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A Comparative study between Plastic Coated Bitumen Roads and Bitumen Roads

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ABSTRACT- In this paper we will concentrate about the examination of bitumen roads with plastic bitumen roads. As the population and improvement exercises is developing quickly the quantum of plastic waste in civil strong waste is expanding, which prompting far and wide littering on the scene. Once the utilized plastic material is by and large tossed out and they don't go through bio disintegration. Hence the waste is either landfilled or burned. Both the activities are not eco-accommodating as it dirties the land and the air. There are numerous approaches to stop the plastic contamination. The heaps of little singular activities can immensely affect the planet. Presently, larger part of Indian roads are cleared with asphalt (Hot &Warm) comprises of aggregate and bitumen combined as one at explicit temperature, created methods to utilize plastic waste for development reason of streets and adaptable asphalts has surveyed. This squander altered bitumen blend show better restricting property, dependability, thickness and more impervious to water.

Keywords: Penetration Test Ductility, Test Softening Point, Flash and Fire Point, Los Angeles Abrasion Test, Deval's Attrition Test, Crushing Value Test, Aggregate Impact Value Test, Water Absorption Test,

OBJECTIVE:

- To look at the manageability of bitumen roads with plastic roads.
- To analyze the expense of roads.
- To analyze the functioning effectiveness of bitumen and plastic roads.

1. INTRODUCTION- Natural or Organic synthetic materials that can be shaped when soft and then hardened, also including some types of proteins, resins; utilized in exchange of other materials is called plastic. The waste thus produced from such materials is called plastic waste. Plastic wastes are more enduring and non-biodegradable. The disposal of plastic waste should be proper as it may cause harm to animals as well as humans. Therefore, plastic waste should not be recycled or disposed in landfills. So, we can use the plastic waste into road construction as a binding material in place of bitumen. using plastic waste in bitumen improves quality as well as minimizes the overall cost of road construction.

2. METHODOLOGY:

Until practical steps are proposed without yielding results, the dispute on proper use and misuse of plastic on environment can persist. Different tests were operated on plastic and bitumen aggregates. There are two important processes for bituminous flexible pavement:

2.1. Wet Process

2.2. Dry Process

2.1. Wet Process

2.1.1. SAMPLE PREPARATION:

Before the preparation of sample, segregation, cleaning and shredding of plastic is done. The shredded plastic is added to the bitumen when the bitumen is at 110-160°C.

2.1.2. PENETRATION TEST:

The sample of bitumen and plastic is then softened to a considerable temperature between 75-100°C above the softening temperature of bitumen. The material is then discharged into a container at a depth which is

at least 15mm above the anticipated penetration. Thus, by taking at least three measurements on each sample at a distance of 100mm, the Penetration of all samples are obtained.

2.1.3. DUCTILITY TEST:

For about 85-90 minutes, the mould assembly is placed. The specimen is attached to the ductility machine. The length at which the bitumen thread of each sample breaks is recorded as the ductility value.

2.1.4. SOFTENING POINT:

For about 15 minutes, the samples are immersed in distilled water. Then in Softening apparatus, the ring is placed by placing ball on the sample of the ring. The temperature in the apparatus is then raised at a constant rate of 5°C per minute with a controlled heating unit, until the bitumen becomes soft and the ball placed on the sample sinks through. This process is redone for one more time to obtain two observations.

2.1.5. FLASH AND FIRE POINT:

2.1.5.1. FLASH POINT:

The temperature at which a flash appears on the surface of the material in the cup is called Flash point.

2.1.5.2. FIRE POINT:

After flash point, heating should be continued at a rate between 5-6°C per minute. The point at which the application of test flame accounts for burning of material for at least 5 seconds is called the Flash Point.

2.2. DRY PROCESS

2.2.1. SAMPLE PREPARATION:

Different sized aggregates are taken, such as 10mm and 12.5mm, for conducting crushing, attrition, impact, abrasion, specific gravity and water absorption test. Gathered aggregates are cleaned and dried. At a temperature of about 110-160°C, plastic starts to melt. The aggregates are then coated with the melted plastic and dried at room temperature.

2.2.2. LOS ANGELES ABRASION TEST:

Depending upon the grade we consider, the size of aggregates and the number of spheres is used. Spheres of diameter 4.8mm and weight of 390-445gm are used. Test is executed for 500 revolutions. The crushed aggregates are then taken out and sieved through 1.7mm size sieve. The crushed aggregates which passed through the sieve are then weighed.

2.2.3. DEVAL'S ATTRITION TEST:

The number of revolutions involved in Deval's Test are 10,000. In this test, consider 2.5kg of aggregates are passing through a 20mm sieve and then handed onto a 12.5mm sieve. The test is then executed for 10,000 revolutions. The crushed aggregates are then taken out and sieved through 1.7mm size sieve. The crushed aggregates which passed through the sieve are then weighed.

2.2.4. CRUSHING VALUE TEST:

The aggregates are disposed in a crushing cylinder of 111.5cm diameter and 18cm height. For the crushing test, a load of 40 tons is applied. The crushed aggregates are then taken out and sieved through 2.36mm size sieve. The crushed aggregates which passed through the sieve are then weighed.

2.2.5. AGGREGATE IMPACT VALUE TEST:

In an impact mould of 9.5cm diameter and 5cm height, the aggregates are placed in 3 layers. Each layer is tampered 25 times with the help of a tampering rod. Impact test is executed for a total of 15 blows.

2.2.6. SPECIFIC GRAVITY:

In this test, a clean and dry pycnometer is used. First, the empty weight of the pycnometer is determined. Then, about 1000gm of the clean sample is put in the pycnometer and weighed. Then, the pycnometer is completely filled with water and weighed again.

2.2.7. WATER ABSORPTION TEST:

The aggregates selected for this process are passed through 125mm sieve and then retained on 12mm sieve.

3. RESULTS:

The results of each individual test are compared for both Dry and Wet Processes and shown below:

3.1. DRY PROCESS:

Table-1- Results based on Dry processes

Type of Test	General Aggregate	Plastic Coated Aggregate	Bitumen Coated Aggregates
Abrasion Test	33.45%	27.5%	16%
Attrition Test	27%	9%	5.5%
Crushing Test	27%	20.75%	15%
Impact Test	23.25%	10.145%	5.7%
Specific Gravity Test	2.56	2.19	2.1
Water Absorption Test	1.7%	1.4%	0.9%

3.2. WET PROCESS:

Table-2- Results based on Wet processes

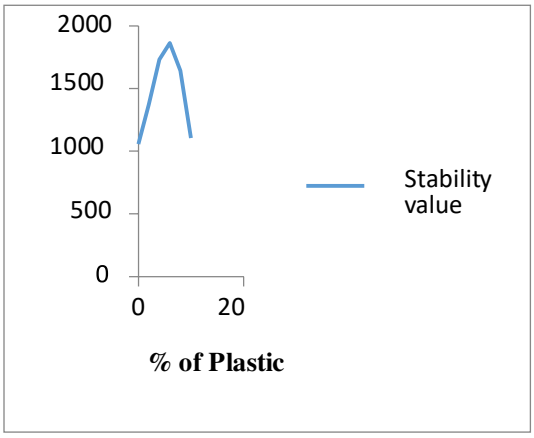
Percentage of Plastic	Ductility Test	Penetration Test	Softening Test	Flash Point	Fire Point
0	103.7	67	52	288	342
2	62.6	57	49	296	342
4	40.1	44	58	310	348
6	30.8	32	60	331	351
8	20.3	22	67	330	344
10	8.9	19	68	298	312

3.3. MARSHALL STABILITY: The values for Marshall Stability test are-

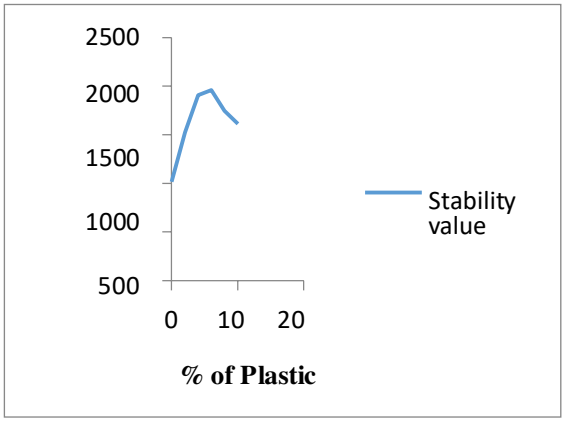
Table-3- Results based on Marshall Stability Test

Content	Percentage of Plastic content

(%)	0	2	4	6	8	10
4	1058	1369	1735	1860	1644	1100
4.5	1020	1522	1914	1958	1750	1610
5	1481	1795	1842	2020	2265	1940
5.5	1972	2047	2214	2347	2405	2321
6	1824	1533	1914	2084	1912	2180



For binder content 4%



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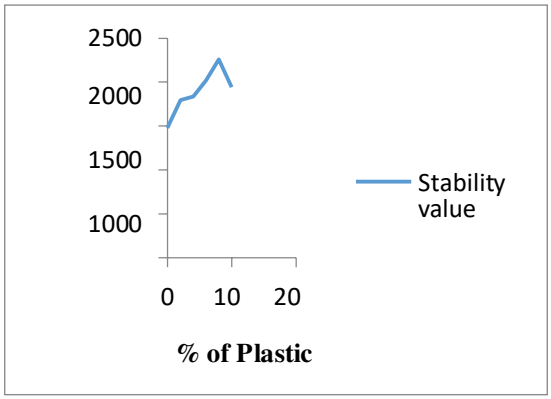

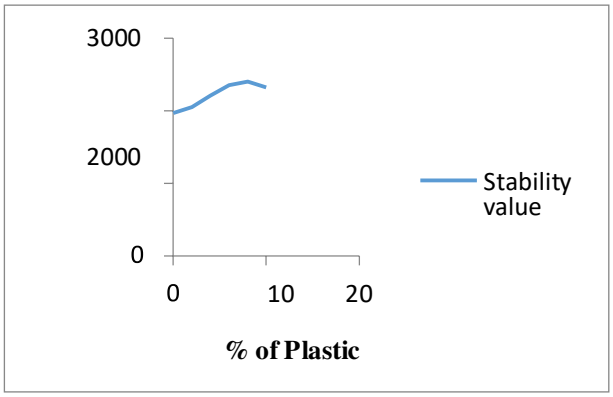

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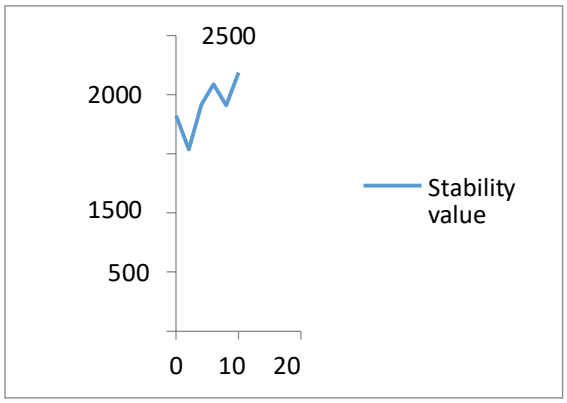
For binder content 5.5%



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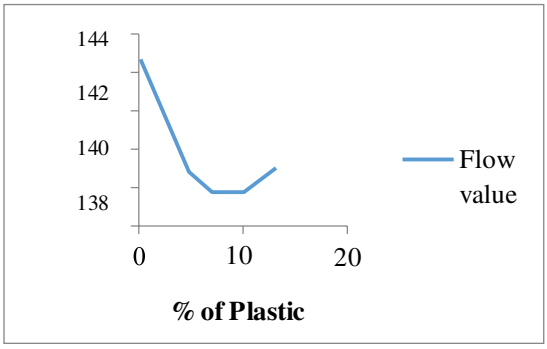
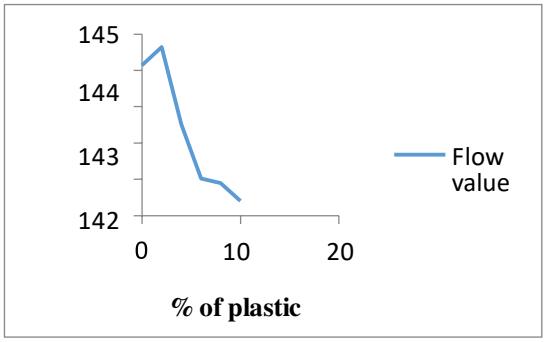
3.4. Flow Values: The Flow values for Marshall Mix design are-

Table-4- Results based on flow values

Binder content (%)	Percentage of Plastic					
	0	2	4	6	8	10
4	142.95	140.10	139.10	137.00	138.50	138.00
4.5	143.62	142.85	140.26	138.65	139.90	139.15
5	144.20	144.55	142.60	140.50	141.20	140.10
5.5	146.10	145.15	144.00	142.00	142.20	140.10
6	147.35	147.20	145.50	143.10	142.50	140.75





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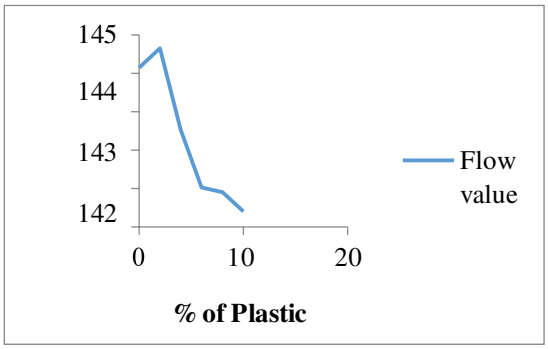

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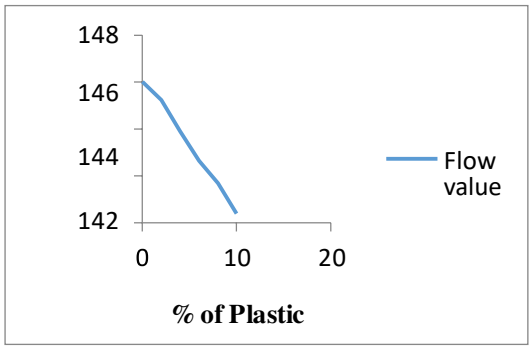

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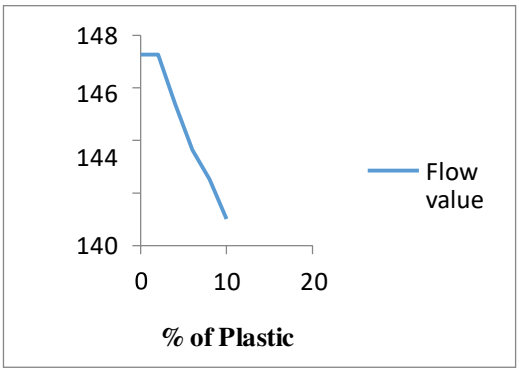

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4. CONCLUSIONS:

1. The use of excessive binder material results in bleeding especially at high temperatures. Whereas an insufficient amount of the binder material may result in cracking, pot holes, etc. Due to manual mixing in India, regulating the temperature and amount of bitumen is very difficult. Therefore, due to its low ductility, enhanced elastic properties and high softening point, polymer (plastic waste) modified binder could be a better solution.
2. Use of polymer modified binder could result in less overall cost of pavement construction and maintenance, as it increases the strength of compacted mix.
3. The pavements made with polymer modified binder have the ability to prevail weather conditions and road construction practices in India.
4. Use of waste plastic, which usually causes drainage problems in urban areas, with bitumen in road construction maybe a better idea.

5. ACKNOWLEDGEMENT

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