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Experimental Studies on Concrete Containing Tyre Rubber Aggregates

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***Abstract*: In this research study of compressive strength and density of a new construction material named as Tyre Rubber Aggregate Concrete (TRAC). TRAC is a concrete made by some quantity replacement of waste tyre rubber aggregates of natural aggregates. Rubber aggregates are made by cut scrap tyres to aggregate sizes pieces using mechanical cutter, grinder or by chisel to required dimensions. Many experiments are carried out to identify the properties of contained rubber aggregates as a partial replacement of coarse and fine aggregates in concrete using weighing batch methods. Many tests are carried out on mixer dry, wet and hardened state of TRAC which are compressive strength, density,unit weight. Results shows that the compressive strength increases from 3% to 5% and then decreases in samples containing 7% rubber aggregates, when the percentage of ingrediant of rubber aggregate increase. Slump test does not show any significant difference in TRAC slump and normal concrete. Although, the study shows 5% of rubber aggregates are best and safest replacement having the high performance of TRAC in all the mechanical and bearing properties. the study shows 7% rubber aggregates having the low performance of TRAC in all the mechanical and bearing properties.**

***Keywords*: Tyre rubber aggregates, Coarse aggregates, Compressive strength, Unit weigth.**

1. Introduction

Use of rubber in making so many products results in a increasing volume of rubber waste. By increase in demand of vehicles, the production and use of tyres are also increased in the developed and developing countries both. Although at least 60% of worldwide rubber manufacturing, and seems to be an even higher percentage of rubber disposals including of vehicles and truck tyres, these thesis have been chosen to focus on rubber waste of tyres. After end of their working life, tyres have to be discarded and changed. It is concluded that all over the world an average of one used tyre per person every year is rejected. Waste of tyres is a major problem.In this paper we replace natural coarse aggregates with tyre rubber aggregates we replace in perpotions 3%, 5% and 7%. we replace coarse aggregates to find any alternative in place of natural coarse aggregates. In last few years, handling and management of waste is the main issue infrant of the countries world wide. The problem of waste is faced as one of the most hazardous problems in the world as a cause of the environmental pollution. One of the wastes to be managed is ‘waste tyre’ because; Now development in transporte system has produced big amount of vehicles these days, so that they discarded big amount of waste tyres. The disposal of the waste tyres is becomes a big waste management problem world wide nowadays. It is calculated that 1250 crores of waste tyre rubber has manufactured world wide in a year (dug fill in land), stocked as piles or dumping in illegal tyres dump.

2. Materials used

A. Cement

Ordinary portland cement (OPC) 43 grade. All tests on cement was performed as per Indian standard code IS 8112-2013.

B. Fine aggregates

Locally available sand was used in research work. All the specifications as per IS: 383-1970.

C. Coarse aggregates

Locally available coarse aggregates having size less then 20mm was used. All the specifications as per IS:383-1970.

D. Water

Normal drinking water was used for mixing.

E. Tyre rubber aggregates

Discarded tyre rubber from that steel part has been taken out in a granular shape and size ranges from 4.75mm to maximum of 20mm particles in size are used as tyre rubber aggregate.

3. Tests performed

A. Slump test

Slump check is carried out of every sample to check workability of concrete. The slump value was checked as per procedures given in IS: 1199 – 1959 in India.

B. Compressive strength test

Compressive Strength tests were performed on concrete sample after 7 days and 28 days. As per specifications given in IS:516-1959.

C. Unit weight test

Unit weight of concrete is checked as per details in IS: 1199-195.

4. Literature review

Effect of replacement of tyre rubber aggregates in place of coarse aggregates stated and results shown that there is effect on workability of concrete as workability increases as we increase tyre rubber aggregates. Compressive strength results showed 1.6% and 1.9% increase in strength at 7 days and 28 days of curing in samples containing 3% tyre rubber aggregates. Samples with 5% replacement of coarse aggregates with tyre rubber aggregates shows 5.4% and 9.8% increment after 7 days and 28 days of curing period. Samples having 7% tyre rubber aggregates have less strength then normal concrete. Unit weigth or density results shows decrement. Weight of normal concrete cube is 7.8kg. As we add tyre rubber aggregates weight of concrete was decreased. Concrete containing 3% tyre rubber weighs 7.65kg and sample having 7% tyre rubber shows 7.40kg. Unit weight of concrete decreased normal concrete have unit weight 2311kg/m^3 where as 3% tyre rubber aggregates samples shows 2267kg/m^3 and samples containing 5% tyre rubber aggregates have 2228kg/m^3 and concrete samples which have 7% tyre rubber have unit weight 2192kg/m^3 from results it can be seen that unit weight is decreased as we increase tyre rubber percentage in concrete.

5. Results

Table 1
Values of slump Test

S. No	Specimen id	% replacement	Sump Value (in mm)
1	CR00	0	75
2	CR03	3	80
3	CR05	5	84
4	CR07	7	90

Table 2
Effect on Unit Weight (Density) of concrete

S. No	Id	Weight	Unit Weight (kg/m^3) (Weight/.003375)
1	CR00	7.8	2311.11
2	CR03	7.65	2266.67
3	CR05	7.52	2228.15
4	CR07	7.40	2192.59

Table 3
Effect on Compressive Strength of test specimen

S.no	Specimen Id	Compressive Strength (MPa)	
		7 Days	28 Days
1	CR00	18.2	25.3
2	CR03	18.5	25.8
3	CR05	19.2	27.8
4	CR07	17.8	24.4

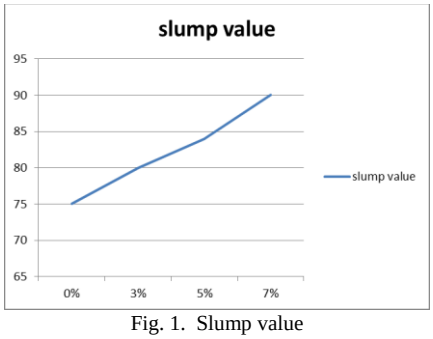

Fig. 1. Slump value

From Table 1, it is clear then slump value is increased as we increase percentage of tyre rubber in concrete. Normal concrete sample have slump value 75mm whereas concrete containing 7% tyre rubber as replacement of coarse aggregates shows 90mm slump value.

From Table 2 of unit weight it clear that unit weight of concrete decreases as we increase percentage of tyre rubber. As we increase percentage of tyre rubber 7% then unit weight decreases by 5%.

From compressive strength result it was clear when we increase percentage of tyre rubber strength of concrete increases from 3% to 5% addition of tyre rubber at 7% tyre rubber strength of concrete decreases.

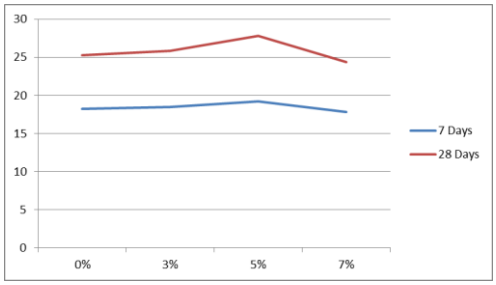

Fig. 2. Compressive strength

6. Conclusion

From above results of compressive strength it was clear strength of concrete increased in 3% and 5% replacement sample of concrete and decreased in 7% replacement sample. Sample containing 5% replacement of coarse aggregates by tyre rubber gives best value of strength. Slump value increases as we increase percentage of tyre rubber aggregates. Unit weight of concrete decreases as we increase percentage of tyre rubber

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