DISPOSE NON METALLIC E-WASTE AS COARSE AGGREGATE IN CONCRETE

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***Abstract*- E- waste generation is a very emerging issue in world. In year 2014 produce approximately 1700000T e-waste in India that includes all waste electronics and electrical equipment (TVs, computers, sound systems, refrigerators etc).As per United Nation University Research America ,China, Japan, Jermaine and India topmost country in world to produce e-waste. This waste not disposes properly finally they affect environment and human health and also create storage problem. This waste is to be utilizing as coarse aggregate in concrete. It is helpful to avoid pollution and provide replacing material to coarse aggregate. In this paper shows analysis of compressive strength of M20 and M25 grade of concrete by replacing coarse aggregate by adding non metallic e-waste in 0% to 25% and it is observed that some percent non metallic e-waste can be use as a coarse aggregate in concrete.**

***Index Terms*- Compressive strength, E-waste, Pollution.**

I. INTRODUCTION

E-waste is waste electronics and electrical equipment. Near about 80 to 85% of various electronic products discarded in landfills or incinerators which can involve or release certain toxics gases into air, may affect human health and environment As per Rajah Sabah analysis 2011 India is topmost country to produce e-waste in yearly. So to avoid pollution and protect environment there is a need to utilize the waste in various purpose. Best way to utilized in concrete as a coarse aggregate.

E–waste was breaks in various sizes and sieve through 4.75mm, 10mm, and 20mm.Then various tests were carried out on it i.e. crushing value, abrasion value, impact value and it was positive. Finally it can use to replace coarse aggregate in concrete in various percentage i.e. 5%, 10%, 15%, 20%, 25%.Marked M20 and M25 grade of concrete block of size 150mmX150mmX150mm each of 2 block for 7days,14days,28days test. Test is carried out on

compressive testing machine having loading capacity 2000KN.

II. MATERIAL

A. Cement

As per IS 1489- 1991 for making concrete cube 43 grade ordinary Portland cement was used. Various tests were conducted on this cement their result shown in table 1.

TABLE 1: PROPERTIES OF CEMENT

Properties of Cement	**Test Result**	**As per IS 1489-1991 Requirement**
Standard consistency	29.8	-
Initial setting time	41minutes	Max. 30 minutes
Final setting time	360 minutes	Max. 600 minutes
Compressive strength after 3days in N/mm^2	29.00	23 N/mm^2
Compressive strength after 7days in N/mm^2	38.6	33 N/mm^2
Compressive strength after 28days in N/mm^2	44.1	43 N/mm^2

B. Fine Aggregate

Locally available sand was used in casting of cube. Various properties are determine as per IS 2386(Part-I) .The result are shown below table 2.

TABLE 2: PROPERTIES OF FINE AGGREGATE

Properties	Test Result
Fineness Modulus	2.3
Specific Gravity	2.7
Bulking	1.9%
Free Moisture Content	0.16%
Silt Content	0.7%

C. Coarse Aggregate

Coarse aggregate was collected from locally available granite crust stone having maximum size 20mm.verious test were conducted on this aggregate as per IS 2386-1963 (Part-IV) result are shown below table 3.

TABLE 3: PROPERTIES OF COARSE AGGREGATE

Properties	Test Result
Fineness Modulus	3.2
Specific Gravity	2.98
Water Absorption	0.6%
Free Moisture Content	0.12%
Aggregate Abrasion Value	12%
Aggregate Impact Value	18.3%
Aggregate Crushing Value	23%

D. Water

Impurities free, clean portable water are use for casting of cube. Also curing was done in curing tank as per IS 456-2000

E. Non-metallic E-waste

Non-metallic e-waste was collected from local body which was discarded in scrap. That can be crushed in various sizes 4.75mm, 10mm, 20mm. various test were conducted on it as per IS 2386-1963 (Part-IV) result is shown below table 4.

Fig-1: Crushed Non Metallic E-Waste

TABLE 4: PROPERTIES OF E-WASTE

Properties	Test Result
Specific Gravity	1.2
Water Absorption	0.1%
Shape	Angular
Color	Red ,White and Dark
Aggregate Abrasion Value	0.6%
Aggregate Impact Value	4.6%
Aggregate Crushing Value	3.6%

III. PROCEDURE

A. Batching

Batching was done method of weight batching by using weighing balance having accuracy 0.001gm.

B. Mixing

Mixing of concrete was done by manually according to the grade of M20 and M25 with water cement ratio 0.50 and 0.40 respectively. Percentage of e-waste added in the concrete as a replacement of coarse aggregate as shown in table 5.

Fig-2: Mixing of E- Waste in Concrete

C. Casting of cube

As per requirement for testing each of 2 blocks for 7days, 14days, 28days test for each grade with different percentage.

TABLE 5: DETAILS OF CUBE CASTING

% of e-waste	0%	5%	10%	15%	20%	25%
M20 30 block	2	2	2	2	2	2
	2	2	2	2	2	2
	2	2	2	2	2	2
M25 30 block	2	2	2	2	2	2
	2	2	2	2	2	2
	2	2	2	2	2	2

TOTAL = 72 BLOCKS

IV. TESTING ON CONCTERE

A. Workability of fresh concrete

For calculating of workability of fresh concrete slump cone test was used result are shown below table 6.

TABLE 6: RESULT OF SLUMP CONE TEST

Grade of Concrete	**Slump in mm**	**Workability**
M20	136	High
M25	129	High

B. Compressive strength test

Compressive strength test was conducted to calculate compressive strength developed in concrete containing e-waste at the age of 7, 14, 21 days respectively. Square mould having size 150X150X150 mm casted for testing. Tests was done on compressive testing machine (CTM) having loading capacity 2000KN.Result is shown in below table7.

Fig-3: E-Waste Block Before Testing And After Testing

TABLE 7: COMPRESSIVE STRENGTH TEST RESULTS IN N/MM^2

FOR M20 GRADE

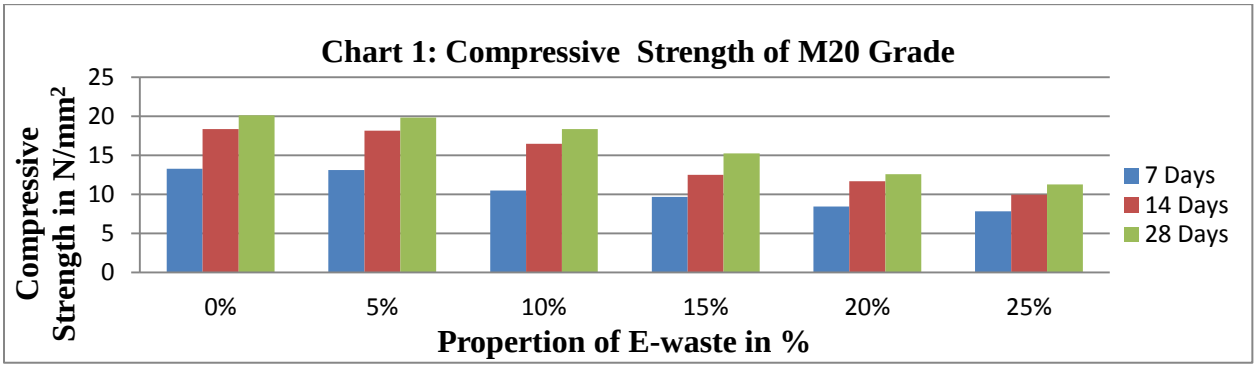
Mix proportion of e-waste	0 %	5 %	10 %	15 %	20 %	25%
7 Days	13.26	13.11	10.48	9.68	8.44	7.83
14 Days	18.33	18.12	16.45	12.47	11.68	9.95
28 Days	20.11	19.80	18.83	15.22	12.56	11.26

FOR M25 GRAD

Mix proportion of e-waste	0 %	5 %	10 %	15 %	20 %	25 %
7 Days	16.96	16.81	13.73	11.21	10.84	9.26
14 Days	22.10	21.03	19.74	15.24	14.22	12.6
28 Days	24.98	23.55	21.53	17.58	15.66	11.8

V. DISCUSSION

An analysis made on strength characteristic by conducting test on non-metallic e-waste concrete. The 3days ,7days and 28days compressive strength result of M20 and M25 grade concrete shown in table 7 and analysis by graphically shown in chart 1and chart 2 .It is observed that compressive strength decrease with increasing e- waste percentage for both grade. Up to 5%, it is nearly same to normal concrete but after 15%, it reduces maximally. Strength reduce because of bonding of e-waste reduces. Volume of e-waste increase then bonding problem occurred in concrete that affect the on strength of concrete



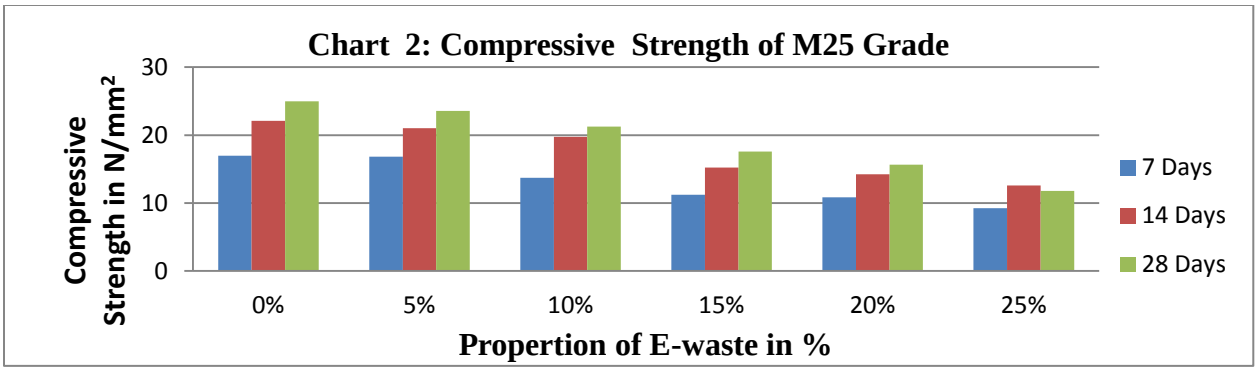


Chart 2: Compressive Strength of M25 Grade
Compressive Strength in N/mm²
30
20
10
0
0%
5%
10%
15%
20%
25%
Propertion of E-waste in %
7 Days
14 Days
28 Days

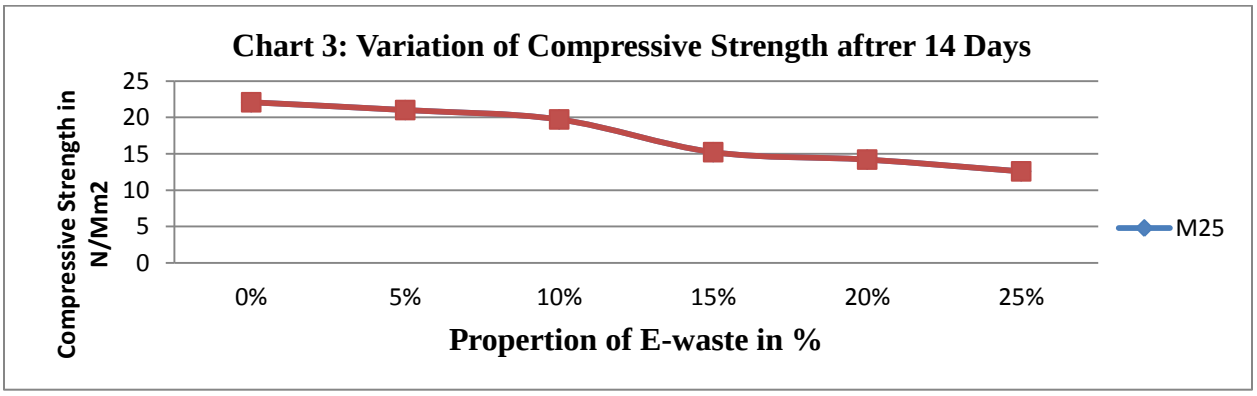


Chart 3: Variation of Compressive Strength aftrer 14 Days
Compressive Strength in N/Mm2
25
20
15
10
5
0
0%
5%
10%
15%
20%
25%
Propertion of E-waste in %
M25

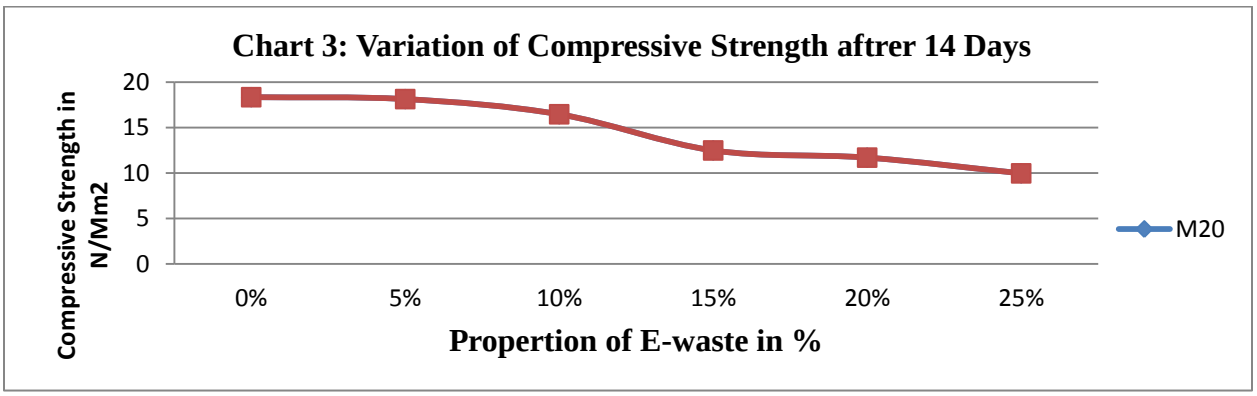


Chart 3: Variation of Compressive Strength aftrer 14 Days
Compressive Strength in N/Mm2
20
15
10
5
0
0%
5%
10%
15%
20%
25%
Propertion of E-waste in %
M20

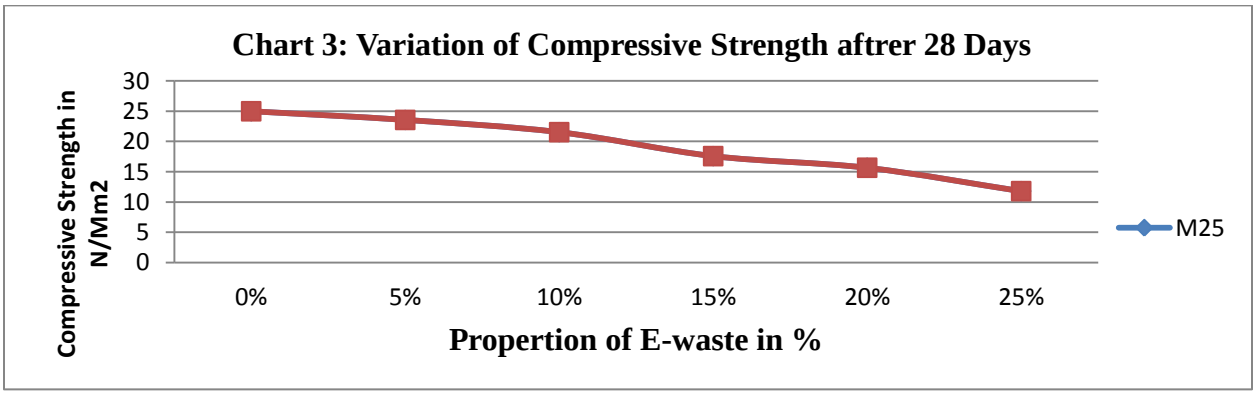
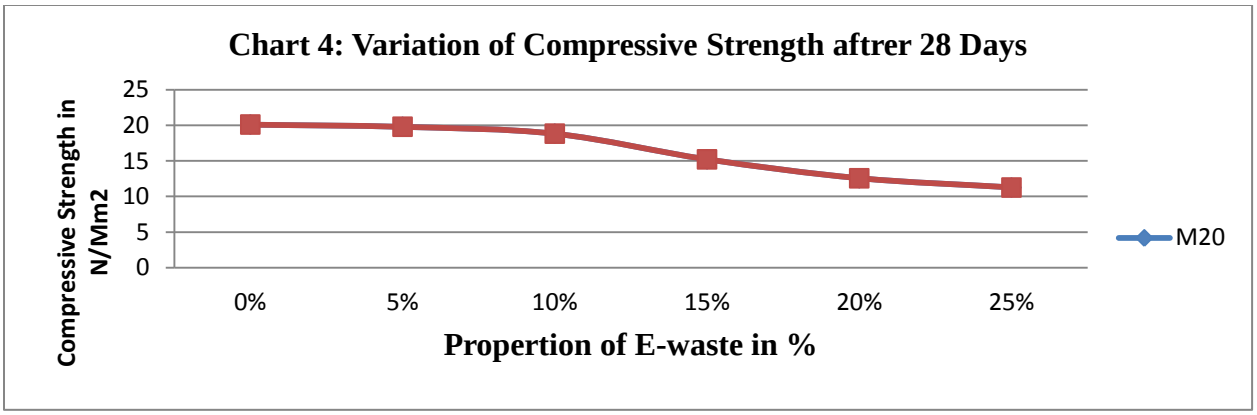


Chart 3: Variation of Compressive Strength aftrer 28 Days
Compressive Strength in N/Mm2
30
25
20
15
10
5
0
0%
5%
10%
15%
20%
25%
Propertion of E-waste in %
M25



VI. CONCLUSION

Form experimental result it is to be observing that e-waste can be use up to some extent in concrete as coarse aggregate.

- It is identified that e-waste can dispose in concrete as a coarse aggregate.
- Volume E-waste on earth reduces, when it use in concrete.
- Up to 10% replacement of e-waste is use in construction where low strength required such as garden wall construction etc.
- More than 15% is not considerably useful for construction field because of strength decreases.
- It was observe that e-waste increase 5% strength decrease 15%.shown in chart 3 & 4
- E-waste concrete block having flexibility it directly not fail during test firstly it compress up to 1cm then break. It is very important at the time of earthquake it provides some time for clearance in structure.
- Solid waste management of e-waste done, when it use in concrete.

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