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FLOATING CONCRETE FOR LARGE WORK BOAT

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Abstract— Light weight concrete has a dry density lower than 1000kg/m3 which help the concrete to float on the surface of water. They are future of the construction because of its high thermal insulation, environment friendly behaviour, earthquake resistance, fire resistance to name a few. Compressive strength of this type of cube is in range from 35 to 45kg which is excellent considering its cost effectiveness.

Keywords—Light weight concrete, polystyrene beads, Plaster of Paris, Aluminium Power, Pumice Stone, Canvas Sheets.

I. INTRODUCTION

The most common material used in of maritime, marine and water structure is wood & steel.Wood on one hand has light weight and can float but has strength issue and longevity beside that wood can get attacked by pest. Steel on other hand get corroded and is difficult to use any floating material.

Due to Breakdown of these structures, the transportation of Goods become difficult & Bridge can be way too costly and difficult to construct, So the construction of Large Work Boat is both Cost effective and Durable Solution

II. LITERATURE REVIEW

1. Partial replacement of coarse aggregates by eps beads in concrete. (Thomas tamut, rajendra prabhu, kata venkataramana, suhash c yaragal)

Abstract : Needs for the construction materials are increasing haphazardly on daily bases due to infrastructure development. In order to compete this demand alternative material has been searched to meet the demand Like EPS beads and pumice stones. EPS beads are replaced coarse aggregates and have been checked for its compressive strength and tensile strength with different proportion of EPS beads with normal concrete. The strength of the materials is checked after 7, 14 and 28 days.

2. The possibility of produce self-compacted polystyrene concrete (Manolia abed l-wahab Ali)

Abstract: In this research paper they have to use expanded polystyrene beads in the replacement of fine and coarse aggregates, sand, super plasticizers and binding modifying agent. Also the Technical properties are tested to make concrete a self-compacted polystyrene concrete. It also stated that as EPS increases, beads strength has been decreasing and by decreasing EPS beads strength is increasing.

3. Polystyrene aggregates concrete (S.G park and D.H. Chisholm)

Abstract: This Article included study of concrete using expanded polystyrene beads instead of coarse and fine aggregates as per needs. There was different type of density of concrete are tested with fly ash and without fly ash. This study also optimize about the segregation of polystyrene beads, low compressive strength and maximum drying shrinkages. Thermal conductivity is partially proportional to weight of concrete. Increasing use of fly ash reduced demand of water.

4. Mechanical properties of polystyrene lightweight concrete (Zaher Kuhail and Samir Shihada)

Abstract: In this study, various factor affecting compressive strength of light weight concrete such as w/c ratio, cement proportion, curing time, compaction, fire resistance, polystyrene cement ratio and admixtures are studied. Further the mix design of polystyrene lightweight concrete is studied.

5. Properties of hardened concrete containing treated expanded polystyrene beads (R.sri ravindrarajah & a.j.Tuck. School of civil engineering, university of technology, Sydney, New South Wales, Australia)

Abstract: In this study, a properties of light weight concrete is studied including chemically treated polystyrene beads or EPS beads. The results shows technical properties and capability of hardened concrete which are affected by w/c ratio. Drying shrinkage is tested after 90 days of 12 mm aggregates and nominal density of 1220 kg/m3, 736 and 655 microns. Empirical formulae was developed to know the strength and modulus of elasticity of particular matter.

After referring the above literatures we came to know that the expanded polystyrene beads can be used as floating lightweight concrete material along with aluminium, lime and other construction materials.

III. MATERIAL USED

The study uses different materials and tools which can be used in project as well as their appropriate properties along with details. Also details about the special materials like pumice stones, aluminium, lime, for the floating lightweight concrete

Cement : A Cement is a binding material, a substance that sets & hardens & can bind strongly other materials with each other. That cement word taken from the Romans who used the term 'opus caementicium' to describe masonry resembling modern concrete that was made from crushed rock and burnt lime as binder. The volcanic ash & pulverized bricks supplements that were added to the burnt lime, to obtain a binder, were later referred to as cement.

Portland Pozzolanic Cement:

This is a kind of Blended Cement which is produced by either mixture of OPC along with gypsum and pozzolanic materials in some needed proportions or grinding the OPC, gypsum and pozzolanic materials separately and thoroughly blending them in as per needs.

Pozzolanic cement is a natural or in some case artificial material consist of silica in a reactive form. It may be further said to be siliceous and aluminous material which in itself possesses little, or no cementitious properties but will in greatly divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperature to form compounds possessing cement properties. It is essential that pozzolana be in a greatly divided state as silica can combine with calcium hydroxide in the presence of water to form stable calcium silicates which have cement type properties.

Figure 1: Pozzolanic Portland cement

The Concrete made using PPC is more impermeable & denser than made using OPC. The strength attained after 90 days in PPC is better than OPC. The pozzolanic material reacts with calcium hydroxide and by the hydrating Portland cement & forms cementitious compounds generally known as C-S-H gel.

Fine Aggregates (Sand): Fine aggregate is an accumulation of grains of minerals derived from the disintegration and deformation of rocks. It is distinguished from gravel only by the size of the grains or particles, but is distinct from clays which contain organic materials.

Figure 2: Fine Aggregate (Sand)

The fine aggregate passing through 4.75mm sieve having has specific gravity of 2.68. The grading zone of fine aggregate was zone-3 as per Indian Standard specifications. Sand is mixed with masonry cement or PPC and lime to be used in masonry construction. Sand is often a principal component of this construction area.

Fly Ash: Fly ash, also known as flue-ash, it is the residues generated in combustion, and comprises the finer particles that rise along with the flue gases. Ash which does not rise & remains at bottom is called bottom ash. In an industrial context, fly ash is usually referred to ash produced during combustion of coal. Fly ash, also known as "flue ash" in the United Kingdom, is one of the residues generated by coal combustion, and is composed of the fine particles that are driven out of the boiler with the flue gases. Ash that falls in the bottom of the boiler is called bottom ash. The use of fly ash in RCC construction has been successful in reducing heat generation without loss of its compressive strength,

increasing ultimate strength beyond 180 days, and in additional it fines for compaction.Replacement levels of primary class fly ash have ranged from 30-70% by solid volume of cementations materials.

Figure 3: Fly Ash

TABLE 1: Specifications of Fly Ash

1	Fineness specific surface by Blaine's permeability method	
2	ROS 45 micron sieve (max)	18
3	Loss on ignition	2.5
4	Water requirement	95%
5	Moisture context (max)	0.5
6	Soundness by autoclave (max)	0.1%
7	Compressive strength at 28 days of plain cement mortar(min)	85%
8	Lime reactivity (min)	5
	CHEMICAL ANALYSIS	
1	1 Sio2 + Al2o3+ Fe2o3	90min
2	2 Sio2	50min
3	3 Cao	5max
4	4 Mgo	4max
5	5 SO3	2max
6	6 Na2O	1.5max

Polystyrene Beads: Expanded polystyrene is a lightweight cellular plastics material consisting of fine spherical shaped particles which are comprised of about 98% air and 2% polystyrene. It has a closed cell structure and cannot absorb water. Therefore, it has good sound and thermal insulation characteristics as well as impact resistance. While most common size is 1 to 3mm in diameter. In addition, extruded foam has a simple, more regular structure than moulded bead foam, as well as a better strength properties and higher water resistance.

Figure 4: Polystyrene Beads

EPS is a lightweight cellular plastics material consisting of small spherical shaped particles containing about 98% air. This microcellular closed cell construction provides EPS with excellent insulating and shock absorbing capabilities it is produced in a wide range of densities providing a varying range of physical properties. These are matched to the various applications where the material is used to optimize its performance. EPS is widely used in many everyday situations where its light weight, strength, thermal insulation and shock absorption characteristics provide economic, high performance products.

TABLE 2: Physical Properties of EPS

Physical Properties	Unit	SL	S	M	H	VH
Compressive Strength at 10% deformation	KPa	72	87	108	138	168
Cross breaking strength	KPa	138	168	208	268	328
Rate of water vapor transmission	Mg/m^2s	638	588	528	468	408
Dimensional stability of length, width, thickness	%	1.1	1.1	1.1	1.1	1.1
Thermal Resistance	$M^2.k$	1.1	1.1	1.2	1.2	1.2
(min) at a mean temperature of 302K	W	4	8	1	6	9
Median flame duration	S	1	2.1	2.1	2.1	2.1
Eight value(max)	S	3.1	3.1	3.1	3.1	3.1
Median volume retained	%	19	23	31	41	51
Eight value(min)	%	16	18	28	38	48

Plaster of Paris: Plaster of Paris is a powder that forms a paste when mixed with water and then thickens and hardens. An example of plaster of Paris is one of the materials used to create a cast for a broken arm as well as in construction work with lime and cement. Calcium sulphate with half of water per molecule of the salt is called plaster of paris.Plaster of Paris is prepared by heating gypsum at 493 K, where it gets half dehydrated. The temperature should be kept below 140°C because further dehydration will take place and the setting property of the plaster will be reduced haphazardly. Mainly used in surgery for setting broken or fractured bones, for making casts for statues, in dentistry, for surgical instruments, and toys, In making black board chalks, and statues, In construction industry.

Figure 5: Plaster of Paris

POP is light and more durable. POP is having low thermal conductivity. POP is very good fire resistant which makes it very good heat insulating material. POP does not shrink while setting so it does not develop cracks on heating or setting. POP forms a thick surface to resist normal knocks after drying. POP mixes up easily with water and is easy to spread and maintain. POP has good adhesion on materials like fibre. POP gives a firm surface on which the colour can placed. POP has no appreciable chemical action on paint and does not cause alkali attack. POP gives a decorative interior finish. Its gypsum content provides it a lot of shine and smoothness. POP can easily be moulded into any shape.
Gypsum plaster is not suitable for exterior finish as slightly soluble in water. It is more expensive than cement and lime plaster. It cannot be used in moist situations as reacts with air. Skilled labour is required for application which increases cost of labour 3.2.6 Aluminium Powder: Aluminium powder is powdered form of aluminium. This was originally produced by mechanical means using mechanical equipment and machines. It reacts with lime and forming bubbles while making aerated concrete. When the aluminium powder is added to slurry of lime, hydrogen is produced in the form of bubbles. Thick slurry is made with lime/cement including aggregates with it. Aluminium powder is added in the final stage of mixing. The mix is poured into moulds. The moulds are autoclaved which imparts strength. AAC is produced using no aggregate larger than sand.

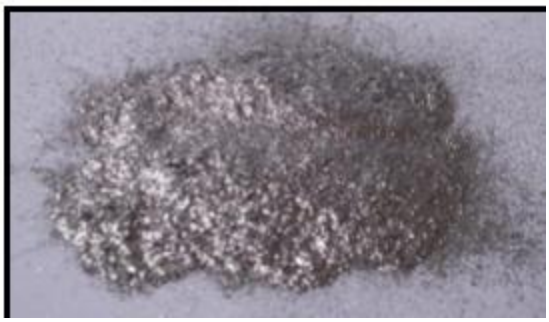

Figure 6: Aluminium Powder

Lime: In the search by architects and conservators for building materials sympathetic to traditional construction, lime was found to be one of the most important. One of the reasons lime binders are promoted by the Society for the Protection of Ancient Buildings for repairs is because they are vapour permeable and allow buildings rescue in any seasons. This reduces the risk of trapped moisture and consequent damage to the building fabric materials. Porous and open textured materials such as lime plasters, help to stabilize the internal humidity of a building by absorbing and releasing moisture. This makes for a more comfortable environment and reduces surface condensation and mould growth. Lime putty, Lime mortar, Lime wash can be used as different forms. Lime plasters are known for being very slow-drying, which allows them to gain strength over a few days, rather than setting very quickly. This can allow the lime plaster to be re-worked if necessary.

Figure 7: Lime

Pumice Stones:

The word ‘Pumice’ is a general term used for a range of porous materials produced during volcanic. Pumice stone can be weak and porous or strong and less porous. Its water absorption is as high as 55% since it is a highly porous material. The major reason behind using pumice as an aggregate is its much light weight and comparatively high strength. Light, spongy, highly porous kind of lava with a vitreous texture. Pumice has high silica & alkali and low calcium & magnesia content. Its spongy cellular texture is a result of the gases escaping from hot lava. It is having low strength and it is a good thermal insulator, sound insulator and fire insulator.

Figure 8: Pumice Stone

Pumice has a number of characteristics that combine to make it a valuable and unique substance in a variety of industrial processes and products. Pumice is amorphous and generally inert, has a neutral pH, so is hard enough to be used as an abrasive. Because of its porous nature, pumice is so light in weight. The friable nature of pumice is one of its most significant characteristics, meaning pumice is easily crushed and refined without losing its utility, at any grade from half inch aggregate to powder, pumice remains abrasive, absorbent, non-compacting, light weight. Sustainable and abundant, pumice is indispensable. Grouped by attribute, the following is a breakdown of where and how pumice is used.

Water: Potable water as mixing agent in construction is taken out. The common specifications regarding quality of mixing water is water should be fit for drinking. Such water should have inorganic solid less than 1000 ppm. This content lead to a solid quantity 0.05% of mass of cement when ratio of w/c is provided 0.5. But some water which are not potable may be used in making concrete with any significant effect. Dark colour or bad odour water may be used if they do not possess deleterious substances. PH of water to even 9 is allowed if it not tastes brackish. In coastal areas where local water is saline and have no alternate sources, the chloride concentration up to 1000 ppm is even allowed for drinking. But this excessive amount of alkali carbonates and bicarbonates, in some natural mineral water, may cause alkali-silica reaction. Determination of suitability of water is a simple way by compare the setting time of cement and strength of mortar cubes using the water in question with corresponding results obtained using known water. About 10% tolerance is generally allowed. Chemical properties like acidity and alkalinity, algae, sea water, chloride, etc also affect.

TABLE 3: Water Chemical Properties

Quality Parameters	Maximum Limit (ppm)
Chlorides	500
SO3	1000
Alkali Carbonates And Bicarbonates	1000
Turbidity	2000

Soluble Oil: Widely used in construction industry, the offered oils prevent any kind of adhesion to cement. Provided oils are processed under the stern supervision of our experts using quality tested chemical compounds and the latest methodology as per the set industry standards. It can be directly used in concrete and cement and ensures perfect texture and colour to concrete. It also Makes the cement more strong and protects from alkali.

IV. CANVAS BRIEFING, IMPLIMENTATION

Overview: This includes detailed study above the various canvas sheets and implementation over the project with the future scope and advantages of project. Photo copies of canvas sheets were also included

Implementation: At the start, we information were gathered about different types of lightweight materials which are used in concrete and present in the market. Looking over the density and strength which they provide for various mixed proportion with different contents we studied behaviour with various components. Visits through different companies and construction sites for searching of special materials like pumice stone and aluminium powder is obtained. For sample casting, we studied various research papers, and adopted the mixed design for trial purpose. And after the result of first casting we note the faults in the mixing methodology, ling of concrete mix design and then made the changes accordingly.

TABLE 4: **Designed Proportions**

Materials	Proportion
Sand	420 kg , 180 kg, 500 kg, 380 kg, 420 kg, 420 kg.
Cement	350 kg, 320 kg, 360 kg, 300 kg, 300 kg, 350 kg.
Fly Ash	180 kg, 80 kg, 0 kg, 80 kg, 100 kg, 150 kg.
EPS	7 kg, 3.5 kg, 0 kg, 3 kg, 3.5 kg, 3.5 kg.
Water	160 l, 128 l, 144 l, 120 l, 135 l, 175 l.
W/c	0.45, 0.40, 0.40, 0.40, 0.45, 0.50

Canvas Sheets:
Aeiou sheet:

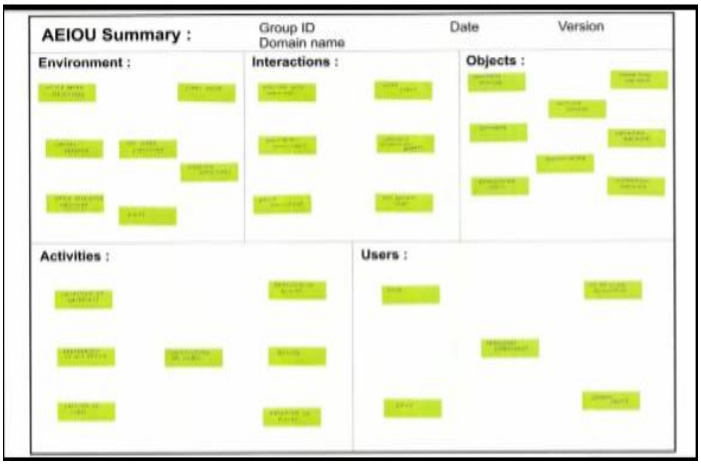

Figure 9: AEIOU Sheets

AEIOU Sheet Includes different sheets like Activities, Elements, Interaction, Objects, Users and those are included General impressions and observations in Activities. In Environment sheet, it includes style, materials and atmosphere about project. In Interaction sheet, it includes who interacting with whom and with what and why at the project time. In Objects sheet, Components which are under use is listed. In user sheet, who are responsible and what are their roles along with project is specified.

Empathy Summary Canvas:
This canvas sheet include AEIOU summary and the major problems which have been faced while project is executed along with their possible solution and implementation.

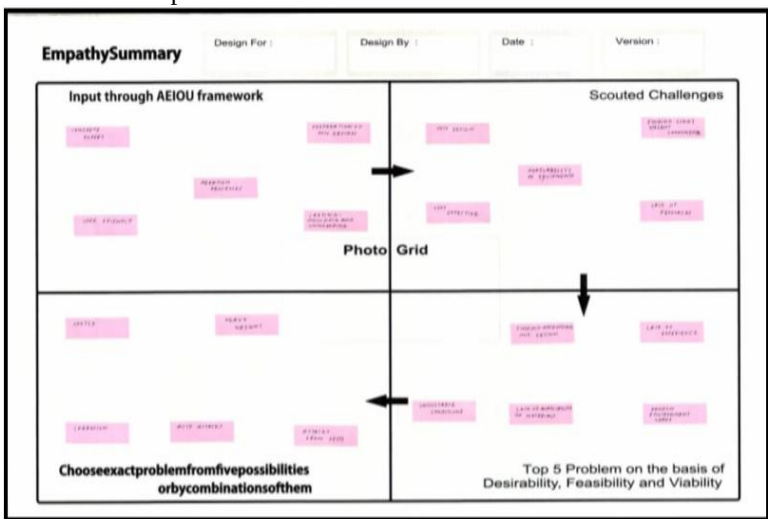

Figure 10: Empathy Summary Canvas

Ideation Canvas:
In Ideation Canvas, Peoples who are involved, Activities which performed, Situation, Location and Context With the possible solution is discussed**.**

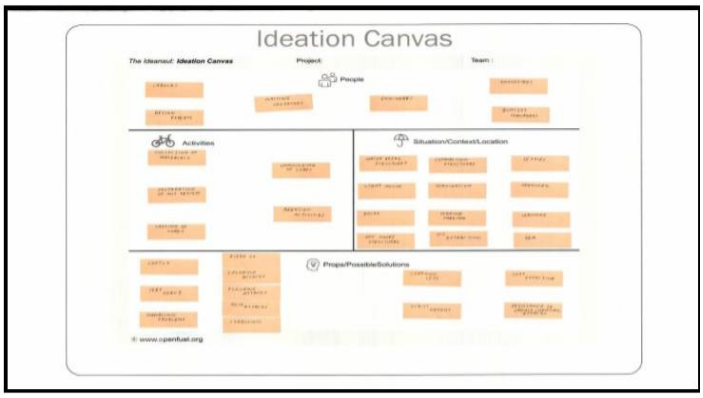

Figure 11: Ideation Canvas

Product Development Canvas:

In this canvas sheet, it included purpose of project, peoples which are involving in project, Product experience and function, Component of product, revalidation, and rejection and repairs if needed is stated.

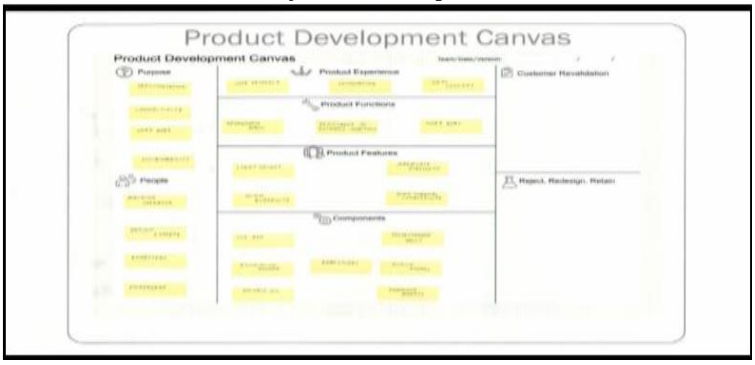

Figure 12: Product Development Canvas

V. CONCLUSIONS

Using lightweight concrete, the dead load of structure is reduced There is decrease in structural reinforcement with less mass requirement to support the additional weight. Lightweight concrete possesses higher resistance to earthquake shocks and thus can be used for earthquake resistance. It has the quality to absorb sound and thus is used for constructing sound proof buildings such as auditoriums, conference rooms; etc.It has an increased fire resistance quality as the thermal conductivity is low compared to regular concrete. Handling of lightweight concrete is very easy compared to regular concrete and it needed not to be cold, damped, dense and hard to work with. It has a variety of implications when comes to aesthetic improvements. Due to its lightweight the handling of the structure on site becomes easier than the conventional concrete. It is very economical compared to regular concrete. The construction of lightweight concrete is very simple and rapid. The nailing and sawing properties of lightweight concrete are far much better than the regular hard concrete. Floating capacity on water bodies with or without weight on it. Life span is impressive as concrete mixture is there and is up to 20 years Reconfiguration as porous in nature and can move easily because of light in weight. Safe and comfortable for users while using instead of wooden plank on rivers and lakes.

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