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USE OF WASTE PLASTIC IN PAVEMENT CONSTRUCTION

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ABSTRACT

Use of plastic along with the bitumen in construction of roads not only increases it's life and smoothness but also makes it economically sound and environment friendly. Plastic waste is used as modifier of bitumen to improve some of bitumen properties roads that are constructed using plastic waste known as plastic roads and are found to perform better compared to those constructed with conventional bitumen. Further it has been found that such roads were not subjected to stripping when come in contact with water. In this paper the use of higher percentage of plastic waste reduces the need of bitumen by 10%. It also increases the strength and performance of the road. Plastic increases the melting point of bitumen and hence mixing can be done in more better and easier way. Plastic waste replaces 10% to 15% of bitumen. Inclusion of plastic waste in road construction eliminates the plastic shrinkage cracking of road surface and reduces the drying shrinkage to some extent.

I.INTRODUCTION

Plastic is everywhere in today s lifestyle. The main problem is what do with the plastic waste. Use of plastic waste which is non biodegradable is rapidly growing and researches have found that the material can remain on earth for 4500 years unchanged and without degradation. This threat of disposal of plastic will not solve itself and certain practical steps have to be initiated at the ground level. On the other hand the road traffic is increasing with time hence there arises a need to increase the load bearing capacities of roads.

In construction of Asphalt pavement, hot bitumen is coated over stone aggregates mixed, laid and rolled. Butwhen the stagnation of water takes place over roads, it penetrates forming depressions called Potholes. Certain anti stripping agents are used but these have limited use and the cost of construction increases. The use of plastic waste for coating aggregates of the bituminous mix found to improve the performance of the pavement improving abrasion, slip resistance and increased the durability and fatigue life. Bituminous mix with recycled plastics mainly LDPE replacing 30% of 2.36 - 5mm aggregates showed 250% increase in Marshall stability and the mix density reduced to 16% and in addition to it the Indirect Tensile Strength (ITS) was also improved. On heating at 100-160'C polythene, polypropylene and polystyrene soften and exhibit good binding properties, blending it with bitumen results in a mix which is suitable for road laying. In Maharashtra 1,500 km of road have been laid by the above mix and other states including Tamil Nadu, Andhra Pradesh, Karnataka,

Pondicherry, Kerala have also laid test roads which have successfully withstood loads due to heavy traffic, rain and temperature variation

II. OBJECTIVES

Basic intention is to efficiently utilize the waste plastic in constructive way so that it can be beneficial to society however main objectives of current project work are:

- To coat the aggregates with the waste plastic materials
- To check the properties of bituminous mix specimen
- To check the properties of bituminous mix specimen due to coating of waste plastic materials
- To evaluate properties of Plastic coated aggregates (PCA) and comparing it to conventional aggregates.
- To determine optimum bitumen content (OBC) of Bituminous Concrete Mix and Optimum plastic content (OPC) by adding thin plastic (by weight of OBC) to obtain plastic coated aggregates for Bituminous Concrete Mix (Dry Method) by Marshal method of mix design and comparing it with conventional Bituminous Concrete Mix.
- To evaluate the Marshal stability, Flow value and volumetric properties bituminous Concrete (BC) Mix by Marshal method of mix design.

III.MATERIALS

- Aggregates.
- Bituminous Binder.
- Mineral Filler.
- Plastic waste material (LDPE).

Fig 1

IV.PREPARATION OF DESIGN MIX

4.1 MIXING PROCEDURE AT HOT MIX PLANT

Step I: Plastics waste like bags, bottles made out of PE and PP cut into a size between 2.36 mm and 4.75mm using shredding machine. Care should be taken that PVC waste should be eliminated before it proceeds into next process.

Step II: The aggregate mix is heated to 1650C and then it is transferred to mixing chamber.
Similarly the bitumen is to be heated up to a maximum of 1600C. This is done so as to obtain a good binding and to prevent weak bonding. During this process monitoring the temperature is very important.

Step III: At the mixing chamber, the shredded plastics waste is added over the hot aggregate. It gets coated uniformly over the aggregate within 30 to 45 seconds. It gives an oily coated look to the aggregate.

Step IV: The plastics waste coated aggregate is mixed with hot bitumen. Then this final resulted mix is used for laying roads. The road laying temperature is between 110oC 120OC. The roller used should be of is 8-ton capacity.

4.2 MIXING BY MINI HOT MIX PLANT

Step I: Plastic waste made out of PE, PP and PS cut into a size between 2.36mm and 4.75mm using shredding machine.

Step II: Similarly the bitumen is to be heated to a maximum of 1600C to have good binding and to prevent weak bonding. (Monitoring the temperature is very important)

Step III: At the mixing chamber the shredded plastic waste is to be added to the hot aggregate. It gets coated uniformlyover the aggregate within 30 Secs, giving an oily look Plastic coated aggregate is obtained.

Step IV: Hot bitumen is then added over the plastic coated aggregate and the resulting mix is used for road construction. The road laying temperature is between 1100C to 1200C. The roller used is 8-ton capacity.

4.3 MIXING BY CENTRAL MIXING PLANT (CMP)

The dry process can also be carried out using central mixing plant. The shredded plastic is added along with the aggregate in the conveyor belt. This is transferred into the hot cylinder. There aggregate is coated with plastic first and then with the bitumen. The mixer so prepared is then loaded in the dipper lorry and transported for road

laying. CMP helps to have better control of temperature and better mixing of this material thus helping to have a uniform coating.

V. CONCLUSION

- The innovative technology not only strengthened the road condition but also increased the road life.
- Plastic will increase the melting point of the bitumen.
- It also help to improve the environment and also creating a source of income.
- Avoid disposal of plastics waste by incineration and land filling.
- Develope a technology which is ecofriendly.
- Increase the strength and performance of road.
- Reduce the cost of project
- Reduce the need of bitumen by around 10%.

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