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To Study the use of Plastic Waste (Plastic Chips) as Partial Replacement of Coarse Aggregate on the Concrete- A Review

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Abstract: ***Most serious problems of the world today is related to removal of waste and to find solution of reusing it. Various waste materials are generated from manufacturing processes, service industries, construction and demolition works and municipal solid wastes. Increasing awareness about the environment has tremendously contributed to the concerns related with disposal of these generated wastes. All Solid waste management is one of the major environmental concerns in the world and with the scarcity of space for land filling and due to its ever increasing cost; waste utilization has become an attractive alternative to disposal. There are numerous researches that are being carried out to utilize these wastes in the construction industry where most of them are related to using these wastes in concrete. This study will help improving the usage of ceramic wastes in concrete and its effect on various required properties of concrete.***

Use of waste products in concrete not only makes it economical but also solves some of the disposal problems. Disposal of plastic waste in an environment is considered to be a big problem due to its very low biodegradability and presence in large quantities. In recent time use of such, Industrial wastes from polypropylene (PP) and polyethylene terephthalate (PET) were studied as alternative replacements of a part of the conventional aggregates of concrete. Plastic recycling was taking place on a significant scale in an India. As much as 60 % of both industrial and urban plastic waste is recycled which obtained from various sources. People in India have released plastic wastes on large scale have huge economic value, as a result of this, recycling of waste plastics plays a major role in providing employment.

Keywords: plastic waste coarse aggregate, strength and durability, concrete, plastic chips.

I. INTRODUCTION

Due to rapid industrialization and urbanization in the country lots of infrastructure developments are taking place. This rapid development led to the acute shortage of construction materials, increased dumping of waste materials. Hence to overcome the above said problems waste products should be employed as a construction material. Fine aggregate used in concrete is replaced partially by pulverized PET bottles in known percentages and properties are tested, the optimum percentage at which higher strength is obtained is calculated. Considerable researches were carried out in some countries like USA, UK on this topic however there have been very limited studies on plastics in India.

Landfill sites are becoming over crowded and expensive for waste disposal, efforts are made to minimize the quantities of materials that are delivered to landfills. The threat due to leaching of non-biodegradable materials like waste plastics, scrap tyres. e-waste may contaminate the soil and ground water. If the production of waste cannot be prevented, then it is attractive to create an alternative use in another process instead of disposal. The benefits of plastic recycling can be economically advantageous, due to abundant availability lower cost for mixing with other variants like concrete, bitumen etc. The development of concrete with nonconventional aggregate, such as polystyrene foam wastes, HDPE, polyethylene terephthalate (PET), and other plastic materials has been investigated for use in concrete in order to improve the properties of the concrete and reduce cost. The use of such plastic wastes(plastic chips) in concrete will contribute to the sustainability of the concrete design and the natural environment.

II. LITERATURE REVIEW

A. Bayasi and Zeng (1993) [1] studied the effects of polypropylene fibers on the slump and inverted slump cone time of concrete mixes. They reported the increase in inverted slump cone time with the increase in percentage of plastics.

B. Khatib and Bayomy (1999) [2]investigated the workability of rubcrete and reported that there is a decrease in slump with increase in rubber content as a percentage of total aggregate volume.

C. Saradhi (2003) [3] shown that the fresh concrete with expanded plastics mixes showed better flow values compared to the normal concrete at similar water cement ratio and also no segregation was observed in any mix even though the concretes were made without the addition of bonding additives.

D. Soroushian (2003) [4] demonstrated that there was decrease in air permeability with the inclusion of discrete reinforcement in concrete. The air permeability test as measured the rate of air through a concrete specimen. Lower airflow rates are preferable, indicating lower permeability. Discrete reinforcement systems were used in the project to reduce permeability of concrete, which could be attributed to reduced shrinkage micro-cracking. Reduced permeability favors long-term durability of concrete systems incorporating discrete reinforcement.

E. Ghaly (2004) [5] concluded that for a giver water-cement ratio, the modulus of elasticity decreases with the increase in plastic content in the mix. Relationship between modulus of elasticity and percentage of plastics was developed. relationship between the modulus of elasticity and the percent of plastics in the concrete mix for the three w/c's tested. This a general trend where the value of the modulus decreases with the increase of the percent plastics in the mix. shows the relationship between the percent reductions in the modulus of elasticity versus the percent of average area of plastics in a concrete cross section. An exponential curve was found to best fit the data.

F. Elzafraney (2005) [6] noticed that high recycled content concrete produced under field conditions successfully satisfied the targeted performance requirements of the project.

G. M.Elzafraney [2005] [7]this study has incorporated use of recycled plastic aggregate in concrete material for a building to work out its performance with regards to thermal attributes and efficient energy performance in comparison with normal aggregate concrete. The plastic content concrete was prepared from refined high recycled plastics to meet various requirement of building construction like strength, workability and finish ability etc. Both buildings were subject to long and short term monitoring in order to determine their energy efficiencies and level of comfort. It was observed that recycled plastic concrete building having good insulation used 8% less energy in comparison of normal concrete; however saving in energy was more profound in cold climate in building with lower insulation.

H. Zainab Z. Ismail [2007] [8] they have conducted comprehensive study based on large number of experiments and tests in order to determine the feasibility of reusing plastic sand as partial replacement of fine aggregate in concrete. They conducted tests on concrete samples for dry/fresh concrete density, slump, compressive and flexural strength and finally toughness indices on room temperature. . Their test results indicate sharp decrease in slump with increasing the percentage of plastic, this decrease was attributed to the presence of angular and non uniform plastic particles. In spite of low slump however, the mixture was observed with good workability. Their tests also revealed the decrease in fresh and dry density with increasing the plastic waste ratio; however increase was reported in dry density with time at all curing ages. Decrease in compressive and flexural strength was observed by increasing the waste plastic ratio which can be related to decrease in adhesive strength between plastic waste particles with cement

I. Bhogayata [2012] [9] they have studied the environment friendly disposal of shredded plastic bags in concrete mix to be use in construction industry which have need for alternative material to be use in lieu of conventional materials They concluded that good workability was shown by the mix added with shredded fibers due to its uniform and higher aspect ratio evenly sprayed in the mix. Addition of plastics up to 0.6% is considered suitable after which reduction in compressive strength and compaction is seen affected. They observed that strength loss was less in concrete having shredded fibers of plastic as compare to hand cut macro fibers.

J. Praveen Mathew [2013] [10] They have investigated the suitability of recycled plastic as partial replacement to coarse aggregate in concrete mix to study effect on compressive strength, modulus of elasticity, split tensile strength and flexural strength properties of concrete. Coarse aggregate from plastic was obtained by heating the plastic pieces at required temperature and crushed to required size of aggregate after cooling. Their test results were based on 20% substitution of natural coarse aggregate with plastic aggregate. Increase in workability was reported when slump test for sample was carried out.

K. P. Suganthy [2013] [11]This study investigate the application of pulverized fine crushed plastic (produce from melting and crushing of high density polyethylene) as replacement of fine aggregate in concrete with varying known percentages. Their main focus was on optimum replacement of natural sand by pulverized plastic sand

L. Khilesh Sarwe.[2014] [12] This study presents the results of addition of waste plastics along with steel fibers with an objective to seek maximum use of waste plastic in concrete. The combine mix of plastic waste and steel fibers has shown more strength as compare to concrete mix prepared only with plastic waste. He has reached to conclusion that a plastic waste of 0.6% weight of cement when used with steel fiber of 0.3 % (weight of cement) has shown the maximum compressive strength.

III. ADVANTAGES OF PARTIAL REPLACEMENT OF COURSE AGGREGATE WITH PLASTIC WASTE CHIPS.

A. Reduces the amount of original aggregates to be created, hence less exploitation of natural resources.

B. While being crushed into smaller particles a large amount of carbon dioxide is absorbed. This reduces the amount of CO_2 is the atmosphere.

C. Cost saving – few research studies have shown a significant reduction in construction costs if plastic waste is used.

D. Conserves landfill space, reduces the need for new landfills and hence saving more costs.

E. Creates more employment opportunities is recycling industry.

F. The use of plastic aggregate can be used to produce lightweight concrete, without affecting strength.

G. This will lead to utilization of wastes.

IV. CONCLUSION

The researchers have represented different forms of plastic waste which can be use in production of concrete. They proposed the replacement of various concrete ingredients (fine and coarse aggregate) with suitable plastic waste material. They have worked on various properties such as workability ,compressive strength, tensile strength, toughness indices etc.by using various forms of plastic waste such as PVC, polystyrene foam waste polyethylene terephthalate(PET) etc. They investigated that the use of plastic waste in improving the required properties of concrete and thus reducing the cost of traditional concrete without affecting the strength upto certain percentage replacement.

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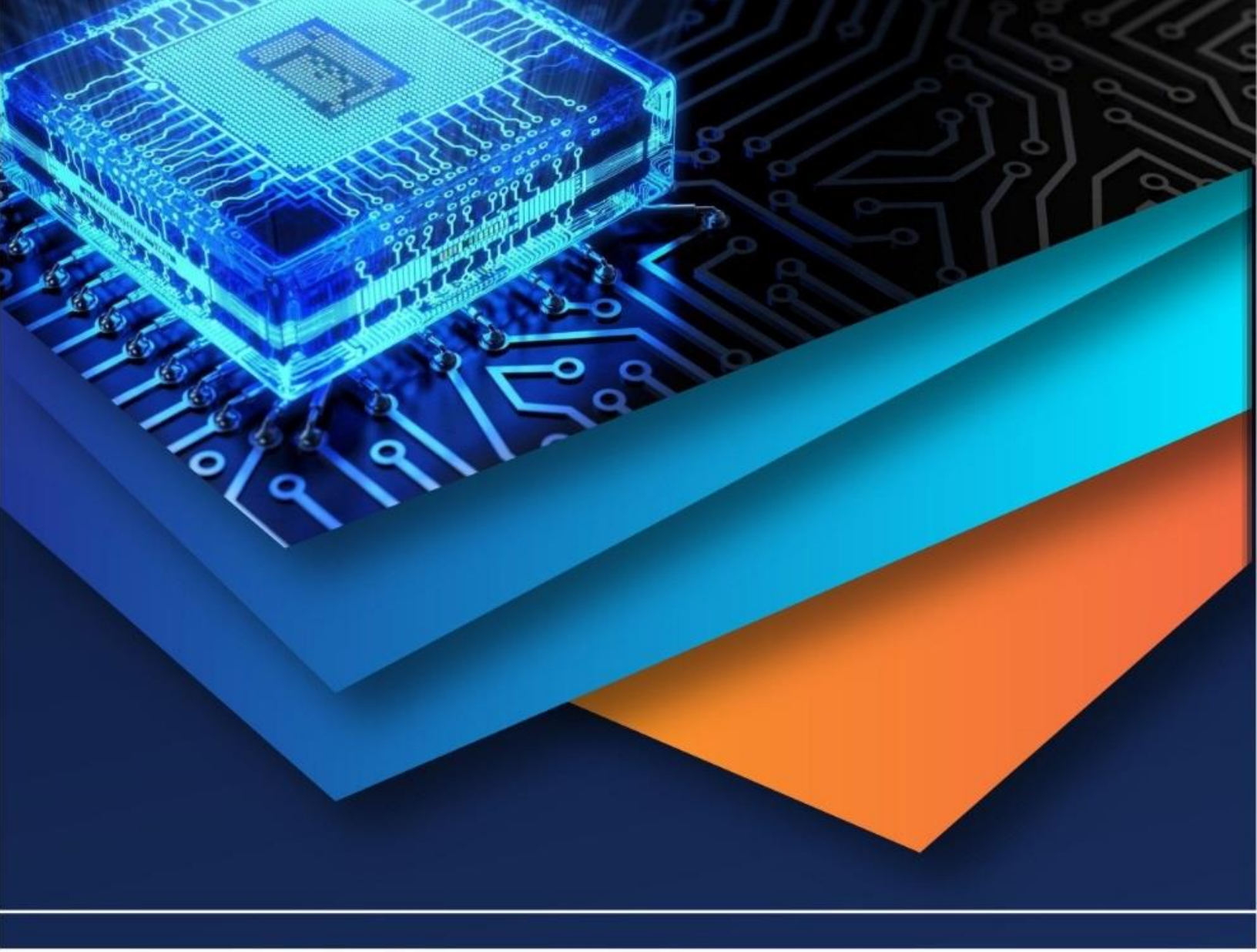

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