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EXPERIMENTAL INVESTIGATION ON FLOATING CONCRETE

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Abstract - *In the present day life, population increased to a great extent. People search for the land to construct the building for their habitants, and so number of apartments and high rise building grows rapidly. In order to find an alternative to build in land, can be damaged.*

In this paper, we present innovative concept of floating concrete. Our aim is to produce concrete which float in water, that serves as an Highperformance concrete which can be used for non-load bearing marine structures and floating structures. The density of the concrete is reduced toattain the light weight as well as to make it economical. In the first few trails coarse aggregate is replaced with light weight materials(wood, thermocol and pumice stone) and fine aggregates with rice husk ash in the mix ratio polypropylene balls and cement mortar of ratio 1:3 comprising of cement and charcoal powder preliminary tests for the materials are conducted prior to preparation of the specimen After casting the specimen is allowed to harden and then the buoyancy test is conducted .

***Key Words*: Thermocol beads, Rice Husk Ash , Pumice stone , wood pieces , Bouncy Test , Water Absorption test, Weight Withstanding Capacity , Depth Of Immersion.**

1. INTRODUCTION

Improve or alter the properties making concrete is an art which is an art one has to be perfectly through otherwise that will end up with bad concrete. Hence as civil engineer one should be thorough with the entire factor of concrete from which he can produce a good concrete. Most concrete cement concrete or concretes made with other hydraulic cements , such as calcium cements. Concrete is the most widely used construction material in the world due to its ability to get cast in any form and shape. It also replaces old construction materials such as brick and stone masonry. The strength and durability of concrete can be changed by making appropriate changes in its ingredients like cementious material, aggregate and water and by adding some special it provides superior fire resistance compared with wooden construction and gains strength over time

Hence the concrete is very well suitable for a wide range of applications. However concrete has some deficiencies as listed below:

- Low tensile strength
- Low post cracking capacity
- Brittleness and low ductility
- Limited fatigue life
- Incapable of accommodating large deformation
- Low impact strength

The ingredients for making concrete are cement fine aggregate coarse aggregate and water. Sometimes creative additive are added to it to improve or alterthe properties making concrete is an art which is an art one has to be perfectly through otherwise that will end up with bad concrete. Hence as civil engineer one should be thorough with the entire factor of concrete from which he can produce a good concrete. Most concrete cement concrete or concretes made with other hydraulic cements , such as calcium aluminate cements.

FLOATING CONCETE

The present day world is witnessing construction of very challenging and difficult civil engineering structures. Researches all over the world are attempting to develop low density or light weight concrete by using different admixtures in concrete up to certain proportions. This study deals with the development of floating concrete using light weight aggregate.

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 lightweight aggregate or by using air entrainingagent. The conventional aggregates are replaced by light weight aggregates which makes the concrete lighter than the conventional concrete. The density of the concrete is reduced to attain the maximum efficiency. The disadvantage of conventional concrete is the high self-weight whereas here the self-weight of the structure is minimized thereby reducing the dead load on structure.

Such concrete can be used to built floating structures and can reduce the usage of high cost fibers that are used for similar purposes. They are High performance concrete which can be used for non-load bearing marine structures and floating structures.

OBJECTIVE

The main objective of our project is to reduce the density of the concrete andmake it float in water and at the same time it should withstand some weight and should not absorb water. The other objective is to find an alternative method for the construction of marine structures which is generally built over an fiber barrel. This will help to reduce the construction cost. Thus to make a High performance concrete in an economical and eco-friendly way.

LITRATURE REVIEW

In this chapter, a various literature related to my project were discussed

ArpitSharma., et.al.(May, 2017) experimentally studied The Floating Concrete by using Light weight aggregates.

In this paper they have conducted experiments to make concrete float by using light weight aggregates. The article says that the density of floating concrete should be less than the density of water. Here the materials adopted are ordinary Portland cement, pumice stone, Styrofoam of size 10 to 20mm. The sand is replaced by pumice stone and Styrofoam. In this the Styrofoam balls are used in the place of sand.

Here, the curing is done by bonding. They made 15cm x15cm x 15cm size cubes. The compressive strength test after 7 days of curing is done. The adopted mix design is M20 grade concrete with nominal mix design. The casting is done by mixing pumice and Styrofoam in various proportions. They performed test for each proportions they have attained by increasing and reducing the percentage of pumice stone and Styrofoam and they observed results after 7 days of curing. During these trails they attained lesser density for the proportion of 6kg cement, 0.42kg of Styrofoam and 0.63kg of pumice powder as a replacement of sand, 0.45kg of pumice stone and 0.13kg of Styrofoam as a replacement of aggregate.

They found that, these light weight aggregates in concrete mixtures can reduce the dead load but decreases the concrete strength. Thus they don't satisfy the strength requirements for load bearing structural elements. However they can beused for separation walls.

A.Suba Lakshmi.Et.al (2017) Experimentally investigated on light weight concrete using pumice aggregate.

The project deals with light weight aggregate by using pumice aggregate. It is the partial replacement of coarse aggregate with differentratio of pumice from 20%, 50%, 80% & 100%. The results are compared withconventional concrete. It reduces the self weight of building. Cement used was 43 grade OPC and specific gravity 3.15, which has initial and final setting time as 40 min 4595 min. Here the fine aggregate was sieved using 4.75mm sieve has specific gravity 2.6 and fineness modulus 2.78. It has to confirm zone – 2 of IS 383-1970 requirements.

They used crushed granite aggregate as coarse aggregate which have to retain on 20mm sieve, has specific gravity 2.74 and fineness modulus 7 and water absorption 4.4%. Pumice aggregate is used after soak in water for 24 hours. It has specific gravity 0.9, low density, highly porous material. Poly carboxyl ether based super plasticizer (PCES) is an admixture with specific gravity 1.08. With a low dosage (0.3-1.5% by cement weight) they allow water reduction up to 40%.

M30 grade with nominal mix as p**Nagaswaram Roopa.Et.al.(March2017)** Experimentally Studied The Light weight concrete by partial replacement of cement and fine aggregate with fly ash and thermocol.

This project involves the replacement of cement by BCS (Black cotton soil) and fine aggregate with fly ash and thermocol to produce light weight concrete. The fine aggregate, coarse aggregate and fly ash have specific gravity 2.614, 2.88 and 2.3. OPC of grade 43 was used.

Three types of mixes are prepared. The first mix contained 100% OPC, 100% sand and 100% coarse aggregate. The second trial mix contained 65% of cement, 35% of fly ash, 99.8% of sand, 0.2% of thermocol and 100% of coarse aggregate. The third trial mix contained 60% of cement,40% of fly ash, 99.7% of sand, 0.3% thermocol and 100% of coarse aggregate.

Gowthama prasanth.U.Et.al (2016) Experimentally Investigated on floating slab with Incorporated Pumice stone and Vermiculite.

This project deals with the concrete precast slab with addition of vermiculite and pumice. Here the Buoyancy plays major role. Materials used are OPC-53 grade, fly ash, sand, vermiculite, pumice stone, admixtures(steel fiber, aluminium powder), super plasticizers, thermocol, reinforcement(bamboo stick, chicken). In the compressive strength test, they made cubes of size 150mm x 150mm x 150mm.

Kamleshsaini,Et.al,(2016) Experimentally studied The Effect on strength properties of concrete by using waste wood powder as partial replacement of cement .The main aim of the experiment conducted is to replace cement with an eco-friendly and economical material waste wood powder from wood factories or

industries and to retain the concrete strength. But, there are some changes in workability, compressive strength and elongation index. Objective – utilization of waste materials and to reduce carbon footprints. The resulted concrete has a density of 1490 kg/m^2. The wooden dust is replaced in varying proportions (0%, 5%, 10%, 15% and 20%) in place of sand. The compressive strength of wood mixed concrete achieved earlier in case of every stage of increase in percentage of wood powder meanwhile the concrete blocks of standard mix achieve compressive strength is seen to be achieved low.

EXPERIMENTL INVESTICTION

The present day world is witnessing construction of very challenging and difficult civil engineering structures. Researches all over the world are attempting to develop low density or light weight concrete by using different admixtures in concrete up to certain proportions. This study deals with the development of floating concrete using light weight aggregate. Here, we are performing different trials to make concrete float. Such concrete can be used to built floating restaurantsand can reduce the usage of high cost fibers that are used for similar purposes. Trials are conducted using different materials for replacement of coarse and fine aggregate in concrete and finally after few trails hollow sections are made using polypropylene balls. The properties of the materials used are

CEMENT

The Bureau of Indian Standards (BIS) has classified OPC in three different grades. The mainly based on the compressive strength composed of 1part of cement to 3 parts of standard sand by weight with a water cement ratio arrived at by a specified procedure. The grades are 33grade, 43 grade, 53 grade. The grade number indicates the minimum compressive strength of cement sand mortar in N/mm^2 at 28 days, as tested by above mentioned procedure .In this project, Ordinary Portland Cement of 53 grade is used.

FINE AGGREGATE

Aggregate which passed through 4.75mm IS Sieve and retained on 75micron IS Sieve is termed as fine aggregate. Fine aggregate is added to concrete to assist workability and to bring uniformity in mixture. Usually, the natural river sand is used as a fine aggregate. Ordinary river sand confirming IS 383-1970 is used in this project

HICE HUSK ASH

During milling of paddy about 78% of weight is received as rice, broken rice and bran. Rest 22% of the weight of paddy is received as husk. This husk is used as fuel in the rice mills to generate steam for the boiling process. This husk contains about 75% organic volatile matter and the balance 25% of the weight of this husk is converted into ash during the firing process.

Rice husk ash

CHARCOAL

Charcoal, impure form of graphitic carbon, obtained as a residue when carbonaceous material is partially burned, or heated with limited access of air. Coke, carbon black, and soot may be regarded as forms of charcoal; otherforms often are designated by the name of the materials, such as wood, blood, bone, and so on, from which they are derived.

Coconut Charcoal

COARSE AGGREGAT

The coarse aggregate for the works should be river gravel or crushed stone. Angular shape aggregate of size is 20mm. The aggregate which passed through 75mm sieve and retain on 4.75mm are known as coarse aggregate.

It should be hard, strong, dense, durable, clean and free from clay or loamy admixtures or quarry refuse or vegetable matter. The pieces of aggregates should be cubical, or rounded shaped and should have granular or crystalline or smooth non powdery surfaces. Aggregate should be properly screened and if necessary washed clean before use. Coarse aggregates containing flat, elongated or flaky pieces or mica should be rejected. The grading of coarse aggregates should

be as per specifications of IS 383-1970. In this project 20mm aggregate are used.

WOOD

Wood is a porous and fibrous structural tissue found in the stems and roots of trees and other woody plants. It is an organic material, a natural composite of cellulose fibers that are strong in tension and embedded ina matrix of that resists compression. Wood is sometimes defined as only the secondary xylem in the stems of trees, or it is defined more broadly to include the same type of tissue elsewhere such as in the roots of trees or shrubs. In a living treeit performs a support function, enabling woody plants to grow large or to stand up by themselves.

PUMICE STONE

Pumice, called pumicite in its powdered or dust form, is a volcanic rock that consists of highly vesicular rough textured volcanic glass, which may or may not contain crystals. It is typically light colored. Scoria is another vesicular volcanic rock that differs from pumice in having larger vesicles, thicker vesicle walls and being dark colored and denser.

pumice stone

THERMOCOL

Thermocol is a commercial name like Coca-Cola. In 1951 the researchers of a German company named BASF successfully restructured chemical bonding of polystyrene (a synthetic petroleum product) molecules and developed a substance named stretch polystyrene. This substance was named Thermocol, whichnowadays is manufactured through a simple process. Thermoplastic granules are expanded through application of steam and air. Expanded granules become much larger in size but remain very light. Thermocol is a good resister of cold and heat but since it is a petroleum product it dissolves in any solvent of petroleum.

WATER

The water should be fit for mixing. The water should not have high concentrations of sodium and potassium and there is a danger of alkali aggregate reaction. Natural water are slightly acidic are harmless but water containing humic or other organic acids may adversely affect the hardening of concrete. Such water as well as highly alkaline water should be tested

PRELIMINARY TEST

CEMENT

SI.NO	PROPERTIES	CEMENT
1	Fineness	2%
2	Normal consistency	31%
3	Specific gravity	3.15

FINE AGGREGATE

SI.NO	PROPERTIES	F.A
1	Fineness modulus	4.9
2	Water absorption	0.8%
3	Specific gravity	2.4

COARSE AGGREGATE

SI.NO	PROPERTIES	C.A
1	Moisture content	0.25%
2	Water absorption	0.4%
3	Specific gravity	2.867

MIX RATIO FOR M20

Cement =0.546m^3

Coarse aggregate =1.373m^3

Fine aggregate =0.943m^3

Mixratio =1:1.67:2.43

TRIAL MIX 1

Sand is used as fine aggregate and wood of 20mm size is used as coarse aggregate .The materials were mixed by volume batching. The slab is casted and allowed to harden. After hardening for 24 hours it is allowed to float in water. The materials were mixed by volume batching. A slab of size 400mm x400mm and depth 45mm was prepared and allowed to harden. After hardening, the slab was allowed to float in water.

Casting of cement and wood pieces

TRIAL MIX 2

Rice husk ash is used as fine aggregate and wood as coarse aggregate. Rice husk ash is replaced in place of sand to reduce weight .Trial mix was prepared as permix ratio using the above materials by volume batching. A slab of size 400 mm x 400 mm and depth 45mm is prepared and after hardening the slab is allowed to float in water.

TRIAL MIX 3

Pumice stone is taken as coarse aggregate and rise husk ash was used as fine aggregate .Mix was prepared as per mix ratio .The slab is made .After 24hrs, the slab is allowed to float and determine its nature. The weight of slab has been compared with weight of nominal mix.

TRIAL MIX 4

Thermocol is used as coarse aggregate and rise husk ash is used as fine aggregate. This prepared by volume batching. A slab is made here glass fibers (1%) is used to increase the bond strength.

After hardening, the slab is allowed to float. The immersion depth is noted and compare the weight with the nominal mix .After hardening, the slab is allowed to float.

Mixing of Thermocol, Cement and Rice husk ash

RESULT AND DISCUSSION

In first trial the weight of the slab was found to be 4.22 kg but due to high water absorption of wood drying shrinkage cracks are formed during hydration process. Because of the poor durability and water absorption of the wood this method is not applicable.

The Specimen Made With Wood Fails to Float in Water

In second trial the weight of slab was found to be 2.9 kg . Even though the specimen floats in water, rice husk ash absorbs more water and the bond between wood and mortar is very poor as it can be easily brokable with hands.

The Bond between Wood and rice husk ash is weak

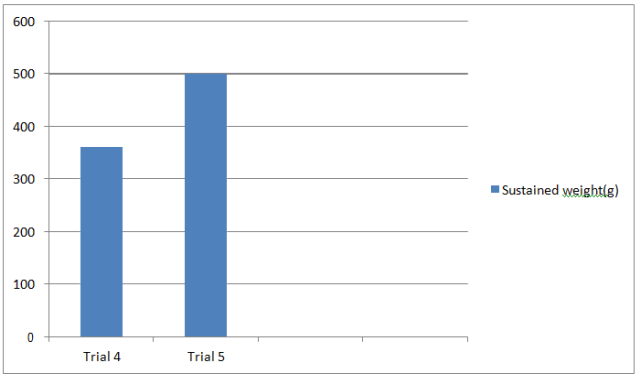
In the third trail the weight of slab was found to be 3.75 kg. The bond between Pumice stone and rice husk ash find to be strong but it absorbs more waterand the slab get immersed in water due to increase in weight.

The Slab Made With Pumice Stone Fails to Float in Water

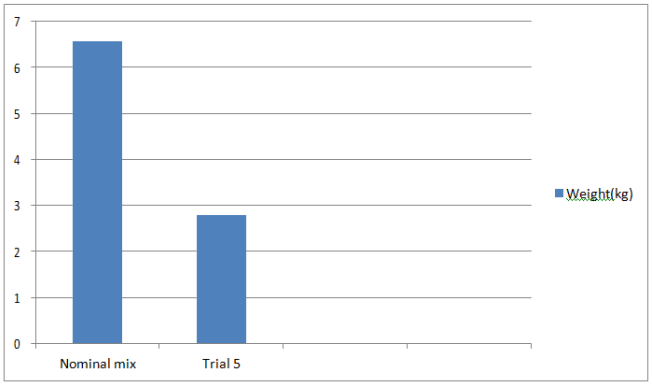
In the fourth trial the weight of slab was found to be 1.93 kg. The slab immersed to the depth of 2.2cm. It withstands weight up to 360g. Even though it floats and carries weight it absorbs more water and salling occurs by time.

The Slab madewith Thermocol floating in water

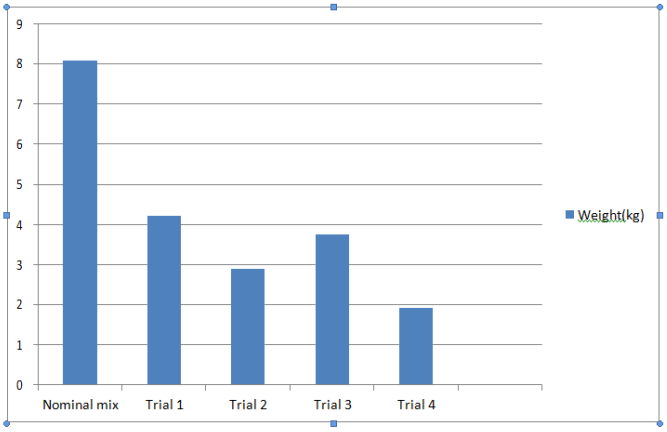
The Slab withstanding 1kg ofweight



Comparing the sustained weight



Comparing the Weight of Nominal Mix and Trial Mix



Comparing the Weight of Nominal Mix and Trial Mixes

CONCLUSIONS

The trial five in which the Hollow slabs made of cement charcoal mortar and polypropylene balls float with less immersion and shows low water absorbing property. It also carry 500grams of weight per 30 square centimeter of area. Charcoal beingrich in carbon adds strength and absorbs less water.

From the experimental study, this method of producing floating concrete can be more promising in coming years and also very useful for constructing marine structures. Instead of using land area this method allows us to construct structures in water logged areas and even in artificially created backwaters.

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