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Study on Electrical Waste and Plastic Waste in Stabilizing Road Constriction

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Abstract- Nowadays with the increasing population usage of electronic applications increased and once the device is used it is either refurbished, reused, or discarded. The discarded electrical waste turns to be called E-Waste whose disposal is very difficult. This waste grows annually at a rate of 3-4% and in which 15% is only been recycled. According to the data around 2021, we will generate 52.2 million tonnes per annum of E-Waste. E-waste recycling becomes difficult due to the Presence of flame retarder and around 20% of plastic material in it.The current review helps to understand how this hard to recycle E-waste can be used in stabilizing and strengthening Indian roads.

Key Words- E-waste, stabilization, strengthening, Indian roads

I. INTRODUCTION

Researchers worldwide are conducting different types of experimental studies to find different kinds of benefits and effects of using electrical waste in concrete. Studies provide that utilization of E-waste in construction work as well as in making the construction economical. It also reduces the disposal issues of E-waste like landfilling, dumping into oceans, and saving energy. The replacement of nonbiodegradable bio-waste like E-waste in concrete was a result of finding the best

disposal method for E-waste instead of landfilling and creating pollution. Therefore, effective waste management methods were considered. E-waste is used in the replacement of cement; coarse and fine aggregates and the latest research states the different advantages of using E-waste in the construction industry which we will see in the present review.

E-Waste – The waste generated when we discard useless electrical appliances like CPUs, smartphones contain destructive materials like lead, brominated flame retardants, or beryllium which makes disposal and recycling of E-waste risky. One of the U.S.A agency EPA classified E-waste into 10 different categories varying from large to small household appliances, IT equipment, consumer products like T.V, Lamps, toys, Tools, etc and medical instruments, automatic dispensers.

E-waste must be recycled before using in concrete as a partial replacement of fine aggregate. The recycling process can be done in two sectors one is the Formal sector and the other one is the Informal sector. In the formal sector recycling unit is set up the same as any other industry where formal recyclers will be responsible for environmental problems and permissions regarding environmental pollution. These recycling units are committed to CSR(corporate socialresponsibility).

In India most of the E-waste recycling is done by the informal sector it's a widespread sector with a lot of workforces where manual dismantling without machinery is done. It is not the same method of recycling because health and environmental protection are taken. Recycling is done in five steps as follows manual separation, shredding, pulverization, density separation, and ball-milling. After converting it into a fine powder it is used in replacement of fine aggregate to increase the strength of concrete specimens.

II. TYPES OF ELECTRICAL WASTE

Electrical waste is nothing but discarded and used electronic devices which can be reused, recycled, and refurbished.This waste consists of pollutant materials like lead, cadmium,brominated flame retardants, and beryllium which will become a risk when gets into contact with the human being. There are many hazardous and non-hazardousmaterials present in E-Waste some of thefollowing areHazardous waste materials we get when E-Waste is discarded are Lead,Americium, cadmium, Mercury, Hexavalent chromium, Sulphur, Beryllium Oxide, and PVC. Non-Hazardous components that can be recycled are Aluminium, Copper, Germanium, Gold, Lithium, Nickel, Silicon, Tin, and Zinc.

In research work done till now, we can see E-waste is used after incineration in the form of ashes. Waste ash consolidated with concrete helped in developing the flexural strength of concrete roads. The addition of electronic waste in concrete decreased the specific gravity of the specimen.

It can also be seen that replacement of coarse aggregate with electronic waste help to enhancethe stability of the specimen. E-waste helped to increase were has plastic waste helped to increase flexibility and durability of specimens and the addition of these waste materials in the

making of bituminous roads gave satisfying results. And helped to reduce the harmful effects of E-Waste and Plastic waste making it economical.

We can also add waste generated from the television and automobile sector many of the products from these industries can be recycled, reused, and refurbished. We can discard them into small pieces and use them in the form of aggregates or can convert it into fine ashes burning the E-Waste and using 10 to 15% of it in road constructionsto increase the stability of bituminous roads and reduce cost. The use of plastic waste in road construction also helped ineffective waste management and economicconstruction. Studies are done by using small plastic shredded waste spread all over the hot aggregate layer that helps in melting and form a thin coat of molten plastic has plastic shows adhesion properties in a molten state and helps to develop the melting point of bitumenand it helps to increase the life span of roads by decreasingthe formation of potholes, ruts and develop havoc.

Use of waste rubber tires and waste glass in making asphalt pavements. Many other materials like coal fly ash, blast furnace slag, bottom ash, boiler slag, steel slagare been used in making road constructions and proved to be reclaimed paving materials over conventional materials. Use of fly ash generated from burning of electrical waste and plastic waste, cement kiln dust, and Phosphogypusumis reused in the construction of highways it is converted into stacksthis industrial wastepossess disposal problems but when used in construction field they help in developing the strength, stability, and durability of the structure.

III. LITERATURE

Chanda Jithendra Sai Raja et.al(1), A Review on the use of Plastic in Construction of Roads. In the present study plastic waste is converted into powder, mixed in a crusher,and used with aggregate and bitumen mixes by heating processes. Polymer coated aggregate and bitumen mix show high strength, better binding property, stability development against wear and tear of roads, better durability. It also helps in recycling plastic waste effectively.

Ahmed Trimbakwala (2),a detailed study on the use of waste plastic in road construction. It provides that the use of plastic waste after proper processing will improve the life of the road. In the present study waste,the plastic material was treated and converted into powder form and 3 to 4% of it was mixed in the bitumen.It helped in improving the surface-initiated cracking, aging, oxidation resistance, resistance towards rutting due to higher viscosity and softening points. It also concluded that using plastic waste as an additive helped in lower pavement maintenance costs, Eco-friendly method of construction, and helps in maintaining environmental conditions.

Huda Shafiq(3), In the present study non-biodegradable plastic waste to construct plastic roads. Using plastic waste also helps to eliminate plastic disposal into landfills. Plastic-coatedaggregates have proved to offer better abrasion, wear and tear.It was shown that the bond between plastic coated aggregates and bitumen is also very strong due to the increased contact area between plastic and bitumen. Adding plastic waste to aggregates increased the performance and life span of roads. Molten plastic is coated at 140c to 160c and spread throughout aggregate

Aniket Ravindra Ingole et al(4), In the present study on the use of electronic waste concrete for road construction they have used ashes of electronic waste in different volume ratios starting from 0.1 m^3 to 1 m^3. Results show that compared to plain cement concrete roads to E-Waste ash concrete roads have better specific gravity, flexural strength, and compressive strength. It demonstrated that E-Waste fiery remains are utilized regularlyas material in concrete road pavement.

Anjali Deshmukh et al (5), in the present study on the performance of E-Waste and polymer, modified bituminous mix in flexible pavement. E-Waste is used as a partial replacement of coarse aggregate. For polymer modified bitumen they have used the wet process by shredding plastic waste and mixing with bitumen and in E-Waste partial replacement of coarse aggregate with e-waste is done. The portions were mixed in percentages starting from 0% to 1% for plastic and 0% to 20% for E-Waste. Results show that 15% E-waste replacement with coarse aggregate gave better results in Marshall Stability testand Flow Value test compared to plain cement concrete and other percentages. In terms of density plain cement concrete has more compared to E-Waste concrete.

S.Sabarai Mani et al (6), the study on the bituminous pavement by using E-Wastefly ash shows that bituminous concrete mixed with 10 to 15% of E-Waste gave optimal results compared to plain cement concrete. Fly ash mixed as filler increasedthe stability of bituminous roads. E-waste reduces the cost of constructionand contributes tothe efficient management of waste.

D.D. Adegoke et al(7), the application of recycled waste materials for highway construction and their prospect and challenges. It gives the significance of different waste materials that can be used in construction work and help to develop stability and strength of the construction. They have done studies on different materials like plastic waste, slag, waste tires, waste glass, demolition wastes, geopolymers, mill tailings, and shingles. Conventional constructionmaterials are still in use to date and continuously used will start developing negative impact on the environment. so, use waste materials that have befit of providing strength and at the same time reduce the environmental effects of incinerating the E-waste. Despite

the drawbacks withthe use of materials with improvement in technology, sustainability is ensured.

A.S. Sandbhor and J.K. Patil(8), the present study on the use of plastic waste in construction of roads shows that using VG 30 bitumen with different percentages of fibers like 1% to 9% and comparing the results with plain cement concrete for different properties like penetration, ductility, softening point and viscosity at 60 degrees. different percentages of fibers show different strength properties like 9% bitumen shows higher viscosity and softening point compared to otherswhereas0% fibers showed better ductility and penetration values.

IV. CONCLUSION

A review of different forms of E-Waste and plastic waste that can be used in the construction of cement concrete and bituminous roads has been discussed in the present paper. Use of different kinds of E-waste in the form of fly ash generated after burning, use of polymers,and use of plastic waste in replacement to coarse aggregate, in the formof shredded pieces whichhelp stabilize the bituminous roads. In present paper helps to review different kinds of waste materials that are been used in combination with concrete and bituminous works that not only helps to stabilize the structure but also helps in making cost-effectiveconstructionsby reducing the waste content and global warming.

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