

Plastic Bituminous Road Pavement Material Testing

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Abstract- *The plastic wastes could be used in road construction and 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 use in road construction is not new. It is already in use as PVC or HDPE pipe mat crossings built by cabling together PVC (polyvinyl chloride) or HDPE (high-density poly-ethylene) pipes to form plastic mats. Waste plastic is ground and made into powder; 3 to 4 % plastic is mixed with the bitumen. The durability of the roads laid out with shredded plastic waste is much more compared with roads with asphalt with the ordinary mix. 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. The debate on the use and abuse of plastics vis-a-vis environmental protection can go on, without yielding results until practical steps are initiated at the grassroots level by everyone who is in a position to do something about it. The plastic wastes could be used in road construction and 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 problem. The present write-up highlights the developments in using plastics waste to make plastic road.*

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I. INTRODUCTION

Now-a- days disposal of different wastes produced from different Industries is a great problem. These materials pose Environmental pollution in the nearby locality because many of them are non-biodegradable. Traditionally soil, stone aggregates, sand, bitumen, cement etc. are used for road construction. Natural materials being exhaustible in nature its quantity is declining gradually. Also, cost of extracting good quality of natural material is increasing. Concerned about this, the scientists are looking for alternative materials for highway construction, and industrial wastes product is one such category. If these materials can be suitably utilized in highway construction, the pollution and disposal problems may be partly reduced. In the absence of other outlets, these solid

wastes have occupied several acres of land around plants throughout the country. Keeping in mind the need for bulk use of these solid wastes in India, it was thought expedient to test these materials and to develop specifications to enhance the use of these industrial wastes in road making, in which higher economic returns may be possible. The possible use of these materials should be developed for construction of low volume roads in different parts of our country. The necessary specifications should be formulated and attempts are to be made to maximize the use of solid wastes in different layers of the road pavement. Plastics are user friendly but not eco-friendly as they are non-biodegradable generally, it is disposed by way of land filling or incineration of materials which are hazardous. Plastic is versatile material and a friend to common man becomes a problem to the environment after its use

II. METHODOLOGY

Various tests such as specific gravity, water absorption, shape tests, impact test, abrasion and crushing tests are conducted as per MORTH standards. The procedure followed to determine the mechanical properties of the mixes are as per Marshall method. Optimum Binder Content was found by preparing Marshall Specimens with varying percentages of bitumen content. Marshall Tests for Stability and flow value are conducted for 3 specimens for each sample of conventional bituminous mix. The procedure is repeated for varying percentages of waste PET and results are analysed.

III. LITERATURE REVIEW

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.

Dr. R. Vasudevan: States that the polymer bitumen blend is a better binder compared to plain bitumen. Blend has increased Softening point and decreased Penetration value with a suitable ductility.

V.S. Punith, (2001): state that some encouraging results were reported in this study that there is possibility to improve the performance of bituminous mixes of road pavements. Waste

plastics (polythene carry bags, etc.) on heating soften at around 130°C.

Sundaram & Rojasay (2008): studied the Effective blending 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.

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.

Dr. R.Vasudevan and S. Rajasekaran, (2007) :stated that the polymer bitumen blend is a better binder compared to plain bitumen. Blend has increased Softening point and decreased Penetration value with a suitable ductility.

Mohd. Imtiyaz (2002):concluded that the mix prepared with modifiers shows: - Higher resistance to permanent deformation at higher temperature.

Sabina (2001): studied the comparative performance of properties of bituminous mixes containing plastic/polymer (PP) (8% and 15% by wt. of bitumen) with conventional bituminous concrete mix (prepared with 60/70 penetration grade bitumen).

IV. WASTE PLASTIC

Plastic products have become a part of our daily life as a basic need. It is produced on a massive scale worldwide and its production crosses 150 million tons per year globally. In India approximately 8 million tonnes plastic products are consumed every year which is expected to raise 15 million tons in the year 2016. It is broadly used in packaging films, wrapping materials, shopping and garbage bags, fluid containers, clothing, toys, household and industrial products, and building materials. Though no authentic estimation is available on total generation of plastic waste in the country; 70% of the total plastic consumption is discarded as waste. This discarded waste results in environmental pollution due to plastic.

V. MARSHAL STABILITY TEST

The Marshall Stability and flow test provides the performance prediction measures for the Marshall Mix design method. The stability portion of the test measures the maximum load supported by the test specimen at a loading rate of 50.8 mm/ minute. Load is applied to the specimen till

failure, and the maximum load is designated as stability. During the loading, an attached dial gauge measures the specimen's plastic flow (deformation) due to the loading. The flow value is recorded in 0.25 mm (0.01inch) increments at the same time when the maximum load is recorded. Standard temperature 60°C corresponding load carried by specimen is called Marshall Stability value and the deformation at failure in units of 0.25 mm is recorded as Marshall Flow value.

COMPARISON BETWEEN ORDINARY BITUMINOUS ROAD AND WASTE PLASTIC BITUMINOUS ROAD:

SR NO	PROPERTIES	PLASTIC ROAD	ORDINARY ROAD
1	MARSHALL STABILITY VALUE	MORE	LESS
2	BINDING PROPERTY	BETTER	GOOD
3	SOFTENING POINT	LESS	MORE
4	TENSILE STRENGTH	HIGH	LESS
5	RUTTING	LESS	MORE
6	STRIPPING (POTHOLE)	NO	MORE
7	SEEPAGE OF WATER	NO	YES
8	DURABILITY OF THE ROADS	BETTER	GOOD
9	COST OF PAVEMENT	LESS	NORMAL
10	MAINTENANCE COST	ALMOST NIL	MORE
11	ENVIRONMENT FRIENDLY	YES	NO
12	PENETRATION VALUE	MORE	LESS

MIX PROPORTION:

In our project we started with aggregate and bitumen testing then bituminous concrete tests are done. 1st we add 3% plastic of bitumen in our proportioned sample of bitumen concrete and marshal test is conducted and results are recorded. Similarly, 6%, 9% and 12% plastic of bitumen are added and same procedure is repeated.

MARSHAL STABILITY TEST RESULT

MIX TYPE	BC	BC	BC	BC
% BITUMEN	6%	6%	6%	6%
PLASTIC USED IN %	3% BY BITUMEN	6% BY BITUMEN	9% BY BITUMEN	12% BY BITUMEN
STABILITY (KN)	14.4	16.3	20.6	15.1
FLOW VALUE	3.2	3.2	2	2
MARSHAL QUOTIENT	4.32	5.09	10.3	7.55

By increasing % of plastic in a sample up to 9% the expected results are rising and then fall down. Here up to 9% stability value and marshal quotient value increases and flow value decreases. Therefore, we can use 6 to 9% plastic for making road pavement. The optimum content of waste plastic in our result 9%.

VI. CONCLUSION

1. The addition of waste plastic modifies the properties of bitumen.
2. The modified bitumen shows good result when compared to standard results.
3. The optimum content of waste plastic to be used is between the ranges of 5% to 10%.
4. The problems like bleeding are reduce in hot temperature region.
5. Plastic has property of absorbing sound, which also help in reducing the sound pollution of heavy traffic.
6. The waste plastics thus can be put to use and it ultimately improves the quality and performance of road.
7. Total material cost of the project is reduced by 7.99%

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