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Manufacturing of Eco-friendly Parking Tiles

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Abstract: ***In this project we have manufactured parking tiles by using Electronic Waste. We use recycled Electronic Waste as a raw material in the manufacturing of parking tiles & it is one of the alternative method for disposal of Electronic Waste. We have replaced Silica & Crush by Electronic Waste in small amount. We have used Electronic Waste in powder form after recycling it. Electronic Waste does not contain metals. After manufacturing of "Eco-friendly Tiles" we get the results as per conventional tiles. Due to use of recycled Electronic Waste cost of tiles increases. Because now a day Electronic Waste recycling plants are minimum or negligible so that cost of parking tiles increases but after some years it becomes minimum due to increase of Electronic Waste recycling plants.***

Keywords: Crush, Eco-friendly parking tile, Electronic Waste recycling plant, Recycled Electronic Waste, Silica.

I. INTRODUCTION

In 21st century the rate of generation of Electronic Waste is increasing day by day. Electronic waste (E-Waste) is a 'waste generated from used electronic devices and household appliances which are not fit for their originally intended use and are destined for recovery, recycling and disposal'. Like hazardous waste, the problem of e-waste has become an immediate and long term concern as its unregulated accumulation and recycling can lead to major environmental problems endangering human health.

So that, to protect the human being & environment from the hazardous characteristics of E- Waste it is necessary to recycle the E- Waste & hence such E- Waste is used as a raw material for manufacturing of parking tiles & it is an alternative method of disposal of E-Waste. We separate the metals from the E-Waste for reducing the cost & harmful effects on tiles. During the last decade the use of ecological products has become an important aspect in the tile industry, in order to optimize & reduce the consumption of natural resources. Recycle E-Waste can be obtained from several sources such as electrical & electronic tools, monitoring & controlling instruments, medical devices, etc.

II. DESIGN AND METHODOLOGY

2.1) RAW MATERIALS-

We use the following raw materials for manufacturing of parking tile. We are consider the quality and quantity of each raw material for best product output.

i) Recyclable Electronic Waste
ii) Silica
iii) White Cement
iv) Crushed stone
v) Cement
vi) Colour
vii) Chemicals

All these raw materials have taken according to composition required for manufacturing of tiles. All these materials should store properly to avoid the moisture content. Cement concrete mixture 1:1.5:3 (M20).

i)Recyclable Electronic Waste:

E-Waste is taken from the E-Waste Recycling Plant present at Dombivli West.

Name of E-Waste Recycling Plant: India MART (Waste Management & Research Pvt. Ltd.) Dombivli West IndiaMART

The used E-Waste is of Printed Circuit Board that contain Plastics, Fiber, Epoxy Resin, etc. That E-Waste is in form of powder & colour of powder is grey. Cost of E-Waste powder is Rs.50 per kg.

Fig.2.1.Recycled Electronic Waste powder

ii) Chemical:

We used Chemical for manufacturing of parking tile is Polycarboxilic Acid Superplastisizer**.** To ensure good workability of concrete at low water cement ratio plasticizer and super plasticizer are used.

2.2. Chemical Composition:

Percentage of materials used for manufacturing of parking tiles by using Electronic Waste are shown in table no.2.2.1.

Table No. 2.2.1. (For Parking tiles using Electronic Waste):

Constituents	**% for each Tile with E-waste**			
E-Waste	5.00	6.60	8.00	10.60
Silica	29.02	28.11	27.62	26.22
White Cement	10.83	10.83	10.83	10.83
Crush	36.60	35.91	35.00	33.80
Cement	18.53	18.53	18.53	18.53
Colour	0.02	0.02	0.02	0.02

2.3. Process of manufacturing of tiles:

i) Batching
ii) Mixing and grinding
iii) Forming
iv) Drying
v) Glazing
vi) Curing

i)Batching-

Generally there are two types of batching i.e. weigh batching and volume batching. But we used weigh batching method for batching of all the materials such as Electronic waste, colour pigment. Silica.

Materials for each Tile (For 6.60% of E-Waste) In Kg:

1) E-Waste 0.20 kg

2) Silica 0.80 kg

3) White cement 0.31 kg

4) Crush 1.02 kg

5) Cement 0.53 kg

6) Chemical 10.0ml

ii) Mixing and Grinding:

we used shell mixer for mixing and grinding. In this process mixing of the materials required for top layer is done.

Fig.2.6. Mixing & Grinding

iii) Forming:

Fill top layer concrete mixture in the moulds make sure concrete fill up to 10 to 12 mm in the mould on vibration table, after filling of concrete mould, move on the vibration table

Material of Mould: Rubber Size of Mould: 12" * 12" Precautions: Mould should be Clean & Moisture free before use	Top layer consist mixture of colour pigment, white cement, silica & admixtures. Thickness of Top layer is 5mm

approximately 45 to 60 sec.

Fig.2.9.Vibration of mould with top layer

Fig.2.10.Vibration of mould with bottom layer

Bottom layer consist mixture of Silica, Crush, Ordinary Portland Cement, Electronic Waste, Chemicals (Hardeners), Water, etc.

iv) Drying: Drying of concrete is defined as providing the proper condition to allow the concrete to achieve a moisture condition appropriate for its intended use.

Fig.2.12.Drying

v) Glazing: In this process, glaze is sprayed by using sponge and for glazing we used lacquer.

Fig.2.13.Glazing

vi) Curing

Curing is necessary to increase strength and improve the quality. We cured tiles for 14 days.

Fig.2.14.Curing

IV) TEST CONDUCTION AND EXPERIMENTATION

4.4. Water absorption:

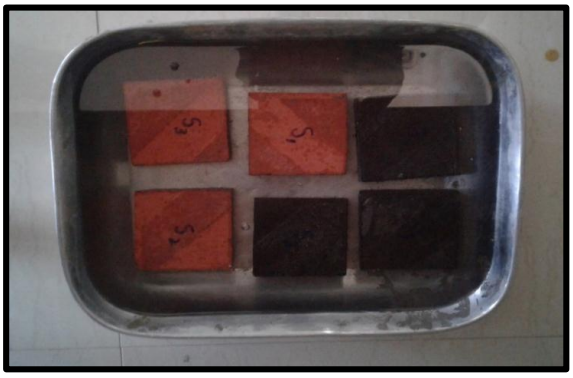

Fig.4.1.Water absorption of tile

Fig.4.2.Oven drying of tiles

Table No.4.4.1: For 10.6 % of E-Waste

Specimen	Saturated mass (M1)	Oven dried mass (M2)	M1-M2	(M1-M2)/M2*100	Average
S-1	0.275	0.245	0.03	10.90	
S-2	0.290	0.265	0.025	8.60	9.50
S-3	0.275	0.250	0.025	9.00	

Table No.4.4.2: For 6.6 % of E-Waste

Specimen	Saturated mass (M1)	Oven dried mass (M2)	M1-M2	(M1-M2)/M2*100	Average
S-1	0.290	0.265	0.025	8.60	
S-2	0.300	0.275	0.025	8.30	7.36
S-3	0.285	0.270	0.015	5.20	

Result:

i) By using 10.6% and 6.6% of Electronic Waste in manufacturing of parking tiles it gives water absorption 9.50% and 7.36%.

Conclusion:

i) Water absorption value is within permissible limit which is less than 10%.

4.2. Compressive strength of tiles:

Fig.4.3.Universal Testing Machine (UTM)

Observation Table:

Table No.4.2.1: For 10.6% of E-Waste

Specimen	Load (KN)	Displacement (mm)
S-1	159.5	24.35
S-2	113.46	26.55
S-3	178.58	23.45
S-4	121.02	21.45
S-5	130.46	22.84

Table No.4.2.2: **For 6.6% of E-Waste**

Specimen	Load (KN)	Displacement (mm)
S-1	105.75	20.25
S-2	96.53	22.75
S-3	71.34	19.48
S-4	65.8	24.30
S-5	61.93	27.40

Result:

i) We get compressive strength in between 30N/Sq.mm-50N/Sq mm.

Conclusion:

i) Tiles manufactured by using 10.6% Electronic Waste gives more strength as compared with tiles manufactured by using 6.6% of Electronic Waste.

CONCLUSION

The aim of this paper is to develop "NEW ECOLOGICAL TILES" that contains some percentage of recyclable raw materials with technical characteristics similar to conventional parking tiles. It reduces overburden on natural resources. The results obtained from water absorption test and compressive strength test are within the permissible limit. Cost of tile manufactured by using Electronic Waste is greater than conventional parking tiles. In future it will be reduce if numberof Electronic Waste recycling plant increases.

If we use the Electronic Waste in the form of fine aggregate instead of powder form then it will give better result and cost of parking tile will also reduce.

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