International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 02 | Feb 2020 www.irjet.net p-ISSN: 2395-0072

Analysis of Fiber Reinforced Concrete with EPS

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Abstract- India also is aiming at a high developmental rate compared to other nations in Asia. This material is a cause of concern to environmentalists. In this study, it is attempted to partially replace coarse aggregates by means of EPS beads. Expanded polystyrene (EPS) is a rigid and tough, closed cell foam. It is usually white and made of pre-expanded polystyrene beads. EPS is used for many applications e.g. trays, plates, bowls and fish boxes. Other uses include molded sheets for building insulation and packing material ("peanuts") for cushioning fragile items inside boxes. The main purpose of this investigation is to study the properties (compressive and tensile strengths) of lightweight concrete containing expanded polystyrene beads. Its properties are compared those of the normal weight concrete (control mix). The results showed that the amount of polystyrene beads incorporated in concrete influence the properties of hardened concrete; that is lightweight aggregate could reduce the strength of concrete. However, the compressive strengths of lightweight concrete with 15 % polystyrene beads (Mix II) at 28 days for example, could maintain up to 86 % compared to those of normal weight concrete, while the tensile strength was 87%.

1. INTRODUCTION

The three fundamental needs of man are nourishment, attire and sanctuary. Structural Engineer has significance with every single fundamental need of man legitimately or in a roundabout way. Man has advanced a great deal in building up the strategy for developing haven. At first man used to remain in cabins and time passed it formed into house that is load bearing. In this developed condition, the increasing expense of building development materials is the factor of extraordinary concern. The expense of building materials are raising step by step. These days a large portion of the scientists have center around utilization of the waste materials in concrete as indicated by their properties. Fly debris, Rice husk, Slag and Sludge from the treatment of modern and local waste water has been discovered appropriate as halfway trade for bond in concrete. The EPS is a material which can sub for coarse total. EPS concrete has better functionality in light of the smooth surface on one side of the shell. The effect obstruction of EPS concrete is high when contrasted and ordinary cement. Dampness holding and water retaining limit of EPS are more contrasted with customary total. Utilizing elective material instead of common total in solid creation makes concrete as practical and condition benevolent Construction material.

Fig -1: Polystyrene aggregate Cube

1.1 FIBRE REINFORCED CONCRETE

For thousands of years, small and discrete fibres ought to use to reinforce brittle materials. In ancient times, for example, the Egyptians used straws to improve the cracking resistance of sun-dried mud bricks used for constructing huts. The feasibility of using fibres to improve the ductility and tensile strength of concrete, however, was not fully realized until the publication of classic reports from Romualdi and Baston in 1963 followed by Romualdi and Mandel in 1964. Soon after, the current period of research and development of fibre reinforcement technologies commenced.

Brittle materials, such as concrete, are measured to have no noteworthy post-cracking strength and ductility. When the principal tensile stress for plain concrete exceeds the tensile strength, cracks will develop. The addition of discrete fibres into the concrete matrix can help to reduce microcracking, decrease localized macrocracking and provide improved post-cracking strength and ductility. However, the addition of fibres has little effect on the behaviour of concrete before cracking.

1.2 ROLE OF FIBRES IN CONCRETE

Fibres are available in different sizes and shapes. They can be classified into two basic categories, namely those having a higher elastic modulus than concrete matrix (called hard intrusion) and those with lower elastic modulus (called soft

intrusion). High modulus fibres improve both flexural and impact resistance simultaneously where as low modulus fibres improve the impact resistance of concrete but do not contribute much flexural strength. In contrast to reinforcing bars in concrete which are continuous and carefully placed in the structure to optimize their performance, the fibres are discontinuous and randomly distributed throughout the concrete matrix. This development makes the weight that will be demonstrated by the measure perusing.

2. MATERIALS

Cement, Portland bond make is a serious vitality process. It discharges high level of carbon dioxide CO2 which is one of the significant ozone harming substances, each ton of concrete produces one ton CO2. Furthermore, Portland concrete creation accounts around 7% of the absolute worldwide CO2 outflows. In addition, enormous amounts of residue are created during the procedure of bond fabricating. Because of every one of these impacts, the need of finding an elective material turns out to be progressively critical.

Table -1: Chemical Properties of Portland cement

Chemical content	Amount (%)
Calcium Oxide (CaO)	60-67
Silicon dioxide (SiO_2)	17-25
Aluminium oxide (Al_2O_3)	3-8
Iron oxide (Fe_2O_3)	0.5-6
Magnesium oxide (MgO)	0.1-4
Sodium oxide (Na_2O)	0.2-1.3
Potassium oxide(K_2O)	0.2-1.3
Sulfur Trioxide (SO_3)	1-3

Aggregate, or just "aggregate", is a general class of coarse to medium grained particulate material utilized in development, including sand, rock, squashed stone, slag, reused concrete and geo synthetic totals. Totals are the most mined materials on the planet. Totals are a segment of composite materials, for example, cement and black-top cement; the total fills in as support to add solidarity to the general composite material.

Expanded polystyrene (EPS) concrete (otherwise called EPScrete, EPS concrete or lightweight cement) is a type of cement known for its light weight produced using bond and EPS (Expanded Polystyrene). It is a well known material for use in earth "green" homes. It has been utilized as street bedding, in soil or geo-adjustment ventures and as sub-reviewing for railroad trackage. It is made by utilizing little lightweight Styrofoam or EPS balls as a total rather than the squashed stone that is utilized in normal cement. It isn't as solid as stone-based cement blends, however has different focal points, for example, expanded warm and sound protection properties, simple molding and capacity to be framed by hand with designing and development apparatuses.

Fig -2: Crushed EPS in same sizes.

Steel fiber having low carbon and hook end type were used.The steel fiber which is used in concrete is of density 7900 kg/m^3. The steel fibers can be of any shape like a crimped wire, hooked or a flat and are described as a parameter called aspect ratio. Steel fiber properties such as, crack resistance and increase in toughness are dependent on the mechanical properties of the fiber, bonding properties of the fiber and matrix, as well as the quantity and distribution within the matrix of the fibers. Steel fibers can be defined as discrete, short length of steel having ratio of its length to diameter (i.e. aspect ratio) in the range of 30 to150. The addition of steel fibers reduces the workability of the concrete. The steel fibers havedimensions of 0.45 x 25mm, aspect ratio of 45, and density of 7.85 g/cm^3.

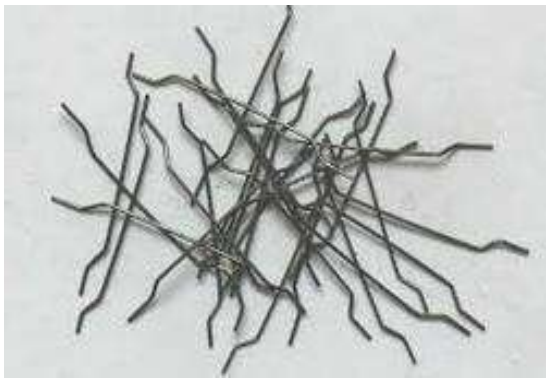

Fig -3: Hook end steel fiber.

Table -2: Properties of steel fiber used in concrete.

Properties	Description
Diameter	0.3 - 0.7 mm (max 1mm)
Length	25 -35 mm
Density	7900 kg/m^3
Young's modulus	2.1 x10^5 N/mm^2
Tensile Strength	500 - 2000 N/mm^2
Specific gravity	7.5
Aspect ratio	45 ,55 , 65 ,80

3. CONCLUSIONS

We built up another basic lightweight cement by absolutely or mostly supplanting coarse and fine totals in elite cement by extended polystyrene (EPS) dots. In this work, the measures of EPS globule were 1.0, 2.5 and 6.3 mm. Lightweight EPS cements with a wide scope of solid densities and compressive qualities were effectively created. Compressive quality, parting rigidity, shrinkage, and water ingestion were inspected. Moreover, fine silica rage (SF) and polypropylene (PP) filaments were added to improve the mechanical and shrinkage properties of EPS cements. The outcomes show that fine SF extraordinarily expands the bond quality between the EPS dabs and bond glue, along these lines expanding the compressive quality of EPS concrete. With incorporation of PP strands, drying shrinkage properties are essentially improved. From the test outcomes, the EPS has a future as lightweight total in concrete. It additionally decreases the all out cost of cementing, on account of the ease and its simplicity of accessibility is abundance. EPS Concrete can be utilized in rustic regions and spots where coconut is bounty and the spots where the normal totals are not monetary. It is inferred that the EPSs are increasingly appropriate as low quality giving lightweight total when used to supplant regular coarse total underway cement. EPS is more capacity to oppose smashing, and effect contrasted with conventional rock total. There is no compelling reason to regard the EPS before use as a total with the exception of water ingestion.

1. Workability increases with increase in polystyrene beads content.
2. Increase in the EPS beads content in concrete mixes reduces the compressive Strength of concrete.
3. Increase in the EPS beads content in concrete mixes reduces the Split Tensile Strength of concrete.
4. Increase in the EPS beads content in concrete mixes reduces the Flexural Strength of concrete.
5. With the increase in w/cm ratio strength of concrete decreases.

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