

**Project reference Number:** 46S\_BE\_3178

**Title of the project-** Evaluation of liquid natural rubber modified bitumen for overlay construction at intermediate and high temperature

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**Keywords-**

**Introduction-**

As a developing country, roads and highways show an important role to associate a place to another, hence road system is a fundamental for the growth of our country. Commonly, roads in India are flexible pavement type. Flexible pavement normally consists of asphalt mixture located over GSB (Granular Sub-base) layer continued through the compacted soil, mentioned by way of subgrade. Flexible pavement construction contains of subgrade, subbase, base coarse and surface course. The surface course is the upper layer is straight in interaction through traffic load. It was prepared of asphalt concrete which contains of high quality and costly materials related to other materials in further layers.

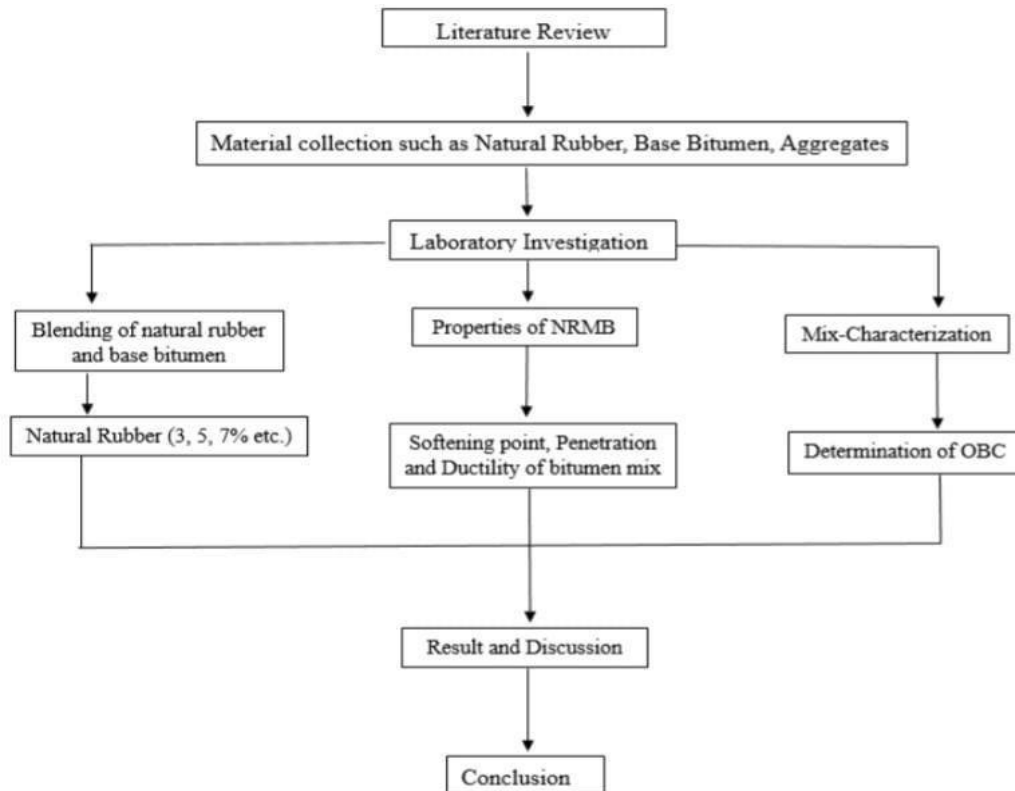
In the past, the use of unmodified bitumen in road construction was enough in supporting load from traffic flow. However, high traffic load placed on the road network nowadays has reached a critical stage. This is due to rapid increase in volume of heavy vehicles coupled with significant increase in allowable axle weight which leads to premature failure of flexible pavement. Heavy and high loading

traffic have been shown to cause early damage to pavements despite its design life, and this will result in higher repair and maintenance expenses. Thus, it is important to find ways to improve the properties of the bitumen in terms of its elasticity and viscosity, temperature susceptibility, softening point, aging resistance and cohesion. Therefore, it is essential to improve the quality of asphalt binder with a material that can lessen its temperature susceptibility, enrich cohesion and increase its viscosity and elasticity.

### Objectives

1. To evaluate the effect natural rubber on the properties of base bitumen.
2. To find the optimum natural rubber content that can be replaced for bitumen binder for better properties.
3. To find optimum binder content by performing Marshall Test on the binder.
4. To evaluate the effect of natural rubber modified bitumen on the Marshall values of the mix.

### Methodology



## **RESULT AND DISCUSSION**

### **Binder characterization (Base binder and NRMB properties):**

- As the temperature increases, the mix becomes soft and the penetration value increases and also the penetration value decreases with the addition of NR.
- Ductility decreases gradually when amount of NR increases in the asphalt.
- The softening point of the binder increases gradually with the increase of percentage of NR at both the temperatures.

### **Mix characterization (Marshall Mix test):**

- Optimum binder content is found to be 5.32% of the total mix.
- Marshall Stability of mix with NRMB is lesser than mix with base bitumen at both High and Intermediate Temperatures. As the percentage of NR increases, stability decreases.
- Low value of NRMB mix is higher compared to base bitumen mix. As the % of NR increases, flow value increases.
- Density of the NRMB mix is better compared to base bitumen mix. As the NR % increases, density increases.
- Voids in the NRMB mix is lesser compared to normal bitumen mix and hence increasing the density of the mix.
- VFB is higher for NRMB mix compared to base bitumen mix. As the NR percentage increases in the mix, VFB is increasing.

## **INNOVATION IN THE PROJECT**

### **SCOPE FOR FUTURE WORK**

1. Present study concentrates only on replacement of bitumen with NR. Chemical properties and composition of the binder is not taken into account. Further, experimentation can be planned for effect of various constituents of NR on bitumen at micro level.
2. In the present study only mechanical properties of the binders are evaluated. Rheological studies of the binders such as shear test can be further studied.

3. Evaluation is conducted only considering specific gradation of aggregate and bitumen as SDBC grade II and PG 80/100 bitumen. Studies can be conducted by considering different gradation and bitumen.
4. Binders are sensitive to temperature. In the present study, temperature evaluation is not done. Study can be further conducted to evaluate the effect of temperature on the binders.