Performance And Cost Analysis Of Modified Bitumen Binder For Flexible Pavement

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Abstract. The best suitable modified bitumen is used for the formation of flexible pavements. It also helps in reducing the amount of wastes that cannot be reduced. As development is a significant part of what Roadways are considered to be one of the most important infrastructure modules and play a significant role in our daily lives. Bitumen has been used as the basic material for pavement infrastructure, surplus products that are readily available on the market for bitumen alteration. In the present study, a transition in bitumen of different amounts has been made. Rubber is a by-product of waste tires India's recycled tires account for about 6-7 per cent of the world's number. As the surrounding tire industry grows at 12 per cent per year, squandering amounts are growing. India has been reusing discarded tires for four decades, although it is claimed that 60 per cent of the tires are disposed of by illegal dumping. The system used to reclaim these recycled items addresses the littering issue and can guarantee a lower level of pollutants in the area. The bituminous binder acts as a flexible, thermoplastic adhesive.

1. Introduction
The nation is trying to reach the Millennium Development Plan, where one of the most important issues is prosperity. The primary goal of this paper is to use all the features of the properties so that they can meet the needs of the present age without hindering the needs of the future generation. Since bitumen is the product of crude, the quality of bitumen relies directly on the cost of oil. This is the reason that the quality of bitumen changes from time to time. Due to the rapid change in value and the need to manageability problems in typical properties, the enhancement of the changed binder is a dire need to mitigate the appeal of non-renewable energy source-based bitumen.

Rubber utilized for these items is obtained from pneumatic tires that have been handled by mechanical methods and ought to be generously free from ground texture, steel and different substances, including dampness. Rubber gives better solidity resistance and strength rubber is used as an alternate material which helps in cost reduction of the project. Rubber bitumen’s stability would match with the normal bitumen used for flexible pavements. It also helps in increasing the life time of the road. To analyse the adaptability of modified bitumen to the conventional bitumen generally employed in constructing a pavement

2. LITERATURE REVIEW
The modification of bitumen with tyre rubber has shown that it has increased performances and the rheological properties compared to natural binder. The rise in rubber content would be 20% shows a increase in bitumen stiffness. Through 16 percent change, he found better performance[1].since these are the factors that regulate the efficiency of the asphalt mixtures resulting from it, the aging process of CRMB is considered[2]. The quantity of tire rubber powder with an increase in G*/sinΔ and the decrease in G*sinΔ which implies a higher in resistance to the rutting and fatigue cracking[3]. examined and introduced the implementation of an asphalt alteration of the compact pavement with crumb rubber. Previous studies have tried to find rubber modifying in hot asphalt to enhance resistance and rutting and to create pavement which improved longevity on reducing distress caused in mix asphalt pavement[3]. The efficiency of rubber modified bitumen and asphalt mixes was contrasted with SBS modified bitumen and asphalt mix to decide whether the use of rubber would substitute SBS as additive to the testing properties of bitumen and the mixtures. The modified bitumen showed a lower phase than the SBS modified bitumen of the same complicated module at low frequencies, suggesting the elastic reaction. According to Khaldounshatanawi [4] in this paper he explained that the modifications of bitumen by rubber has been shown
to increase binders such as viscosity, softening point. It performs the test by using the CRM of the passenger tire, the truck tire by using different tires the binding viscosity has been shown to be the grind the waste tires and the base binding and the viscous properties of the binder depend on the CRM types of the source.

3. EXPERIMENTAL STUDIES

Aggregate is tested for impact test is done to note the amount of energy absorbed and it is been done izod method and abrasion test in been done to to find the abrasion value of coarse aggregate and the crushing value is also been obtained usin the los angels abrasion test and the specific gravity is been obtained by using the pycnometer and the same can be used for finding the water absorption in the coarse and fine aggregate, flakiness and elongation index is been used to find the shape of the material it would be done using the scale to divide the aggregate based on the size. Bitumen is tested for ductility and elasticity recovery test is done to find the recoverable strain which is measurable by ductilio meter, Penetration and softening point is been done to bitumen to find the penetration value of the bitumen and the softening point is done to find the softening of the elected bitumen.

| RUBBER PERCENTAGE | Bitumen content (%) | Air voids (%) | VMA (%) | VFB (%) | Stability (kg) | Flow value (mm) | Bulk Density (g/cc) |
|-------------------|---------------------|---------------|---------|---------|---------------|----------------|-------------------|
| 12                | 4                   | 4.69          | 13.98   | 66.47   | 1540.43       | 3.4            | 2.37              |
|                   | 4.5                 | 4.15          | 14.53   | 71.44   | 1641.18       | 3.6            | 2.37              |
|                   | 5                   | 3.86          | 15.29   | 74.78   | 1563.3        | 3.73           | 2.36              |
| 16                | 4                   | 3.44          | 12.85   | 73.22   | 1476.45       | 3.63           | 2.4               |
|                   | 4.5                 | 3.11          | 13.61   | 77.12   | 1531.02       | 3.8            | 2.39              |
|                   | 5                   | 3.04          | 14.57   | 79.15   | 1485.72       | 3.43           | 2.37              |

4. GRAPHICAL REPRESENTATION

Figure 1. Flow value with bitumen content.
Figure 2. Marshall stability with bitumen content.

Figure 3. Unit Weight / Bulk Density graph with Bitumen Content.

5. COSTANAYSIS
The costs of roads dependent on the factors like - Width of Road, Load Factor, Traffic Handling capacity of roads, climatic conditions in the region etc. Only 30% of what you see (the black portion on the top), rest of the costs, road elements are hidden below the black top. In India, roads have been categorized into several variants depending on several things:
1. Single Lane Roads: The load of lighter vehicles. Hence these are the really cheaper ones. And one can assume them to be somewhere around Rs 30 ~ 35 Lac Per KM.
2. Double Lane Rural Roads: which is essentially double of the single lane roads.
3. Urban Roads, with double lanes which are capable of handling heavier weights (~ 33 tonnes) would cost somewhere near 1 Crore per KM (+/- 10%). If the region has Back Cotton Soil, then the whole soil needs to be replaced and filled with some other soil or create an alternate arrangement to prepare the base of the road. In such cases the costs may run up to twice the usual costs. (Technical specification is the key)
4. The Expressways and the highways, where you usually vehicles at more speed 100+ KM/PH. They have multiple lanes (usually 3–8 each side). Those roads have a concrete base on which the black top rests. The cost of building on roads will start from 6~7 Cr Per KM and goes in the range 20 ~ 25 cr per KM.

6. RESULTS & DISCUSSIONS
When the service roads with low volume of traffic modified bitumen binder is better option instead of VG30 not exceeding the percentage of modifier 12 percent of discarded tires. Main intention is to utilize discarded tires that are unclaimed and this serves as disposal method in this case. This would improve the performance of bituminous pavement resistance to deformation during building and roads. From the above tests, we infer that with a 12 percent change in bitumen we get the appropriate value compared to normal bitumen and the stability value still stays the same compared to normal bitumen.

Bitumen rubber technologies services are being carrying the research for the future development and it is been implemented by united states of America. This study defines the cost management which would help in the reduction of the capital cost. The road would cost around of 94875 kg for 1 km of VG 30 bitumen. With the replacement of tyre rubber we can reduce the bitumen quantity of 11385 kg. For the span of 1 km we can observe a cost reduction of Rs. 2,61,855 (INR). This method can be adopted in the urban roads and also temperature should be considered.

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