EXPERIMENTAL STUDY ON THE IMPACT ON STRENGTH, PARTIAL REPLACEMENT OF COARSE AGGREGATE BY ELECTRONIC WASTE WITH FLY ASH IN CONCRETE

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Abstract: In this paper, In this thesis of research project Coarse aggregate is partially replaced by electronic waste from 0% to 30% Then in these mix 10%, 20% and 30% of fly ash is also added by partial replacement of cement. Various test like Specific Gravity Test, fineness modulus, Bulking of Sand, Water absorption Test, Aggregate Crushing Value, Aggregate Impact Test and aggregate abrasion value, slump cone test, compressive strength test is also performed on concrete ingredient and concrete.

Keywords: concrete, Electronic waste, partial replacement coarse aggregate, fly ash, compressive strength, crushing loads.

1. INTRODUCTION

Concrete is a composite material, where coarse and fine aggregates are filler material and cement paste are binding material. Concrete is composite of sand, gravel, crushed rock, or other aggregate held together by a hardened paste of hydraulic cement and water. The thoroughly mixed ingredients, when properly proportioned, make a plastic mass which can be cast or molded into a predetermined size and shape. Upon hydration of the cement by the water, concrete becomes stone like in strength and hardness and has utility for many purposes. Concrete is a most popular construction material in the world. It is made by mixing coarse and fine aggregates, water, cement, and additives in a certain prescribed proportion.

Recycling is the practice of recovering used materials from the waste stream and then incorporating those same materials into the manufacturing process. Recycling is one of the prominent issues in this environmentally conscious era. There are three main arguments for recycling: first, it preserves the precious natural resources; secondly, it minimizes the transportation and its associated costs; and thirdly, it avoids the environmental load caused by waster material, i.e. space requirement. The great strides have been made to increase recycling rates worldwide in recent years. The major consideration to support recycling all over the world is the expansion of infrastructure for recycling. The need to recycle electronic wastes is clear. Over 22 million tons of electronic wastes are discarded each year in the trash. While electronic wastes account for only 9.2% (in 2000) of the trash Americans generate each year, electronic waste products do not decompose in landfills and are difficult to reduce in size. There are a few technological and economic constraints that currently limit the full and efficient recycling of electronic waste wastes into useful products.

2. LITERATURE REVIEW

In this part we have talked about the distinctive materials which are much of the time utilized for mentioning the concrete and objective facts of the diverse creators by utilizing the diverse materials by literature review.

Varsha Rathore (2019) In the present study the influence of E-waste as a partial replacement of coarse aggregate in concrete mixture is investigated. The mix design of M20 grade of concrete for normal mix (without E-waste) and with a partial replacement of coarse aggregates with E-waste material with 5%, 10%, 15%, 20%, 25% and 30% is carried out. The effect of E-waste particle size using less than 10 mm, between 10 to 15 mm and up to 20 mm on compressive strength of concrete cubes and flexural strength of beam is also studied. The compressive strength of concrete cubes and flexural strength of beam tests at 7, 14 and 28 days is determined with and without E-waste material. It is observed that the compressive strength of concrete is found to be 20.35 % higher when coarse aggregate is replaced by 15% with two sizes of E-waste material. The flexural strength of concrete beam is found to be 15.69 % higher when coarse aggregate is replaced by 15% with two sizes of E-waste material. Generally, greater than 15% replacement with any size of E-waste is not practicable or useful for the construction work. Thus, from the present study it can be concluded that E-waste material can be used as a partial replacement of coarse aggregate up to 15%. The problem of disposal of E-waste disposal can be solved and hence helps the environmental pollution generated by E-waste materials.

Jafar Ali .M(2018) The rate of E-waste generation is increasing day by day in the modern world. 80 to 85% of different electronic items wastes disposed of in landfills or incinerators which can include or discharge certain lethal gases into air, may influence environment and human health conditions. The extraordinary measure of lead in e-waste alone causes harm in the vision, blood and kidneys of person. Just 12.5% of e-waste is right now reused. Most ideal approach to dispose e-waste is to use it as partial replacement for coarse aggregate in concrete which is eco-friendly measure. It helps to eliminate the concrete materials deficiency problem which is currently going on in construction industry and it also reduces the cost of concrete. Concrete mixes with different percentages of E-waste were casted. It has been decided to make three different types of conventional specimens with partial replacement of E-waste on a percentage of 10%, 20%, and 30% to coarse aggregate in M25 grade of concrete with water cement ratio of 0.45. Conventional specimens are also prepared for same grade of concrete. The mechanical properties of the concrete specimens were compared and studied.

Aakash garg(2020) In this work we did the usage of E-waste for field add-ons in the concrete mix M20 separately and then we measured the level of stress, flexure intensity and tensile resistance at the percentage of E-waste with coarse aggregates from 0%, 3%, 7.5%, 12% and 15% respectively the results shows increase in compressive strength and then decrees in flexure strength which gives light weight of concrete. We use HDPE separately, including Fine aggregates in the M20 concrete mix, as opposed to the compression intensity, flexure resistance & Split tensile force measurements for HDPE percentage and fine aggregates. From 5%, 7.5%, 10%, 12.5% and 15% respectively the results shows increase in compressive strength and then decrease in flexure strength which gives light weight of concrete as well. But as per our topic it is clear that we have to use both e-waste and hdpe simultaneously. We make a mix of concrete M20 in which we use the same percentage of Waste in coarse aggregates and HDPE as a fine aggregates and same tests and results shows that use of both simultaneously increases the strength of M20 concrete up to 60%.Waste usage is an effective disposal since the utilization of waste content lowers the expense of concrete in residential construction. Limited substitution of RCA by E waste relative to standard concrete to achieve mechanical characteristics and chemical properties (corrosion and alkaline attack) (compressed and bending resistance).

3. Material & Tests

A.GENERAL:- In this examination an study on the partial replacement coarse aggregate by plastic waste with fly ash. The methodology took after, tests directed for determination of configuration blend is examined in this part .

1) Specific gravity Test:
- Specific gravity Test for cement
- Specific gravity Test for fine aggregates
- Specific gravity Test for coarse aggregates

2) Water absorption Test
- Water absorption Test for fine aggregates
- Test for coarse aggregates
- Sieve analysis
- Surface moisture Test
- Bulk density Test
- Water adsorption
- Fineness of cement Test .

3) destructive Test
Compressive Strength

MATERIAL USED:-

A) Materials:-

a) Cement:
Cement is a fine, grey powder. It is mixed with water and materials such as sand, gravel, and crushed stone to make concrete. The cement and water form a paste that binds the other materials together as the concrete hardens. Ordinary Portland cement having 28days compressive strength of 46 MPa (ASTM 1994) was used for preparation of all concrete cubes. By using one type of cement, the effect of varying the types of coarse aggregate in concrete is investigated.

TABLE:-I Properties of cement

S. No.	Characteristics	Values obtained	Standard values
1	Normal consistency	33%	
2	Initial Setting Time	47 min	Not less than 30 min.
3	Final Setting Time	573 min.	Not Greater than 600 min.
4	Sp.Gr.	3.12	
5	Fineness	4.8	

b) Fine Aggregate:
The sand used for the experimental programmed was locally procured and conformed to Indian Standard Specifications IS: 383-1970. The sand was first sieved through 4.75 mm sieve to remove any particles greater than 4.75 mm and then was washed to remove the dust.

c) Coarse Aggregate:
The broken stone is generally used as a coarse aggregate. The nature of work decides the maximum size of the coarse aggregate. Locally available coarse aggregate having the maximum size of 20 mm was used in our work. The aggregates were washed to remove dust and dirt and were dried to surface dry condition. The aggregates were tested as per Indian Standard Specifications IS: 383-1970.

d) Waste Plastics
it is defined that the electronic wastes are synthesized high polymers which have electronic wasteity, and consequently substances made of these natural materials are precluded.

Electronic wastes can be separated into two types. The first type is thermo electronic waste, which can be melted for recycling in the electronic waste industry. These electronic wastes are polyethylene, polypropylene, polyamide, polyoxymethylene, polytetrafluorethylene, and polyethylene terephthalate. The second type is thermosetting electronic waste. This electronic waste cannot be melted by heating because the molecular chains are bonded firmly with meshed crosslink. These electronic waste types are known as phenolic, melamine, unsaturated polyester, epoxy resin, silicone, and polyurethane.

e) Fly Ash
Fly ash basically originated from thermal power plant as an end product after burning that can be collected from the dust collecting unit, which is in the form of fine spherical particle. The size of these fly ash particle ranges from 1 to 150 micron average is being 45 microns and it depends upon type of collection unit installed in the early period they use to have mechanical collector which give rise to coarse particles but as technology advances people started to use electro static

precipitators giving rise to finer particles using electrostatic precipitators.

4. RESULT AND DISSCUSSION

4.1 CONSISTENCY OF CEMENT TEST
The Normal Consistency of Cement is portrayed as that level of water required to convey a bond paste of standard consistency. For affirmation reason, run of the mill consistency is taken as the water content at which vicat's plunger penetrates up to a condition of 5 to 7 mm from the base of the vicat's frame. When we add water to the bond, the paste starts solidifying and gets quality. The fundamental point is to find the water content required to make a security paste of standard consistency as demonstrated by the May be: 4031 (Part 4) – 1988. The control stick had normal consistency of 33%.

Standard initial and final setting time of cement

Type of cement	**Initial setting time**			**Final setting time**		
Portland-pozzolona cement 43 grade	**As per IS (IS 4031: PART 5)**		**Test time**	**As per IS (IS 4031: PART 5)**		**Test time**
	Minimum	**Maximum**	**46 min**	Minimum	**Maximum**	**573 min**
	30 min	55 min		190 min	600 min	

4.2 Crushing Value Test
Form the result of crushing value we come to know that the Electronic waste is having more resistance to the wear and tear than the natural aggregate. Result of Crushing value test is given below in table

Aggregate	Crushing Value
Natural Coarse Aggregate	14.22%
Electronic waste	2.35%

Table 7: Aggregate Crushing Value

4.3 Impact Value Test
Impact test is the good indicator of strength and durability from the test result we can say that natural and Electronic waste are having wide difference of impact and crushing value, which again shows that aggregate of electronic waste is stronger than that of natural aggregate. Result of impact test is given below in table

Aggregate	Impact Value
Natural Coarse Aggregate	7.90%
Electronic waste	1.95%

Table 8: Aggregate Impact Value

4.4 Abrasion Value Test
Los angles abrasion test result shows that abrasion value of natural coarse aggregate is much higher than electronic waste.

Aggregate	Impact Value
Natural Coarse Aggregate	11.90%
Electronic waste	3.57%

Table 9: Aggregate Abrasion test

4.5 Specific Gravity Test
Specific gravity is the ratio of the density of a substance to the density (mass of the same unit volume) of a reference substance. Result given in table

Aggregate	Specific Gravity
Natural Coarse Aggregate	2.71
Natural Fine Aggregate	2.64
Electronic waste	1.20
Cement	3.14

Table 10: Result Specific Gravity Test

4.6 Fineness Modulus
Sieve analysis test is performed on the aggregate i.e Natural coarse aggregate, Natural fine aggregate and Electronic waste and their result given in table

Aggregate	Fineness Modulus
Natural Coarse Aggregate	2.70
Natural Fine Aggregate	1.90
Electronic waste	2.50
Cement	4.3

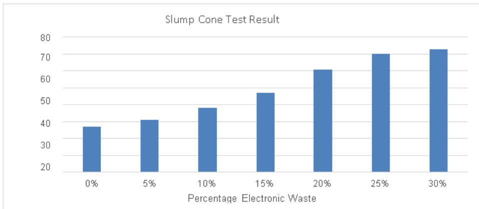
Table 11: Result of sieve Analysis Test Result

4.7 Water absorption
Water absorption of is performed on the aggregate and it has find that all aggregate have water absorption below 5% and their result given in table

Aggregate	Water Absorption %
Natural Coarse Aggregate	0.60
Natural Fine Aggregate	0.30
Electronic waste	0.04

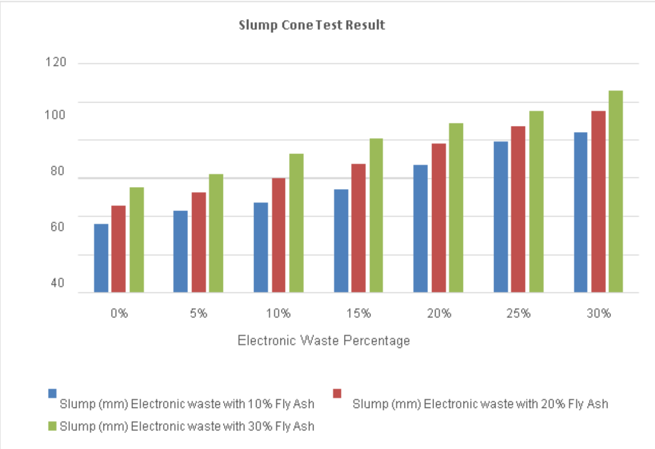
Table 12: Result of Water Absorption Test

4.8 Slump Cone Test
The slump test indicates a decreasing trend of workability when the percentage of Electronic waste increased. Table 15 below shows the average slump recorded during the test. Graph 1 and 2 below shows a graphical representation of slump height

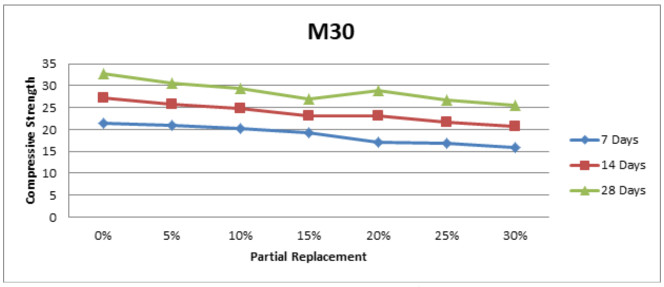


Graph 1: Workability Test Result of Electronic waste Concrete (Line Chart)

4.8.1 Electronic waste with fly ash Concrete



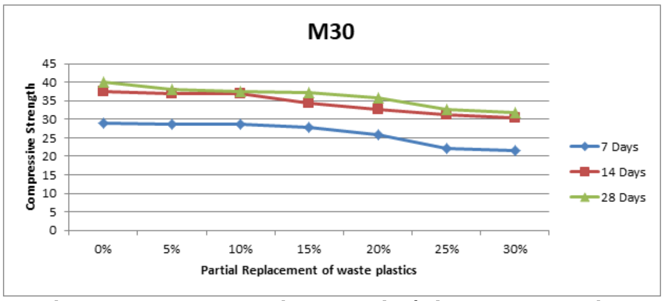
4.9 Compression Test Result and Analysis



Graph 03: Compressive Strength Test Result of Electronic waste Concrete

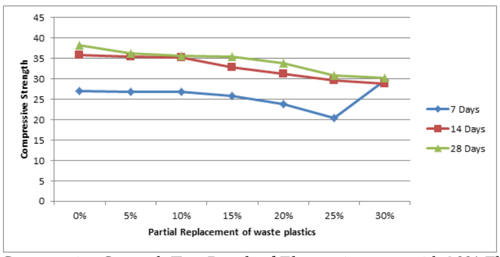
4.10 Compressive Strength of Concrete with Electronic waste and Fly Ash

4.10.1 Compressive Strength of Concrete with Electronic waste and 10% Fly Ash



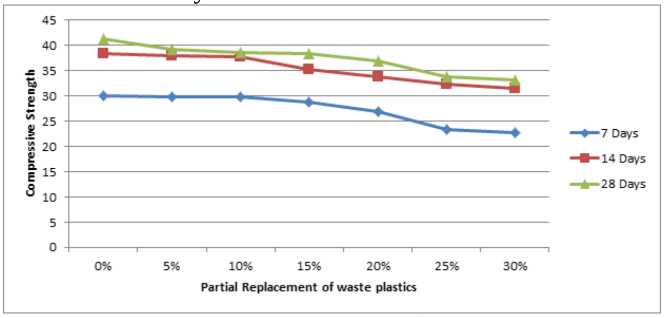
Graph 06: Compressive Strength Test Result of Electronic waste with 10% Fly ash

4.10.2 Compressive Strength of Concrete with Electronic waste and 20% Fly Ash



Graph 07: Compressive Strength Test Result of Electronic waste with 20% Fly ash

4.10.2 Compressive Strength of Concrete with Electronic waste and 30% Fly Ash



Graph 08: Compressive Strength Test Result of Electronic waste with 30% Fly ash

5. CONCLUSION

Following are the salient conclusions of the study:-
An experimental study has been done on concrete using electronic waste as coarse aggregate and also with fly ash as replacement of cement and following points is observed from the present study.

1 Workability of the concrete increases when percentage of the electronic waste increases.
2. When fly ash content added to electronic waste concrete, it has been observed that workability increased. Workability of fly ash with electronic waste concrete is even more than conventional and electronic waste concrete.
3. Compressive strength of electronic waste concrete decreases with increase in the percentage of e-waste.
4. It has been observed that when we replace cement by fly ash in concrete along with electronic waste as a coarse aggregate compressive strength increases.
5. Cement replacement of 30% by fly ash along with electronic waste gives best result.
6. Current study concluded that Electronic waste can replace coarse aggregate upto 10% or 20%.
7. Current study also concluded that electronic waste can replace coarse aggregate upto 30% in concrete when 30% fly ash is replaced by cement.

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