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"EXPERIMENTAL STUDY ON STRENGTH BEHAVIOR OF HIGH-PERFORMANCE CONCRETE MADE FROM RECYCLED TIRE AND POLYETHYLENE FIBER"

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Abstract: Concrete is strong in compression but weak in tension and brittle extra. As immediately as cracks start to appear because of where the concrete is, though. These three flaws prevent the use of regular concrete in pavements because they lead to failure, fracture, and lack of ductility. By using fibres as reinforcement in the concrete mix, these flaws in concrete can be minimised. Tires and polyethylene waste contribute to environmental contamination, which causes a host of health problems. Waste tyres and polyethylene can be recycled and utilised effectively as fibre reinforcement in concrete. A synthetic hydrocarbon polymer called polyethylene can enhance ductility, power, shrinkage features, and other properties. The consequences of polyethylene fibre insertion on concrete houses are discussed in this essay.

Keywords - **Concrete, tension, reinforcement, synthetic, hydrocarbon, polyethylene.**

I. INTRODUCTION

For a developing nation such as India, road networks play a crucial role in providing a durable and comfortable surface for vehicles. Pavements are mostly made using bitumen. However, in certain situations concrete pavements are also preferred. Many additives have been explored for beneficial use of concrete as a paving material. A recent research has shown that fiber reinforced concrete (FRC) can be used for the construction of pavements as it is found to be very good in strength and it also exhibits other desirable properties.The definition of FRC given with the aid of ACI Committee 544 is "fiber strengthened concrete is a concrete that is made from cements containing excellent and coarse aggregates at the side of water for acquiring cementious properties and discontinuous fibers". The fibers used are of numerous sorts such as metallic fibers, polymer or natural fibers and so on. As said in advance, fiber strengthened concrete is that form of concrete where fibers are placed into the concrete as reinforcement to be able to growth the electricity characteristics and other mechanical houses of the concrete. Fiber bolstered concrete isn't just supplied for local strengthening in tensile place but it's far provided for acquiring a advantage in compression and tension in conjunction with reduced deflections and shrinkage and improved ductile assets. Apart from the above noted homes, polymeric fibers additionally assist in corrosion reduction. Commonly, Recron 3s, polyester and polypropylene were used for the purpose of FRC. Recently, other sorts of recycled fibers like plastic, disposed tires, carpet waste and wastes from textile enterprise also are being followed for the equal cause. Basic feature of these fibers is to act as crack arresters. Fibers assist in resisting the minor cracks and could now not let them develop into macro cracks. Hence, the cloth transforms into a cloth with stepped forward ductility and longevity to failure.

II. OBJECTIVES OF THE PRESENT STUDY

To give high performance concrete the desired strength.

To determine the amount of tyre fibres and waste polyethylene at which concrete gains greater strength.

The process of calculating compressive strength Concrete beam deflection, conventional concrete beam shear strength, and concrete and flexural strength.

Waste polyethylene and tyre fibres are industrial waste as well, and by using them, we may slow down the deterioration of the environment.

III LITERATURE SURVEY

Lee and Won(2014) In this study, steel fibres and structural nano-synthetics were employed to decrease the distribution of steel rebar in precast reinforced concrete composite members. Utilizing longitudinal steel ratios of 1.65 and 1.20 as well as a transverse steel ratio of 0.20, the members' flexural performance was assessed. Along with the steel rebar, hybrid fibre mixtures that contained varying percentages of hooked-end steel fibres and structural nano-synthetic fibres were used as reinforcing materials. Steel fibre contents were 5, 10, and 20 kg/m3, whereas the volume fractions of nano-synthetic fibres were 0.4, 0.5, and 0.6 vol%. Tests on the flexural performance of the resulting hybrid fiber-reinforced cement composites were conducted. The test findings showed that when the mixture contained 0.4 vol.% of nano-synthetic fibre and 20 kg/m3 of steel fibre, the hybrid fiber-reinforced cement composites satisfied the necessary conditions to replace the general reinforcing bars according to the RILEM standard. The flexural behaviour of a 350mm*180mm*1500mm precast composite member reinforced with such a hybrid fibre mixture and steel rebar was assessed; its maximum load was 3.5% higher than that of a steel fiber-reinforced composite member and 30% more than the specified ultimate load. The material performance of concrete reinforced with a blend of steel fibres and reinforcing structural nano-synthetics was assessed. The performance of the optimal mixture was then tested in a precast RC composite component utilising the least amount of steel possible. The experimental findings can be summed up as follows: a. Regardless of the fibre volume fraction, same flexural strengths were obtained for all mixes. The flexural toughness did, however, get better with the fibre volume fraction, and mixes with 20 kg/m3 steel fibre had greater flexural toughness values. The hybrid NSyn04St20 mixture, which contains 20 kg/m3 of steel fibre and 0.4 vol.% of structural nano-synthetic fibre, demonstrated the best flexural performance.

According to the RILEM standard, St05, which contained 0.5% steel fibre, and NSyn04St20, which employed 0.4% structural nano-synthetic fibre and 20 kg/m3 steel fibres, were suitable for general reinforcement.The precast HFRC member's maximum load was 30.1% higher than its intended ultimate load, and it performed on par with the precast SFRC component. The HFRC member that was precast was also more ductile.

Hoe Kwan and Ramli (2014) Marine constructions are subject to seismic and impact loads brought on by waves, collisions with solid objects, and water transportation in addition to chloride and sulphate attacks. As a result, it is necessary to clarify the flexural behaviour and impact resistance of Fiber-Reinforced Concrete (FRC) in a marine environment. Such information is hardly ever reported, though. As a result, the goal of this work is to determine the relationship between the two parameters as well as the effects of simulated aggressive settings on the flexural strength and impact resistance of FRC. In this investigation, three different types of fibers—coconut fibre, Bar chip fibre (BF), and alkali-resistant glass fiber—were utilised. The dosage of fibre was 0.6% to 2.4% of the volume of the binder. With a constant water to binder ratio of 0.37, all of the mixtures had compressive strengths more than 60 MPa. The specimens were ready and subjected to three distinct aggressive exposure habitats for up to 180 days each, including a tropical climate, cyclical air and seawater conditions, and a seawater environment. Results show a direct correlation between fibre content and FRC's flexural strength and impact resistance. Although changing the fibre type has a greater impact on flexural strength than increasing the fibre dosage, both changes would have a significant impact on impact resistance. Flexural strength of the BFRC composite is substantially lower than the tensile strength of a single BF (640 MPa). As a result, failure of the concrete matrix was seen to take place before the fibre rupture, which in turn caused the fibre to pull away from the concrete matrix. The FRC with the greatest BF content (2.4%), out of all the FRC tested, performed the best in terms of flexural strength. After 180 days, it was shown that the flexural strength of the Bar chip FRC had grown by 11–13% across all exposure settings. The impact load test results showed that the pre-crack energy absorptions increased by 60–63%

when compared to the control concrete, which showed no post-crack energy absorption. For various environmental exposure scenarios, the post-crack energy absorptions of the 2.4BF were discovered to range between 3.67 J and 3.71 J. Flexural strengths significantly increased after six months of exposure to the various hostile environment conditions, particularly in seawater, according to analysis of variance (ANOVA) data. This might be the result of salt crystal formation, which improved the frictional bond between the fibre and matrix. The performance of the impact resistance, however, is.

IV BASIC MATERIALS

The basic materials which compose concrete are:

1. Water
2. Cement
3. Fine aggregate
4. Coarse aggregate
5. Admixture (Plasticizer)

In case of polymer fiber reinforced concrete fibers are added. For this experiment 2 types offiber are chosen. The fibers to be used in the concrete mix are:

1. Polyethylene fiber
2. Tire (Nylon) fiber

Both fibers to be used in concrete matrix will be made from the waste materials. The wasted pouches of Sachi milk will be used for making the polyethylene fiber whereas wasted tire will be used to prepare nylon fiber.

Table.1 Sieve Analysis of Fine Aggregate

I.S. Sieve Size	Weight Retained (gm)	Cumulative Weight Retained (gm)	Cumulative Percentage Weight Retained	Cumulative Percentage Weight Passing
10 mm	2	2	0.4	99.6
4.75 mm	6	8	1.6	98.4
2 mm	20	28	5.6	94.4
1.18 mm	76	104	20.8	79.2
850 microns	224	328	65.6	34.4
425 microns	114	442	88.4	11.6
150 microns	54	496	99.2	0.8
<150 microns	4	500	100	0.0

Table.2. Physical Properties of Fine Aggregate (Tests as per IS: 2386 – 1968: Part III)

S. no	Physical properties	Values
1	Specific gravity	2.65
2	Fineness Modulus	2.83
3	Water Absorption	0.84%
4	Bulk density (kg/m3)	1654

Table.3. Physical Properties of Course Aggregate (Tests as per IS: 2386 – 1968 Part III)

S. No	Physical properties	Values
1	Specific gravity	2.65
2	Fineness Modulus	2.73
3	Water Absorption	0.68%
4	Bulk density (kg/m3)	1590
5	Aggregate Impact value (%)	11.2
6	Aggregate Crushing value (%)	25.12

V.CONCLUSIONS

There is a gain of 17.93%, 15.98% and 16.1% in compressive strength of M30, M35 and M40 grade concrete respectively.

Gain in flexural strength were found to be 37.34%, 39.70% and 39.66% for M30, M35, and M40 respectively. And respective reduction in deflection were 22.22%, 23.53% and 20.78%.

There is a significant amount of gain found in shear strength. Gain in shear strength were found to be 31.33%, 32.56% and 32.72% for M30, M35, and M40 respectively. And respective reduction in deflection were 38.69%, 36.23% and 33.75%.

From the above observations it can be seen that the gain in flexural strength is more than gain in shear strength. However the center point deflection due to shear force is much more reduced than deflection due to flexure.

From theoretical analysis of results it is observed in case of 4-point bend test that the percentage of variation of deflection in fiber introduced concrete is much higher than that of conventional concrete and it goes on increasing with increase in characteristic strength for both conventional concrete and fiber introduced concrete.

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