Systematic Study of Application of E- waste And Plastic Waste in Flexible Pavement

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Abstract— The purpose of this paper is to study the application of mixture of E-waste and Plastic waste in flexible pavement. In this paper various research papers and experimental information have been studied and found that the E-waste and plastic waste have various chemical composition which are useful for flexible pavement. But we are found that the research is available for separate on E-waste and separately on plastic waste. And very few research is made in the combination of these both waste, therefore study of E-waste and plastic waste have a great essence for the study. We also describe here the results of various tests like Aggregate Impact test performed in laboratory.

Keywords: E-waste, Plastic waste, Flexible pavement, Aggregate Impact test

I. INTRODUCTION

A. *E-waste*

E-Waste means Electronic Waste for example deteriorated cell phones, damage remotes, Medical electronic equipment, electrical sub-assemblies which are the part of time of discarding. Now a days due to lots of electronic companies we can get lots of electronically waste in large quantity in cheapest prices. According to the United Nations Environment Program, 20 to 25 million tonnes of electronic waste are produced worldwide each year [1]. The various material composition of E-waste are describe by the following diagram

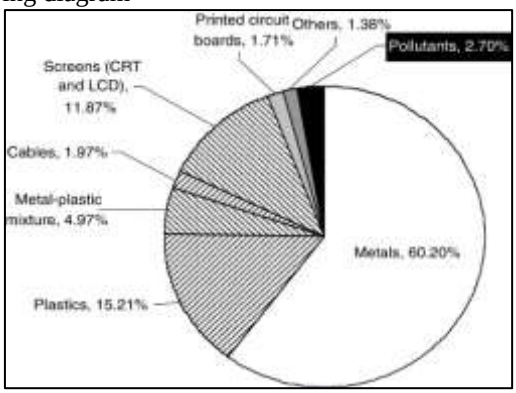

Fig. 1: Material Fractions in e-waste [2]

B. *Plastic Waste*

Plastics are sturdy and non-degradable the chemically bond that make plastic so solid make it similarly impervious to common procedure of degradation plastic can be isolated in two significant classes : Thermoses and Thermoplastic .A thermoset hardens or sets irreversible when warmed . They are helpful for their durability and quality and are along these lines use essentially in avtos and development applications plastic in various structure is seen as nearly 5% in city strong waste which is poisonous in nature

Fig. 2: Road from plastic waste [4]

Fig. 3: Plastic waste [5]

C. *Flexible Pavement*

An flexible pavement can be characterize as an pavement layer containing a blend of aggregate and bitumen warmed and blended appropriately and afterward laid and compact on a bed of granular layer. The structure limit of flexible pavement is gain by the joined activity of diverse layer of the pavement . The heap from truck is straight for wardly applied on wearing course and afterward at last to ground. Since the pressure instigated by traffic loading is most noteworthy at the head the surface layer has greatest firmness and commitment the most to increases pavement quality.

Flexible pavement is made out of bituminous material surface course underlaying base and sub base course .The bituminous is thick in nature which permits noteworthy plastic deformation.

The flexible pavement construction involves the construction of the following layers:

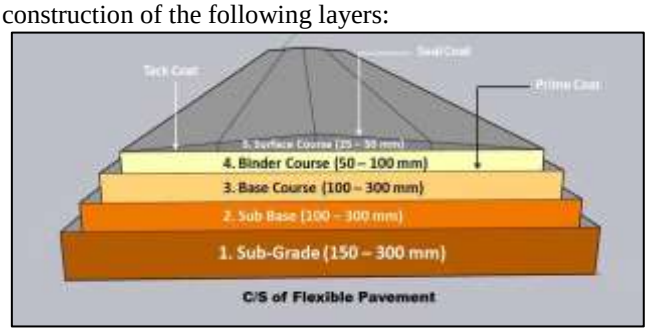

Fig. 4: Layers in flexible payment

II. OBJECTIVE

- To Identifying the effective use of combination of plastic and E-waste
- To study the various tests of mixture
- To improve the marshall stability value at specific percentage
- To improve the properties of aggregates by including plastic waste and e-waste in it
- To give flexural strength to flexible pavements

III. MATERIALS AND METHODOLOGY

A. General

We make list of the information required the task work that appeared as how contamination it is step by step and how significant the development of transportation framework is so eco accommodating should be the best way to defeat both conditions single plant so we need to accomplish trial in chipway at the utilization of plastic and e waste for adaptable clearing for this we have put away. The important thing for adaptable clearing etc. we at that point tried material security on the bitumen test made with bitumen and after that we did all the material together in comprised of bitumen plastic and e waste .The test we have given it is considered as such after that morth test we got our outcome and depend on this outcome we arrive at over conclusion.

B. Material used

1) Aggregate

Stone are first utilized in the development of different asphalt layer .it is grain size, shape, surface and gradation. We have generate stone aggregate from where development. It is going on. We have gathered around 50 kg of total our work .subsequent to storing we do it sieved the whole from 12.5 mm Is sieved , 10 mm Is sieved , 4.75 mm Is sieved and 2.36 mm Is sieved. In the different bag with various sizes.

2) Bitumen:

Bitumen it is the mind boggling natural material. bitumen material are usually utilized for highway development in light of fact that these are authoritative and waterproofing properties .we utilized 5 kg of bitumen for our exploratory work.

3) E-waste:

We had utilized e waste these are following examples : cell phones , tablets , pc, damage remotes , medical electronic equipment , electronics lamps, etc. we cut them in small pieces we collects almost 5 kg of e waste

4) Plastic waste:

We had utilized just LDPE plastic well spring of the LDPE plastic these are accompanying: plastic bottles, packs, waste plastic pieces, plastic old box, etc.

There are two type of plastic: Thermoses, and Thermoplastics. We gathered around 300 to 400 gm plastic subsequent to gathering the plastic waste we calibrated it with a little size by utilizing little scissors

C. Material Testing

1) Aggregate Impact test

Fig. 3.1

a) Observation:

W_1=620gm W_2=150.4gm Aggregate Input Value = W2/W1*100=150/620*=24.25%

2) Penetration test

Fig. 3.2

a) Observations:

Dial reading	Test 1	test 2	Test 3
Initial	210	280	350
final	280	350	404
Penetration value	65	69	78

Table 3.1

Actual test temperature = 25ºC Mean penetration value=71

3) Ring ball test for softening point of bitumen

a) Observations

Sr No	Description	Ball-1	Ball- 2
1	Softening point	50.2	5 50.3
2	Average softening point	50.5	

4) Soundness Test of Aggregate

Fig. 3.4

a) Observations

W0 = 90 gm

W1= 75 gm

Percentage loss = (W0-W1/W0)*100% (90-75/90)*100%

16.66% (Magnesium sulphate is used)

5) Marshall Stability Test:

Fig. 3.4

a) Observations:

The quantity of bitumen place in the samples is given in percentage which is shown in the following table.

Mould no	Bitumen%	The weight of bitumen
1	5.5	75
2	6	84
3	6.5	88
4	7	89

Table 3.2

For Bitumen Mix made somewhat Replacing Aggregates with E-waste

Mould no	E-waste%	The weight of E-waste	The weight of aggregate after replacement
1	8	100	1210
2	10.5	140	1120
3	13	180	1084
4	15.5	200	1052

Table 3.3:

For Bitumen Mix Made some amount Replacing Bitumen with Plastic

Moulds no	Plastic %	Weight of plastic	Weight of bitumen after replacement
1	7	5.3	85.2
2	7.5	7.2	90.4
3	8	8.5	97.2
4	8.5	9.3	98.5

Table 3.4

IV. RESULTS

Sample % adding aggregate and bitumen	Wt of sample (gm)	Stability value (kg)	Flow value (mm)	Allowable stability value (kg)	Allowable flow value (mm)
5.5	79	5883.66	0.13	-	-
6	84	5598.42	0.8	-	-
6.5	88	5662.52	0.142	-	-
7	89	5748.82	1	-	-

Table 4.1

Sample % partially alternating aggregate with E-waste	Wt of sample (gm)	Stability value (kg)	Flow value (mm)	Allowable stability value (kg)	Allowable flow value (mm)
8	100	6040.72	0.15	5883.66	2
10.5	140	6042.72	0.17	5598.42	2
13	180	5775.76	0.136	5662.52	1.7
15.5	200	4524.32	0.127	5748.82	1.65

Table 4.2

Sample % partially alternating aggregate with plastic	Wt of sample	Stability value (kg)	Flow value (mm)	Allowable stability value (kg)	Allowable flow value (mm)
7	5.3	6734.42	0.14	5883.66	1.85
7.5	7.2	7172.40	0.135	5597.42	1.8
8	8.5	7252.41	0.128	5662.51	1.75
8.5	9.3	7281.54	0.126	5749.82	1.66

Table 4.3

Replacing bitumen with plastic and aggregate with E-waste

Sr No	Stability value (kg)	Allowable stability value (kg)	Flow value (mm)	Allowable flow value (mm)
1	5987.72	5883.66	0.15	2
2	5647.57	5597.42	0.129	2
3	4588.72	5662.51	0.14	1.5
4	2089.44	5749.82	0.144	1.8

Table 4.4

V. CONCLUSION

As per after reset of E-waste 10.5%it gives great strength get past 13%substitution stability performance is become poor so we need to took 10.5% of half way substitution of E-waste. As indicated by test it has demonstrate that E-waste useful and plastic waste is useful for better performance of flexible pavement and it is even cost sparing.

As per after effect of plastic waste 7%to 8.5% half way substitution of plastic with bitumen gives great stability value It can even builds the life expectancy of flexible pavement because of such plastic waste and E-waste

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