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To Study the Behaviour use of Locally Materials in Highway Subgrade

Amit Kumar Bhobria[1], Er Nitin Thakur[2]

[1]M. Tech Scholar, [2]Assistant Professor,
[1,2]Department of Civil Engineering, OITM, Hisar, Haryana, India

ABSTRACT
Concrete is strong in compression but weak in tension and brittle also. Cracks also start forming as soon as the concrete is placed. These above-said drawbacks don't permit the use of normal concrete in pavements as they lead to a lack of ductility along with fracture and failure. These weaknesses in concrete can be mitigated by using fibers as reinforcement in the concrete mix. Waste materials in the form of polyethylene and tires cause environmental pollution which leads to various health problems. Polyethylene and waste tires can be reused and used efficiently in the concrete as reinforcement in the fiber form. Polyethylene is a synthetic hydrocarbon polymer which can improve the ductility, strength, shrinkage characteristics. This study deals with the effects of addition of polyethylene fiber on the properties of concrete. In this study, Polyethylene and tire fibers were cut into the size of 25mm x 8mm and they were used 1.5% each by volume. Grades of concrete used were M 30, M 35 and M 40. IRC 44:2008 was followed for the design of concrete mix. In this study, the results of the strength properties of Polyethylene fiber reinforced concrete have been presented. Four-point bending and double shear test were performed in the laboratory for flexure and shear strength determinations. There was seen an increase of 18% in the 28-day compressive strength along with an increase of 39% in flexure Strenght and 32% in shear strength. It is also found that 22% reduction in the four-point bending test and 36% reduction in deflection by double shear tests were initiated out from the experiments. Theoretical analysis of deflection was carried out with the help of energy methods. Practical values were verified with the theoretical values within the allowable limits. Finally, it is concluded that polyethylene and tire used efficiently in reinforced cement concrete.

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INRODUCTION

The term fibre-reinforced concrete (FRC) is defined by AC1 116R, Cement and Concrete Terminology, as concrete containing dispersed randomly oriented fibers. With time a lot of fibres have been used in order to improve the properties of concrete and even waste materials like fly ash, silica fumes have also been used. The concept of using natural fibers has also evolved but its durability remains questionable A modern research has shown that fiber reinforced concrete (FRC) can be used for the construction of pavements as it is initiated to be very good in strength and it also exhibits other desirable properties Waste tyres were used in the form of chips and fibers. The fibers were further divided into batches with different lengths to determine the effects of length put on the properties of concrete. Fiber-reinforced concrete is the form of concrete where fibers are put into the concrete as reinforcement in order to increase the strength characteristics and other mechanical properties of the concrete. Pavements are mostly made using bitumen but now-a-days there are many situations like water prone locations, strength issues where it is made necessary to build concrete pavements

LITERATURE REVIEW

Lee et al. (2017) developed ''tire-added latex concrete'' to incorporate recycled tire rubber as a part of concrete. Crumb rubber from used tires was used in TALC (tire-added latex concrete) as a substitute for fine aggregates or styrene-butadiene rubber (SBR) latex while maintaining the same water cementitious materials ratio. TALC showed higher flexural and impact strengths than those of Portland cement, latex modified concrete and rubber added to concrete. Pictures taken using the SEM seem to support that there was better bonding between crumb rubber and Portland cement paste due to latex. TALC showed potential as a viable construction material that is less brittle than other types of concrete.

Biel and Lee (2015) reported that the type of cement noticeably affects the compressive strength of rubcrete. They used two types of cement, magnesium oxychloride cement and Portland cement, in making rubcrete. The percentage of fine aggregate substitution varied from 0 to 90% by weight. It was observed that 90% loss in compressive strength occurred for 30 both Portland cement rubber concrete (PCRC) and magnesium oxychloride cement rubber concrete (MOCRC) when aggregates (90% of fine aggregate and 25% of total aggregate) were replaced by untreated rubber. Magnesium oxychloride cement concrete exhibited approximately 2.5 times the compressive strength of PCC for both inclusions of rubber and without the inclusion of rubber in the concrete. In terms of splitting tensile strength, PCC specimens made with 25% of rubber by total aggregate volume retained 20% of their splitting tensile strength after initial failure, whereas the magnesium oxychloride cement concrete specimens with the same rubber content retained 34% of their splitting tensile strength. They further noted that the use of magnesium oxychloride cement may provide high strength and better bonding characteristics to rubber concrete, and rubber concrete made with magnesium oxychloride cement could possibly be used in structural applications if rubber content is limited to 17% of the total volume of the aggregate. 2.5.5 Shrinkage

Eldin and Senouci (2016) soaked and thoroughly washed rubber aggregates with water to remove contaminants, while Rostami et al. (1993) used water, water and carbon tetrachloride solvent, and water and a latex admixture cleaner. Results showed that concrete containing water washed rubber particles achieved about 16% higher compressive strength than concrete containing untreated rubber aggregates, whereas this improvement in compressive strength was 57% when rubber aggregates treated with carbon tetrachloride were used.

Khatib and Bayomy (2015) investigated the workability of rubber concrete and reported that there was a decrease in slump with increase in rubber content as a percentage of total aggregate volume. They further noted that at rubber contents of 40%, slump was almost zero and concrete was not workable manually. It was also observed that mixtures made with fine crumb rubber were more workable than those with coarse tire chips or a combination of tire chips and crumb rubber.

Tests Result

Compressive Strength Test

The compressive strength test is the most important test done on the concrete as it determines thecharacteristic strength of the concrete which represents the resistance of concrete against the crushing load. The casted cubes are tested for compressive strength in the compression testing machine.

Compressive strength of conventional concrete cubes

GRADE OF CONCRETE	SPECIMEN NO.	FAILURE LOAD (Tonne)	COMPRESSIVE STRENGTH (N/mm^2)	MEAN COMPRESSIVE STRENGTH (N/mm^2)
M30	1	82	36.77	37.13
	2	83	37.37	
	3	83	37.27	
M35	1	94	42.20	42.45
	2	95	43.10	
	3	96	42.66	
M40	1	104	46.21	46.72
	2	107	48.00	
	3	104	47.63	

Compressive strength of fiber introduced concrete cubes

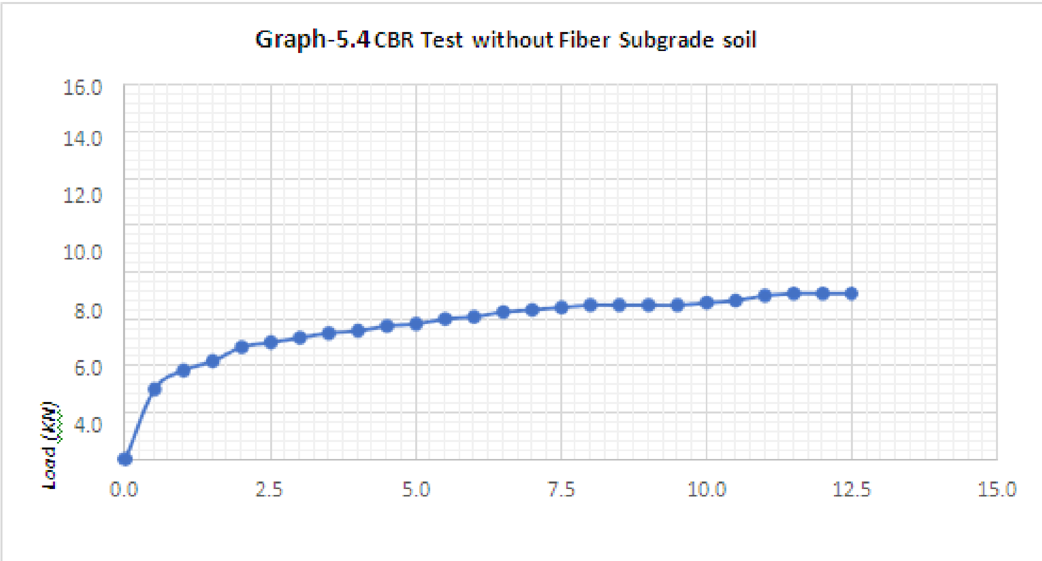
GRADE OF CONCRETE	SPECIMEN NO.	FAILURE LOAD (Tons)	COMPRESSIVE STRENGTH (N/mm^2)	MEAN COMPRESSIVE STRENGTH (N/mm^2)	STRENGTH GAIN (%)
M30	4	99	43	42.52	17.93
	5	99	43		
	6	98	41.56		
M35	4	111	48.23	48.55	15.98
	5	112	48.68		
	6	112	48.76		
M40	4	124	53.11	53.55	16.1
	5	122	53.22		
	6	122	53.12		

CALIFORNIA BEARING RATIO (CBR)

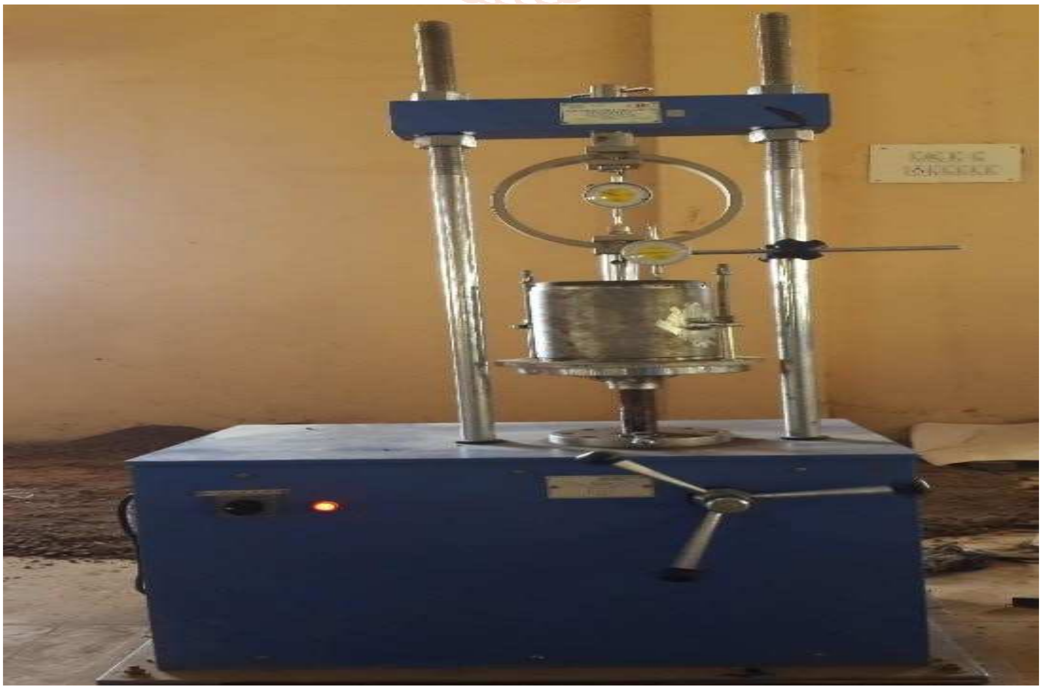
1. **WITHOUT FIBER *CBR Test***

SL No:	Penetration in mm (C1)	Proving Ring Readings (C2) KN	Proving Ring Readings in division (C3=C2*5)	Load in Kg C4=C4*0.915
1	0.0	0.0	0.0	0.0
2	0.5	2.74	14.35	12.64
3	1.0	2.63	18.57	16.75
4	1.5	3.52	20.68	18.86
5	2.0	3.56	23.79	21.35
6	2.5	4.36	24.97	21.57
7	4.0	4.74	26.57	24.68
8	5.0	4.85	28.46	25.35
9	7.5	5.4	31.35	28.86
10	10.0	5.83	32.48	31.68
11	12.5	6.72	34.96	31.46

Soil Sample without FIBER



Penetration



California Bearing Ratio Test

2. WITH GEOGRID AT H/4 FROM THE BOTTOM

CBR Test Data with WITH FIBER @ H/4 from bottom

SL No:	Penetration in mm (C1)	Proving Ring Readings (C2) KN	Proving Ring Readings in division (C3=C2*5)	Load in Kg C4=C4*0.915
1	0.0	0.0	0.0	0.0
2	0.5	2.4	11.48	10.34
3	1.0	2.2	15.57	15.43
4	1.5	4.7	15.45	15.46
5	2.0	3.7	22.75	20.75
6	2.5	4.4	26.56	24.86
7	4.0	5.7	28.74	26.59
8	5.0	5.9	29.49	26.55
9	7.5	5.3	30.36	27.84
10	10.0	5.8	33.25	32.39
11	12.5	6.0	34.14	31.29

Laboratory Experiment* WITH FIBER *in CBR Mould

Objectives

The effect of polyethylene as admixture on the strength of bituminous mix The present work is aimed at using two polymeric waste materials, such as polyethylene and tire fibers as reinforcement in concrete pavement. The basic objective of this work is to assess the advantages of using such waste materials such as increase in compressive, flexure and shear strength and reduce in deflection characteristics of the resultant concrete To study resistance to permanent deformation of mixes with and without polyethylene and also the determination of the deflection in the laboratory testing then its comparison to the theoretical deflection and check whether the errors are in the allowable limits of 20%.

Polyethylene and tire to achieve greater concrete strength properties in order to reuse them into something very useful and helping in reducing the environmental impact that the both of them have.The effect of polyethylene as admixture on the strength of bituminous mix with different filler and replacing some percentage of fine aggregate

Conclusion

The following inferences have been drawn from the experiments done on concrete with polyethylene and tire fibers:

1. There is a gain of 17.93%, 15.98% and 16.1% in compressive strength of M30, M35 and M40 grade concrete respectively.
2. Gain in flexural strength was initiate to be 37.34%, 39.70% and 39.66% for M30, M35, and M40 respectively and the respective reduction in deflection was 22.22%, 23.53% and 20.78%.
3. There is a significant amount of gain initiate in shear strength. Gain in shear strength was initiate 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% and33.75%.
4. 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.
5. From the theoretical analysis of results, it is observed in the case of Four-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 the rise in characteristic strength for both conventional concrete and fiber introduced concrete.
6. However in the case of double shear test that the percentage of variation of deflection in fiber introduced concrete is nearly equal to that of conventional concrete and it goes on increasing with the increase in characteristic strength for conventional concrete and reduces for fiber introduced concrete beams.

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