

## Use of Plastic Waste in Road Construction

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### ABSTRACT:

The generation of waste plastics is increasing day by day. The growth in various types of industries together with population growth has resulted in enormous increase in production of various types of waste materials, world over. Generally these wastes are non biodegradable. On the other side, the road traffic is increasing. The load bearing capacities of the road are to be increased. Our present work is helping to take care of both these aspects. Plastic waste, consisting of carry bags, cups and Thermopolis can be used as a coating over aggregate and this coated stone can be used for road construction. The main aim of this study is to focus on using the available waste/recycled plastic materials and waste rubber tyres present in abundant which can be used economically and conveniently. The use of these materials as a road construction proves eco- friendly, economical and use of plastic will also give strength in the sub-base course of the pavement. This process is socially highly relevant, giving better infrastructure.

**Keywords:** Plastic Waste, Bitumen, Aggregates, Plastic Road.

### 1. INTRODUCTION:

Plastics like polythene, bottles, garbage bags, milk bottles etc have become the very important part of life that's why waste plastics pollution is increasing which hazardous to environment. Plastics are durable and degrade very slowly; the chemical bonds that make plastic so durable make it equally resistant to natural processes of degradation. Plastics can be divided in to three major categories: thermoses, elastomers and thermoplastics. A thermo set solidifies or "sets" irreversibly when heated. They are useful for their durability and strength, and are therefore used primarily in automobiles and construction applications. These plastics are polyethylene, polypropylene, polyamide, polyoxymethylene, polytetrafluorethylene, and polyethyleneterephthalate. Elastomers are usually thermosets but may also be thermoplastic. The molecular structure of elastomers can be imagined as a meatball structure. These are also used on automobiles .A thermoplastic softens when exposed to heat and returns to original condition at room temperature. Thermoplastics can easily be shaped and moulded into products such as milk jugs, floor coverings, credit cards, and carpet fibres. These plastic types are known as phenolic, melamine, unsaturated polyester, epoxy resin, silicone, and polyurethane.

Under this circumstance, an alternate use for the waste plastics is also the needed..Plastic waste when mixed with hot bitumen, plastics melt to form an oily coat over the aggregate and the mixture is laid on the road surface like a normal tar road. In the construction of flexible pavements, bitumen plays the role of binding the aggregate together by coating over the aggregate. It also helps to improve the strength of the road. A common method to improve the quality of bitumen is by modifying the rheological properties of bitumen by blending with organic synthetic polymers like rubber and plastics. Use of plastics in flexible pavement then its increase the marshal stability of road by approx three times as comparison to normal flexible pavement road. Plastic road is also economical than normal road by Rs.110 per cube meter (as 2001 data).

## 2. METHODOLOGY

Waste plastic bags were collected from roads, garbage trucks, dumpsites and compost plants, rag-pickers, waste-buyers at Rs 5-6 per kg. Household plastic was also collected for the project work, like empty milk bags, used plastic bags etc. The collected Plastic waste was sorted as per the required thickness. Generally, polyethylene of 60 micron or below is used for the further process. Less micron plastic is easily mixable in the bitumen at higher temperature (160°C-170°C). It is clean by de-dusting or washing if required. Collected Plastic was cut into fine pieces as far as possible. The plastic pieces were sieved through 4.75mm sieve and retaining at 2.36mm sieve was collected. Firstly, Bitumen was heated up to the temperature about 160°C-170°C which is its melting temp. Pieces were added slowly to the hot bitumen of temperature around 160-170°C. The mixture was stirred manually for about 20-30 minutes. In that time period temperature was kept constant about 160-170°C. Polymer-bitumen mixtures of different compositions were prepared and used for carrying out tests i.e. Penetration test, Ductility test.

The bio-medical syringe plastic waste needed for the work was collected from a private organization.

### 2.1. TEST ON AGGREGATE

- Aggregate crushing value test
- Aggregate impact value test
- Specific gravity test
- Water absorption test
- Los Angeles abrasion test

### 2.2. TEST ON BITUMEN

- Penetration Test
- Softening Point Test
- Ductility Test
- Viscosity
- Flash Point and Fire Point

## 3. Materials used:

### 3.1) AGGREGATE:

- Aggregate of 20mm, 10 mm
- Stone Dust and Lime as Filler

### 3.2) BITUMEN:

- 60/70, 80/100 grade bitumen .

### 3.3) WASTE PLASTIC:

- Waste plastic in the shredded form

Type Of Plastic	Chemical Formation	Density (gm/cm <sup>3</sup> )	Softening point
Low Density Poly-ethylene Plastic (LDPEP)	(-CH <sub>2</sub> -CH <sub>2</sub> -) <sub>n</sub>	0.9 to 0.95	100° C to 120° C
High Density Poly-ethylene Plastic (HDPEP)	(-CH <sub>2</sub> =CH <sub>2</sub> -) <sub>n</sub>	0.95 to 0.96	120° C to 130° C

#### 4. TEST OF BITUMEN

Test	Result	Ranges
Ductility Test	77.50 cm	Min 40
Penetration value	63 mm	60-70 mm
Viscosity value	50.1 sec	-
Softening Point	48.25 <sup>0</sup> C	45- 600C
Flash Point Test	280 <sup>0</sup> C	>65 <sup>0</sup>
Fire Point Test	302 <sup>0</sup> C	175 <sup>0</sup> C

#### 5. CONCLUSION:

Plastics will increase the melting point of the bitumen. The use of the innovative technology not only strengthened the road construction but also increased the road life as well as will help to improve the environment and also creating a source of income. Plastic roads would be a boon for India's hot and extremely humid climate, where temperatures frequently cross 50°C and torrential rains create havoc, leaving most of the roads with big potholes. It is hoped that in near future we will have strong, durable and eco-friendly roads which will relieve the earth from all type of plastic-waste.

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