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PARTIAL REPLACEMENT OF COURSE AGGREGATE BY Expanded POLYSTYRENE BEADS IN CONCRETE

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Abstract:
Modern world emerges with new techniques in construction field. Concrete technology has made tremendous strides in the past decade. The development in specifying a concrete according to its performance requirements, rather than its constituents and ingredients has opened innumerable opportunities for both producers and users of concrete to design concrete catering to their specific requirements. One of the most outstanding advances in the concrete technology over the last decade has been "Lightweight Concrete" (LWC). Now a day's concrete plays a major role in construction industry. Availability of construction material is less day by day. So we can introduce a new kind of material in construction industry to reduce the cost as well as user friendly material. The main objective of the project, by using the available waste material to introduced in concrete industry. Fully replacement of concrete is not possible, so we can made an attempt to develop partial replacement of concrete material. In the last few decades there has been rapid increase in the waste materials and by-products. Some of the industrial by-products like GGBS, fly ash, copper slag, steel slag, Expanded polystyrene (EPS) have been successfully replaced for cement and concrete in the construction industry. It reduces the consumption of natural resources. Steel slag is one of the materials that is considered as a by-product (waste material) obtained during the matte smelting and refining of copper. It has the physical properties similar to the fine aggregate, so it can be used as a replacement for fine aggregate in concrete. Likewise replacement of coarse aggregate is done by some materials, which makes the concrete light weight. This work shows the results of an experimental study on various workability and durability tests on concrete containing Polystyrene as a replacement of coarse aggregate such as compressive test, split tensile test and flexural strength. For this research work M20 grade are used and the tests are conducted for various proportions of Polystyrene with coarse aggregate 2.5%, 5%, 7.5%, 10%, 12.5%, 15%, 17.5%, 20%, 22.5% & 25%. The obtained results were compared with those of conventional concrete.

INTRODUCTION:

General

Concrete is a most commonly used building material which is a mixture of cement, sand, coarse aggregate and water. It is used for construction of multi-storey buildings, dams, road pavement, tanks, offshore structures, canal lining. The method of selecting appropriate ingredients of concrete and determining their relative amount with the intention of producing a concrete of the necessary strength durability and workability as efficiently as possible is termed the concrete mix design. The compressive strength of harden concrete is commonly considered to be an index of its extra properties depends upon a lot of factors

e.g. worth and amount of cement water and aggregates batching and mixing placing compaction and curing. The cost of concrete prepared by the cost of materials plant and labour the variation in the cost of material begin from the information that the cement is numerous times costly than the aggregates thus the intent is to produce a mix as feasible from the practical point of view the rich mixes may lead to high shrinkage and crack in the structural concrete and to development of high heat of hydration is mass concrete which may cause cracking. The genuine cost of concrete is related to cost of materials essential for produce a minimum mean strength called characteristic strength that is specific by designer of the structures. This depends on the quality control measures but there is no doubt that quality control add to the cost of concrete. The level of quality control is often an inexpensive cooperation and depends on the size and type of job nowadays engineers and scientists are trying to enhance the strength of concrete by adding the several other economical and waste material as a partial substitute of coarse aggregates and cement or as a admixture fly ash, Glass Powder, steel slag, stone dust, EPS etc are the few examples of these types of materials. These materials are generally by-product from further industries for example fly ash is a waste product from power plants and a by-product resulting from decrease of high purity quartz by coal or coke and wood chips in an electric arc furnace during production of silicon metal or ferrosilicon alloys but nowadays Glass Powder is used in large amount because it enhances the property of concrete. 9 Increase in the developmental activities world over, the demand for construction materials is increasing continuously. This trend will have certainly greater impact on the economic system of any country. India is also aiming at a high developmental rate compared to other nations in Asia. There is heavy demand for the building materials in the domestic market, which is becoming scarce day by day. At this point researchers and engineers who have the foresight to keep the developmental activities abreast and curtail the cost factor should look out for other alternative building materials. Lightweight concrete can be prepared either by injecting air in its composition or it can be achieved by omitting the finer sizes of the aggregate or even replacing them by a hollow, cellular or porous aggregate. Particularly, lightweight concrete can be categorized into three groups:

- No-fines concrete.
- Lightweight aggregate concrete
- Aerated/Foamed concrete

OBJECTIVE:

To investigate the strength properties of EPS as replacement of coarse aggregates in concrete mix is a subject of interest to many researchers all over the world and EPS have been observed to improve the strength and durability properties of concrete. In the present work, the effect of addition of EPS on strength characteristics of concrete are investigated. The precise objectives of the study are follows-

- To determine the Workability of concrete with and without EPS in different proportions at different grade.
- To determine the Compressive Strength of concrete with and without EPS in different proportions at different grade.

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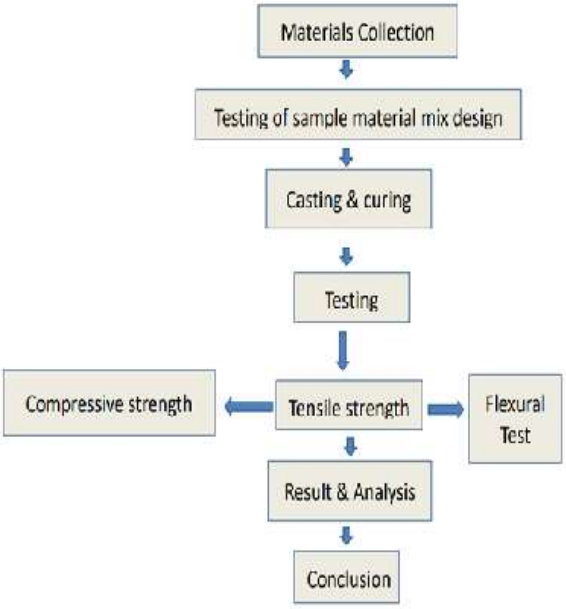
• To determine the Split Tensile Strength of concrete with and without EPS in different proportions at different grade.
• To determine the Flexural Strength of concrete with and without EPS in different proportions at different grade.

METHODOLOGY:

Flow chart:



SCOPE:

1.To evolve a light weight concrete which provides thermal and sound insulation and also aesthetically good appearance

2. To evolve a light weight concrete which can be used at various sections of a building.

3. The important objective of this investigation is to study the strength features of concrete containing different proportions of EPS beads and replacement to natural coarse aggregate, like compressive strength, tensile strengths and flexure test of light weight concrete comprising Expanded Polystyrene beads.

4. To know the essential properties of materials used as a part of the concrete and design the mix for conventional concrete

5. To determine the effect on partial replacement on EPS beads with variable percentage by weight of coarse aggregate, in properties of fresh concrete.

6. To determine the effect on partial replacement on EPS beads with variable percentage by weight of coarse aggregate, in properties of hardened concrete.

7. To study the durability properties of EPS concrete.

8. To know the behavior of EPS concrete on density compared to conventional concrete mixes.

Fig:-1.Cement

Fig:-2.Coarse Aggregate

CALCULATIONS

Quantities required for Conventional Concrete Cement Grade M25 [1:1:2] Cube Dimension = 0.15 x 0.15 x 0.15 Volume of Cylinder = 0.0053 Beam Dimension= 0.15 x 0.15 x 0.17

CUBE	CYLINDER	BEAM
Cement = 1.3967 x 12 = 16.7604kg Fine Aggregate = 4.33 x 12 = 51.96kg Coarse Aggregate = 4.630 x 12 = 55.56kg	Cement =2.994x12 =26.328kg Fine Aggregate = 6.808 x 12 =81.696kg Coarse Aggregate = 7.2434 x 12 =87.2808kg	Cement = 6.5245 x 12 =78.294kg Fine Aggregate = 20.2286 x 12 =242.7432kg Coarse Aggregate = 21.6112 x 12 =259.3344kg

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Quantities required for Polystyrene Beads Concrete

POLYSTYRENE BEADS (kg)	CUBE (kg)	CYLINDER (kg)	BEAM (kg)
6%	Polystyrene beads - 0.785 Cement - 4.33 Fine Aggregate - 13 Coarse Aggregate - 12.301	Polystyrene beads = 1.309 Cement - 6.909 Fine Aggregate - 23.424 Coarse Aggregate - 20.519	Polystyrene beads - 3.889 Cement - 20.2296 Fine Aggregate - 69.68 Coarse Aggregate - 60.914
8%	Polystyrene beads - 1.047 Cement - 4.33 Fine Aggregate - 13 Coarse Aggregate - 12.04	Polystyrene beads - 1.745 Cement - 6.808 Fine Aggregate - 20.424 Coarse Aggregate - 20.075	Polystyrene beads - 5.186 Cement - 20.2280 Fine Aggregate - 60.68 Coarse Aggregate - 59.64
10%	Polystyrene beads - 1.308 Cement - 4.33 Fine Aggregate - 13 Coarse Aggregate - 11.781	Polystyrene beads = 2.182 Cement - 6.909 Fine Aggregate - 26.424 Coarse Aggregate - 19.639	Polystyrene beads - 6.483 Cement - 20.2296 Fine Aggregate - 69.69 Coarse Aggregate - 58.347
12%	Polystyrene beads - 1.570 Cement - 4.33 Fine Aggregate - 13 Coarse Aggregate -	Polystyrene beads - 2.6184 Cement - 6.808 Fine Aggregate - 26.424 Coarse	Polystyrene beads - 7.779 Cement - 20.2280 Fine Aggregate - 60.68 Coarse Aggregate

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