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EXPERIMENTAL STUDY ON CONCRETE COMPRESSIVE STRENGTH USING E PLASTIC WASTE

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Abstract: India has emerged as fifth largest "ELECTONIC WASTE" producer in the world; discarding roughly 18.5 lakh tons of electronic waste every year. Developing countries are facing enormous challenges related to the generation and management of e waste. The utilization of E waste plastic as partial replacement to concrete is solution for some of the environmental and ecological problems. Usage of E waste plastic in concrete could be worth experimenting and also reduces the shortage of raw material and safe disposal of plastic waste. An experimental study was made on utilization of E waste plastic as coarse aggregate in concrete with a percentage replacement of 8% and10% on the strength criteria of M40 concrete. This study gives the effort to utilize e-plastic as filler material in concrete. Recent studies have shown that the reuse of finely grounded plastic waste in concrete has economical and technical advantages for solving the issues of disposal of waste. Many researchers have been done on this topic for resolving the E plastic disposal problem and environmental issues. In the present research Fly ash has been replaced with the cement of about 20% and E waste of about 15%, 20%, 25% and 30% with coarse aggregate. Fly ash acts as admixture which improves the strength of concrete and used the water cement ratio 0.45 to adequate the workability for the fresh concrete. Compressive strength test has been carried out and comparison of the E waste plastic concrete to the conventional concrete has been done.

Keywords: E-Waste, Fly ash, Compressive Strength, Durability, Disposal

I. INTRODUCTION

Concrete is the most important material consumed after water. The main reason behind its popularity is its high strength and durability. At present our world is advancing too fast and our environment is changing progressively. Attention is required for safeguarding environment and natural resources and recycling of waste materials. Due to rapid industrialisation and urbanisation in the country, a lot of infrastructure developments are taking place. This process has in turn pose question to mankind to solve the problem generated by this growth. The problem defined is acute shortage of construction material and increased dumping of waste materials. Hence in order to overcome the above said problems waste products should be employed as construction material. Now a day's E- waste is also a waste material and it is used in construction industry. To solve the problem of disposal of large amount of E-waste material, reuse of E-waste in concrete industry is considered as the most feasible application. E-waste describes loosely discarded surplus, obsolete, broken electronic devices. Every year several tones of E-waste have to be disposed these become a challenging problem. E-waste is a serious problem to human health and also to the environment as it contains potentially harmful components such as lead, cadmium, and beryllium or brominates retardants. Recycling and disposal of E-waste may involve significant risk to health of workers and communities in developed countries.

II. LITERATURE REVIEW

H. Sai venu madhav2015 says It is observed that with the addition of E-plastic for 4cm and 3cm is added the compressive strength gets increase up to a maximum of 5.9% and 10.6% respectively when compared with the compressive strength of conventional concrete. The improvement mechanical properties of concrete depending on sizes of fiber are resulted.

B.T Ashwini manjunath, 2015 says "The feasibility of utilizing E-waste plastic particles as partial replacement of coarse aggregate has been presented. In the study, compressive yielded stability was very good for compressive strength of 53 grade cement.

Vikash patidar, sunil ahirvar, pratiksha malviya vikhash kumar singh 2016 says "The main of this study is to investigate the changing in mechanical properties of concrete with addition of electronic waste in concrete. It is found that the use of electronic waste aggregates result in the formation of light weight concrete. In this research article coarse aggregate is partially replaced by E-waste from 0% to 30% then in these mix 10%, 20% and 30% of fly ash is also added by partial replacement of cement.

K.Alagusankareswari, S.Sandeep Kumar, K.B.Vignesh and K.Abdul Hameed Niyas 2016 The yield of concrete reduces when E-waste is used as a replacement material for sand. It is coherent that E-waste can be biased by using them as constructional material. The compressive strength and split tensile strength of concrete pertaining to E-waste aggregate is slightly lesser in comparison with control mix concrete sample.

S.R.Shamilic. natarajan, J.Karthikeyan 2017 says "The behaviour of concrete with incorporation of E-wastes show the strong possibility of using E-wastes as a substitute of aggregates eventually it reduces the use of natural aggregates in concrete.

Dr.K.Ramadevi, menakad,2017says "The project work is conducted on M30 concrete the partial, replacement of coarse aggregate with electronic waste is in range of 10%,20%,30% moreover, 25% of cement is to be replaced by fly ash and 25% of fine aggregate is to be replaced by M sand. The strength results were compared with those of the conventional concrete at 7 day to 28 days.

R. Shobana, 2017 says "Use of E-waste materials not only helps in getting them utilized in cement, concrete, and other construction materials, it helps in reducing the cost of cement and concrete manufacturing, but also has numerous indirect benefits such has reduction in landfill cost, saving in energy, and protecting the environment from the possible pollution effects.

III. MATERIALS

3.1 Flyash

The fly ash (FA), the ground granulated blast furnace slag (GGBS) and the silica fume (SF) has been used widely as supplementary cementitious materials in E-waste concrete. These mineral admixtures, typically fly ash and silica fume (also called condensed silica or micro silica), reduce the permeability of concrete to carbon dioxide (CO2) and chloride-ion penetration without much change in the total porosity.

FIGURE3.1: FLY ASH

3.2 E-Waste

Now-a-days, electronic products have become an integral part of daily life which provides more comfort, security, and ease of exchange of information. Printed circuit boards (PCB) are one of the electronic devices. PCB contains about 30% metals and 70% non-metals waste. It is classified into three groups, namely organic, metals and ceramic. The organic group in PCB consists of plastics with flame retardants and paper. In PCB, generally hazardous components like chromium, lead, beryllium, mercury and cadmium are also present. Metals are sent to recovery operations and non-metals can be reused. In developed countries, previously it was about 1% of total solid waste generation and now it grows to 2% by 2010. In developing countries, percentage of E-waste is about 0.01% to 1% of the total municipal solid waste generation. Printed Circuit Boards (PCB) forms most of its weight by 3% of WEEE (Waste of Electrical and Electronics Equipment) are the fundamental of all Electric and Electronic waste materials.

FIGURE 3.2: E-WASTE

TABLE 3.1 PHYSICAL PROPERTIES OF E-WASTE

S.No	Property	Result
1	Specific gravity	1.01
2	Water absorption	<0.2
3	Colour	White & dark
4	Shape	Angular
5	Crushing value	<2%
6	Impact value	<2%

IV. DIFFERENT MIXES:

Table 4.1 Different Mixes

Mix 1	Conventional concrete
Mix 2	15% replacement of coarse aggregate with E-waste and 20% Fly ash with cement.
Mix 3	20% replacement of coarse aggregate with concrete with E-waste and 20% fly ash with cement.
Mix 4	25% replacement of coarse aggregate with concrete with E-waste and 20% fly ash with fly ash
Mix 5	30% replacement of coarse aggregate with concrete with E-waste and 20% fly ash with fly ash.

4.1 TESTS ON FRESH CONCRETE:

4.1.2 Preparation of Specimens

Moulds of standard size 150 mm X150 mm X 150 mm were used for casting the cubes. The internal surfaces of moulds are cleaned and one coat of cutting oil is applied. The moulds are filled in three layers and the height of each layer is about 1/3rd height of mould, each layer is compacted by giving 25 blows with a tamping rod over the entire cross section of the mould uniformly. After filling and compact the moulds, the top surface are made smooth and kept for a period of 24 hours. Then the mould is removed and the cubes were kept under water for 28 days. The curing of specimens was done by pounding method of curing. Water should be clean and free from impurities and 15% of ph 1 sulphuric acid is added to the water. Then after completing the curing period all the specimen were removed and kept for drying for one day. The surface of the specimens should be cleaned and the test is carried out. 30 numbers of cubes were being cast for compressive strength test for M40 grade concrete. The total number of specimens casted for M40 grade concrete is shown in table

Table 4.2: Representation of Test Specimens Casted

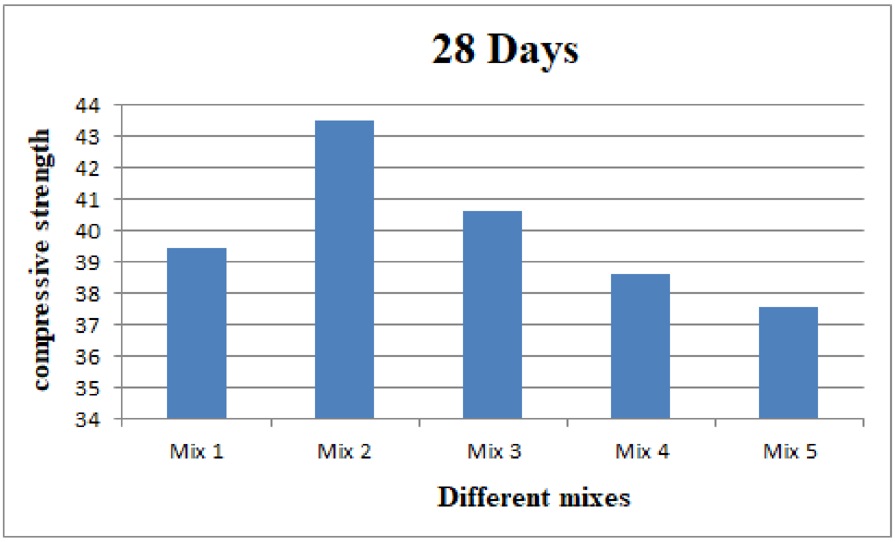
Mix	% Of Replacement	No Of Specimens
I	-	5
II	10% SF	5
III	10% GGBS	5
IV	15% GGBS	5
V	10% VA	5
VI	15% VA	5
	TOTAL	30

V. RESULTS AND DISCUSSIONS

Table 6.2 Compressive strength result

Mix	7days(N/mm2)	14days(N/mm2)	28days(N/mm2)
1	25.98	35.24	39.62
2	27.99	38.73	43.52
3	26.78	36.24	40.62
4	25.42	35.38	38.62
5	24.37	34.85	37.56

Graph 6.7 Compressive Strength



From the above graph it is observed that, For 28 days that the compressive strength of concrete was high for 15% replacement of e waste and very low for 30% replacement of e waste.

CONCLUSION

1. E-waste concrete is on increasing trend in the construction industry and is being seen as an optimised solution considering the economics, strength and durability required for structures.
2. For replacing cement by fly ash 20% and replacement of coarse aggregate with e-waste by 15%, 20%, 25%, 30% the optimum value is given by 15% replacement of e-waste.
3. The workability of concrete increased with the 20% replacement of cement by fly ash, and 15% and 20% replacement by E-waste.
4. It is found that increment in compressive strength for M40 grade concrete when cement is replaced with fly ash, and E-waste with coarse aggregate at 7 days of curing is moderate.
5. It is found that increment in compressive strength for M40 grade concrete when cement is replaced with fly ash, and E-waste with coarse aggregate at 14 days of curing is moderate.
6. It is found that increment in compressive strength for M40 grade concrete when cement is replaced with fly ash, and E-waste with coarse aggregate at 28 days of curing is equal to the conventional concrete
7. Durability of concrete was high for 15% replacement of E-waste.

FUTURE SCOPE

Following are the scope for future work.
1. In the present work M40 grade of concrete is studied further work can be carried out on the higher grades of concrete and also M20, M25, M30, M35 grade.
2. Ground granulated blast furnace slag; silica fume can be used as a partial replacement for fine aggregates or cement.
3. Flexure behaviour of larger size beams can be studied.
4. Durability studies like Water absorption, Porosity, Resistance to abrasion etc can be carried out.
5. Admixtures like Silica fume, ground granulated blast furnace slag, and volcanic ash can also be further replaced partially by 20%, 25%, 30%, 35%, 40% etc.

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