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LITREATURE REVIEW ON: FLOATING CONCRETE BY USING EXPANDED POLYSTYRENE BEADS

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Abstract: As there is increase in demand for construction materials, man has improved and discovered a lot in new construction techniques of structures. In earlier ages the structures are built with heavy ingredients, but in this modern era old techniques are being more costly due to heavy loading. So use of lightweight materials are started. The Expanded Polystyrene Beads are the material which substitutes in the place of coarse aggregate. This project deals with study of floating concrete using EPS Beads. Concrete will float if the density of concrete will be less than that of water.

Keywords: Floating concrete, Expanded Polystyrene (EPS) beads, Mix design, Construction, Density

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INTRODUCTION

EPS or expanded polystyrene is a rigid cellular plastic originally invented in Germany in 1950. It has been used in packaging solutions since 1958. It is 98% air but the rest is made from tiny, spherical EPS beads - themselves made only of carbon and hydrogen. [1]

Concrete is a composite material composed of fine and coarse aggregate bonded together with a fluid cement (cement paste) that hardens over time. Most concretes used are lime-based concretes such as Portland cement concrete or concretes made with other hydraulic cements,[12] such as calcium aluminate cements. However, asphalt concrete, [12] which is frequently used for road surfaces, is also a type of concrete, where the cement material is bitumen, and polymer concretes are sometimes used where the cementing material is a polymer. [3]

Normal concrete consists of – cement + sand + water+ (fine + coarse) aggregates + admixtures. Whereas in floating concrete we had used EPS beads as light weight aggregates to make the concrete light. [13], [14]

Nowadays enormous amount of waste polystyrene is produced in the world. This will ultimately cause pollution and is detrimental to the ecosystem.[14] National and international environmental conventions have become more inflexible increasingly which have made it expensive to dispose. Therefore using leftover polystyrene in concrete production not only solves the problem of disposing this ultra-light solid waste but also helps preserve natural resources. From this eps we can make floating concrete which is light in weight.



Fig-1 floating concrete

I. Literature review

1) ROSHAN GAWALE

LIGHT WEIGHT COCRETE BY USING EPS BEADS. March 2016

They had concluded that the lightweight concrete using EPS beads has a desirable strength to be an alternative construction material for the construction of partition wall, foot path, parapet wall, bed concrete. The strength of light weight concrete using EPS beads are low for lower

density mixture. This resulted in increment of voids throughout the sample caused by the Air entraining admixture. Thus the decrease in compressive strength of the concrete.[1]

2) Er. ARVIND SINGH GAUR
LIGHT WEIGHT CONCRETE

In this they had concluded the lightweight concrete prepared with thermocol beans has a desirable strength to be an alternative construction material for construction partition walls. The strength of aerated lightweight concrete is little higher. This resulted in the increment of voids throughout the sample caused by the foam.[7]

3) JAYDEEP SINGH
LIGHT WEIGHT CONCRETE USING EPS

In this they had concluded the results of an experimental investigation into the engineering properties, such as compressive strength, modulus of elasticity, drying shrinkage and creep, of polystyrene aggregate concrete varying in density. [8]

4) B.A. HERKI
LIGHTWEIGHT CONCRETE MADE FROM WASTE POLYSTYRENE AND FLY ASH. 21/09/2013

In this they had concluded that there is a tendency for the compressive strength and UPV to decrease when natural sand and Portland cement are replaced with the increasing amounts of Stabilised Polystyrene (SPS) aggregate and fly ash, respectively. The level of decrease depends upon the replacement level of SPS aggregate and FA. However, adequate strength can be achieved using an appropriate replacement level of SPS aggregate and FA.[9]

5) ABHIJIT MANDLIK
LIGHTWEIGHT CONCRETE USING EPS

In this they had concluded that Increase in the EPS beads content in concrete mixes reduces the compressive and tensile strength of concrete. All the EPS concrete without any special bonding agent show good workability and could easily be compacted and finished. The replacement by using EPS has shown a positive application as an alternate material in building non-structural members, and it also serves as a solution for EPS disposal.[10]

6) NAGASWARAM ROOPA
EXPERIMENTAL STUDY ON LIGHT WEIGHT CONCRETE BY PARTIAL REPLACEMENT OF CEMENT AND FINE AGGREGATE WITH FLY ASH AND THERMOCOL

In this they had concluded that the workability of concrete in terms of slump cone and compaction factor shows that Compaction factor changes slightly with increasing fly ash, Thermocol replacement and the slump cone also changes with the % increase in the replacement of fly ash, Thermocol content and the values falls within the value for normal range of concrete. For 28 days of curing period, it is observed that the strength of

Concrete at partial replacement of fly ash and Thermocol is increased compared to normal cubes. It is for the proportion of 35% fly ash and 0.2% Thermocol. [11]

II. Advantages

Rapid and relatively simple construction. Economical in terms of transportation as well as reduction in man power. Significant reduction of overall weight results in saving structural frames, footing or piles. Mixing time is longer than conventional concrete to assure proper mixing. Most of light weight concrete have better nailing and sawing properties than heavier and stronger and conventional concrete. [7]

III. Disadvantages

Very sensitive with water content in the mixtures. Difficult to place and finish because of the porosity and angularity of the aggregate. In some mixes the cement mortar may separate the aggregate and float towards the surface. [7]

IV. Materials used in floating concrete

a) Cement

A cement is a binder, a substance used for construction that sets, hardens and adheres to other materials, binding them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together. Cement is used with fine aggregate to produce mortar for masonry, or with sand and gravel aggregates to produce concrete.



Fig-2 cement (Source: Heidelberg cement <http://www.heidelbergcement.com/en/cement>)

Cements used in construction are usually inorganic, often lime or calcium silicate based, and can be characterized as being either hydraulic or non-hydraulic depending upon the ability of the cement to set in the presence of water. [3]

b) Expanded polystyrene beads

Polystyrene is a versatile plastic used to make a wide variety of consumer products. As a hard, solid plastic, it is often used in products that require clarity, such as food packaging and laboratory ware.



Fig-3 eps beads (Source: hw manufacturing <http://hwmfg.ca/aboutUs.html>)

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c) Sand:

Sand is a naturally occurring granular material composed of finely divided rock and mineral particles. It is defined by size, being finer than gravel and coarser than silt. Sand can also refer to a textural class of soil or soil type; i.e., a soil containing more than 85 percent sand-sized particles by mass.

The composition of sand varies, depending on the local rock sources and conditions, but the most common constituent of sand in inland continental settings and non-tropical coastal settings is silica (silicon dioxide, or SiO_2), usually in the form of quartz.



Fig-4 sand (Source: stroy product <http://stroyproduct.com.ua/stroitelnye-materialy/pesok-karernyj/mytyj-pesok/>)

Sand is a non-renewable resource over human timescales, and sand suitable for making concrete is in high demand. [3]

d) Water:

Water is a transparent and nearly colourless chemical substance that is the main constituent of Earth's streams, lakes, and oceans, and the fluids of most living organisms. Its chemical formula

is H_2O , meaning that each of its molecules contains one oxygen and two hydrogen atoms that are connected by covalent bonds. Strictly speaking, water refers to the liquid state of a substance that prevails at standard ambient temperature and pressure; but it often refers also to its solid state (ice) or its gaseous state (steam or water vapour). It also occurs in nature as snow, glaciers, ice packs and icebergs, clouds, fog, dew, aquifers, and atmospheric humidity. [3]



Fig-5 water (Source: phys orgs <https://phys.org/news/2016-12-scientists-state.html>:)

Concrete is produced by mixing binding materials and inert materials with water. Thus, water and its quality (and also its quantity) plays an important role in determining the quality of concrete... Ultimately, by chemically reacting with cement, water helps to produce the desired properties of the concrete.

V. CONCLUSION

From this we have concluded that, EPS beads can be used as an alternative light weight aggregate in manufacturing of concrete and reduces concrete's density. Making of light weight concrete by using EPS beads makes its density lesser than that of water which makes it float. The replacement of coarse aggregates by using EPS beads has shown a positive application as an alternate material in building non-structural members, and it also serves as a solution for EPS disposal. Decreasing the density of concrete also reduces the strength of concrete.

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