



# Use of Plastic in Bituminous Road Construction

Godavari Hullyal<sup>1</sup>, Smita .A<sup>2</sup>, Vijalaxmi .H .I<sup>3</sup>, Lakshmi Devi .B<sup>4</sup>, Rajesh Jadav<sup>5</sup>

BE Student<sup>1,2,3,4</sup>, Assistant Professor<sup>5</sup>

Department of Civil Engineering

STJIT Ranebennur, Karnataka, India

## Abstract:

Use of bottles, container and packing strips etc. increasing day by day. So that amount of waste plastic is also increases. This causes various environmental problems. Therefore it is very important to use waste effectively with technical development in each field. Plastic waste includes carry bags, cups and other utilized plastic can be used as a coating over aggregate and this coated stone can be used for road constructing. The mix polymer coated aggregate and tyre modified bitumen gives high strength. Waste plastic effectively used to help for road construction. Now day's waste plastic is used in bituminous road construction.

**Keywords:** Lifecycle Assessment Persistent, Municipal Solid Waste (WSW), Toxic, Replacement, Plastic waste, Bitumen.

## 1. INTRODUCTION

Plastic are users friendly but not eco-friendly as they are non-biodegradable. Today nearly more than 12 tones of plastics are in INDIA. A serious problem has been perceived by there visibility and made plastic a target in the management of solid waste. It also have a very long life time and burning of plastic waste could also lead to production of many hazardous depends upon type of plastics (polymers). Polymer modified bitumen is one of the important construction of flexible pavement. In road construction the polymer modified bitumen show better properties and plastic waste can find it's use in this process and helps to solving problem of pollution. Now-a-days disposal of different wastes produced from different Industries is a great problem. These materials pose environmental pollution in the nearby locality because many of them are non-biodegradable. Traditionally soil, stone aggregates, sand, bitumen, cement etc. used for road construction. Natural materials being exhaustible in nature, its quantity is declining gradually. Also, cost of extracting good quality of natural material is increasing. Concerned about this, the scientists are looking for alternative materials for highway construction, and industrial wastes product is one such category. If these materials can suitably utilize in highway construction, the pollution and disposal problems may partly reduce. In the absence of other outlets, these solid wastes have occupied several acres of land around plants throughout the country. Keeping, in mind that, the need for bulk use of these solid wastes in India, it was thought expedient to test these materials and to develop specifications to enhance the use of these industrial wastes in road making, in which higher economic returns may be possible.

### 1.1 MATERIAL

#### 1. Bitumen.

It is a obtained from crude petroleum. 60/70 grade of bitumen used.

#### 2. Aggregate.

Aggregate should have resistance to impact, abrasion, crushing, and toughness.

## 3. Waste plastic:

### 3.1 Characteristics of waste plastics:

**3.2 Thermal study:** A study of the thermal behavior of the polymers namely polyethylene, polypropylene. Around 130-140<sup>0</sup>c these polymers get easily softened without production of harmful gases.

**3.3 Binding property:** the molten plastic waste inhibits good binding property.

## 1.2 TESTS

### 1. Test on bitumen

Softening point test: Is the temperature at which the substance attains a particular degree of softening under specified condition of test. Due to the addition plastic waste to bitumen softening point increases as shown in below table.

**Table.1. Test on Softening Point**

SL NO	% of polymer in bitumen	Softening point <sup>0</sup> c	
		polyethylene	Polypropylene
1	0	55	55
2	0.5	59	60
3	1	61	63
4	1.5	62	64
5	2	64	65

### 2. Penetration test:

Determines the hardness or softness of bitumen by measuring the depth in tenths of a millimeter to which a standard loaded needle will penetrate vertically in 5 seconds. Penetration value is decreases with increase in percentage of polymer and type of polymer as in below table, hence hardness of bitumen increases.

**Table .2. Penetration Test**

SL NO	% Of polymer in bitumen	Penetration(1/10 <sup>th</sup> of mm)	
		polyethylene	Polypropylene
1	0	70	70
2	1	65	67
3	1.5	62	65
4	2	60	60
5	2.5	49	58

**3. Ductility test:** It is important that the binders form ductile thin films around the aggregate .Ductility value decreasing by the addition of plastic waste as shown in below table. This is due to interlocking of polymer molecules with bitumen.

**Table.3. Ductility test**

SL NO	% of polymer in bitumen	Ductility(cm)	
		polyethylene	Polypropylene
1	0	95	95
2	0.5	92	90
3	1	85	82
4	1.5	59	54
5	2	34	33

**4. Flash and fire point:** “The flash point of material is the lowest temperature at which the vapour of a substances momentarily takes fire in the form of a Fire point the fire point is the temperature at which the material gets ignited and burns under specified conditions of the test”. The studies of the flash and fire points of the plastic waste bitumen blend helps to understand the inflammability nature of the blend. Flash and fire point of the plain bitumen is 175-210<sup>0</sup>c.

**Table.4. flash & fire test**

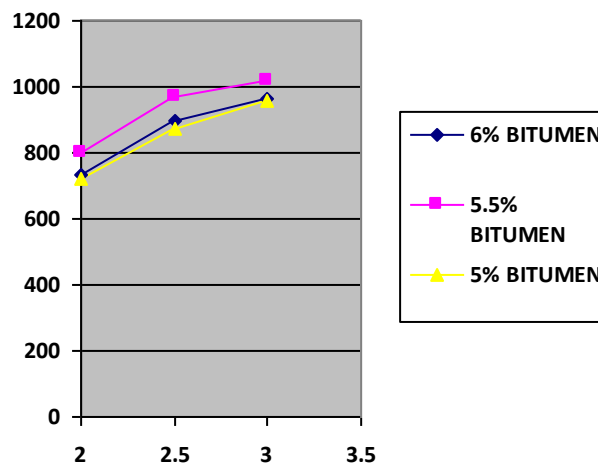
SL NO	% of polymer in bitumen	polyethylene		Polypropylene	
		Flash point	Fire point	Flash point	Fire point
1	0.25	280	340	320	345
2	0.5	290	350	330	340
3	0.75	295	330	333	338
4	1.00	340	350	342	335

**5. MARSHAL STABILITY TEST:**

**Table.5. Marshal Stability test**

SL NO.	Bitumen added (%)	Plastic added (%)	Stability (kg)
1	6	2	735
		2.5	897
		3	963
2	5.5	2	798
		2.5	970
		3	1020
3	5	2	720
		2.5	872
		3	955

Stability on y-axis, plastic in gm on x-axis



**3. CONCLUSIONS**

- 1 plastic will increase the melting point of the bitumen.
- 2 This innovative technology not only strengthened the road construction but also increased the road life.
- 3 Plastic would be boon for Indian's hot and extremely humid climate, where temperature frequently cross 50<sup>0</sup>c.
- 4 Waste plastic can be used as coating materials in bituminous concrete mixture for road construction.
- 5 Properties of BC can be further improved used of waste plastic.
- 6 Help to improve the environment.
- 7 This small investigation not only utilize beneficially, the waste non-degradable plastic but also provides us an improved with better strength and longer life period.

**4. REFERENCES**

- [1]. Rebound Deflection / Benkelman Beam;IRC:81-1997
- [2]. Dr.Vasudevan and S Rajasekaran,(2007). ‘Utilization of waste plastic in construction of Flexible pavement (Reuse of waste plastic –apath-breaking initiative)’
- [3]. Verma S S (I.C.J.), (2008).’Roads from plastic waste’
- [4]. Sundaram and Roja,(2008)’The use of recycled material in highway construction’
- [5]. Unevenness/Roughness; Source IRC: SP: 16-2004
- [6]. V.S.Punith,(2001) ‘Study of the effect of plastic modifier on bituminous mix properties’
- [7]. Use of “Waste plastic in construction of Flexible pavement .
- [8]. Use of waste Plastic as a strength Modifier in surface Course of flexible and Rigid Pavements.
- [9]. Use of plastic in construction of bituminous road.
- [10]. Use of waste plastic and waste rubber tyres in flexible highway pavement.