

Case Study

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Modern and Traditional Construction

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1.0 - Introduction

In this report it will take a look into a structure that will be offices to be placed in SA1 Swansea. It will look into the most appropriate primary structure based on the drawings provided and also decided what materials could hold the structure during heavy weather issues like strong winds and large amounts of rain, the bore hole logs will also help determine what foundations will fit this project best. The report will also look into the different systems of enclosure to help protect the building and will state which one will fit the new building better based on the information from the drawings that have been provided.

2.0 - Primary Structure

This section includes the information for the foundations and the building structure as well as an important factor that needs to be considered in the projects location.

2.1 - Foundations

After looking at the bore hole logs provided and looking at different types of foundations and the benefits each of them hold, the most appropriate foundations to be used on this design would be pile foundations. As pile foundations are used on larger structures where there is weak strata or it is water based, this foundation will help take the buildings weight pressure until it gets to more solid made ground. This will be very suitable for this project as it is a three story office building this is which will have a heavy weight load. There are many different types of pile foundations some of the most popular ones to used are bored or driven piles, but for this project the best version would be bored piles. As they are easier to place in small confined areas due to the equipment needed, this will also benefit this site as SA1 is a busy area with little to no extra space to hold big machinery, this site is very likely to be placed next to an existing occupational buildings. The bored piles will allow there to be minimum vibration to the surrounding existing buildings not causing much disruption during the build, to the other buildings purpose/usage and to any other foundations in the area (*Constrofacilitator, September 2020*). It will also prevent large amounts of disruption to the soil on site and decrease ground vibrations, as with certain foundation types or excavations large amounts of vibrations will cause backfill, this is where the soil will collapse refilling the hole just dug out. This method also allows the installation of the piles to be easily completed, as the concrete bored piles are poured into the space made available will not need to be measured and cut before delivery, it allows it all to happen onsite. The downfall to this would be that the site workers will have to wait for the concrete to be dry and will not be able to continue with the works until it has fully dried (*Bored Pile Foundation, January 2019*).

The depth of the hole will reach about 18 metres down, as the bore hole log shows this is where the grey mudstone is, which is the most solid part of the hole (See appendices 5.1 for piles foundation drawing). The grey mudstone is hard and will allow the pile foundation to sit comfortable on top of the surface, while all the strata above this is loose sand with gravel which would cause the foundation to be weak not allowing the building to sit right while taking strong wind and rain loads, having a weak foundation can cause many issues, such as structural damage like the walls cracking. Poor foundations can also cause building sinkage meaning the building can lean more one way, it can also cause floors to be uneven (*Foundation Problems, January 2022*).

2.2 - Wind Loads

When deciding on the buildings materials it will have to look at the different types of wind loads like the upwards wind lift, shear wind load and the lateral wind load. Each of these different winds can cause different issues when it comes to the building. (*What is Wind Load and Why is it Important in Architectural Glazing?*, April 2017). The upwards wind can cause roofing issues like the the roof being taken off or suffering from large damages. Due to recent strong winds in the UK during the Storm Eunice, in London at the O2 Arena they suffered significant damages on the roof, as the roof is a tent material it was lifted and pulled up to cause damage to the arena, this was leaving a large part of the building not sheltered causing closure until the roof was repaired (*Sky News*, February 2022). Shear wind load is a horizontal wind blow and causes vertical structure or walls to cause cracks and leads to the building to tilt or structural issues. The lateral wind load is also a horizontal pressure, this can lead to structures being blown off the foundations. When considering buildings material choices, each wind load needs to be considered and the wind loads will vary due to location factors and need to be taken into account when developing the drawings and the time frame as certain season times through the year will suffer worse weather than another (*What is Wind Load and Why is it Important in Architectural Glazing?*, April 2017).

2.3 - Building Structure

This project requires a material that will be able to hold a three story building strength while being appropriate for the locations weather, this project also has small thin columns throughout the building and a relatively thin external wall as seen on the projects drawings. Steel would be considered the better option over a concrete frame, this is due to the fact that in order for the concrete to achieve the same tensile strength steel has, it would need to have a larger thickness for the column as concrete does not have the same compressive strength steel does. With this information in mind the best choice would be for a steel frame. If concrete was to be the material used then the builders would have to wait for the concrete to set, as with steel it allows the builders to have all the materials on site ready to install and not take up too much space on the site, it also is very durable and easy in weight. Steel will also be very cost effective compare to concrete when it comes to labour costs as well as the products costs (*Structural Steel Vs Reinforced Concrete*, January 2018).

A steel frame is also very weather and fire resistant, as the office building is based down SA1 Swansea it will need to be able to stand heavy winds from the water front and a large amount of rain fall. When completing the steel frame it will have to be checked to ensure that it is fitting all the building regulations requirements. After looking through the Approved Document A, 1.6 shows that there is different British Standards to follow depending on what you intend to do with your material (*Approved Document A*, 2019 p12).

The steel framework will follow the main body of the new build, the structure will be placed where the main supporting walls will be, it will also be around the window frames this will provided solid support to the buildings frame (see appendices 5.4 - Steel Frame Work).

3.0 - System of Enclosure

For the external covering of the project, placed on top of the steel frame would be a concrete panel. The concrete panel will be to hold the living green wall on top, this will help to continue the growth of the living wall. Green walls are on the rise and hold many benefits to the building as well as the environment and occupants of the building. Due to the amount of rainfall the UK has it will allow the living green wall to be watered on a regular bases decreasing the water costs, compared to if the building was based in a dry country or one that doesn't have regular rain fall such as Dubai (*Benefits of Outdoor Living Walls, 2022*). While deciding on measurements for the external wall, the designers will have to ensure they are creating a building suitable to fit the fire protection, protection from elements and acoustics insulation. To follow the fire protection rules it can be found in the approved documents B of the building regulations. The external wall will have the living green wall on the outside, underneath will be a concrete panel, then the steel frame will be there with the insulation and the board panels to seal the wall on the inside (*Facades, 2019*). (See appendices 5.3 - *Wall Cavity with Green Wall*). Keeping the changes to the approved document B2 in mind, when choosing the insulation for the external walls it will need to be approved. One of the biggest used solutions are to use stone mineral wall, this is chosen as it is "Current NHBC & LABC technical guidance states that mineral wool manufactured to EN 13162 must be used" (*Facades, 2019*).

The wall cladding presents many hazards if not placed and secured correctly. Section 3 of the Approved Document A in the building regulations provide guidance on ensuring the secure fitting of the wall cladding. 3.2 states the safety requirement it will need to meet to ensure the secure fit of the cladding. It also says "Fixings shall be corrosion resistant and of a material type appropriate for the local environment" this statement will help ensure the correct materials are chosen for each area, this will include the usual weather reports of that area as well as local areas to get a full range of data to analysis, as each build will have to fit the requirements in the building standards (*Approved Document A, 2019 p47*).

3.1 - Benefits of Living Green Wall

The green wall can help improve air quality, building performance, sense of well-being, increase biodiversity, reduce the urban temperature and enhance the urban area (*Benefits of Outdoor Living Walls, 2022*).

The air quality improve as plants help capture gases and toxins making the air we breathe better and healthier. With buildings growing in height over the years the taller they get the more toxins they trap, the toxins are the highest in cities like London for example as they will circulate between the buildings with people taking in the harmful air (*Benefits of Outdoor Living Walls, 2022*). Over the years the World Health Organisation have been studying air quality in depth and how they can improve it, as in 2016 they completed a study that showed that "3 million deaths a year are linked to exposure to outdoor air pollution" since this study they have been trying to encourage the public to make greener choices to help improve the worlds air (*air pollution exposure and health impact, September 2016*).

When creating a building the user is the main focus as it will determine what requirements are need for the build, the purpose of this building is to be offices for businesses. Having the green wall which increases peoples sense of well-being, it is also shown in research experiment that it improves our productive and give the illusion of parting from urban life surroundings. The study shows this increase is due to biophilia, this is where the human

instinct comes to connect with nature and living beings. Buildings with green areas are also considered more desirable and will increase the buildings' sale cost more (*Benefits of Outdoor Living Walls, 2022*).

An external living green wall can help reduce the surrounding area's temperature up to 10 degrees, this will help benefit the building's running costs. The running costs of the building could be reduced, as in the summer period the green wall will prevent less heat to be transferred into the building meaning, this will mean there will be less of a need to use air conditioning decreasing the running costs during that period of time. During the winter season the green wall will act as an extra layer of insulation helping prevent heat from leaving the building as allowing that season's running costs to also be reduced as the heating through the building won't be required as often or be used for long periods at a time (*Green Wall Benefits, 2022*).

4.0 - References

(Constrofacilitator, September 2020), *Constrofacilitator*, <https://www.constrofacilitator.com/different-types-of-pile-foundation-and-their-use-in-construction/> Web page accessed on 24th February 2022

(Structural Steel Vs Reinforced Concrete, January 2018), *GLW Engineering & Construction LTD*, <https://blog.glwengineering.co.uk/structural-steel-vs-reinforced-concrete-which-is-stronger> Web page accessed on 26th February 2022

(Benefits of Outdoor Living Walls, 2022), *Biotope*, <https://www.biotope.uk.com/benefits/benefits-of-exterior-living-walls/> Web page accessed on 27th February 2022

(air pollution exposure and health impact, September 2016), *WHO World Health Organisation*, <https://www.who.int/news/item/27-09-2016-who-releases-country-estimates-on-air-pollution-exposure-and-health-impact> Web page accessed on 27th February 2022

(Facades, 2019), *Continued Professional Development*, <https://cpd.building.co.uk/courses/cpd-20-2019-facades/> Web page accessed on 1st March 2022

(What is Wind Load and Why is it Important in Architectural Glazing?, April 2017), *Glass on Web*, <https://www.glassonweb.com/article/what-wind-load-and-why-it-important-architectural-glazing> Web page accessed on 1st March 2022

(Sky News, February 2022), *Sky News*, <https://news.sky.com/story/storm-eunice-roof-of-londons-o2-ripped-open-by-high-winds-12545218> Web page accessed on 1st March 2022

(Green Wall Benefits, 2022), *Fantastic Gardens*, <https://www.fantasticgardeners.co.uk/living-walls-installation/what-are-the-benefits-of-a-green-wall/> Web page accessed on 1st March 2022

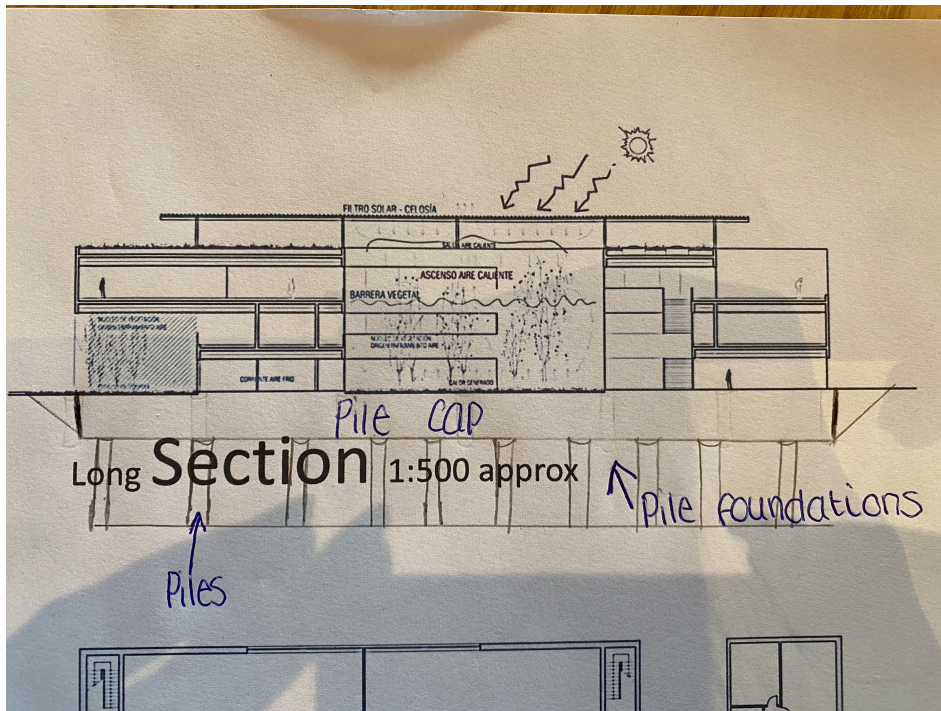
**(Approved Document A, 2019 p47),
(Approved Document A, 2019 p12)**
Building Regulations, <https://gov.wales/sites/default/files/publications/2019-04/170403building-regs-approved-document-a-structure-en.pdf> accessed on 3rd March 2022

(Bored Pile Foundation, January 2019), *Small Business*, <https://www.thebalancesmb.com/bored-pile-advantages-also-referred-as-drilled-shafts-844753> Web page accessed on 4th March 2022

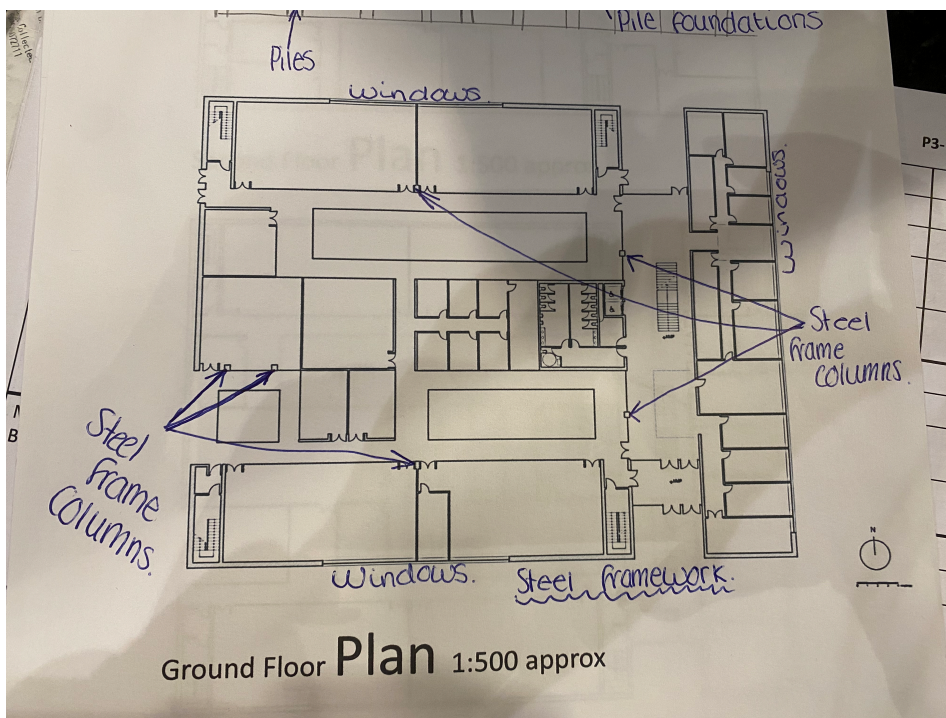
(Foundation Problems, January 2022), *HD Foundations*, <https://hdfoundationrepair.com/how-to-identify-8-common-signs-of-foundation-problems-in-houses-or-commercial-buildings/> Web page accessed on 4th March 2022

5.0 - Appendices

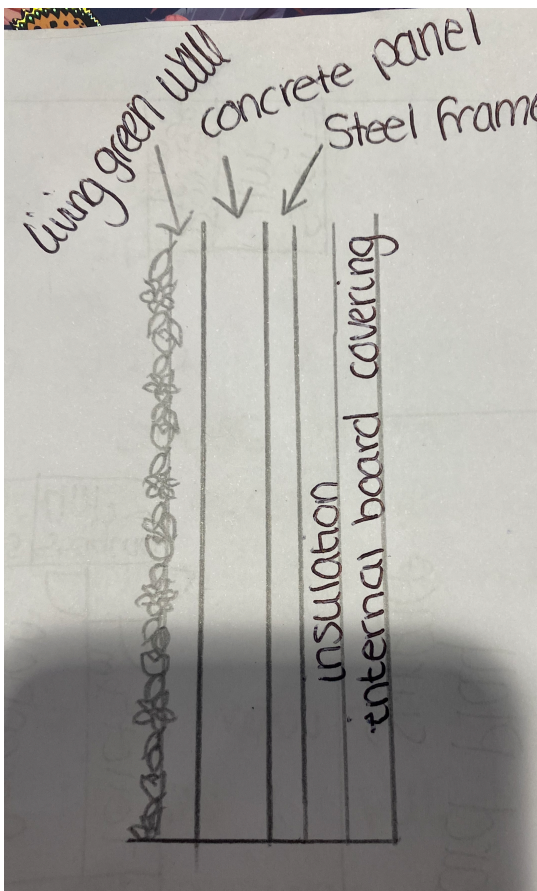
5.1 - Foundation Drawing



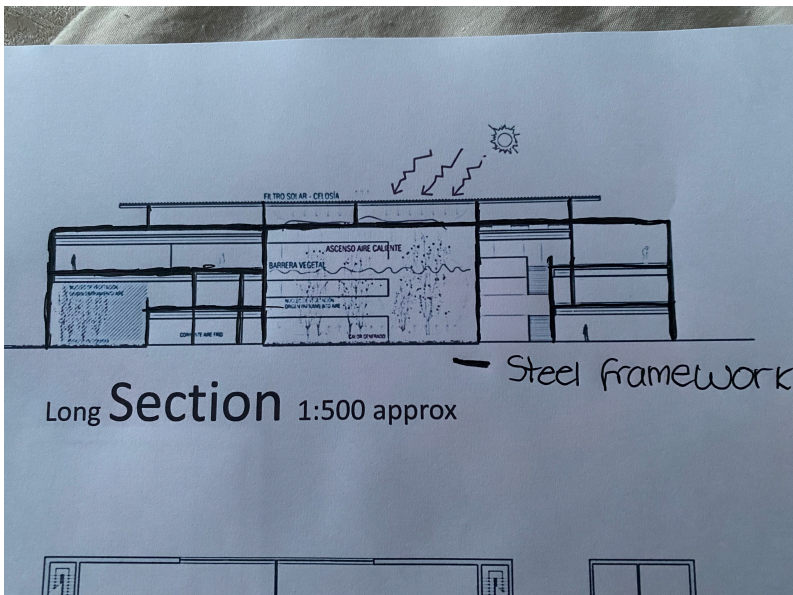
5.2 - Ground Floor, Frame Structure



5.3 - Wall Cavity with Green Wall



5.4 - Steel Frame Work



The darker lines on the drawing are to represent the steel framework placement.