LIGHT WEIGHT CONCRETE

(Partial replacement of cement and coarse aggregates)

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ABSTRACT:

This paper presents an experimental investigation on structural concrete with partial replacement of coarse aggregates using electronic plastic waste (E-Plastic) and cement using waste paper. The use of waste paper and E-plastic in concrete formulations was investigated as an alternative to landfill disposal. In view of utilizing the non-degradable waste in construction industry, plastic from computer ,TV, printer , etc. and newspaper was considered as a coarse aggregates and cement was replaced with different percentage (0, 5, 10, 15) of E plastic and paper by volume for M 25 mix. Test was performed for properties of fresh and hardened concrete at different ages such as 7 and 28 days. As a result compressive strength increase upto 10% addition of waste paper and E plastic, further increase in waste paper and E plastic reduces the strength gradually.

Keywords: E-plastic, coarse aggregates, compressive strength, alternative.

INTRODUCTION:

Lightweight concrete can be defined as a type of concrete which includes an expanding agent in that it increases the volume of the mixture while giving additional qualities such as lessened the dead weight. It is lighter than the conventional concrete. One of the ideas to make concrete lighter is by the introducing waste paper and E plastic in concrete as a partial replacement of cement and coarse aggregate respectively. Electronic waste or e-waste describes discarded electrical or electronic devices. Used electronics which are destined for reuse, resale, salvage, recycling or disposal are also considered as e-waste. Informal processing of electronic waste in developing countries may cause serious health and pollution problems, as these countries have limited regulatory oversight of e-waste processing. For solving the disposal of large amount of recycled plastic material, the reuse of plastic in concrete industry is considered as the most feasible application. Recycled plastic can be used as coarse aggregate in concrete with partial replacement of coarse aggregate by E plastic by 5%, 10%, 15%.

Use of waste paper in structural concrete could become an economical and environmental friendly which helps to minimize harmful effects of construction process. Therefore the cement is partially replaced by 5%, 10%, and 15% with waste paper. Paper is the most frequent; type of waste found in all activity areas and,

exemplifies an, important source of cellulous, fibers. In different forms (quality paper, mixed paper, newspapers and journals) paper exemplifies about 41% of all household waste produced today.

EXPERIMENTAL PLAN:

Material Properties:

Cement: The cement used in this experimental work is ordinary Portland cement OPC – grade 53 (Ordinary Portland Cement) (Ultratech cement). Table 1 represents physical properties of cement.

Table 1: Physical properties of cement

SR NO	PARTICULARS	RESULT
1	Consistency (%)	80
2	Fineness (%)	32
3	Initial setting time (min)	75
4	Final setting time(min)	195

Fine aggregates: Aggregates which are passed through 4.75 IS Sieve and retained on 75micron (0.075mm) IS Sieve is termed as fine aggregate. Fine aggregate is added to concrete to assist workability and to bring uniformity in mixture. Table 2 represents physical properties of fine aggregates.

Coarse aggregates: The coarse aggregate for the works is river gravel or crushed stone. Angular shape aggregate of size is 20mm and below. The aggregate which passes through 75mm sieve and retain on 4.75mm are known as coarse aggregates. Table 2 represents physical properties of coarse aggregates.

Sr no	Particulars	Results	
		M1 (10mm)	M2 (20mm)
1.	Specific gravity	2.75	2.82
2.	Impact value	14.8	16.47
3.	Abrasion value	17.22	17.19
4.	Flackiness index (%)	9.26	12.15
5.	Water absorption (%)	0.94	1.20

Table 2: Physical properties of Aggregates

Water: Portable water free from impurities and salts was used for mixing and curing concrete specimens.

E-plastic: The E-Plastic used as a partial replacement for coarse aggregate was in the form of discarded monitors, keyboard, mouse and CPU, and other discarded electronic items. A sample of E-plastic as shown in figure 1.

Figure 1: E-plastic aggregates

Waste paper: Paper is an anisotropic material and Strength of its fiber is depends upon

Several factors like type of wood, % of recycle paper, amount of water pulp, the way of pulping and the speed of drying. A sample of waste paper as shown in Figure 2

Paper soaked in water after grinding

Figure 2: waste paper

Concrete mixes:

The mixes were designated with the grade of concrete and the type of aggregate used. IS 10262:2009 and IS 456:2000 were used for design of concrete mixes as per the properties of material found from the tests conducted. The E-plastic content and waste paper were calculated on volumetric basis as cement and fine aggregates in conventional mixes. Assuming the use of E-plastic particles and waste paper as substitute of coarse aggregate and fine aggregate and cement remaining mix ratio as the same with conventional mix with concrete mixes as much as possible and achieve suitable compressive strength and workability is attempted and strength criteria of grate M-25 concrete mix is analyzed.

TESTS:

1. Slump cone test:

The workability of all concrete mixture was determined through slump test utilizing metallic slump mould. The difference in level between the height of mould and that of highest point of the subsided concrete was measured are reported as slump.

Figure 3: slump cone test

2. Compressive strength test:

From each concrete mixture, cubes of size 150mm x 150mm x 150mm and 150mm were casted for the determination of compressive strength. The concrete specimens were cured under normal conditions and were tested at 7 days and 28days for determining compressive strength. Compression test machine is as shown in figure 4.

Compressive strength of specimen was calculated by using the formula:

fck = P/A

P = load in compression, in KN

A = Loaded area of the specimen, in mm

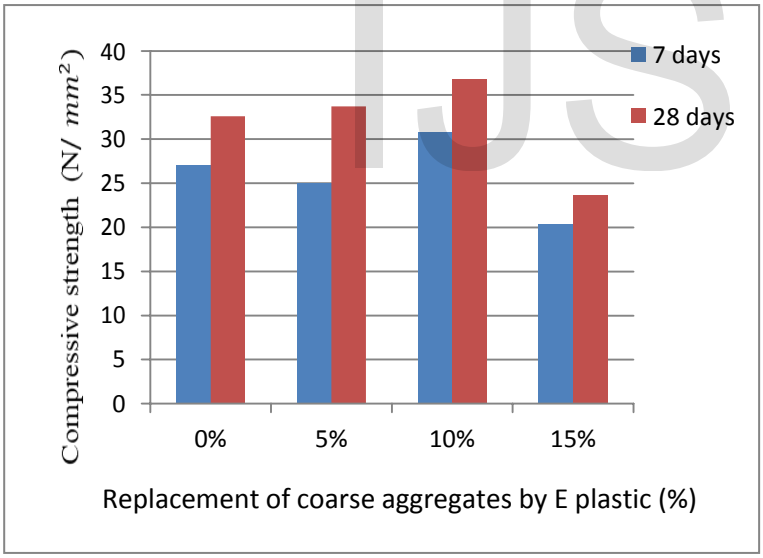
figure 4: Compression test machine

RESULTS AND DISCUSSION:

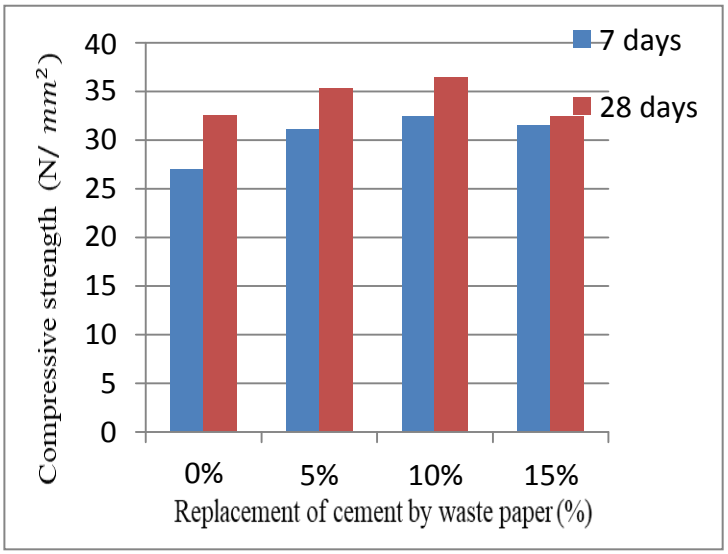
This experimental study shows that E-plastic and waste paper can be recycled as construction material in concrete industry by performing and comparing various tests on E- plastic and coarse aggregate, cement and waste paper, we conclude that E plastic and waste paper can be used as a partial replacement to conventional aggregate and cement.

Case 1:

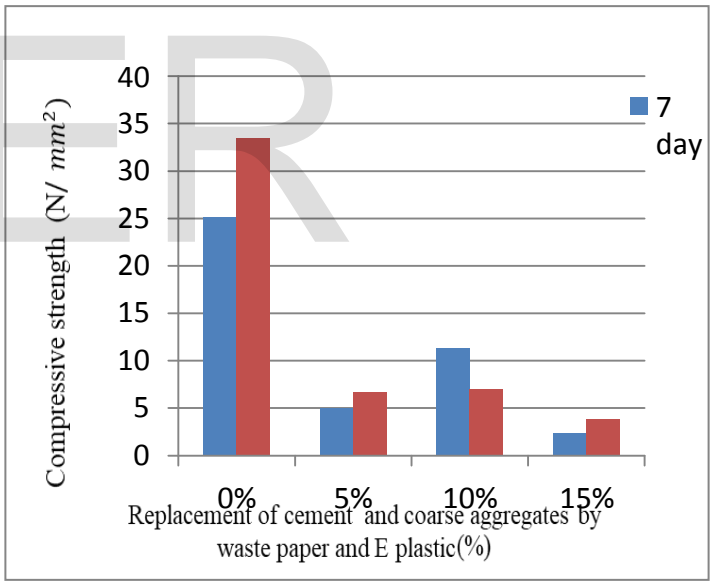
First we replaced E plastic as a coarse aggregate by 0%, 5%, 10% and 15% in mix proportion. Then compression test was performed. We observed that up to 10% replacement we get comparable result but as we go for higher replacement strength was decreased rapidly.



Case 2: Secondly, we replaced cement with waste paper by 0%, 5%, 10% and 15%. In mix proportion we performed compressive test to check hardened properties of concrete.



We calculate the compressive strength at 7 and 28 days.



Case 3:

Lastly ,the and pap coarse aggregate and cement both partially replaced by E plastic and waste paper by 0%,5%,10% and 15% respectively. We observed that the mix was failed completely in every replacement.

CONCLUSION:

Case 1 :(Coarse aggregate partially replaced by E plastic)

• From the test results it is observed that the compressive strength is increased by 20.86% and 11.89% at 7 th and 28 th days respectively than conventional mix at 10% replacement.

• The density at 10% replacement is observed which gets reduced by 5 %

• From table 5.4, the cost of production of concrete when compare with nominal mix at 10% replacement gets reduced by 5.17%

Case 2 :(Cement partially replaced by paper)

• From the test results it is observed that the compressive strength is increased by 14.28% and 12.98% at 7 th and 28 th days respectively than conventional mix at 10% replacement.

• The density at 10% replacement is observed which get reduced by 1.24%

• From table 5.5, the cost production of concrete when compared with nominal mix at 10% replacement gets reduced by 4.28%

Case 3 :(Coarse aggregate partially replaced by E plastic and Cement partially replaced by paper)

• This mix design fails to give percentage increase in compressive strength at any percentage replacement.

• Thus this mix design is not recommended for the construction work.

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