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Waste Tyre Crumb Rubber Particle as a Partial Replacement to Coarse Aggregate in Concrete

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ABSTRACT

Concrete is known for its brittleness, with its tensile strength usually only reaching about one-tenth of its compressive strength. To enhance its properties, conventional concrete is commonly reinforced with steel bars. These reinforcements primarily serve to boost energy absorption and toughness while also augmenting the concrete's compressive strength.

The management of waste tires is a significant worldwide issue, as their improper disposal leads to environmental and health hazards. This project delves into the exploration of a diverse array of physical and mechanical characteristics of concrete incorporating recycled tire aggregates. Waste tires are crushed into coarse particles of varying sizes and employed to substitute coarse aggregates in concrete. Incrementally, coarse scrap tire aggregates are introduced at 10%, 15%, and 20% proportions to replace conventional coarse aggregates. The objective of this study is to ascertain the optimal utilization of these waste materials as coarse aggregates in concrete composites. The investigation extends to assessing the compressive strength of different concrete mixtures incorporating these waste components.

Hence,weinthisprojecthaveaimedtostudytheeffectivenessofrubberassubstitutefor coarse aggregate and utilize the crumb rubber tires in concrete, to minimize globalwarming.Aggregatepropertiesviz,specificgravity,waterabsorption,weretobeconducted to ascertain the properties concrete specimens were to be casted and tested forconcrete mix with various percentage of replacement (10%,15% &20%) and its viabilityforreplacementarediscussed in this project.

Keywords:

I. INTRODUCTION

Scrap tires from various vehicles accumulate continuously in landfills worldwide. Once the lifespan of two-wheeler tires ends, their storage and disposal pose a significant challenge for municipal authorities. In response to this issue, many countries have prohibited the dumping of waste tires in landfills, necessitating a viable and eco-friendly solution for their disposal. Various methods have been employed, such as using tires as fuel, applying ground rubber for playgrounds or sports surfaces, incorporating them into new rubber products, and integrating them into asphalt rubber modified concrete. In civil engineering, these tires find use in road and landfill construction, septic tank installations, among other applications, before the remaining tires are ultimately sent to landfills. Utilizing waste tire rubber particles in concrete offers an efficient means of

repurposing rubber, providing enhanced environmental benefits through its incorporation into concrete structures.

By partially substituting waste tire crumb rubber particles for coarse aggregate in concrete, the waste tire rubber enhances the engineering properties of the concrete. Each of these waste materials contributes distinct effects to both the fresh and hardened concrete properties. Incorporating waste products into concrete not only renders it cost-effective but also addresses disposal challenges. Repurposing bulky waste is deemed the most environmentally sound approach to waste management. Therefore, an effort has been made to replace coarse aggregate in concrete, reducing the reliance on river sand and yielding environmental advantages. Additionally, this substitution is expected to decrease concrete costs, particularly those associated with cement, which typically represents over 27% of the total concrete cost.

II. METHODOLOGY

A. Aim

The purpose of this experimental investigation was to investigate the effect of M25 grade concrete on strength characteristics in mixes containing varying proportions of waste tyre in concrete.

B. Mainobjectives

- ToinvestigatetheeffectofmixScraptirewiththepartiallyreplacedincoarseaggregateproportion onstrength of concrete.
- Tofindouttheinfluenceofdifferentreplacementratiosofrecycledmaterialsonthestrengthofthe designedconcrete.
- To achieve strength results with maximum economy by using scrap tire as acombinedmaterial withcoarseaggregate.
- TheuseofcrumbrubberinconcretemixisverymuchbeneficialtoenvironmentalConcernandtosolvetheproble mrelatedtodisposalofwastetirerubberthroughoutthe world.

C. Materials required for Concrete

1) Cement: Cement in general can be defined as a material which possesses very good adhesive andcohesive properties which make it possible to bond with other materials to form compactmass.
2) Types of cement:Asper IS:456-2000,thecementusedshall heanyofthefollowing andthe typeselectedshouldbeappropriatefor the intended use:

- 33GradeordinaryPortlandcementconformingtoIS 269
- 43GradeordinaryPortlandcementconformingtoIS8112
- 53GradeordinaryPortlandcementconformingtoIS 12269
- RapidhardeningPortlandcementconformingtoIS8041
- PortlandslagcementconformingtoIS455
- Portlandpozzolanacement (flyash based)conformingtoIS1489 (Part 1)
- Portlandpozzolanacement(claimed claybased) conformingtoIS 1489(Part 2)
- HydrophobiccementconformingtoIS8043

III.RESULTS

TABLE I

	7Days			28Days		
	CTMREADING (KN)	CUBESCOMPRESSIVE STRENGTH (N/MM2)	AVERAGE	CTMREADING (KN)	CUBESCOMPRESSIVESTRENGTH (N/MM2)	AVERAGE
0%	478.72	21.30	20.31	675.51	30.01	29.58
	440.52	19.59		688.91	30.62	
	452.72	20.10		632.32	28.11	
10 %	364.48	16.22	16.34	539.53	23.95	23.97
	367.51	16.35		546.91	24.31	
	370.94	16.47		532.75	23.66	
15 %	241.45	10.79	10.79	399.95	17.76	17.31
	248.72	11.04		380.57	16.95	
	237.41	10.54		386.73	17.19	
20 %	188.70	8.39	8.40	244.48	10.85	10.93
	191.17	8.48		249.61	11.08	
	189.31	8.40		245.44	10.91	

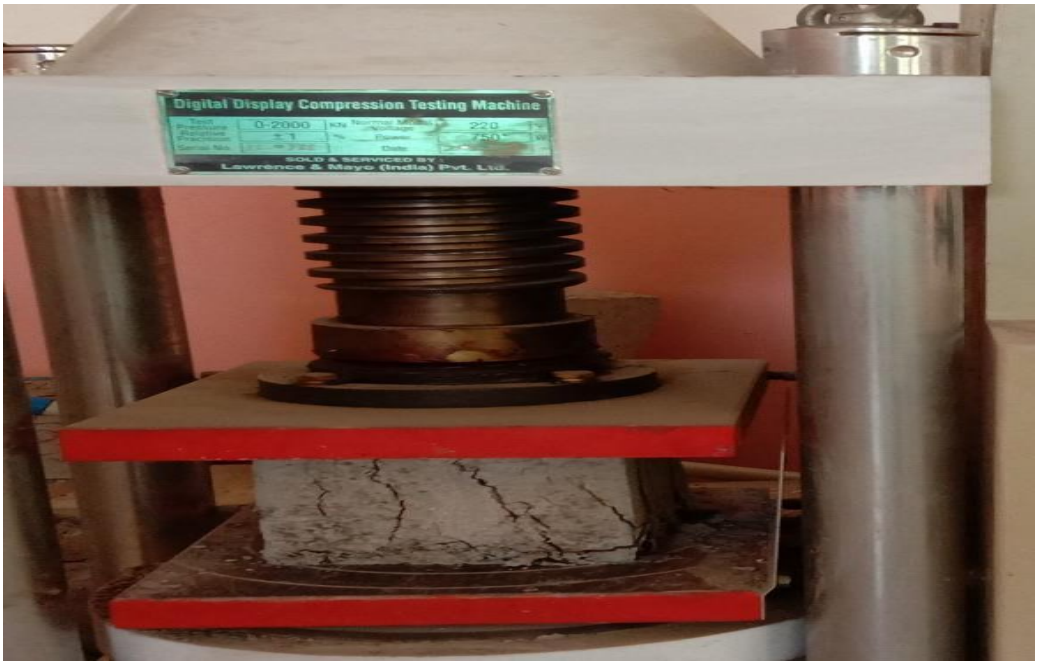

Figure1:

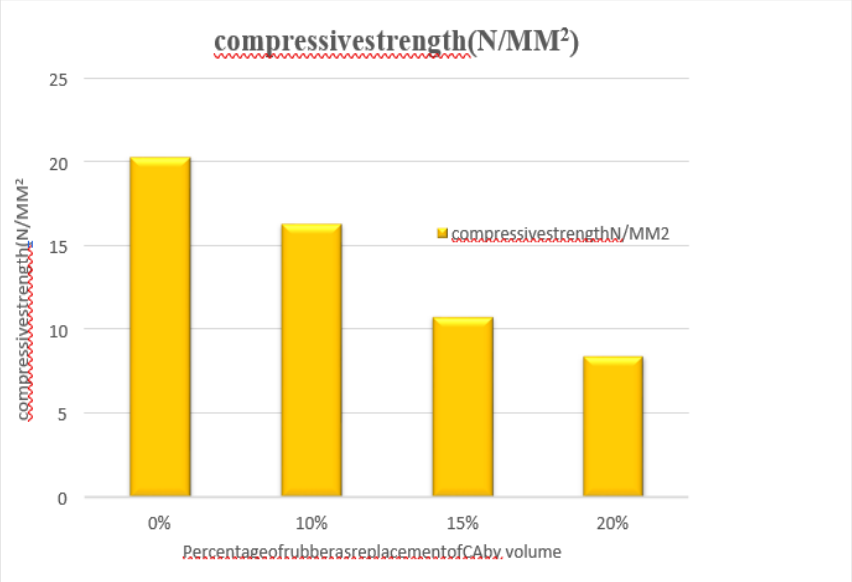

Figure2:Testresultsofcubesafter7 Daysofcuring

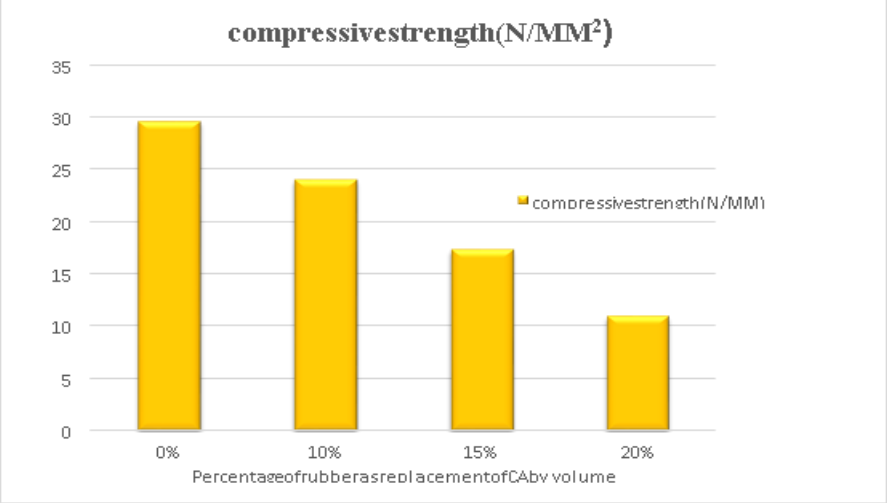

Figure3:

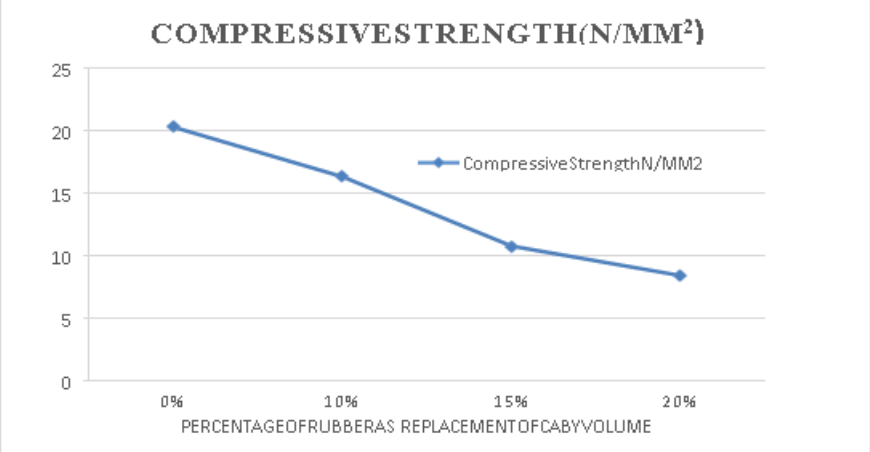

Figure4:GraphShowing ResultsofDifferentPositionofCrumbRubberincubesAfter7 daysofcuring

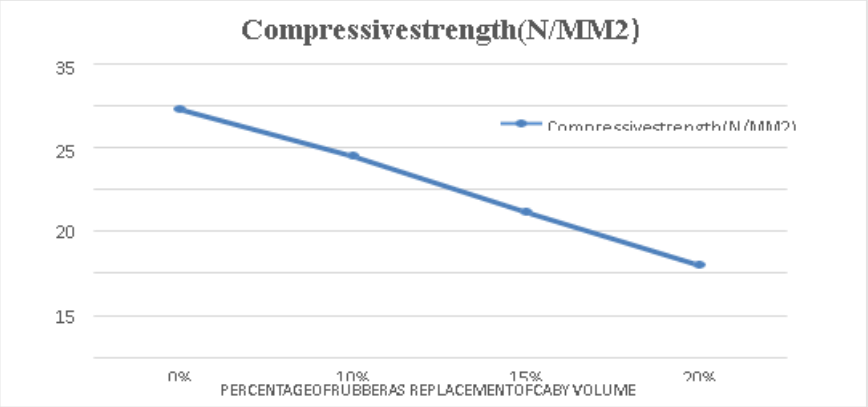

Figure5:

IV. CONCLUSION

- OptimumresultsareobtainedforcompressivestrengthwithrubberatRandomPosition.
- The main objective of this review article was a literature overview of fresh and hardenedproperties of self-compacting concrete with partially replaced natural coarse aggregatewithrecycledaggregatematerial.From this, itcan beconcluded:
- The use of crumb rubber in concrete mix is very much beneficial to environmentalconcernandtosolvetheproblemrelatedtodisposalofwastetirerubberthroughouttheworld.
- Waste tire rubber can be used as a replacement aggregate material in self-compactingconcrete.
- Safedisposalofwastetire,preventingitfromcausingpollutionanddiseases.
- Self-weight of concrete is reduced with the addition of tire particle, so it can be used aslightweightconcrete. Cost effectivesolution
- Further investigation is necessary to improve the hardened properties of rubber filledconcrete, to gain the loss strength due to the use of waste tire crumb rubber at highercontent inconcrete mix.

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