EXPERIMENTAL STUDY ON CONCRETE USING E-WASTE

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Abstract— Concrete is the most important component used in the construction industry throughout the work. The present work is directed towards developing a better understanding on strength characteristics of concrete using electronic waste (E-waste) powder as a partial replacement of fine aggregate. This work is carried out with M25 grade concrete for which the E-waste powder is replaced by 0%, 5%, and 10% by weight of fine aggregate. The cubes were casted for various percentages for 7 days, 14days and 28days.And conventional specimens are also prepared for M25 grade concrete without using E-waste powder. For all the mixes compressive, flexural and split tensile strength are determined at different days of curing. By conducting test for both specimens, which shows the E-waste gives good compressive strength of concrete, When compared to conventional concrete. The reuse of E-waste results in reduction of waste.

Index Terms E-waste, Compressive strength, concrete, Fine aggregate, split tensile strength, flexural strength.
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1 INTRODUCTION

In the present scenario, no construction activity can be imagined without using concrete.Concrete is the most widely used building material in construction industry.The main reason behind its popularity is its high strength and durability.Today, the world is advancing too fast and our environment is changing progressively. Attention is being focused on the environment and safeguarding of natural resources and recycling of waste materials.One of the new waste materials used in the concrete industry is E-waste.For solving the disposal of large amount of e-waste in concrete industry is considered as the most feasible application.E-waste is one of the fastest growing waste stream in the world.In developed countries,previously it was about 1% of total solid waste generation and currently it grows to 2% by 2010.In developing countries,it ranges 0.01% to1% of the total municipal solid waste generation.

E-waste is an emerging issue posing serious pollution problem to the human and the environment option need to be considered especially on recycling concepts.E-waste describes loosely discarded broken ,electrical or electronic devices.Rapid technology change, low initial cost around the globe.E-waste contains numerous types of substances and chemicals creating serious human health and environment problems if not handled properly.

To scarcity of fine aggregate for the preparation of concrete ,partial replacement of E-waste with fine aggregate was attempted.The work was conducted on M25 grade of fine aggregate with E-waste in the range of 0%(CC),5%(CCE5).10%(CCE10).

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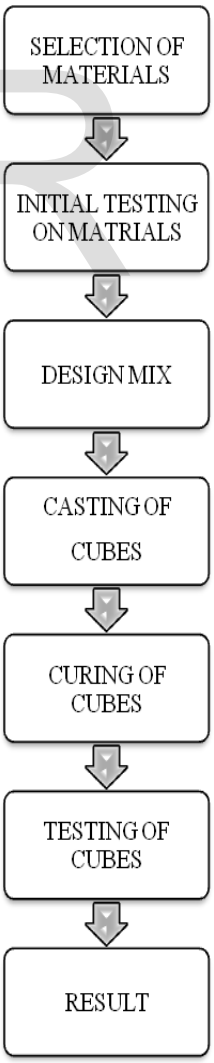
2 METHODOLOGY

The below flow chart shows the methodology of the project



3EXPERIMENTAL INVESTIGATION

3.1.Materials

The materials used in the research comprised OPC 53 grade (IS 12269, 1987) the physical and chemical composition of OPC was shown in Table 1.

In this study the locally available river sand as a Fine Aggregate (FA) (IS 383-1970) With specific gravity 2.66, Crushed stone as Coarse Aggregate (CA) (IS 383-1970) with Specific gravity 2.67 is used.

E-waste(EW) had specific gravity 1.22 and colour of brown and dark is used

Portable water is used to making blended CC was as per IS456:2000.

Table 1 The Physical and Chemical Properties of OPC.

Contents	OPC
Physical Properties	
Specific gravity	3.15
Initial setting time	65
Initial setting time	250
Soundness	1.0
Normal consistency	1.0
Chemical Properties	
SiO2	21.04
Al2O3	5.02
Fe2O3	3.12
CaO	62.11
MgO	2.44
K2O	0.56
Na2O	0.28

3.2Mix proportion

The grade 25 concrete was prepared by conducting the trails according latest IS10262-2019 is presented in Table 2. Initially Control Concrete (CC) is prepared without adding E-waste. Then concrete made up of E-Waste replaced by 5% Fine Aggregate (CCE5) and E-Waste replaced by 10% Fine Aggregate (CCE10) was prepared.

Table 2: Mix proportions

Mix designation	Quanity(kg/m3)				
	W/P	OPC	FA	CA	EW
CC	0.45	492	630	1170	-
CCE5	0.45	492	598.5	1170	31.5
CCE10	0.45	492	567	1170	63

3.3. Hardened Concrete Test

Testing of hardened concrete is important in concrete constructions. The following tests are conducted for hardened concrete:

- ✓ Compressive strength test
- ✓ Flexural strength test
- ✓ Split tension test

To determine compressive strength(IS 516-1969),Split tensile strength (IS 5816- 1999) and flexural strength (IS 516-1959) three cubes of size 150mm×150m×150mm,cylinders of 150mm×30mm and prism of 100mm×100mm×500mm were cast and tested for each mix and also for 7,14,28 days curing.

4 RESULTS AND DISCUSSION

4.1. Compressive Strength test

The compressive strength were evaluated at 7, 14 and days and results illustrated in Table 3.From the result we observed that CCE10(12.86%) and CCE5(6.04%) had higher compressive strength than CC.

4.2 Split tensile Strength test

The Split tensile strength were estimated at 7, 14 and days and results presented Table 4.From result we observed that CCE10(7.83%) and CCE5(2.16%) had liitle higher spilt tensile

4.3 Flexural Strength test

The Flexural strength were estimated at 7, 14 and days and results shows in Table 5.From above result we observed that CCE10(22.03%) and CCE5(7.01%) had higher flexural strength than CC.

Table 3 Compressive strength results.

S. No	MIX	COMPRESSIVE STRENGTH (N/mm2)		
		7 Days	14 Days	28 Days
1.	CC	15.65	24.18	31.10
2.	CCE5	17.72	26.19	32.98
3.	CCE10	19.16	28.12	35.10

Table 4 Spilt tensile strength results				
S. No	MIX	FLEXURAL STRENGTH (N/mm2)		
		7 Days	14 Days	28 Days
1.	CC	4.60	6.12	10.21
2.	CCE5	4.92	6.67	10.98
3.	CCE10	5.45	6.98	12.46

Table Spilt tensile strength results				
S. No	MIX	FLEXURAL STRENGTH (N/mm2)		
		7 Days	14 Days	28 Days
1.	CC	4.60	6.12	10.21
2.	CCE5	4.92	6.67	10.98
3.	CCE10	5.45	6.98	12.46

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CONCLUSION

From test result the following conclusions were made below.

- The strength development of E-waste concrete is similar to that of conventional concrete but there is increase in strength of concrete using E-waste at all the curing ages
- The replaecment of E-waste 10% in fine aggaregate give better result in all the strength properties.
- The use of E-waste in concrete is possible to improve its mechanical properties and can be one of the economical ways for their disposal in environment friendly manner.
- .The concept of replacement of E-waste in concrete would be environment friendly and reduces the disposal of E-waste in landfills

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