International Journal of Research in Engineering, Science and Management
Volume-2, Issue-5, May-2019
www.ijresm.com | ISSN (Online): 2581-5792

Behaviour of Concrete with Partial Replacement of Fine Aggregates by Crumbed Rubber

M. Karthik[1], Varsha S. Danavandi[2], V. G. Ajey Kumar[3]
[1,2]*Asst. Prof., Construction Technology & Management, Dayananda Sagar College of Engg., Bangalore, India*
[3]*PG Student, Construction Technology & Management, BMS College of Engineering, Bangalore, India*

***Abstract*: There is a substantial increase in the number of vehicles all around the globe. The increase in vehicles results in increase of discarded tyres which is a threat to the environment. Many methods are adopted for recycling such waste tyres according to the need although the tyres are recycled, generation of such tyre wastes exceeds than which are recycled.one way to overcome this is to find the use of such discarded tyres in the construction industry by recycling them. Hence, in this project recycles crumbed rubber as partial replacement of Fine Aggregates has been aimed upon.**

***Keywords*: Concrete, fine aggregates, crumbed rubber, waste tyres**

1. Introduction

A. Concrete

Concrete is a composite material made out of fine and coarse aggregates together with cement paste (fluid cement) that solidifies after some time. Portland cement is the generally utilized kind of cement for generation of concrete. There are diverse sorts of restricting material utilized other than cement, for example, lime for lime cement and bitumen for black-top solid which is utilized for street development. Materials are blended in explicit extents to get the required quality. Quality of blend is indicated as M5, M10, M15, M20, M25, M30 and so forth, where M implies Mix and 5, 10, 15 and so on as their quality in kN/m^2. In United States, concrete strength is determined in PSI which is Pounds per Square Inch.

Parts of concrete will be cement, coarse and fine aggregates, admixtures and water. Blend of Portland concrete and water is called as paste. Along these lines, concrete can be called as a blend of cement, sand and totals aggregates. Concrete is produced or blended in extents w.r.t. cement quantity. There are two sorts of concrete mixes, i.e. nominal mix and design mix. For normal construction such as small residential buildings, most popular nominal mix proportion is 1:2:4.

Concrete is commonly utilized in two kinds of construction, for example plain concrete and reinforced concrete. In PCC, it is poured without reinforcement. This is utilized when the member is exposed just to the compressive load and not bending. At the point where concrete is exposed to bending, reinforcements are required to withstand tension, as concrete is weak in tension. For the most part, strength of concrete in tension is only 10% of its compressive strength.

B. Rubber

Rubber is polymer of butadiene and a standout amongst the most vital synthetic fixings, which is generally utilized in the distinctive field of current development world. Rubber is most abundantly utilized in the tire industry, which is utilized in the different sort of vehicles. Rubber items require rubber as a raw material. Natural rubber is a material, which is frequently cultivated on large plantations – with every one of the issues related with a monoculture or alternatively synthetic rubber, which is produced utilizing crude oil. The two procedures utilize a high amount of natural resources. Toward the finish of the chain, heaps of vehicle tires crop up on the scene. These waste destinations are taken on by utilized tire and rubber reusing plants these days. Waste tire recycling technology is very cost effective and performs 100% wastage tyre recycling.

In this procedure no, chemical ingredients are utilized; therefore, it is environmental friendly. Raw material (wastage tire) is cheap and effectively accessible, there is a quick market increment of rubber powder in India. Demand for rubber powder in India is expanded by 5%-8%. There is reasonable extent of scope for this item. They create profitable and economical items out of waste tires. Additionally, each reused ton of tires prevents 10 tons of carbon dioxide (CO_2) that is a noteworthy ozone harming substance. India positions third in production and fourth in utilization of natural or cultivated rubber on the planet.

C. Manufacturing process for crumb rubber

Since the wheel got invented, it has been reproduced and redesigned as per convenience of humans. Today, we can see there is an overwhelming load of traffic on roads. This heap is more on account of urban areas when compared with that of rural areas because of distinction in way of life and infrastructure. The quantity of vehicles (autos, transports, trucks, cruiser) are expanding exponentially with time. These vehicles keep running out and about through wheels by means of tires.

Manufacturing of rubber powder from utilized tires is a three-stage processing principally shredding, after that granulation and finally fine grinding through which top notch materials for

reusing are ultimately produced.

Fig. 1. Waste tyres

2. Literature review

Crumb Rubber is irregularly shaped torn tyre particles obtained by the tearing or reducing the size of Tyre rubber. Earlier studies showed that use of scrap tyre in asphalt mixes showed better skid resistance, reduced fatigue cracking and longer pavement life. In Portland cement mixes properties like lower density, expanded toughness and ductility, higher impact resistance, heat efficient and sound protection was accomplished. The reduction in strength in rubberized mixtures in many cases might limit their application in structural applications. The present project work is based on replacement of fine aggregates by 5% and 10% by Crumb Rubber.

Nithiya P and Portchejian G (2014) found that mix design was done as per IS:10262-2009 to achieve the target strength. The concrete mixes were made by replacing fine aggregate with 5%, 10%, 15% and 20% for M20 grade concrete. M. R. Wakchaure (2014) studied the impact of waste tire crumb rubber particle of size going passing 1.18mm IS sifter and held on 600 μ IS sieve utilized in concrete on compressive, flexural and split tensile.

Camille A. Issa and George Salem (2013) found that used recycled crumb rubber as a substitute for fine aggregate in concrete at 0% to 100% replacement to crushed sand in concrete mix. Hanbing Liu, Xianqiang Wang, Yubo Jiao and Tao found that crumb rubber concretes with different replacement forms and replacement levels were done.

3. Methodology

Basic laboratory test on cement, fine aggregate, coarse aggregates and plastic coarse aggregate were conducted to know its physical and chemical behavior and its binding property with each other to achieve the homogeneous mix.

The core of concrete lies in the cement. A few tests were performed to decide the qualities of cement and its similarity with different materials in the concrete mix design. Compressive strength testing of mortar cubes at 3, 7 and 28 days of aging are utilized to watch the advancement of the strength increase of the mortar over time. A chemical examination of the cement will give a sensible gauge of the composition of the cement. These are only a few of the tests that can be utilized to decide the quality of cement. Fine aggregates are fundamentally sands won from the land or the marine condition. Fine aggregates largely comprise of natural sand or squashed stone with most particles passing through a 9.5mm sieve.

As aggregates are the important constituents in concrete. They offer body to concrete; decrease shrinkage and impact economy. The mere fact of that the aggregate occupy the 70%-80% of the total volume of concrete. Recycled crumb rubber as partial replacement of fine aggregate has been aimed upon. Crumb rubber is irregularly shaped torn tyre particles obtained by the tearing or reducing the size of rubber tyre.

Mix design of concrete by replacing 10% of fine aggregate with crumb rubber as per IS 10262:2009, 350:140:1131.31:703.29:22.466:7:0.40 (Cement: Water: CA: FA: Rubber: Superplasticizer: W/C ratio). Fresh concrete or plastic concrete is a freshly blended material which can be formed into any shape. The general amounts of cement, aggregates and water blended together, control the properties of cement in the wet state as well as in the solidified state.

Hard concrete moulds were made in the shape of the cube, cylinder and beam for the compressive strength, split tensile strength and flexural strength respectively

4. Conclusion

- From 28 days test results, for 10% replacement compressive strength was 14.2% lesser compared to conventional concrete.
- From 28 days test results, for 10% replacement split tensile strength was 14.2% lesser compared to conventional concrete.
- From 28 days test results, for 10% replacement flexural strength was 14.8% lesser compared to conventional concrete.
- Since compressive strength above 40 MPa was achieved for 5% and 10% replacement, hence it can be opted in place of conventional concrete to find a solution for the excess amount of waste tyre generated.
- Using such an alternate material will be eco-friendly & it also solves the problem related to scarcity of conventional material.

References

[1] "Concrete Technology" by M.S Shetty, 7th Edition,2013
[2] Camille A. Issa and George Salem, "Utilization of recycled crumb rubber as fine aggregates in concrete mix design", Construction and Building Materials,42,48-52, February 2013.

[3] Hambing Liu, Xianqiang Wang, Yubo Jiao and Tao Sha, "Experimental Investigation of the mechanical and Durability Properties of Crumb Rubber Concrete,' 2016.
[4] M.R Wakchaure: "Waste tyre crumb rubber particle as a partial replacement to fine aggregate in concrete", IJERT, Vol. 3, Issue 6, June 2014.
[5] Nithiya P and Portchejian G: "Behaviour of partial replacement of fine aggregate with crumb rubber concrete", International journal of structure and civil engineering research, Vol. 3, No. 3, August 2014.
[6] S. Selvakumar and R. Venkata Krishnaiah, "Strength properties of concrete using crumb rubber with partial replacement of fine aggregate," International journal of innovation research in science, engineering and technology, Vol. 4, Issue 3, March 2015.