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EXPERIMENTAL INVESTIGATION ON LIGHT WEIGHT CONCRETE BY USING PERLITE AND GLASSFIBRE

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1. *Abstract* - The paper presents an Experimental investigation on light weight concrete by using perlite and grassfibre in this day to increasing importance of concrete consumption some researches have been done about lightweight concrete with perlite in order to prevent from damage of seismic earth quake loads

.In this project perlite and glass fiber is used for strength and bonded together with fluid cement.30% of perlite is used for replacing of aggregate, 0.4%,0.6%,0.8% glassfibre was added to the percentage of cement, to reduce the dead weight and to increase the strength of the concrete.The process of selecting suitable ingredients of concrete and determining their relative amount with the objective of producing a concrete of required strength ,durability in an economical way . Cubes were casted with W/C ratio of 0.45 by considering the replacement of perlite in 30 % and for additional strength properties glass fiber are been used . The cubes are tested for 7 days ,14 days and 28 days to study their strength performance.

1. INTRODUCTION

1.1 GENERAL

Concrete is a composite material composed of fine and coarse aggregate bonded together with fluid cement that hardens over time. Fine aggregate, which is one of the important constituents of concrete, is a loose granular substance resulting from the erosion of siliceous and other rocks. The composition, shape and size of the aggregate have significant impact on the workability, durability, strength, weight and shrinkage of the concrete. To reduce the dead weight and to increase the strength of the concrete, it has forced to use an alternative materials.

2.LITERATURE REVIEW

In this topic, by the study in various journals and articles related to the topic and knowledge about the properties of light weight concrete and it's utilization in concrete as well as replacement of perlite

and glass fiber. The literature studies that we have done are as follows

2.1 Kasagani et al. (2018) Effective blending of short length and long length fibers in concrete is termed as Graded fiber reinforced concrete. Effective blending of short length and long length fibers in concrete is termed as Graded fiber reinforced concrete. In 0.3% fiber volume, different fiber volume combination of Glass fibers in Short Graded form (3 mm + 6 mm length fiber), combination of Glass fibers in Long Graded form (12 mm + 20 mm length fiber) and combination of Short Graded + Long Graded fibers to form Combined Graded fibers (3 mm + 6 mm + 12 mm + 20 mm length fiber) were studied. The most important advantage of addition of fibers in concrete is increase of tensile strength and enhancement of energy absorption capacity. Graded fibers improved workability of GFRC. Specimens with Short length fibers (3 mm and 6 mm) have given higher tensile strength than the specimens with Long length fibers (12 mm and 20 mm).

2.2 AlejanEnfedaque et al. (2010) Glass fiber reinforced cement (GRC) is a composite material produced by the union of a cement mortar matrix and chopped glass fibers. Glass fibers improve cement mortar tensile strength and ductility, while cement mortar avoids buckling of glass fibers when compressing them. Damage in glass fibers occurred mostly during the first 40 days of immersion. Jagged fracture surfaces were obtained when a large number of glass fibers were pulled out. Consequently, irregular fracture surfaces were obtained only when testing GRC in its early stages of life.GRC cement mortar increasing the number of fibers pulled out in a tensile test. Even fracture surfaces appear as result of massive glass fiber rupture.

2.3 Topcu et al. (2007) Expanded perlite aggregate (EPA) is a heat and sound insulator, and lightweight which ensures economical benefits in constructions. This paper investigates the properties Received in revised form of concrete containing EPA considering cement types (CEM II 32.5R and CEM I 42.5R), dosages(300, 350 and 400) and replacement ratios (0, 15, 30, 45 and 60). In experiments, the minimum unit weight of concretemixture was 1800kg/m^3 at the dosage of 300, and compressive strengths of EPAC (expanded Lightweight concrete perlite aggregate concrete) were obtained between 20 and 30MPa at the replacement ratios Expanded perlite aggregate of 30% considering cement types, thus it was proved that EPAC can be used as lightweight Fresh and hardened properties concrete with adequate replacement ratios, despite some losses in mechanical properties. In this study, initially 30% replacement ratio of EPA was used to determine the effects of cement type; secondarily various replacement ratios were used to determine the effects of EPA on compressive and splitting tensile strengths for prediction of lightweight properties of concrete. According to results, concrete quality between C20 and C40 can be obtained with improving cement quality, dosage or replacement ratio of EPA. It was proved that EPA can be used as fine aggregate in concrete with appropriate replacement ratios along with the lightweight property.

2.4 Anandaraj et al. (2018) This experimental study investigates structural distress in glass fibre-reinforced concrete containing marble and granite dusts exposed to various loadings and aggressive environments. The properties of concrete determined includes mechanical compressive strength, split-tensile strength, flexural strength, and durability chloride ingress and acid attack.This includes the resistance in aggressive environment, such as acid and sulphate attack, and chloride ingress in concrete over a long period of time. concrete elements produced with glass fibre , marble and granite dust as described in this study are expected to have a prolong service life when subjected to a severe environmental condition.

2.5 Hilles et al. (2019) Effects of alkali resistant glass fiber (AR-GF) with various contents on the mechanical behavior of high strength concrete (HSC) were investigated on this study. The experimental results showed that the strengths increase as fiber percentage increases until a threshold the compressive strength increased from 57.85 to 66.6 MPa when fiber percentage increased from 0.0 to 1.2 respectively. The addition of closely spaced and uniformly dispersed small fibers to concrete would act as crack arrester and would sub-stantially improve its mechanical behavior and ductility. Maximum compressive strength of HSC was obtained at 1.2percentage of fiber and achieved 13.14% increase over the reference mix without fibers. 12.36% strength increase was recorded with 0.6% fiber which can consider the optimal fiber content for compression strength and that increase after is minimal.

3.Perlite

Perlite is an amorphous volcanic glass that has a relatively highwater content, typically formed by the hydration of obsidian. It occurs naturally and has the unusual property of greatly expanding when heated sufficiently. It is an industrial mineral and a commercial product useful for its low density after processing. Perlite softens when it reaches temperatures of 850–900 °C (1,560–1,650 °F). Water trapped in the structure of the material vaporizes and escapes, and this causes the expansion of the material to 7–16 times its original volume. The expanded material is a brilliant white, due to the reflectivity of the trapped bubbles. Unexpanded ("raw") perlite has a bulk density around 1100 kg/m^3 (1.1 g/cm^3), while typical expanded perlite has a bulk density of about 30– 150 kg/m^3 (0.03–0.150 g/cm^3).

4.GLASS FIBERS

Glass fiber is formed when thin strands of silica-based or other formulation glass are extruded into many fibers with small diameters suitable for textile processing. The technique of heating and drawing glass into fine fibers has been known for millennia; however, the use of these fibers for textile applications is more recent. Until this time, all glass fiber had been manufactured as staple (that is, clusters of short lengths of fiber). The most common types of glass fiber used in fiberglass is E-glass, which is alumino-borosilicate glass with less than 1% alkali oxides, mainly used for glass-reinforced plastics. Other types of glass used are A-glass (Alkali-lime glass with little or no boron oxide), E-CR-glass(Electrical/Chemical Resistance; alumino-lime silicate with less than 1% alkali oxides, with high acidresistance), C-glass (alkali-lime glass with high boron oxide content, used for glass staple fibers and insulation), D-glass (borosilicate glass, named for its low Dielectric constant), R-glass (alumino silicate glass without MgO and CaO with high mechanical requirements as reinforcement), and S-glass (alumino silicate glass without CaO but with high MgO content with high tensile strength).

5.MIX DESIGN

The process of selecting suitable ingredients of concrete and determining their relative amounts with the objective of producing a concrete of required strength, durability, workability in an economical way is termed as concrete mix design. The water cement ratio for the desired mean target obtained using the empirical relationship between compressive strength and water cement ratio was checked. The water content for the required workability and maximum size of aggregates is selected based on Table 2 of IS 10262:2009.

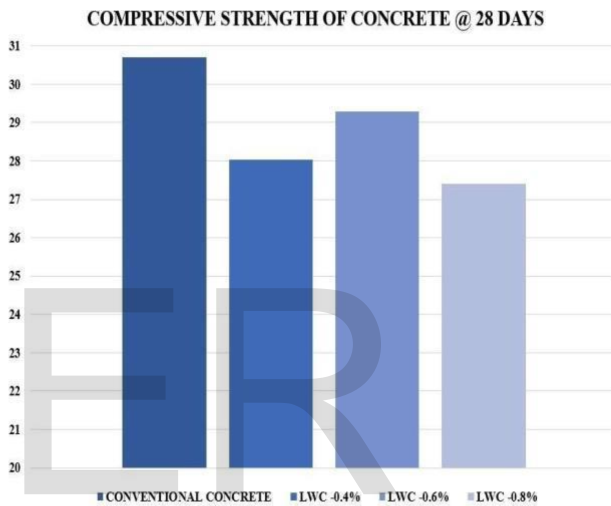
5.1 REQUIREMENTS OF CONCRETE MIX DESIGN

The cement content from the water-cement ratio and the final water content are calculated after the cement content is checked against the minimum cement content making suitable corrections. From Table 5 of IS 456, minimum cement content for 'severe' exposure condition is accounted. The percentage of coarse aggregate in total aggregate by absolute volume is calculated from Table 3 of IS 10262:2009 corresponding to 20mm size aggregate and fine aggregate (Zone II) for desired water-cement ratio can also be calculated.

6.STRENGTH TEST

6.1 COMPRESSIVE STRENGTH TEST

RESULT:



7.CONCLUSION:

Based on the results obtained from this study, the following conclusions can be drawn. It has been observed that the compressive strength of LWC at 28 days with glass fiber of 0.4%.0.6% & 0.8% gives results slight lower than the conventional concrete. Hence it is concluded that there is no increase in compressive strength of concrete by using glass fiber and perlite but it not very severe**.**

By using 30% perlite as the partial replacement of the volume of coarse aggregate we can able to attain the weight of concrete was attained as 1792 kg/m3.

Also it has been observed that the flexural strength and split tensile strength has been increased by using glass fiber.

At 0.6% of glass fiber, flexural strength was increased compared to the conventional concrete.

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