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BEST MIX DESIGN OF FLOATING CONCRETE USING PUMICE STONE

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Abstract - *The present day world is witnessing construction of very challenging and difficult civil engineering structures. Researchers all over the world are attempting to develop low density or lightweight concrete by using different admixtures in concrete up to certain proportions. This study deals with the development of Floating concrete by using lightweight aggregate (Pumice stone).Floating concrete is made by introducing air or gas into concrete slurry, so that when the mix sets and hardens, uniform cellular structure is formed. Pumice stone is a lightweight aggregate of low specific gravity. It is a highly porous material with a high water absorption percentage. In this we do not use the conventional aggregate and replace it by the pumice stone. Floating concrete is a type of light weight concrete which is light in weight and density is also less than the density of water. Through floating concrete we are providing a platform to support solar panels on dam reservoirs which are otherwise left idle. The water surface provides a very smooth and level surface which is necessary for setting up solar panels. Before designing the mix, various tests were done on the materials to study their properties like durability, workability, specific gravity, standard consistency, resistance to corrosion and chemicals. The study involves the analysis and comparison of the test results to arrive at conclusions whether floating concrete can be used for the base preparation for solar panels to be established over dam reservoirs.*

Key Words: Floating concrete, Pumice stone, Solar panels, Pumice Powder, Aluminium powder, Chicken Mesh

1.INTRODUCTION

Floating concrete is a type of concrete having density less than water and it floats on water. There are many types of lightweight concrete which makes the concrete float either by using light weight aggregate or by using air entraining agent. The conventional aggregate are replaced by light weight aggregates which makes the concrete lighter than conventional concrete. Comparison has to be made between plain cement concrete and light weight concrete having different proportions of aggregates, pumice stone, aluminium powder has been taken into account.

1.1 RELEVANCE

Aim of an engineer is to have an economic development which is conducted without depletion of natural resources. In a world of limited resources it is a mandatory to bring out new ideas for the efficient use of resources without compromising the ability of future generation to meet their own needs. Through high strength light weight floating concrete it can replace other less durable materials like wood and is suitable for use in non-load bearing walls, thermal and sound insulation. Moreover it is cost efficient and more durable.Through floating concrete we are providing a platform to support solar panels on dam reservoirs which are otherwise left idle. The water surface provides a very smooth and level surface which is necessary for setting up solar panels.

1.2 OBJECTIVE AND SCOPE

- To study the effect of pumice stone in making the concrete float and, air entraining agents in making the concrete lighter.
- To obtain the best mix design of floating concrete slabs, having enough wait carrying capacity to support uniformly distributed solar panels in it.

2. METHODOLOGY

1. Study on effects of light weight aggregates such as Styrofoam, pumice stone, air entraining agents in making the concrete lightweight enough to float on water.
2. Before designing the mix, various tests were done on the materials to study their properties like durability, workability, specific gravity, standard consistency, resistance to corrosion and chemicals.
3. Preparation of mix design of floating concrete.
4. Concrete cubes of side 15 cm and slabs of 100×50 cm were decided to be casted. The lightweight aggregates are used in different mix proportions and mesh reinforcement is provided.
5. Air entraining agents are added to the mix to make concrete lighter than the conventional concrete.
6. The concrete will be cast in the moulds based on the finalized mix design.
7. After curing these specimens for 28days, they are tested for the floating ability, compressive strength, reinforcing strength, weight carrying capacity.
8. The study involves the analysis and comparison of the test results to arrive at conclusions whether floating concrete can

be used for the base preparation for solar panels to be established over dam reservoirs.

3. LITERATURE REVIEW

According to the research article published by Arpit Sharma, ManaliSehrawat, Kamaldeep Singh and MadhurSaraf on the topic "Floating concrete by using light weight aggregates", they used different proportions of pumice stone and light weight aggregates, three different light weight mixtures were produced with a satisfied strength. Aggregates size and proportion affects the unit weight and compressive strength of concrete. The results showed that it is possible to produce a floating and a satisfied strength concrete by using pumice stone as aggregate. It was also seen that light weight aggregates in concrete mixture can reduce the dead load but decreases the concrete strength. These light weight concrete does not satisfies the strength requirements for load bearing structural elements so can be used as separation walls.

4. MATERIALS USED FOR SLAB CONSTRUCTION

4.1 PUMICE STONE

Pumice stone is a natural lightweight aggregate which is formed by the sudden cooling of molten volcanic matter. One of the most significant of the advantages of pumice aggregate concrete is its lightweight quality. The lower thermal conductivity of pumice concrete provides less heat loss. Pumice concrete has superior resistance to harsh weather conditions like freezing and thawing.

4.2 ORDINARY PORTLAND CEMENT

OPC is the most commonly used cement in the world. PPC means Pozzolanic Portland Cement. Pozzolans are siliceous material than can be added to concrete mixtures, to potentially lower the mix cost without harming the performance characteristics.43 and 53 are two grades of OPC (Ordinary Portland Cement). 43 Grade Cement attains compression strength of 43 mpa (mega pascals) in 28 days of setting compared to 53 mpa attained by 53 Grade cement. Initial Strength: 53 Grade cement are used for fast paced construction were initial strength is to be achieved quickly.

4.3 ALUMINIUM POWDER

Aerated concrete is achieved by introducing air bubbles into a mortar to reduce the density, so that when the combination sets and hardens a uniformly cellular structure is created. During an extended programme investigating the performance of aerated concrete it was noted that variation in particle size of the aluminium powder used to create the aeration caused variation in results.

4.4 CHICKEN MESH AS REINFORCEMENT

Chicken wire, or poultry netting, is a mesh of wire commonly used to fence in fowl, such as chickens, in a run or coop. It is made of thin, flexible, galvanized steelwire with hexagonal gaps.Concrete reinforced with chicken wire or hardware cloth yields ferro-cement, a versatile construction material. In reinforced concrete, an arrangement of steel bars or wire normally in two directions at right angles, tied or welded at the intersections or interwoven.

5. CONSTUCTION OF THE FLOATING SLABS

Cubes of size 60cm x 30xm x 6cm were casted.

5.1 MIX PROPORTIONS

- Pumice Stone = 3kg
  Pumice Powder = 2 kg
  Cement = 3 kg
  Mix proportion = 1: 3.5: 6
- Pumice Stone = 3.4 kg
  Pumice Powder = 2.5 kg
  Cement = 3 kg
  Mix proportion = 1: 4.37: 7.14
- Pumice Stone = 2.75 kg
  Pumice Powder = 1.8 kg
  Cement = 4 kg
  Mix proportion = 1: 2.3: 4.3
- Pumice Stone = 0.2 kg
  Pumice Powder = 1.5 kg
  Cement = 4.5 kg
  Mix proportion = 1: 1.76: 2.81

6. STRENGTH TESTING

6.1 CONCRETE CYLINDER TEST

Cylinder moulds of 150mm diameter and 300mm height were casted and the 28th day compressive strength of cylinder = 2.3 N/mm^2

6.2 COMPRESSIVE STRENGTH OF CUBE

The test was carried out using 150mm concrete cubes on a Universal testing machine or compressive testing machine. The average Compressive strength at 28 days = 2.1 N/mm^2

6.3 SPLITTING TENSILE STRENGTH TEST

Cylinder moulds of 150mm diameter and 300mm height were casted and the splitting tensile strength of the specimen = 0.67N/mm^2

7. CONCLUSION

In this study, the influence of the aggregate types, the weight carrying capacity and the characteristic compressive strength of concrete were investigated. Using different aggregate proportions different lightweight concretes were produced with satisfied strength. The result of the investigation showed that aggregate size and proportion influenced the unit weight and compressive strength of the concrete. Moreover, the result showed that it is possible to produce floating concrete with pumice stone as coarse aggregate. It was also seen that, using light weight aggregate in the concrete mixture it can reduce the dead load of the concrete, but it shows reduction in the strength of the concrete. The best mix design was obtained for sample 3 which had a mix proportion of 1:2.3:4.3. We were able to obtain a weight carrying capacity of 5.55 kg/m^2. The characteristic compressive strength obtained for the best mix design was 2.3 N/mm^2. From the cost study analysis it was derived that the cost of the floating concrete obtained was higher than the normal conventional concrete.

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