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Behavior of Recycled Tyre Rubber and Stone Dust in Concrete

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ABSTRACT

The present investigation aims in the study of properties of concrete in which stone dust is used as a partial replacement for natural sand and partial replacement of tyre of size 4.7 to 100 mm for coarse aggregate by weight for concrete. Stone dust is replaced at replacement levels of 0%, 20%, 25%, 30%, 35% and 40%. A set of 6 numbers of concrete cubes were constructed with cement Concrete ratio 1:1.5:3, , 6 numbers cube in each ratio, fine aggregate being river sand and 150 micron free stone dust with replacement levels of 20%, 25%,30%,35% and 40% in each ratio i.e. substituting natural river sand. After this 30% stone dust replace the sand cube gives max strength, then replace coarse aggregate as tyre about 2%,5%,10% and checking strength. In the investigation 6 numbers of standard cubes were constructed using strength Nlmm2 with cement concrete. ratio 1:1.5:3, 6 numbers in each ratio, fine aggregate being river sand and 150 micron free stone dust with replacement levels of 0%, 10%, 20%, 35%, and 40% in each ratio i.e. substituting natural river sand. fine aggregate with concrete ratios are compared with allowable compressive strength requirements of concrete specified by IS 516-1959. The investigation indicates that the stone dust can replace natural sand partially in concrete with higher or same strength and cheaper cost. All a comparison between Stone dust as substitute to natural river sand and tyre as substitute to grit.

Keywords-:OPC cement, Coarse Sand, Stone Dust, Tyre size 4.75 to 10mm

1 INTRODUCTION

Sand collected from Aeolian deposit is expensive due to unwanted cost of transportation from natural sources. Large scale exploitation of natural sand creates environmental impact on society. River sand is most commonly used fine aggregate in concrete but due to acute shortage in many areas, availability, cost & environmental

impact are the major concern. To overcome from this crisis, partial replacement of sand with stone dust can be an economic alternative. In developing countries like India, quarry dust has been rampantly used in different construction purposes but replacement technology has emerged as an innovative development to civil engineering material.

Grit collected from mountains is also expansive due to unwanted cost of transportation from natural sources. Concrete is one of the most popular construction materials. Due to this fact, the construction industry is always trying to increase its uses and applications and improving its properties , while reducing cost. The objective of this experimental study is to test the properties of concrete when recycled rubber from automotive tyres is used as a partial aggregate. Test should be taken to concrete specimens contains 2%, 5%,10% substitution of junk tyre rubber as a natural aggregate. The replacement of coarse aggregate by junk rubber in concrete has resulted in reduced compressive strengths and densities. The reductions in compressive strength and density depended on the amount of rubber added.

The use of such materials not only results in conservation of natural resources but also helps in maintaining good environmental conditions. The inability of the nature to replace it and increasing pressures from local bodies, to protect the environment, either replacement or substitution for sand and grit is warranted during this decade and for future.

Due to rapid growth in construction activity, the consumption of concrete is increasing every year. This results in excessive extraction of natural river sand. The use of the material is being constrained by urbanization, zoning regulations, increased cost and environmental concern. Thus, it is becoming inevitable to use alternative materials in concrete waste material like stone dust, tyre etc.

India has taken major initiative on developing the infrastructures such as express highways, power projects and industrial structures etc.to meet the requirements of globalization. In the construction of buildings and other structures concrete play rightful role and a large quantum of concrete is being utilized. Coarse aggregate, which is one of the constituent used in the production of conventional concrete has become highly expensive and also scarce. In the backdrop ,there is large demand for alternative materials from wastes. Waste tyre dumping or disposal of these materials causes

environmental and health problems. Waste tyre management is a serious global concern. Millions of waste tyres are generated and stock piled every year, often in an uncontrolled manner, causing a major environmental problem. As tyres are durable and not naturally biodegradable ,they remain in dump sites with little degradation overtime, presenting a continuing environmental hazard. Therefore, recycling of waste materials plays a vital role in concrete Tyre wastes increasing annually, because now-a-days motor vehicle usage is rapidly increased. Waste tyre from vehicle is used for various process like retarding and other works etc., These type of tyres shredded to use shaped like a coarse aggregate to replace coarse aggregate partially in this process. In this scrap tyre rubber modified concrete is termed as Rubberized concrete. The public, governments and industry are all greatly interested in green design and engineering approaches towards better environmental quality and sustainable development. At the same time, these studies can help producers to take conservative action aimed at making the environmental impact less harmful. An emerging use is the production of concrete, in which junk tyre rubber particles partially replace natural aggregates. This has the additional advantage of saving in natural aggregates used in the production of concrete which are becoming increasingly scarce. This experiment investigated a wide range of physical and mechanical properties of concrete containing recycled tyre aggregates assess its suitability as a construction material.

The influence factors such as rubber aggregate content and size, as well as curing time was also considered. The quantities of concrete produced worldwide for such applications could ensure the viability of this product. Therefore, this type of concrete shows promise for becoming an additional sustainable solution for tyre rubber waste management.

STONE DUST:

RUBBER TYRE:

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CHIPPED RUBBER SAMPLE:

2.LITERATURE REVIEW

1)Nagraj T.S et.al (1996)(1), reported that rock dust due to its higher surface area consumes more cement in comparison to sand which increases workability. He studied to effect of rock dust and pebble as aggregate in cement and concrete and found that crushed stone dust could be used to replace the natural sand in concrete.

2)Nagaraj T.S(2), reported that there are three possibilities of ensuring the workability namely combination of rock dust and sand, use of super plasticizers and change water content.

3)Shukla et al. (1998)(3), investigated the behavior of concrete made by partial or full replacement of river sand by crushed stone dust as fine aggregate and reported that 40 percent sand can be replaced by crushed stone dust without effecting the strength of concrete.

4)Venugopal (1998) et al.(4), examined the effect of rock dust as fine aggregate in cement and concrete mixes. They have suggested a method to proportion the concrete using rock dust as fine aggregate

5) Eldin N.N and Senouci A.B.(1993),"Rubber tyre particles as coarse aggregates "examined compressive and tensile strengths of rubberized concrete. He notes that rubberized concrete did not perform as well as normal concrete under repeated freeze-thaw cycles. It exhibited lower compressive and tensile strength than of normal concrete but unlike normal concrete, rubberized concrete had the ability to absorb a large amount of plastic energy under compressive and tensile loads. It did not demonstrate the typical brittle failure, but rather ductile, plastic failure mode.

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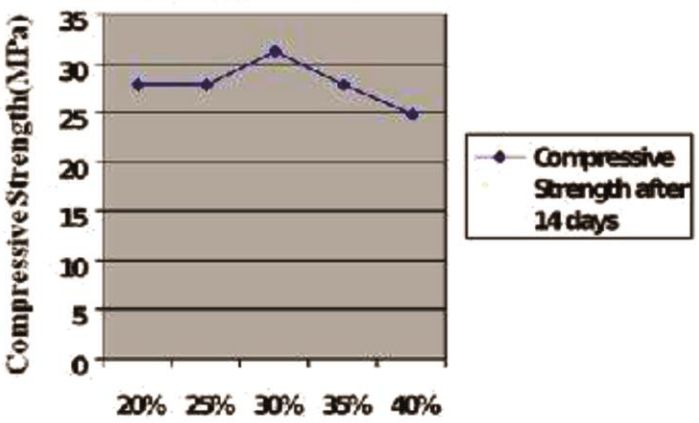
6)Toutanji,H.A (1996) "The use of rubber tyre particles in concrete to replace mineral aggregates" Cement concrete investigated the effect of replacement of mineral coarse aggregate by rubber tyre aggregate. Shredded rubber tyres used had a maximum size of 12.7mm and a specific gravity of about 0.61. The incorporation of these rubber tyre chips in concrete exhibited a reduction in compressive and flexural strength. The specimens which contained rubber tyre aggregate exhibited ductile failure and underwent significant displacement before fracture. The toughness of flexural specimens was evaluated for plain and rubber tyre concrete specimens. The test revealed that high toughness was displayed by specimens containing rubber tyre chips as compared to control specimens

3. TEST RESULTS

TABLE 3.1 **Average Compressive Strength at 14 Days**

% Stone dust	Mix design	Cube compressive strength in Mpa
20	1:1.5	27.84
25		27.82
30	:3	31.15
35		27.84
40		24.41



GRAPH 3.1 **Compressive strength vs % of stone dust**

TABLE 3.2 **Average Compressive Strength at 14 Days**

% Of Tyre Mix	% Of Stone Dust Mix	Mix Design	Cube Compressive Strength In Mpa
2	30	1:1.5:3	23.12
5	30		22.30
10	30		19.50

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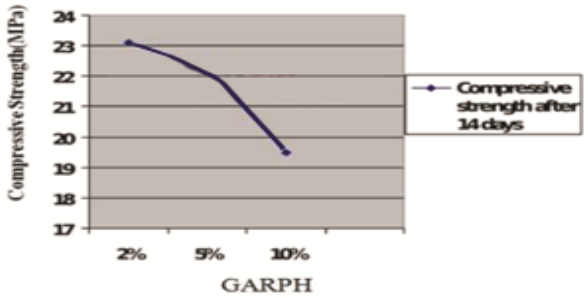
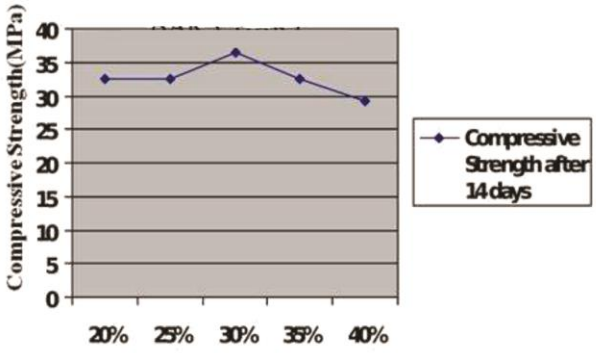


GRAPH 3.2 **Compressive strength vs % of tyre mix**

Table 3.3. Average compressive strength at 28 days

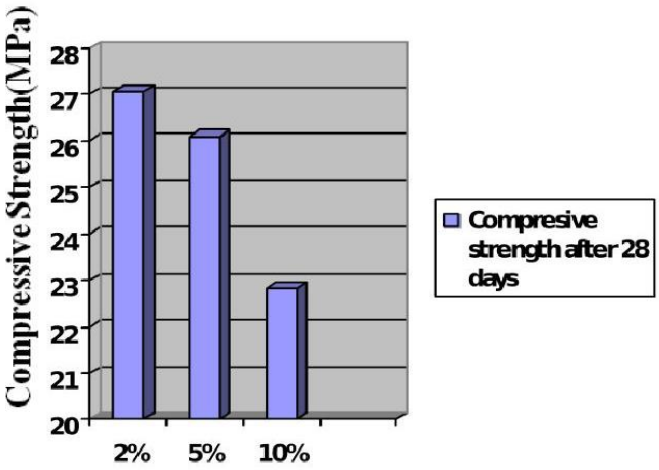
% Stone dust mix	Mix design	Cube compressive strength in Mpa
20	1.:1.5:3	32.57
25		32.55
30		36.45
35		22.57
40		29.15



Graph 3.3. Compressive strength vs stone dust

Table 3.4. Compressive strength at 28 days in % tyre mix & % of stone dust

% Tyre mix	Mix design	% stone dust	Compressive strength in Mpa
2	1:1.5:3	30	27.05
5			26.09
10			22.08



Graph 3.4. Compressive strength vs % of tyre mix

4. Conclusions

Based on the results obtained in this investigation the following conclusions are drawn regarding the effect of Stone dust as a substitute to natural river sand and tyre as a substitute to coarse aggregate compressive strength of concrete.

A) The substitution of natural river sand to stone dust is taken to 30% replacement of weight of sand in ratio 1:1.5:3 of concrete the ultimate strength more somewhat same to the ultimate strength of concrete without substitution. The substitution of natural river sand to stone dust up to 40% replacement of weight of sand in ratio 1:1.5:3 of concrete led to a corresponding drop in the strength. This is due to the fact that above the 30% weight the presence of stone dust tends to reduce the bonding between cement and aggregate Lending to a consequent decrease in strength

B) From the present experimental study and literature review it can be concluded that despite the observed lower values of the mechanical properties of concrete there is a potential large market for concrete products in which inclusion of rubber aggregate would be feasible. These can also include non-primary structural applications of medium to low strength requirements, benefiting from other features of this type of concrete. Even if rubber tyre aggregate was used at relatively low percentages in concrete, the amount of waste tyre rubber could be greatly reduced due to the very large market for concrete products worldwide. Therefore the use of discarded tyre rubber aggregates in concrete shows promise for developing an additional route for used tyres.

Finally conclusion is that the use of stone dust and tyre used for concrete is reduce the pollution and perform as low weight concrete and used in road base etc.

REFRENCES

Nagaraj. T.S and Zahida Banu, (1996) “Efficient utilization of rocks dust and pebbles as aggregate in Portland cement concrete”, The Indian concrete journal, Vol 70, No.1, PP14.

Shukla M, Shau A.K and Sachan A.K., (1998) “Performance of stone dust as fine aggregate in Portland replacing Sand on concrete and mortar”, National seminar on advances in special concretes, Indian concrete institute, banglore, India, pp 241248.

Venugoal S. and Nagaraj T.S., (1999) "Cement concrete mixes with rock dust as fine aggregate Analysis and methodology", proceeding of the fifth international conference on concrete technology for developing countries, NCB New delhi, India, pp i3 – 12.

A.K. Shau, Sunil Kumar and A.K. Sachan (2003) "crushed stone waste as fine aggregate for concrete" the Indian concrete journal, pp 845848.

M. Shukla and A. K. Sachan, "Stone dust-environmentally

hazardous waste, its utilization in building construction," in Materials and Machines for Construction, L. K. Mishra and Y.

P. Gupta, Ed. :New age International publishers, 2000, pp. V77-V81.

T. Kaosol, "Reuse concrete waste as crushed stone for hollow concrete masonry units," in Proc. The 3rd Technology and Innovation for sustainable development international conference (TISD2010), Faculty of engineering, Khon Kaen University, Thailand, 2010, pp. 176.

M. Joel, "Use of crushed granite fine as replacement to river sand in concrete production," Leonardo Electronic Journal of Practices and Technologies, ISSN 1583-1078, issue 17, pp. 85- 96, July-December 2010

1. Sivakumar and Prakash M. ì Characteristic studies on the mechanical properties of quarry dust addition in conventional concrete in the Journal of Civil Engineering and Construction Technology Vol. 2(10), pp. 218-235.