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Review Paper: Utilization of Waste Polythene in Bituminous Concrete for Pavement Construction in Sagar Municipal Corporation

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Abstract – *Rapid industrialization and urbanization in Sagar causes migration of peoples to Sagar form surrounding villages, which generates thousands of ton of municipal solid waste which consisting a large amount of non-biodegradable substances like plastics and polythene. This is producing enormous pollution to the environment and does not decompose up to thousands of year. On the other hand, Continues increasing population in Sagar causing increasing traffic intensities on each and every road is rapidly in terms of commercial vehicles. This causes continuous formation of potholes on road due. Again and again repairing and maintenance requirement cost is increasing for the existing pavements.*

This paper forms part of research to solve two main problems in Sagar Municipal Corporation SMC as discussed above: Firstly, the Solid Waste Management SWM (Particularly deals with polythene and plastic waste) and secondly continuous formation of potholes on road due excessive traffic and axle loads. This problem can be reduce by thinking some alternate way to improvise the pavement characteristics and quality by applying some necessary modification which shall satisfy economical as well as strength aspects and It is needed to use this polythene waste for some beneficial purposes so that amount of these non-biodegradable substances can be reduced.

Key Words: Solid Waste Management, Rheological properties of bitumen.

1. INTRODUCTION

With the increase in population, urbanization and changes in life style the use of polythene is increasing day by day. In developing city like Sagar. The disposal of waste plastic has become a serious problem. Polythene is non-biodegradable and environmentally unacceptable. So, to dispose these plastics we have to make alternate use of it and, there is the need to adopt effective methods to utilize these plastics waste.

It is possible to improve the performance of bituminous concrete pavements by adding polythene content to bitumen. Studies will inspect that the use of polythene with bitumen binders enhances the physical and structural behavior of bitumen concrete mixes. It will inspect by in field tests that polythene wastes used after proper processing as an additive would enhance the life of pavements. Due to the development and industrial revolution, large scale polythene is being produced. Plastic is a non biodegradable material and can remain on earth for 5000 years without disintegration. Polythene waste causes many health related problems. In developing country it is not easy to ban the use of polythene completely but we can utilize it effectively for constructive work.

Various percentages of polythene are used for preparation of mixes with a selected aggregate grading as given in IRC code. The role of polythene in the mix is studied for various engineering properties by preparing Marshall Samples of bituminous concrete mixtures with and without wastes. Various properties such as stability, flow value, unit weight, air void are used to determine optimum polythene content for given grade of bitumen. This study will enhance environmental scenario and reduce the amount of pollution that is occur due to non-biodegradable waste.

1.1 Scenario of Municipal Waste in Sagar City

Since Sagar is a developing city of Madhya-Pradesh state of India. A Waste quantification study was conducted in the Sagar city during the month of June (19thJune 2014to 22nd June 2014) with the objective of estimation of per capita waste generation rate in the city. About 40 samples were collected from various locations within the city of Sagar for assessment of current waste generation rate for the city.

As the result of this study overall waste generation rate of the Sagar city is 291 GPCD which includes residential waste, marketing waste, institutional waste and street sweeping waste. According to this SMC produces 133 TPD solid wastes in 2019. By some forecasting method it can be say that in 2035 there will be 210 TPD MSW will be generate daily in the Sagar city. Plastic and polythene waste contribute up to 18.7% of total waste according to which at present 24.9 ton polythene and plastics are going to be in MSW and this will be 39.27 in the year 2035. So it is highly necessary to find some way to use this non-biodegradable waste [5].

1.2 Objectives

Following are the objectives of this research

- To utilize waste plastic as a pavements ingredient.
- To evaluate the rheological properties of modified bitumen and conventional bitumen.
- To evaluate the performance test like Marshall Stability and marshal flow value using polymer modified bitumen and conventional bitumen.
- To study & compare the effect of modified bitumen in the bituminous concrete mix design with conventional bitumen.
- To give a bifacial alternative to solid waste management to Sagar city.

2. Proposed Methodology

Experimental work in proposed in three stages in this study

- Determination of Property of Raw Material
- Preparation of Marshall Sample
- Marshall Testing

2.1. Determination of Property of Raw Material

Following test will be perform for determination of physical properties of material

2.1.1 Test on Aggregate

Following test will be performing on selected grade of aggregate:

Sr	Test	Method
1	Impact Test	IS:2386 PART-4
2	Flakiness Index	IS:2386 PART-1
3	Elongation Index	IS:2386 PART-1
4	Specific Gravity Test	IS:2386 PART-3
5	Water Absorption Test	IS:2386 PART-3
6	Aggregate Crushing Test	IS:2386 PART-4
7	Abrasion Value Test	IS:2386 PART-4

2.1.2 Test on Bitumen Sample

Following test will be performing for conventional as well as modified bitumen:

Sr	Test	Method
1	Penetration Test	IS:1203-1978
2	Softening Point test	Is:1205-1978
3	Ductility Test	IS:1208-1978
4	Specific Gravity Test	IS:1202-1978
5	Flash Point Test	IS:1209-1978
6	Fire Point Test	IS:1209-1978

2.2 Preparation of Marshall Sample

The mixes were prepared according to the Marshall procedure specified in ASTM D1559. For bituminous concrete mix the coarse aggregates, fine aggregates and filler were mixed with bitumen and polyethylene according to the adopted gradation as per MORTH 5th revision (Section 500). A comparative study will be made on bituminous concrete mix with and without polyethylene in mixes.

2.3 Marshall Testing

In this method, the resistance to plastic deformation of a compacted cylindrical specimen of bituminous mixture is measured when the specimen is loaded diametrically at a deformation rate of 50 mm/min. There are two major features of the Marshall method of mix design

- Stability, flow tests and
- Voids analysis.

The Marshall stability of the mix is defined as the maximum load carried by the specimen at a standard test temperature of 60°C. The flow value is the deformation that the test specimen undergoes during loading up to the maximum load. It is a very popular method of characterization of bituminous mixes due to its simplicity and low cost. In the present study the Marshall properties such as stability, flow value, unit weight and air voids were studied to obtain the optimum binder contents (OBC) and optimum polyethylene contents (OPC).

3. Conclusion

In this study an inspection is made to inspect the effect of mixing waste thermo plastic polymers (i.e. Polythene) in 60/70 grade of bitumen (VG-30) at various percentages by weight of bitumen. This can enhance property of bitumen as well as reduce the amount of non-biodegradable waste. The plastic were shredded in small pieces and then blended with bitumen at temperature ranging between 160OC to 1700C. A comparative study is made to find resultant change in rheological property between unmodified bitumen and polythene modified bitumen (such as viscosity, penetration, ring and ball softening point, flash and fire point and ductility of bitumen sample).

The outcomes will demonstrate that the usage of waste polythene in bituminous concrete mix will modify property of the mix. The amount of polythene waste can be reduced by this proposed method. This can reduce amount of polythene waste in nature and need of its disposal. Since Sagar city is continuously growing due to selection in Smart City scheme under central government of India. The construction rate of road till 2035 will be increasing rapidly so by the use of this study amount of polythene waste which is highly non biodegradable can be reduced.

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