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Reuse of TYRE Waste Dust as PartialReplacement of Fine Aggregate in Concrete

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Abstract:
Disposal of waste tyres is considered one of the major environmental challenges the whole country is facing as a result of waste rubber is not simply perishable even when treatment. One of the solutions suggested was the use of tyre waste dust as partial replacement of fine aggregate in cement-based materials. An experimental program was carried out to investigate the compressive strength of concrete with tyres waste dust as a fine aggregate in concrete. A number of cubes were casted of M25 grade for this study. The replacement of fine aggregates with tyre waste dust was partial in the concrete specimens according to the mix designs required in terms of weight and strength. The specimens were cured in water for required number of days before testing. Test results indicate clear substantial reduction in strength of the concrete when fine aggregate is replaced beyond 15% tyres waste dust compared with the compressive strength of concrete with no tyre waste dust.
Keywords: *Concrete, replacement of fine aggregate, tyre waste dust, ATMA*

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I. INTRODUCTION

"Energy cannot be created, nor be destroyed. it can be only transferred from one state to other", it is the base of all intellectual and spiritual thoughts of human beings. Energy is always subjected to cycles. Thus nothing as such is a waste. so called waste of one process is in fact a raw material for some other process. Globally the tyre production is estimated to be 1 billion per year. With the exponential growth in number of automobiles in India during recent years, the demand of tyres as original equipment and as replacement has also increased. In India an annual cumulative growth rate of 8% is expected in buses, trucks, cars/jeep/taxis

1.1 Background:

Application of scrap tyre waste dust should minimize environmental impact and maximize conservation of natural coffers. One possible result for this problem is to incorporate rubber patches into cement- grounded accoutrements. Scrap tyres can be Tattered into raw accoutrements for use in hundreds of scruple rubber products. The other part of the problem is that aggregate product for construction purpose is continuously leading to the reduction of natural coffers. Also, some countries are depending on imported total and it's surely veritably precious. For illustration, the Netherlands does not retain its own total and has to import. This concern leads to a largely growing interest for the use of indispensable Accoutrements that can replace the natural summations. Thus, the use of recycled waste tyres as an total can give the result for two major problems the environmental problem created by waste tyres and the reduction of natural coffers by aggregate productaccordingly the deficit of natural summations in some countries. According to the Automotive Tyre Manufacturers Association (ATMA), in India, further than92.2 million tyres of Colorful orders were manufactured . Grounded on an estimate, 60 of the waste tyres are disposed off via unknown routs. The raw accoutrements in tyres include natural and synthetic rubber, carbon dark, nylon, polyester and indeed killer cord, sulfur, canvases and resins, and other chemicals. Tyre rubber with fiber and sword begirding comprise the major rudiments of tyres presently being used. Of all the possible styles of tyre disposal, the creation of rubber scruple potentially offers the most effective environmental result, because this is the material that can be used in a variety of other products. Tyre rubber is ground to a particulate form nominated as scruple rubber modifier (CRM) because its addition modifies parcels of the asphaltic material. Waste rubber consists of patches ranging in size from4.75 mm (No. 4 Sieve) to lower than0.075 mm (No. 200 Sieve). The composition of CRM depends greatly upon the original chemistry of the tyre rubber and posterior impurity during its use. Tyres can be used for environmentally safe operations in whole, cut, or stamped form in civil engineering workshop similar as trace crash walls, sound absorbing walls, boat carouses on harbor walls as sequestration in Erecting foundations, and road base accoutrements besides in Portland cement concrete system.

Fig. 1 Material Used For Study

II. Literature Review

This Project aims at the study of Partial Replacement of fine aggregate with waste tyre to attain high strength and economical concrete Also, this research deals with the environmental waste reduction by using tyres aggregate waste as fine aggregate.

1.2 Review of past research in this field:

Kshirsagar P.S, Pardeshi P.B :- (2017) [1]

It has been stated that the disposal of waste material is one of the most serious environmental concerns globally. There is no difference of opinion that the increasing piles of tires are creating environmental issues. For that matter there must be a way to dispose-off these tires. These tires have potential risks to environment and health. Compressive strength of rubberized concrete depended on two factors; grain size and shape of rubber aggregate and percentage of replacement.

Sree D, Gowthama Raja G, Kumar K K, Prabhakaran R:- (2016) [2]

It has been stated that the substitution of waste tyre to concrete is taken to 5% replacement of weight of coarse aggregate and the compressive strength is somewhat same to the concrete without substitution At the same time, 15% replacement of weight of coarse aggregate, the compressive strength drops down compared to conventional concrete. The presence of tyre more than 5% weight tends to reduce the bonding between cement and aggregate leading to a consequent decrease in strength. The use of rubber aggregates from waste tyres addresses many issues such as reduction of the environmental threats caused by waste tires, introduction of an alternative source to aggregates in concrete.

Radhakrishnan A, Das A, John E (2016) [3]

It has been stated that slump tests are used to find the workability of concrete and super plasticizer content in concrete. All mixes prepared show adequate workability (100 mm to 115 mm) by varying the super plasticizer content in small percentage. Mixes are made by replacing fine aggregate with 5%, 10%, and 15% crumb rubber are tested. The compressive strength, flexural strength and splitting tensile strength are studied for 3, 7 and 28 day. Compressive strength, Flexural strength and splitting tensile strength decreases with increase in the percentage of crumb rubber. Maximum values for compressive strength, flexural strength and splitting tensile strength of concrete after the replacement is obtained at 5% which is 14.81 N/mm2, and 1.13 N/mm2 (28 day strength)The loss of strength may be due to the lack of adhesive property of crumb rubber. Mixes are made by replacing fine aggregate with 10% crumb rubber and cement with 5%, 10% and 15% silica fume are tested. The compressive strength is studied for 7 and 28 day. From the result it is observed that the strength of concrete increases as compared to the concrete in which 10% fine aggregate is replaced by the crumb rubber. There for the strength increases in crumb rubber silica fume combination rather than the crumb rubber cement combination. The compressive strength obtained for the concrete block is less than that of the concrete cubes for the same mix. Maximum strength is obtained at 5% cement replacement with silica fume and it is 11.55N/mm2 and that of the concrete block is 9.69N/mm2

Shirule P.A, Husain M:- (2015) [4]

It has been stated that use of the waste rubber tyre in concrete is a techno-economically feasible and environmentally consistent method of waste disposal. The addition of rubber tyre under certain proportion of rubber tyre for specific property. Further higher proportion of rubber tyre degrades the concrete properties. The

optimum values for specific concrete properties are presented in the previous section. (Results and Discussions). The proportion of rubber tyre, higher than the optimum can also find application in uses like partition walls etc. Where low density is the major requirement. there is great potential to use rubber tyre waste in concrete.

More T.A, Jadhao P.D, Dumne S.M:- (2015) [5]

It has been stated that addition of recycled crumb rubber aggregates into normal concrete mix leads to decrease in workability for the various mix samples. Flexural strength of concrete decreases about 40% when 3% sand is replaced by crumb rubber aggregates and further decrease in strength with increase of percentage of crumb rubber aggregates.

Alam I, Mahmood U.A, Khattak K:- (2015) [6]

It has been stated that when rubber was used instead of aggregates in concrete it shows less compressive strength when compared with ordinary concrete. But it also shows some ductile behavior before failure. Rubberized concrete shows reduction in density of concrete when compared with control concrete specimen. Concrete made of crumb rubber as fine aggregate shows much strength when compared with concrete made ofchipped rubber as coarse aggregate

Shah S.N, Jadhao P.D, Dumne S. M: - (2014) [7]

It has been stated that reduction of solid load carrying material in rubberized concrete is directly affects to reducing the strength of concrete. It can be concluded that as the amount of rubber content increases then there is reduction in flexural strength. The results of splitting tensile strength test strength show, there is a decrease in strength with increase in rubber aggregate content like reduction observed in the flexural strength tests. Oneof the reasons that split tensile strength of rubberized concrete is lower than the normal concrete is that the bond strength between cement paste and chipped rubber aggregates is poor.

Turer A et al: - (2009) [8]

It has been stated that this chapter illustrated various uses of scrap tyres through recycling as a whole, in parts,or after chemically decomposition of materials inside scrap tyres. Industrial development brought luxury of cars to our modern lives that produces scrap tyres in an increasing rate. As in the cases of other natural resources in the world, we need to learn using less of natural resources while recycling readily available tyres by findingways not to pollute the environment. All cars in the world constantly generating about one scrap tyre per person every year causes scrap tyres generation in the order of billions on a global scale. The ideal solution would have been recycling each scrap tyre to brand new tyre, since when someone throws away a used tyre has to buy a new tire. Using tyres on slope stability and land fill, inside asphalt and concrete is not adequately spread enough and in right quantities to use all manufactured tyres. Structural uses of scrap tyres remain to be at limited instances either enforced by government such as in the case of roads and pavements or experimentally sparse and rare mostly applied by good intentioned environmentalists or low-budgeted projects. Chemical decomposition using pyrolysis is a highly promising approach; however, could not quite reach its full potential yet. On the other hand, burning scrap tyres at high temperature furnaces at cement producing kilns and thermo electric power plants as fuel is quite efficient and widely used. Provided that chimney filtering is defined by regulations and rules are properly enforced from toxic material emissions, scrap tyre burning seems to be a good source of recycling and transforming otherwise useless and harmful discarded material into energy.

Liu H, Wang X, Jiao Y and Sha: - (2002) [9]

It has been stated that in this paper, crumb rubber concretes with different replacement forms and replacement levels were produced. The effect of the volume content of crumb rubber and pretreatment methods on the performances of concrete was investigated. The following conclusions have been obtained. Adding crumb rubber into concrete resulted in a significant decrease of the mechanical properties, but increased the durability. The effect caused by replacing the mixture with crumb rubber was higher than that caused by fine aggregate replacement

Objectives

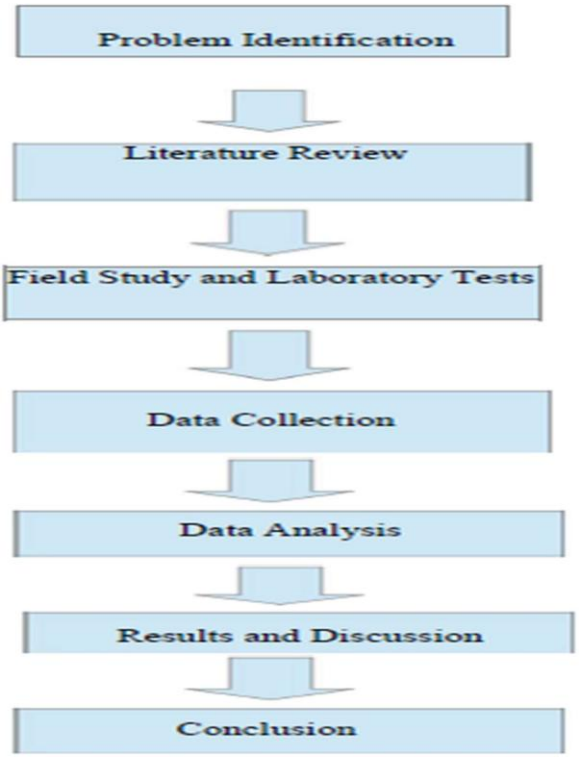
To evaluate the effects of waste tyre rubber powder in concrete.

III. Methodology:

Remoulding of tyre is done for its further use. During the process of remoulding, fine rubber particle are obtained buffing of the layer of tyre by buffing machine. These waste fine particles of rubber are used as replacement of locally available natural sand. The part of their research work in which he used scrap rubber as

partial and complete replacement fine aggregate in concrete and reported the various performance levels of concrete subject to the different phenomenon like shrinkage, segregation, workability, flexural bending stresses, shear bending stresses, normal consistency of cement paste and the initial and final setting times determination.

Methodology flow chart:



Methodology Chart

IV. CONCLUSION:

From the literature survey we concluded following points.

4.1.1 5% replacement of tyre waste dust has more workability, strength in compression and tensile strength than the regular M25 concrete.

4.1.2 5% replacement of tyre waste dust has low flexural strength than normal concrete but it confirms the IS specification hence it can be used construction purpose.

4.1.3 For rubberized concrete, the test results show that the addition of rubber dust fine aggregate more than 5%will result in a reduction in concrete compressive strength compared with the normal concrete. This reduction increased with increasing percentage of rubber dust fine aggregate. Losses in compressive strength are observed. The reason for the strength reduction is due to lack of adhesion at the boundaries of the rubber dust fine aggregate, soft rubber particles behave as voids in the concrete matrix.

4.1.4 Rubberized concrete showed capability to absorb a large quantum of plastic energy and didn't show brittle failure under contraction or split pressure lading.

4.1.5 The results of the splitting tensile strength tests show that, there's a drop in strength with adding tyre waste dust total content as reduction observed in the compressive strength tests. Still, there was a lower reduction in blistering tensile strength as compared to the reduction in the compressive strength.

4.1.6 Advanced content of tyre weast dust produces light weight concrete.

4.1.7 Advanced content of tyre waste dust flyspeck shows advanced to medium plasticity.

4.1.8 Because of the long term performance of these Composites aren't known in the field, especially for pavement sections, the use of similar composites are recommended in places where high strength of concrete isn't as important (e.g. sidewalls).

4.1.9 There's a implicit large request for concrete products in which addition of tyre dust summation would be doable which will use the discarded rubber tyres the disposal of which is a big problem for terrain pollution.

4.1.10 The actuality of any chemical responses between the tyre rubber total and other ingredients of the rubberized concrete to make sure that there's no undesirable goods that are analogous to alkali-silica and alkali-

carbonate responses in natural fine aggregates need to be delved.

4.1.11 This exploration was done by preparing single graded rubber summations of size 4.75 mm. The effect of different sizes should be studied in the future. Besides to this, the goods in different chance reserves other than those made in this exploration needs to be delved.

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