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USE OF DISCRETE FIBERS IN ROAD CONSTRUCTION

Vipin Bihari[1], Devi Charan Dubey[2]

[1]*M.Tech, Civil Engineering, Lucknow Institute of Technology, Lucknow, India.*
[2]Assistant Professor, Civil Engineering, Lucknow Institute of Technology, Lucknow, India.

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Abstract:

Concrete has a strong resistance to breaking when it is subjected to compression, but it has a poor resistance to breaking when it is subjected to tension and it is also delicate. The surface of the concrete begins to develop fissures almost immediately after it is poured, and these fissures can be seen in all directions. Regular concrete is not suitable for use in paving because it cannot tolerate fractures and failures without becoming brittle. These three restrictions prevent regular concrete from being suitable for use in paving. One potential strategy for reducing the effects of these weaknesses in concrete is to include fibres, which serve as reinforcement, into the concrete mix. Waste materials, such as polyethylene and tyres, are a primary contributor to environmental pollution, which in turn plays a role in a wide range of health problems. Concrete may make effective use of recycled polyethylene and used tyres, which can be processed into a kind of reinforcement that takes the shape of fibres and is then used to reinforce the material. It is possible for the material's ductility, strength, shrinkage characteristics, and other attributes to be improved by adding polyethylene, which is a synthetic hydrocarbon polymer. This investigation's objective is to determine what, if any, changes take place in the properties of concrete as a result of the addition of polyethylene fibre to the mixture. Polyethylene and tyre fibres were each employed at a volume percentage of 1.5% and were each cut into pieces measuring 30mm by 6mm before being included. The building was constructed of concrete of the grades M30, M35, and M40 respectively. During each and every stage of the design process for the concrete mix, IRC 44:2008 was used. The results of this inquiry provide the conclusions of the parameters of strength shown by polyethylene fibre reinforced concrete. A four point bending test and a double shear test were used, respectively, to determine the flexure and shear strengths of the material that was being tested in the laboratory. After 28 days, not only was there an increase of 39% in the flexure strength and 32% in the shear strength, but there was also an increase of 18% in the compressive strength. The examinations found that there was a decrease in deflection of 36% in the double shear test and a reduction of 22% in the 4 point bending test. Both of these results are significant improvements. The investigation of deflection in a theoretical context was finished with the help of several energy approaches. Both the theoretical and practical numbers were compared to one another and confirmed against one another within the margins of error that were permitted. At long last, we have reached the point where we are in a position to arrive at the realisation that it is possible for polyethylene and rubber to be effectively used in reinforced cement concrete.

Keywords — Cracks, Concrete, Fibers, Polythene, Compressive Strength

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1. INTRODUCTION

The presence of road networks ensures that motorists will always have access to a surface that is not just long-lasting but also pleasurable to drive on. Road networks play such an essential role in the expansion of a nation like India since this is such an essential component in the growth of a nation like India. Road networks also play such a vital role in the expansion of China. The use of bitumen as a

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component in the building of roadways and other paved surfaces is the single most essential step. Pavements made of concrete, on the other hand, may also serve as references in some situations; this, of course, is contingent on the specifics of the situation in question. When concrete was originally used as a building material, a broad range of additives were researched for the chance that they may enhance the performance of the material in some manner. This was done in the hope that the additives could make concrete a better material overall. Recent research indicates that fiber-reinforced concrete, which is also known as fiber-reinforced concrete or FRS, may one day find use in the construction sector. This is as a result of the fact that not only is its strength regarded as being of the highest possible quality, but it also has a number of other qualities that are highly sought for. It is considered to be quite excellent in terms of both its strength and its durability, which is one of the reasons why this is the case. These properties include the material's capacity to absorb sound and heat, as well as its resistance to fire. Another attribute is the material's ability to transmit heat. The following is the definition of fiber-reinforced concrete that was developed by ASI Committee 544: "fiber-reinforced concrete is a concrete that is constructed of sediments including fine and coarse aggregates in addition to water with the goal of attaining cementious characteristics and discontinuous fibres." These products are manufactured utilising a wide range of various types of fibres, including natural fibres, polymer fibres, natural fibres, and steel fibres, amongst other types of fibres. As was mentioned earlier, fiber-reinforced concrete is a specific type of concrete in which fibres are rutted into the concrete as reinforcement in order to increase the strength, characteristics, and other mechanical properties of the concrete. This kind of concrete is known as "fiber-reinforced concrete." A fiber-reinforced concrete composite is the name given to this particular kind of concrete. Additionally known as fiber-reinforced concrete and concrete with fibre reinforcement, this specific kind of concrete goes by a few other names as well. Fiber-reinforced concrete is utilised not only for the purpose of local strengthening in the tensile region, but it is also utilised for the purpose of obtaining a gain in compression and tension, in addition to reduced deflections and shrinkage, and increased ductile property. These objectives can all be accomplished through the utilisation of fiber-reinforced concrete. In addition to achieving a gain in compression and tension, this step is taken for the purpose of achieving the desired result. In a nutshell, it might be used for each and every one of these purposes as it is made accessible. This is made possible due to the fact that the fiber-reinforced concrete incorporates strands of glass fibres throughout the whole of its make-up. In addition to the benefits that were just covered, polymeric fibres also play a part in limiting the negative effects that are caused by corrosion. This is something that was not covered before. One of the numerous advantages of using polymeric fibres is this particular feature. Compounds such as usually, reason 3s, polyester, and polypropylene have been used at different stages over the whole of the FRS manufacturing process. These compounds have been used in various ways. The properties of a number of different kinds of recycled fibres, including as elastic, worn tyres, garret garbage, and waste from the textile industry, are now being modified in order to enable them to be used in the same manner. These fibres' principal purpose is to perform the operation of operating as stray-light arrestors; this is the primary goal for which they were produced. This is the primary function that these fibres are designed to carry out. The fibres were helpful in warding off the less severe soaks and preventing them from progressing into the more significant mistakes that may have been created by them. The fibres were also effective in preventing the less severe soaks from causing the more serious blunders. As a consequence of this, the material undergoes a change that, in the long term, leads to an increase in its resistance to abrasion and fracture.

Figure-1: Polypropylene fiber

1.1. Use of Waste polyethylene and tires

Plastics are very long-lasting and do not degrade in the natural environment in which they are placed. Plastics are very long-lasting and resistant to the conventional techniques of gradation. This is due to the chemical links that keep them together, which retain them together. The quantity of plastic that people use on a daily basis has fast increased, and it has become a common practise for people to simply throw away the plastic, which has contributed to the contamination of the environment. This has led to an increase in the amount of pollution in the environment. Since the 1950s, over one billion metric tonnes of plastic have been produced all over the globe, and it is projected that the pace of production will stay relatively constant for the foreseeable future. These wastes are often mixed up with municipal solid waste (MSW) or are simply thrown away, both of which are detrimental to society and should be avoided at all costs. Plastics and tyres both have an immediate need to be recycled since there is no other method to get rid of them that does not entail harming the environment, and recycling is the only answer to this issue. Recycling is the only solution to this problem. For instance, there are two ways to get rid of waste: one is to burn it, and the other is to bury it in the ground. If the wastes are just thrown away in a landfill, they will cause damage to the soil as well as the water; however, if they are burnt, they will cause damage to the air that we breathe. As a consequence of this, there is an urgent need to convert waste products into something useful that does not have a detrimental effect on either the natural environment or the process by which it is used.

2. FIBER PROPERTIES

In order to develop this summary, a large number of qualified people have concentrated on the effects of a variety of strands, and then compiled their findings. They have conducted study on the real characteristics that cement has, in addition to looking at the mechanical features that cement possesses. In any event, a considerable amount of research into polyethylene fibre built up concrete and waste tyre fibre concrete has not been conducted. It may be difficult to get information on the function that these strands serve as supports in concrete due to the nature of the material. The method by which strands are incorporated into the structure as a whole is one of the ways in which the characteristics of FRC are modified. This is only one of the many ways that these traits are influenced by their environment. During the course of the study, it was found out that the filaments that had a greater total volume of components and were of a larger size displayed balling behaviour when they were being blended. This was observed as a result of the inquiry. As a direct result of this, the essential glue will grow more solid. When the volume sections of filaments are made longer, it adds further to a loss in the utility of the filaments. This loss of utility is compounded when the length of the volume sections is increased. This is due to the larger volume parts of the filaments having a higher surface area than the smaller volume components of the filaments. In addition to the mechanical properties that it already has, the cement's quality will be negatively impacted as a result of this factor. The most common method that is utilised to prevent breaking in plastic as well as the loss of volume in plastic is the use of customised filaments.

3. RESULT AND ANALYSIS

The following tests are required to be carried out in order to investigate the many aspects of polymeric fibre reinforce concrete that have an effect on the amount of time a paved surface may be used before requiring significant maintenance:

3.1. Point bend test (2-Point load test)

In order to explore the many characteristics of polymeric fibre reinforced concrete that have an effect on the length of time that a paved surface may be utilised before needing a considerable amount of care, the following research need to be carried out:

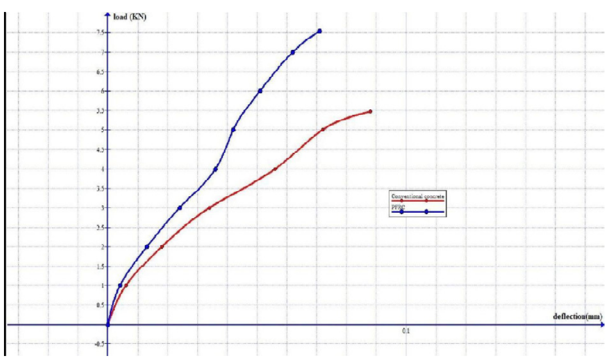

Figure-2: Test for point bends Deflection vs. Load for M30 Concrete

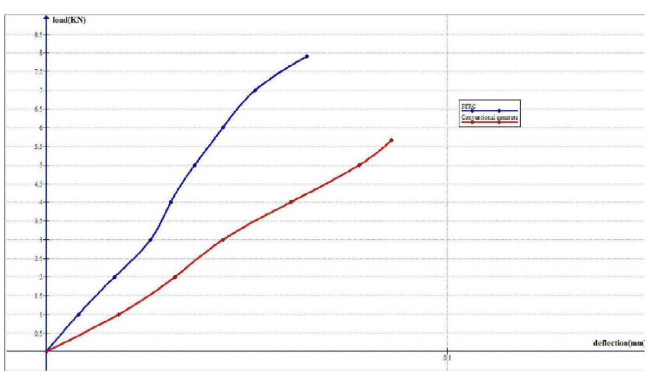

Figure-3: Point bend test for M35 concrete: Load vs. Deflection

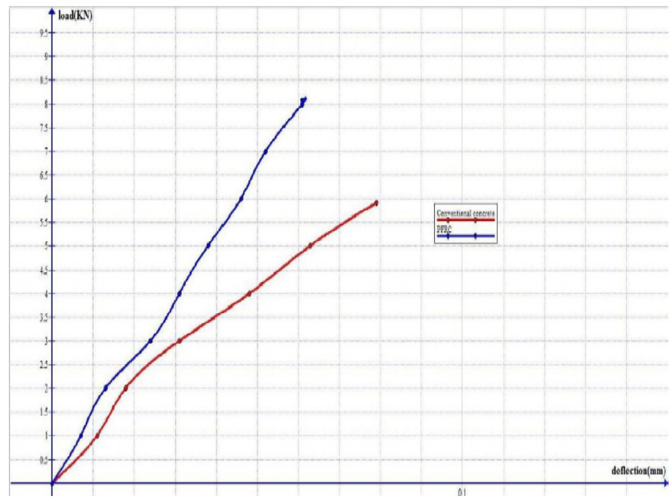

Figure-4: Point bend test for M40 concrete: Load vs. Deflection

3.2. Double Shear Test

It is generally agreed that the shear strength of the concrete is one of the material's most important qualities. Concrete's shear strength may be thought of as the amount of resistance it offers against shear force when the material is put under stress. Tests of the cast beams' shear resistance are carried out using compression testing equipment that has been configured in a certain manner.

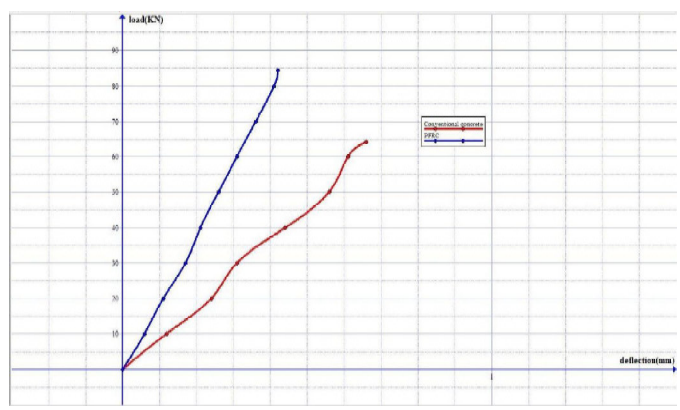

Figure-5: Test for double shear Deflection vs. Load for M30 Concrete

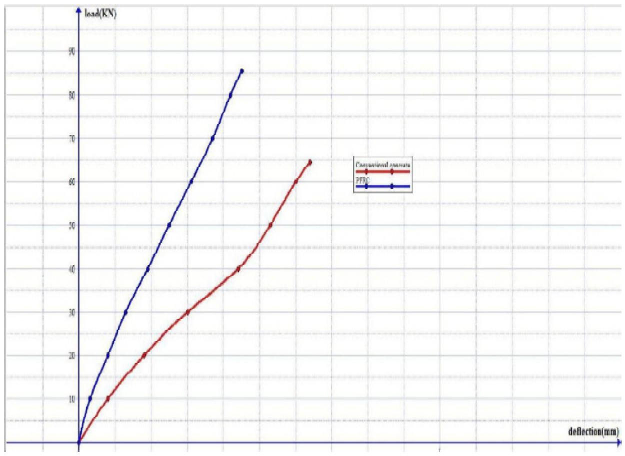

Figure-6: Test for double shear Deflection vs. Load for M35 Concrete

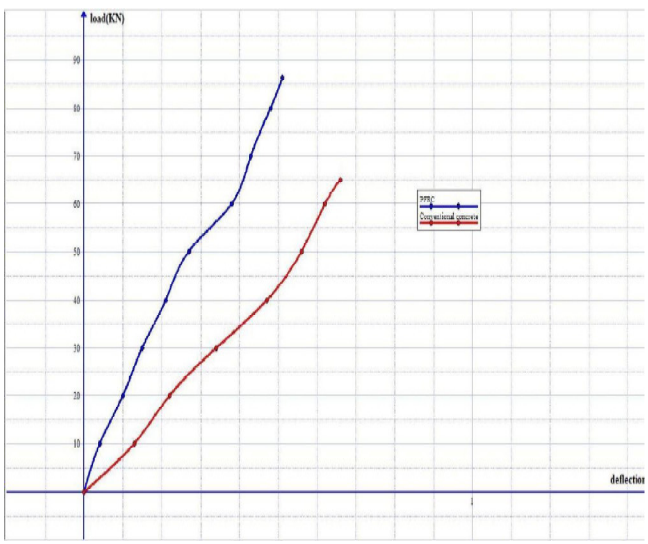

Figure-7: Test for double shear Deflection vs. Load for M40 Concrete

4. CONCLUSION

The following discoveries were made as a result of experiments carried out on concrete using strands of polyethylene and tyres:

When using concrete of the M30 grade, the compression strength improves by 17.93%; when using concrete of the M35 grade, it increases by 15.98%; and when using concrete of the M40 grade, it increases by 16.1%. It was anticipated that the flexural strength of M30, M35, and M40 would improve by 37.34 percent, 39.70 percent, and 39.66 percent, respectively. In addition, there was a reduction in the volume of traffic that was diverted by 22.22 percent, 23.5 percent, and 20.7 percent, respectively. There is a clear indication that the material's shear strength has been significantly improved. The gains in shear strength that were projected for the M30, M35, and M40 materials, respectively, were expected to be in the ranges of 31.33%, 32.56%, and 32.72%, respectively. In addition to that, there was a drop of 38.69%, 36.233%, and 33.75% accordingly in the number of individual redirections. The examples that have been shown up to this point illustrate that an increase in flexural strength resulted in a greater overall improvement than does an increase in shear strength. of the flexure that shear strain causes, the typical location of the intermediate point of diversion is significantly changed from what it would normally be.

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