

## **Partial Replacement Of Waste Polythene In Bituminous Concrete Mix**

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**Abstract:** Bituminous Concrete normally used in construction projects like road surfacing, airports, parking lots etc is a composite material. It consists of asphalt or bitumen and mineral aggregate which are mix together & lay down in layers then compacted. In these days the large increment in high traffic intensity in terms of commercial vehicles, and the compelling variation in daily and seasonal temperature put us in a demanding situation to think of some alternatives for the improvisation of the pavement characteristics and quality by applying some necessary modifications which shall satisfy both the strength as well as economical aspects. Also considering the environmental approach, due to excessive use of polythene in day to day life the pollution to the environment is increased significantly. Since the polythene is non biodegradable the need of the current hour is to use the waste polythene in some beneficial purposes. This paper presents a research conducted to analyze the behavior of BC mix modified with waste polythene. Various percentages of polythene are used for preparation of mixes with a selected aggregate grading as given in the IRC Code. By preparing Marshall Samples of the concrete mix the role of polythene in bituminous is studied for various engineering properties BC mixtures with and without polymer. Marshall Properties such as stability, flow value, unit weight, air voids are used to determine optimum polythene content for the given grade of bitumen (60/70).

*Key Words: Bituminous Concrete (BC), Indian Road Congress (IRC), Polythene.*

### **1. INTRODUCTION**

Surveying in India and other countries around the world have bring to light that properties of bitumen and bituminous mixes can be improved to meet requirements of pavement with the incorporation of certain additives or a blend of additives. These additives are called bitumen modifiers and the bitumen mixed with these modifiers is known as Modified Bitumen. Modified bitumen is considered to have longer life period than unmodified bitumen mix. Modified Bitumen is expected to give 50 to 100 per cent higher life of surfacing depending upon degree of modifications and type of additives used. Polymer modified bitumen is emerging as one of the fruit full construction material used in flexible pavements. The polymer modified bitumen show better properties for road construction and waste polythene can find its use in this process providing improved performance of flexible pavements and this can help solving problem of pollution due to waste polythene too.

## **2. MATERIALS**

A bituminous concrete mix is generally composed of aggregate and bitumen. On the basis of particles size of aggregates, the aggregates are usually divided into coarse aggregates, fine aggregates and filler fractions. The following portion covers the description of the coarse aggregate, fine aggregates, bitumen and waste polythene used in the study.

**2.1 Course Aggregate:** The coarse aggregates should annex good impact value abrasion value, and also crushing strength. The function of coarse aggregates is to deliver the stress due to wheel loads. Function of coarse aggregates is also to resisting wear due to abrasion. That portion of the mixture according to the Asphalt Institute retained on 2.36 mm sieve is termed as coarse aggregates.

**2.2 Fine Aggregate:** Voids which remain unfilled in the coarse aggregates are filled by the fine aggregates. So the function of fine aggregates is to fill the voids of coarse aggregates. Fine aggregates consist of crushed stone or natural sand. Aggregates that passed through 2.36 mm sieve and retained on 0.075 mm sieve were selected as fine aggregate. The source of fine aggregates used was River sand.

**2.3Waste Polythene:**The polythene waste polythene is used as raw material for preparation of the samples. This polythene was washed after collecting and cleaned by putting them in hot water for 3-4hours. They were then dried. Specific Gravity of polythene = 0.905

**2.4 Bitumen:**Asphalt binder 60/70 and 80/100 is used in this research. The bitumen used must have the following properties.

- Grade of bitumen used in the pavements must be selected on the basis of climatic conditions and their performance in past.
- It is recommended that after certification by the supplier the bitumen shell be accepted (along with the testing results) and the State project, verification samples.

## **3. SAMPLE PREPARATION AND TESTING**

Thecollectedpolythene wasteswere washed,cleanedand dried. The polythenes were then shredded into very tiny pieces. The required quantities of polythene to be added with specified amount of bitumen for preparation of different percentage of polythene-bitumen blend were weighted and added in required percentage by weight of bitumen to the hot bitumen and the mixture was stirred wellforabout30minutesundertemperaturearound170- 180°C.

### **3.1MarshallMould**

The aggregates of different grades were sieved through different IS Sieves and they were kept in different containers with proper marking. The mixing of materials required for mould preparation was done as : Required quantities of coarse aggregate, fine aggregate & mineral fillersweretakenin anironpan.Thiswaskeptinanoven at temperature 160 °C for 2 hours. This is because the aggregate and prepared blends are to be mixed inheated state so preheating is required. The prepared blend was alsoheateduptoitsmeltingpointpriortothemixing.The

Aggregates in the pan kept in oven were taken and heated on a controlled gas stove for a few minutes maintaining the temperature. Now blend (60 gm.), i.e. 5% was added to this mix and the whole mix was mixed uniformly and homogeneously. This was continued for 15-20 minutes till they were properly mixed. Then the mix was transferred to the Marshall sampling mould. The mix in the mould was then compacted by the Marshall Hammer. 75 numbers of blows were given on each side of the sample so a subtotal of 150 no. of blows was given per sample. Then these samples with moulds were kept separately and marked accordingly to the percentage of polythene added by weight of bitumen.

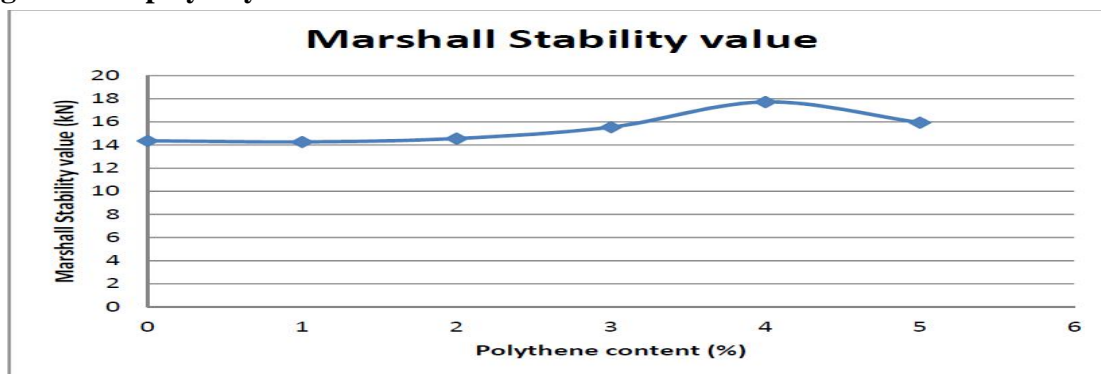
**3.2 Physical Values of Polythene Modified Bitumen**

The values for physical properties of Polythene Modified Bitumen tested through experiment are given in table 1. Below:

**Table 1 Physical Properties of Modified Blend**

properties	0% Plastic P0	1% Plastic P1	2% Plastic P2	3% Plastic P3	4% Plastic P4	5% Plastic P5
Softening Point (°C)	47.2	50.1	51.2	53.4	55.7	55.9
Penetration Value (mm)	65.2	55.1	50.2	48.6	46.2	44.1
Ductility (cm)	100	95	91	86	77	55
Flash & Fire Point (°C)	>280	>350	>350	>350	>350	>350

**Fig-1: Ms vs polyethylene content**



#### **4. RESULTS AND ANALYSIS**

The desired properties of bitumen binders were improved by introducing polythene as an additive. This process of modification of bitumen with waste polythene has enhanced resistance to cracking, pothole formation and rutting by increasing softening point, hardness and reducing stripping due to water, thereby improving the general performance of roads over a long period of time. It is observed that Marshall Stability value increases with polyethylene content up to 4% and thereafter decreases. We observe that the Marshall Flow value decreases upon addition of polythene i.e. the resistance to deformations under heavy wheel loads increases.

#### **5. CONCLUSIONS**

The results indicated that the utilization of waste polythene in bituminous concrete mixtures shows improved property of the mixtures thus formed. The waste polythene utilized in the mix will get coated over aggregate of the mixture and reduces porosity, absorption of moisture and improves binding property. The bitumen modified with 4% Polythene Waste is showing better performance as compared to other mixes. The Marshall Stability which is a strength parameter has shown increasing trend with a maximum increase percent of 34.26% as compared to conventional mix when modified with 4% Polythene Waste. It is observed that Marshall Stability value increases with polythene content up to 4% and thereafter decreases. Thus the use of higher percentage of waste polythene is not preferable. While talking to environmental pollution due to these non-biodegradable plastics waste where disposal of such materials has become a serious problem, its use in construction of flexible pavement will give a better place for their burying and thus solving the problem of their disposal on one hand and providing a better flexible pavement with improved performance on the other hand.

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