# Utilization of Assorted Rubber as Bitumen Stand – By

**Ashish Dhiman, Sandeep Singh**

***Abstract*** ***Waste plastic and rubber occur everywhere in world and cause various environmental issues and effects. In this study we found a solution to somehow minimize this issue by using waste rubbers with bitumen to make rubber modified bitumen (RMB). The main object of this research study is to find out the results of laboratory experimental work in which virgin bitumen is mixed with different types of rubber. Various mixtures are made in this research work with different types of rubber at different proportions .Marshall samples were made of rubber modified bitumen to determine Marshall stability values. By making such mixtures it not only decrease the quantity of bitumen in bituminous mixtures but also decrease the construction cost. Various tests were performed on bitumen to determine various properties.***

***Keywords:*** *RMB, bitumen*

## I. INTRODUCTION

From the past few years the disposal of wastes materials such as plastic and rubber has becoming a big trouble. Rubber is generally used for the manufacture of tires. In India, amount of waste tires consists nearly about 6-7% of the total world. As the local tire industries are growing the volume of waste rubber are also rising. Nowadays in civil engineering sector rubber tires are generally reclaimed into the hot melt asphalt and also as an aggregate in cement concrete. From past few years, the demand of asphalt modification by using various types of polymers in many countries has increased. The main purpose of modification of bitumen and bituminous mixes is to improve the properties and performance of bitumen concrete mixtures. The addition of such material not only improves the characteristics of bitumen but also improve the mechanical performances of the bituminous mixtures. The modification of bitumen improves resistance to rutting, fatigue and thermal cracking. By using such waste materials in the highway sector it provides an alternate for effective disposal of such materials, which decrease the disposal rate and also save the environment from pollution. In general, the polymer-modified binders exhibit better properties with respect to virgin bitumen.

## II. MATERIAL

### *A. Bitumen*

Bitumen is also known as asphalt. It is a sticky and highly viscous liquid. It is generally black in color and is consider as semi solid form of petroleum. It is form through the distillation of crude oil. Nowadays bitumen is mostly used in terms of viscosity grades rather than penetration grade.

### *B. Aggregates*

Aggregates generally consist of coarse and fine aggregates. Different sizes of aggregates are used in this research work according to gradation limit.

### *C. Rubber*

In this research work four types of rubber are used out of which one is natural rubber and the other three rubbers lies under synthetic rubber.

***a. Natural Rubber***

Natural Rubber is a kind of elastic material that is generally generated from the latex of trees. It is generally an elastomer. It is also known as Indian rubber. This kind of rubber is excellent barrier to water. It also has excellent abrasion and tear resistance.

**b. Synthetic Rubber**

Synthetic rubber is generally a man-made rubber that is produced by synthesizing petroleum and various minerals. It is basically known as artificial polymer. By adding different chemicals, it can be converted into hard or soft material. It is of following types:

***i. Butyl Rubber***

Butyl rubber is a type of synthetic rubber and is a copolymer of isobutylene with isoprene. It is generally used in fuel and lubricant additive, tire tubes and gas masks. This type of rubber has excellent weather, water and heat resistance.

***ii. Nitrile Rubber***

Nitrile rubber is also a type of synthetic rubber and known as Nitrile Butadiene Rubber (NBR .It is best known for its excellent resistance to mineral oils, petroleum oils, abrasion and water. This type of rubber is generally used to make goods, footwear's and gloves.

***iii. SBR***

SBR is known as Styrene Butadiene Rubber. It is a type of synthetic rubber and derived from styrene and butadiene. This rubber has excellent abrasion and water resistance. It is generally used for the manufacture of shoe soles, adhesives and car tires.

## III. METHODOLOGY AND TESTS:

1. Firstly the collection of all material is done (i.e. bitumen, aggregates and rubber).
2. Various tests were conducted then on aggregates and on bitumen.
3. After testing, various Marshall Mixtures were made consisting of all rubbers in various proportions in various combinations viz. primary, binary, tertiary and quaternary.
4. The Marshall mixtures were made by first heating aggregates, bitumen and rubber in different containers according to their define temperature range.
5. Then prepare a mix of all containing aggregates, bitumen and rubber in a single container up to desired temperature limit.

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6. After mixing well place that mixture in a Marshall Specimen mould and then compaction is done on both the sides of specimen.
7. After cooling the specimen place the specimen in Marshall Testing machine to determine its stability values.

I. Properties of aggregates

| Sr. No. | Property | Obtained Value (%) |
|---|---|---|
| 1 | Aggregate Crushing Test | 22.5 |
| 2 | Aggregate Impact Test | 15.9 |
| 3 | Aggregate Abrasion Test | 22.1 |
| 4 | Flakiness And Elongation Test | 27.02 |
| 5 | Specific Gravity Test | 2.5 |

II. Properties of bitumen

| Sr. No. | Property | Obtained Value |
|---|---|---|
| 1 | Penetration Test | 37mm |
| 2 | Softening Point Test | 49ºC |
| 3 | Ductility Test | 50.7cm |
| | | |
| 4 | Specific Gravity Test | 27.02 |

## 1. RESULT :

1. Firstly the Optimum Bitumen Content was found before making modified Marshall Samples. The OBC was found to be 5%.
2. After OBC, modified samples were made in primary, binary, tertiary and quaternary combinations with rubber.
3. In primary arrangement Natural Rubber at higher content shows the maximum stability as compared to other combination of primary arrangement..
4. In binary arrangement combination of Natural and Nitrile Rubber shows the maximum stability as compared to other combination of binary arrangement.
5. In tertiary arrangement combination of Natural, Nitrile and SBR Rubber shows the maximum stability as compared to other combination of tertiary arrangement.
6. In quaternary arrangement combination of all four rubbers at middle level shows the maximum stability as compared to other combination of quaternary arrangement.

Fig (a): Primary arrangement of rubber

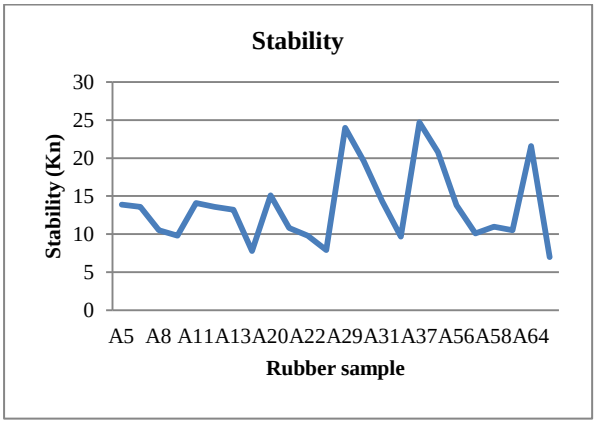


Fig (b): Binary arrangement of rubber

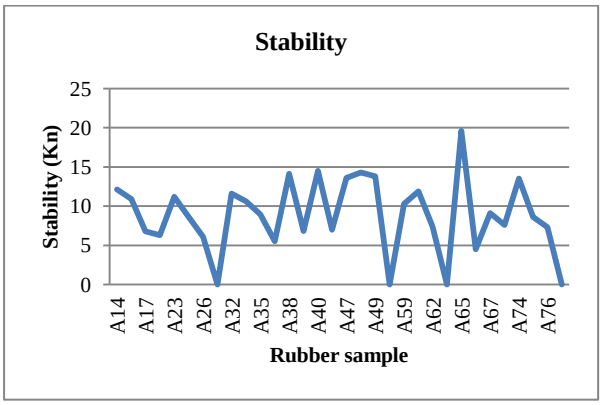


Fig (c): Tertiary arrangement of rubber

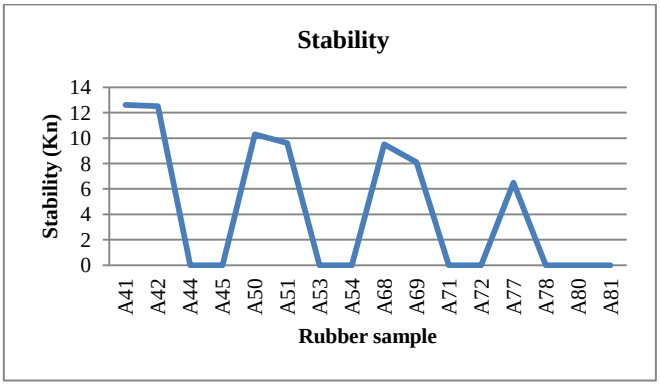


**Fig (d): Quaternary arrangement of rubber**

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