Cost Comparison Plastic Road with Regular Bitumen Road

1Akshar Patel, 2Shweta J Chahan, 3Brijen Prajapati, 4Nilay Kanojia
1Assistant Professor, 2,3,4Students
Sardar Patel College of Engineering
Bakrol (Anand) India

ABSTRACT: The population growth, industrialization, consumerism and scientific development have led to the uncontrollable accumulation of waste. Proper waste disposal is of great importance in both pastoral and metropolitan areas. This study discussed the suitability of plastic waste materials for pavement construction. The waste is mixed in different proportions to the soil sample and their influences on geotechnical properties were studied. The results of the tests indicated that plastic alone is not suitable for pavement subgrade. When quarry dust was added along with soil plastic mix, it maintains the CBR value within the required range.

KEYWORDS: Plastic, Bitumen, Atterberg’s limit, HRS Specification, CBR Value

INTRODUCTION
The rate of production of waste has increased tremendously in almost all parts of the world in the past few decades. The quantities of these waste that are accumulating, are causing serious disposal problems. The conservative methods of disposal are found to be inadequate. Due to population growth, industrialization, consumerism and technological development there has been a tremendous increase in the rate of production of waste. Every year, 7.2 million tons of hazardous waste is produced and its disposal is becoming a major issue and about one km² of additional landfill area is needed every year. Indian government spends about Rs 1600 crore for treatment & disposal of these wastes. In addition to this, industries release about 150 million tons of high volume low hazard waste every year, which is mostly dumped on open low lying land areas. In this situation, the conventional waste disposal methods are found to be derisory. Through this project, a small attempt has been made at deducing a new technique of waste disposal. This paper aims at proposing a new method of disposal of plastic, quarry dust, and tyre waste by using them in the sub-grade soil of pavement. The Main objective of this study are safe and prolific disposal of wastes - plastic, quarry dust, and tyre, the study of index properties and CBR values of variable mixes of soil and waste and suitability of soil-waste mix in sub grade.

Basic process
Waste plastic is ground and made into powder; 3 to 4 % plastic is mixed with the bitumen. Plastic increases the melting point of the bitumen and makes the road retain its flexibility during winters resulting in its long life. Use of shredded plastic waste acts as a strong “binding agent” for tar making the asphalt last long. By mixing plastic with bitumen the ability of the bitumen to withstand high temperature increases. The plastic waste is melted and mixed with bitumen in a particular ratio. Normally, blending takes place when temperature reaches 45.5°C but when plastic is mixed, it remains stable even at 55°C. The vigorous tests at the laboratory level proved that the bituminous concrete mixes prepared using the treated bitumen binder fulfilled all the specified Marshall mix design criteria for surface course of road pavement. There was a substantial increase in Marshall Stability value of the BC mix, of the order of two to three times higher value in comparison with the untreated or ordinary bitumen. Another important observation was that the bituminous mixes prepared using the treated binder could withstand adverse soaking conditions under water for longer duration.

Types of plastic
1. Thermosets.
2. Elastomers.
3. Thermoplastics.

COST ESTIMATION
The Cost of Waste Plastics: Rs.7 / Kg.
The Cost of Processing: Rs.5 / Kg.
The Total cost of Waste Plastics: Rs.12 / Kg.[5]

• Optimum percentage of plastic in the blend as per the test results is around 8% (% Wt. of bitumen)
• Generally roads in India are constructed in basic width of 3.0 m, 3.75 m and 4.0 m.
• Consider 1 Km length road of width 3.75 m. it uses bitumen approx. 21300 Kg. For new work and 11925 Kg.

For Up-gradation,
The Cost of Bitumen: Rs.8400 / Drum (200 Kg.)[6]
The Cost of Bitumen: **Rs.42 / Kg.**

1. **Cost of New Road / Km including BBM, Carpet, and Seal Coat:** Rs. 18,95,000/

   → Bitumen required for work (approx.): **21,300 Kg. / Km**
   → Cost of bitumen in new work: **Rs.8,95,000 / Km.**
   → Waste plastic, co-processed with bitumen for PMB (8% by Wt.): **Rs.1,704 / Kg.**
   → Cost of waste plastic used: **Rs.20,450 / Kg.**
   → Cost of Bitumen saved (1704 Kg. equivalent to plastic used): **Rs.71550**
   → Total savings per Km.: **Rs. 51,100**

   • Cost of Road (Up gradation)/km including Carpet and Seal Coat: **Rs. 10, 80,000**

     → Bitumen Required for work (approx.): **11925 Kg. / KM.**
     → Cost of bitumen in repairs (Up gradation) per Km.: **Rs. 5,01,000/-**
     → Waste plastic, co processed with bitumen for PMB (8% by Wt.): **954 Kg.**
     → Cost of waste plastic used: **Rs. 11450**
     → Cost of Bitumen saved (954 Kg. equivalent to plastic used): **Rs.40,050**
     → Total savings per Km.: **Rs.28,600**

   • Optimum amount of waste plastic used in dry process: **10% (by Wt. of aggregates)**

     → The Amount of aggregates used in road construction (1 Km length x 3.75 m width): 3750 sqm x 12.5 Kg per sqm (Avg.) = **46875 Kg.**
     → Therefore Amount of waste plastic used in the road (10% by Wt.): **4687.5 Kg.**

2. **Total Amount of waste plastic** used in road construction using both the processes together (i.e. Combination of wet process & dry process): **1704 + 4687.5 = 6391.5 Kg**

3. **Total Cost of waste plastic** used in road using mix process: **Rs.76,700**

4. **Extra cost** for construction of road (Cost of waste plastic used in road construction – Total savings using modified bitumen): **76,700 – 51,100 = Rs.25,600 / Km**

**REFERENCES**

2. Mercy Joseph Poweth, Solly George, Jessy Paul, the study of the use of plastic waste in road construction.
5. M/S Sahu Polymers , Akola , Maharashtra, India.
6. Sales Officer, Hpcl , Akola, Maharashtra, India.