

Site Investigation Case Study

The City and County of Swansea have chosen to enter into a joint agreement with Marriot Hotels to create a new restaurant and ice-cream parlour, including a manager's apartment on Swansea bay's foreshore. The site is located between County Hall and the Marriott hotel. The building, which is to share parts of the car park of both existing adjacent facilities, is to have a GIA at ground floor level of approximately 300 square metres. The building will contain a restaurant, café bar, ice-cream parlour, kitchen and food-stores. At second floor level, there is to be a self-contained manager's apartment and staff welfare facilities. The project is procured by a Design and Build contract.

Throughout this study I will be considering the factors needed for a preliminary desk study of the site and it's adjacent buildings, as well as give my advice of which elements of the site investigation I consider being most significant and applicable to this particular site, given the site's historic background.

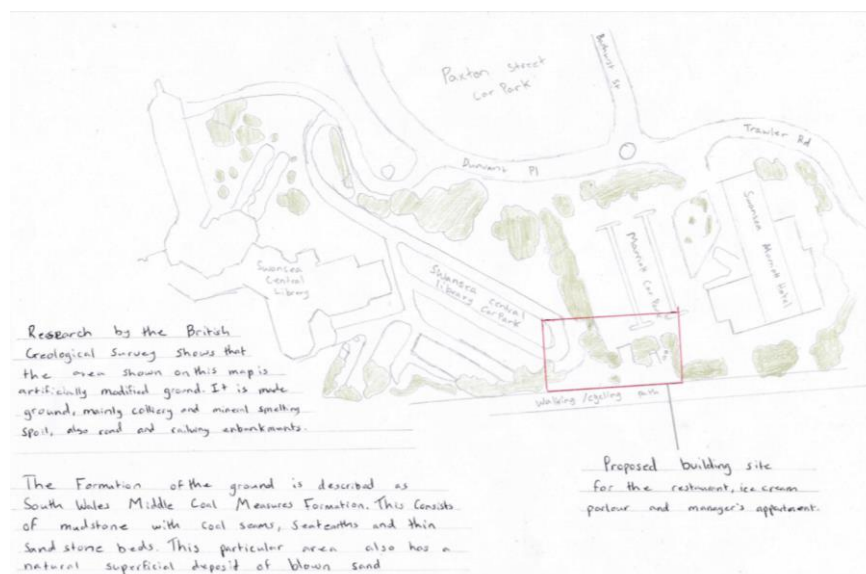


Figure 1: In this image I have drawn the area of the site for the restaurant, ice cream parlour, manager's apartment and its surrounding area.

Research made by the British Geological Survey shows that the area shown on the drawing is artificially made ground. It is 'Made Ground', which mainly consists of colliery and mineral smelting spoil. There are road and railway embankments as well. Made Ground is deposited upon natural rock or superficial deposits. It is common throughout the study area, but most extensive in the Swansea, Neath and Port Talbot. In these areas, the topography associated with specific areas of Made Ground, especially colliery and metal works spoil, have been

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smoothed over during subsequent development. (British Geological Survey, 1911)

Commonly, within the urban areas there have been several generations of land use and associated deposition of Made Ground at a single site. The British Geological Survey also found that this area has a natural deposit of blown sand, as expected due to the close distance from beach. The ground formation is the South Wales Middle Coal Measures Formation. The formation consists of shale/mudstone with coal seams, 'seatearths' and thin limestone beds. Seatearths are clay-rich fossil soils, it is found beneath a coal seam, representing the soil in which the coal-forming vegetation grew. (Waters *et al*, 2005)

Radon is an important factor to consider as it can be dangerous if in a confined space with little ventilation. The site located in the drawings attached has a 1-3% maximum radon potential. There are many methods to reduce the radon. (PropertECO, 2016). One method called sub-slab depressurization is used. In this method a pipe is installed through the subflooring that leads to an outside wall or to the roof. A fan draws the radon from below the house and expels the radon before it can enter the home. This method is also referred to as a 'radon sump' Other methods include to increase ventilation, or to seal main access routes for the radon to enter the building. Positive pressure is another method of reducing radon into the building. Positive pressure is a method that uses a fan either in an external wall or in the roof which draws external air into the house creating a positive pressure, which in turn stops the radon from entering the building.



Figure 2: In this image we see a close-up drawing of the current site for the restaurant, ice cream parlour and manager's apartment.

Health and safety is always a crucial part of any construction project, therefore it's important to examine the site and its surrounding's history. Recently at the Hafod Morfa industrial complex site in Swansea, 19th century metal work foundries have been found beneath the construction site. It's important to investigate the area's history to gain an understanding of the unforeseen circumstances that may affect the project later during the construction phase. Foundries under the construction builds may cause serious failures and collapses. If such foundries were discovered beneath the construction site for the restaurant and ice cream parlour, not only would it threaten the lives of construction workers during the construction phase, but it would threaten the lives of people inside and in the surrounding area after the construction is complete. Research into the site's area from The Coal Authority shows that there are no coal mine entries or shafts near the proposed building site, also the site is not in a development high risk area.

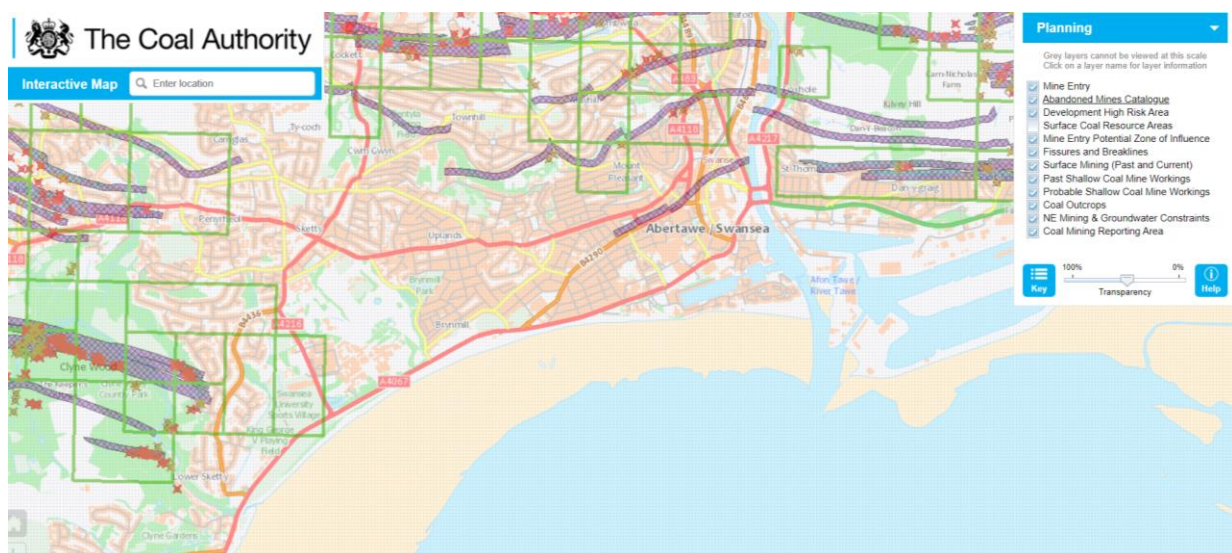


Figure 3: image of the Swansea bay area showing the coal authority's interactive map. This map indicates where mine entrances and shafts as well as highlighting the development high-risk areas. (British Geological Survey, 2019)

As pictured on figure 1, there's plenty of vegetation on site. Soils and vegetation have a reciprocal relationship. Fertile soil encourages plant growth by providing plants with nutrients, acting as a water tank of sort, and serving as the substrate to which plants anchor

their roots. In return, vegetation, tree cover prevents soil desertification and degradation by stabilizing the soil, maintaining water and nutrient cycling, as well as reducing water where soil is too saturate with water. Mature trees can help regulate water flow and play an important role in reducing the risk of natural disasters and preventing floods. A mature evergreen tree can absorb more than 15 000 litres of water per year.

A very common fears with trees are that their roots will damage house foundations. British standards building regulations state that tree to damage distance will depend on the size and type of tree. The book *Tree Roots, and Buildings* by Cutler, D F and Richardson indicates the distance that the type of tree should be from the building. Usually with a high-water demand species, soil drying influence is expected to extend outwards from the tree to a distance equivalent to the height of the tree. For a medium/low water demand species the influence is unlikely to extend more than 50% of the tree's height. But other factors contribute to damage occurring and most trees never cause problems for buildings. (FAO, 2016).

A visit to the proposed building site shows that access and egress for machinery and plant may be a problem as it would disturb residents staying at the Marriott as well as visitors to the Swansea Central Library. Parking space is key for workers and the plant/machinery. While visiting the site I found that the best place to park would be in the Marriott as there is easier access due to the lack of barriers and enough space at the entrance. While in the Central Library it would be hard for plant and machinery to enter through the narrow space leading into the car park. Procuring a segment of the car park for plant and machinery from the Marriott hotel would be of great assistance to the build. Reserving a small part of the library's parking may also be of great use to contractors' or any sub-contractor's vans. Site visitors would also benefit from parking in the library as it is easy for small vehicles to enter through the barriers leading into the car park a possible parking for sub-contractors or site visitors As well as access to parking, access to the site is much easier as there is more space to move rubble and debris from the demolition stage. Public access will be restricted therefore I propose a pathway from the library to the seaside be constructed, as the current one will be out of access to the public due to the boundaries of the site.



Figure 4: A map of the area surrounding the site with the proposed parking area for plant and machinery and parking for visitors and small vehicles.

Foundations are absolutely one of the most important part of a construction project as every factor from the project depends on it. Foundations are there to carry the whole weight of the building, transferring the loads to the ground safely by spreading the weight of the building. Not only does it give the building stability, but it also gives a level and flat surface to build on. There are many types of foundation that can be used depending on the condition of the ground and its history. Reducing the settlement of buildings is extremely important. Because the site will be in an area with a history of landslips and coal mining fields, it may be a good idea to use pile foundations. It is important to consider the minimum depth of foundations, density of soil, angle of repose of soil and the bearing capacity. (Chudley and Greeno, 2006) Driven piles will be used on the project as it is useful in soft squeezing soil and densifies loose soil. This type of pile foundation is driven, jacked, vibrated or sometimes even 'screwed' into the ground, displacing the material outwards and downwards instead of removing it. In turn this procedure densifies the soils around the pile. These can be square, octagonal, cylindrical or sheet piles. They are percussion driven piles which are used where bored piles would not be suitable to running water or very loose soils. They have a load range of 300-1,200 kN and can reach up to 30 m. pile foundations are exceptional at reducing settlement. It is also very

good at managing settlement where expected. Settlements happen when there is failure of the soil below the foundation. Sometimes, settlement is under control and is called equal settlement, where the building settles equally across the whole area of the foundation and only by a very miniscule amount. But other times where it is not controlled, we can also have a **differential settlement** below the foundation surface. Differential settlement is much more dangerous to the stability of the structure. Differential settlement is when the area of the building settles at different rates which can lead to the building cracking due to the building essentially 'snapping'.

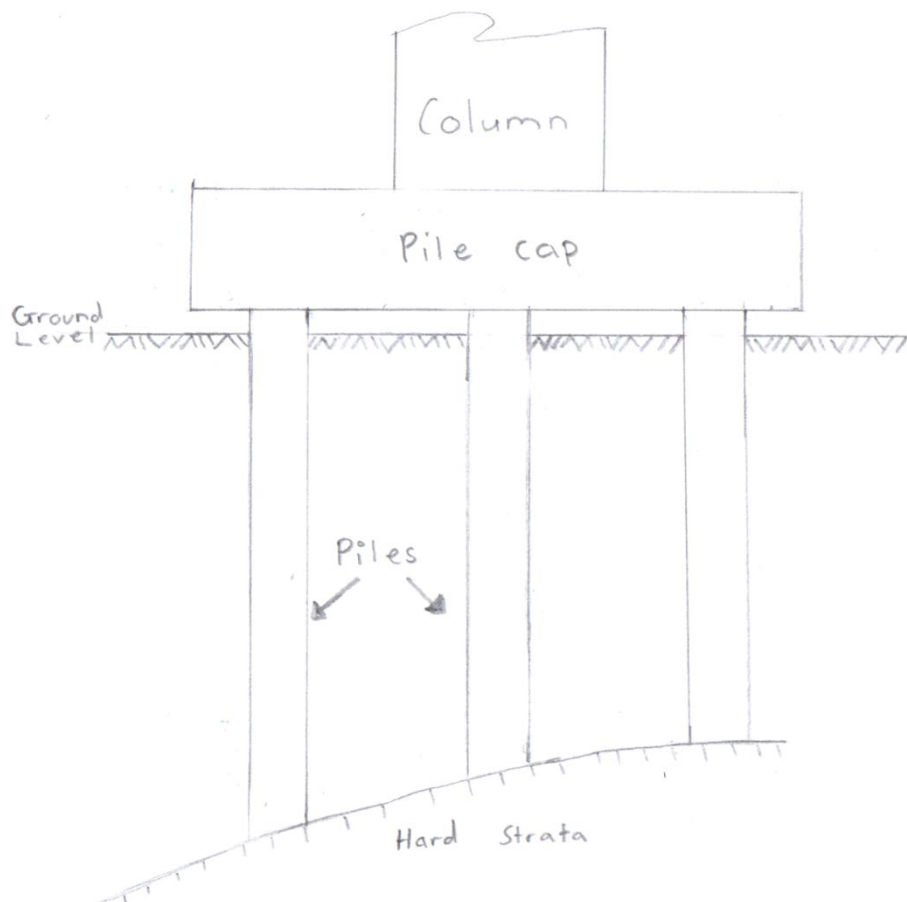


Figure 5: Drawing of a pile foundation Resting upon Hard strata beneath the ground.

I propose using Pile foundation for the project as it eliminates the risk of differential settlement as it is bespoke to the depth of the hard strata in different areas across the base of the restaurant project. Every pile has a zone of influence on the soil around it. Care needs to be taken to ensure that the piles are spaced far enough apart so that loads are evenly distributed over the entire pressure bulb of soil that supports them, and not concentrated into too specific of areas. Pile driving can be very noisy and causes immense vibrations in the

soil. For this reason, it can be difficult to use them in sensitive locations such as the library and the Marriott hotel. Driving piles would cause majorly unwanted disturbance, which may lead to a loss of money for the hotel's business as customers may be unhappy. The vibrations could also cause structural damage to the other buildings that are nearby. In such situations it is possible to use 'micropiling' or helical piling, neither of which rely on hammering. Micropiles or 'minipiles' are small piles that are constructed by making a hole slightly larger than the diameter of the pile, and the length of the pile is dug out using a similar tool to a soil boring machine. A concrete precast pile is pushed down into the hole and a concrete grout is used to fill the gap between the earth and the pile.

The other option is Helical piles. These are steel tubes that has spiral blades attached to them. They are drilled into the ground, the same way that a screw is drilled into wood. The pile is rotated and pushed into the ground. Once the steel pile is driven into the ground, the pile cap is constructed on top of the pile the same as a normal concrete pile to prepare it for the construction of the superstructure above. As a conclusion micropiles would be a better choice to construct the foundations of the project as they can hold over 1000kN of load while more helical piles would need to be added to hold this amount of load. There is not much difference between both types of piles overall. And due to the site being in such a very water saturated area corrosion would be a risk, as a result of this I would recommend concrete foundations would be better than steel.

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