

PLASTIC WASTE IN CONCRETE –A Study Report

Karthika.H¹, Shanmuganathan N², Dhilshath Begam J³, Gokila M⁴, Akalya A⁵, Abirami D⁶

^{1&2}Assistant Professor, civil department, Dhaanish Ahmed College of Engineering, India

^{3, 4, 5 & 6}BE-Final Year, civil department, Dhaanish Ahmed College of Engineering, India

Abstract

The utilization of industrial waste in a useful manner is a major challenge in this current situation, because of the pollution there is a great harm to the nature and common life. For this purpose the very harmful and non-degradable material waste, Plastic is chosen, in order to minimize the stack piling of plastics in the environment and to control the pollution on earth. Hence it needs an immediate remedy and according to the past studies made on the use of plastic waste plastic in concrete tell us that the usage of waste material in structural elements is a challenging activity in the construction industry. Now a day in the construction industries, the availability of coarse aggregate (gravel) is a major problem. Thus for minimizing the usage of gravel in the making of concrete, many alternative investigations are carried out. In this paper studied various literature about the replacement of plastic wastes in concrete, based on this study concluded plastic attains high compressive strength up to 20% replacement.

Keyword: Aggregate, crushed stone, Gravel, conventional material, replacement.

1. PLASTIC AS AGGREGATE IN CONCRETE

According to the results of the study, a maximum of 33% replacement of granite by recycled plastics can be used in producing normal weight concrete. The percentage reductions in compressive strength and density increased as the percentage replacement increased [1]. This modified cement concrete mix is applicable in the construction of rigid pavements. The compressive strengths of modified cement concrete are as equal as plain cement concrete. The optimum modifier content of waste plastics is found to be 4% for paver blocks and 2% for solid blocks[2]. Addition of Fly Ash in the mix considerably improves strength index of control mix as well as e waste concrete. The strength development of flyAsh based e plastic concrete in early days found to be less but 28 days compressive and split tensile strength has proven results in comparison with controlled concrete up to 25% e plastic replacement [3]. The use of Plastic in concrete mix for the percentage of water cement ratio was taken as 0.4, 0.45 & 0.50, reduces the tensile and compressive strength and also lower the density [4].

2. COARSE AGGREGATE USING E-WASTE IN CONCRETE

The strength reduction due to the addition of waste plastic was compensated by the addition polypropylene[5] comparing the results with conventional concrete at 28 days strength it is observed that the compressive strength of concrete is found to be 27% higher when coarse aggregate is replaced by 15% with E-Waste. More than 15% of replacement for coarse aggregate is not considerably useful for construction field because of strength decrease [6]. Plastics can be used to replace the aggregates in a concrete mixture. This contributes to reducing the unit weight of the concrete. Introduction of plastics in concrete tends to make concrete ductile, hence increasing the ability of concrete to significantly deform before failure [8] E-waste is the potential viable material is used as fine aggregate to produce durable concrete.

TABLE: 1 COMPARATIVE ANALYSES CRUSHED

Si.no	Title of the project	Journals name	Author name	Year of publish	Replacement %	Result
1	Experimental Study On Utilization Of Waste Plastic As Aggregate In Cement Mortar	International journals of engineering science and technology (IJES)	MD HASHMATH(ASS T PROF)	August 2015	-	The effect of water cement ratio of strength development is not prominent in the case of plastic concrete.
2.	Utilisation Of Waste Plastics As A Partial Replacement Of Coarse Aggregate In Concrete Blocks	Indian journal of science and technology (IJST)	S. VANITHAV.NAT RAJAN AND M.PRABA	June 2015	0%, 2%, 4%, 6%, 8% and 10%	The compressive strengths of modified cement concrete are as equal as plain cement concrete.
3	Studies On Concrete Containing E Plastic Waste	International journals of environmental Science (IJES)	LAKSHMI.R,NAG AN.S	2010	0 % ,4%,8%,12%,16 %,20% and 25%	It is identified that e-waste can be disposed by using them as construction material. since the e-waste it not suitable to replaced fine aggregate. It is used to replace the coarse aggregate.
4	Properties Of Concrete By The Addition Of Plastic Solid Waste	International Journals Of Science And Research (IJSR)	M. MUZAFAR AHMED, S.SIDDI RAJU	2013	0 % to 20%	The use of plastic in concrete mix for a given water cement ratio, reduces the tensile and compressive strength and also lower the density.
5.	Evaluation Of Strength And Durability Of Waste Plastic Mix Concrete	International Journals Of Research In Advent Technology	PROF. M. KUMARAN M.NIDHI, P.R. BINI	June2015	15%	These results suggest that plastic waste mix concrete may be a useful cementitious composite with better durability characteristics

						than normal concrete
6.	Investigation On Partial Replacement Of Coarse Aggregate Using E-Waste In Concrete	International Journals Of Earth Science And Engineering (IJESE)	BALASUBRAMANIAN B.GOPALA KRISHNA GVT AND SARASWATHY V	June 2016	5%, 10%, 15%, 20%, 25% and 30%	Similarly split tensile strength and flexural strength test shows good result on 15 % replacement of e-waste.
7.	Experimental investigation on coarse aggregates by using waste plastics & polymers	International journal of innovative research in engineering and management (IJIREM)	K. L. A.V. HARNADH A.M.N.KASHYAP CH.L.K.M.GUPTA Dr.T.T.CHANDR AH SEKHARRAO	May-2015	-	It is showed better values than conventional aggregate.
8.	Recycled Plastics As Coarse Aggregate For Structural Concrete	International journal of innovative research in science engineering and technology (IJIRSET)	PRAVEEN MATHEW SHIBI VARGHESE THOMAS PAUL ELDHO VARGHESE	March 2013	20%	A percentage replacement of 22% NCA with PCA was found to be of superior concrete compressive strength with regard to its tensile behavior the bonding strength of PCA with matrix needs more attention,since PCA concrete has a substantial reduction in split tensile strength and elastic modulus.
9.	Scope Of Utilisation Of E-Waste Inconcrete	International Journal Of Advance Research In Science And Engineering (IJARSE)	SALMAN SIDDIQU SIKANDHAR SHAKIL MOHD.SHABAB SIDDIQUI	March 2015	-	E waste is the potential visible material to be used as fine aggregate to produce durable concrete.
10.	Experimental	International	DANIEL YAW	May	25%, 50%, 75% and 100%	The percentage reduction in

	Investigation On Recycled Plastics As Aggregate In Concrete	Journal Of Structural And Civil Engineering Research	OSEI	2014		compressive strength and density increased as the percentage replacement increased.
--	---	--	------	------	--	---

3. RESULTS AND DISCUSSIONS:

Md Hashmath (2015) : The main aim of the study is to investigate the change in mechanical properties of concrete with the addition of crushed plastics in concrete. Along with the mechanical properties, thermal characteristics of the resultant concrete is also studied from the above papers. Introduction of plastic waste in concrete tends to make concrete ductile, hence increasing the ability of concrete to significantly deform before failure.

This characteristic makes the concrete useful in situations where it will be subjected to harsh weather such as expansion and contraction, freeze and thaw. The inclusion of recycled aggregates in the concrete of the buildings under investigation has been shown to be advantageous from an energy point of view. The use of plastic aggregates makes the interior cooler, when the outside temperature is raised, as compared to the corresponding control concrete

S. Vanitha V.Natrajan and M.Praba (2015) : Usually M20 concrete is widely used for constructional works. Waste Plastics were incrementally added in 0%, 2%, 4%, 6%, 8% and 10% to replace the same amount of Aggregate in concrete. Paver and Solid Blocks of size 200 mm X 150 mm X 60 mm and 200 mm X 100 mm X 65 mm were subjected to casted and tested for 7, 14 and 28 days strength. The obtained compressive strengths of modified cement concrete are as equal as plain cement concrete. The favourable modifier content of waste plastics is found to be 4% for paver blocks and 2% for solid blocks. The cost of construction will reduce and also helps to avoid the general disposal technique of waste plastics namely incineration land filling which have certain burden on ecology

M. Muzafar Ahmed, S.Siddi Raju (2013) :The properties of concrete such as compressive as well as tensile strength are reduced with the addition of plastic in concrete. Further the thermal conductivity of concrete is also reduced, when the coarse aggregate partially replaced by the plastics in concrete. The use of Plastic in concrete mix for a given w/c ratio, reduces the tensile strength and compressive strength and also lower the density. The replacement of plastic in concrete pavements it can be with stand at high temperature and also reduction in thickness achieved.

Balasubramanian B , Gopala Krishna GVT And Saraswathy V (2016): Different types of conventional cubes with partial replacement of E-waste as 5%, 10%, 15%, 20%, 25% and 30% to coarse aggregate with water cement ratio as 0.5 was made. The main aim of this study recommends the replacement of E-waste as an aggregate in the production of new concrete. By comparing the results of modified concrete with conventional concrete at 28 days strength it is observed that the compressive strength of concrete is found to be 27% higher when coarse aggregate is replaced by 15% with E-Waste. More than 15% of replacement for coarse aggregate is not considerably useful for construction because of strength decrease. Similarly Split tensile and Flexural strength tests shows good result on 15% replacement of E-wasteHence it solves a potential disposal problem and it reduces the usage of natural aggregate.

DANIEL YAW OSEI (2014): When the percentage of recycled plastic increased, the density and compressive strength of concrete reduced. However, the workability of recycled plastic concrete mixtures were not significantly different from the control concreteBased on the results of the study, a maximum of 33% replacement of granite by recycled plastics can be used in producing normal weight concrete.

4. Conclusion:

These results suggest that plastic waste mix concrete may be a useful cementitious composite with better durability characteristics than normal concrete. Similarly split tensile strength and flexural strength test shows good result on 15 % replacement of E-waste & crushed plastic waste posse's good strength up to 20%. A percentage replacement of 22% NCA with PCA was found to be of superior concrete compressive strength with regard to its

tensile behavior the bonding strength of PCA with matrix needs more attention, since PCA concrete has a substantial reduction in split tensile strength and elastic modulus. From the above study concluded that the 20% replacement of crushed plastic waste with higher grade (M_{40}) results good compressive strength.

5. REFERENCE

- [1] Balasubramanian B, Gopalakrishna GVT and Saraswathy V (2016), "Investigation on Partial Replacement of Coarse Aggregate using E-Waste in Concrete ISSN 0974-5904, Volume 09, No. 03.
- [2] Daniel Yaw Osei (2014), "Experimental Investigation on Recycled Plastics as Aggregate in Concrete" International journal of structural and civil engineering research ISSN 2319 – 6009.
- [3] Dr.KiranTajne and Mrs.Pranita Bhandari (2016), "Waste Plastic Used As A Coarse Aggregate in Concrete" International Journal for Research in Applied Sciences.
- [4] Harsh vardhan Shukla, Himanshu Rajput ,Anshul Jain, DevashishGurjar, Gaurav Awasthi(2016), "Study of Compressive Strength of Concrete by Using E-Waste" IJSTE - International Journal of Science Technology &Engineering Volume 2 Issue 10 .
- [5] K. L. A.V. Harnadh, A. M. N. Kashyap, CH. L. K.M. Gupta, Dr.T.Chandrahsekharrao (2015) ,"Experimental Investigation On Coarse Aggregates By Using Waste Plastics & Polymers" International Journal of Innovative Research in Engineering & Management (IJIREM) ISSN: 23500557, Volume-2, Issue3.
- [6] Lakshmi. R, Nagan.S(2010),"Studies on Concrete containing E plastic waste" International Journal Of Environmental Sciences Volume 1, No 3
- [7] Muzafar Ahmed, Dr. S. SiddiRaju (2013), "Properties of Concrete by the Addition of Plastic Solid Waste"International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064.
- [8] Md Hashmath, Md Meraj(2015),"Experimental Study On Utilization Of Waste Plastic As Aggregate In Cement Mortar" International Journal Of Engineering Sciences & Research Technology.
- [9] Pramod S. Patil, J.R.Mali, Ganesh V.Tapkire, H. R.Kumavat (2014), "Innovative Techniques of Waste plastic Used In Concrete Mixture" International Journal of Research in Engineering and Technology.
- [10]Praveen Mathew, Shibi Varghese, Thomas Paul, Eldho Varghese(2013),"Recycled Plastics as Coarse Aggregate for Structural Concrete" International Journal of Innovative Research in Science, Engineering and Technology Vol. 2, Issue 3.
- [11]Indian Standard code for Specification for 53 grade Ordinary Portland Cement, IS 12269: 2013, Bureau of Indian Standards, New Delhi.