Review on Effects on Workability of Glass Fiber Reinforced Concrete by Partial Replacement of Cement and Sand with Industrial by- Products

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***Abstract*- Silica fume as partial replacement with cement as 15% and 30% where sand is replaced with Pond ash by 10% and 20%. I will prepare cubes, cylinders and finally slump test, compressive strength test, splitting tensile strength test and flexible test will be conducted to obtain the necessary results. A large number of trial mixes are required to select the desired optimum replacement of cement and sand by silica fume and pond ash.**

***Index Terms*- Glass fiber reinforcement, workability, cement, sand**

I. INTRODUCTION

Concrete is the most versatile construction material because it can be designed to withstand the harshest environments while taking on the most inspirational forms. Concrete is the second most consumed material after water by mankind. Thus it is not surprisingly that the second most populous country in the world, that is India, is also the second highest consumer of cement in the world after China. The concrete structures stands without any reported distress even today, although exposed to extremely aggressive marine environment. Concrete possessesa high compressive strength and is usually more economical than steel and is not subjected to corrosive weathering. It has the distinction of being formed into any shapes. Hence concrete is used in all present day construction and also engineers are continually pushing the limits to improve its performance with the help of innovative chemical admixtures and supplementary cementious materials.

CEMENT CONCRETE

The cement concrete is specified by proportions of different ingredients. It is composite man made material obtained by mixing cement, fine aggregate, coarse aggregate and water in predetermined proportions. Sometimes admixtures are also added to improve certain qualities. In this way or by substitution for the cementious and aggregate phase, the finished product can be tailored to its application with varying strength, density, or chemical and thermal resistance properties. The moulded concrete mix after sufficient curing becomes hard like stone due to chemical action between the water and binding material. Concrete is most widely used for making architectural structures, bridges, pavements etc.

The basic ingredients are as follows:-

i. Cement: In general sense it is the adhesive and cohesive material which is capable of binding together particles of solid matter into a compact durable mass. It is in the form of powder, a sticky substance that can be used for mending broken objects or for making things adhere. Cement is an extremely ground material having adhesive and cohesive properties which provide a binding medium for the discrete ingredients. The processes used for manufacture of cement can be classified as dry and wet. The cement commonly used is Portland cement; it is also defined as hydraulic cement, i.e. cement which hardens when it comes with water due to chemical reaction but there by forming a water resistant product.

ii. Sand: It is mixed with masonry cement to be used in masonry construction. It is composed of finely divided rock and mineral particles. It is defined by size, being finer than gravel and coarser than silt.

iii. Aggregate: Aggregate is a broad category of coarse particulate material used in construction. Aggregates are most mined materials in the world and a component of composite materials such as

concrete. It serves as reinforcement to add strength to overall composite material. It can also use as a stable foundation, road/rail base with predictable, uniform properties, or as a low cost extender that binds with more expensive cement to form concrete. The aggregates the vast majority of which are held on 4.75mm IS sieve.

iv.Water: Combining water with a cementious material forms a cement paste by process of hydration. The cement paste glues the aggregate together, fills voids within it, and makes it flow freely. Lower water-cement ratio yields a stronger, more durable concrete, whereas more water gives a free flowing concrete with a higher slump. Water is the one most essential element of cement. Water assumes the vital part of hydration of concrete which frames the coupling lattice in which the dormant totals are held in suspension medium until the grid has solidified, furthermore it serves as the lubricant between the fine and coarse aggregates and makes concrete workable.

v.Admixture: The chemicals used to aid the properties of concrete. It is in the form of powder or fluids when added to concrete it give it certain characteristics not obtainable with plain concrete mixes. In normal use, admixture dosages are less than 5% by mass of cement and are added to concrete at the time of mixing/batching. The utilization of admixture is necessary to offer a change which is not financially achievable by changing the extents of water, cement and though not influencing the performance and durability of the concrete. Usually used admixtures are accelerating admixtures, retarding admixture, air-entraining admixtures and water-reducing admixture. In our case a water reducing admixture was used to obtain the desire workability as with increase in fiber content the mixture was becoming stiffer.

II.MATERIAL AND METHODOLOGY

In recent years, several studies have been conducted to investigate the flexural Strengthening of reinforced concrete (RC) members with fiber reinforced composite fabrics. In this composite material, short discrete fibers are randomly distributed throughout the concrete mass. The behavioral efficiency of this composite material is far superior to that of plain concrete and many other construction materials of same cost. Due to this benefit, the use of FRC has steadily increased during last two decades and its current field of application includes airport and highway pavements, earthquake resistant and explosive resistant structures, mines and tunnel linings, bridge deck overlays, hydraulic structures, rock slope stabilization.

Extensive research work on FRC has established that the addition of various types of fibers such as

- Steel fiber
- Glass fiber
- Synthetic fiber
- Carbon fiber

It concrete improves strength, toughness, ductility, and post cracking resistance etc. The major advantages of fiber reinforced concrete are resistance to micro-cracking, impact resistance, and resistance to fatigue, reduced permeability, and improved strength in shear, tension, flexure and compression.

1.4 GLASS FIBER REINFORCED CONCRETE

Fiber is a natural or synthetic string or used as a component of composite materials, or, when matted into sheets, used to make products such as paper, papyrus, or felt. Concrete is brittle by nature and is weak in flexure as well as direct tension therefore in order to improve these properties fibers are added to concrete. Fibers may be short discrete or in forms of rods or may be even in form of textile fibers or woven mesh fibers.

Various types of fibers have been added to concrete some have high modulus of elasticity some have low modulus of elasticity each category can improve certain properties of concrete. In our case short discrete glass fibers were used and as glass fiber is susceptible to alkali we used alkali resistant glass fibers. A fiber is a material made into a long filament with a diameter generally in the order of 10 tm. The main functions of the fibers are to carry the load and provide stiffness, strength, thermal stability, and other structural properties in the FRC.

Glass fiber reinforced concrete (GFRC) is a cementious composite product reinforced with discrete glass fibers of varying length and size. The glass fiber used is alkaline resistant as glass fiber are susceptible to alkali which decreases the durability of GFRC. Glass strands are utilized for the most part for outside claddings, veneer plates and different components where their reinforcing impacts are

required during construction. GFRC is stiff in fresh state has lower slump and hence less workable, therefore water reducing admixtures are used. Further the properties of GFRC depend on various parameters like method of producing the product. It can be done by various methods like spraying, casting, extrusion techniques etc. Cement type is also found to have considerable effect on the GFRC. The length of the fiber, sand/filler type, cement ratio methods and duration of curing also affect the properties of GFRC.

Scope and Objective of work:

•To analyze the properties of the silica fume and pond ash concrete as compared to Portland cement concrete.

•To test some of the properties of silica fume and pond ash concrete

•To do a cost comparison of silica fume and pond ash concrete with Portland cement concrete.

The research shall seek to find out the mineral composition of silica fume and pond ash and further test it as a cement and sand replacement alternative. The research shall also seek to find out the optimum mix design for the use of silica fume as a partial replacement of cement.

Materials used and its Testing:

1. Grade designation: M20
2. Type of cement: OPC-43
3. Silica fume and Pond Ash
4. Maximum nominal size of the Aggregate: 20 mm
5. Water Cement Ratio: 0.45
6. Aggregate Type: Crushed Angular Aggregate

Laboratory Tests to be performed:

1. Slump Cone Test
2. Compaction Factor Test
3. Flow Table Test
4. Compressive strength Test
5. Splitting Tensile strength Test
6. Flexural Strength test
7. Water Permeability Test
8. Water absorption Test

III.CONCLUSION

The objective of the research is to find out the variation in various properties (Workability, Compressive strength, Tensile strength and Modulus of Elasticity) with different proportions of silica fume and pond ash as a replacement in an ordinary concrete.

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