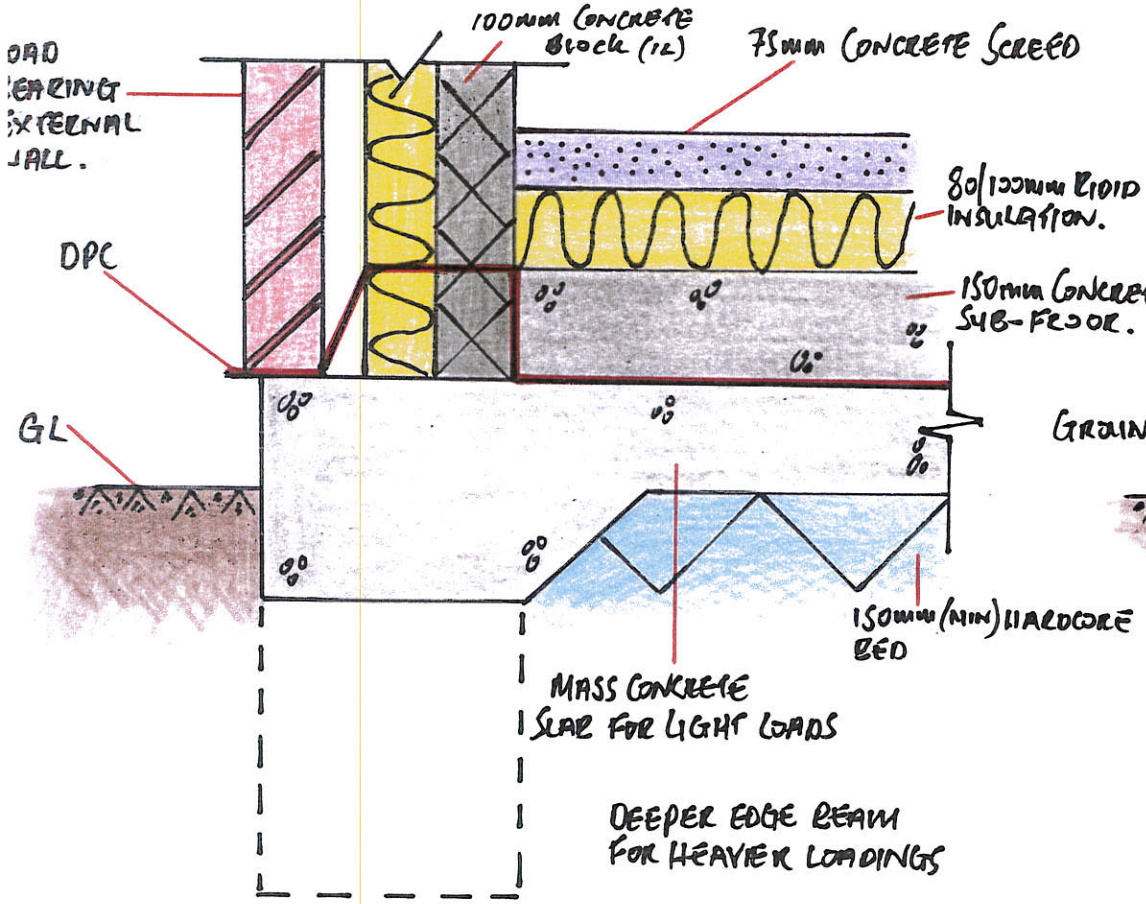


Raft foundations can be used for large loaded buildings on poor soil conditions where approximately the top 450mm to 600mm of soil is overlaying a poor-quality substrate. Therefore, they are commonly used in commercial buildings which tend to be much larger. They are designed to spread the load of the substructure over a large base to reduce the load per unit area being imposed on the ground. This type of foundation also helps when individual column loads are heavy. In this case raft foundations, would be suitable but the concrete slab would need to be reinforced again using steel fabric reinforcement bars as detail in the drawing. The reinforcement bars are vital to the load bearing of the building. This will increase the strength of the foundation.

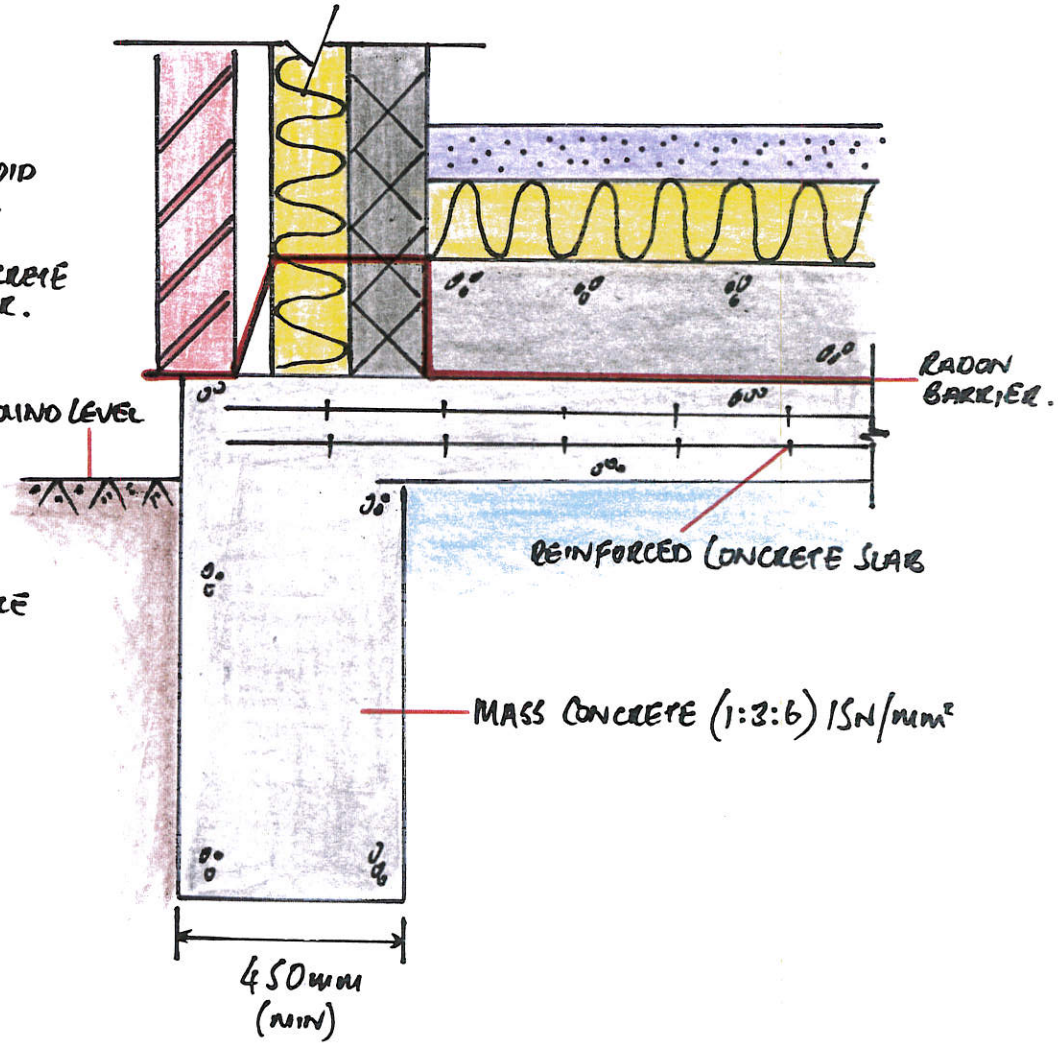
RAFT FOUNDATION DETAILED DRAWING.



SOLID SLAB RAFT FOUNDATION



BEAM AND SLAB RAFT FOUNDATION



The reinforced concrete raft is supported on compacted hardcore minimum of 150mm deep, this will extend past the edge of the raft. The edge of the raft is stepped, this will allow the brick/block work to rest of the raft. Creating a "toe" this allows the external block work (outer leaf) of the wall to continue below ground level. Raft foundations will use more concrete than other foundations

Advantages and disadvantages using raft foundations: Rafts are cheap and quicker to use than traditional foundations. This is because the foundation and floor slab are combined, this saves time and materials. They also have shallower excavations. Other reasons for rafts are the engineering benefits, as they are ideal for poor/soft grounds conditions, where as normal footings would not cope as they do not spread the load effectively like rafts.

Rafts will also reduce differential settlement, where settlement in the ground occurs at different rates/locations across the ground, rafts will reduce cracks and more serious problems.

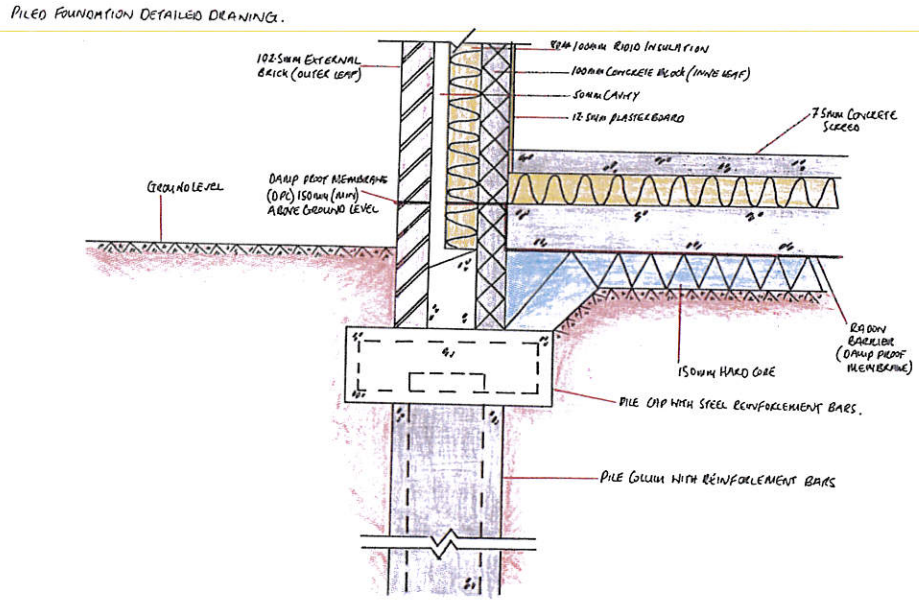
Disadvantages of raft foundations is that if they are not treated properly they are prone to erosion.

Piled Foundation:

Pile foundations are very deep foundations that are used where soil, earth below is poor. Foundations are considered deep where they extend beyond 3 metres. Piles are used to spread the load of the building through unstable ground conditions deeper to firmer ground below. Piles are usually pre-cast or poured in-situ concrete on site with reinforced bars. A ring beam will sit on the piles, this will give a base for the brick/block to be built on. Piles will also act as an anchor system, where taller structures are likely to be lifted or pushed over. Piles will support the lateral load and stop the building from falling over sideways.
There are two different types of piles:
Replacement piles: These are piles which are placed into the ground that has be dug up beforehand. The concrete, or steel will simply replace the earth that has been excavated.
Displacement piles: These are pre-cast or pre-formed piles that are driven not the ground by a piling rig. (Basically, a large hammer). This will displace the earth below that the piles are driven into.
Considerations when using piles:
The cost against using other foundation types.
The load of the building or structure to be supported.
Using a piling rig may disrupt other existing buildings.
The condition of the ground and surrounding strata.

Piling is used more often today due to the increase in muck-away from the huge number of tonnes of soil when using a strip or raft foundation.
There are several different types of foundation piles that can be used:
End bearing piles: the most easily understood. The pile is driven into soft ground until it is embedded into harder soil usually the bedrock.
Friction Piles: Where the pile is driven into the ground this will compact the ground beneath which gives greater strength to the end bearing load. Also, the friction from the soil that it is driven into will also make it more secure.
Settlement reducing piles: This piles are used and designed to offer stability in subsidence and settlement in the ground. these foundations will reduce sagging in existing foundations.
Tension piles: These are piles that are used to provide stability to taller buildings. Tension piles will anchor the building into the ground. this will give it strength from the forces of heavy winds ect. Piled foundations are a series of columns constructed or driven into the ground at a low level of subsoil. The columns of concrete will then transmit the loads of a structure to a low-level point, these will then all be connected by a ring of concrete called a ground beam. Like the strip foundation method but not as wide.

Drawing of Pile Foundation below: **(Full detailed drawing on next page)**



Pile foundations are usually used when other foundations are not suitable due to the subsoil not be adequate and or if there is no interference with other existing buildings or low level services. The lack of suitable foundations may be caused by:

6. Low bearing capacity of subsoil.
7. High water level
8. Layers of highly compressible subsoil material such as peat, and recently filled materials which have not settled and consolidated.
9. Subsoils which may have a higher level of moisture causing movement.

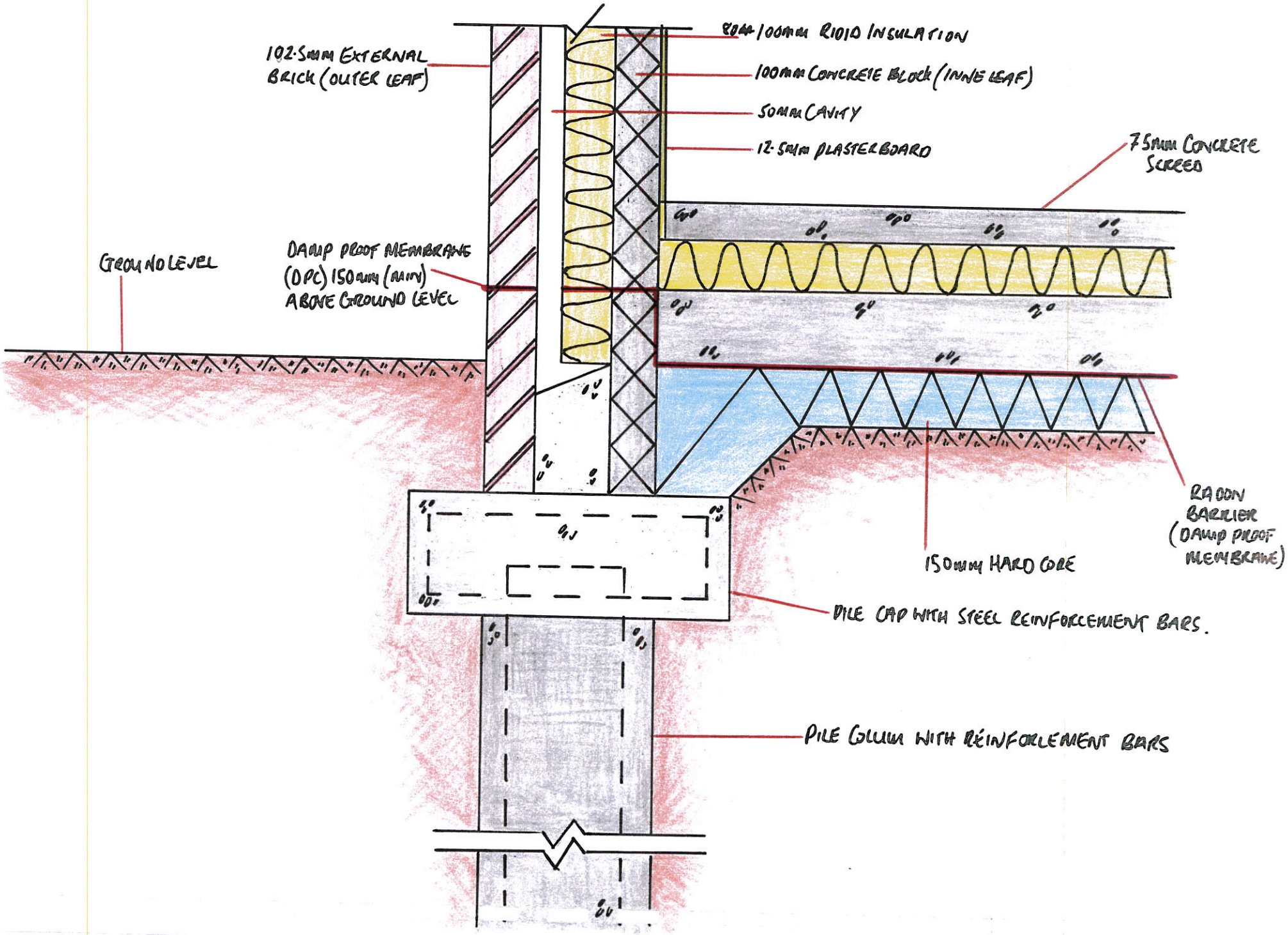
There are many different options when using pile foundations. The choice of material, the way they are constructed above ground and in the ground and the way there are designed to function.

One method is driving the precast pile into the subsoil using specialised percussion plant. A drop or single-acting hammer will penetrate the ground without boring holes out beforehand. The hammer weight and drop height would be chosen to suit the pile type and subsoil. The head of the pile can be protected against the impact blow with a steel helmet or another material like hardwood block, also known as a dolly.

Another method of using pile foundations require pre-drilling or boring out holes which then get poured with concrete. These would be reinforced with steel.

Piles can be used singly to support a load but it is more economical for piles to be used in clusters linked together with a reinforced concrete cap also call a ground beam. Once the piles are in place the ground beam can be constructed. The ground beam will be the surface where the walls of the building can be built.

PILED FOUNDATION DETAILED DRAWING.



The usual minimum spacing for piles is:

1. Friction Piles – 1.100 or not less than 3 x pile diameters, whichever is the greater.
2. Bearing Piles – 750mm or not less than 2 x pile diameters, whichever is the greater.

150mm minimum of compacted hardcore will be installed to form a base for the subfloor. The radon barrier will protect against any rising gases and act as a damp-proof membrane. The DPC is vital as it will rebel any rising damp, this will be taken over the blockwork to form a water tight seal over the entire floor of the building. As per building regulations the DPC will be a minimum of 150mm above finished ground level. The 150mm of concrete subfloor will then be poured on the hardcore, this will provide a strong sturdy platform base for the insulation. 75mm of concrete screed will then provide a finished smooth floor.

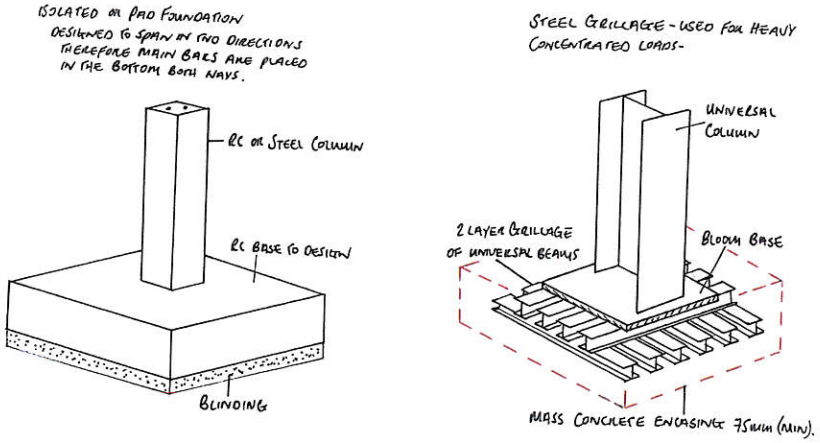
Pad Foundations:

Pad foundations are suitable for most subsoils but not recommended for loose sands and loose gravel areas. Pad foundations are usually reinforced with steel and are normally square in size.

Drawings below show the typical pad foundation detail, concrete and reinforced with steel method.

This type of foundation would not be suitable for the new development as the load may be to excessive and other foundations would be more stable and reliable. **(Full detailed drawing on next page)**

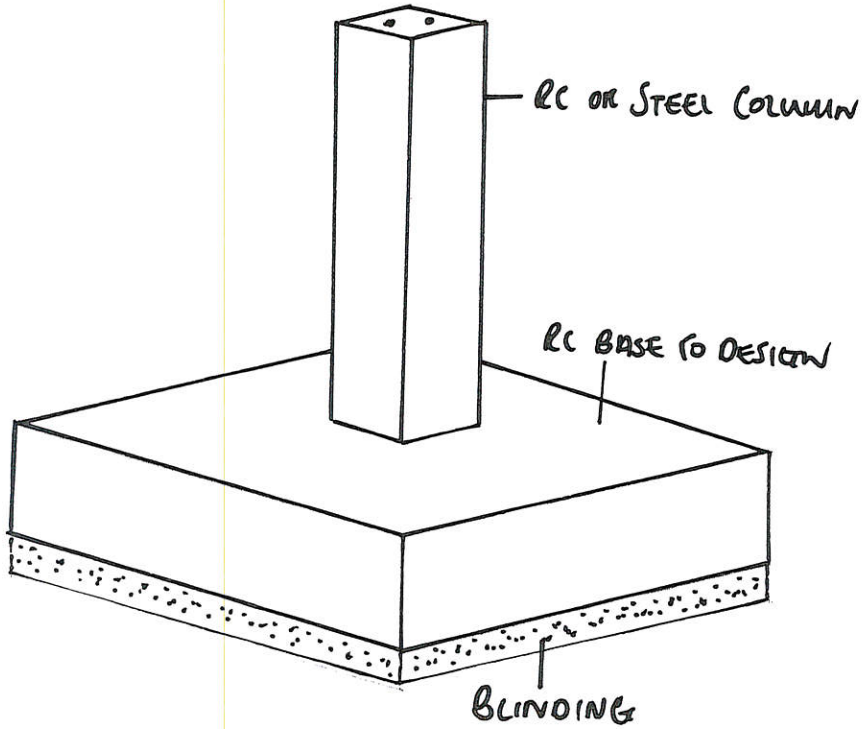
PAD FOUNDATIONS DETAILED DRAWING



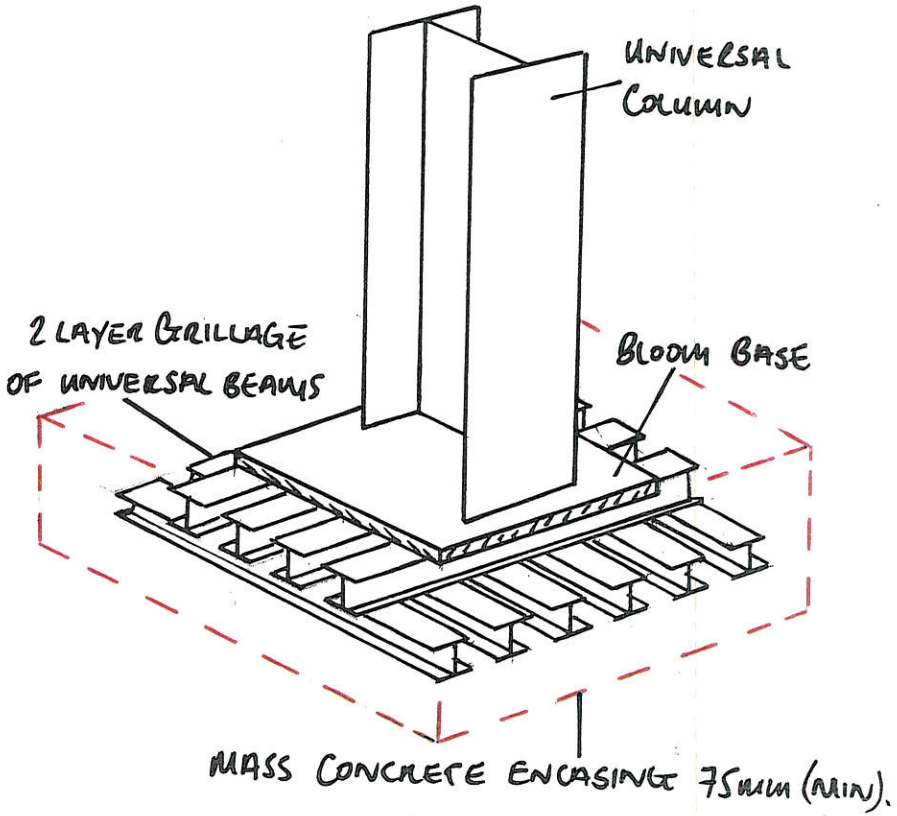
PAD FOUNDATIONS DETAILED DRAWING

ISOLATED OR PAD FOUNDATION

DESIGNED TO SPAN IN TWO DIRECTIONS THEREFORE MAIN BARS ARE PLACED IN THE BOTTOM BOTH WAYS.



STEEL GRILLAGE - USED FOR HEAVY CONCENTRATED LOADS-



Steel Frame construction:

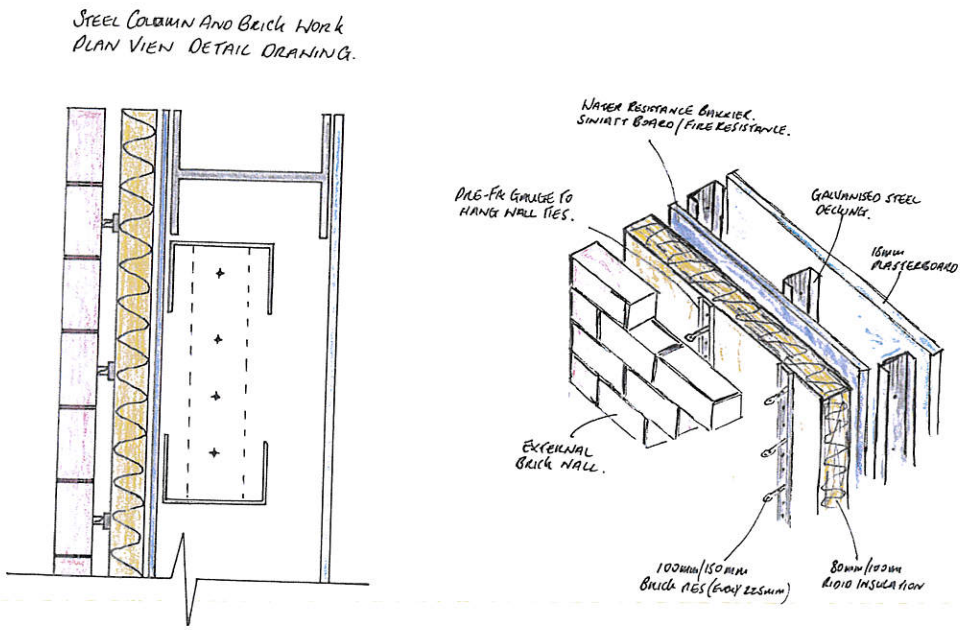
Below are details of a steel frame constructed onto a strip/pad reinforced foundation. Steel frame construction has many advantages as listed below:

1. Pre-fabricated - Factory made so the standards and tolerances have better quality control.
2. Simple to assemble on site. Bolted together in pre-formed holes.
3. Dimensionally stable, consistent composition and are unlikely to move once assembled correctly.
4. Moisture will not affect the steel.
5. They will not burn in a fire.
6. Insects will not affect the steel.
7. They have a greater span for a roof structure compared to timber.

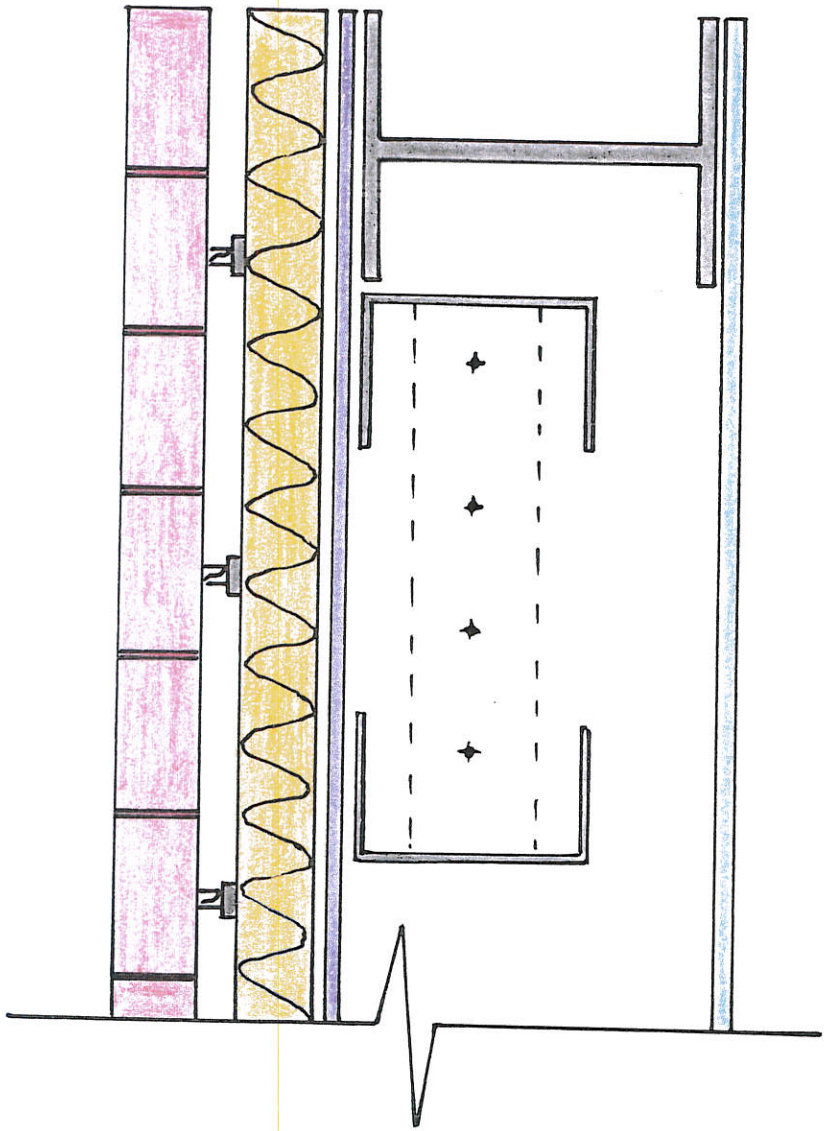
Disadvantages for steel frame:

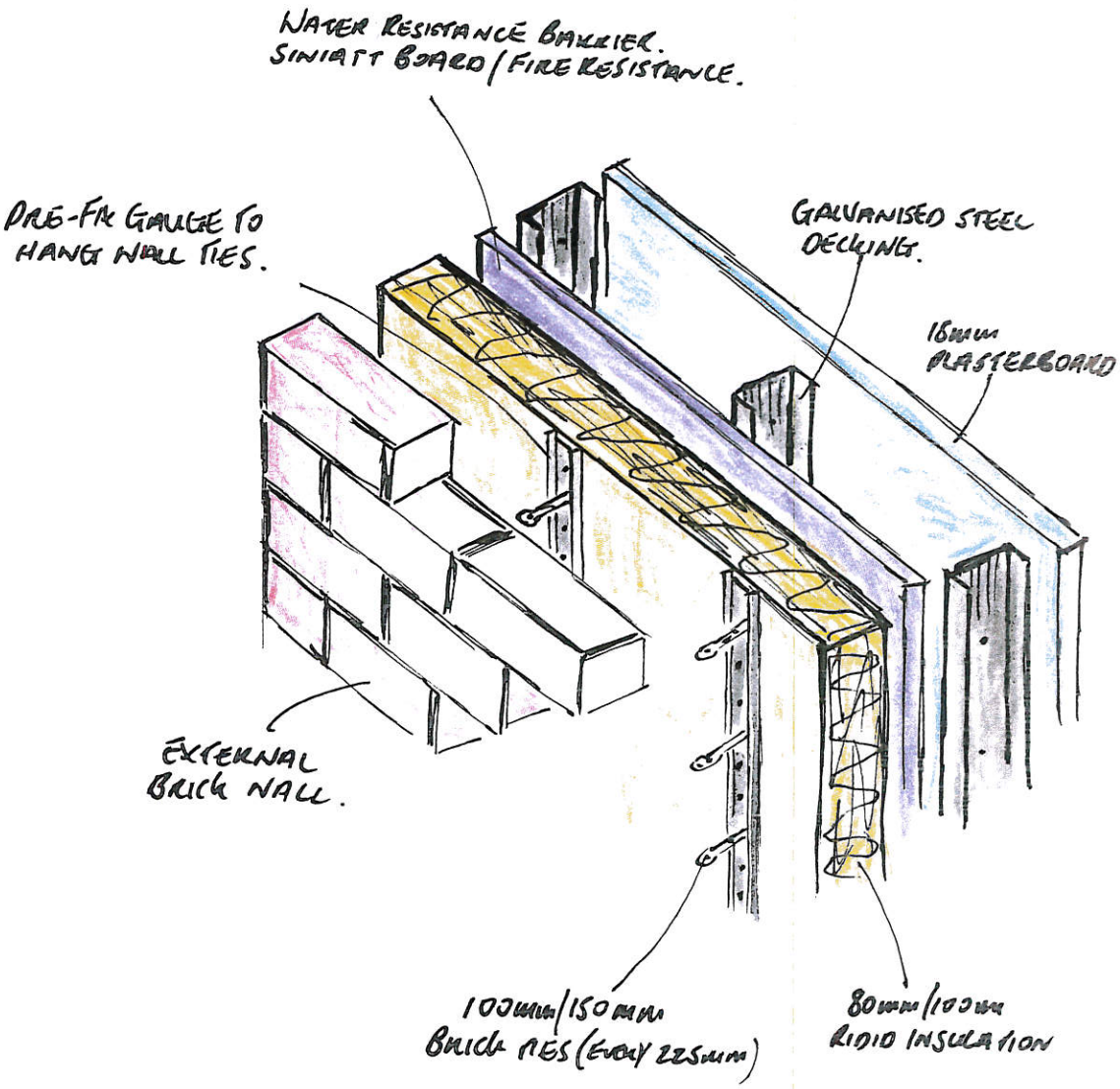
1. If the protected layer is damaged and exposed this may lead to corrosion.
2. At high temperatures, the steel may de-form. Even though steel don't burn the heat will affect expansion and this could be unpredictable.
3. All steel must be earthed with electrics.

Drawings Below of Steel Column and brick work plan. **(Full detailed drawing on next page)**

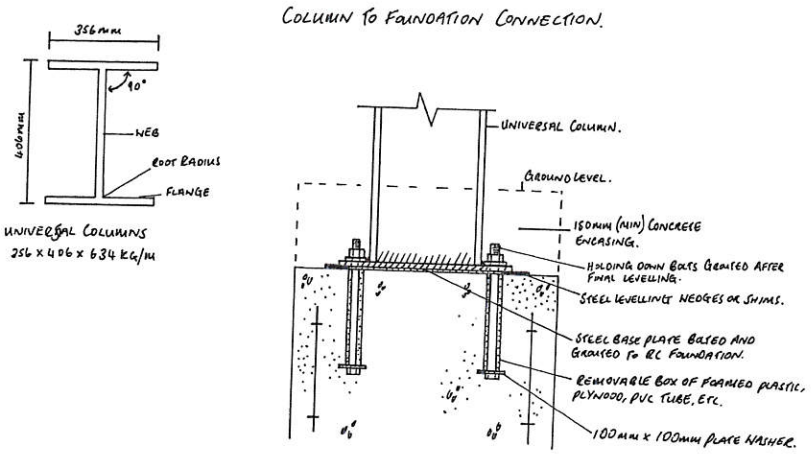


STEEL COLUMN AND BRICK WORK
PLAN VIEW DETAIL DRAWING.

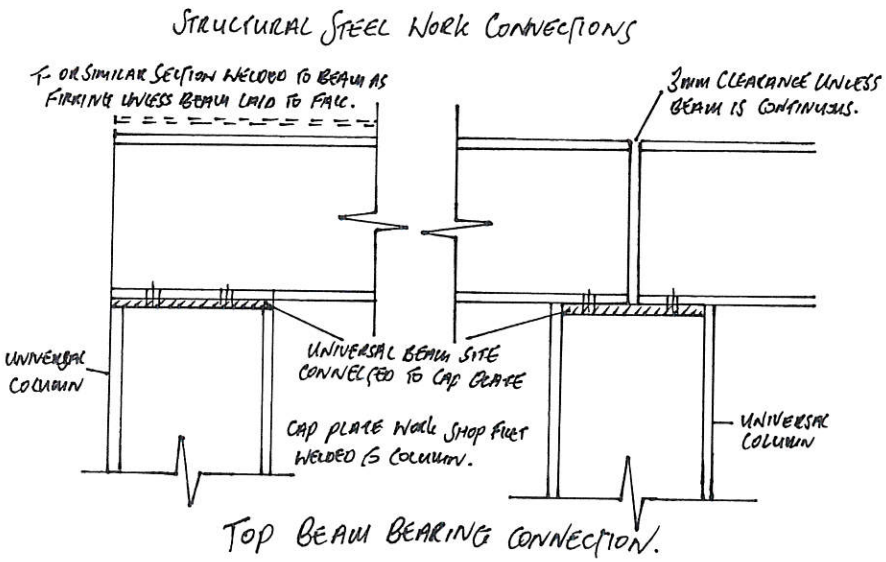




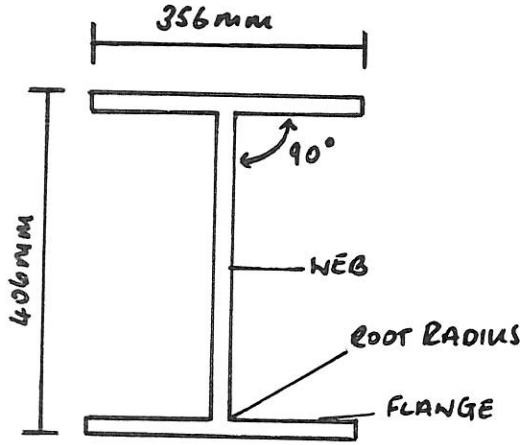
Drawing below of Structural steel column to foundation connections: (Full detailed drawing on next page)



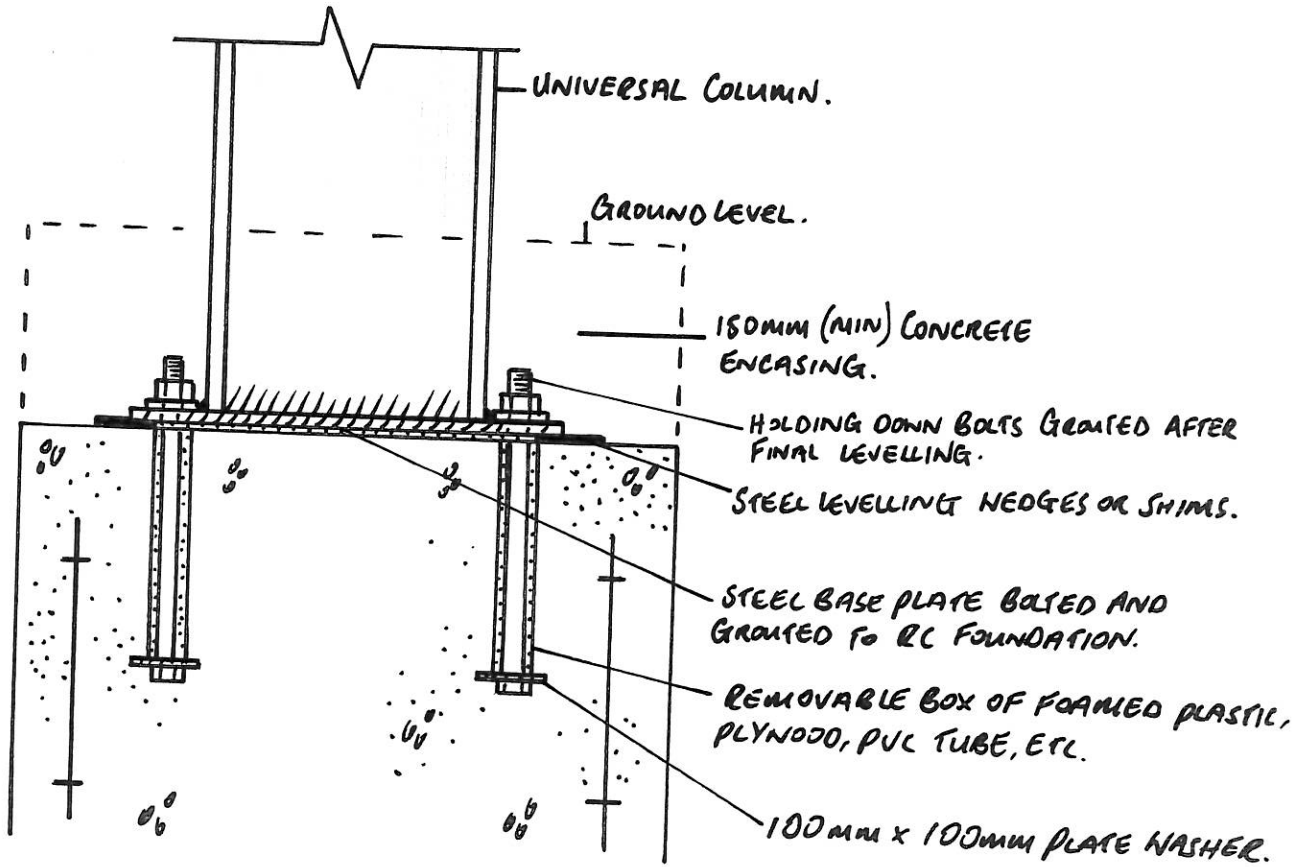
Drawing below of Structural steel column and beam connections: (Full detailed drawing on next page)



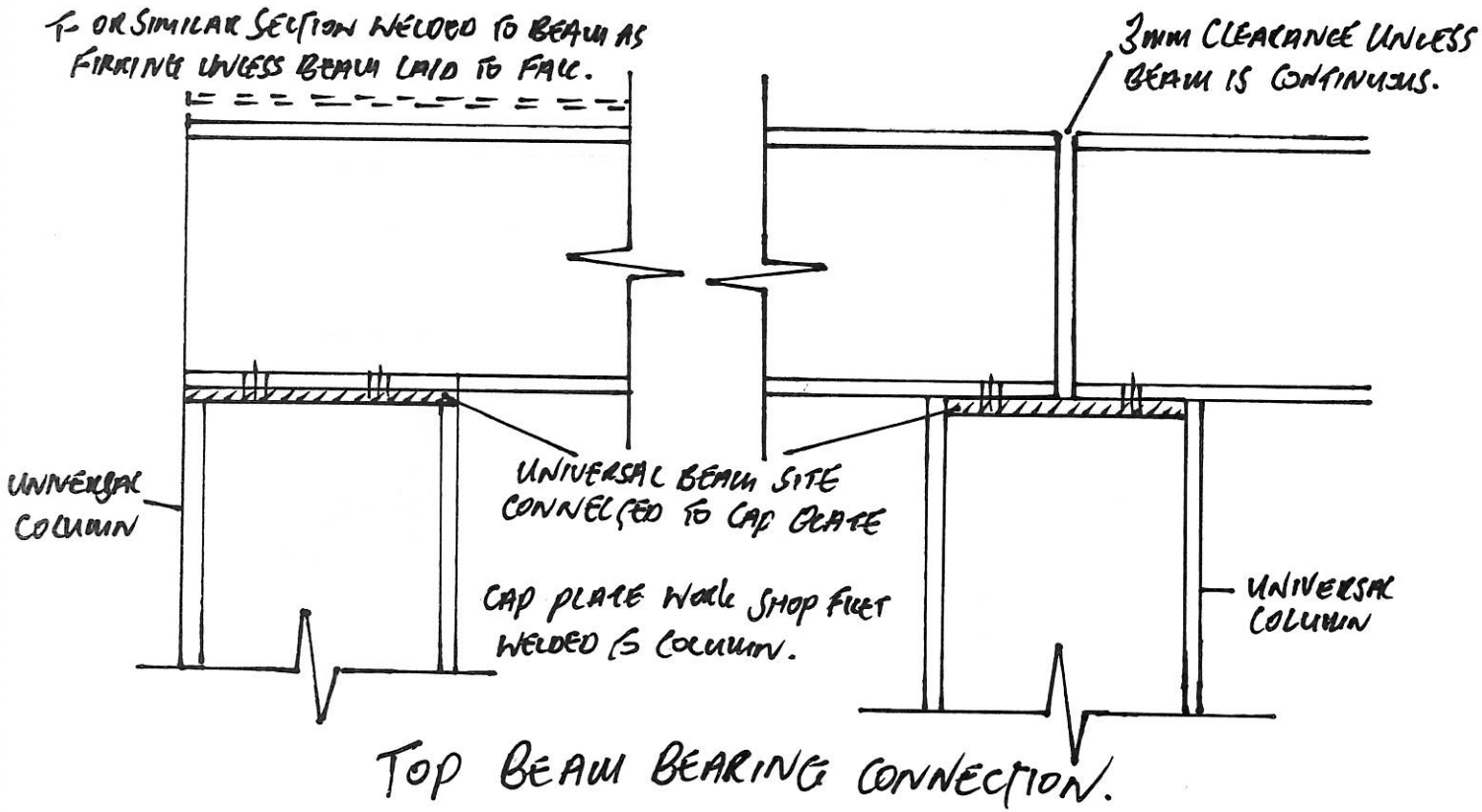
COLUMN TO FOUNDATION CONNECTION.



UNIVERSAL COLUMNS
356 x 406 x 634 KG/M



STRUCTURAL STEEL WORK CONNECTIONS



TOP BEAM BEARING CONNECTION.

Eaves:

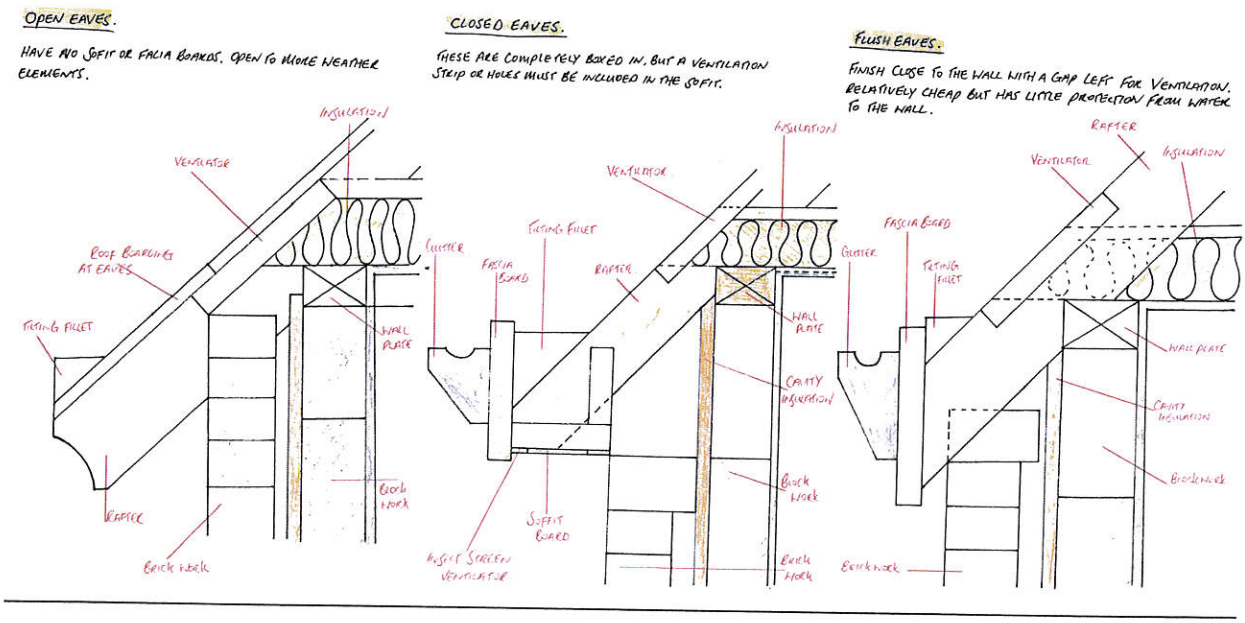
Eaves are the edge of the roof which overhang the face of a wall, ad would normally project beyond the side of a building. The eaves form an overhang to throw water clear of the walls. There are three types of eaves finishes: Flush, open and closed.

The function of eaves is to keep rainwater off the walls and to prevent the ingress of water at the junction where the roof meets the wall. Eaves may also protect pathways around the perimeter of a building from rain. Eaves create an opening for ventilation and can also have an aesthetic impact to the finish of a building.

Advantages of Eaves: Eaves encourage water to run off the side of the building rather than directly down the face of the walls. If water could run down the side off walls, leakage/damp problems may occur. Leaks between the joins of the roof and walls may occur. Eaves also protect water building up at ground level close to foundations Eaves can provide shading to windows and could also influence the climate control costs of a building.

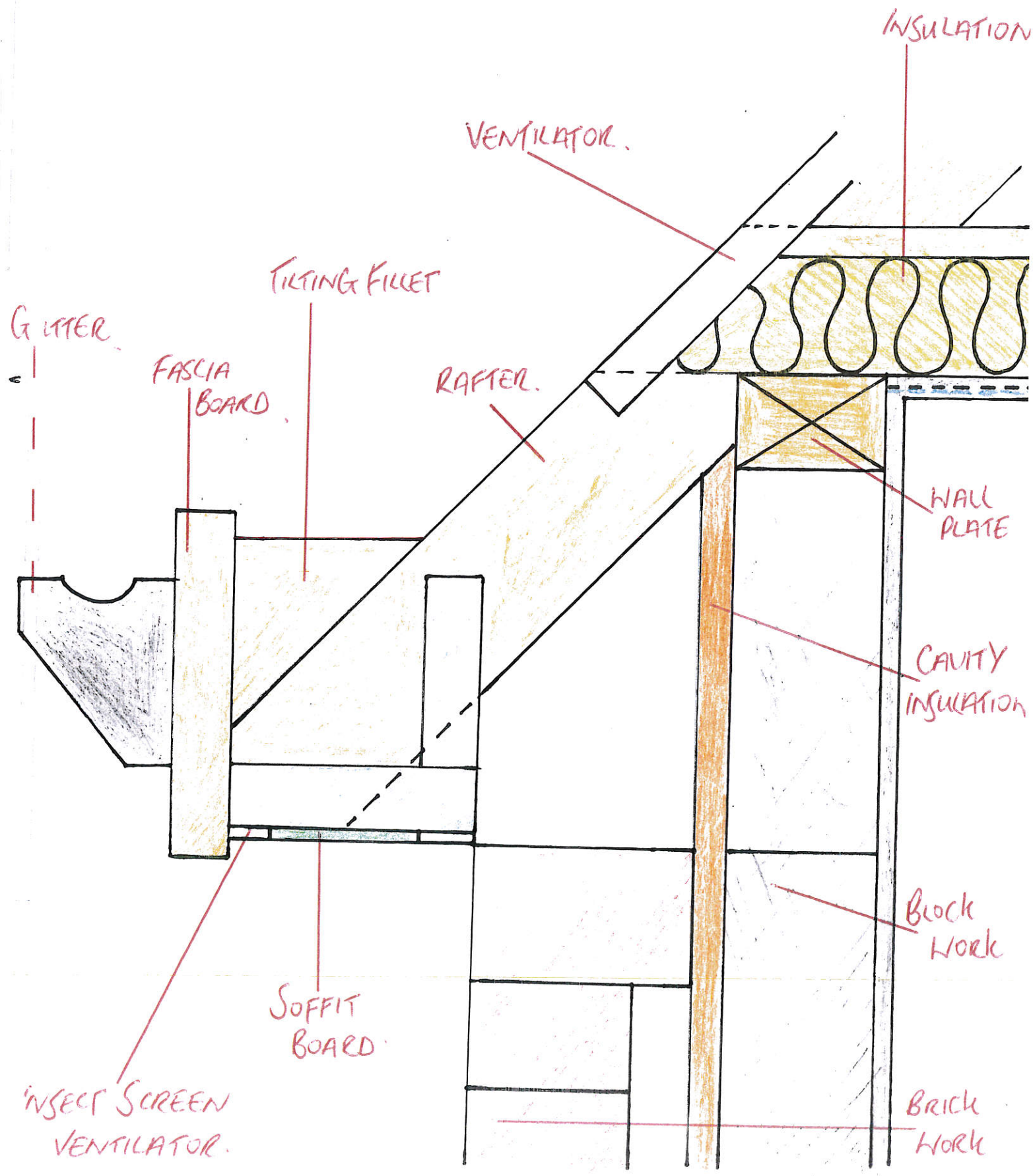
Disadvantages of Eaves: Eaves must be designed for local wind speeds, as the overhang can significantly increase the wind loading on the roof structure. Eaves would also increase the cost of the constructed building.

Drawings below of open, closed and flush eaves: **(Full detailed drawing on next page)**



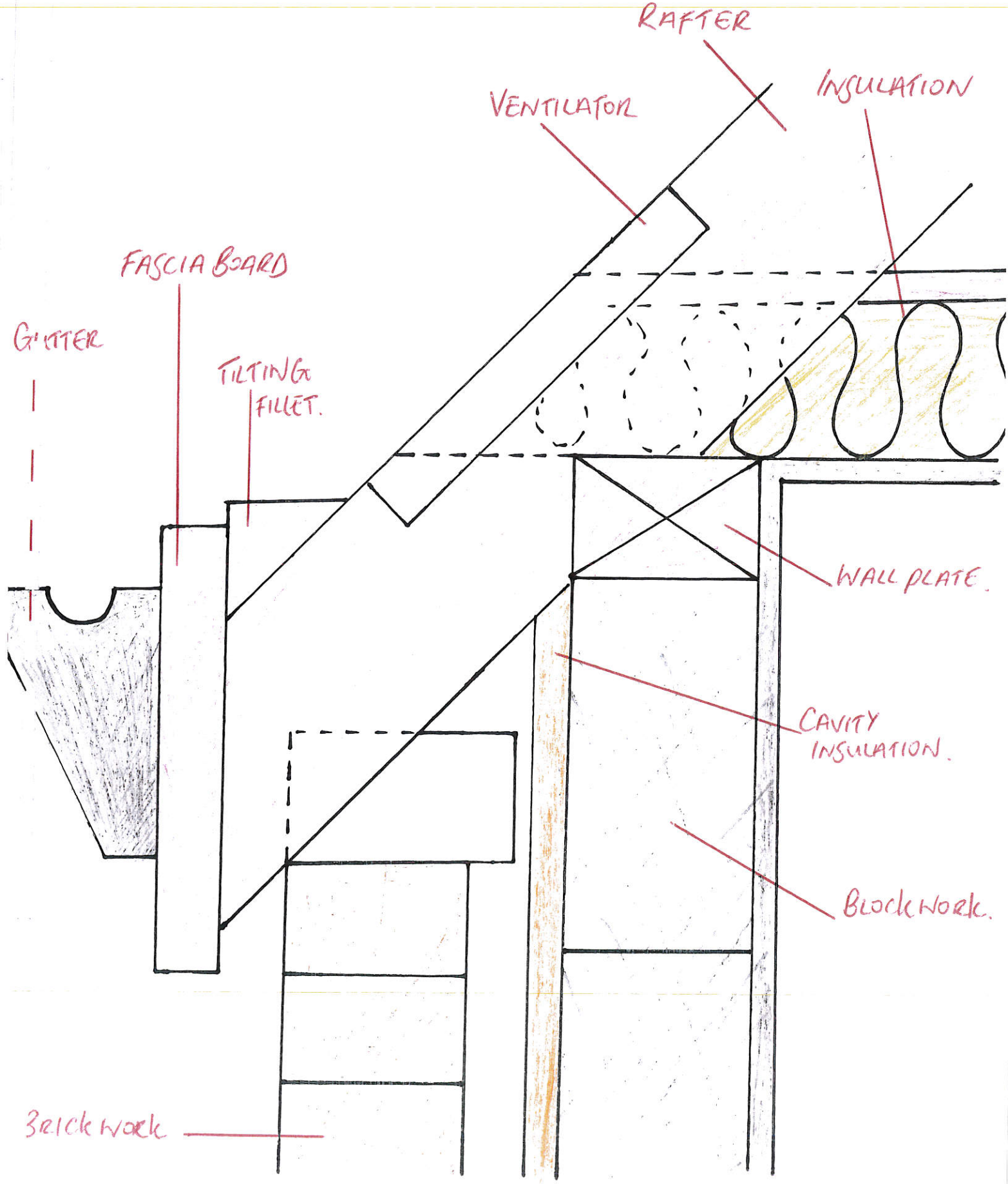
CLOSED EAVES.

THESE ARE COMPLETELY BOXED IN, BUT A VENTILATION STRIP OR HOLES MUST BE INCLUDED IN THE SOFIT.



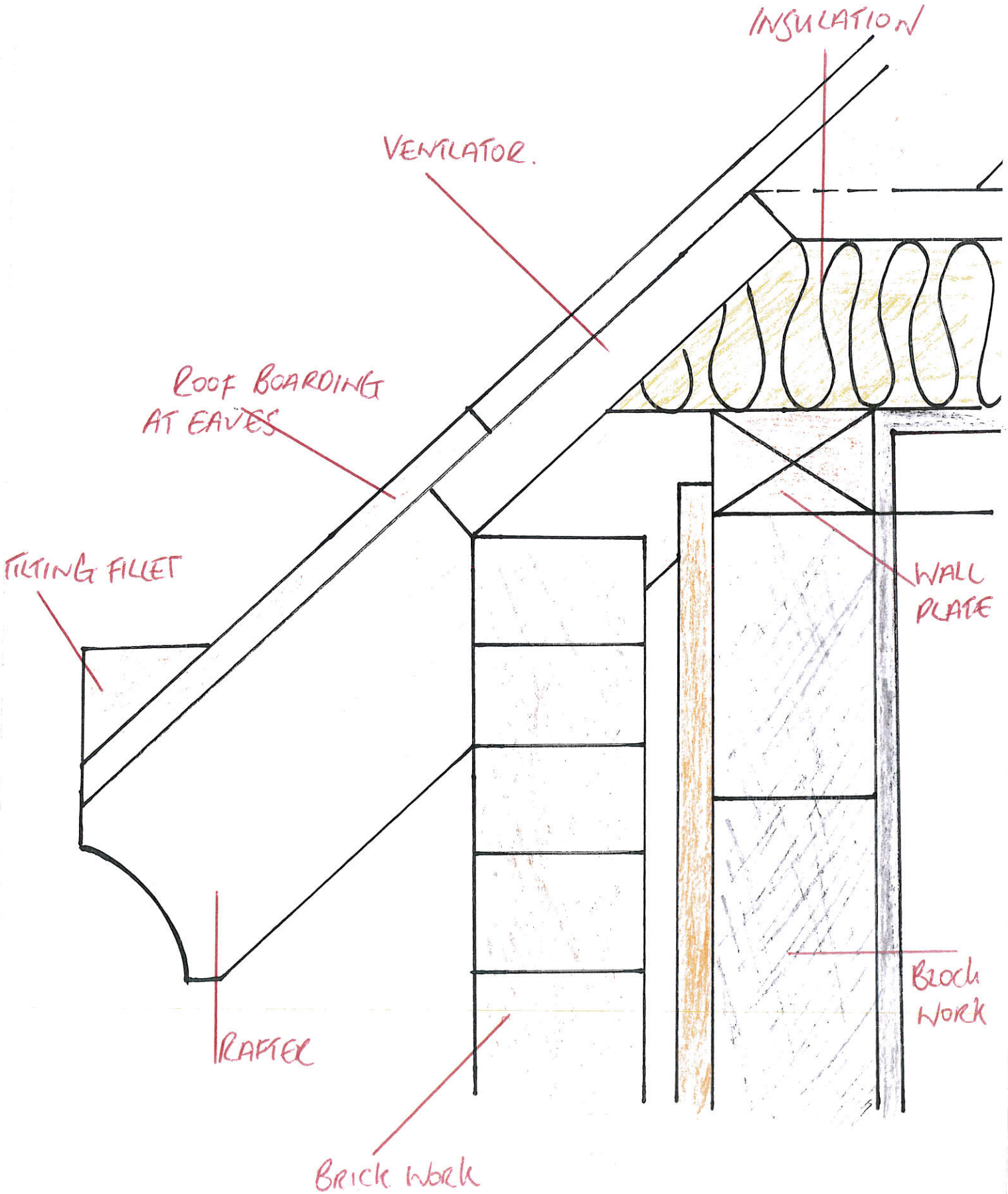
FLUSH EAVES.

FINISH CLOSE TO THE WALL WITH A GAP LEFT FOR VENTILATION.
RELATIVELY CHEAP BUT HAS LITTLE PROTECTION FROM WATER TO THE WALL.



OPEN EAVES.

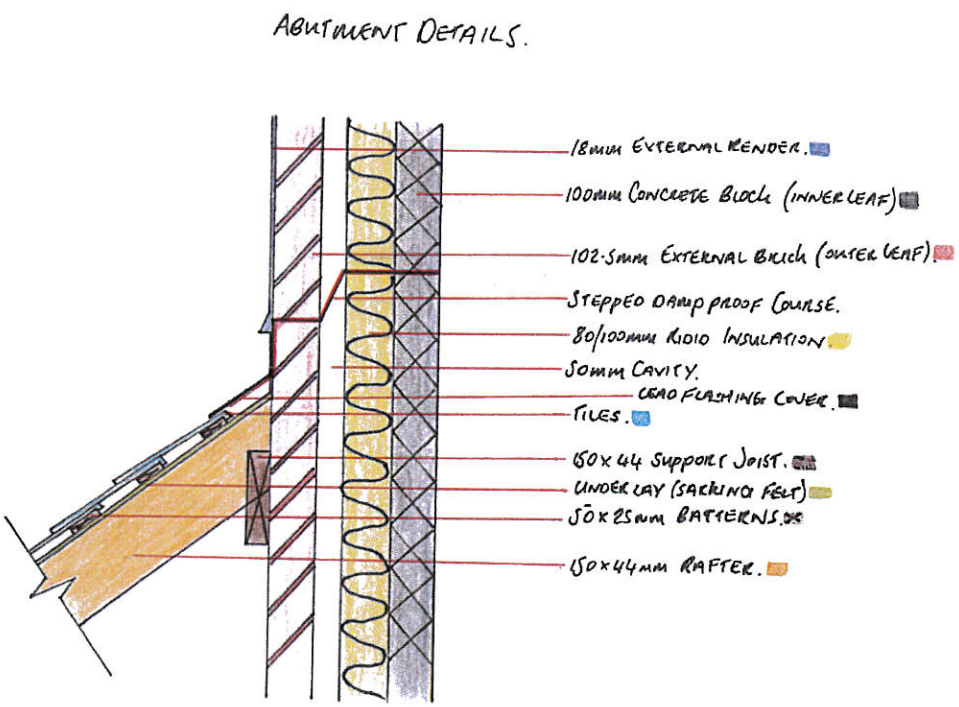
HAVE NO SOFIT OR FACIA BOARDS. OPEN TO MORE WEATHER E EMENTS.



Abutment details:

Abutments are essential when sealing the roof to the building to ensure that water and moisture penetration is prevented. The new development will require details of abutments. Below are drawings that may be required when constructing the building.

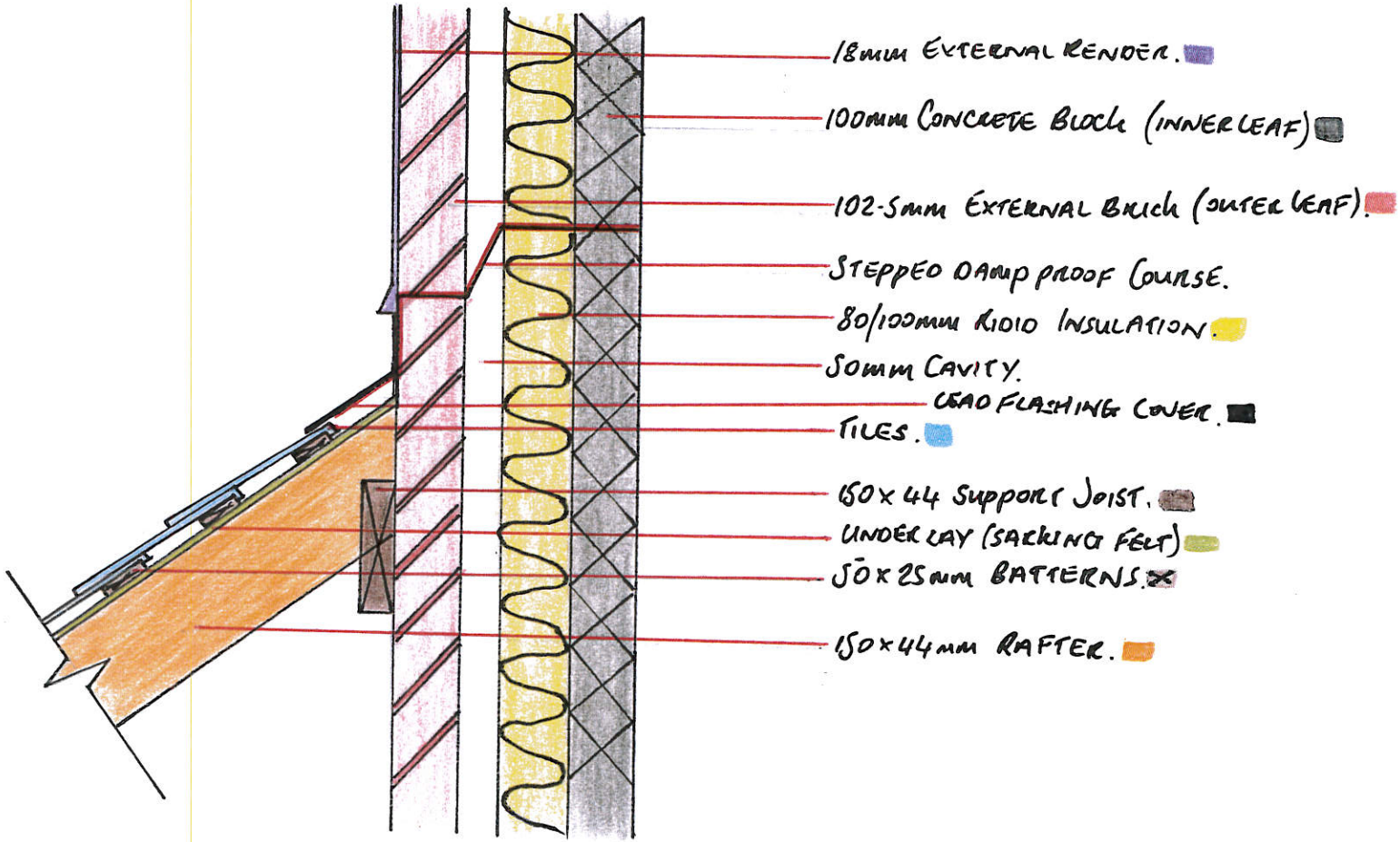
A damp-proof membrane DPC across the cavity will resist moisture penetration from above. This will also ensure that any moisture that penetrates the external block work will not travel down the cavity. As detailed below. **(Full detailed drawing on next page)**



the lead flashing is chased into the external brick work which enables it to overlap the lead upstand coming from the tiles.

As per building regulations, Approved document C2, Section 5: *A wall may be built with a damp-proof course of bituminous material, polyethylene, engineering bricks or slates in cement mortar, or any other material that will prevent the passage of moisture.*

ABUTMENT DETAILS.



DPC materials that may be used are as follow;

Lead – Soft and easy to work with when applying cavity trays. Mortar may corrode lead. Should be coated with bituminous paint. Lead is also suited when there is movement in a wall.

Copper – expensive and can cause staining to external masonry. Resistant to corrosion.

Bitumen in various bases: Hessian/Fibre /Hessian and Lead/Fibre and Lead – Hessian and fibre are likely to decay with age but will still act as a DPC. Easy to tear if not protected.

(LDPE) Polyethene – Very unlikely to deteriorate but is difficult to bond with other materials. Any movement in walls polythene will act well.

Bitumen polymer and pitch polymer

All DPCs above as a minimum standard would need to be at least 100mm overlapped at joints and adhesive sealed. All DPCs at floor level should be continuous with any DPM in the floor as shown in the below drawing.

Roof and abutment details and drawings:

All roofs can be classified as flat – pitch from 0 degrees to 10 degrees or pitched which is anything over 10 degrees. Anything which is over a 70-degree incline would be classified as a wall.

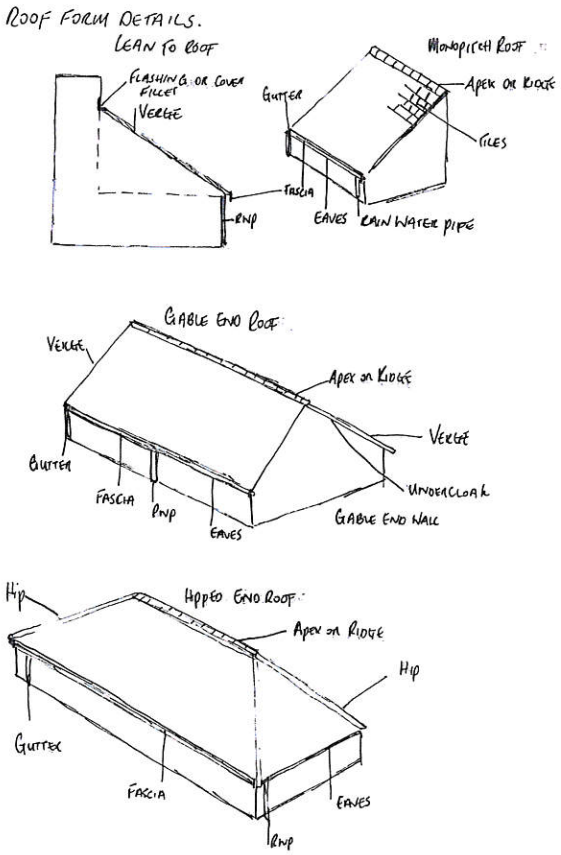
Roofs can be designed in many different forms/shapes and use a variety of different material. The function of any roof structure is to:

8. Provide an adequate barrier to the penetration of the elements.
9. Maintain the internal environment by providing an adequate resistance to heat loss.

All roofs need to be designed in such a manner that they can safely resist all imposed loadings such as rain, snow and wind. They must can accommodate thermal and moisture movements and be durable. When roofs are constructed maintained to the roof should be incorporated.

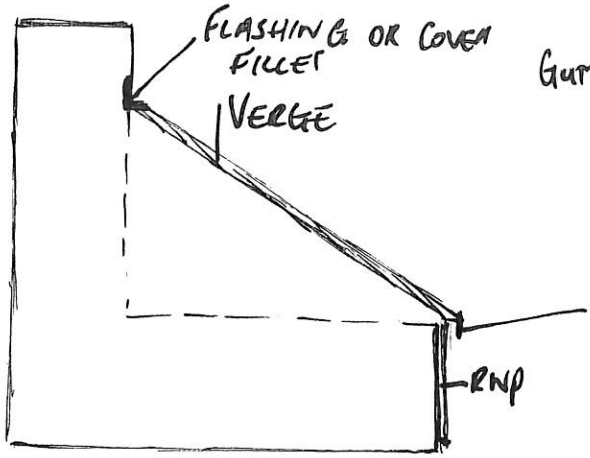
The New development has a ground floor area of a maximum 300m2. With a first-floor area of a maximum 150m2.

Below drawings are some recommendations for the different type of roof structures that may be suitable for the new development. **(Full detailed drawing on next page)**

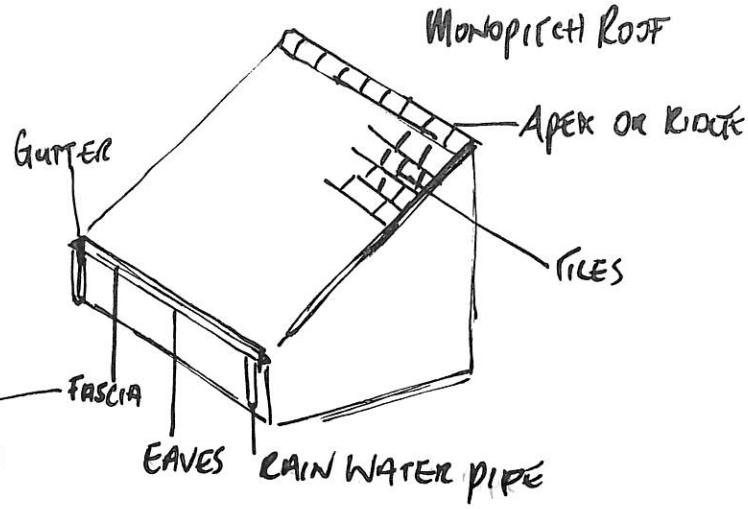


ROOF FORM DETAILS.

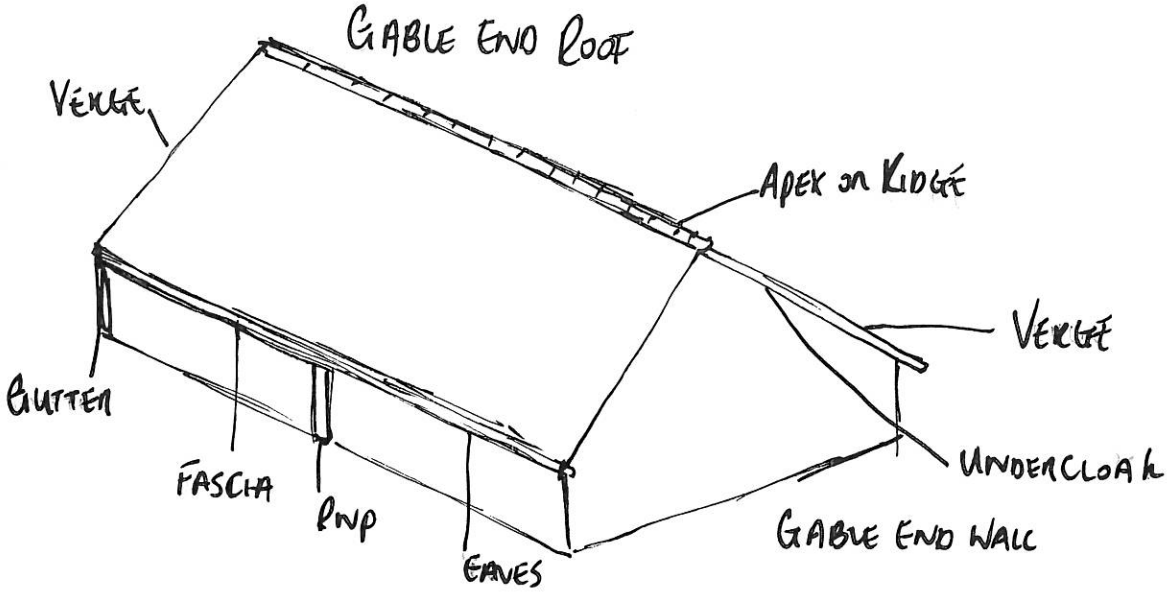
LEAN TO ROOF



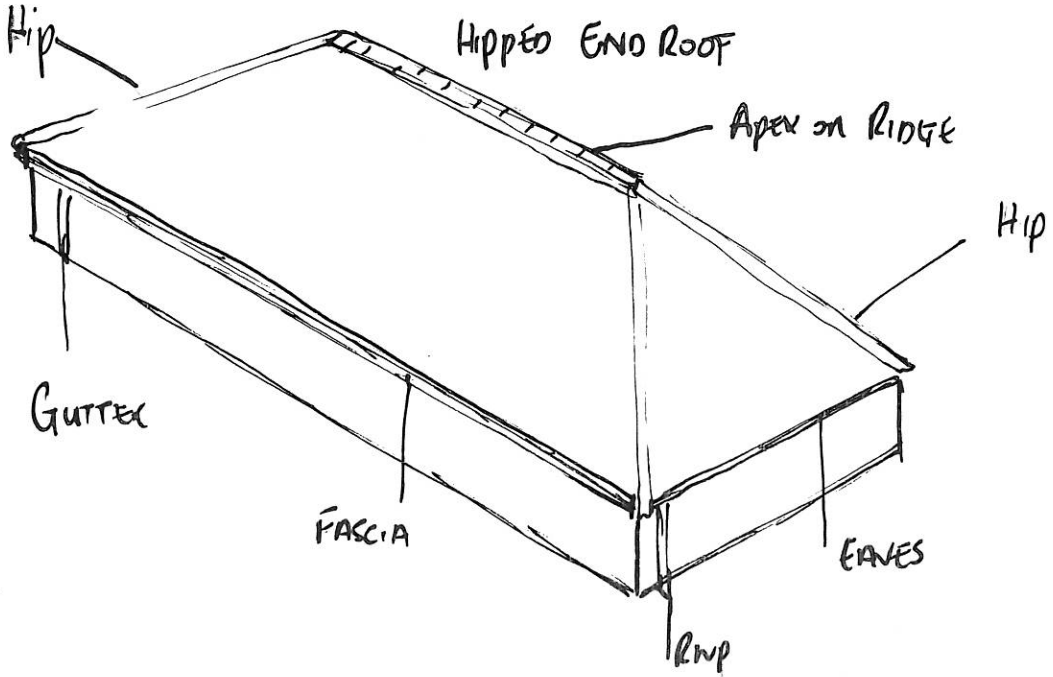
MONOPITCH ROOF



GABLE END ROOF



HIPPED END ROOF

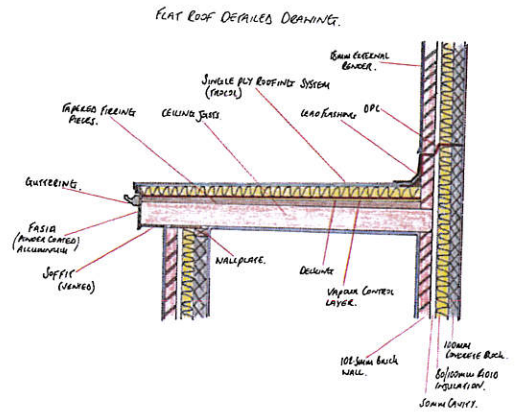


Flat roof details and drawings:

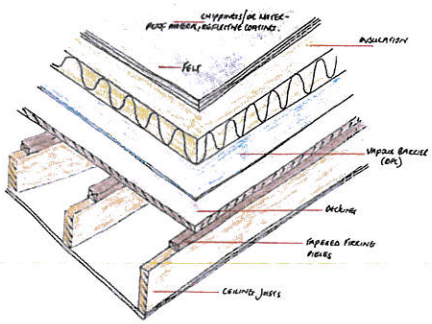
Flat roofs are pitched at 10 degrees or less. If not installed correctly flat roofs are prone to leakage. People do avoid flat roofs for this reason. Commercials building will use flat decked roofs as these tend to be on a bigger scale. The slight pitch on the roof will direct the surface/rainwater into gully's where a siphonic systems can be used to clear the roof of water.

Drawing below is a warm deck flat roof. This method of construction the ceiling joists are used as the platform for the roof coverings. Firring pieces used will give you a slight fall. The insulation is placed on top of the roof deck and vapour barrier, this will ensure that the deck holds a warm temperature during the cold season. A damp-proof membrane or water covering will cover the insulation and then a protective layer of 20mm asphalt may be used. There are various water proof materials that can be used for flat roofs.

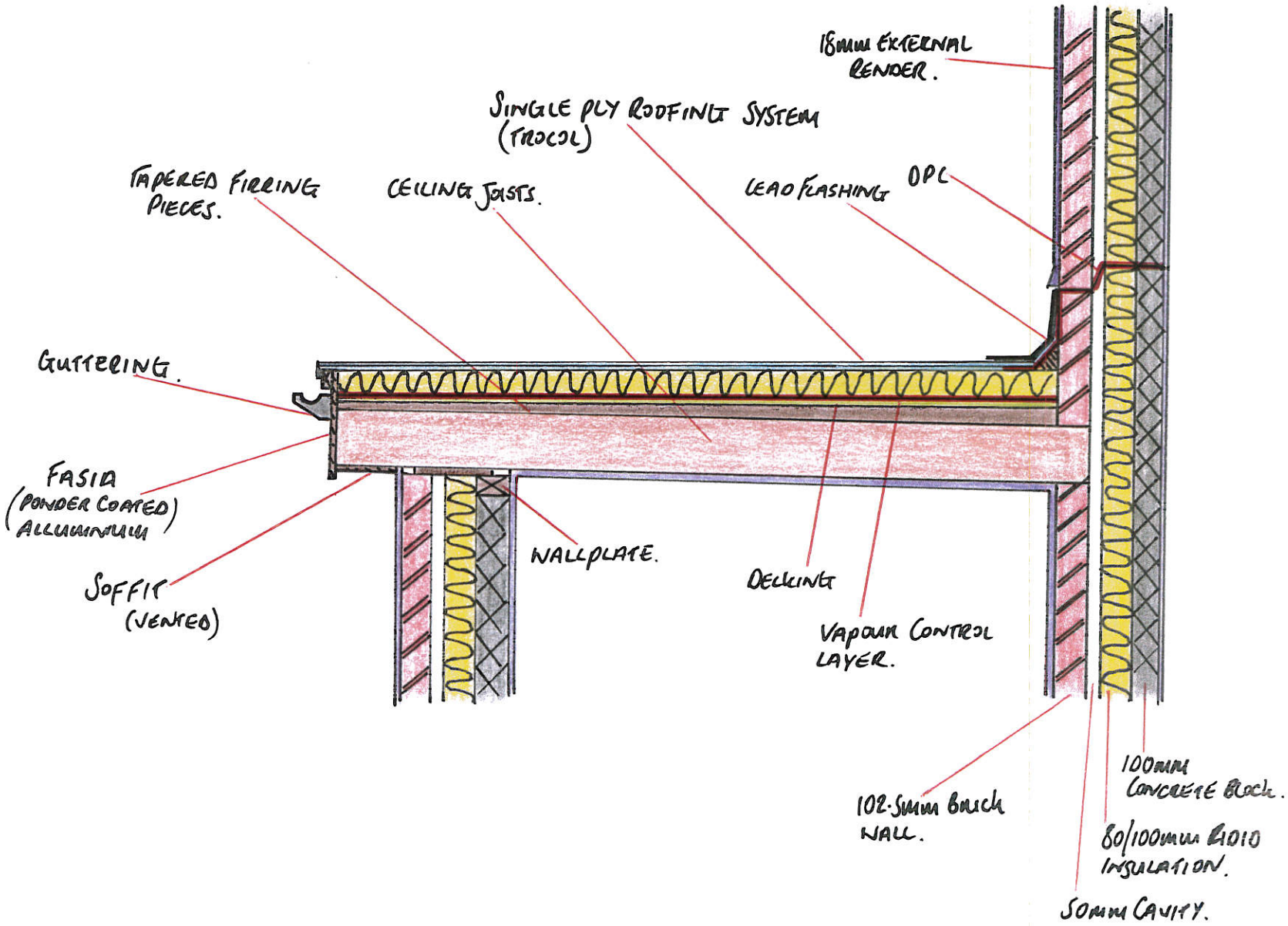
Flat roof detailed drawing below with abutment to external wall detail: **(Full detailed drawing on next page)**

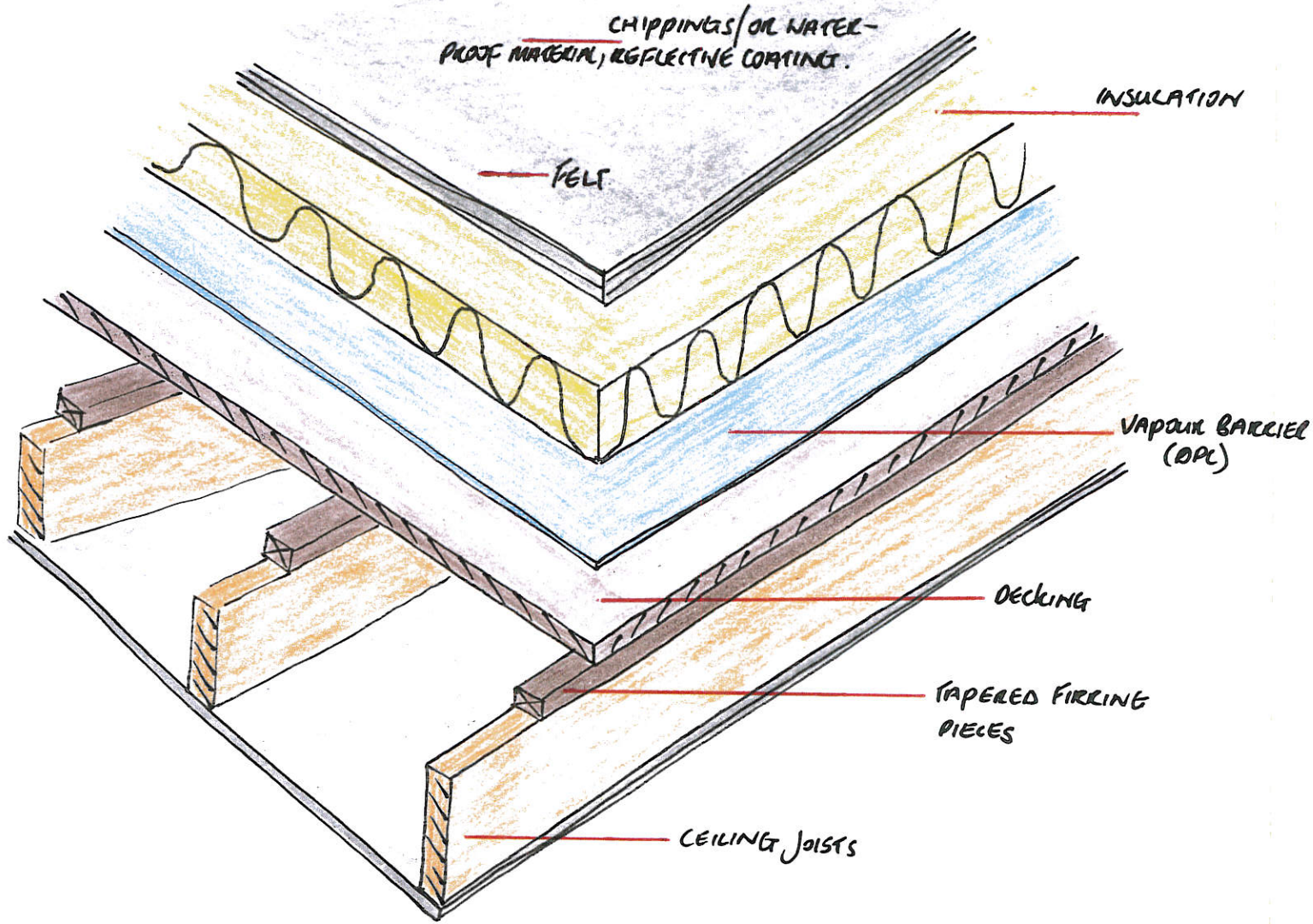


Detail drawing below of the breakdown of material required for a flat roof: **(Full detailed drawing on next page)**



FLAT ROOF DETAILED DRAWING.




CHIPPINGS/OR WATER-
PROOF MATERIAL, REFLECTIVE COATING.
INSULATION
FELT
VAPOUR BARRIER
(DPC)
DECKING
TAPERED FIRRING
PIECES
CEILING JOISTS

Window and Door details:

When installing windows and doors into a building there is a high possibility of heat loss and or condensation. This is known as thermal or cold bridging. Window and door openings have a high U-Value than anywhere else in a building. this means that these openings will lose heat a lot more than the rest of the building.

To minimise heat loss, it is vital to continue the insulation in the external envelope. This will prevent thermal bridging. In some case this is not possible due to the design of the building.

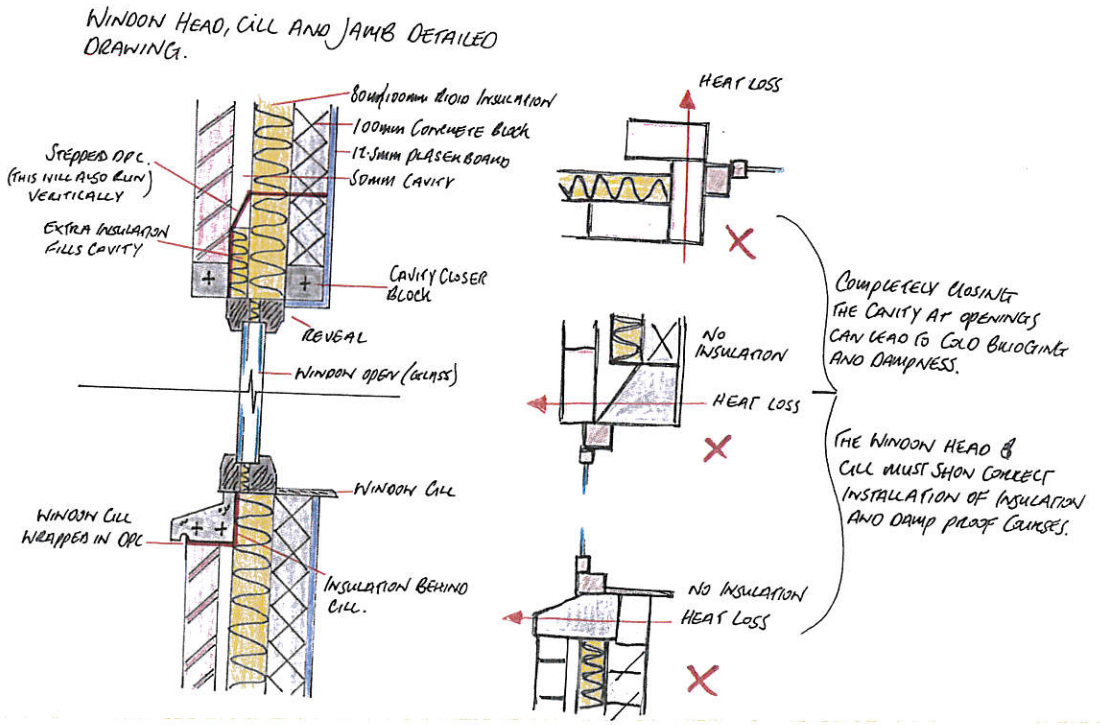
Window openings in a building consist of a head, jambs and sill. There are different variations in the way they are constructed. The purpose is to give adequate support around the void. Reinforced concrete lintels would be installed above the window head, this will transfer the loads from above to the walls on either side of the window.

Jambs may be bonded in solid walls or unbonded in cavity walls. The cavity walls must prevent the ingress of moisture from the outer leaf to the inner leaf. Drawings below of typical jamb details.

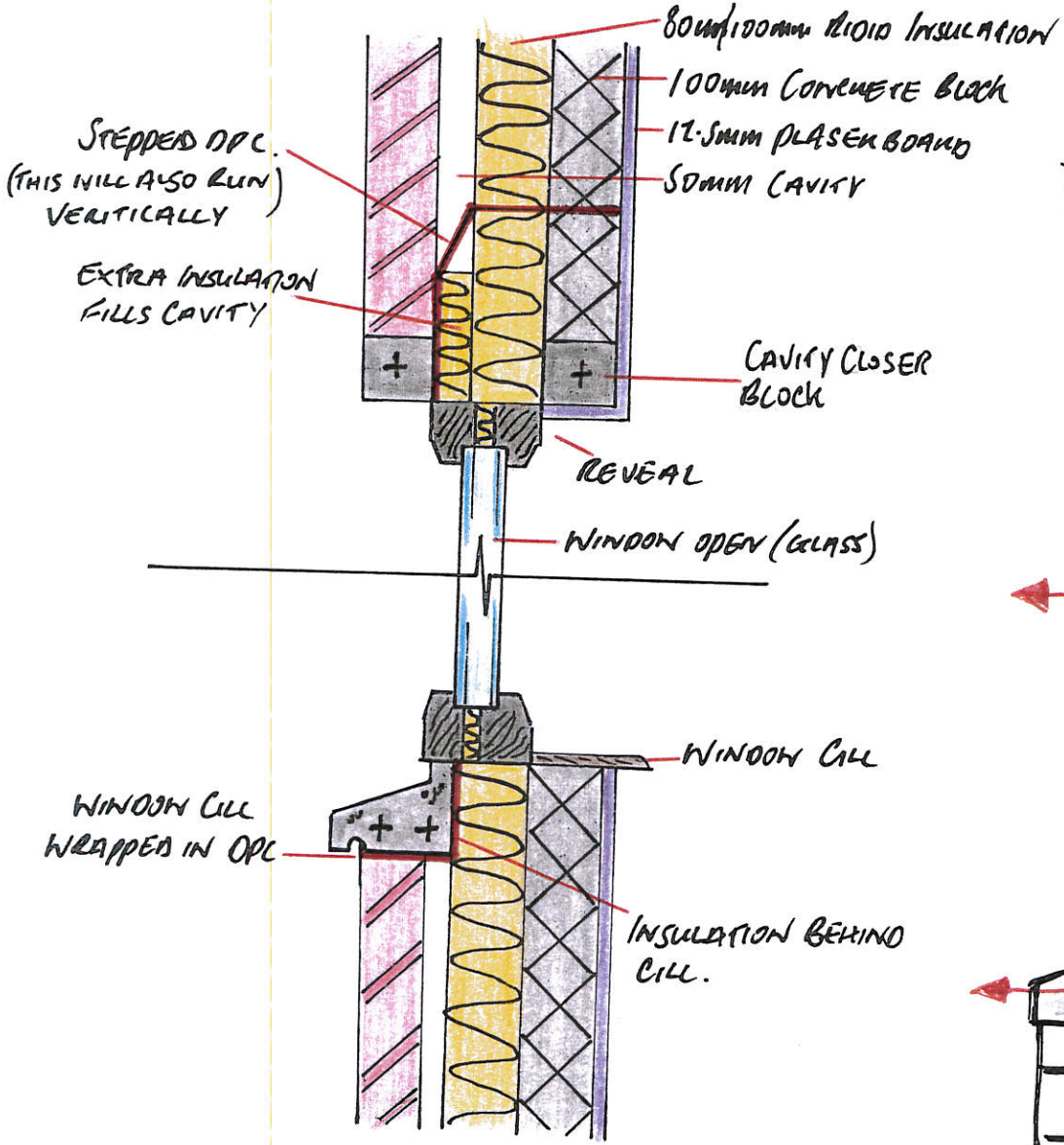
Typical head detailed drawings below, that may be used.

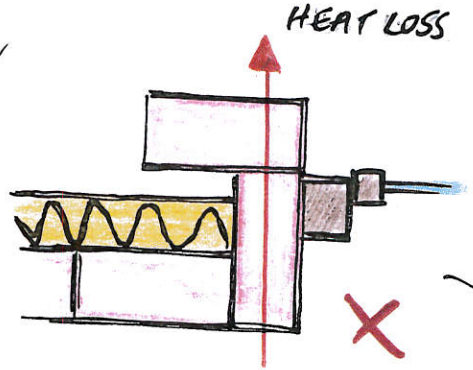
The function of a cill is to collect rainwater running down the face of the window or door and clear it from the walls below.

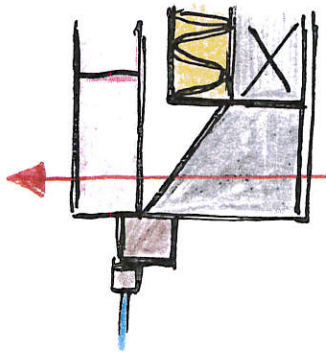
Typical cill detail drawings below. **(Full detailed drawing on next page)**

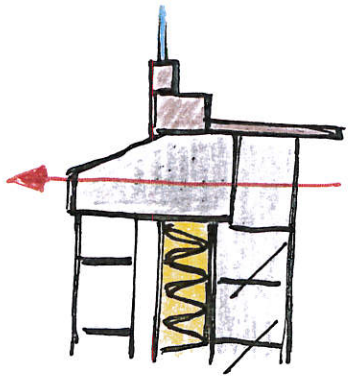


WINDOW HEAD, CILL AND JAMB DETAILED DRAWING.





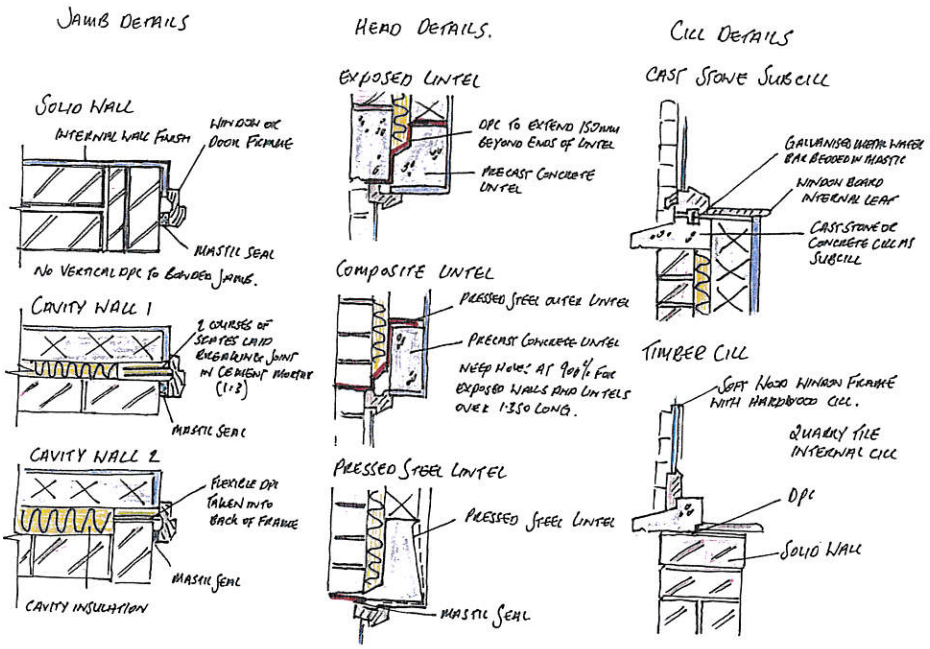




COMPLETELY CLOSING THE CAVITY AT OPENINGS CAN LEAD TO COLD BRIDGING AND DAMPNESS.

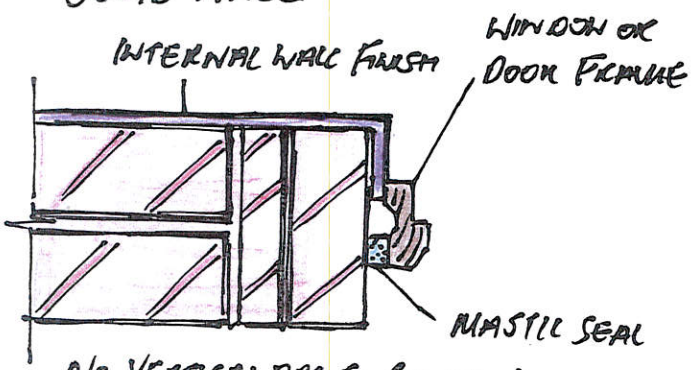
THE WINDOW HEAD & CILL MUST SHOW CORRECT INSTALLATION OF INSULATION AND DAMP PROOF COURSES.

Jamb / Head and Cill detailed sketches below: (Full detailed drawing on next page)



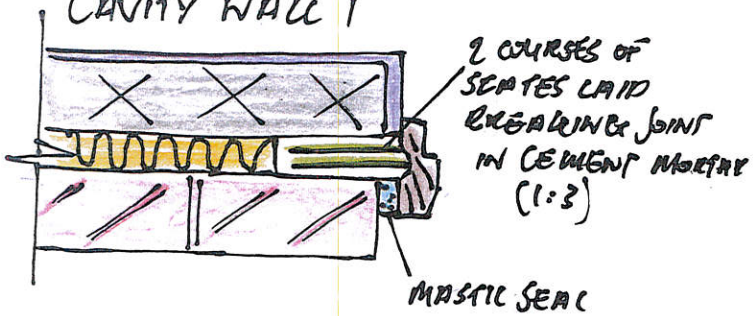
JAMB DETAILS

SOLID WALL

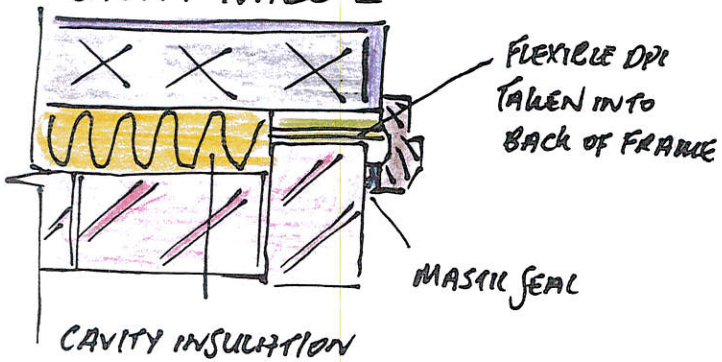


NO VERTICAL DPC TO BONDED JAMB.

CAVITY WALL 1



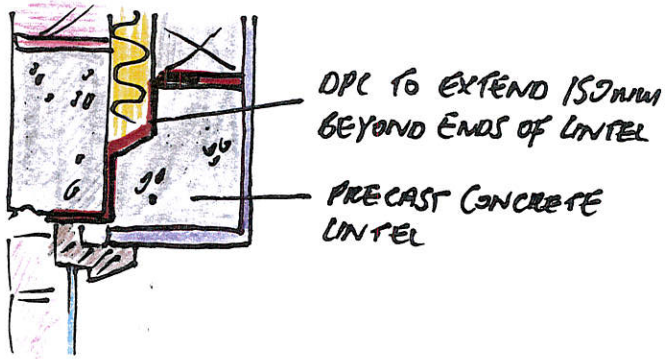
CAVITY WALL 2



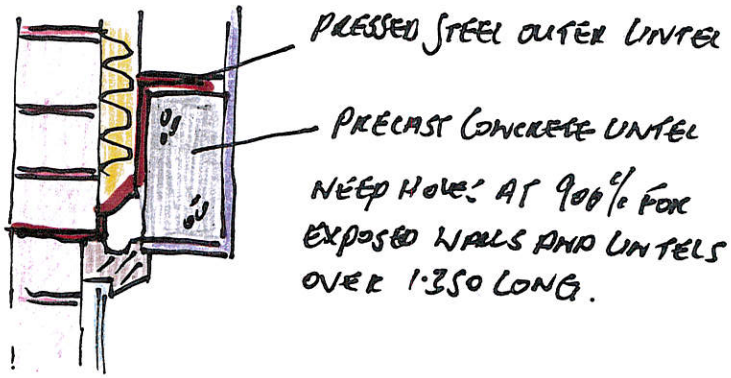
CAVITY INSULATION

HEAD DETAILS.

EXPOSED LINTEL

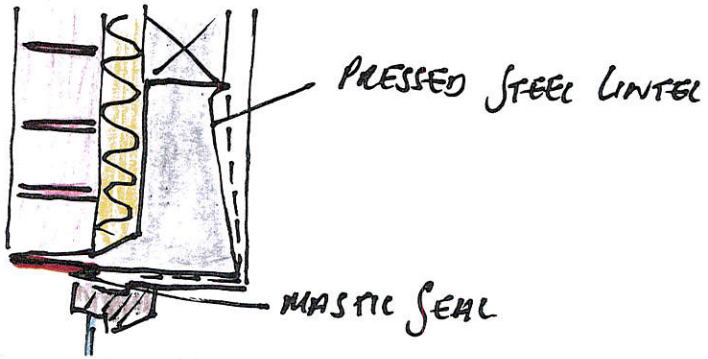


COMPOSITE LINTEL



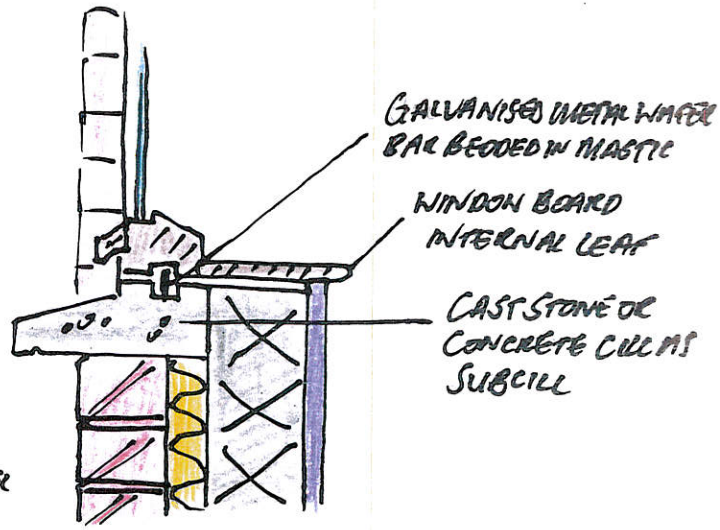
WEEP HOLES AT 900% FOR EXPOSED WALLS AND LINTELS OVER 1·350 LONG.

PRESSED STEEL LINTEL

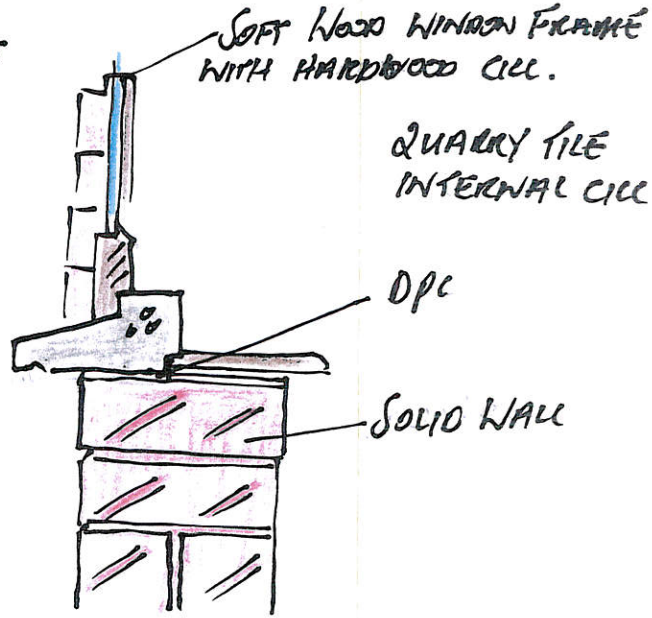


CILL DETAILS

CAST STONE SUBCILL



TIMBER CILL

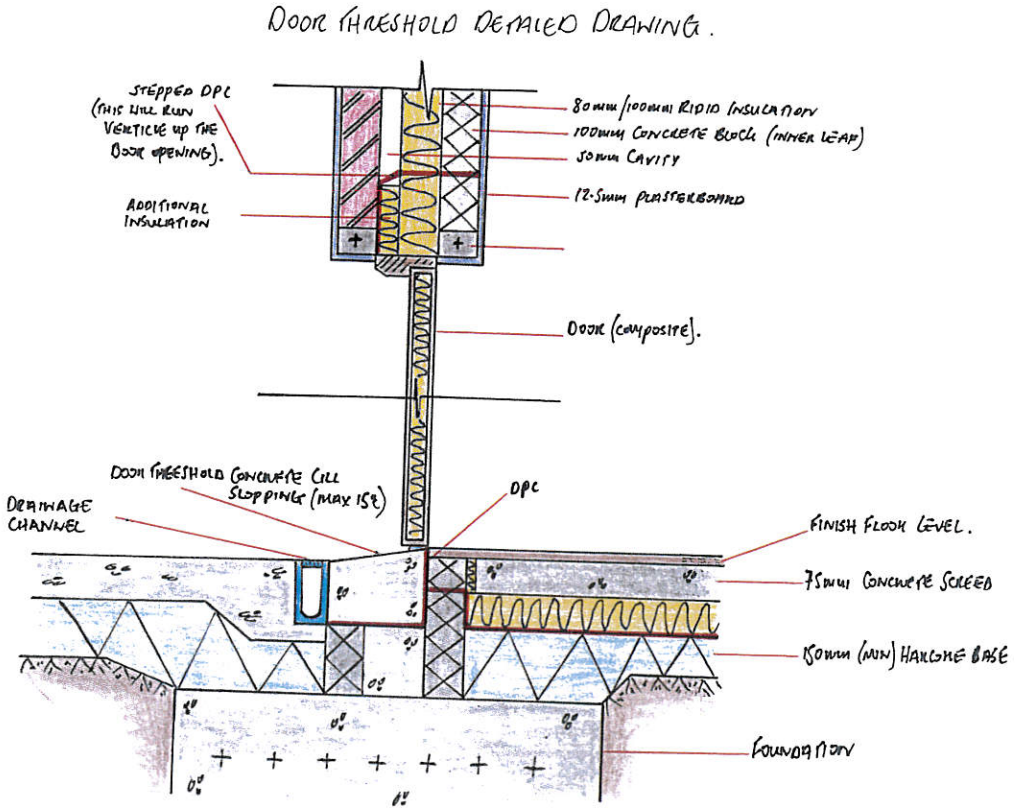


Door Threshold details and drawings:

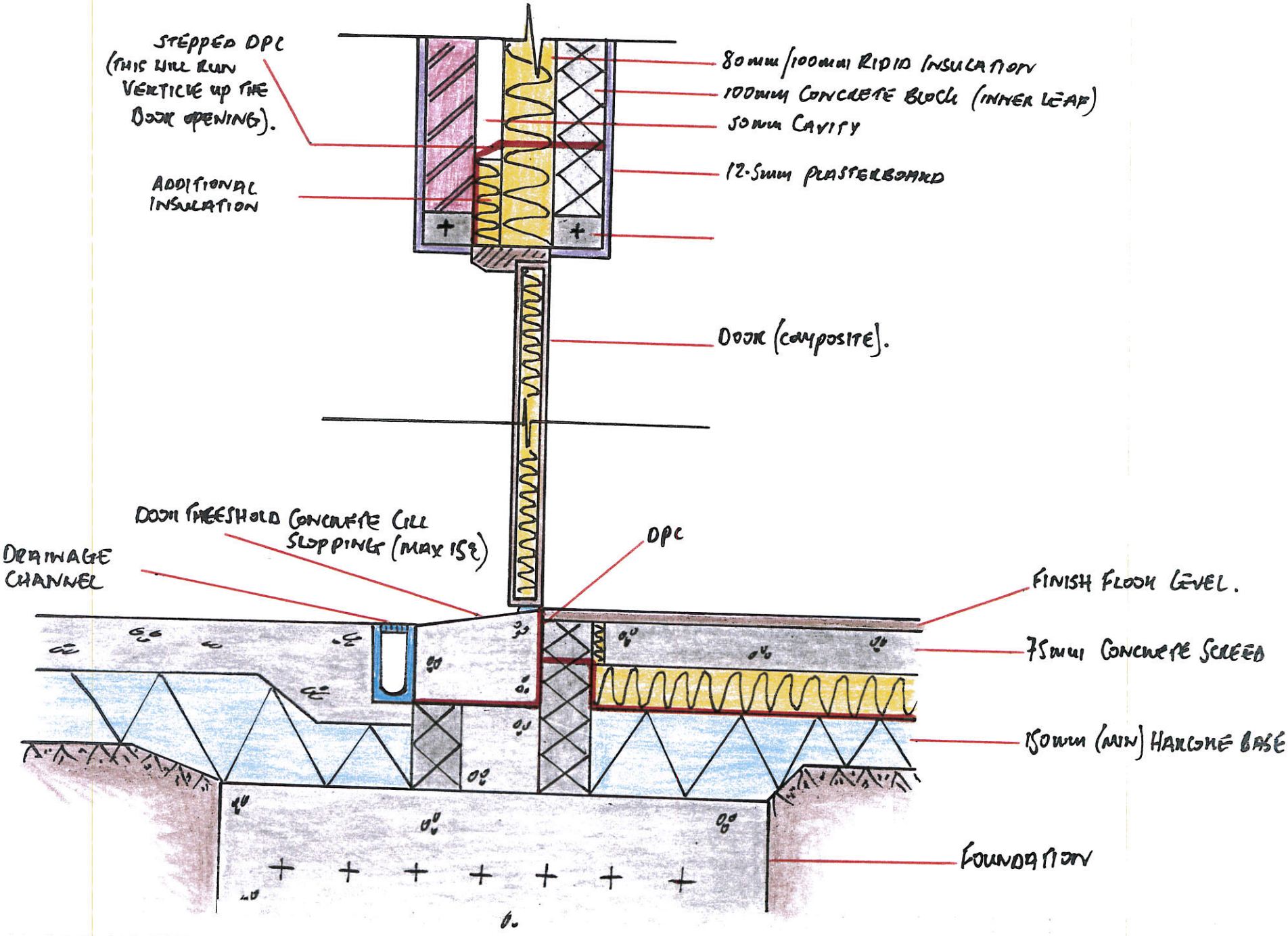
Building Regulations Part M1 – *Reasonable provision shall be made for people to gain access to the building.* Approved Document M, Section 0 – *People, regardless of disability, age or gender, should be able to gain access to the buildings.* The access to a building can be defined as the approach, entry or exit.

The door threshold is where the bottom of the door meets the finished floor level. Doors must ensure that they are stable and can with stand the wind driven rain and prevent a trip hazard when designing the threshold. The threshold must not exceed 150mm in height, this will accommodate wheelchair access. Any lower than 150mm may cause a trip hazard. When constructing a door threshold, it is important that water do not travel into the building. A sloped cill would be used =, this would dispose of any excess water and keep water from running onto the building. The door frame should have an air tight seal and like window openings the head of a door would have a reinforced concrete lintel to ensure the above weight to transferred to the walls around the door. The damp proof membrane would also run underneath the door threshold cill to prevent any damp moisture ingress.

Detailed drawing of a door opening and threshold below: **(Full detailed drawing on next page)**



DOOR THRESHOLD DETAILED DRAWING.



New Restaurant, ice-cream parlour and Manager's apartment: **Envelope details.**

Further to my research and site investigations. Below is a proposed envelope detail for the New restaurant, ice-cream parlour and manager's apartment.

Sub-Structure / Foundation and Ground Slab:

Strip / pad foundation with steel reinforced cages as per drawings below (figure and figure). These have been created using Sketch-up modelling 2018.

Type 1 fill below ground floor slab (150mm min)

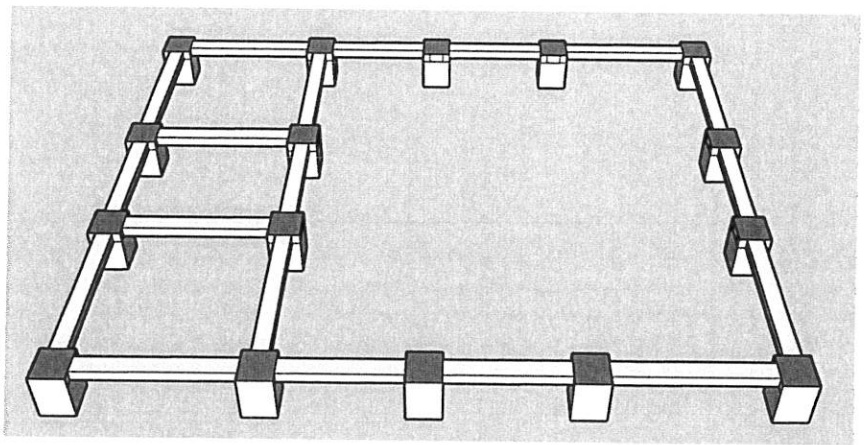
Brickwork below DPC

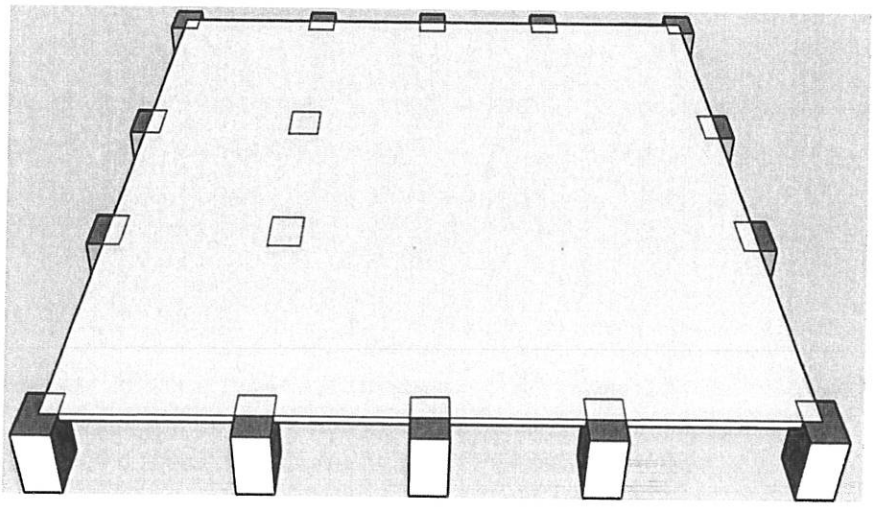
DPM to ground floor slab

Underfloor insulation Kingspan K70

Bolt boxes cast into pad foundations for column to foundation connection (drawing)

Ground Floor Slab 200mm thick



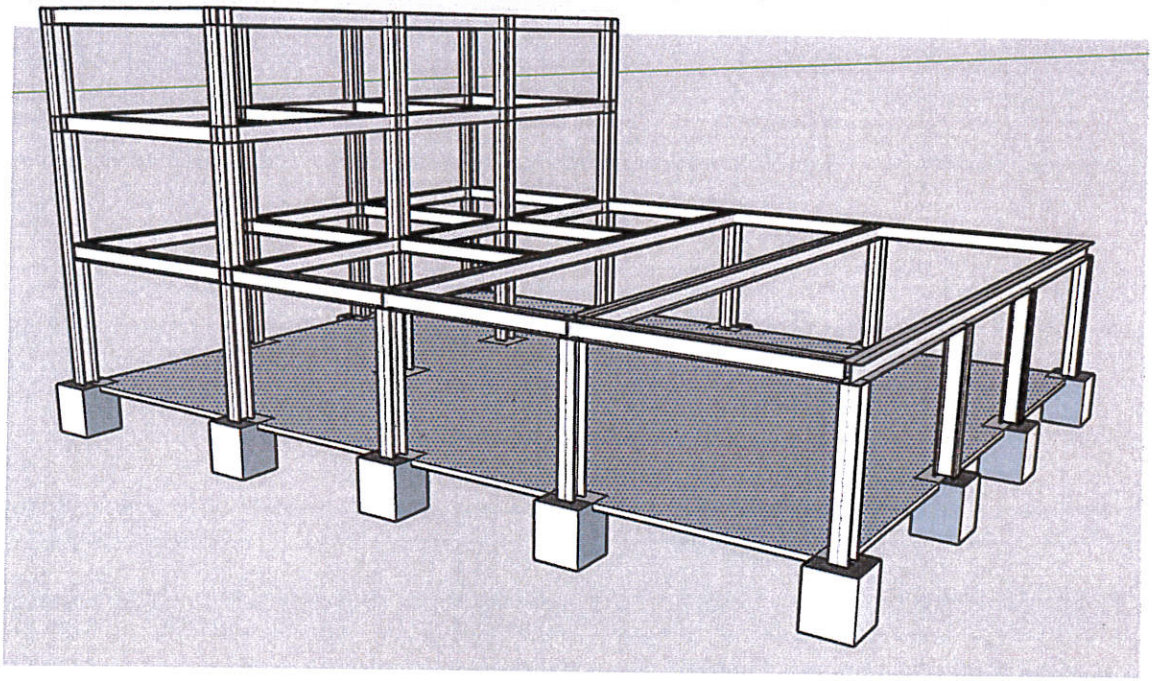


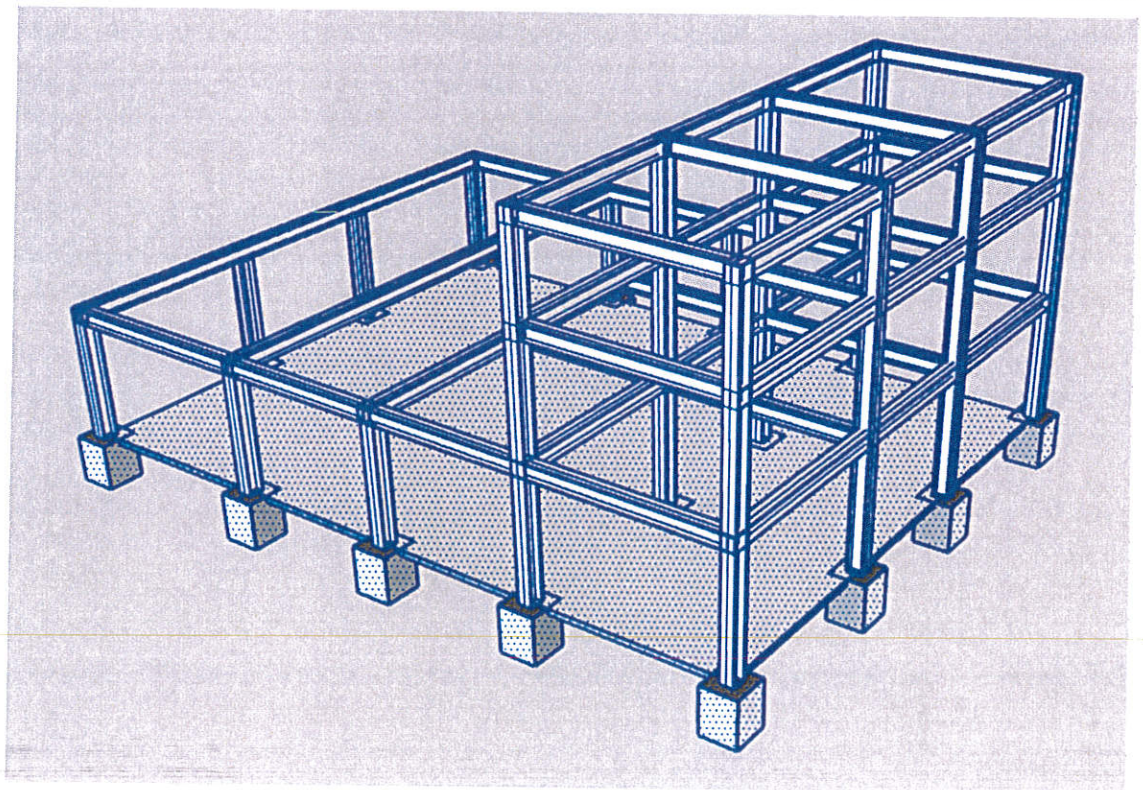
Super Structure:

Universal Steel Column frame with columns beams to suit structure. Sketch-up models below.

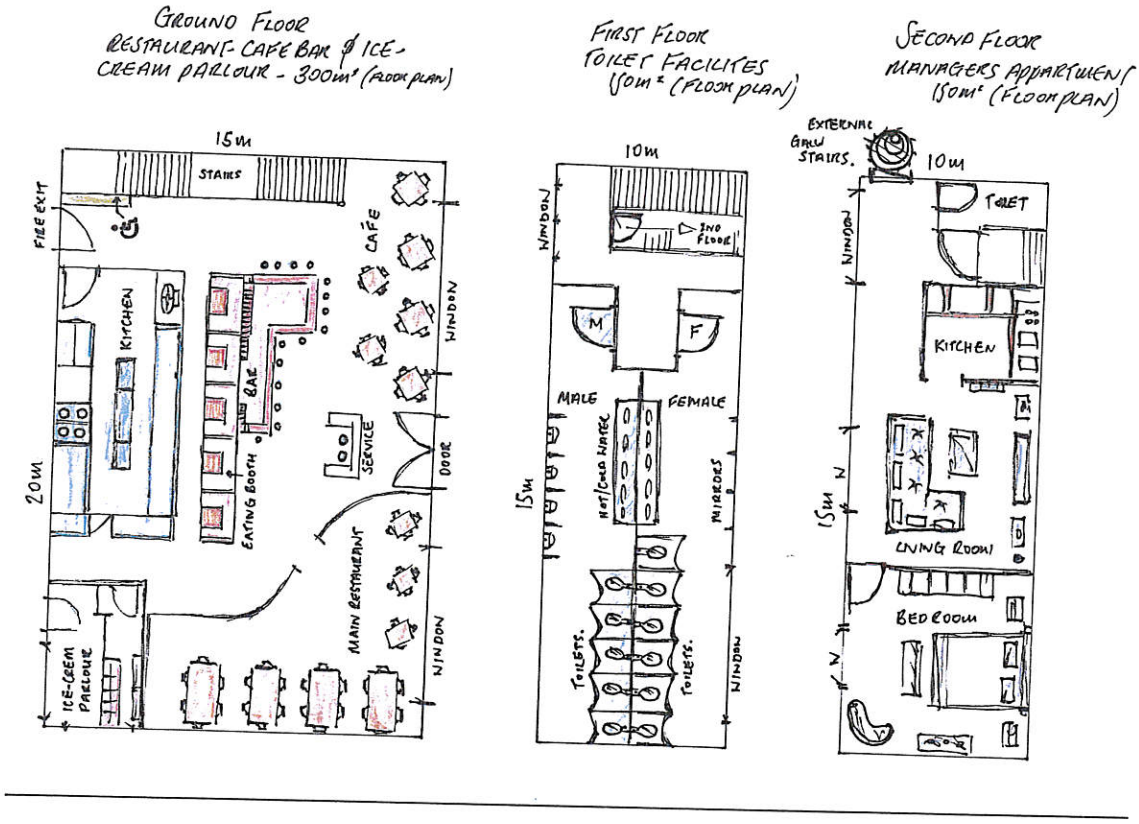
Secondary steel cladding rails to roofs.

Composite floor to residential area (metal deck and concrete with shear studs; single layer A193 mesh)

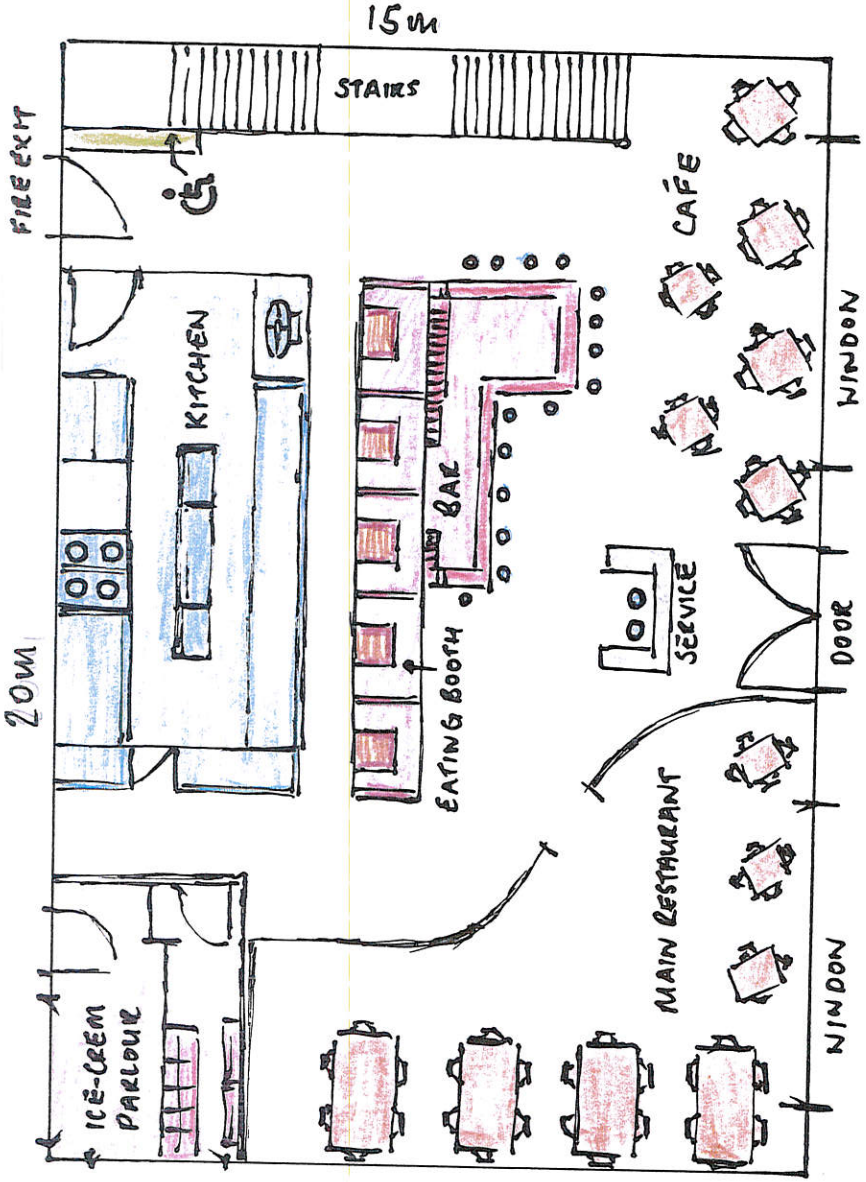




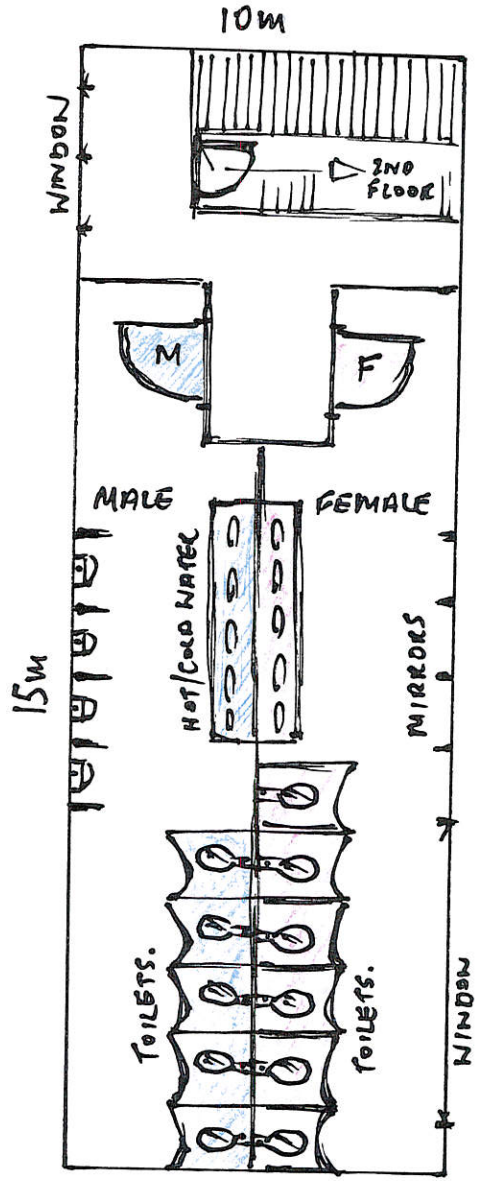
Ground Floor Plan / First Floor Plan / Second Floor Plan – Drawing below: (Full detailed drawing on next page)



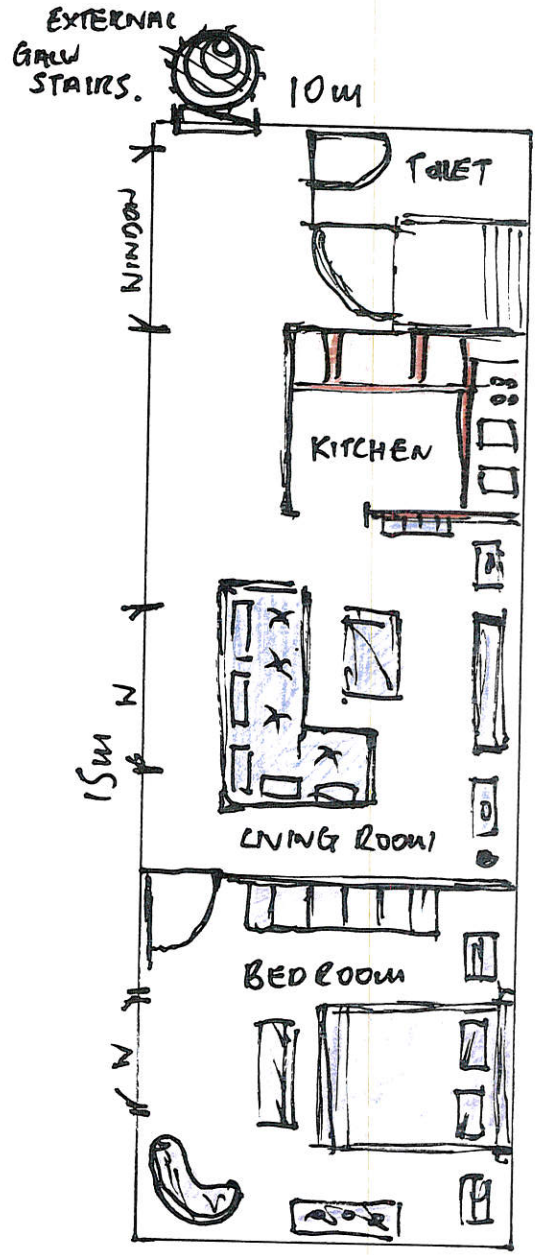
GROUND FLOOR
RESTAURANT - CAFE BAR & ICE-CREAM PARLOUR - 300m² (FLOOR PLAN)



FIRST FLOOR
TOILET FACILITES
150m² (FLOOR PLAN)

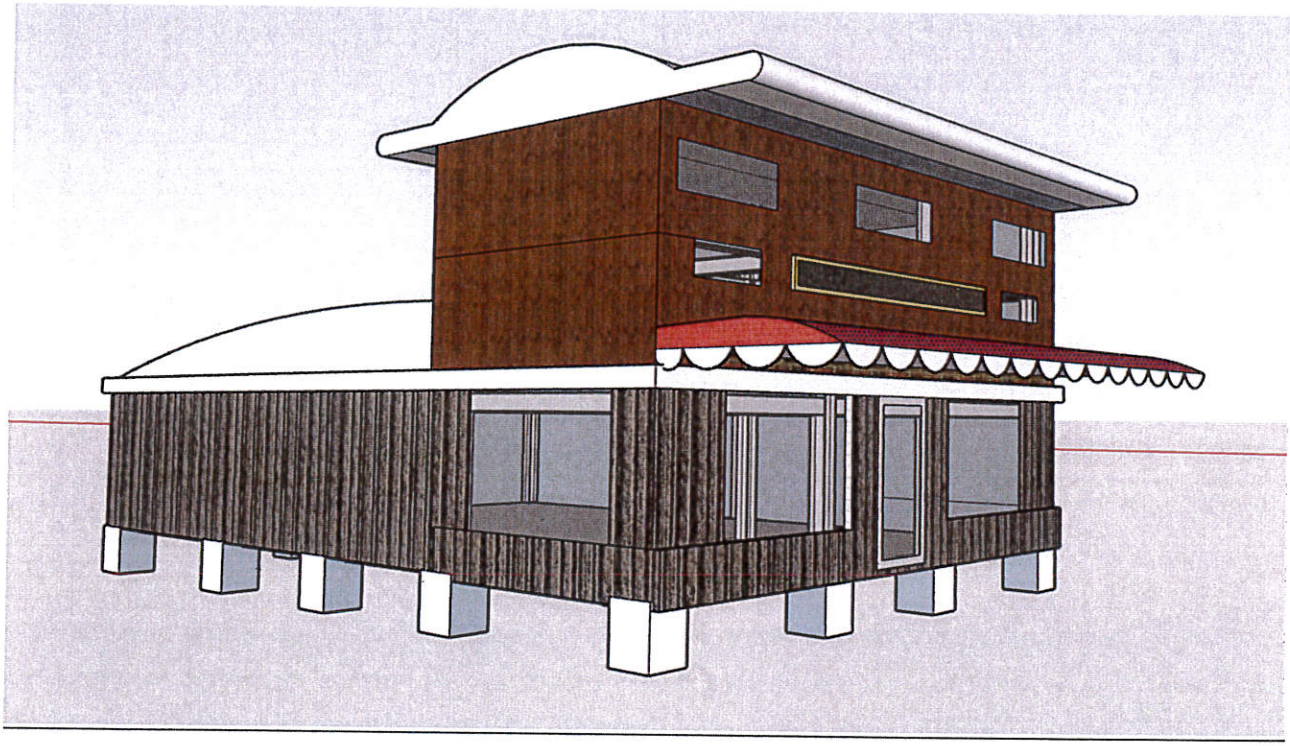


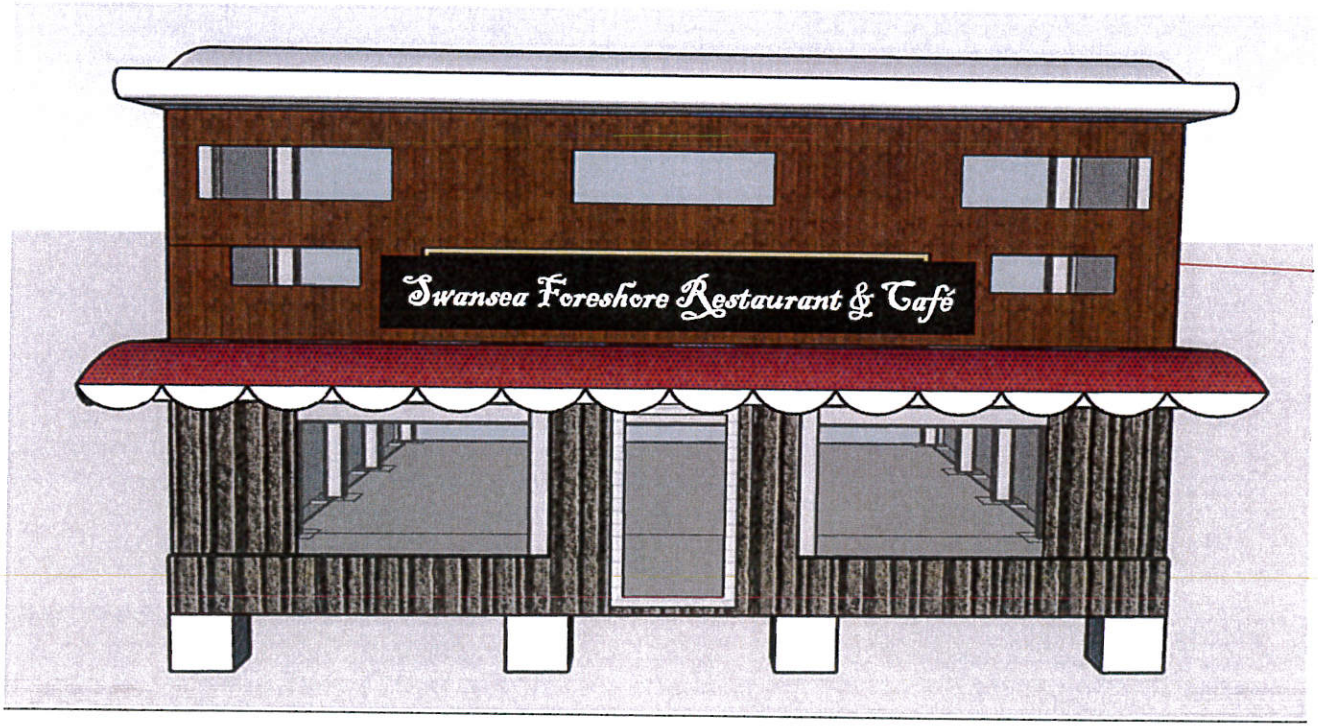
SECOND FLOOR
MANAGERS APPARTMENT
150m² (FLOOR PLAN)



New development sketch-up drawings:

Below are drawings I have produced using sketch-up modelling 2018. This is an idea of the outcome for the New Swansea restaurant, ice-parlour and manager's restaurant.





Sub-Contractor supply chain:

Below is a list of a local supply chain that would possibly carry out the necessary contract works for the New Development at Swansea Foreshore.

TRADE	COMPANY NAME	TOWN
Groundworks	Calibre Contracting Ltd	Pontypridd
Groundworks	Cuddy Group	Swansea
Groundworks	Hedland Civil Engineering (Newport)	Newport
Groundworks	Ian Thomas Construction Services Ltd	Carmarthen
Steel Frame	Dollcast Ltd	Bridgend
Steel Frame	Hayes Engineering Services Ltd	Cardiff
Steel Frame	Morgans of Usk Ltd	Monmouthshire
Steel Frame	Overdale Construction Services Ltd	Bridgend
Steel Frame	Shufflebottom Limited	Llanelli
Metal Decking	Hayes Engineering Limited	CARDIFF
Metal Decking	Prodeck-Fixing Limited	Somerset
Metal Decking	Studwelders Ltd	Monmouthshire
Concrete Floors	Hayes Amondeo	Cardiff
Brick/Blockwork	ACL Build Ltd	Caerphilly
Brick/Blockwork	Advanced Brickwork Contractors Ltd	Neath
Brick/Blockwork	Millisun	Pontypridd
Brick/Blockwork	Port Talbot Brickwork	West Glamorgan
Brick/Blockwork	Reussir Ltd	
Brick/Blockwork	Watts Brickwork Ltd	
Carpentry/Joinery	A W Lewis Carpentry Ltd	Port Talbot
Carpentry/Joinery	D&K Carpentry Contractors	Swansea
Carpentry/Joinery	Hazelwood Carpentry	Pontypridd
Carpentry/Joinery	Ian Williams Carpentry Ltd	
Carpentry/Joinery	SD Carpentry & Joinery Services Ltd	Mid Glamorgan
Curtain Walling	AB Glass (Doors & Windows Ltd)	Swansea
Curtain Walling	Denval Co Ltd	Cardiff
Curtain Walling	Dudley's Aluminium Limited	Cardiff
Curtain Walling	EYG JonWindows Ltd	Barry
Curtain Walling	Poppy Aluminium	Hengoed Mid Glam
Curtain Walling	Vision 2000 (UK) Limited	South Wales
Electrical	Blues Electrical Limited	Cardiff
Electrical	Interserve (Swansea)	Swansea
Electrical	J W & E Morris & Son Ltd	Bridgend
Electrical	Lorne Stewart (Cardiff)	Cardiff
Electrical	Tremorfa Ltd	Cardiff
Mechanical	CMB Engineering (Cardiff)	Cardiff
Mechanical	Geoff Tremblett Plumbing & Heating	Pontyclun

Mechanical	F P Hurley and Sons (Bridgend)	
Mechanical	J W & E Morris & Son Ltd	Bridgend
Mechanical	Lorne Stewart (Cardiff)	Cardiff
Mechanical	Narbeths Mechanical Services Ltd	Bridgend
Mechanical	Steve Hughes (Plumbing) Ltd	
Mechanical	Tremorfa Ltd	Cardiff
Painting/Decorating	A&N Lewis	Cardiff
Painting/Decorating	Classic Decorators (UK) Ltd	Barry
Painting/Decorating	G & S Decorite (Cardiff) Ltd	Caerphilly
Painting/Decorating	Gerald Davies Decorators Ltd	Cardiff
Painting/Decorating	Haines Painting & Decorating Ltd	Cardiff
Painting/Decorating	Q-DL	
Painting/Decorating	R&M Williams Ltd	Cardiff
Plasterboard/Drylining	Manorcraft	Pontypridd
Plasterboard/Drylining	M and P Group	RCT
Plasterboard/Drylining	Neath Dry Lining Ltd	West Glamorgan
Plasterboard/Drylining	Optimum Drywall Systems Ltd	Bristol
Plasterboard/Drylining	Richard Kemble Ceilings	Cardiff
Plasterboard/Drylining	WK Plasterers Ltd	Pontypridd
Suspended Ceilings	Crest Ceilings & Partitions	Swansea
Suspended Ceilings	Korbuild Ltd	Pontypridd
Suspended Ceilings	Liberty Ceilings & Partitions	Swansea
Suspended Ceilings	Richard Kemble Ceilings	Cardiff
Single Ply Roofing	Darlington Brothers Ltd	South Glamorgan
Single Ply Roofing	Hodge Single Ply Roofing Limited	Avon
Single Ply Roofing	Single Ply Services Ltd	Avon
Single Ply Roofing	Sharland Roofing Ltd	Wiltshire
Bird Repellant	Eco Environmental Services Ltd	Devon

Bibliography:

Books:

Building Construction Handbook 11th Edition

Authors: Roy Chudley and Roger Greeno

Investigation of potentially contaminated sites – Code of Practice

BSI Standards Publication: 10175:2011

British Standards

Barrys Introduction to Construction of Buildings 2nd Edition

Authors: Stephen Emmit & Christopher A. Gorse

Wiley-Blackwell Publications

Web:

Maps of Swansea foreshore SA1 3SA.

Glamorgan XXIV (includes: Coed Ffranc; Swansea.)
Surveyed: 1876 to 1877
Published: 1884 https://maps.nls.uk/view/102342508#

Glamorgan XXIV (includes: Coed Ffranc; Swansea.)
Revised: 1913 to 1914
Published: 1921 https://maps.nls.uk/view/102342505

Glamorgan XXIV.SW (includes: Swansea.)
Revised: 1947
Published: 1951 https://maps.nls.uk/view/102183138

Area **Information for Paxton Drive, Swansea**, Wales, **SA1** 3SB

https://www.streetcheck.co.uk/postcode/sa13sb

Search **borehole** scans | British Geological Survey (BGS)

http://www.bgs.ac.uk/search/home.html?q=swansea+&qSearchBtn=+

BGS Geology – Bedrock Theme – British Geological Survey

DIY DOCTOR – Foundations advantages and disadvantages

http://www.diydoctor.org.uk/projects/rafts.htm