Study on Fractional Replacement of Sand and Aggregate by Crumb Rubber in High Strength Concrete

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Abstract:

In this study, the result of the quantity content of crumb rubber and pre-treatment ways on the performances of concrete was calculated. Firstly, the fine combination and mixture were part replaced by crumb rubber to supply crumb rubber concrete. Then the mechanical and sturdiness properties of crumb rubber concrete with completely replacement different forms and the volume contents had been calculated. Finally, the crumb rubber once pre-treatment by some modifiers was introduced into the concrete mixture. Corresponding tests were conducted to verify the effectiveness of pre-treatment ways that as compared to the concrete containing untreated crumb rubber. It had been observed that the mechanical strength of crumb rubber concrete was reduced Relative tests were conducted to verify the effectively of pre-treatment ways in which as compared to the concrete containing untreated crumb rubber.

Keywords - *Crumb rubber, rubberised concrete*

I. INTRODUCTION

Various studies are done worldwide to dispose these solid waste materials by exploitation them for partial or complete replacement of aggregates in cement concrete. so as to forestall the environmental drawback from growing, utilization tire is associate innovative plan or means during this case disposal of tires has become one in all the intense issues in environments. Land filling is turning into unacceptable attributable to the speedy depletion of obtainable sites for waste disposal. Utilization tire is that the processes of utilization vehicles tires that aren't any longer appropriate to be used on vehicles thanks to wear or irreparable injury with the speedy development of transportation and industries an excellent quantity of scrap rubber is created. Utilization of scrap tire is turning into additional necessary with the world increasing of the environmental drawback so as to cut back the build-up of scrap tire in landfills.

If it not properly disposed then these materials become major sources of environmental pollution and also the issues regarding it because the natural resources area unit decreasing daily. On the opposite hand there's a good demand for natural aggregates because the construction activities area unit increasing daily. Second though waste tyres area unit tough to ignite, this risk is usually gift some different materials which will serve the aim of the natural aggregates ought to be introduced. Environmental and Ecological disturbances are caused thanks to vast accumulation of waste by-products generated throughout the various producing and production processes a thermal decomposition of those wastes within the absence of gas so as to provide by-products that have low economic viability. The cracker mill method tears apart or reduces the scale of tire rubber by passing the fabric between rotating furrowed steel drums. By this method associate degree on an irregular basis formed torn particles having massive area unit created and this particles are unremarkably referred to as crumb rubber. during this work the foremost relevant information regarding the properties and broken rubber to exchange coarse aggregates the sturdiness of concrete containing tyre rubber wastes the scale of waste particles and also the waste replacement volume on the contemporary and hardened properties of concrete are reviewed.

II. EXPERIMENTAL OBJECTIVE

With the rise in urban particle of nations like Bharat the quantity of vehicles and consequently the number of used tire goes to extend considerably within the close to future. Hence, the no environmental nature of those wastes goes to be a possible threat. This study will show another manner of utilization tires by incorporating them into concrete construction. Of course, the thought that the matter emerges from urbanization and therefore the resolution goes at the side of it may also be appreciated. Therefore; it's the aim of this study to introduce associate environmental friendly technology, which might profit the society and therefore the nation.

III. MATERIALS USED

All paragraphs must be indented. All paragraphs must be justified, i.e. both left-justified and right-justified.Ordinary Portland cement of J.K. 43 grade cement brand confirming to IS 12269-1987(3) was used in the present study.

The properties of cement are shown in Table 1

TABLE I

Compressive Strength	(MPa)
28 days	Min. 45.0
7 days	Min. 35.0
3 days	Min. 25.0

TABLE III

Setting Time	(Minutes)
Initial	90 -120
Final Max.	200
Fineness (Blaine or cm /gm.)	Min. 2850
Autoclave expansion (%)	Max.0.10

Natural sand as per IS: 383-1987 was used. Locally available river sand having bulk density 1860kg/m3 was used. The properties of the fine aggregate are shown in Table 3.

TABLE III

S. No	Property	Result
1	Specific Gravity	2.56
2	Fineness Modulus	2.29%
3	Water Absorption	0.49%

Crushed aggregate confirming to IS: 383-1987 was used. Aggregate of size 10 mm of specific gravity 2.53 and fineness modulus are shown in Table 4.

TABLE IV

S. No	Property	Result
1	Specific Gravity	2.63
2	Fineness Modulus	6.75%
3	Water Absorption	2.4%

By using different processes the crumb rubber achieved after has a nominal size between -0.23mm to 4.57 mm. The crumb rubber used in this study was obtained from a local industrial unit in Indore (M.P.) the crumb rubber was used in the concrete mix to partially substitute for fine aggregates and sand in various percentages of 0%, 8%, 16%, and 24%

TABLE V

S. No	Property	Result
1	Specific Gravity	1.71
2	Fineness Modulus	4.385%
3	Water Absorption	1.9%

To organize the recycled crumb rubber concrete specimens, fine aggregates replaced by rubber crumb in different percentages ratio like 0%, 8%, 16%, and 24% in separate concrete mixes. For every combine, cubes of a 150 X 150 X 150 millimetres, cylinders of a hundred and fifty millimetre diameter by three hundred millimetre height. All specimens were fancied so cured in water for twenty eight days in accordance with Indian normal 10262. For every concrete combine, slump tests were performed and recorded at the casting time of the specimens. Once twenty four hours of casting cubes, beams and cylinders were taken out from the mould so submerged in cistern for natural process. Totally thirty cubes, thirty cylinders and thirty prisms were forged the strength parameters. The constituents were weighed and therefore the materials were mixed by hand admixture.

The flexural strength of the traditional and crumb rubber concrete for the various proportions of crumb rubber in fine mixture at seventh and twenty eighth day results got within the

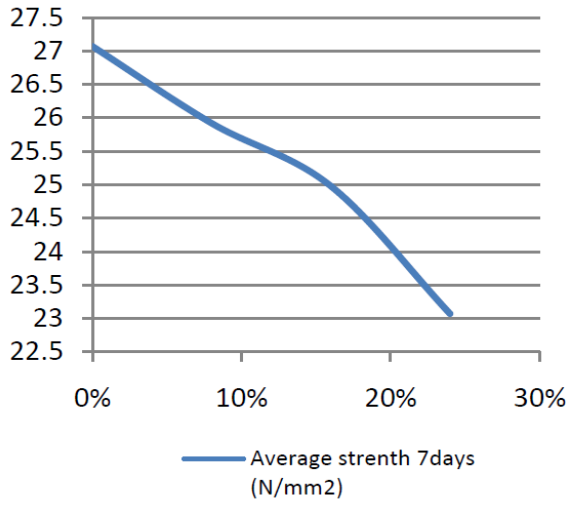
Specimen Details

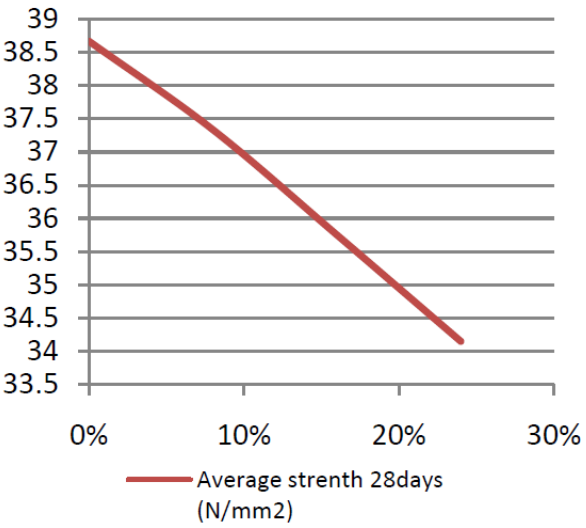
We have already study in the previous literatures, the grade of conventional concrete was chosen as M30 for replace the crumb rubber in the fine aggregate. Tests for physical properties of the materials have done and the mix ratio for the concrete was calculated by the materials properties as 1:1.83:4.06 and the water to cement ratio of 0.44% had been chosen. About the specific gravity of rubber powder taken 1.05 and that of the other sizes were 1.13. Other raw materials for concrete such as aggregates, water, cement and chemical admixtures have been used as per the requirement for concrete mix design.

TABLE VI

Replacement of Fine Aggregate by crumb rubber	Average Density of the cube (gm/cc)	Average strenth 7days (N/mm2)	28days (N/mm2)
0%	2.663	27.07	38.66
8%	2.659	25.92	37.33
16%	2.661	24.98	35.75
24%	2.653	23.07	34.15

As mentioned an decadently volumetrically replacement of stone based mostly aggregates with crumb rubber ends up in a decrease in unit weight, a decrease in compressive strength, and a decrease in enduringness. No important amendment within the modulus of rupture was observed once normalized with reference to the root of the compressive strength. The materials utilized in this study area unit in line with those observations





CONCLUSIONS

The following conclusions are drawn from analysis on mistreatment rubber as mixture and send concrete Rubberized concrete it shows less compressive strength in comparison with normal concrete. However it conjointly shows some ductile behaviour before failure once rubber was used rather than aggregates. Rubberized concrete conjointly shows reduction in density of concrete in comparison with management concrete specimen. Combine style product of crumb rubber as fine mixture shows abundant strength in comparison with concrete product of broken rubber as coarse mixture.

The mechanical properties of crumb rubber concrete were tested and are listed in above table the compressive strength of crumb rubber concrete cured for 28 days was lower than that of the control concrete 29.47MPa. It was also observed that the compressive strength of crumb rubber replacing fine aggregate reduced from 38.66 MPa down to 37.33 MPa with increasing rubber content from 0% to 8 %. Than observed that the compressive strength of crumb rubber replacing fine aggregate reduced from 37.33 MPa down to 35.75 MPa with increasing rubber content from 8% to 16 %.

At last the compressive strength of crumb rubber replacing fine aggregate reduced from 35.75 MPa down to 34.15 MPa with increasing rubber content from 16% to 24 %. The minimum compressive strength at the 16% replacement level satisfied the strength requirement of M 30 concrete. When 8% of the total mixture was replaced, the compressive strength had an acceptable value of 34.15 Mpa. However, a reduction was observed at the 8 % replacement level. There is no considerable increment within the compressive strength of concrete density by mistreatment completely different share of rubber as fine aggregates in concrete. The negative impact of crumb rubber on mechanical strength may well be reduced and avoided by pre treatment of the crumb rubber using modifiers. These pre treatments increased the adherence between the rubber and cement paste and achieved the uniform distribution of rubber particles in mixture.

REFERENCES

[1] IS: 8112-1989 Method of testing of cement. Determination of Initial and Final setting time.

[2] IS: 2386 (part 2) Method of testing of sand. Determination of Specific gravity of sand.

[3] Mehra, P., Gupta, R.C., Thomas, B.S.: Properties of concrete containing jarosite as a partial substitute for fine aggregate. J. Cleaner Prod. (2016). 10.1016/j.jclepro.2016.01.015

[4] Toutanji, H. A. (1996), "The use of rubber tire particles in concrete to replace mineral aggregates." Journal of Cement & Concrete Composites, ELSEVIER, 18, 135-139

[5] Michelle Danko, Edgar Cano and Jose Pena, Use of Recycled Tires as Partial replacement of Coarse Aggregate in the Production of Concrete, Purdue University Calumet, 2006.

[6] Dhir RK (Ed.), Proceedings of the International Conference on Concrete 2000, University of Dundee, Scotland, UK pp. 379–390

[7] Goulias DG, Ali AH (1997) Non-destructive evaluation of rubber-modified concrete. Proceedings of a Special Conference, ASCE, New York, pp. 111–120.

[8] Issa, C.A.; Salem, G. Utilization of recycled crumb rubber as fine aggregates in concrete mix design.Constr. Build. Mater. 2013, 42, 48–52. [CrossRef]

[9] Mohammadi, I.; Khabbaz, H.; Vessalas, K. In-depth assessment of Crumb Rubber Concrete (CRC) prepared by water-soaking treatment method for rigid pavements. Constr. Build. Mater. **2014**, 71, 456–471.

[10] Skripkianas G, Grinys A, "Using tire rubber Waste for modification of concrete properties", Architecture Proceedings of conference ,Kaunas Technology, 2005, 132-137.

[11] Mohammed Islamuddin Faraz , Utkarsh Jain, Ketan Jain, Shailendra Singh, "Effect of Crumb Rubber Material on Concrete Mix", SSRG International Journal of Civil Engineering (SSRG-IJCE) – volume 2 Issue 4 April 2015 ISSN: 2348