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COMPARATIVE EVALUATION OF FIBRE REINFORCED CONCRETE OF M_{40} BY USING STEEL FIBRE AND POLYESTER FIBRE

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Abstract - This paper focus on the comparative evaluation of fiber reinforced concrete in rigid pavement of M_{40} grade by using steel fibre and polyester fibre. Fibre reinforced specimen having different proportion is investigated. The parameter of investigation includes compressive strength and flexural strength. In this project work steel fibre (0.25%, 0.50%, 0.75%, 1%, 1.25%, and 1.50%) and polyester fibre (0.1%, 0.2%, 0.3%, 0.4%, 0.5%, and 0.6%) of different proportion is used. The structural behavior of fibre reinforced concrete is compared to that of the normal concrete.

***Key Words*:** Fibre Reinforced Concrete, Steel Fibre, Polyester Fibre, Compressive Strength, Flexural Strength.

1. INTRODUCTION

Concrete is the most widely used construction material in the world. The concrete pavement is also called rigid pavement. Rigid pavement is a concrete layer that is in contact with traffics directly. The design of rigid pavement is based on providing a structural cement concrete slab of enough strength to resist the load from traffic. The rigid pavement has rigidity and high modulus of elasticity to distribute the load over a wide area of soil. The reinforcement is provided in the slab depending upon the soil strength and loading conditions.

Fibre Reinforced Concrete

The concept of using fibre as reinforcement is not new. In ancient times, fibre can be used as reinforcement. Fibre reinforced concrete is the type of concrete containing fibrous material which increases its engineering properties. Fibres have advantages to improve the pre-crack tensile strength, impact strength, shrinkage crack, ductility performance, and eliminate the temperature. Fibre Reinforced Concrete provides a great requirement of pavement material which is economy and reduced pollution.

Types of Fibre Reinforced Concrete

There are many types of fibre used in construction field such as-

- Steel Fibre Reinforced Concrete.
- Polypropylene and Polyester fibre reinforced concrete.
- Glass Fibre Reinforced Concrete.
- Carbon Fibre Reinforced Concrete.

2. LITERATURE REVIEW

(1) K Vamshi Krishna, J. Venkateshwara Rao (2014) studied about "Experimental study on behavior of Fibre Reinforced Concrete for Rigid Pavement." paper deals with experimental investigation on mechanical properties of M_{20} grade concrete by polyester fibre in the mix. Polyester fibres of 0.1%, 0.2%, 0.3%, 0.4%, by weight of cement are added to the mix. He observed that 0.3 % fibre by weight of cement was the optimum dosage. It also resulted in 20% reduction of pavement thickness.

(2) H.S Jadhav (2013) he observed, flexural behavior of hybrid fibre reinforced concrete beam is investigated. The combination of steel and polypropylene fibres was used as hybrid fibre. The hybrid fibre of different proportions such as 0%, 0.25%, 0.5%, 0.75%, 1% and 1.25% by volume of concrete were used. The reinforced concrete beams of M_{25} grade of concrete were casted as per IS10262:2009. Three specimen of 0% and six specimen of each remaining percentage (0.25%-1.25%) were casted. The test result shows that use of hybrid fibre improves the flexural performance of the reinforced concrete beams.

(3) Dipan patel (2013) studied the use of steel fibre in rigid pavement.M20 concrete mix was prepared with crimped end steel fibre with 25mm length and0.5mm diameter (A/R50).Cube specimens were casted tested for 0.4 and 0.5% of volume of concrete. The results showed that the compressive strength of steel fibre concrete increased when compared to plain cement concrete. Addition of steel fibre in concrete, the pavement thickness is decreased by 23% and which is economical when compared to plain cement concrete slabs.

(4) Rajarajeshwari B Vibhuti (2013) studied the effect of addition of mono fibres and hybrid fibres on the mechanical properties of concrete for pavements. Steel fibres of 1% and polypropylene fibres 0.036% were added individually to the concrete mixture as mono fibres and then they were added together to form a hybrid fibre reinforced concrete. The result shows that hybrid fibres improve the compressive strength marginally as compared to mono fibres. Whereas, hybridization improves split tensile strength and flexural strength.

3. EXPERIMENTAL WORK

3.1 MATERIAL

Cement: In this project work Portland pozzolana flyash based cement of 53grade is used which is taken from Baloda Bazaar.

Fine aggregate: The fine aggregate is obtained from the river bed. Size of fine aggregate is taking by passing 4.75mm sieve.

The specific gravity of fine aggregate is 2.61and water absorption is 0.80.

Coarse aggregate: For the project work 40mm size of coarse aggregate is used. The specific Gravity and water absorption is 2.64 and 0.82 respectively.

Steel fibre: In this project rounded crimped type steel fibre are used and the length of steel fibre is 50mm and diameter is 1mm.it is added in proportion "0.25% - 1.25%" by volume of concrete. The steel fibre is taken from Purushottam Steelwool Industries, Nagpur.

Polyester fibre: Polyester triangular synthetic fibre is used. The length of polyester fibre is 12mm and 0.4mm diameter. The proportion of polyester fibre is "0.1% - 0.6%" by the weight of cement. Polyester fibre is taken from Surya Infratech, Jaipur.

3.2 TEST SPECIMEN

Compressive Strength Test- For compressive strength test, cube specimens of dimensions 150 *150 *150 mm were casted. The moulds were prepared with 0%, 0.1%, 0.2%, 0.3%, 0.4%, 0.5%, 0.6% for polyester fibers and 0.25%, 0.50%, 0.75%, 1%, 1.25% and 1.50% for steel fibre. The samples were tested for their compressive strength at 7, 14 and 28 days. Cubes were tested on compression testing machine. In each category three cubes were tested and their average value is obtained.

Flexural Strength Test- For flexural strength test, beam of size 150*150*700mm were casted. Concrete is placed in mould and compact properly through vibrating machine. After 24hours the beam is demoulded and it can be placed in tank for curing at 28 days. The beam is removed from curing after 28 days and it should be tested in flexural testing machine. The flexural strength of beam is tested in center point loading method.

4. RESULT AND CONCLUSION

Result of Compressive Strength Test- The average compressive strength of the steel fibre reinforced concrete and polyester fibre reinforced concrete at 7, 14 and 28days are given in table below-

Table 1- Avg. compressive strength of SFRC

SN.	Day	Avg. compressive strength of SFRC, N/mm^2						
		PC	0.25%	0.5%	0.75%	1%	1.25%	1.5%
1	7	19.62	18.46	21.56	23.3	27.5	23.9	22.3
2	14	31.24	26.42	28.19	32.52	39.40	34.31	32.67
3	28	49.45	34.62	37.17	39.56	52.75	48.2	46.04

Table 2- Avg. compressive strength of PFRC

SN.	Day	Avg. Compressive Strength of PFRC, N/mm^2						
		PC	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%
1	7	19.62	19.81	20.32	23.01	27.13	24.81	23.30
2	14	31.24	30.91	32.00	35.19	39.27	35.23	34.83
3	28	49.45	39.10	42.18	47.95	50.43	47.41	45.21

Result of Flexural Strength Test- The average flexural strength of steel fibre reinforced concrete and polyester fibre reinforced concrete at 28 days is given by the table below-

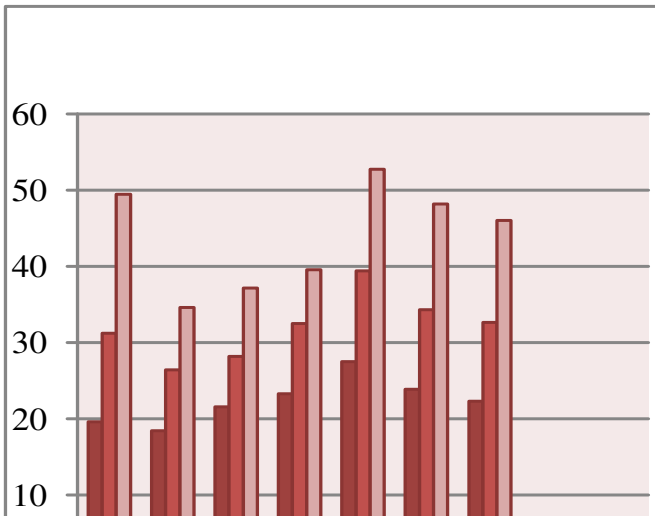
Table3- Average Flexural strength of SFRC

Day	Avg. flexural strength of SFRC, N/mm^2						
	PC	0.25%	0.5%	0.75%	1%	1.25%	1.5%
28	2.14	2.78	3.52	4.89	5.19	5.87	4.90

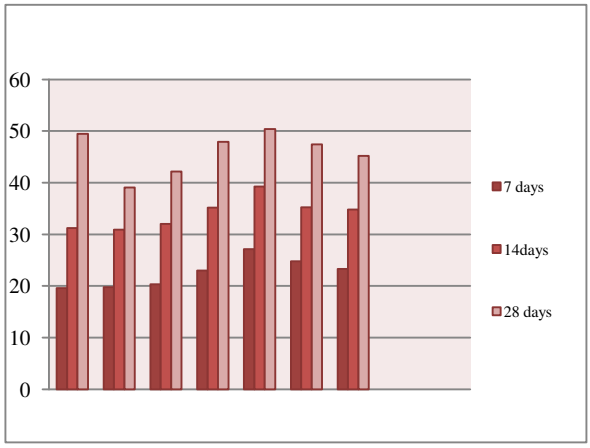
Table4- Average flexural strength of PFRC

Day	Avg. flexural strength of PFRC, N/mm^2						
	PC	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%
28	2.14	2.69	3.40	4.99	4.81	3.92	3.30

The variation in compressive strength of steel fibre reinforced concrete and polyester fibre reinforced concrete is shown in the graph below-

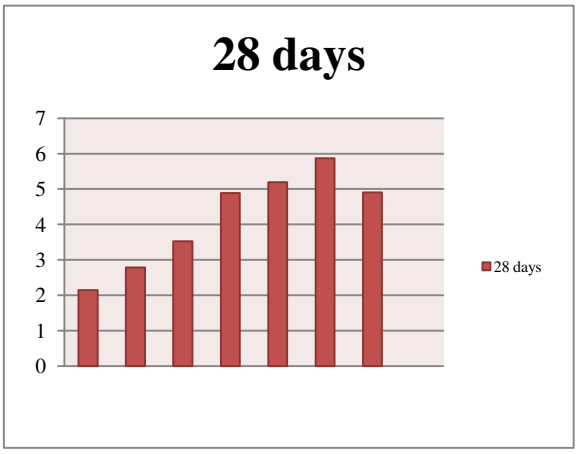


Graph1- Compressive Strength of SFRC

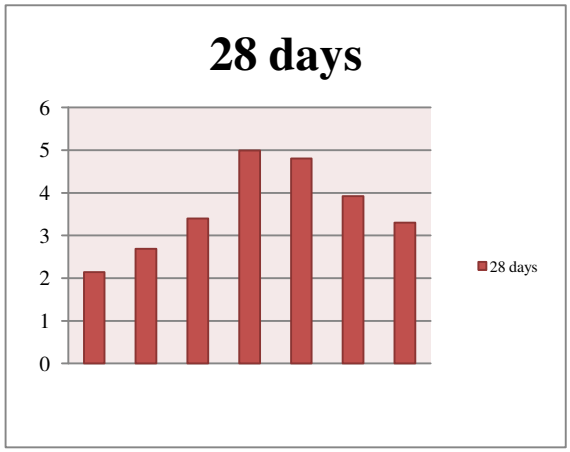


Graph2- Compressive Strength of PFRC

The variation in flexural strength of steel fibre reinforced concrete and polyester fibre reinforced concrete is shown in graph below-



Graph3- Flexural Strength of SFRC



Graph4- Flexural Strength of PFRC

5. CONCLUSIONS

It is obtained that the maximum compressive strength of steel fibre reinforced concrete at1% is 52.75N/mm2 and polyester fibre reinforced concrete at 0.4% is 50.43 N/mm2.The maximum flexural strength is given at1.25% of steel fibre reinforced concrete is5.87 N/mm2 and 0.3% of polyester fibre reinforced concrete is 4.99 N/mm2. Increasing the percentage of fibre in concrete, the strength start decreasing. To compare the steel fibre reinforced concrete and polyester fibre reinforced concrete, the steel fibre reinforced concrete gives higher strength than the polyester fibre reinforced concrete. The strength of fibre reinforced concrete increases than the normal concrete.

REFERENCES

1. K. Vamshi Krishna, j. Venkateswara Rao, “Experimental Study on Behavior of Fiber Reinforced Concrete for Rigid Pavements" IOSR Journal of Mechanical and Civil Engineering, Volume: 11, Issue: 4, 2014.
2.Rajarajeswari B vibhuti, Radha Krishna, “Mechanical Properties of Hybrid Fiber Reinforced Concrete for Pavement” in International Journal of Research in Engineering and Technology (IJRET), e-ISSN: 2319-1163, p-ISSN: 2321-7308, 2013.
3. H. S. Jadhav, M. D. Koli, “Flexural Behavior of Hybrid Fibre Reinforced Concrete Beams” International Journal of structural and Civil Engineering Research Vol.2 No.3, 2013.
4. Dipan patel, "Use of Steel Fiber in Rigid Pavement," in Global research analysis, Vol.2, 2277-8160, 2013.
5. Dr. Vagheesha S. Mathda1, Ms. Hemali K. Khaire2 “Study of Effects of Polyester Fibers on Compressive Strength of Concrete” IJRASET Volume 4 Issue I, IC Value: 13.98 ISSN: 2321-9653, 2016.
6. Milind V. Mohod “Performance of Steel Fibre Reinforced Concrete” International Journal of Engineering and Science, Volume: 1, Issue: 12, ISSN: 2278-4721, 2012.
7. IS: 10262-2009, “Recommended guidelines for concrete mix design, Bureau of Indian standards”.