

Use of Plastic in Flexible Pavement

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Abstract— The use of plastic and related materials is increasing day by day due to grisly growth in population and over garbage and urbanization and changed life style leads to widespread littering of plastic on the landscape. Disposal of waste plastic is a serious problem globally due to their non-biodegradability and dangerous to human health, since these are not disposed scientifically and thus, create land and water pollution and air pollution after burning. Plastic is a curse to mankind but we used as a boon for mankind by using it as additives in road construction, it will proved to be the best solution over bad road condition. These days the techniques had been developed to use plastic waste for construction of bituminous roads and flexible pavements. In general bitumen is used as binder in road construction. Binding properties of this bitumen can be modified by mixing it with waste small plastic pieces. It can be used for construction purpose. Waste plastic coated the road aggregates and it can increase road strength. This modified bitumen mix and aggregates show better binding property, stability, density and more resistant to water thus increasing durability of roads with increased resistance to wear and tear of road.

Keywords: Plastic

I. INTRODUCTION

Plastic is a multipurpose material. Due to the industrial revolution, and its large scales production plastic seemed to be a cheaper and easily available raw material. Today, every crucial sector of the economy. It also ease our life, starting from building construction to packaging of food product, electronic items. Plastic is a non-decomposable material it is one of many types of waste that take too long to decompose and researchers have found that the normally plastic items take up to 1000 year to decompose in landfills.

The concept of utilization of waste plastic in the construction of flexible road pavement by mixing it with bitumen has been done since the year 2002 in India. In the construction of flexible pavements, bitumen plays the major

role of binding the aggregate together by coating over the aggregate and provides the smooth surface over the aggregate. It also helps to improve the strength and life of road pavement. But its resistance towards water is poor. A common method to improve the quality of bitumen is by modifying the rheological properties of bitumen by blending with synthetic polymers like rubber and plastics. Use of plastic waste in the bitumen is similar to polymer modified bitumen. In India, 52000 tons of plastic waste are produced per year.

Plastic wastes consisting of mainly polyolefins from items such as carry bags, cups, thermocol and packaging films pose a major problem for their disposal. In this study, the plastic wastes were shredded into small size i.e, 2 mm to 4 mm, molten and thereafter coated over hot aggregate at 160°C. Several roads have been built in this manner using polymer-coated-bitumen aggregate.

II. WHY USE OF PLASTIC

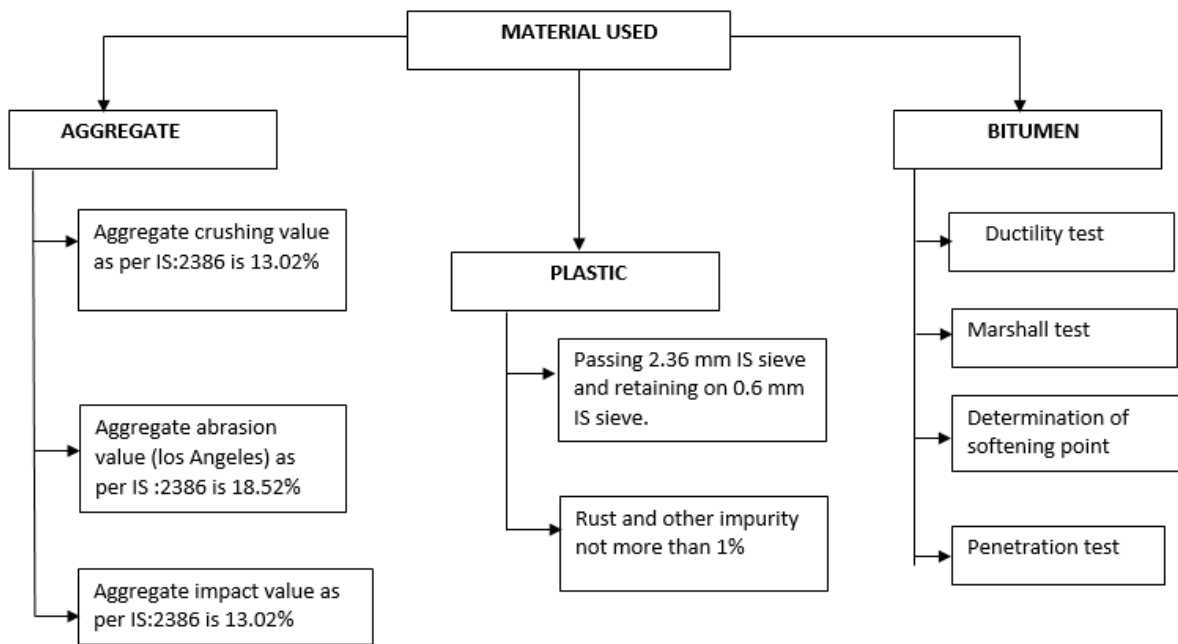
Polymers have a number of vital properties, which exploited alone or together make a significant and expanding contribution to construction needs.

- Durable & corrosion resistant.
- Good insulation for cold, heat & sound saving energy and reducing noise pollution.
- It is economical and has a longer life.
- Maintenance free.
- Hygienic & problems.
- Ease of processing/ installation.
- Light weight

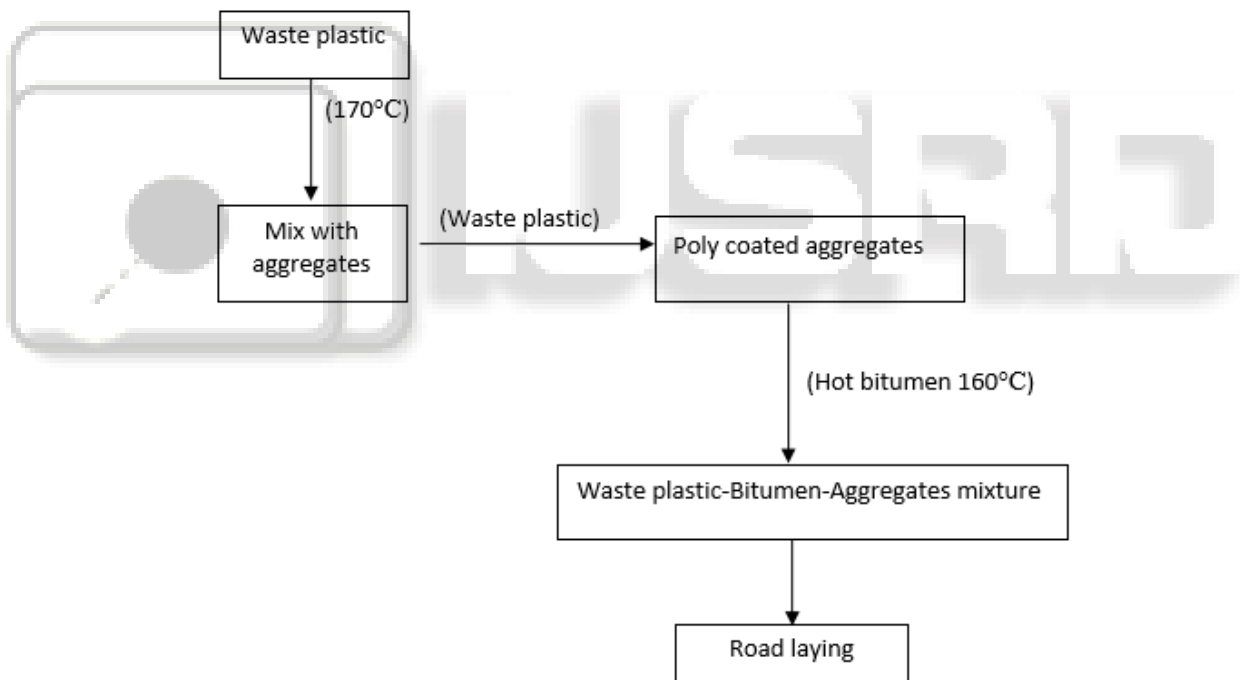
III. SPECIMEN PHASE DIAGRAM

Bitumen (90%) + Plastic (10%)
Filler
Fine aggregates
Coarse aggregate

IV. MATERIAL REQUIRED



Process of road laying by using waste plastic aggregate and bitumen.



- 1) Plastic waste (bags, cups, bottle) are cut into a size between 2.36 mm and 4.75 mm using shredding machine
- 2) The aggregate mix is heated to (165°C to 170°C) and transferred to mixing chamber
- 3) Bitumen is heated up to 160°C to have good binding and to prevent week bonding monitoring temperature is important
- 4) At the mixing chamber the threaded plastic waste is added. It got quoted uniformly over the aggregate within 30 to 60 second given and oily look
- 5) The plastic waste coated aggregate is mixed with bitumen and the resulted mix is used for road

construction. The road laying temperature is between (110°C to 120°C)

V. ECONOMICAL ASPECT OF PLASTIC ROAD

In wet process, we use waste plastic for modification of bitumen, whereas in dry process, waste plastic is used for coating over aggregates. Waste plastic collection in India is typically a huge network of man power, engaged at various stages. Thus a separate economy is running there.

On the other hand, we travel a lot by roads than any other means of travelling such as railways, airways or waterways, as roadways are the most convenient &

economical ways of travelling. But the condition of the roads is decreasing day by day. The cost for up gradation is increasing as the availability of natural resources are minimizing. Therefore any techniques for improving quality of roads parallelly saving some of natural resources such as bitumen and aggregates are needed. Use of this novel technique for up gradation of roads proved to be useful and economical, saving thousand Crores of rupees. There are tremendous possibilities of road up gradation in terms of quality and cost effectiveness, as condition and quality of roads are declining with next day.

[9] Wes Heidenreich, "Recycled plastic in highway construction and maintenance." State Research report #525, July 1997

VI. COMPARISON

- 1) The durability of the roads laid out with shredded plastic waste is much more compared with roads with asphalt with the ordinary mix.
- 2) While a normal 'highway quality' road lasts four to five years it is claimed that plastic bitumen roads can last up to 10 years.
- 3) Rainwater will not seep through because of the plastic in the tar.
- 4) The cost of plastic road construction may be slightly higher compared to the conventional method.
- 5) The maintenance cost is low as compared to conventional method.
- 6) Its initial cost is slightly more as compared to conventional method.

VII. CONCLUSION

Plastic waste helps increase the strength of the road, reducing road fatigue. These roads have better resistance towards rain water and cold weather. Since a large amount of plastic waste is required for a small stretch of road, the amount of waste plastic strewn around will definitely reduce.

REFERENCES

- [1] Indian Roads Congress IRC: 37-2012 - Guidelines for the design of flexible pavements-August 2012
- [2] R. Vasudevan.) "A technique to dispose waste plastics in an eco friendly way – Application in construction of flexible pavements" Construction and Building Materials Vol. 8 Department of Chemistry, Thiagarajan College of Engineering, Madurai, Tamil Nadu, India, pp 311–320.
- [3] Miss Apurva J Chavan - Use of plastic waste in flexible Pavements -ISSN 2319 – 4847, Volume 2, Issue 4, April 2013
- [4] S.S Verma - Roads from plastic waste - The Indian Concrete Journal - November 2008
- [5] Vinoth - Use of plastic wastes in road construction – Central Institutes of Plastic Engineering and technology
- [6] N. R. R. D. A., Ministry of Rural Development, GOI, Guidelines for use of Plastic Waste in Rural Road Construction (2007).
- [7] Handbook for PWD Engineers (Building & Road construction), Public Works Department, Mumbai (2002).
- [8] Source: M/S. Sahu Polymers, Akola, Maharashtra, India (2012).