

UNDERWATER CONSTRUCTION: A REVIEW

Digvijay Rajput¹, Aniruddh Dubal²

¹U.G. Student, Construction Engineering and Management, SSPU School of Construction Engineering and Infrastructure Management Kiwale, Pune, India

²Assistant Professor SSPU School of Construction Engineering and Infrastructure Management Kiwale, Pune, India

Abstract: This research focuses on the underwater construction, its techniques and the challenges faced during the construction. Underwater construction basically means constructing a structure underwater. Each underwater structure is built to fulfill a purpose. We will be researching on the various underwater construction techniques and the various materials in the construction. Analysis of few notable underwater constructions is also done in this research

Key Words: Underwater construction, caissons, cofferdams, tremie method, pump, method

I. INTRODUCTION

Underwater buildings are structures which are built under the water and every constructing built features a specific motive associated with it keep with the sort of its construction. The idea of the underwater production become started with through the development of underwater research stations through Jacques Cousteau's team inside the 1960's. To a layman, he has by no means notion of getting to an underwater constructing and thru the event of underwater homes it's a replacement improvement and enhancement of the generation.

Underwater construction is that the destiny goal or future foundation in order that you'll have an splendid impact on the environment, it'll additionally cause a number of the troubles to the surroundings which can be confronted due to the appliance of this technology but if we get fulfilment in reaching it'll be an incredible gain to the environment which is getting crowded day by day thanks to the growing populace. Approximately 3/4th of the earth's floor is protected with the assistance of water and our water resources. For this reason the event closer to the underwater production technology are going to be useful to the mankind.

A. RESEARCH OBJECTIVE

- To find the materials which are suitable for underwater construction.
- To study the different techniques used in underwater construction.
- To study the different difficulties faced in the underwater construction.
- To do analysis of different underwater construction projects.
- Benefits of Constructing Underwater structures

II. Benefits of Constructing Underwater structures

For a developing country like India underwater construction will benefit the citizens. there'll be a decrease within the populated places present on the surface of land. there'll be a progress and enhancement in technology used for its construction. it'll promote tourism as all the people from everywhere the planet would come for the astonishing experience of various fishes and coral and it'll be provide as a source of entertainment for them. And also the corals are protected against the touching and diving of the people. The people will get fascinated by it and if this idea gets success then it'll get easily spread among the people. After asking some people it had been found that almost all of the people accepted the thought of visiting the underwater city for the means of entertainment or so as to induce a replacement exotic experience. Hence this project may get success.

III. Techniques used in Underwater Construction

A. Caissons

The term caisson is gotten from Latin, which means box or case. Caissons are empty inside and as a rule developed at site and soaked set up into a hard bearing layer. It's a pre-assembled empty box or chamber. It is sunk into the water to some ideal profundity and afterward loaded up with substantial in this manner shaping an establishment. There are various kinds of caissons box caisson, open caisson, attractions caisson, pneumatic caisson and so forth.

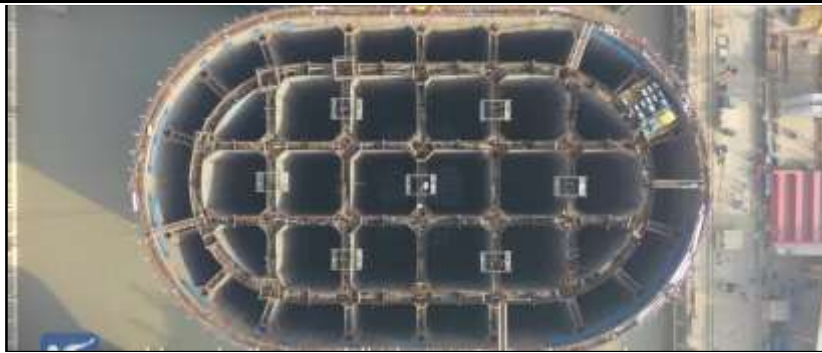


Figure 1. Caission

B. Cofferdams

A cofferdam, additionally called a coffer is a nook worked inside, or two by two across, a waterway to permit the encased region to be siphoned out. This siphoning establishes a dry work space so the work can be completed securely. Encased cofferdams are normally utilized for development or fix of perpetual dams, oil stages, connect wharfs and so on, worked inside or over water. These cofferdams are typically welded steel structures, with segments comprising of sheet, heaps, ridges and cross supports. Such designs are typically destroyed after the development work is finished. There are various sorts of cofferdams earthen cofferdam, rockfill cofferdam, single-walled cofferdam, twofold walled cofferdam, Cell cofferdam, supported cofferdam and so forth.

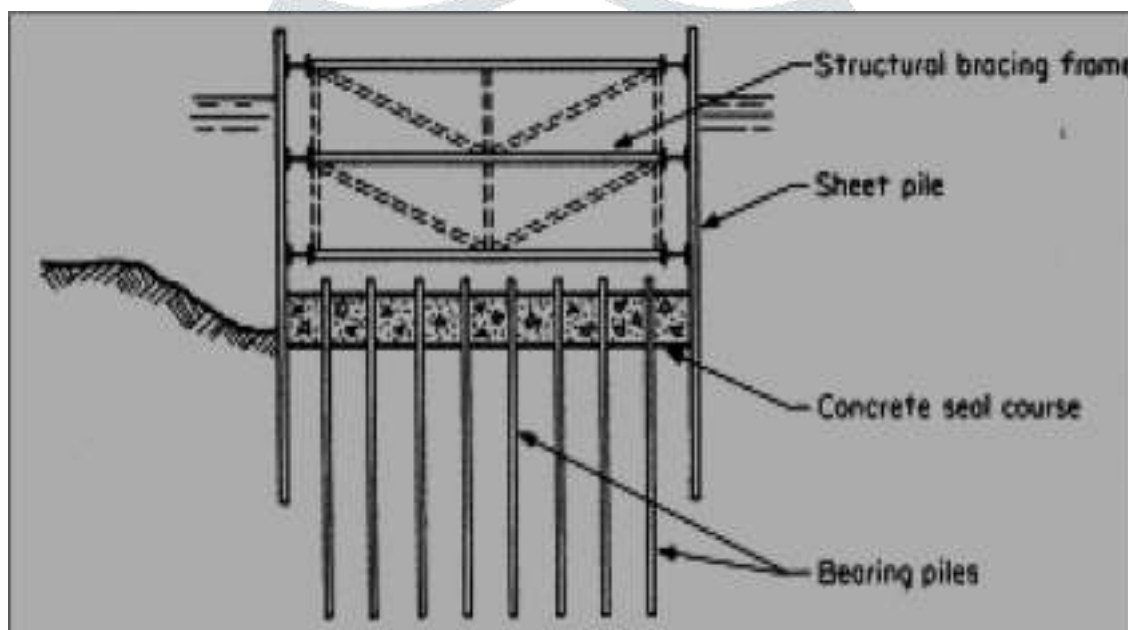


Figure 2. Cofferdam with a seal

C. Tremie Method

Tremie strategy is perhaps the most widely recognized strategies that is utilized for cementing submerged. In this strategy, a long steel pipe (named as tremie) having a distance across of 15 to 30 cm is embedded upward into the water. The line ought to be long sufficient that it compasses to the bed of water keeping its one end over the water level. The tremie is then fitted with a container at the upper end for pouring cement inside the line. The lower end of the tremie pipe should be shut with a check valve prior to embeddings it into the water. From that point forward, newly blended cement is poured with the assistance of container. At the point when the substantial is poured, it dislodges the air and water present in the line lastly reaches to the bed.

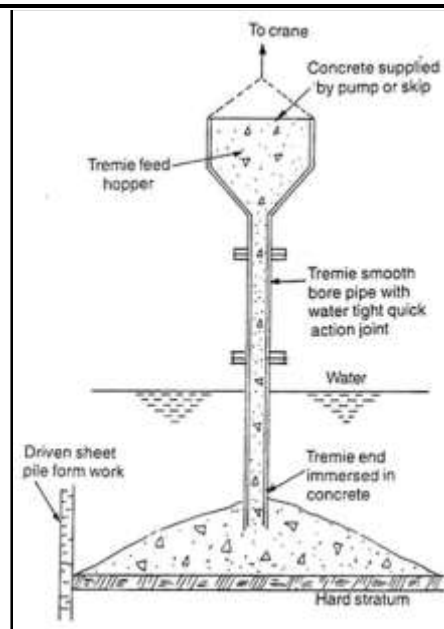


Figure 3. Arrangement for Tremie Method

D. Pump Method

Underwater cementing utilizing siphoning strategy is a created adaptation of Tremie pipe and it is speedier technique for cementing in regions that is hard to access, for example, under wharfs. Siphoning give a few benefits that Tremie pipe is missing for instance, pouring cement from blender to formworks straightforwardly, address blockages in the line in light of the fact that cementing is through siphoning as opposed to utilizing gravitational power, and hazard of isolation is diminished.

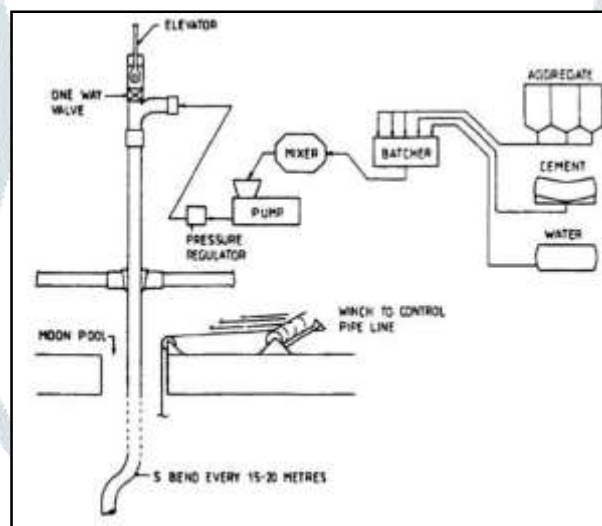


Figure 4. Configuration of underwater concreting pump line

E. Toggle Bags Method

Toggle Bag technique is helpful when modest quantity of cement is required. A reusable material sack is fixed at the top with chain and got with flips is loaded up with concrete and dropped cautiously into the decided area then through opening at the lower part of the pack the substantial is released. Utilized for fix work. It is one of the most established and least complex procedures of setting concrete submerged. The sacks are pliable in nature so they can be interlocks each other without any problem. When the sacks are set, they are spiked along with support bars of little size.

F. Bag Work Method

Bag work substantial technique is utilized for recharge stabilizer or to seal openings for a brief time. The sacks are created from significantly solid texture with limit of 10 - 20 liters and it conveyed by jumpers to the chose position. The substantial droop is between 19-50 mm and 40 mm is the greatest total size that can be utilized. The establishment of the sacks is like blocks to make bonds.

IV. Analysis of some Underwater Construction Projects

A. Dubai Underwater Resort

It's far all things considered underneath advancement. The inn is situated at 33 feet underneath the outside of water. The complete expense of this task is more than \$550 million. The surface station can be connected with the primary task underneath the water with a 515 meter extensive passage through which an unconstrained trains will transport individuals to the submerged inn. It is 260 hectares place comprised of the air pocket molded suits 220 in numbers which are framed at 20 meters underneath the outside of the water.

The inn may even have numerous wellbeing highlights. It comprises of grouping of waterproof doorways which can be utilized in the event



of any euphoria. It will furthermore have its own rocket ensuring machine in the circumstance of any radical attack.

Figure 5. Dubai Undersea Resort

B. Undersea- The Poseidon Luxurious Resort

The thought was created by an American designer Bruce Jones. The Poseidon resort as displayed in the figure can be reached with the assistance of the lift. It is developed in the space of 11 lakh rectangular foot. The space of each room involves 550 rectangular foot. The complete



expense for the improvement of this task was 100 million dollar.

Figure 6. Poseidon Luxurious Resort

C. The Undersea Restaurant- Itha

It is the principal submerged café worked all through the globe. It is found 16 feet beneath the outside of water in the Indian Sea. He outside is covered with clear acrylic.

An individual can reach to the eating spot of Itha eatery with the assistance of the wooden walkway as displayed in the figure beneath. The development and improvement of this eatery was troublesome on the sea shore of rangali in light of specialized issues, limited resources and excellent difficulties.

The development was done in Singapore. Its improvement began in the year 2004, and the work got over in October 2004 along with set up of the acrylic straightforward curves, climate control systems and electric fueled channels. The lifespan of the structure is 20 years.



Figure 7. Itha Undersea Restaurant

V. Difficulties faced during the Underwater Construction

A. Budget

Working underneath water is an exorbitant path due to utilizing large equipment, gadgets and expert representatives. Working underneath water likewise incorporates some of government assistance and it desires to huge value range.

B. Corrosion and Erosion

Undersea undertakings in waterfront conditions should consider the destructive impacts of saltwater. Disintegration is the strategy for enduring and conveyance of solids (residue, soil, rock and diverse stone particles) in the regular environmental factors or their source and stores them somewhere else. It typically happens due to move with the asset of wind, water, or ice so designs should select fitting materials for underneath water building.

C. Water Pressure

Both during development and over the existence of a design, the impacts of water pressure assume a vital part. Stress plays out a huge trademark in convincing the rules of the building also individuals comes to issues either at some stage in the improvement framework or eventually of the insurance method.

D. Finding Suitable Material

When working in water, materials should be utilized that can withstand an assortment of intricacies, including water pressing factor, consumption, and disintegration. The most widely recognized materials utilized in submerged development incorporate cement, steel and acrylic glass.

E. Location of Fuel

Any happenstance may likewise be conceivable when the driller machines and other apparatus are attempting to discover oil or to any transport additionally can harm the standpoint and construction of the structure it's out of sight oversee.

F. Temperature of water

The temperature shifts sensibly over the outside of water, it is warmed starting from the earliest stage the underneath by the utilization of sunshine hours, yet at profundity limit of the water might be freezing.

G. Environmental Hazards

Most likely that the essential issue that will be had to us at the equivalent time as talking around the advancement of submerged frameworks is the issue of air circulation. There should be a stockpile of inexhaustible air that aides in respiratory, and eliminating undesirable gases. Licenses find an answer, for the wind current issue, that changed into executed simultaneously as the improvement of the submerged Holland burrow.

VI. Remedies

- By the legitimate plan of submerged designs utilizing experienced specialists and planners can decrease the expense of development. Development wellbeing likewise considered on the grounds that it additionally increment the expense of development. Appropriate timetable of work is kept up by development the executives s it will diminish the expense and time during work. By utilizing materials like cement and acrylic glass most erosion because of ocean water can be controlled. Disintegration is the another test because of wind, water, ice and so on in water so it tends to be decreased utilizing jetties covered with geo-textiles. It doesn't make any water contamination moreover.
- To defeat water pressure state of design is significant. By investigation we can say that circular shape is generally appropriate to with stand water pressure. Yet, this circle shape is frequently toppled by a blend of different elements. To recognize these variables three materials frequently utilized for submerged designs; steel, cement and glass/acrylic glass were broke down. The manufacture measures, development strategies and material properties all impact the plan prospects of every material. While hypothetically every material can take any shape, a few shapes demonstrated simpler to build and consequently are less expensive.

• There are numerous materials utilized in land development however as we come submerged development the material is restricted on account of pressing factor, erosion and so forth so we basically utilize normal materials in submerged development like steel, cement and acrylic glass. Area of fuel is out of oversee however prior to beginning the work little examination directed identified with fuel area might be useful.

• Temperature is the another issue in submerged development. By utilizing the acrylic glass it could be decreased. Ecological components are thought about primarily for wellbeing of when development. Legitimate ventilations are given on structures. Supply of air utilizing siphon is likewise significant. There are numerous advanced procedures for this air circulation.

VII. Conclusion

Underwater construction development is a significant and furthermore an interesting theme in this advanced world. The principle a piece of this article are writing resources and contextual analyses. Subsequent to contemplating writings identified with Underwater construction development we can comprehend the Underwater construction development is a confounded and expensive work. The caissons and cofferdams are the strategies utilized for the development of Underwater construction designs. Caissons are empty inside and for the most part developed at site and soaked set up into a hard bearing layer. A cofferdam, additionally called a coffer is a nook worked inside, or two by two across, a waterway to permit the encased region to be siphoned out. There are a few strategies to do Underwater cementing, for example, termie technique, siphoning strategies, switch pack strategy and sack work technique. As of now, the Tremie arrangement strategy is the standard method of setting top notch concrete submerged. The other position technique can't dependably put excellent submerged cement for significant constructions, in spite of the fact that they may discover application in exceptional cases. For huge Underwater construction substantial development of route structures, the siphon technique ought to be restricted. There are numerous difficulties that influence the Underwater construction. It's solution are likewise clarified in this article.

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