isrjournals

International Journal of Advanced Research in Civil,Structural,Environmental and Infrastructure Engineering and Developing

Volume: 3 Issue: 1 Apr,2021,ISSN_NO: 2320-723X

# EXPERIMENTAL STUDY ON TILES USING E-WASTE

**Assistant Professor K.Sharan Kumar[1]**
*Department of Civil Engineering,*
*Panimalar engineering college,*
*Chennai,India,*

**Pradeep A[2]**
*Department of Civil Engineering,*
*Panimalar engineering college,*
*Chennai,India,*

**Prem S P[3]**
*Department of Civil Engineering,*
*Panimalar engineering college,*
*Chennai,India,*

**Swaminathan[4]**
*Department of Civil Engineering,*
*Panimalar engineering college,*
*Chennai,India,*

**Logeswaran N[6]**
*Department of Civil Engineering,*
*Panimalar engineering college,*
*Chennai,India,*

## ABSTRACT

**E-Waste that is increasing day by day turning into a major threat to public health and successively pollutes the setting. India ranks fifth in the world for e-waste generation; about a pair of million a lot of e-waste is generated associate rally and an unrevealed quantity of e-waste is foreign from alternative countries around the world. 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.**

## I. INTRODUCTION

E-waste can be defined as the disposal created by discarded electronic devices and components as well as substances involved in their manufacture and production. E-waste is a term used to cover almost all types of electrical and electronic equipment (EEE) that has or could enter the waste stream. Although e-waste is a general term, it can be considered to cover TVs, computers, mobile phones, white goods (e.g. fridges, washing machines, dryers etc), home entertainment and stereo systems, toys, toasters, kettles – almost any household or business item with circuitry or electrical components with power or battery supply.The European Waste Electrical and Electronic Equipment Directive Directive classifies waste in ten categories: Large household appliances (including cooling and freezing appliances), Small household appliances, IT equipment (including monitors), Consumer electronics (including TVs), Lamps and Luminaires, Toys, Tools, Medical devices, Monitoring and control instruments and Automatic dispensers. These include used electronics which are destined for reuse, resale, salvage, recycling, or disposal as well as re-usables (working and repairable electronics) and secondary raw materials (copper, steel, plastic, etc.). The term "waste" is reserved for residue or material which is dumped by the buyer rather than recycled, including residue from reuse and recycling operations, because loads of surplus electronics are frequently commingled (good, recyclable, and non- recyclable). Several public policy advocates apply the term "e-waste" and "e-scrap" broadly to all surplus electronics. Cathode ray tubes (CRTs) are considered one of the hardest types to recycle.

E-waste is used as a generic term embracing all types of waste containing electrically powered components. e-Waste for short - or Waste Electrical and Electronic Equipment (WEEE) - is the term used to describe old, end-of-life or discarded appliances using electricity. It includes computers, consumer electronics, fridges etc which have been disposed of by their original users. e- Waste contains both valuable materials as well as hazardous materials which require special handling and recycling methods.

E-Waste for short - or Waste Electrical and Electronic Equipment (WEEE) - is the term used to describe old, end-of-life or discarded appliances using electricity. It includes computers, consumer electronics, fridges etc which have been disposed of by their original users.

Electronic waste, e-waste, e-scrap, or waste electrical and electronic equipment (WEEE) describes discarded electrical or electronic devices. There is a lack of consensus as to whether the term should apply to resale, reuse, and refurbishing industries, or only to product that cannot be used for its intended purpose. Informal processing of electronic waste in developing countries may cause serious health and pollution problems, though these countries are also most likely to reuse and repair electronics.

All electronic scrap items, such as CRTs, may contain contaminants such as lead, cadmium, beryllium, or brominated flame retardants. Even in advanced countries recycling and disposal of e-waste may involve significant risk to workers and communities and great care must be taken to avoid unsafe exposure in recycling operations and leaching of material such as heavy metals from landfills and incinerator ashes.

**NEED FOR THIS STUDY**

- New waste management options are needed to divert End-Of-Life (EOL) electronics from landfills and incineration.
- Increasing the need for landfills is a burden to our environment. Also with the storage of landfill capacity and an increased concern about environmental quality, newer waste treatment methods are desired.
- Incineration is the process of burning of the electronic wastes and converting them into ashes which makes it simple to dispose them of well in the natural resources
- Incineration may lead to air pollution due to uncontrolled burning of wastes and also when disposed of in natural resources it causes contamination of its quality which is a threat to environment
- Electronic product in construction industry is one of the environmentally friendly aspects.
- But it contains several toxic components in composition so it requires several treatment and processes to remove those components and make it feasible for useful purposes those are really effective.

## II. LITERATURE REVIEWS

In a study by jalal uddin (2012), through innovative changes in product style below extended producer responsibility (erp), use of environmentally friendly substitutes for dangerous substances, these impacts can be mitigated. A legal framework must be there for imposing epr, rohs for attaining this goal. Adoption of environmentally sound technologies for usage and employ of e-waste at the side of epr and rohs offers workable answer for environmentally sound management of e-waste. Manufacturers & suppliers need to set goals for reducing electronic waste. Encourage them to buy back old electronic products from consumers, disposing bulk e-waste only through authorized recyclers and send non tradable e-waste to authorized private developers for final disposal.

Yamini Gupt & Samraj Sahay (2015) suggested that financial responsibility of the producers and separate collecting and recycling agencies contribute significantly to the success of the extended producer responsibility-based environmental policies. Regulatory provisions, takeback responsibility and financial flow come out to be the three most important aspects of the extended producer responsibility. Presence of informal sector had a negative impact on the regulatory provisions

## III. MATERIALS AND METHODOLOGY

A Tile is a manufactured piece of hardwearing material such as ceramic, stone metal, or even glass, generally used for covering roofs, floors, walls, showers, or other objects such as tabletops. Alternatively, tile can sometimes refer to similar units made from lightweight materials such as perlite, wood, and mineral wool, typically used for wall and ceiling applications. In another sense, a tile is a construction tile or similar object, such as rectangular counters used in playing games (tile based game).

In this project we are compare the conventional concrete tiles and electronic wastes used concrete tiles.

### 3.1 RAW MATERIALS

- Electronic waste
- Cement
- M sand
- Coarse aggregate (6mm)
- 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 1:1.5:2 (M20).and the electonice waste is added to 15%of overall weight of tiles.

### ELECTRONIC WASTE

E-Waste is taken from the E-Waste Recycling Plant present at chennai. The used E-Waste is of Printed Circuit Board that contain Plastics, Fiber, Epoxy Resin, etc. That E-Waste is in form of small pieces & colour of powder is grey. Cost of E-Waste pieces is Rs.30 per kg.

**Fig 3.1: Recyclable e-waste**

### 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.

### 3.2 MANUFACTURING PROCESS OF TILES:

Once the raw materials are processed, a number of steps take place to obtain the finished product. These steps include batching, mixing and grinding, spray-drying, forming, drying, glazing, and firing. Many of these steps are now accomplished using automated equipment.

- Batching
- Mixing and grinding
- Forming
- Drying
- Glazing
- Curing

**Batching**

For many ceramic products, including tile, the body composition is determined by the amount and type of raw materials. The raw materials also determine the color of the tile body, which can be red or white in color, depending on the amount of iron-containing raw materials used. Therefore, it is important to mix the right amounts together to achieve the desired properties. Batch calculations are thus required, which must take into consideration both physical properties and chemical compositions of the raw materials. Once the appropriate weight of each raw material is determined, the raw materials must be mixed together.

**Mixing and grinding**

Once the ingredients are weighed, they are added together into a shell mixer, ribbon mixer, or intensive mixer. A shell mixer consists of two cylinders joined into a V, which rotates to tumble and mix the material. A ribbon mixer uses helical vanes, and an intensive mixer uses rapidly revolving plows. This step further grinds the ingredients, resulting in a finer particle size that improves the subsequent forming process.

Sometimes it is necessary to add water to improve the mixing of a multiple-ingredient batch as well as to achieve fine grinding. This process is called wet milling and is often performed using a ball mill. The resulting water-filled mixture is called a slurry or slip. The water is then removed from the slurry by filter pressing (which removes 40-50 percent of the moisture), followed by dry milling.

**Fig 3.2 Mixing of e waste**

**Spray drying**

If wet milling is first used, the excess water is usually removed via spray drying. This involves pumping the slurry to an atomizer consisting of a rapidly rotating disk or nozzle. Droplets of the slip are dried as they are heated by a rising hot air column, forming small, free flowing granules that result in a powder suitable forforming

**Forming**

Most tile is formed by dry pressing. In this method, the free-flowing powder—containing organic binder or a low percentage of moisture—flows from a hopper into the forming die. The material is compressed in a steel cavity by steel plungers and is then ejected by the bottom plunger. Automated presses are used with operating pressures as high as 2,500 tons

**Fig 3.3 forming of tiles**

**Drying**

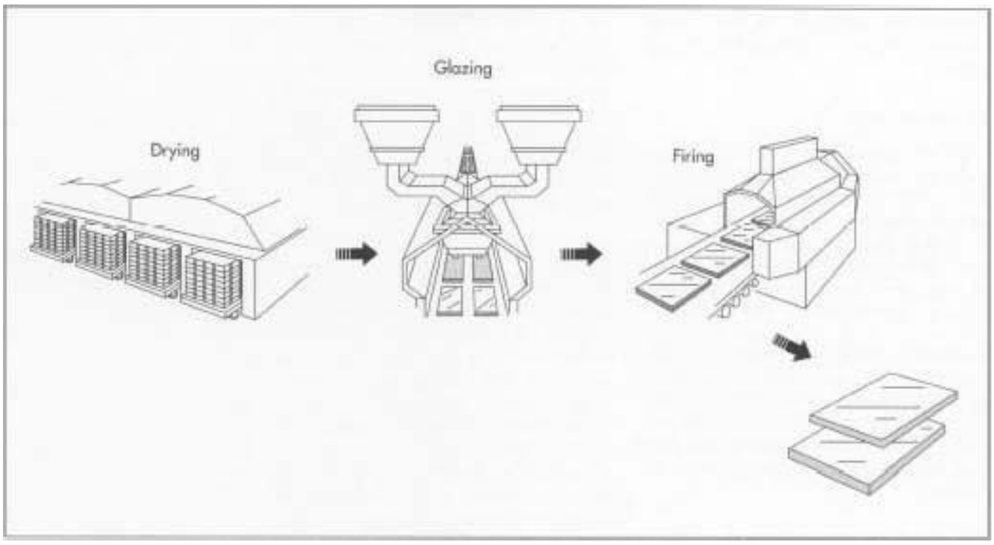
Ceramic tile usually must be dried (at high relative humidity) after forming, especially if a wet method is used. Drying, which can take several days, removes the water at a slow enough rate to prevent shrinkage cracks. Continuous or tunnel driers are used that are heated using gas or oil, infrared lamps, or microwave energy. Infrared drying is better suited for thin tile, whereas microwave drying works better for thicker tile. Another method, impulse drying, uses pulses of hot air flowing in the transverse direction instead of continuously in the material flow direction.

**Glazing**

To prepare the glaze, similar methods are used as for the tile body. After a batch formulation is calculated, the raw materials are weighed, mixed and dry or wet milled. The milled glazes are then applied using one of the many methods available. In centrifugal glazing or discing, the glaze is fed through a rotating disc that flings or throws the glaze onto the tile. In the bell/waterfall method, a stream of glaze falls onto the tile as it passes on a conveyor underneath. Sometimes, the glaze is simply sprayed on. For multiple glaze applications, screen printing on, under, or between tile that have been wet glazed is used. In this process, glaze is forced through a screen by a rubber squeegee or other device.

**Firing**

After glazing, the tile must be heated intensely to strengthen it and give it the desired porosity. Two types of ovens, or After forming, the file is dried slowly (for several days) and at high humidity, to prevent cracking and shrinkage. Next, the glaze is applied, and then the tile is fired in a furnace or kiln. Although some types of tile require a two-step firing process, wet-milled tile is fired only once, at temperatures of 2,000 degrees Fahrenheit or more. After firing, the tile is packaged and shipped




## IV. MATERIAL PROPERTIES

### 4.1 Cement

Cement is used right from ancient periods in construction industry. The most commonly available Portland Pozzolana cement was selected for the investigation

**Specific gravity of cement = 3.15**

### 4.2 Coarse Aggregates

Ordinary crushed stone with size 6mm was used as coarse aggregate in concrete mixes. They generally possess all the essential qualities of a good stone showing very high crushing strength, low absorption value and least porosity

**Specific gravity of coarse aggregate = 2.65**

**Fineness modulus = 9.04**

### 4.3 Fine Aggregates

Ordinary m sand was used as coarse aggregate in concrete mixes.

**Specific gravity of fine aggregate = 2.61**

**Fineness modulus = 4.84**

### 4.4 Other Properties

| Properties | E- waste particle | Coarse aggregate |
| --- | --- | --- |
| Colour | White and Dark | Dark |
| Shape | Angular | Angular |
| Crushing value | <2% | 15% |
| Impact value | <2% | 26% |

## V.RESULTS AND DISCUSSIONS

### 5.1 Compressive strength test

The Conventional concrete tiles and electronic waste (15% of total weight of tiles) mixed concrete tiles are tested.

| Trial no | Specimen details | Test results | | |
|---|---|---|---|---|
| | | Weight (KG) | Ultimate load (KN) | Compressive strength ($N/MM^2$) |
| 1 | Conventional concrete tile | 3.85 | 2010 | 29.39 |
| | E waste concrete tile | 3.53 | 2144 | 31.34 |

**Table: 5.1 compressive strength results**

### 5.2 Flexural strength test

| Trial no | Specimen details | Test results | | |
|---|---|---|---|---|
| | | Weight (KG) | Proving Ring division | flexural strength ($N/MM^2$) |
| 1 | Conventional concrete tile | 3.79 | 31 | 5.49 |
| | E waste concrete tile | 3.58 | 26 | 4.61 |

**Table: 5.2 flexural strength results**

### 5.3 Water absorption test :

| Trial no | Specimen details | Test results | | |
|---|---|---|---|---|
| | | Dry Weight (kg) | wet Weight (kg) | Water absorption |
| 1 | Conventional concrete tile | 3.85 | 4.04 | 4.94 |
| | E waste concrete tile | 3.53 | 3.75 | 5.67 |

**Table: 5.3 water absorption results**

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

## VI. CONCLUSION

From this project, there is a Better and perfect alternating solution for reusing of e-waste in easiest way is to be found and new creative parking tile to be introduced. Tests are carried out successfully and results are to be obtained in perfect manner as per standard specifications. we get more compressive strength than conventional concrete tiles. The characteristics and properties of e-waste tiles are similar to the normal tiles and cost of the E-waste tile is greater than when compared to normal parking tile. In future it will reduce by increasing in large level of production. And it will be a good solution for reducing the E-waste.

## VII. REFERENCES

1) Anwesha Borthakur and Kunal Singha- “Generation of electronic waste in India: Current scenario, dilemmas and stakeholders.” Vol.7 (9),pp.899-910,September 2013.

2) D. Fraga, A.Gyozova, S.Kozhukharov, S.Alleepuz, C.Lazazao, V.Trilles, J.Carda- “Development of New Ceramic Tiles by Recycling of Waste Glass and Ceramic Materials.”

3) Sivakumaran Sivaramanan - “E-Waste Management, Disposal and Its Impacts on the Environment.” Volume 3, Issue 5: 531-537,2013.

4) G. Gaidajis, K. Angelakoglou and D. Aktsoglou – “E-waste: Environmental Problems and Current Management.” Journal of Engineering Science and Technology Review 3 (1) (2010) 193-199.

5) IS Code referred –

- IS:13801-2013
- IS: 1237-2012
- IS: 8042:1989
- IS: 15658-2006