Based on Waste Management Electronic Waste Roads, (E - Waste Roads)

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Abstract- *In an approach to bridge the digital divide, it is necessary to get an affordable, equitable and quality access to ICT. It is estimated that two third of world's population is still offline so there is a need to provide affordable access to internet for all. For developing countries, it has become a priority area to alleviate poverty by promoting access to ICT. At the same time, tremendous growth in use of ICT devices and services, faster change of technology and frequent innovations in ICT sector, had left the world with a threat of deterioration in environmental conditions and human health as the-waste of electronic and electrical equipment, which contains hazardous components, is still handled in an environmentally unfriendly manner mainly in developing nations. It is huge challenge for the nations to handle e-waste in responsible manner and protect the environment. In this paper an approach is made towards assessing the present situation of e-waste management globally as well as in India, considering the present regulations and guidelines.*

It is also a fact that major part of recycling of e-waste is being handled by informal sector who have little/no knowledge about the consequences of exposure to hazardous substances.

I. INTRODUCTION

Electronics waste, commonly known as e-scrap and e-waste, is the trash we generate from surplus, broken and obsolete electronic devices. E-waste or electronics recycling is the process of recovering material from old devices to use in new products. We are creating e-waste at a rapid rate. With such a very short useful life, these electronics transition into e-waste at a rapid pace.

In fact, it was estimated that there were 422 million unused and unwanted cell phones accumulating in people's homes by the end of 2015. Globally, a cell phone is sold to around one of every four people on an annual basis. Every year millions of electronic devices such as mobile phones, TVs, computers, laptops, and tablets reach the end of their useful life.

Unfortunately, the majority of these electronic products end up in landfills and just a tiny percentage comes back as/in new electronic devices. According to a UN study, in 2014 alone, 41.8 million tons of electronic waste (e-waste) was discarded worldwide, with only 10 to 40 percent of disposal done properly.

Disposal of a variety of E-Wastes in an eco-friendly way is the thrust area of today's research. Looking forward the scenario of present lifestyle a complete ban on the use of waste plastic cannot be put, although the waste plastic taking the face of a devil for the present and the future generation. But the use of waste plastics in road construction is gaining importance these days because plastic roads perform better than ordinary ones and the e-waste and plastic waste considered to be a pollution menace, can find its use. And then the behavior of these waste in the replacement was studied by conducting various tests.

II. MATERIALS USED

2.1 AGGREGATES

Aggregate constitutes the granular part in bituminous concrete mixtures which contributes up to 90-95 % of the mixture weight and contributes to most of the load bearing & strength characteristics of the mixture. Hence, the quality and physical properties of the aggregates should be controlled to ensure a good pavement. The properties that aggregates should have to be used in pavement are shown below.

2.2 COARSE AGGREGATE (CA)

Coarse aggregate should be screened crushed rock, angular in shape, free from dust particles, clay, vegetations and organic matters. Coarse aggregates are of size 6mm, 12.5mm, 20mm and fillers are main use in binding process of the bituminous mixes while mixing the plastics it should be the most compacting material in the mixes.

2.3 BITUMEN

Asphalt binder RS-1 and VG grade are used in this research. The bitumen are of various percentage for RS-1 from 5%,5.25%,5.5%,5.75%,6%,6.25% and VG grade of 4.5%,5%,5.5%,6%,6.5%.

2.4 ELECTRONIC WASTE

Electronic Waste is the term used to describe old, end-of-life electronic appliances such as computers, laptops, TVs, DVD players, mobile phones, mp3 players etc. which have been disposed of by their original users. While there is no generally accepted definition of e-waste, in most cases, e-waste comprises of relatively expensive and essentially durable products used for data processing, telecommunications or entertainment in private households and businesses. PC industry is growing at a 25% compounded annual growth rate. The e-waste inventory based on this obsolescence rate and installed base in India for the year 2005 has been estimated to be 146180.00 tones. This is expected to exceed 15,00,000 tons by 2015. There is a lack of authentic and comprehensive data on

E-waste availability for domestic generation of E-waste and the various State Pollution Control Boards has initiated the exercise to collect data on e-waste generation.

III. EXPERIMENTAL INVESTIGATION

3.1 SPECIFIC GRAVITY

The specific gravity of an aggregate is considered to be a measure of strength or quality of the material. Stones having low specific gravity are generally weaker than those with higher specific gravity values. Specific gravity of a material may be defined as the ratio of density of the material to the density of water at a specified temperature.

3.2 ABRASION TEST

Abrasion test is carried out to test the hardness property of aggregates. The principle of Los Angeles abrasion test is to find the percentage wear due to relative rubbing action between the aggregate and steel balls used as abrasive charge.

3.3 INITIAL TESTS FOR BITUMEN

The initial test for the bitumen and tar should have proper Standards on methods of tests was first published in 1958. However, during the course of this period a number of improvements have since been made in carrying out of these methods of tests.

- PENETRATION TEST
- DUCTILITY TEST
- SOFTENING POINT TEST
- FLASH AND FIRE POINT TEST
- MARSHAL STABILITY TEST

3.4 PENETRATION TEST

The penetration of a bituminous material is the distance in tenths of a millimeter that a standard needle will penetrate vertically into a sample of the material under standard conditions of temperature, load and time.

3.5 DUCTILITY TEST

The ductility of bituminous material is the distance in centimeters to which it will elongate before breaking when a briquette specimen of the materials is pulled at a specified speed and at specified temperature.

3.6 SOFTENING POINT TEST

The softening point of a bituminous material is the temperature at which the material attains a certain degree of softness under specified conditions of test. This study was carried out to design and fabricate a cost effective and efficient softening point tester to classify bitumen into grades.

3.7 FLASH AND FIRE POINT

Flash point of bitumen is the temperature at which, it's vapour will ignite temporarily during heating, when a small flame is brought into contact with the vapour. The knowledge of this point is of interest mainly to the user, since the bitumen must not be heated to this point. The flash point tells the critical temperature at and above which suitable precautions are required to be taken to eliminate the danger of fire during heating. This temperature, however, is well below that at which the bitumen will burn. The latter temperature is called the fire point.

FLASH POINT

It is the lowest temperature at which the vapour of a bituminous material momentarily takes fire in the form of a flash, under specified conditions of test.

FIRE POINT

It is the lowest temperature at which bituminous materials ignite and burn under specific conditions of test.

3.8 MARSHAL STABILITY TEST

The Marshall test method is widely used for the design and control of asphaltic concrete and hot rolled asphalt materials, it cannot be applied to open textured materials such as bitumen macadam. Materials containing aggregate sizes larger than 20 mm, are liable to give erratic results.

IV. RESULTS

The initial tests which was conducted for find out the optimum proportion of replacement of electronic waste in road is detail studied in the chapter 3. From that the results are obtained and the comparition between the results are done and shown in the pictures. The result and comparition graphs are shown below, which gives the relationship of electronic waste and bitumen and the behavior of the electronic waste.

Table 4.1 Penetration test result

S. NO	% OF E-WASTE	PENETRATION TEST
1	0%	88
2	3%	91.5
3	5%	94
4	10%	93

Table 4.2 Ductility test result

S. NO	% OF E-WASTE	DUCTILIY TEST
1	0%	74
2	3%	78.7
3	5%	89
4	10%	84.6

Table 4.3 Softening point test result

S. NO	% OF E-WASTE	SOFTENIG POINT TEST ^{0}C
1	0%	63
2	3%	65
3	5%	68
4	10%	66

Table 4.4 Marshal stability test result

S. NO	% OF E-WASTE	MARSHAL STABILITY TEST
1	0%	675
2	3%	689
3	5%	787
4	10%	767

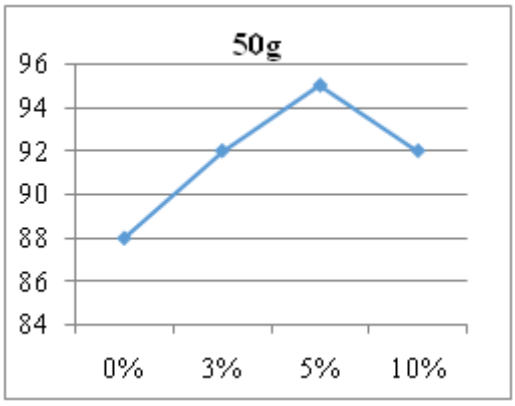

FIG 4.1 COMPARITION RESULT OF PENETRATION VALUE

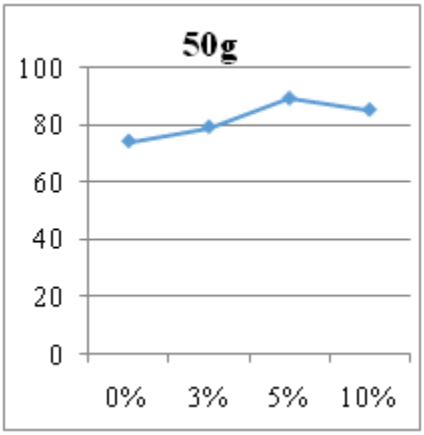

FIG 4.2 COMPARITION RESULT OF DUCTILITY VALUE

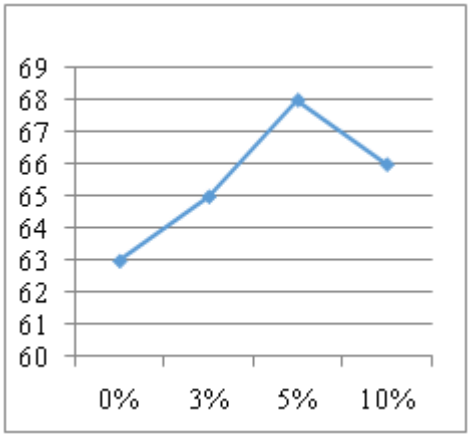

FIG 4.3 COMPARITION RESULT OF SOFTENING VALUE

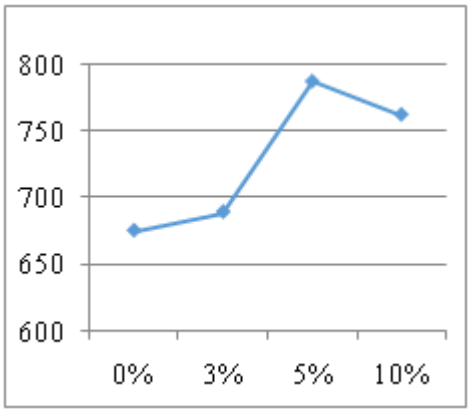

FIG 4.4 COMPARITION RESULT OF MARSHAL STABILITY VALUE

V. CONCLUSIONS

The result shows that with increase of E-waste in bitumen increases the properties of aggregate and bitumen. Using of E-waste in flexible pavements shows good result when compared with conventional flexible pavements. The optimum use of 5% E-waste in bitumen based on Marshal Stability test.

This has added more value in minimizing the disposal of E-waste is the eco-friendly technique. Utilization of E-waste in bituminous concrete mixtures shows improved property of the mixtures thus formed. The E-waste utilized in the mix will get coated over Aggregate of the mixture and reduces porosity, absorption of moisture and improves binding property.

By the study of this project we should know about the optimum proportion of E-waste replacement in the road construction. In chapter-4 and chapter-5 the detailed study should be taken for the replacement of E-waste in the bitumen and aggregate.

The tests are taken with different percentage of replacement of E-wastes.

At first the test was conducted with 0% replacement of electronic waste in bitumen and then different kinds of tests.

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