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Study on Flextural Behaviour of OPC Concrete with Partial Replacement of Cement with Marble Dust and Waste Rubber as Fibre

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Abstract: ***The concrete plays important role in the construction of structures. The need for concrete increases day by day. Materials required for concrete are getting depleted, so there is a requirement to find alternatives. At the same time the alternative materials should posses the property of the actual materials used in concrete and also they must provide the required strength to the concrete. Normally Concrete is strong in compression but weak in tension and shear. The purpose of this study is to find the behavior of concrete reinforced with fibers. By adding rubber tyres in percentages of 2% to the concrete, the properties like compressive, flexural and split tensile strength are investigated. The optimum percentage of fiber was found to be 2%. Marble has been widely used in structures since ancient times. The present study is aimed at utilizing waste marble dust (WMD) in construction industry itself as cement in concrete, replacing and also coarse aggregate by adding the optimum percentage of rubber tyre as 2% fibers. The replacement is done partially in the various proportions like 0%, 10% and 20% and its effect on properties of concrete were investigated.***

Keywords: rubber tyre, waste marble dust, concrete,compressive strength,flexural strength.

I. INTRODUCTION

A. General

Concrete is an indisputable material for the construction of various types of structures in the modern advancement of civil infrastructures. Concrete is strong in compression but weak in tension and shear. To eliminate, the introduction of fiber was brought in as an alternative to developing concrete in view of enhancing its tensile and shears strength as well as improving its ductile property. Hence, the purpose of this study was to investigate thermo chemical behaviour of concrete reinforced with macro (structural) synthetic fiber. To determine these properties experimental work was carried out.

B. Fibre Reinforced Concrete

Fiber-reinforcement is mainly used in concrete, but can also be used in normal concrete. Fiber-reinforced normal concrete are mostly used for on-ground floors and pavements, but can be considered for a wide range of construction parts (beams, pillars, foundations etc) either alone or with hand-tied rebar's.

The main reasons for adding fibres to concrete matrix is to improve the post-cracking response of the concrete i.e., to improve its energy absorption capacity and apparent ductility, and to provide crack resistance and crack control. Also, it helps to maintain structural integrity and cohesiveness in the material.

C. Historical Perspective

The concept of using fibers as reinforcement is not new. Fibers have been used as reinforcement since ancient times. Historically, horsehair was used in mortar and straw in mudbricks. In the early 1900s, asbestos fibers were used in concrete, and in the 1950s the concept of composite materials came into being and fiber reinforced concrete was one of the topics of interest. There was a need to find a replacement for the asbestos used in concrete and other building materials once the health risks associated with the substance were discovered. By the 1960s, steel, glass (HFRC), and synthetic fiber such as polypropylene fiber were used in concrete, and research into new fiber reinforced concretes continues today.

D. Effect Of Fibers In Concrete

Fibers are usually used in concrete to control plastic shrinkage cracking and drying shrinkage cracking. They also lower the permeability of concrete and thus reduce bleeding of water. Some types of fibers produce greater impact, abrasion and shatter resistance in concrete. Generally fibers do not increase the flexural strength of concrete, so it cannot replace moment resisting or structural steel reinforcement. Some fibers reduce the strength of concrete.

The amount of fibers added to a concrete mix is measured as a percentage of the total volume of the composite (concrete and fibers) termed volume fraction (V_f). V_f typically ranges from 0.1 to 3%. Aspect ratio (l/d) is calculated by dividing fiber length (l) by its diameter (d). Fibers with a non-circular cross section use an equivalent diameter for the calculation of aspect ratio. If the modulus of elasticity of the fiber is higher than the matrix (concrete or mortar binder), they help to carry the load by increasing the tensile strength of the material. Increase in the aspect ratio of the fiber usually segments the flexural strength and toughness of the matrix. However, fibers which are too long tend to "ball" in the mix and create workability problems.

Some recent research indicated that using fibers in concrete has limited effect on the impact resistance of concrete materials. This finding is very important since traditionally people think the ductility increases when concrete reinforced with fibers.

The results also pointed out that the macro fibers is better in impact resistance compared with the longer fibers. The High Speed 1 tunnel linings incorporated concrete containing 1 kg/m³ of polypropylene fibers, of diameter 18 & 32 μm, giving the benefits noted below.

E. Developments In Fiber Reinforced Concrete

The newly developed FRC named Engineered Cementations Composite (ECC) is 500 times more resistant to cracking and 40 percent lighter than traditional concrete. ECC can sustain strain-hardening up to several percent strain, resulting in a material ductility of at least two orders of magnitude higher when compared to normal concrete or standard fiber reinforced concrete. ECC also has unique cracking behavior. When loaded to beyond the elastic range, ECC maintains crack width to below 100 μm, even when deformed to several percent tensile strains.

Recent studies performed on a high-performance fiber-reinforced concrete in a bridge deck found that adding fibers provided residual strength and controlled cracking. There were fewer and narrower cracks in the FRC even though the FRC had more shrinkage than the control. Residual strength is directly proportional to the fiber content.

A new kind of natural fiber reinforced concrete (HFRC) made of cellulose fibers processed from genetically modified slash pine trees is giving good results. The cellulose fibers are longer and greater in diameter than other timber sources.

Some studies were performed using waste carpet fibers in concrete as an environmentally friendly use of recycled carpet waste. A carpet typically consists of two layers of backing (usually fabric from polyolefin tape yarns), joined by $CaCO_3$ filled styrene-butadiene latex rubber (SBR), and face fibers (majority being nylon 6 and nylon 66 textured yarns). Such steel and polyolefin fibers can be used for concrete reinforcement.

F. Marble Dust

Marble is a metamorphic rock resulting from the transformation of a pure limestone. The purity of the marble is responsible for its colour and appearance. It is white if the limestone is composed solely of calcite (100% $CaCO_3$). Marble is used for construction and decoration. Marble is durable, has a noble appearance, and is consequently in great demand. Chemically, marbles are crystalline rocks composed predominantly of calcite, dolomite or serpentine minerals. The other mineral constituents vary from origin to origin. Quartz, muscovite, tremolite, actinolite, microline, talc, garnet, osterite and biotite are the major mineral impurities whereas SiO_2, limonite, Fe_2O_3, manganese, $3H_2O$ and FeS_2 (pyrite) are the major chemical impurities associated with marble. The main impurities in raw limestone (for cement) which can affect the properties of finished cement are magnesia, phosphate, leads, zinc, alkalis and sulfides. A large quantity of powder is generated during the cutting process. The result is that the mass of marble waste which is 20% of total marble quarried has reached as high as millions of tons. Leaving these waste materials to the environment directly can cause environmental problem. The advancement of concrete technology can reduce the consumption of natural resources and energy sources which in turn further lessen the burden of pollutants on the environment. Presently, large amount of marble dust are generated in natural stone processing plants with an important impact on the environment and humans.

II. LITERATURE REVIEW

Rakesh Gupta, P.A.Shirule, AtaurRahman (2014) studied on "Partial replacement of cement with marble powder", technical journals and concluded that for M20 grade concrete the compressive strength of cubes are increased with addition of waste marble power upto 10% replaced by weight of cement and
further any addition of waste marble powder the compressive strength decreases.The split tensile strength of cylinders are increases with addition of waste marble powder upto 10% replace by weight of cement and further any addition of waste marble powder the split tensile strength decreases.

Jashandeepsingh, R.S.Bansal (2015) studied on "Partial replacement of cement with waste powder with M25 grade" IJTRA, Vol. 3, issue 2,pp 202-205 and concluded that upto 12% replacement of cement with waste marble there is an increases in all mechanical properties.The replacement of 12% of cement with waste marble powder attains maximum compressive and tensile strength.The optimum % of replacement of marble powder with cement is almost 12% cement for both cubes and cylinders.
V. M. Sounthararajan and A. Sivakumar (2013) studied on "Effect of the lime content in marble powder for Producing High Strength Concrete". ARPN journal of engineering and appiled sciences, Vol 8, No 4, April 2013 ISSN 1819-6608. Adds lime content in marble powder and check its effects on concrete mix. In this research work the waste marble powder upto 10% by weight of cement was investigated for hardened concrete properties. The effect of different % replaces marble powder on compressive strength, splitting strength and flexural strength was calculated.The immense increases in compressive strength of 46.80 MPa at 7 days for 10% replacement of marble powder in cement content was calculated and also showed an improvement in mechanical properties as compared to the conventional concrete.

III. MATERIAL USED

The basic material for mixing concrete are required such as
Cement
Fine and Coarse Aggregate,
Marble dust, Tyre fiber
The cement used for present investigation was ordinary Portland cement.

IV. MATERIAL INVESTIGATION

Charateristics Properties Of Cement

	Charateristics	Specified value as per IS:8112-1989
1	Consistency of cement(%)	30
2	Specific gravity	3.15
3	Initiial setting time (minutes)	>30
4	Final setting time (minutes)	<600
5	Compressive strength (N/mm^2) (i)7 days (ii)28days	 >33 >43
6	Soundness (mm)	10
7	Fineness of Cement(gm)	10

Physical Properties Of Fine Aggregate

Sr.No	Physical properties	Specified value as per IS:383-1970
1	Specific gravity of Fine aggregat	2.60
2	Free Moisture Content	2%
3	Water Absorption	1.82%

Seive Analysis Of Fine Aggregate

Sr.No	IS Sieve Designation	IS:383-1970 requirements for zone-II
1	4.75mm	90-100
2	2.36mm	75-100
3	1.18mm	55-90
4	600µ	35-55
5	300µ	8-30
6	150µ	0-10

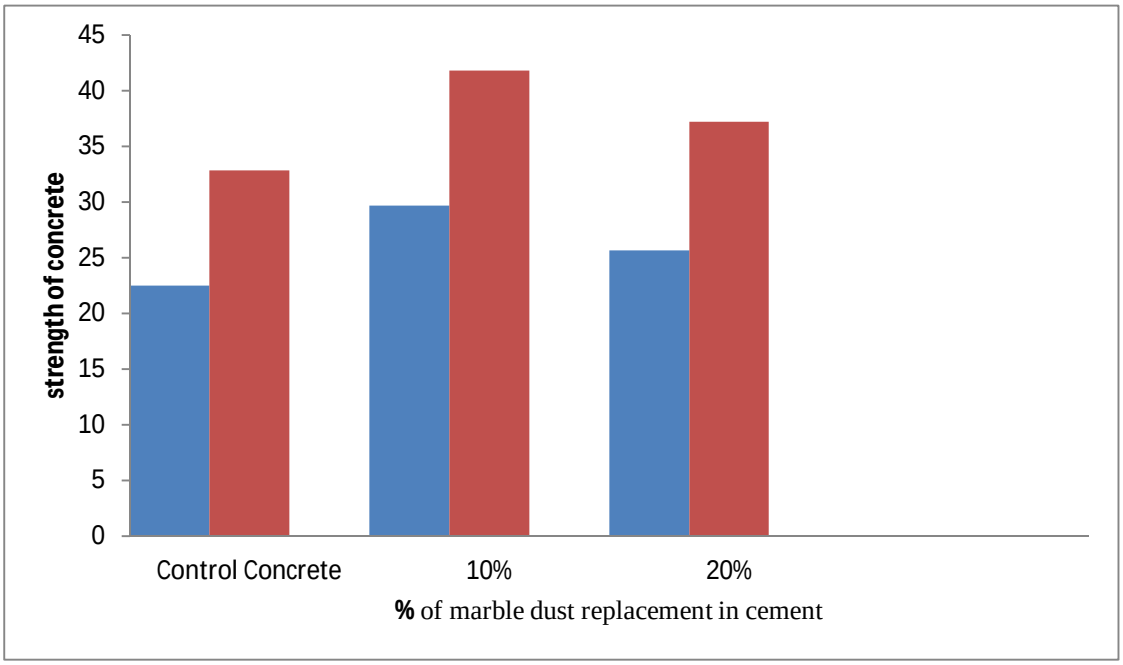
V. RESULT ANALYSIS

A. *Compressive Strength*

From the above 7th and 28th day result of Tyre Fiber Reinforced Concrete is 0.2% found to be optimum, so it is fixed and other ratio of cement replacement to be carried out.

Compressive Strength for 0.2% Tyre fiber and various percentages of Marble dust in concrete

Sl.No	No of Days	% Marble dust Replacement in Cement		
		CC	**10%**	**20%**
1	7	22.52	29.68	25.67
2	28	32.82	41.80	37.20



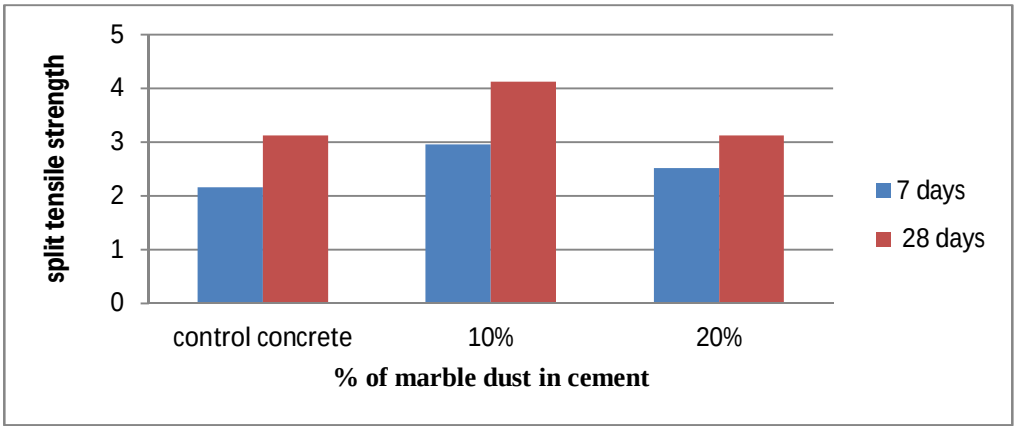
Variation of Compressive Strength for 0.2% Tyre Fiber and Marble Dust

B. *Split Tensile Strength*

From the above 7th and 28th day result of Tyre Fiber Reinforced Concrete is 0.2% found to be optimum, so it is fixed and other ratio of Cement replacement is carried out.

Split Tensile Strength for 0.2% tyre fiber and variation of various percentage of Marble dust in concrete

Sl.No	No of Days	% Marble dust Replacement in Cement		
		CC	**10%**	**20%**
1	7	2.16	2.96	2.51
2	28	3.12	4.12	3.64



Variation of Split Tensile Strength for 0.2% Tyre Fiber and Marble Dust

VI. DISCUSSION OF TEST RESULT

A. The compressive strength of concrete improves with increases in adding of Tyre fiber.
B. The split tensile strength was also improving with increase in adding of Tyre fiber.
C. The flexural strength of concrete on adding of Tyre fiber was increasing, but decreased at certain percentage.
D. On use of marble dust as replacement for cement the weight of concrete got reduced with increase in replacement.
E. The optimum percentage of adding of Tyre fiber and cement with marble powder was found to be 0.2% and 20%.

VII. CONCLUSION BASED ON TEST RESULTS

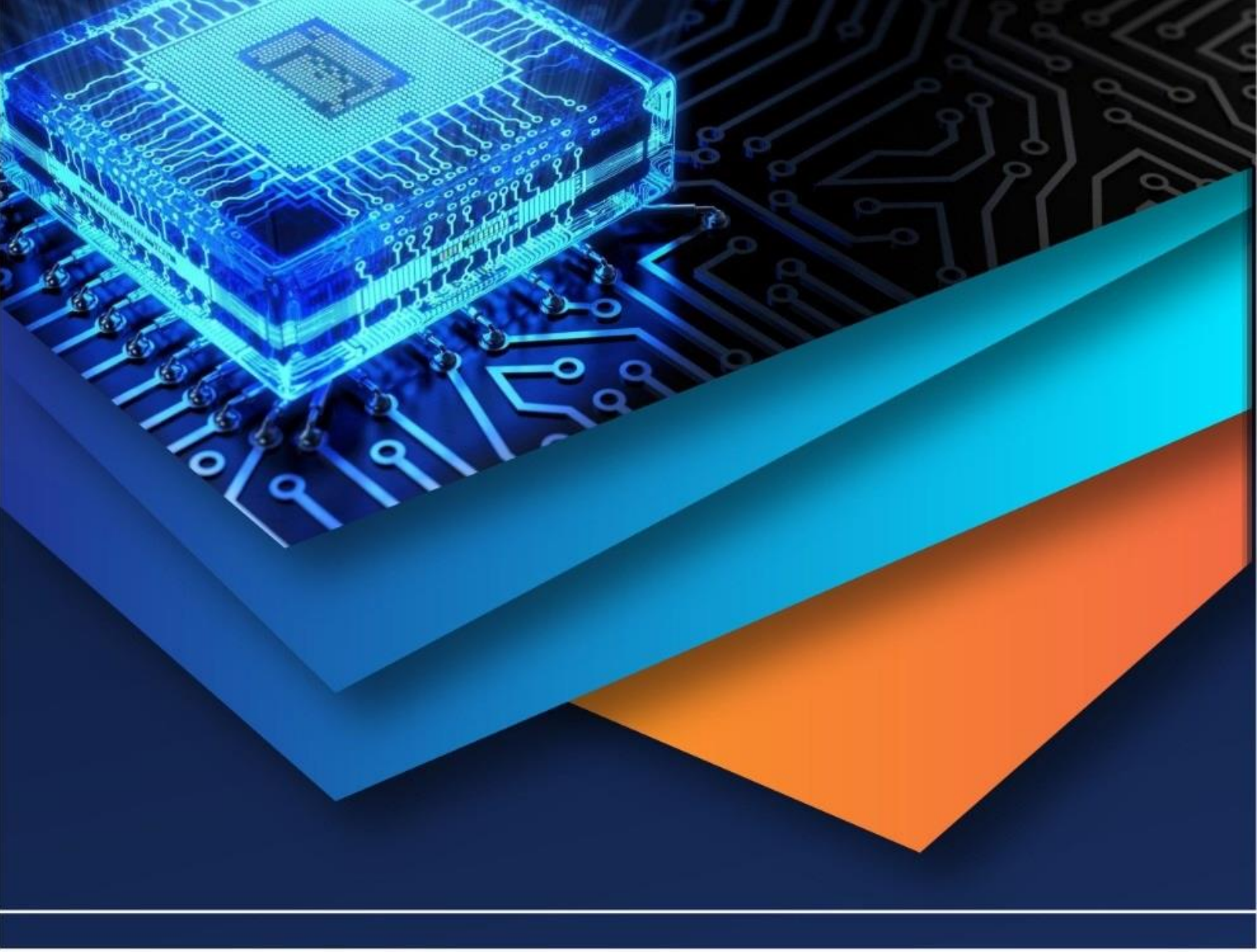
The result obtained after casting the concrete, the optimum percentage of Tyre fiber of compressive strength, split tensile strength is 0.2%.The result obtained after casting the concrete the optimum percentage of Tyre fiber and marble dust of compressive strength, split tensile strength is 20%.

The percentage increase in compressive strength, split tensile strength of optimum percentage of Tyre Fiber than control concrete is 16.08%, 32.05% respectively. The percentage increase in compressive strength, split tensile strength of optimum percentage of Tyre fiber and marble dust than control concrete is 27.36%, 32.05% respectively.

REFERENCES

[1] Aalok D. Sakalkale, G. D. Dhawale, R. S. Kedar, Experimental Study on Waste Marble Dust in Concrete,Int. Journal of Engineering Research and Applications Vol. 4, Issue 10(Part - 6), October 2014
[2] Ashok k. Jain - Reinforced concrete limit state design
[3] BaharDemirel,The Effect of the Using Waste Marble Dust as Fine Sand on the Mechanical Properties of the Concrete,International Journal of the Physical Sciences Vol. 5(9), pp. 1372-1380, 18 August, 2010
[4] IS 10262: 2009 –Concrete Mix Proportioning – Guideline
[5] IS 1489 (Part 1): 1991 – Portland Pozzolana Cement – Specification
[6] IS 2386 (Part 3): 1963 – Methods of test for Aggregates for Concrete

[7] IS 8112: 1989 – Ordinary Portland Cement, 43 Grade- Specification
[8] M.S.Shetty – Concrete Technology
[9] Nitisha Sharma, Ravi Kumar, Review on Use of Waste Marble Powder as Partial Replacement in Concrete Mix, International Journal of Civil Engineering (SSRG-IJCE) – EFES April 2015
[10] Park, R., and Paulay, T-, Reinforced Concrete Structures, John Wiley and Sons, 1975
[11] Paulay, T. And Priestley, M.J.N., Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley and Sons, 1992
[12] Prof. M.A. Jamnu,JayeshPatel,Study on Properties of Concrete Using Marble Dust, International Journal for Scientific Research & Development| Vol. 2, Issue 05, 2014
[13] Ramamurtham.S - Design of reinforced concrete structures



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