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# INVESTIGATION OF EPS CONCRETE

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**Abstract -** *EPS concrete is useful for minimizing the dead load of structure and thus reducing the overall cost of the project. EPS beads can be used with the standard concrete making materials to produce lightweight polystyrene aggregate concrete, having a wide range of performance characteristics. It is as light as that its density is about hundredths of soil. As it is a lightweight concrete, its thermal conductivity is low so it has good thermal insulation property. There is a strong need to utilize alternative material for sustainable development. Expanded polystyrene beads are used as whole or partial replacement to coarse aggregate. This review paper is concentrated on the study of lightweight concrete containing expanded polystyrene beads as partial replacement to coarse aggregate.*

***Key Words***: EPS- Expanded Polystyrene, Hydrophobic admixture, Lightweight concrete

## 1. INTRODUCTION

In this study, EPS concrete have been investigated and a particular review on the application, mixture design of EPS concrete is discussed. In this study, the mechanical properties of concrete with EPS beads are tested.

It is a huge problem to decompose polystyrene, so through this research we have made an effort to examine the possibilities to utilize expanded polystyrene as a packing material in the form of beads in concrete. In this study an attempt is made to replace coarse aggregates by EPS beads wholly; cement by fly ash; and sand by quarry dust partially.

The application of EPS concrete for structural application is spreading rapidly. EPS concrete has substantially better fire resistance qualities than normal concrete. As it is a lightweight concrete, it has good scope in future to reduce the weight of structure.

## 2. LITERATURE REVIEW

Wenbow Shi, Linchang Miao et al, said EPS concrete is advantageous for small density, thermal insulation and good seismic performance. Their experiment is having EPS concrete of particles volume ratio ranging from 0% to 40%. To find out the effect of presence of an intrinsic particle content on compressive strength and durability of EPS concrete they worked on increasing the compressive strength and improving the workability of grout. They studied the influence of mixing ratio on the concrete compressive strength. Through there experiment they proved that EPS concrete has good durability from the durability test. It has very good use in practical which has seismic requirement and cyclic load.

Vishakh T. M, Dr. Vasudev R. discussed about the production and application of EPS along with environmental concern. They stated in this article Lightweight concrete is better fire resistant and less heat transmitted through it. It is cost saving and makes the structure more sustainable as it is durable and no plastering and cladding is required. They divided LWC into categories based on bulk density and compressive strength-

1. Thermo insulating light weight concrete
2. Low strength light weight concrete
3. Structural light weight concrete

Behnam Vakhshouri and Shami Nejadi studied the mixture design and all the mechanical properties of EPS concrete. They replaced coarse aggregate by EPS beads. They explained the mechanical properties like compressive strength, modulus of elasticity, modulus of rupture, and splitting tensile strength in tabular form. They explained mechanical properties by plotting stress strain curve in graphical presentation. They developed and compared the EPS concrete model with existing models in literature and concluded that mechanical properties are strongly dependent on concrete density. The lower the density of concrete, lower the compressive strength. They found out segregation is the crucial problem in mix design. Various chemical admixtures confirm the possibility to design EPS concrete with no mixing problem.

Ratnesh Ojha, Sumit Kumar Singh et al, studied the production of lightweight concrete using EPS beads. The

study covers the insulation property of EPS concrete and its applications. They estimated that the strength of EPS concrete increases slightly and durability of concrete is good. EPS beads makes concrete lighter than standard concrete. Their study gives an idea to use other waste material and check on it.

Pratichhya Pradhan and Sanjeev Maharjan studied on concrete bricks using expanded polystyrene and its cost estimation. They made samples of EPS concrete bricks and compared the cost of concrete bricks and normal bricks. As a result they found out hand mixing and hand compaction can also result satisfactory finishing. Their study suggest that cost of concrete bricks dependable on amount of cement and cost of EPS concrete bricks is reasonable than common brick.

Francesca tittaralli, Alessandra Mobili et al studied effect of recycled EPS beads in concrete. They compared properties of lightweight concrete manufactured with virgin or recycled EPS at same dosage. They investigated the effect of adding hydrophobic mixture in recycled EPS concrete to improve its durability. They replaced sand volume with virgin and recycled EPS with 33%, 66% and 100%. In this research, mechanical properties like mechanical strength, capillary water absorption, water vapour permeability and thermal conductivity are studied. As a result they found out the use of recycled EPS does not affect the workability, increases density, mechanical properties, capillary water absorption. Use of recycled EPS is economical.

It is possible to use fly ash in concrete. It is Suitable alternate material for construction industry. In this work standard aggregates were replaced by fly ash and author studied the strength and durability of fly ash concrete.

Lakshmi Kumar Minapu, et al. (2014), More environmental and economic benefits can be achieved if waste materials can be used to replace the fine lightweight aggregate. Natural aggregates and synthetic light weight aggregate are new sources of structural aggregate which is produced from environmental waste. The use of structural grade light weight concrete reduces the self weight and helps to construct larger precast units. In this study, an attempt has been made to study the Mechanical properties of structural grade light weight concrete using the light weight aggregate as a partial replacement to coarse aggregate and mineral admixture material like Fly Ash. The study is also extended for blending of concrete with different types of mineral admixtures.

## 3. MATERIALS USED

### 3.1 EPS beads

Polystyrene is a polymer of synthetic aromatic hydrocarbon made up of the monomer styrene. General purpose of polystyrene is clear, hard and rather brittle. Polystyrene is one of most widely used plastics.

Fig.1 EPS Beads

### 3.2 Cement

It was made with Ordinary Portland Cement of grade 53.

### 3.3 Fine Aggregates

The sand used is passing from 1.70mm sieve and retaining on 1.18mm sieve. Quarry dust is also used as a replacement of sand partially.

### 3.4 Admixture

As an admixture Aquaplast-N-10R a total plasticizing solution is used. It is a versatile economic liquid, normal plasticizing & net retarding admixture for concrete. It is normal plasticizer and retarder. It improves workable time by controlled retardation. It also improves compaction due to increased workability, without bleeding and segregation. It reduces shrinkage and lowers the permeability. It gives high ultimate strength without increasing cement content.

### 3.5 Fly Ash

To make the concrete more environment friendly fly ash is used as a partial replacement of cement.

## 4. MIXTURE DESIGN

In the EPS concrete the coarse aggregates are replaced wholly by EPS beads, cement is replaced by Fly ash and sand is replaced by quarry dust partially.

There is wide variety of mixture proportions to produce EPS concrete with different EPS volumes. EPS particles are hydrophobic in nature. During mixing process of EPS concrete it shows less workability and durability due to hydrophobic nature of EPS beads. EPS beads can cause segregation and inhomogeneity of EPS concrete in mixing process leading to decrease in the compressive strength. To improve workability and compressive strength sodium lignosulphonate based plasticizer was used. The mixing method would ensure the workability and homogeneousness of the EPS concrete.

## 5. COMPARISION BETWEEN COMMON BRICK AND EPS CONCRETE BLOCKS

1. The major difference between both the bricks is compressive strength. The resistance of concrete bricks against compression of loading is called compressive strength. Having seen that the material of clay brick and concrete brick are made it is clear that the concrete bricks have much more compressive strength.
2. Since concrete bricks are water resistant means nearly waterproof so are very beneficial for construction work.
3. The life span of concrete is lesser than clay brick. Concrete bricks works well for around 60-100 years, while clay bricks have been known to last for 1000 years and more.
4. By environmental prospective clay bricks are best because they are made up of natural resources and concrete bricks are not environment friendly.
5. According to architect point there is beauty in clay bricks and strength in concrete work.

## 6. APPLICATIONS OF EPS CONCRETE

EPS concrete is mostly used for;

1. Environmentally “green” homes

   Environmentally greenhouses are the buildings which are less harmful to environment. Green house are made up of the materials which emits less $CO_2$ and are reusable. To reduce the amount of plastic on the earth use of plastic in the form of EPS beads is a good idea for environmentally green projects. It provides thermal insulation to building which prevents the energy loss in buildings so it is useful in environmentally green projects.

2. To reduce the weight of structures

   EPS concrete is also called as lightweight concrete. EPS beads are lighter than the conventional aggregates. So it reduces the weight of structural members resulting in reduction of total weight of structure.

3. As road bedding

   EPS concrete is used as road bedding in rigid pavements. It can be used in base course of rigid pavement.

4. In soil or Geo-stabilization projects

   EPS concrete can be used in geo-stabilization projects to improve load bearing capacity of subgrade. It can be used to support pavements and foundations.

5. As sub-grading for railroad trackage

   EPS concrete can be used as subgrade for railroad trackage.

6. Flooring

7. Low cost house

   Cost of EPS beads is less than the conventional aggregate. EPS concrete is better option to construct low cost structure as it gives reasonable strength in low cost.

## 7. CONCLUSION

It is concluded that replacement of aggregates with EPS beads is better and economical. By replacing the aggregates concrete becomes lighter than standard concrete. Durability of concrete better estimated. This study gives an idea to use a waste material in construction work. This study forces us to use other waste material and check for construction work.

An application of polystyrene concrete includes walls, claddings, panels, tilt up panels and composite flooring from literature survey. It is understood that there is scope for future studies in this field.

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