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Experimental Study of Rubberized concrete

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Abstract:

Solid waste management has gained a lot of attention to the research community now-a- days. There are various solid wastes, but waste tires are non- biodegradable nature therefore, it create major problem in environment. Discarded vehicle tires are the type of solid waste which is generally disposed by landfills method. But now a day's disposal of whole or shredded tires by land filling technique is ban by EU policies. An emerging use is the production of concrete, in which tire rubber particles partially or fully replace natural aggregates. This has the additional advantage of saving in natural constituent which is used in the production of concrete. This project study the experimental behavior of physical and mechanical properties of rubberized concrete The influence of factors such as rubber aggregate content and size, as well as curing time was also considered. There is M25 grade concrete use with fly ash. From this experimental study it is observed, that there great loss in strength, this type of concrete was acceptable for various architectural applications requiring medium to low compressive strength. Thus, the use of waste tire rubber for formation of concrete it is the best disposal method to protect the our environment.

Keywords — **Solid waste management, Crumb rubber, Rubberized concrete, Fly ash, Mechanical properties.**

I. INTRODUCTION

Now a day's several researchers have been studying final disposal method for non decaying material such as tire rubber waste which is generated in great volume from automobile industry. Therefore, reuse and recycled of waste rubber in concrete as alternative construction material it is the best solution for disposal of tire rubber waste. Because, demand for ingredients of concrete is increases continuously, due to the speedy growth in construction industry. Also concrete is basic element of construction which is most extraordinary and versatile, there is requirement for modifying concrete properties. Due to this reason if we combine concrete and waste tire rubber material then there is possibility for modifying concrete properties and also we get the way for disposal of tire rubber waste which is helpful in reducing environment pollution.

Guoqiang Li et al. [1] investigated mechanical properties by modifying waste tire rubber concrete. For this experimental study waste tire rubber used in two form one is chipped particle and other is fiber form. In this study waste tire rubber treated by NaOH solution for making their surface rough and also for improvement in bond physical anchorage are formed by drilling hole at the centre of chips. Result of Experimental work shows that fiber tire rubber waste gives good performance than the chip tire rubber waste. And also it is concluded that NaOH surface treatment does not gives good performance for large size of chip particle.

Topcu[2],Chung and Hong [3],Segre and Joekes[4],and Kosievith et al. [5] all studied used of waste tire rubber as a composite of concrete. From this study they conclude that mechanical properties of decreases with addition of waste tire rubber.

The main aim of this experimental work is to protect our environment by using non decaying material such as waste tire rubber in concrete. For this experimental study various mechanical test are conducted like compressive strength, spilt tensile

strength, and flexural strength with crumb rubber particle.

II. EXPERIMENTAL DETAILS

For this experimental study, concrete ingredients are used such as aggregate, sand, cement, Fly ash and water with waste tire rubber. Therefore this concrete is also called as a rubberized concrete. The cement used was ordinary Portland cement of 53 grades.

A. Concrete mix design

For this experimental study M25 grade concrete mix design are used. Concrete mix design are prepared using IS method. The specimens were prepared with replacements of the fine aggregate by 5, 10 and 15 percentage of crumb rubber aggregate. For comparative analysis, M25 grade concrete mix is prepared with no replacement of crumb rubber aggregate. Adding the 5% Fly Ash by weight of cement into normal concrete and crumb rubber mix concrete. For mixing process machine mixer are used and after casting of specimens employed tamping rod and table vibrator. In this evaluation, tests are performed as workability by slump cone test, unit weight, compressive strength, flexural strength, split tensile strength at 7th and 28th days on various concrete mixes. Concrete mix proportion for M25 concrete is given below:

- Cement – 1
- Fine aggregate -2.11
- Coarse aggregate – 3.17
- W/C ratio -0.4

B. Preparation of specimen

For this experimental work, there are four mixes are used and specimen casted for each mix are shown in Table 1.

TABLE I
DETAILS OF DIFFERENT TYPE OF MIX

Sr. No.	Mix Identification	% of Rubber
1	MIX-0	0
2	MIX-0	5
3	MIX-0	10
4	MIX-0	15

III. EXPERIMENTAL RESULTS AND DISCUSSION

C. Workability of concrete

From Fig.1 it is observed that workability of concrete is decreases as the percentage of waste tire rubber is increases. Reduction in slump value is occurred due to the particle size of tire rubber therefore if we used smaller size particle for replacement then workability of tire rubber concrete is increases.

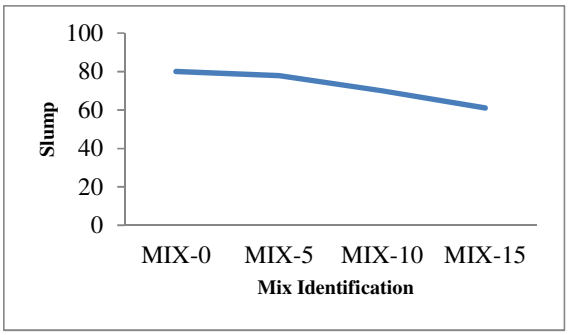

Fig . 1 Workability of concrete for different mix

D. Unit weight

The specific gravity of the rubber chips are 1.10 which is very low as compared to the mineral coarse aggregates is 2.80.Therefore,there is reduction in unit weights of rubberized concrete with addition crumb rubber percentage into concrete.

TABLE III
VALUE OF UNIT WEIGHT OF CUBE

Specimen	% of Rubber aggregate	Unit weight	% unit weight loss
MIX- 0	0	2638	0
MIX -5	5	2553.6	3.19
MIX – 10	10	2385.52	9.57
MIX – 15	15	2345.24	11.09

E. Compressive strength

From Fig .2 it is observed that the compressive strength of concrete is increases up to 10% addition of rubber in concrete. But after that it gradually

decreases with addition of rubber in concrete. Results of compressive strength are generally depending upon the size and texture of tire rubber particle.

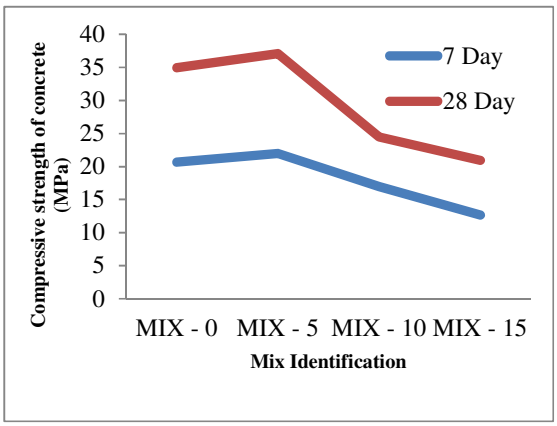

Fig. 2 Compressive strength after 7 and 28 days

F. Spilt tensile strength test

From this experimental study it is observed that the normal concrete is spilt into well defined failure pattern than the rubberized concrete. But strength of tire rubber concrete is decreases with addition of tire rubber waste due to the weak bonding between concrete ingredient and tire rubber particle.

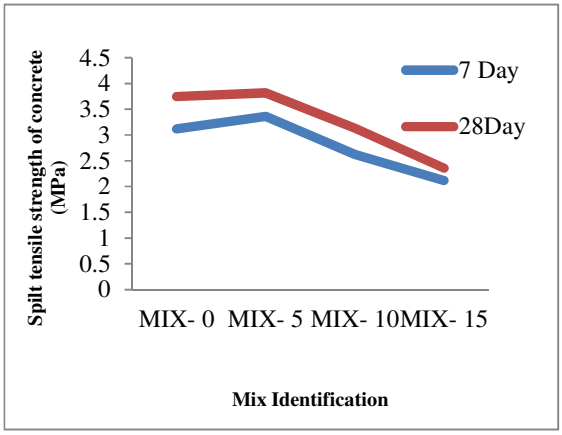

Fig. 4 Spilt tensile strength after 7 and 28 days

G. Flexural strength test

Flexural strength result for 28 days curing is shown on graph in Fig.4. From this graph it is observed that flexural strength of concrete is reduces but for 5% replacement of tire rubber it gives good result than the controlled concrete. This result will be improved by surface treatment for tire rubber particle.

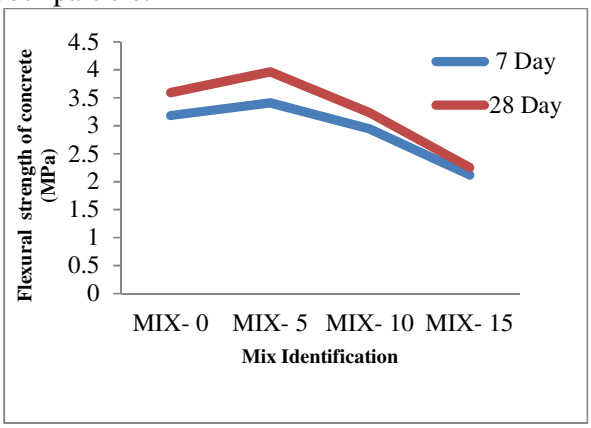

Fig.4 Flexural strength after 7 and 28 days

IV. CONCLUSIONS

Based on the experimental work in rubberized concrete following conclusion is drawn.

1. Slump value is reducing as the percentage of replacement of tire rubber waste increased. So reduce in workability.
2. From this experimental study, it is noted that unit weight of cube specimens has been decreases up to increasing the percentage rubber into concrete. From this test it has to be concluded that rubberized concrete is used in the light weight structures but not useful in the structural application.
3. If we compared normal and rubberized concrete failure pattern then it is observed that normal concrete split into two parts but rubberized concrete does not give well defined failure pattern.
4. The compressive strength of concrete is reduced as we increase the percentage of rubber in concrete. But, at 5% replacement of rubber the compressive strength increases with comparison of normal concrete.
5. The results of split tensile strength and flexural strength test shows that, there is a decrease in strength with increase in rubber aggregate in concrete. But, at 5% replacement of rubber the split tensile strength increases with comparison of normal concrete.

6. The strength in rubber mixed concrete decreases as increase in percentage of rubber and cement paste which is occurred due to the surface texture of rubber waste.

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REFERENCES

1. *I.Topcu "The Properties of rubberized concretes" Journal of Cement and Concrete Research, Volume 27 ,Issue 8 August 1997, Pages 1135-1139.*
2. *Kotresh K.M, Mesfin Getahun Belachew, "Study On Waste Tyre Rubber As Concrete Aggregates"International Journal of Scientific Engineering and Technology ,Volume No.3 ,Issue No.4, pp : 433-436 1,April 2014*
3. *Tushar R More, Pradip D Jadhao And S M Dumne "Strength Appraisal of Concrete Containing Waste Tyre Crumb Rubber" International Journal of Structural. & Civil Engineering Research ,Vol. 4, No. 1, November 2015*
4. *Vishal Porwal And Ravi Dwivedi "Studies on Tyre Aggregate Concrete with Fly Ash " International Journal of Science And Research, Volume 5, Issue 8, August 2016*
5. *K. Jagannadha Rao And Mohammed Abdul Mujeeb "Effect of Crumb Rubber on Mechanical Properties Of Ternary Blended Concrete"International Journal of Civil, Structural, Vol. 3, Issue 3, Aug 2013, 29-36*
6. *Arabi N.S. Al Qadi, Mahmoud B.A. Alhasanat and Madhar Haddad "Effect of Crumb Rubber as Coarse and Fine Aggregates on the Properties of Asphalt Concrete" American Journal of Engineering and Applied Sciences, 2016, 9 (3),558.564*
7. *Onuaguluchi,O. and Panesar,K.D., "Hardened properties of concrete mixtures containing pre-coated crumb rubber and silica fume",Journal of Cleaner Production ,82 (2014), pp.125-131.*
8. *Her-Yung Wang , Bo-Tsun Chen, Yu-Wu Wu, "A study of the fresh properties of controlled low-strength rubber lightweight aggregate concrete (CLSRLC)",Journal of Construction and Building Materials ,41 (2013), pp.526–531.*
9. *Xie Jian-he, Guo Yong-chang , Liu Li-sha, Xie Zh i-hong "Compressive and flexural behaviours of a new steel-fibre-reinforced recycled aggregate concrete with crumb rubber",Journal of Construction and Building Materials ,79 (2015) ,pp.263–272.*

rubber is due to lack of bonding between