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Study on Replacement of Steel Reinforcement to Glass Fiber Reinforcement Rebars

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Abstract: ***As we know Plain Concrete has limited ductility, strength in tension as well as low cracking resistance. Micro cracks are present in concrete and these propagates at a great extent and results in extensive brittle fracture. Experiments in past and numerous researches in the last decade were focused merely on developing novel techniques of improving tensile strength of concrete. Among these mostly used is GFRP (Glass Fiber Reinforced Polymer) is easily available, which is low in cost than CFRP (Carbon Fiber Reinforced Polymer), and that's why various studies is done to strengthening of concrete by using GFRP particularly in countries like India. GF is latest introduction cum revolution in production FRC. It overpowers all the synthetic fibers, due to its excellent strength, extreme durability, supreme wear-tear resistance and exceptional tensile and impact strength. At this time GFRC (Glass Fiber Reinforced Concrete) excelled as a great remedy for civil engineers. Tensile strength of GFRC lies between 1024 and 4080 N/mm^2. It is the benefit of using glass fibers in reinforcement of concrete.***

Construction Industry is accelerating day-by-day. Today is the scenario of sky scrapping and complex infrastructures, which results in increasing demand of basic civil engineering material i.e. cement. Engineers are looking for alternative of expensive construction since long. Cement, binder in concrete, is an expensive and exorbitant civil engineering material and it increases the Constructional budget. Not only this, but also cement marks the highest consumption throughout the world after water. The carbon credits to the environment during cement production, is an alarming issue. If it keeps following the exact pace as today, it is probable to reach annual cement production up to about 600 metric tons by 2025 in India alone and the globe will change into hot air balloon. Cement industry alone contribute to 2.4% to the total carbon emissions round the globe.

To eradicate this converse effect of cement industry on the environment, engineers are working hard to find efficient substitutes which are in-expensive, eco-friendly and can possess better cementing properties. Agricultural and commercial wastes are the best choice and have the characteristics favouring their utilization in concrete production. These by-products are complete waste and if re-used in any sort releases a huge burden from environment.

Keywords: Glass Fiber, Workability, Compressive strength, Compaction factor, Slump test

I. INTRODUCTION

1.1 GF is latest introduction cum revolution in production FRC. It overpowers all the synthetic fibers, due to its excellent strength, extreme durability, supreme wear-tear resistance and exceptional tensile and impact strength. At this time GFRC (**Glass Fiber Reinforced Concrete)** excelled as a great remedy for civil engineers. GF Rebar are non-corrosive, having high tensile strength as well as light weight and it also possess a very high strength to weight ratio. Glass Fiber are added at various percentages like 0.2%, 0.4%, 0.6%, 0.8 % and 1.0% by the weight of cement to concrete mix and rest the specimen for 28 days for curing to find out the workability as well as compressive strength of the specimen by testing on it. On the basis of various researches is done, various conclusions has been drawn these are as following: The addition of 0.2% fibre poses high compressive strength and this have good workability of concrete. The maximum compressive strength is takes by adding 1% fibre into it and 0.8% is best plasticizer when it is compared with the reference mix.

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At this time GFRC (**Glass Fiber Reinforced Concrete)** excelled as a great remedy for civil engineers. Tensile strength of GFRC lies between 1024 and 4080 N/mm^2. It is the benefit of using glass fibers in reinforcement of concrete. This type of modified concrete can explicitly be used in many significant arenas of construction industry. Some of which are detailed as below:

1) Renovation/repair of building
2) Hydraulic works/construction of water headwork
3) Lining the internal surfaces of tunnels
4) Construction of decks of Bridge
5) Cladding and form work
6) Sound insulations

II. LITERATURE REVIEW

It served as a foundation stone to the present investigation. Many substitutes of cement in concrete production are developed and investigated by numerous engineers in the past, some of which are relevant to the present work and provided pace to current investigation. Some of these works are reviewed and briefed as under:

A. In the study of Kumar J.D. , he observed 1-5% increase in compressive strength with varying percentage content of glass fiber.
B. In the study of N.Pannirselvam, he investigated experimentally the workability and load bearing properties of concrete blended with waste glass fiber as additive/admixture into the conventional control mix and he observed 28.57% to 40% increment of ultimate load for 3 mm thick Glass Fiber Reinforce Polymer (GFRP) sheet and 28.57% to 128.57% increment of ultimate load for 5 mm thick Glass Fiber Reinforce Polymer (GFRP) sheet.
C. In the study of Dr. P. Srinivasa Rao, he observed that the concrete produced through incorporation of glass fibers @ 1 to 5%, can induce characteristic feature in concrete like Enhanced durability , negligible chances of bleeding and excellence resistance to acid attack.
D. In the study of Nadeem A. Siddiqui, (2009) **in** his paper highlighted certain engineering properties of concrete blended with waste glass fibers as admixture. He investigated experimentally the workability and load bearing properties of concrete blended with waste glass fiber as additive/admixture into the conventional control mix.
E. In the study of Kannan et al, 2010, he observed that the permeability and workability of cement improved as the proportion of water and binder is reduced due to addition of glass fiber.
F. In the study of S. S. Pimplikar, in his research proposed an easy alternative to utilization of Glass-fiber reinforced concrete (GRC) as a partial substitute of cement.

A couple of studies have been completed on the remains got legitimately from the enterprises to examine the properties of Glass Fiber Rebar and they have been discussed above.

III. OBJECTIVE

There are two types of objectives associated with the present work namely Specific objective and Derived objectives.

1) Specific Objectives: The prime objectives or the foremost goals for which this investigation is carried out are as follows:

- To understand the characteristic features of GFRP Concrete.
- To investigate impact of GFRP on important engineering property i.e Compressive strength of hardened concrete.

2) Derived Objectives: Other objectives which are achieved by their own after successful achievement of specific objectives are:

- To lessen the problem of disposal of Glass fiber
- To lessen the release of CO2 during manufacturing of cement.

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3) *Experimentations:* In this research was carried out mainly to justify the usage of GFRP as a modifier of conventional concrete. This modification is validated by detailed experimental program on hardened concrete. These properties studied through tests are listed as below:

- Yield Strength
- Cracking Strength
- Ultimate Strength

IV. CONCLUSION

With the help of the obtained experimental test result, the strong and rigid GFRC gives full lateral support on both sides of the studs, and it prevent them from buckling and twisting laterally. The result of this, the panel is lightweight in comparison with traditionally reinforced concrete, yet is strong and durable and can be easily handled. Higher load carrying capacity with improved resistance to deformation is observed in case GFRP coated HFRC beams and There is no proper maintenance required during the addition on the concrete, Fibers at lower quantity and at reasonable cost fulfill all the required condition of the concrete The concrete mix design should not affected after the addition of fibers. Thus to sum up the properties like bleeding is reduced to a great extent along with the chances of segregation and effect of freeze thaw cycles are extremely diminished with this proposed modification. From these concluding notes briefed as above it can be inferred that the content of glass fiber enhances the structural strength of the composite. The most common place you have to see this type of material is in the construction industry. It's used in most commonly cases such as in architectural cladding that's hang several storeys above sidewalks or even more for aesthetics such as interior furniture pieces like GFRC Coffee tables.

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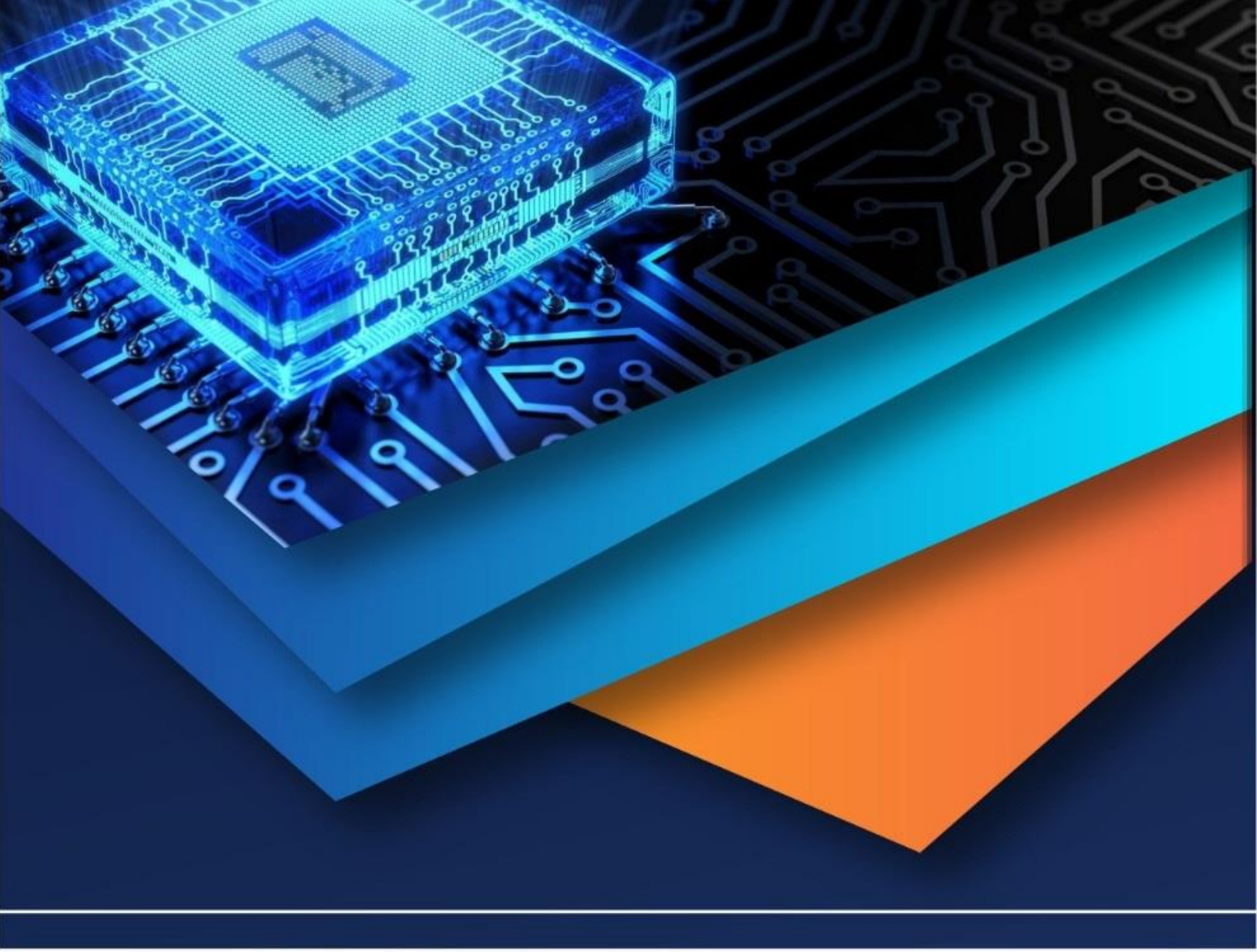

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