



Renovation of Plastic Waste with Plastic Road

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Abstract:

Plastics are the non-biodegradable materials it degrade our environment. Plastic waste is a big nuisance in today's world. So, this plastic waste should be reused to eliminate the threat to the surroundings. One such reuse can be in the construction of flexible pavements. Plastic coated aggregates have proved to offer better resistance to abrasion and wear and tear. Moreover the bond between these plastic coated aggregates and the bitumen is also very strong due to increased contact area between plastic (polymers) and bitumen. Such roads show better performance and have increased life spans. This makes the recycle of plastic in an efficient manner.

Keywords: *Plastic waste, aggregates, bitumen, Cost*

Introduction:

In India, Chennai was among the first cities globally to adopt the technology in a big way when the municipality commissioned 1000 km of plastic roads in 2004. The first plastic road in Tamil Nadu was laid down in Kambainallur, a Panchayat Town of the Dharmapuri district as per the guidelines of then Chief Minister. Plastic wastes include polyethenes, disposable cups, and bottles that are collected from garbage dumps. Australia, Indonesia, India, the United Kingdom, the United States have trailed technologies that can incorporate plastic waste into an asphalt mix. It is light in weight, moisture resistant, flexible and very inexpensive. Based on the present usage scenario of plastics waste, its complete ban will not be justified; hence we have to find the alternatives to reuse the plastics.

Today every sector around the world from agriculture to electrical, packing, automobile, building construction, communication sector are widely using plastic. The usage was started after the industrial revolution and its large scale production seemed to be cheap. Generally plastic is a non-biodegradable and many research found that plastic take around 4500 years to degrade. Several studies proven that the disposal of plastic causes many



health problems and also reduces the fertility of soil. The plastic production over the world has crossed 400 million tons and the recycling of plastic is only 10%. Various experiments are being conducted in order to improve the properties of bituminous road. The recent advancement in that study is use of waste plastic in road construction.

Need of the Study:

- Disposal of waste plastic is a major problem.
- It is non-biodegradable.
- It mainly consists of low-density polyethylene.
- Burning of these waste plastic bags causes environmental pollution.

Objective of Study:

- To reduce the cost of making roads
- Use higher percentage of plastic waste
- To reduce the need of bitumen by around 10%
- To increase shelf life of Indian roads
- To reduce accidents on roads
- To reduce plastic waste in India and Step towards sustainable environment.

Generation of plastic waste:

In India Amount of waste plastic in (2022)

- 3.46 lakhs Million Tonnes Annually
- 25,940 tonnes every day

Government expenditure on construction of roads: Rs. 60,261 Crores (51%)

Estimation of Cost:

Bitumen Required for New Normal Road

Total cost of Bitumen = Rs.42

Bitumen + Plastic Required for New Plastic Road

Total Cost of waste plastic = Rs.12 (Cost waste Plastic + Cost of Processing)

Process /Material used for plastic road:



Comparison between waste plastic road V/s ordinary Bituminous road:

Waste Plastic Bituminous Road V/s Ordinary Bituminous Road			
Sr. No.	Properties	Plastic Road	Ordinary Road
1.	Marshal Stability Value	More (200-300%)	x Less (25%)
2.	Binding Property	Better	x Good
3.	Softening Point	Less	x More
4.	Penetration Value	More	x Less
5.	Tensile Strength	High	x Less
6.	Rutting	Less	x More
7.	Stripping (Pot Holes)	No	x More
8.	Seepage of water	No	x yes
9.	Durability of roads	Better	x Good
10.	Cost of Pavement	Less	x Normal
11.	Maintenance Cost	Almost Nil	x More
12.	Environment Friendly	Yes	x No.



Advantages of Plastic Road:

- Disposal of waste plastic will no longer be a problem.
- The up gradation cost is less compared to normal roads.
- The cost of road construction also reduced.
- Plastic roads have less moisture absorption than normal roads.
- Better resistance towards rain water and water stagnation.
- Increases binding strength of the aggregate and bitumen.
- The strengthen of the road is increased by 100%.
- The maintenance cost of road is almost nil.
- Reduced construction time on site.
- Boost National Economy

Disadvantages of Plastic Road:

- These micro plastics can also absorb other pollutants.
- Pure plastic roads require use of compatible plastics.
- Plastics in the road can break down into micro plastics .
- Every time maintenance is performed on these modular roads the flow of power, water, and internet that has been installed within will be interrupted.

Present Status of use of Plastics for Roads:

The process of using plastics for road construction gained momentum in 2015, when Union government issued guidelines on plastic use with hot mixes for bitumen roads around urban areas. The Ministry of Road Transport and Highways has issued guidelines for use of plastic waste in wearing course of National Highways on pilot basis. The plastic waste has been used in the state of Tamil Nadu for about 11 Km length and about 1 Km length in the state of Kerala. Subsequently, India has built one lakh kilometres of roads in at least 11 states using discarded plastic. The front runners have been following cities:

- Chennai
- Pune
- Surat
- Indore

Case Study:

Samriddhi Mahamarg Used 55,49,060 metric tonne cement & steel (701 Km)

**Conclusion:**

Plastics will increase the melting point of the bitumen. The use of the innovative technology will not only strengthen the road construction but also make it economical as well as increase the life span of roads. Plastic roads will be most feasible for a country like India, where temperature is around 50°C and leaving the roads with potholes. It also boosts to Indian economy with use of the innovative technology. Hence, the use of waste plastics for pavement is one of the best methods for easy disposal of waste. The composition of plastic roads mainly depends on the percentage of plastic used, grade of bitumen and size of aggregate. It is suggested to use an aggregate of size 10mm - 20mm, 60/70, 80/100 grade of bitumen and maintaining the laying temperature between 110°C to 120°C. As the percentage of plastic increases softening point, flash point and fire point increases whereas penetration value and ductility decreases. From the experimental results the percentage of plastic is given as 10%. The porosity should be less than 2%. Due to this porosity the air is accumulated in bitumen and it causes oxidizing of bitumen. This makes bitumen hard. The coating of plastic reduces the porosity. Also stone dust and lime are used as filler materials. The Impact value and Los Angeles abrasion value decreases with increase in percentage of plastic.



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