

# UTILISATION OF WASTE PLASTIC IN BITUMINOUS MIXES FOR ROAD CONSTRUCTION

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## ABSTRACT

Now a days usage of plastic increasing day by day in our daily life which leads to more amount of production of plastic. Due to this many of the waste plastic produced in an environment. As it is non-biodegradable many of the waste remains in the environment. This causes various environmental problems. Therefore, it is necessary to utilize wastes effectively with technical development in each field. Many products use wastes of plastic as coating over aggregate and this can also be used for road construction. The mix polymer coated aggregate and tyre modified bitumen have shown their higher strength. By mixing this with wastes of plastic can also be used for road construction. In this project we are going to discuss in detail about the successful use and its applications.

## I. INTRODUCTION

Bitumen is used as binder for construction . Different grades of bitumen like 30/40, 60/70, 80/100 are available on the basis of their penetration values. The intense increase in commercial and non-commercial and increase in traffic in the road demands for improved roads. For the improvement of the roads there must also be improved binder is also needed.



Traditionally soil, stone aggregates, sand, bitumen, cement etc. are used for construction. These minerals are exhaustible in nature, its quantity declines gradually. And 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 products is one such category. If these materials can be suitably utilized in highway construction, the pollution and disposable problems may partly reduced.



One of the alternative ways is to mix wastes plastics with bitumen as it has several benefits. It gives more durability to those materials used for road constructions and also decreases the pollution caused by plastics. These waste plastics are either mixed with Municipal Solid Waste and/or thrown over land area. This have certain impact on the environment. Thus alternative use of waste plastics is also needed. The waste polymer bitumen blend can be prepared and the study of the properties can throw more light on their use of road laying.

## II. WASTE PLASTICS – AS BINDER AND MODIFIER :

Waste plastics on heating soften at around 130 degree C. thermo gravimetric analysis has shown that there is no gas evolution in the temperature range of 130-180 degree C. Moreover the softened plastics have a binding property. Hence, the molten plastics materials can be used as a binder and they can be mixed with binder like bitumen to enhance their binding property. This may be good modifier for the bitumen, used for road construction.

## III. DIFFERENT TYPES O WASTE PLASTIC (POLYMER) AND ITS ORIGIN:

Type of waste plastic(polymer)	origin
Low density polythene(LDPE):	bags, sacks, bin lining and squeezable detergent bottles etc.
High density polythene(HDPE):	bottles of pharmaceuticals, disinfectants, milk, fruit juices, bottles caps etc.
Polypropylene(PP):	bottle cap and closures, film wrapping for biscuits, microwave trays for ready-made Meals etc.
Foamed Polystyrene:	food trays, egg boxes, disposable cups, protective packaging etc.
Polyvinyl Chloride(PVC):	mineral water bottles, credit cards, toy, pipes and gutters; electrical fittings, furniture, folders and pens; medical disposables; etc.

## IV. CHARACTERIZATION OF WASTE PLASTICS:

**THERMAL STUDY:** Thermal behavior of the polymers namely PE, PP and PS is shown in Table1.

**Table 1. Thermal Behavior of Polymers**

Polymer	Solubility		Softening Temp in Deg. C	Products reported	Decomposition Temp Deg. C	Ignition Temp Deg. C
	Water EPT*					
PE	Nil	Nil	100-120	No gas	270-350	>700
PP	Nil	Nil	140-160	No gas	270-300	>700
PS	Nil	Nil	110-140	No gas	300-350	>700

## V. BINDING PROPERTY

The molten plastics waste exhibits good binding property. Various raw materials like granite stone, ceramics etc... were coated with plastics and then molded into a stable product. On cooling, it was tested for compression and bending strengths.

**Table 2. Binding Property**

The increase in the value of the compression strength and bending strength shows that the plastics can be used

Percentage of plastics coating over aggregate	Compression strength (Tones)	Binding Strength (kg)
10	250	325
20	270	335
25	290	350
30	320	390

as a binder.

## VI. CONCEPT OF UTILISATION OF WASTE PLASTIC IN BITUMINOUS MIXES FOR ROAD CONSTRUCTION:

The Concept of Utilization of waste Plastic in Bituminous Mixes for road construction has been done since 2000 in India. These technologies are reviewed below :

## VII. MATERIAL USED

### Aggregate :

- Aggregate of 20mm,10mm.
- Stone dust and Lime Fillers.



**Bituminous:**

- 60/70,80/100 grade bitumen.



**Waste Plastic:**

- Waste plastic in the shredded form

**METHODOLOGY:**

- Segregation.
  - Cleaning Process.
1. Shredding and mixing of bituminous.
  2. Laying of bituminous mix

**Segregation:**

3. Plastic waste collected from various
4. source (roads, garbage trucks, dumpsites
5. etc.) must be separated from other waste.



**Cleaning Process:**

6. Waste plastic litter are sorted, de-dusted
7. and washed if necessary.



### **VIII. SHREDDING AND MIXING OF BITUMINOUS**

Different types of plastic wastes are mixed together cut into small pieces and shredded using shredded machine. The aggregate is heated upto 160 C in central mixing plant. Similarly bituminous is also heated up to 160C.



### **IX. LAYING OF BITUMINOUS MIX**

The plastic waste coated aggregate mixed with hot bitumen and the result mix is used for road construction. The road laying temperature is between 110°C to 120°C. The roller used is 8-tons capacity.

### **X. MARSHALL TEST**

Laboratory studies were carried out at the Centre for Transportation Engineering of Bangalore University on the possible use of the processed plastic bags as an additive in bituminous concrete mixes. The material used in the study was supplied by M/s KK Poly Flex (P)Ltd, Bangalore. The processed plastic was used as additive with heated bitumen in different proportions (ranging from zero to 12% by weight of bitumen) and mixed well by hand, to obtain the modified bitumen.

The properties of the modified bitumen were compared with ordinary bitumen. It was observed that the penetration and ductility values of the modified bitumen decreased with the increase in proportion of the plastic additive, up to 12% by weight. The softening point of the modified bitumen increased with the addition of plastic additive up to 8% by weight.



**XI. COMPARISON BETWEEN ORDINARY BITUMINOUS ROAD AND WASTE PLASTIC BITUMINOUS ROAD**

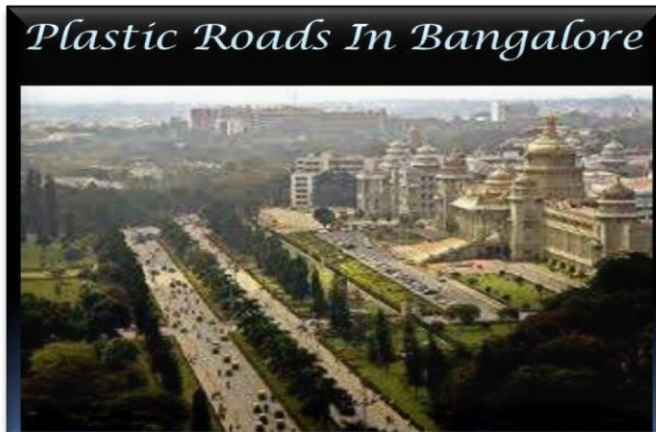
SL.NO.	PROPERTIES	PLASTIC ROAD	ORDINARY ROAD
1.	MARSHALL STABILITY VALUE	MORE	LESS
2.	BINDING PROPERTY	BETTER	GOOD
3.	SOFTENING POINT	LESS	MORE
4.	PENETRATION VALUE	MORE	LESS
5.	DURABILITY OF ROADS	BETTER	GOOD
6.	MAINTENANCE COST	ALMOST NIL	MORE
7.	ENVIRONMENT FRIENDLY	YES	NO

**XII. ADVANTAGES OF WASTE PLASTIC BITUMINOUS**

- ✚ Stronger road with increased Marshall Stability Value.
- ✚ Better resistance towards rain water and water stagnation.
- ✚ No stripping and no potholes.
- ✚ Increase binding and better bonding of the mix.
- ✚ Reduction in pores in aggregate and hence less rutting and travelling.
- ✚ No leaching of plastics.

**XIII. SOME ROADS OF INDIA USED OF WASTE PLASTIC IN BITUMINOUS**





#### XIV. CONCLUSION

1. The addition of waste plastic modifies the properties of bitumen.
2. The modified bitumen shows good result when compared to standard results.
3. The optimum content of waste plastic to be used is between the ranges of 5% to 10%.
4. The use of these technology not only strengthened the road but also increase durability of road as well as help to improve the environment and also creating source of income.
5. Hoping that in future we will have strong, durable and eco friendly roads which will relieve the earth from all type of plastic waste.

#### REFERENCE

1. Ministry of Road Transport and highways manual for construction and supervision of bituminous works, New Delhi, November 20001.
2. Sri Ram Institute for Industrial Research, Plastics Processing and Environmental Aspects, New Delhi -7
3. Vasudevan, R., Utilization of waste plastics for flexible pavement, Indian High Ways(Indian Road Congress), Vol 34,no.7.(July 2006).