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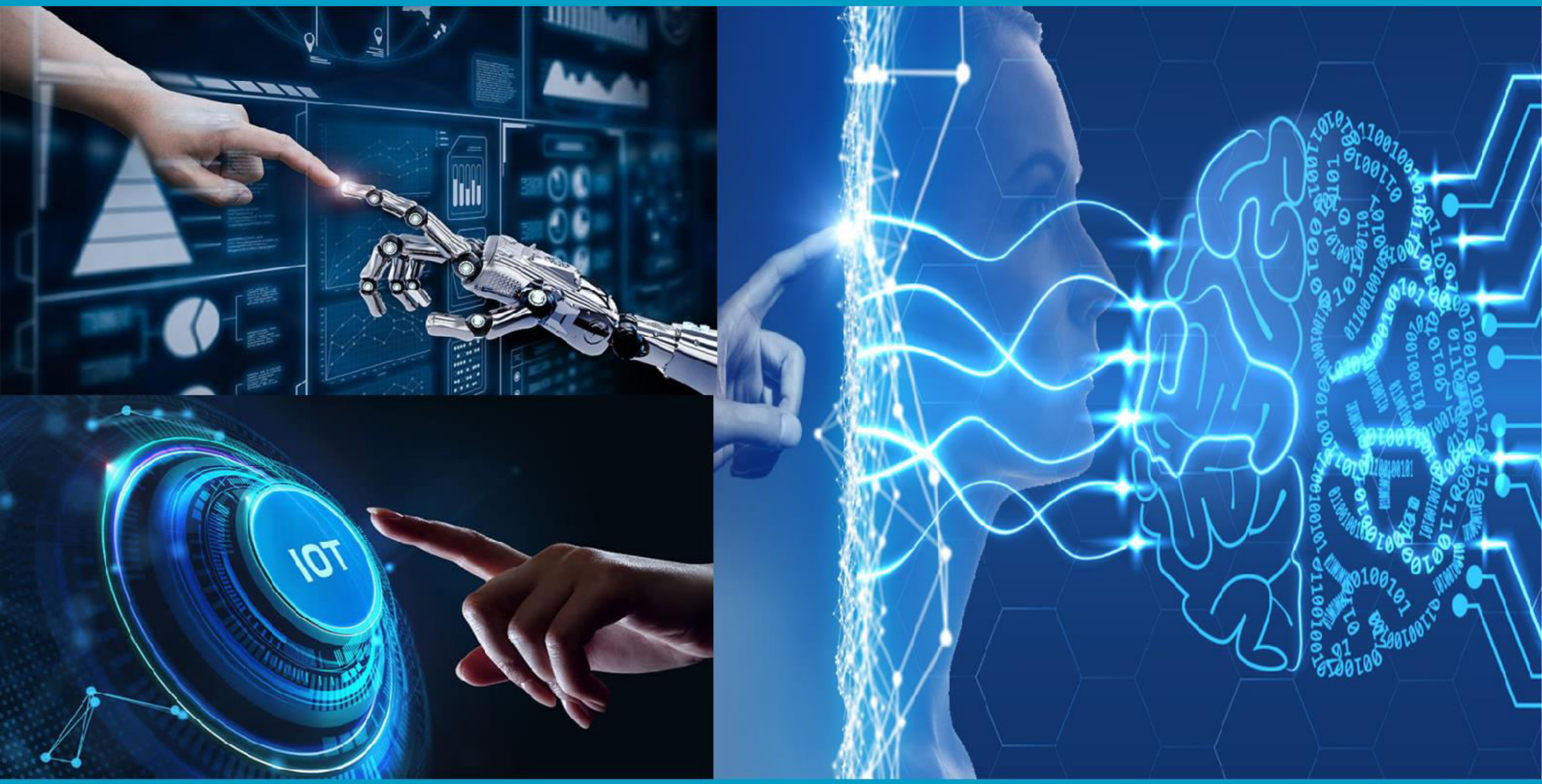

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A Review of Pozzolanic Materials and its Partial Replacement as Steel Fibers and Steel Bars

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ABSTRACT: Concrete is the most-used man-made building material. Materials, water, aggregates, and other admixtures are combined. Pre-cast concrete has the fluidity of fresh material but hardens over time. Water and cement chemically interact to strengthen the material over time. Polypropylene fibre is a modern substitute for steel fibres and bars. Polypropylene fibres may be preferred over other concretes for enhancing toughness or watertightness. Fiber reinforced concrete is mostly used in developing countries (FRC). American Concrete Institute studies recommend fiber-reinforced concretes. Steel FRC has stronger compressive and characteristic strength than polypropylene FRC. Because fibres can stretch axially, they are stronger than steel.This research employed lab time and equipment to highlight the benefits of fiber-reinforced concrete. Using a super plasticizer allows for strength with a low water-cement ratio. Steel fibre in OPC has a maximum 28-day compressive strength of 3%. Polypropylene reduces concrete's compressive strength by 11%. Steel and polypropylene increase compressive strength. Increasing fibre fraction in both aspect ratios produces small changes. 50 and 60 aspect ratios in polypropylene fibre have compressive strengths of 1.23x10-6 and 8.64x10-5 using the T-Test. These data support the null hypothesis 95%. 50/60 aspect ratio steel and polypropylene samples have a split tensile strength of 0.000479 and 9.68x10-5. Method ensures 95% success. Future researchers may use pozzolanic materials such as steel fibres and polypropylene fibres as a partial cement substitute to boost building strength and minimize costs.

KEYWORKS:steel fibers, steel bars.steel fibres and polypropylene fibres

I. INTRODUCTION

1.1 General

Concrete is the most often used man-made building material. Cemetery materials, water, aggregates, and other admixtures are combined in a certain ratio. Pre-cast concrete has the fluidity of fresh material, but it hardens over time to the rock-like quality of finished product. Because of chemical interactions between water and cement, the material becomes stronger with time.During the last century, OPC round steel bars of mild steel, which were freely available on the market, were the principal source of RCC structures' long-term durability. The outward look, characteristics, and strength of these materials also altered throughout time. As an example, Pozzolana cement and TMT bars have replaced mild steel bars in the construction industry [Ravichandran et al., 2009].The component's strength is measured in accordance with Indian Standards. The findings of the testing machines are flawless after 28 days of casting and curing cubes, cylinders, and beams in water.

1.2 Background

High-strength oriented steel bars with their maximum surface deformations, as well as diverse additional ingredients in cement and admixtures with their ability to accelerate or decelerate, were used in concrete buildings constructed after 1970 or after that. Steel bars have been replaced with fibers of steel, polypropylene, natural polymers, etc.However, structural engineers must also consider long-term performance and the qualities of the structures they design. We must be able to meet the demands of long-term durability.Precast building parts and high-strength concrete are increasingly being used in the construction industry to meet pre- and post-tensioning requirements. These difficulties must be solved since in large-scale concreting, the concrete may interact with diverse soil compounds and alter their characteristics.

1.2.1. Cement

OPC is a critical component in the production of concrete and cannot be substituted anywhere else in the industry. When cement is made, a lot of CO_2 gas is emitted into the atmosphere, which has an impact on the environment and contributes to global warming and the greenhouse effect. As a result, it would be a fantastic idea to look for alternate materials that can either partially or completely replace cement. When an alternative or supplemental material may be utilized in lieu of cement, it has a direct influence on the environment and global sustainable development. With the passage of time and to satisfy the need, the area of building and civil engineering is constantly evolving. In the late 1960s, the development of water-reducing admixtures paved the way for the development of high-strength precast

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products. From M60 to M120 concrete grades have been introduced due to technological advancements since then. This is the result of scientific research.

1.2.2 Concrete Reinforced with Fibers

FRC accepts steel, glass fiber, synthetic fibers, and natural fibers as materials. Only steel and polypropylene are taken into account in this study for the sake of research. Due to their widespread usage, these are the most prevalent types of fibers.Incorporating fibers into the mix improves the qualities of the finished product. Concrete is known for its durability, flexural strength, toughness, resistance to impact, and compressive strength, among other characteristics. Fiber type, size, arrangement, and quantity all affect the physical improvement [V. Mohod, 2012].

1.2.3 Steel Fiber Reinforced Concrete

A wide range of industries use SFRC for anything from tunnel lining and rock stabilization to mining and thin shell dome building.To create SFRC, steel fibers and concrete are mixed together. Using the same mixing and placing equipment as for regular concrete, it may be placed down. Steel fiber, up to 2% of the total volume of the reinforced concrete, improves flexural properties, toughness, and ductility. Certain applications up to 815oC for components on one side are achievable with the use of steel fibers at higher temperatures. As an additional option, stainless steel fibers may be used to create refractory concrete.

Steel fibers can:

- Increase the structure's tensile strength.
- Reduce the need for steel reinforcement.
- Increase the ductility of the skin.
- Improve durability by strictly controlling crack widths.
- A common construction method is to combine the advantages of goods, such as the structural benefits of steel fibers and the resistance to plastic shrinkage and explosive spalling provided by polymeric fibers, into a single product.

II. LITERATURE REVIEW

2.1 Introduction

As a major aim, the concrete must have features such as a low absorption rate and high life duration. As a consequence, in order to achieve the aforementioned objectives, we need to use fabric components and a super plasticizer with a low water cement ratio. High activity and capacity to generate high-performance concrete make use of various fibers including polypropylene and steel fiber in concrete making. A broad number of structural disciplines are using fiber-reinforced concrete because of its positive influence on a wide range of concrete properties.

Fiber materials other than steel, glass, or other natural fibers have been developed and utilized for fiber-reinforced concrete in the construction sector. Synthetic fibers like this are classified using the SNFRC code. Technological advances in the textile and petrochemical industries have resulted in the development of synthetic fibers, which are among the most advanced man-made materials. Fibers such as aramid and carbon may be incorporated into the concrete matrix. It is also possible to utilize polythene and polyester. In order to reinforce structural components, fiber reinforced concrete (FRC) is a concrete mix consisting of water, cement, aggregates, and fibers of various lengths and diameters.

2.2 Previous Researches

They claim that fibers may be used as a kind of reinforcement at any given moment, according to Bentur and Mindess (2007). When it came to building materials in early twentieth-century America, asbestos was the first to be extensively employed. Glass, steel, asbestos, synthetics, and natural fibers like jute, sisal, and cellulose may all be used to make synthetic fibers. Concrete has a brittle character, with low tensile strength and high compressive strength before reinforcing with steel and other elements that offer strength to withstand the load. For tensile and shear zones, the use of standard continuous reinforcing bars does not enhance the load-carrying capacity. Cracks can be controlled, however, because of a lack of uniformity in the mixing of concrete. Fiber-reinforced concrete's ductility rises as a result. It is possible to utilize fiber-reinforced concrete in thin and complicated members, where standard reinforced concrete cannot be used.

Twenty-first-century interest in synthesized fibers as building materials was originally noted in 1965. For the Engineers

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Research and Development Section of the United States Army, synthetic monofilament fibers were employed in blast-resistant buildings. To put it another way, the fibers were of the same size and form as those that were tested with steel and glass fibers (SFRC and IGF) (GFRC). According to the findings of this study, tiny amounts of these kinds of fibers may be considered for combining. Due to the addition of 0.5 percent synthetic fibers, a material with increased ductility and impact resistance was created.

During the late 1950s and early 1960s, research on random metallic fibers and closely spaced wires led to the patenting of steel fibers. In 1950, the Portland Cement Association (PCA) conducted research on the use of fiber as reinforcement. Composite materials ethics were used to the study of fiber-reinforced concrete analysis. The inclusion of fibers was made in order to improve its toughness, which results in a much higher strength value when tested using a first crack. The strength of the binding and the usage of fiber aspect ratios were the subject of a second 1972 patent. So far, a slew of innovative steel fibers have been developed. In the 1960s, steel fibers were predominantly used as reinforcement in floor slabs, pavement roads, and different refractory materials prestressed and pre-cast in concrete products. In 1971, a truck weighing station in Ashland, Ohio, employed the first commercial steel fiber reinforcement. Other recent advancements in the concrete industry have expanded the use of steel fibers.

However, it was another fifteen years before large-scale synthetic fiber development initiatives started. To better disperse cracks, decrease the size of cracks, and enhance the other qualities of concrete, commercially available synthetic fibers have been demonstrated to work in the range of 6 to 60 deniers. Initially employed in the late 1970s, synthetic fibers were first used in applications ranging from 300 to 400 microns, with low aspect ratios, in the early 1970s. As long as they were available, it was possible to employ these fibers. The usage of finer denier fibers, which have a smaller diameter and a higher aspect ratio, started with volumes of fibers that were about one-fifth the size of those previously used with coarser fibers. It was found that i0.1 to i0.3 percent of the volume was occupied by these low-volume applications. In spite of this fact, the fiber count and the specific surface area are similar to values observed with volume percentages of larger size fibers, even at low volumes.

III. SUMMARY & CONCLUSIONS

The whole research effort is predicated on incorporating fibers into traditional concrete. Conventional concrete resists compression stresses, whereas steel bars provide tensile strength to them. When steel bars are laid and fixed in an organized manner, progress is delayed and needless work has to be done because of these processes.We may utilize fibers of steel to replace the heavy steel bars in tiny places, such as on the pavement of roads, since the steel density bars and fibers will be the same. In addition, steel is susceptible to corrosion as a result of environmental factors. Steel fibers will have a much less impact.Polypropylene fiber is a relatively new material to be used in place of steel fibers and steel bars. However, as described in the thesis' literature analysis and introduction, polypropylene fiber's current utility is overstated. When it comes to improving certain attributes like toughness or water tightness, these Polypropylene fibers might be favored above all other forms of concretes. PPFRC may be used in a wide range of constructions, including buildings, bridges, highways, industrial floors, and hydraulic systems.Foreign nations in the early stages of development are the primary users of fiber reinforced concrete (FRC). FRCs have not been used in carrying structures because the fibers have been prohibitively costly and have not been commercially viable.There is too much difference between the methods employed in rich nations and those utilized in developing ones. Fibers were subject to their own set of criteria. Fiber reinforced concretes have been suggested by the American Concrete Institute in certain papers. Only Indian standards are used while developing processes in India.The findings of this study's experiments suggest that many fibers should be used in lieu of reinforcing steel. It has been shown that the compressive and characteristic strength of steel FRC is greater than that of polypropylene FRC. Steel's fiber shape differs from polypropylenes in that it has a higher ductility, hence aspect ratios play a role. The polypropylene fiber was shown to have excellent flexural strength in both situations of aspect ratios, as demonstrated by three-point observations. Fibers have a greater tensile strength than steel because they have the ability to stretch axially.We employed the t-test approach, a statistical tool for correlating generic characteristics. The null hypothesis with 0.05 alpha label values yielded a significance level of 1.96. Only by using as many samples as feasible was it able to achieve this level of data analysis excellence.

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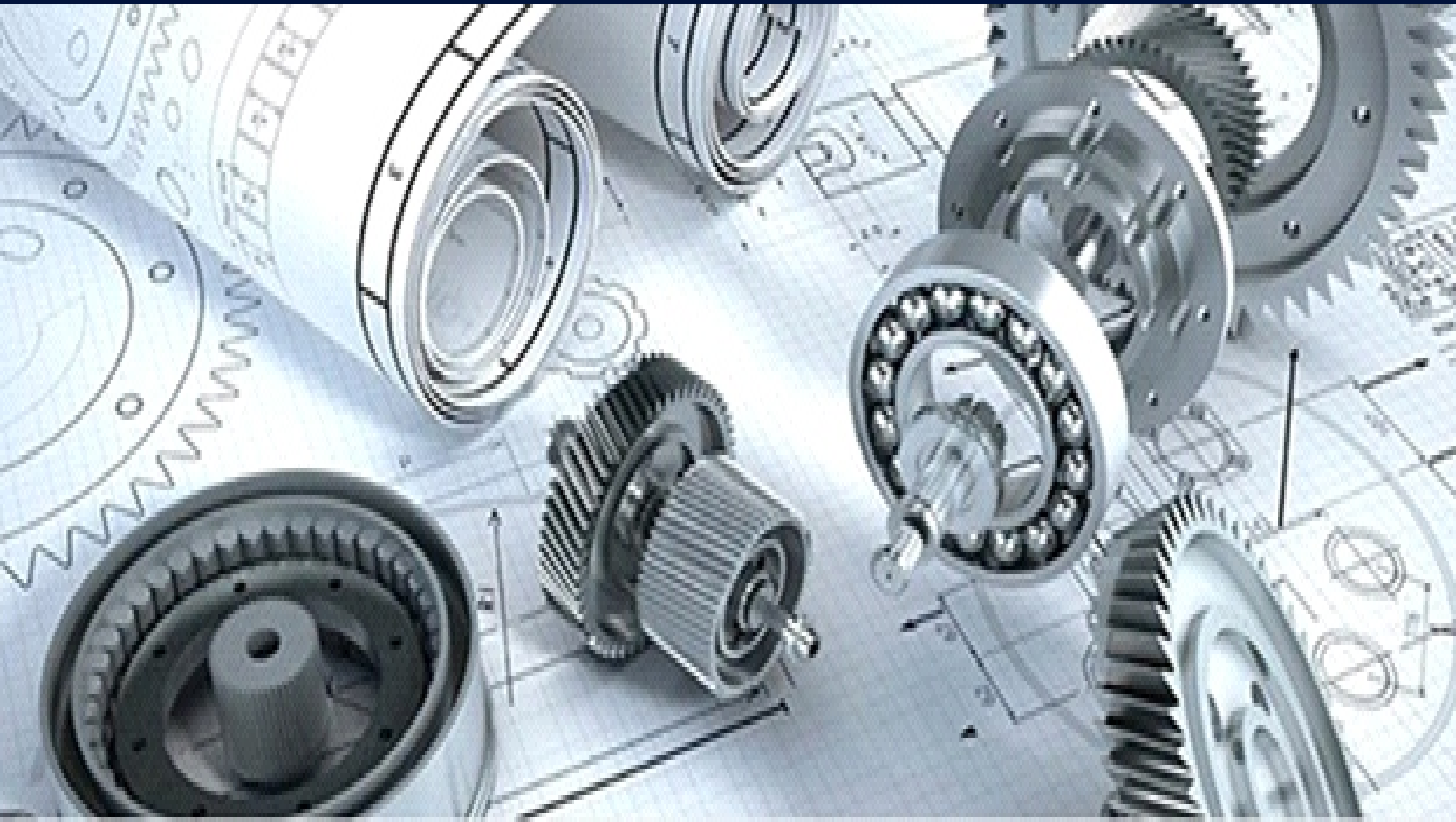

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