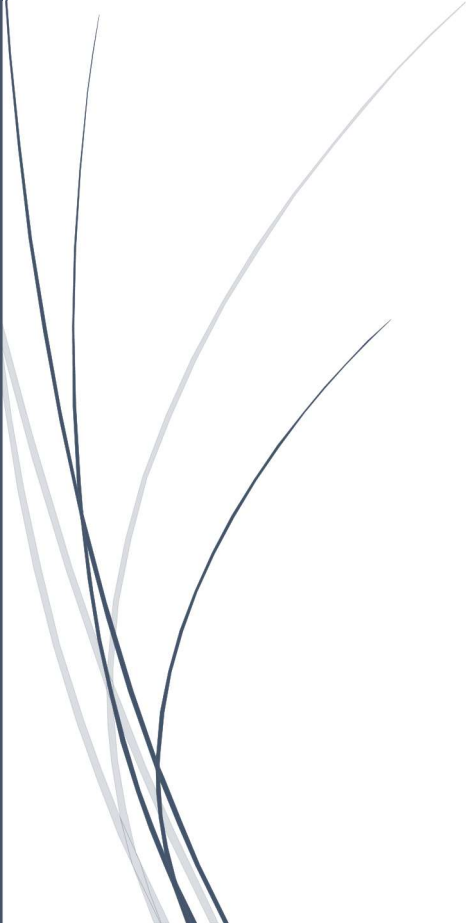


A dark blue vertical bar runs down the left side of the page. A blue arrow points to the right from this bar, containing the date 5/2/2023.

5/2/2023

4.2 Identify the construction methods and machinery used

Several thin, curved lines in shades of blue and grey sweep upwards from the bottom left corner of the page.

Jonathan Triggs & Richard Murray

SPRINGFIELD DESIGNS

WORK COMPLETED BY RICHARD MURRAY WILL BE HIGHLIGHTED
YELLOW

Contents

Steel	2
CFA Piling.....	3
Cofferdam Piling.....	4
Conclusion.....	5

Steel

Firstly the design of the bridge has allowed the construction to be split up into 3 sections. This is due to steel being strong and being able to span large distances. This makes the construction of the bridge much easier as the steel sections can be pre-fabricated off site and then bolted together once on site which also takes up much less storage space which isn't available on this site. Due to steel being prefabricated off-site and then quickly assembled on site, this saves time and reduces disruption to local communities during the construction process. Steel is an extremely strong and durable material, which makes it ideal for building bridges that can withstand heavy loads and extreme weather conditions. With this bridge being close to the sea and above water this is essential in the sustainability of the bridge as it will be exposed to the harshest of weather conditions. Steel can be shaped and welded into a variety of different forms, allowing engineers to design bridges that are highly customized to meet specific needs and requirements. This flexibility allowed us to come up with a unique design which pays tribute to the history of Swansea. Although the upfront cost of steel may be higher than some other materials, it is more cost-effective in the long run due to its durability and low maintenance requirements. As the bridge spans over water access to maintain the bridge would be difficult and costly so using a durable material is essential. Steel is also a highly sustainable material that can be recycled and reused, making it an environmentally friendly choice for bridge construction.

CFA Piling

CFA piles are more cost-effective than other types of foundation systems, such as drilled shafts or driven piles, because they require less equipment and labour to install. Due to the bridge being above water and access being difficult this was a major aspect in choosing CFA piles as there is less of an access requirement needed to being able to construct the piles. CFA piles can be installed quickly and efficiently, which reduced project timelines and minimizes disruption to surrounding areas which again played part as the access to where the abutments needed to be piled were within water this made the construction process quick and effective. CFA piling produces less noise and vibration during installation compared to other types of piles, which is crucial in not disrupting the near wildlife within the body of water and the surrounding high rise buildings which could be effected by the vibration of piling. CFA piles have a high load-bearing capacity, this is essential in the design of the bridge as it allows us to use large spans across the water with minimalizes the work required to construct the bridge structure.. As CFA piles can be installed in a variety of soil types and ground conditions, this makes them a versatile foundation solution for different types of construction projects. The underwater nature of the piles could cause adverse damage on the piles so CFA piles were suitable option to combat this. CFA piles produce minimal spoils or waste during installation, which reduces the environmental impact and this reduces any potential spills into water courses which would effect the wildlife living in the dock.

Cofferdam Piling

Cofferdam Piling unlike CFA Piling is a type of piling which is used in order to keep the working area dry, this would typically be utilised when construction is undertaken below the water table, or within a Marine environment. As construction of the bridge supports needs to be carried out within the Prince of Wales Dock, and large amounts of water will make CFA Piling impossible due to water mixing with the concrete mixture; the options are as below;

- Drain the Harbour
- Remove the Water from the working area

The option to drain the harbour would be feasible, if the harbour was a small area, or a dry dock, as the harbour does not have the capacity to drain itself, and this would adversely affect the marine ecology located within the harbour, the only viable means would be to remove the water from the working area.

This would be achieved by installing large sheet piles or interlocking sheets in a perimeter around the proposed zone, these would be sealed, and then the internal water pumped out of the working area.

This in turn would allow construction to take place within the marine environment in a safe, and dry manner.

As outlined in the proposed plans larger piling would first be installed in order to allow for the installation of a pile cap, with the internal area inside the Cofferdam area filled with suitable material allowing for the formation of the pile cap.

There are a wider array of Cofferdam types which could be utilised, however in this instance Steel Sheet Piling would be the most applicable, as the depth of the Prince of Wales Bay would require a substantial pile. This pile would then need to be suitably braced to resist the hydrostatic pressures associated with the water depth.

Conclusion

CFA Piling would be utilized in the first instance with a large steel cone placed by specialist marine equipment, this in turn would allow for the creation of large piles drilled to a suitable depth. This would in turn allow for the loads associated with the bridge to be transferred directly into the strata.

The addition of Cofferdam would be to allow the construction of suitable reinforcement for the pile cap, and introduction of suitable material around the main Concrete Pile. Due to the location of the excavation the exclusion of water from the working zone is an important factor, as such cofferdam construction would be a requirement in this instance.