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A Study on Underwater Concrete Structures

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ABSTRACT: Engineers' most recent breakthrough in the underwater construction of locks and dams is the in-the-wet construction method. In Underwater Concreting, precast concrete modules are used as an in-situ process for positioning concrete directly underwater. Underwater concrete is designed to work with precast concrete. According to comprehensive analysis, in-the-wet construction saves money and time while also minimizing the effect on river traffic during construction and eliminating navigation during restoration. There are several examples of high-quality concrete that has been submerged. However, there have been several mistakes, which have resulted in substantial cost overruns and delays. Due mainly to incorrect concrete mixtures and positioning methods, these accidents could have been avoided if state-of-the-art underwater concrete technology had been more widely disseminated. This research focuses on the fundamental performance characteristics of underwater concrete materials, emphasizing practical design issues for in-the-wet navigation structure construction. The final parts of the study are on how to construct underwater concrete structures.

KEYWORDS: Underwater Concrete, Admixtures, Strength, Anti washout.

I. INTRODUCTION

Underwater concrete is created by pouring concrete into a body of water. While the differences in properties are minor, the issue of concrete washout necessitates admixtures' addition to reduce the washout properties of Under Water Concrete. Concrete placement underwater and in very deep foundations, such as caissons, necessitates techniques that vary from those used for air placement. A concrete underwater repair usually is complex and requires the use of specialist products and systems and the expertise of highly trained and skilled professionals.

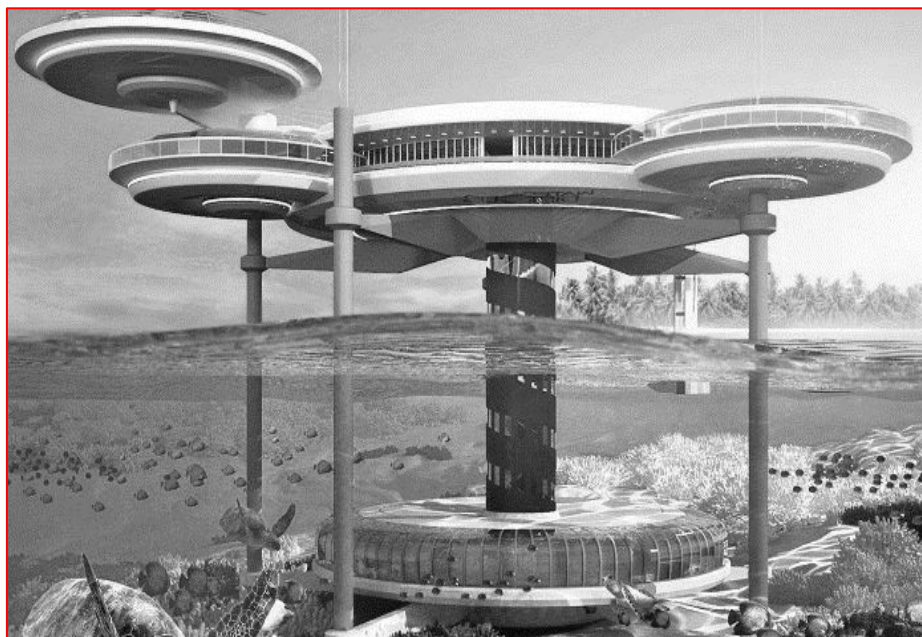


Fig. Underwater Concrete Structure



II. LITERATURE REVIEW

Khayat 1999 et al.

This Research Paper author explains underwater concrete and its applications and statistical models used to proportionate the UWC structures. This author carried out slump consistency with mathematical models and conducted a compressive strength test to develop UWC for solid structures better. The author has also conducted tests on various types of cementitious materials that are used in the UWC. It is discussed how to use models to optimize concrete mixtures to balance slump consistency, washout resistance, compressive strength, and cost.

Sonebi et al.

In this paper author, is explains about mechanical properties of Underwater Concrete structures. This author uses one of the methods of UWC is a micro indentation, and this study is based on nanotechnology. This UWC is made without using any washouts. This author has also conducted a compressive strength test on concrete cubes and compared them with Underwater concrete.

Ashraf 2015 et al.

In this Research Paper author is explained on properties of underwater concrete. Also, the author described underwater coarse aggregates and used steel slag as coarse aggregate material. This author has tested about twenty mixes of underwater concrete. Finally, tested compressive strength test results are compared with underwater concrete.

III. METHODOLOGY

Concrete is the most widely used building material in all forms of civil engineering projects around the world. We must use UWC when building bridges, dams, or any other structure with a base that is likely to be submerged. Building on water presents numerous challenges, especially in areas with significant depth. As a result, proper mix design, concrete manufacturing, placement, and quality control should all be followed.

- Underwater concrete comes in a variety of forms:
- Concrete pouring
- Armoured concrete
- Concrete that lasts a long time
- Concrete of colloidal particles
- Injection of concrete
- Concrete is poured.
- Concrete and steel fibers
- The concrete is grouted.

OBJECTIVES & USES

- Cohesion against washout and segregation
- Low hydration heat
- Regulated set time
- Compression intensity

DIS ADVANTAGES

- Water contamination
- increased W/C ratio
- washout
- Segregation of fine and coarse aggregates

MIX DESIGN

- The production and distribution system must be capable of delivering concrete at the necessary placement rate.
- The materials must be supplied to the batch plant at the required rate.

MATERIALS USED

Cement used in underwater concrete include:

1. Ordinary Portland Cement is a type of cement that is commonly used in construction (OPC)
2. Portland Cement - Sulphate Resistant (SRPC)
3. Portland Cement - Low Heat (LHPC)



Aggregates of a Coarse Kind The coarse aggregate used in concrete intrusions must be of the following gradation: Maximum Size: 1.5-2 inches and 100 per cent shall pass a 75 mm sieve & Minimum Size - material moving through a 19 mm sieve must not account for more than 5% of the coarse aggregate's mass.

Aggregates of Fine Quality The intruded grout sand must be well graded, ideally of round grains, and must meet the following gradation: 1.18 mm sieve: 95-100% & 600 mm sieve: 60-85%.

ADDITIVES FOR THE UWC

Something that makes it easier to deal with should be considered. Slump about 7 inches. The MSA can account for 45 per cent of the overall aggregate. Add an air-entraining admixture to the mix. Requires the use of an anti washout admixture. Some of these admixtures are made from Cellulose ether or Whelan gum, increasing the concrete's cohesion and viscosity.

METHODS FOR PLACEMENT

It is a method of pouring ready-mixed concrete below the water's surface using appropriate methods.

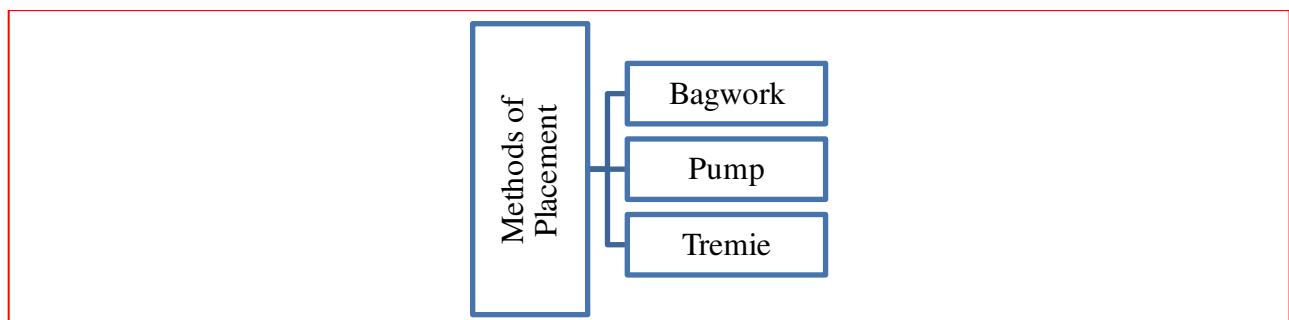




Fig. Pumping Method

It needed both horizontal and vertical concrete delivery because it was pumping concrete directly into its final position. Pumping concrete has the benefit of operational consistency and the potential for time and labour savings. Pumps cannot be used for large-scale underwater concrete navigation systems.



Fig. Bagwork Method

The material used to make the bags is the open weave. Diver-handled bags typically have a capacity of 10 to 20 litres, but 1cub.m bags can be mounted with the help of a crane.

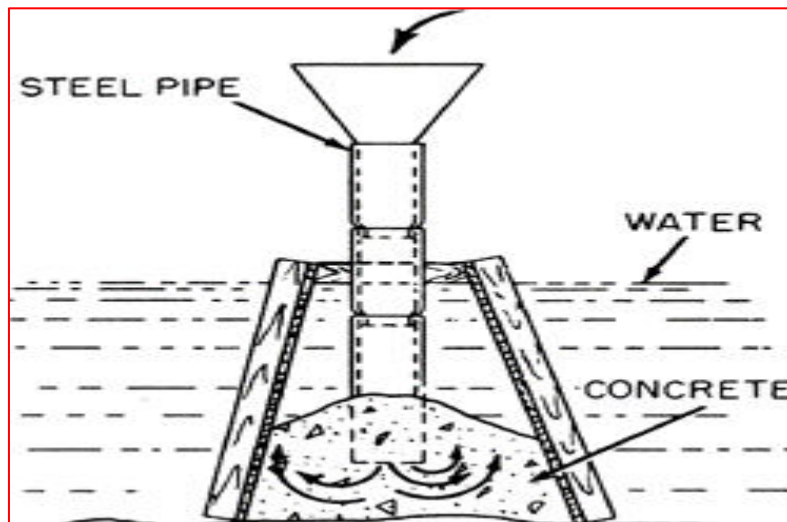


Fig. Tremie Method

Tremie concrete is made with gravity and a formwork/pipe with one end above water and the other immersed in water. Air and water must be kept out of the pipe until it can be concreted, and it must still be full of concrete. The funnel and pipe should both have the same capacity for this to work. The air is displaced by first inserting a plug into the pipe under the weight of fresh concrete.

Initial inspection, corrosion estimation, inspection, and assessment are all part of the maintenance process. Technology, as well as social and economic factors, should be considered during building. The use of anticorrosion or protective materials will provide adequate corrosion protection.

APPLICATIONS

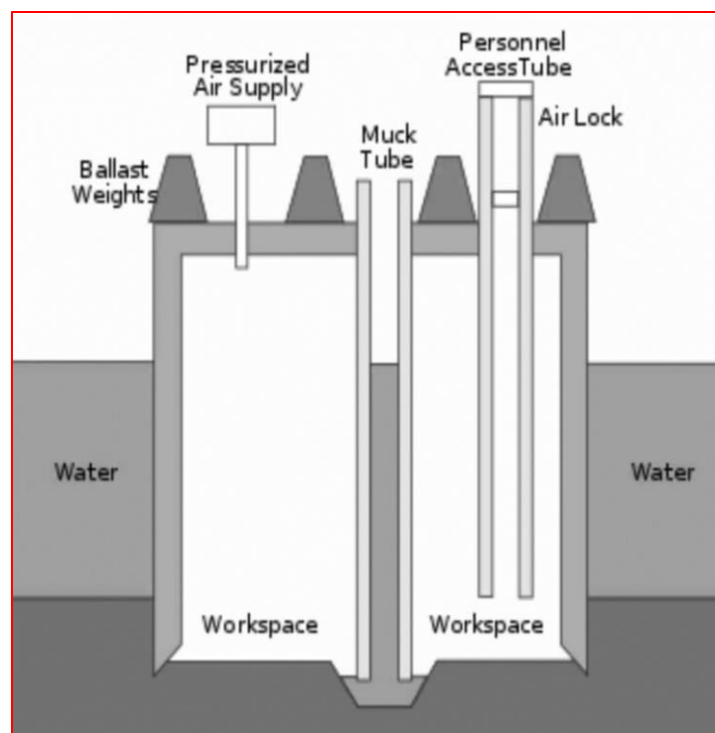


Fig. Caissons



Fig. Cofferdams



Fig. Piles

IV. CONCLUSION

It can result in a significant overrun in construction cost and schedule if it is not done correctly, with the appropriate concrete mixture and placement. The workability criteria are the main difference between underwater concrete and traditional concrete. Conventional concrete is compacted with mechanical vibration, while underwater concrete must flow horizontally and compress itself under its weight.



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