

# Bitumen Modification with Sasobit: A Scientific Investigation of Its Effects on Bitumen's Chemical, Physical, and Mechanical Properties

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**Abstract**— Bitumen is a good binding material that gives rigidity and tough when it goes to room temperature. Bitumen combines with the gravel and gives more stability, due to properties of bitumen, it has ability to become liquid when we raise temperature, and becomes solid when it gets to room temperature.

But now a day's normal room temperature 25oc to 38oC , due to increasing of these temperature in environment because of several conditions such as global warming, increasing of chloro-florocarbons, emission of CO (carbon monoxide)from the vehicles and other factors.

Now a day's rutting failure occurring in all roads due to increasing of temperature in environment the bitumen reaching the softening point, so that the pavement gets weak in day time. At the same time the heavy load vehicles pass on this pavement the rutting occurs.

In order to overcome from this problem I would be like to change bitumen softening point by adding the additive sasobit for the bitumen.

By adding sasobit for bitumen, several properties of bitumen will change. Such as enhanced workability, improved process reliability, temperature reduction (Warm Mix) and extended service life

**Index Terms**— Sasobit, bitumen emulsion, flexible pavement, hot mix asphalt

## 1: INTRODUCTION

### 1.1 Introduction

Road network development is the first step for the growth of Indian economy. A good road network will develop the basic infrastructure that grow up the development process through connectivity of door to door chain network. They are several types of roads we have, apart from all national highways plays major role because they are connecting all over the country. Now coming to the point, national highways will be laid by flexible pavements mostly. Due to raising of temperature in the present environment the bitumen reaches softening point of the quickly, due to heavy

loads passing over the pavement on day times the rutting failure occurring.

My project aim is to increase the bitumen softening point. many ways to increase bitumen softening point, apart from all I choose sasobit. I know sasobit can replace all other additives Sasobit is the new generation additive for the bitumen, it is the versatile additive, which is perfectly set for applications by asphalt

### 1.2 Production of Bitumen

Bitumen is the buildup or result when the rough petroleum is refined. A wide assortment of treatment facility forms, for example, the straight refining procedure, dissolvable extraction process and so on might be utilized to deliver bitumen of various consistency and other attractive properties. Contingent upon the sources and qualities of the unrefined oils and on the properties of bitumen required, more than one handling strategy might be utilized.

### 1.3 Different forms of bitumen

#### 1.3.1 Cutback bitumen

Typical practice is to warm bitumen to diminish its consistency. In certain circumstances inclination is given to utilize fluid covers, for example, Cutback bitumen. In Cutback bitumen reasonable dissolvable is utilized to bring down the consistency of the bitumen. From the natural perspective additionally reduction bitumen is liked. The dissolvable from the bituminous material will dissipate and the bitumen will tie the total. Cutback bitumen is utilized for cold climate bituminous street development and upkeep. The distillates utilized for planning of reduction bitumen are naphtha, kerosene, diesel oil, and heater oil. There are various kinds of reduction bitumen like rapid curing(RC), medium curing(MC), and moderate slow curing (SC). RC is suggested for surface dressing and interwoven. MC is suggested for premix with less

amount of fine totals. SC is utilized for premix with calculable amount of fine totals.

#### Cutback Classification

Cutbacks are partitioned into two arrangements, Rapid-Curing (RC) and Medium-Curing (MC) contingent upon the dissolvable utilized. They are additionally characterized by a number which shows the base kinematic consistency (ease) of the reduction.

#### 1.3.2 Bitumen Emulsion

Bitumen emulsion is a fluid item where bitumen is suspended in a finely isolated condition in a watery medium and balanced out by appropriate material. Regularly cationic sort emulsions are utilized in India. The bitumen in the emulsion is around 60% and the remaining is water. At the point when the emulsion is applied out and about it separates bringing about arrival of water and the blend begins to set. The hour of setting relies on the evaluation of bitumen. The thickness of bituminous emulsions can be estimated according to Seems to be: 8887-1995. Three kinds of bituminous emulsions are accessible, which are Rapid setting (RS), Medium setting (MS), and Slow setting (SC). Bitumen emulsions are perfect covers for slope street development. Where warming of bitumen or totals are troublesome. Quick setting emulsions are utilized for surface dressing work. Medium setting emulsions are favored for premix employments and fix fixes work. Slow setting emulsions are favored in stormy season.



Figure 1: Sasobit

Sasobit Available forms:

- Sasobit is available in several forms.
- Granules ( it is about  $\phi$  5mm )



Figure 2: Granule form of sasobit

- As a small Granules (it is about  $\phi$  1mm in )



Figure 3: Small Granule form of sasobit

- Flaked form (3mm chips)

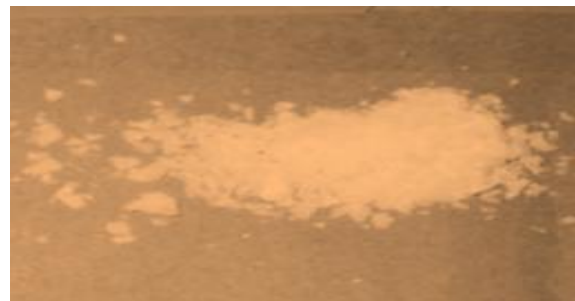


Figure 4: Flaked form of Sasobit

## 2: LITERATURE REVIEW

In recent days technology day to day increasing. Technology in the sence in all fields. Not only mobiles and electronic gadgets. In our civil engineering field also more new technical tools are using day to day life. Several trails were applied to on sasobit, to more application to daily life use.

All the authors found that Sasobit Can Enhance the bitumen properties which are requied to pave or other uses not only civil and also for other related branches, some of the chemical and mechanical authors also wrote regarding sasobit.

Ambika Behl, Prof Satish Chandra, Prof V.K Aggarwal (Sep. 2013)(1)ponder the warm blend black-top (WMA) which getting to be prevalent as of late because of its profitable highlights of vitality funds and natural advantages. WMA is an innovation which utilizes a few added substances or advances to diminish the thickness of fastener and to change the rheological conduct of black-top folios, and hence prompts upgrade the workability of the blend at brings down temperature. In this examination, Sasobit (a paraffin wax-based added substance) is utilized to decrease the thickness and hence amid HMA creation the blending and compaction temperature diminishes.

### 3 MIXING METHODOLOGIES

Mixing Method plays major role in this project. Bitumen has great property that it can be mix with all types of polymers. In this we have taken 4 stages to get proper mixing to achieve good strengths.

Step 1:

Make the Solid or semisolid form of bitumen to liquid from by heating up to 70-80oc. We use gas or electric stove to make solid or semi solid bitumen to liquid form. Bitumen may be present in solid form or semi solid form in stored form. It may be useful for the bitumen pavements. In this process we create an opportunity to add any emulsion in the bitumen when we heat it up to get liquid stage. After achieving liquid state for the bitumen, it can allow to mix different properties of emulsions

In this step we need to count weight for the bitumen inorder to add % of sasobit to this bitumen. The modified bitumen may have different properties such as low penetration value, high temperature softening point.

Step 2:

After achieving the liquid state add sasobit which is weighted earlier as per test. We are considering weight as per the % of sasobit we need to add. For example if it is 100 gr of bitumen then we need to add like 5 gr, 10 gr and 15 gr like this. So than we can get good graph that can be easily predicted by the flow line, there hence the value for the 3% bitumen also can be estimated by that model graph.

### 4 : TEST ON BITUMEN

- Penetration test
- Ductility test

- Softening point test

#### 4.1 Penetration test

Bitumen penetration test defines bitumen hardness or softness by measuring the mill meter depth to which a regular charged needle can penetrate vertically in five seconds while the bitumen sample temperature is held at 25 OC.

#### 4.2 Apparatus for Penetration Test

Container :

A flat cylindrical dish having 55mm dia and 35 mm height . The container should be metallic because we pour hottest bitumen in it and it has to be sustained from that temperature.

Needle : A hard cylindrical steel rod having straight and highly polished.

Water bath:

It is container containing water less than 10 lt at  $25^{\circ} \pm 0.1^{\circ} \text{C}$ . And specimen should placed below the water depth 100mm from top in water bath

Penetration apparatus :

Should be such that it allows needle to penetrate without much friction& is accurately calibrated to give results in one tenth of a millimeter.

Thermometer :

Capacity 0- 50  $^{\circ}\text{C}$

Time measuring device :

Least count should be 1 sec

### 5 PENETRATION TEST WITH SASOBIT

#### 5.1 Penetration test for bitumen with 0% sasobit

##### 5.1.1. 0% Sasobit:

- Procedure as per mentioned above
- In order to calculate the 5 % of sasobit we need to calculate the amount of bitumen that can fill the bottle and empty weight of bottle are to be noted.

- Empty weight of bottle = 300gr
- Weight of the bottle with bitumen = 450 gr
- Bitumen weight =150 gr

##### 5.1.2. Conditions of making of sample:

- Room temperature = 25o c
- Pouring temperatures =80 o c
- Cooling period =1hr in air
- 1hr in water bath
- Procedure as per penetration test as shown in above.

##### 5.1.3. Penetration Values:

The Penetration Values are shown below.

Penetration dial reading	Test 1	Test 2	Test 3
(a) Initial	95	96	95
(b) Final	150	148	150
Penetration Value	55	52	55

### 5.3 Preparation of 10% sasobit sample

#### 5.3 .1. 10% sasobit

First of all make the semi solid bitumen to liquid form and make it to reach 80oc and mix the sasobit weighed 15 gr i.e. 10% from total weight of bitumen.

Weight of sasobit =15 gr

Empty weight of bottle = 300gr

Weight of the bottle with bitumen = 450 gr

Bitumen weight =135 gr

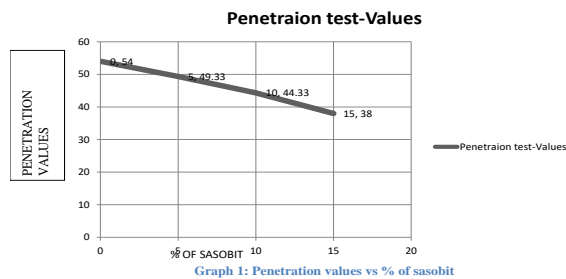
#### 5.3 .2 Conditions of making of sample:

Room temperature = 25o c

Pouring temperatures =80 o c

Cooling period =1hr in air

1hr in water bath



### 6: DUCTILITY TEST

#### 6.1. Introduction

Ductility of bitumen is its property to extend under traffic load without getting split in road construction and development works. Ductility test on bitumen quantifies the separation in centimeters to which it stretches before breaking.

Mechanical assembly required, hypothesis, method, safeguards, perceptions, revealing and prescribed estimations of bitumen ductility is talked about in this article.



**Table 1 : Ductility Test Sample Table**

Observations	Test : 1	Test : 2	Test : 3
(a) Initial Reading	Initial readings	-do-	-do-
(b) Final Reading	Final readings	-do-	-do-

### 7: DUCTILITY TEST WITH SASOBIT

#### 7.1 Ductility value of bitumen with addition of sasobit :

The process of mixing sasobit to the bitumen is essential for getting good ductility values. Ductility of bitumen gives warning before the pavement gets failure. More ductility value the more the elongation of bitumen, then give more life span. The more loads coming on the pavement then the loads coming to the pavements gets rutting failure there by pavement is going to failure. My aim is to decrease the elongation temperature, by introducing sasobit to the bitumen.

I am going to test like

- 0% Sasobit mix with the bitumen
- 5% Sasobit mix with the bitumen
- 10% Sasobit mix with the bitumen
- 15% Sasobit mix with the bitumen

#### 7.2 Ductility test for bitumen with 0% sasobit

##### 7.2.1. 0 % Sasobit:

In order to calculate the 5 % of sasobit we need to calculate the amount of bitumen that can fill the bottle and empty weight of bottle are to be noted.

Empty weight of bottle = 300gr

Weight of the bottle with bitumen = 450 gr

Bitumen weight =150 gr

Procedure as per ductility test as shown in above.

##### 7.2.2. Conditions of making of sample:

Room temperature = 25o c

Pouring temperatures =80 o c

Cooling period =1hr in air

1hr in water bath

Procedure as per ductility test as shown in above.

##### 7.2.3. Observations of Ductility Test

Bitumen Grade = VG 35

Pouring Temperature = 80-100oc

Test Temperature = 50 oc

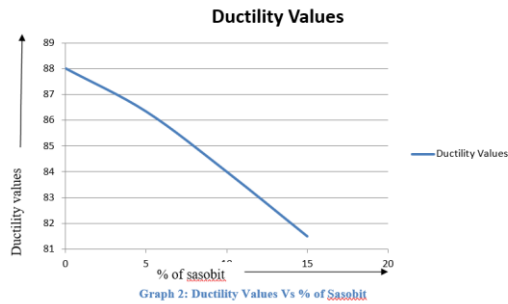
Period of cooling in minutes

In air = 1hr

In water bath = 1hr

Observations	Test : 1	Test : 2	Test : 3
(a) Initial Reading	0	0	0
(b) Final Reading	81	81.5	82

7.6. Graphical Analysis of Ductility Test



## 8 : SOFTENING POINT TEST WITH SASOBIT

### 8.1 SOFTENING POINT:

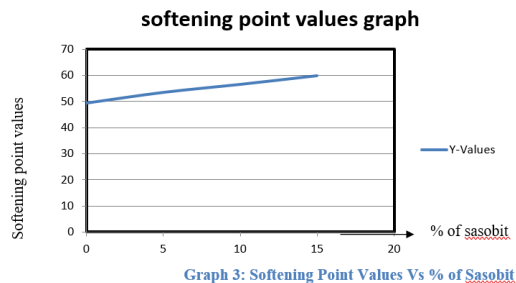
#### 8.2 Softening test for 0% sasobit addition to bitumen

##### 8.2.1 0% Sasobit:

- Procedure as per mentioned above
- In order to calculate the 0 % of sasobit we need to calculate the amount of bitumen that can fill the bottle and empty weight of bottle are to be noted.



Figure 24: Softening point Setup



% of sasobit increases the softening point also increase

% of sasobit  $\propto$  Softening point value

## 9 CONCLUSIONS

Higher softening value ensures that they're going to not flow throughout service. Higher the softening value, lesser the temperature condition. bitumen with higher softening value is most well-liked in hotter places.

Sasobit can change the all bitumen properties such as penetration values, ductility test results, softening point values etc. By adding sasobit to the bitumen we can alter the all normal bitumen properties.

By increasing penetration values we can achieve more durability of the pavement and good protection from super loads. In order to get higher softening point we are going to mix sasobit to the bitumen.

It can be rapidly increase use of this sasobit because its having great ability of getting stronger than stronger up to certain limit.

Hence we will get higher softening point and less chance of getting rutting in the flexible pavement and also higher temperature values for getting liquid state then that bitumen is more suitable in hot climate areas and summer seasons.

Sasobit can enhance hardness of the bitumen when we use in high temperature regions, and also when we use for high loading regions also.

Sasobit can be reduce rutting failure coming from high loads from the wheel base, due to having its property of hardness.

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