

Use of Waste Plastic in Bituminous for Road Making

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Abstract—Plastic is the most commonly and widely used polymer in India. It is used in different forms in daily life such as poly bags, bottles, bucket etc. Plastic varieties can generate high amount of waste materials and its disposal is a very big problem now-a-days. Combustion of plastic produces PCBs which are dioxins and destructive to environment and living. Dioxins are persistent organic pollutants which remain in the environment for a long time due to their strong chemical structure. Therefore the reuse of waste plastic is reasonable and for that it can be mixed in bitumin and utilize for road construction. It is economical for road construction. This paper presents a research on utilization of waste plastic in bitumin for road making. For this purpose waste plastic is added in various percentages of 5%, 10%, 15% in respective bitumin and the aggregate. Waste plastic will not only increase the strength but also increase durability.

Keywords: Polymer, Plastic varieties, Combustion, Destructive, Aggregate.

1. INTRODUCTION

Plastic is the combination of one or more organic polymer of large molecular weight solid in its finished state can be shaped by its flow [1]. Plastic is a light weight material and easily used in bituminous road and plastic is not decomposed easily. They can decompose in at least 30 to 35 years and plastic is melt and used in some amount in bitumen and plastic is a good resistance of water and protect the road in rainy season [2-3]. Plastic is a non degradable waste cause green house effect and global warming [4]. Plastic is compound and hydrogen has properties of poly-ethylene, poly-styrene, poly-propylene. Plastic and bitumin are some properties is same and they can easily mixing and used for flexible pavement [5]. It is important to maintain required temperature and time for optimum result. Plastic can be divided into two major categories [6]:

- a. Thermoset or thermosetting plastic – once cooled and hardened, these plastics retain their shapes and cannot return to their original form. They are hard and durable. Thermoset can be use for auto part, aircraft parts and tires
- b. Thermoplastics – less rigid than thermosets, thermoplastic can soften upon heating and returned to original form. They are easily molded and extruded into films, fibers and

packaging.

The plastic waste is added to hot aggregate will form a fine coat of plastic over the aggregate. in our country hot and extremely humid climate plastic pavement of greatest advantage.

The main part of bituminous concrete construction is coarse aggregate, fine aggregate and bitumen. the flexible and rigid pavement are two types based on design considerations.

2. OBJECTIVE

- To find out the properties of soil.
- To design the bituminous pavement.
- To find out the properties of aggregate, bitumen and plastic.
- Find out the quantity of bitumen.
- The design flexible bituminous concrete with mixed with aggregate, bitumen and plastic.

3. METHODOLOGY

The mixing of plastic, aggregate and bitumen first we are collecting polymer waste plastic bottles, bags, polythene. Plastic segregated is shredded in to 3 to 6mm particles. The can perform of the standard test of aggregate and properties of bitumen and check the property of plastic. Then clean the disposal waste plastic and after the clean the heated of plastic and changing in liquid form and also heated of bitumen in 170C changing in liquid form and both material are coat around in 40 to 50 seconds and heated the aggregate in 185C temperature and all materials are mix in respective proportion. Its create the sample of mix aggregate bitumen and plastic after create the sample on various test are performed like as Marshall test were conducted on plastic modified mix specimens to study different parameters. And find out the strength and stability of sample. For the same some important tests are held such as-

3.1 Aggregate impact test

Aggregate impact test is use for the check of toughness of aggregate. When on the road vehicle applied sudden impact load of the aggregate is fracture it is called impact on aggregate. Aggregate impact value is the major of resistance suddenly impact to load also its resistance to gradually applied compressive load. When aggregate impact value is greater than 30% it is not use for the road construction.

3.2 Aggregate crushing test

Aggregate crushing test is use for the check of crushing value course aggregate. And also determined the measure of resistance to crushing under gradually applied compressive load. It also determined suitability of course aggregate is used for different type of load.

3.3 Marshall stability test on bitumen

Marshall Stability test is mainly used for the stability of the bituminous mixture. The principle of this test is that resistance to plastic flow of cylindrical of a bituminous mixture load on the lateral surface. Load capacity of mixed at 60 c and measure in kg. Maximum load carried by the during stability test.



Fig. 2: Marshall Stability test

3.4 Softening test on bitumen

The temperature at which the bitumen attains particular degree of softening under the specific test this test is conducted by ring ball apparatus. The brass ring containing test sample on bitumen is suspended in liquid like water and glycerine at a specific temperature and steel ball is filled by bitumen sample and the liquid medium is heated at 5 C per minute and temperature note down the touch of ball on the steel plate. This temperature is touch the ball on the plate. This temperature is known as softening point of bitumen.

3.5 Viscosity test

For this test equipment is needed to major absolute viscosity of viscosity graded paving bitumen (IS:73-2006) at 60 C in accordance with IS:1206 (PART 2) (similar to ASTM D 2171) this are used a vacuum capillary viscometer, the bitumen is heated not more than 90 C above its approx. The softening point until is become sufficiently fluid to pore viscosity test.

4. CONCLUSION

On the basis of above tests this paper conclude that-

- The plastic is mixed with bitumen and aggregate, they can improve the result of Marshall Stability test.
- The mixing of plastic and bitumen they can increases the melting point of bitumen.
- This flexible pavement can improve the strength and durability and it can increase the bearing capacity of the road.
- The plastic content is the mix the flow value goes continuous increasing.
- Increase in the percentage of waste plastic in mixture Marshall Value is increased and maximum stability is found for the mix containing 9% plastic by weight of the bitumen at 11% plastic content the stability value has decreased.

REFERENCES

- [1] Somesh Jethwani, Shubham Ashish Jha, Dheeraj Sangtiani, "Utilization & Specification of Plastic Waste in Bituminous Roads", International Journal of Engineering Research ISSN:2319-6890 (online),2347-5013(print) Volume No.6, Issue No.2, pp :91-94 1 Feb. 2017 IJER@2017 Page 91
- [2] R.Manju, Sathya S, Sheema K, "Use of Plastic Waste in Bituminous Pavement", International Journal of Chem Tech Research CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555, Vol.10 No.8, pp 804-811, 2017
- [3] Pratiksha Singh Rajput and R. K. Yadav, "Use of Plastic Waste in Bituminous Road Construction" IJSTE - International Journal of Science Technology & Engineering | Volume 2 | Issue 10 | April 2016 ISSN (online): 2349-784X All rights reserved by www.ijste.org
- [4] IRC:SP:98-2013, "Guidelines for the use of waste plastic in hot bituminous mixes in wearing courses"
- [5] Khanna S.K. and C.E.G Justo,(2007) "Highway Materials Testing" Nem chand and bros., Roorkee, India, pp 63-87.
- [6] Indian Roads Congress IRC: 37-2012 - Guidelines for the design of flexible pavements-August 2012.
- [7] IRC:SP:98-2013, "Guidelines for the use of waste plastic in hot bituminous mixes in wearing courses".