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Use of Plastic Waste in Road Construction for Sustainable Development

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Abstract: *The quantum of plastic waste in municipal solid waste (MSW) is increasing due to increase in population, urbanization, development activities and changes in life style which leading widespread littering on the landscape. This waste plastic partially replaced the conventional material to improve desired mechanical characteristics for particular road mix. In the present paper develop technique to use plastic waste for construction purpose of road and for its sustainable development. In conventional road making process bitumen is used as binder. This waste plastic modified bitumen mix so better binding property, stability, density and more resistance to water. The plastics were shredded and blended with the bitumen in situ with a shear mixer at a temperature range of 160 C – 170 C. Basic rheological parameters such as penetration, ring & ball softening point and viscosity tests were employed to determine the resulting changes from base bitumen.*

Keywords: MSW, Plastic waste, Bitumen Mix, Shear Mixer, Binding property.

I. INTRODUCTION

The threat of disposal of plastic will not solve until the practical steps are not initiated at the ground level. It is possible to improve the performance of bituminous mixed used in the surfacing course of roads. Studies reported in the used of re-cycled plastic, mainly polyethylene, in the manufacture of blended indicated reduced permanent deformation in the form of rutting and reduced low – temperature cracking of the pavement surfacing. The field tests withstood the stress and proved that plastic wastes used after proper processing as an additive would enhance the life of the roads and also solve environmental problems. Plastic is a very versatile material. Due to the industrial revolution, and its large scale production plastic seemed to be a cheaper and effective raw material. Today, every vital sector of the economy starting from agriculture to packaging, automobile, electronics, electrical, building construction, communication sectors has been virtually revolutionized by the applications of plastics. Plastic is a non-biodegradable material and researchers are found that the material can remain on earth for 4500 years without degradation. Several studies have proven the health hazard caused by improper disposal of plastic waste. The health hazard includes reproductive problems in human and animal, genital abnormalities etc., Looking forward the scenario of present life style a complete ban on the use of plastic cannot be put, although the waste plastic taking the face of devil for the present and future generation.

We cannot ban use of plastic but we can reuse the plastic waste.

II. LITERATURE SURVEY

- 1) Dr. R.Vasudevan and S. Rajasekaran, (2007) Bituminous mixes used in the surface course of the bituminous pavements are being improved in their performance by incorporating various types of additives to bitumen such as rubber latex, crumb rubber, styrene, butadiene styrene, styrene – ethylene –butylenes, recycled Polypropylene , low density polyethylene, Polyethylene, Ethylene vinyl acetate (EVA) (5%) and polyolefin.
- 2) Sundaram & Rojasay (2008) studied the Effective blend technique for the use of plastic waste into bitumen for road laying and Polymer-bitumen mixtures of different compositions were prepared and used for carrying out various tests.
- 3) Verma S.S. (2008) Concluded that Plastics will increase the melting point of the bitumen. This technology not only strengthened the road construction but also increased the road life.
- 4) Prof.C.E.G. Justo states that addition of 8.0 % by weight of processed plastic for the preparation of modified bitumen results in a saving of 0.4 % bitumen by weight of the mix or about 9.6 kg bitumen per cubic meter (m³) of BC mix. Modified Bitumen improves the stability or strength, life and other desirable properties of bituminous concrete mix. Aggregate is one of the most important materials used for flexible pavement construction. Properly selected and graded aggregates are mixed with bitumen to form hot mix asphalt (HMA) pavements.
- 5) Ms. Apurva Chavan (2013) says that using plastic waste in mix will help reduction in need of bitumen by around 10%, increase the strength and performance of road, avoid use of anti-stripping agent, avoid disposal of plastic waste by incineration and land filling and ultimately develop a technology, which is eco-friendly.



III. METHODOLOGY

A. Overview

We will collaborate with Hot Mix Plant located in Yerwada, with their help we will make 5 different mixes with change in bitumen content and perform different laboratory tests. Based on these tests, we will conclude regarding the suitability of plastic as an ingredient.

B. Steps

- 1) *Step 1:* Plastic waste like bags, cups, bottles made out of cut into Step 1 a size between 2.36mm and 4.75mm using shredding machine.
- 2) *Step 2:* The aggregate mix is heated to 165°C and transferred to mixing chamber. Amount of plastic to be added is 6 to 10% of bitumen.
- 3) *Step 3:* Similarly the bitumen is to be heated up to a maximum of 160°C to have good binding and to prevent weak bonding. (Monitoring the temperature is very important).

C. Merits Of Plastic Road

- 1) Stronger road with increase Marshall Stability Value.
- 2) Better resistance towards rain water and water stagnation.
- 3) No stripping and potholes and reduction in pores in aggregate.
- 4) Increase binding and better bonding of the mix.

D. Demerits Of Plastic Road

- a) Cleaning process toxics present in the co-mingled plastic waste would start leaching.
- b) During the road laying the presence of chlorine will definitely release noxious HCL gas.
- c) Micro Plastics pose a danger to the environment, as they are impossible to eliminate and they have long decomposition rate.

IV. CONCLUSION

- A. Evidence of Better Performance of the Plastic Tar Roads, the performance studies carried out on our specimen indicated satisfactory performance with good skid resistance, good texture value, stronger and less amount of progressive unevenness over a period of time.
- B. 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, leaving most of the roads with big potholes.

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