Research Paper Engineering

Comparison Of Conventional 60/70 grade of Bitumen with CRMB60 for Roads

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ABSTRACT

Due to rapid industrialization coupled with high rate of increase of vehicles plying on conventional bituminous high density corridor roads results in failure of flexible pavements affecting the serviceability conditions within the design life of pavements. This calls for enriching the life span of pavement by using Crumb Rubber Modified Bitumen. The paper highlights the comparison of conventional bitumen 60/70 grade and CRMB60 reflecting the economy as well as serviceability condition in the long run.

Keywords : Bitumen, Flexible Pavement, Crumb Rubber

PREAMBLE

Road Transport affects our daily lives in its myriad forms. It is the back bone of our country as the economy depends upon it. Before independence transport system was primary developed to provide communications with major ports and large cities. But after independence in order to fit to the developmental needs of the economy rebuilding of road transport network became the thrust area. Hence the capacity needs to be enhanced and road quality has to be improved to cope with the increasing pressure of road traffic. Over the year, the number of personalized vehicles has increased significantly. The number of registered vehicles has recorded a spectacular increase, for private as well as commercial vehicles. The upward trend in the registration of vehicles indicates that while in 1971 the total number of vehicles was 18.65 lakh, the number has gone up to 53.91 lakh in 1981 and to 337.86 lakh in 1996; this further increased by more than two and a half times by the year 2006 (896.18 lakh). The growth over the period 1970-71 to 2006-07 has been 12.37 percent per annum. The total road length of our nation is 3.5 million km, the second largest in the world. Due to the increasing pressure of road traffic day by day this poses load induced stresses on the roads.

According to several studies the useful life of the bituminous road is about 2-4 years that compels to maintain the roads for the minimum acceptable serviceability standards. Ministry of Road Transport and Highways estimated that they need 2 lakh crores of rupees in coming 10 years to complete the National Highways and to connect them to cities. In order to increase the life span and improve the riding quality while maintaining the economy is a must for a developing nation like ours. All this pronounces the requirement of modified bituminous material for the road network.

II:THEORY OF MODIFIED BITUMEN BINDERS

Due to the increasing cost of virgin bituminous material and environmental concerns, usage of reclaimed asphalt pavement (RAP) has drawn a great deal of attention from transportation agencies. The basic need for enhancing the conventional property of the 60/70 grade of bitumen is felt for enriching the durability of flexible pavement and also to protect the rapid damage of roads. Crumb Rubber (CRMB) is commonly used in pavement engineering. The objective of this research is to investigate the properties (penetration test, softening point, stripping value and elastic recovery) of conventional 60/70 grade of bitumen and ready made mix of CRMB 60 grade.

III:METHODOLOGY ADOPTED

In this study CRMB60 is utilized to compare with the conventional 60/70 grade bitumen. CRMB60 is recommended for hot climate areas. It is added at the rate of 10% by weight of bitumen. The binder is mixed at the temperature of 170°c to 180°c. The stirrer is then started and run for about half an hour so that blend produce is homogeneous. The blend from the refinery needs to be transported in insulated tanks maintained at 120°c and needs to be utilized for construction within 6 hours after production.

IV:COMPARISON AND ANALYSIS OF CONVENTIONAL BITUMEN WITH MODIFIED BITUMEN

The bitumen grade 60/70 and CRMB60 obtained from Tikitar industries Halol, Gujarat was tested in the laboratory yielded the following results as shown below:

Table 1 : Results of Laboratory test

Sr no.	Property	Bitumen 60/70 grade	Modified bitumen	% Increase or decrease
1	Penetration at 25°c , 0.1mm, 100 gm,5 sec.	63.54	46.44	26.91
2	Softening Point (R&B), °C, Minimum.	46.7	64.7	38.54
3	Elastic recovery of half tread in Ductillometer at 15°c, per percent	5	65.80	-
4	Stripping value	Traces	Nil	-

The results obtained fully satisfy the specifications as laid down by Indian Roads Congress. High temperatures can soften the bitumen and consequently reduce the stiffness of asphaltic concrete, making the mix more susceptible to rutting. On the other hand, low temperature, can increase the

stiffness of bitumen and reduce the flexibility of the asphaltic concrete, inducing fatigue failure as a result, cracking of the pavement surface may develop, which adversely affects the performance of the asphaltic concrete. Thus, high temperature stiffness and low temperature flexibility are important properties in bituminous mixtures respectively to avert rutting and cracking. The use of modified bitumen enhances the softening point which makes it less susceptible to temperature. This results in increase strength at high temperature to bear load. The elastic recovery is also high due to which even at low temperature the resistance to cracking is improved, prevents rutting due to excessive load at high temperature and lessens the fatting up of material which improves the skid resistance property of the road surface. Lower penetration value indicates low deformation at high temperature and load. On the other hand the stripping value obtained by the addition of CRMB60 grade is nil which improves the water repellent property.

One of the research paper shows that bitumen grade 60/70 obtained from Mathura Refinery mixed with 10% crumb rubber modifier used on a 400m long and 10.5m wide test section of the ring road between Shantivan and Rajghat, New Delhi showed no sign of pot holes and ravelling even after 15 months of construction. It also conveyed that the mix obtained increases the load carrying capacity to bear more number of standard axle loads thereby increasing life of the pavement also it reduce the wear and tear of vehicles by helping in the smooth performance of the road surface. All this makes the use of modified bitumen highly suitable for tropical country like ours where the temperature at same place can vary from 0°c in winters to 50°c in summers along with two to three months of monsoon season.

V: ECONOMIC VIABILITY

One of the leading scientist and engineer of this field, Prof. P.K. Sikdar, Ex Director Central Road Research Institute (CRRI), New Delhi stated that natural rubber modified binder obtained from Kochi Refineries Ltd (KRL) at rate of Rs.10,500 per tonne which makes it cost effective. Moreover the difference between the cost of rubberized bitumen and ordinary bitumen is only around Rs 1,000 per tonne. If natural rubber is used as an additive to the bitumen for maintaining the roads the cost goes up by 6% initially. But this shoot up gets compensated due to the increased life of the surfacing which may be as high as 100%.

Many states in our country produce large quantities of natural rubber. If we could use this rubber for modifying the bitumen then nor only will it improve the road quality and performance but also the prospects of farming community.

VI: ENVIRONMENTAL EFFECTS

As the life span of conventional bitumen 60/70 grade is 2 – 4 years and the failures are witnessed at the early stages which causes the high volumes of traffic in the urban areas to show high levels of noise. Exposure to such high level of noise for prolonged periods can produce detrimental effects like stress, reduced efficiency, behavioural changes etc. But if CRMB60 is used then the impacts produced due to the movements of vehicles get reduced which in turn reduces the noise levels up to 50%. According to Ottawa River Institute more than 20 million tires are wasted each year. Rubber tires are ultra violet resistance, ozone resistant, have high strength due to the presence of sulphur. Using the old used tires as additives in the bitumen embed these properties in the bitumen itself. Also the use of old used tyres help in conservation of natural resources. The problem of disposing the old used tires also gets solved because these tires are normally disposed off by burning which pollutes the environment.

VII: SCOPE AND USE OF MODIFIED BITUMEN FOR DIFFRENT PROJECTS AT THE NATIONAL LEVEL

1. National Highways Authority Of India Project – Ministry Of Road Transport and Highways:

This project is also known as the Golden Quadrilateral. It passes through Delhi, Mumbai, Chennai, and Kolkata. It also connects Kashmir to Kanyakumari and Sichar to Porbandar.

2. Various Test Projects in Kerala and Tamil Nadu being carried out by Central Road Research Institute (CRRI).

   These include Airport-Seaport road, Kollam - Sengkattal road (National Highway No.8) and Trichy Pudkuttal - Karalkudi Road (National Highway No.210).

3. Railway Station Road at Kottayam , Kerala that is 1 km long – At the international level:

International Surfacing Systems and C.H. Mc Donald have developed a procedure for modifying the bitumen by the use of crumb rubber. This technique has been in use in many countries worldwide like Australia, South Africa, Portugal and Korea for the last 30 years.

VIII: CONCLUSION

Crumb rubber cannot be considered a waste material. It is a valuable commodity with ongoing expansion and growth in diversified markets. Its use in asphalt is not making a highway into a linear landfill. Crumb rubber has proven to be one of the only additives to hot mix asphalt derived from a waste material that has a beneficial impact and actually improves performance. Some conclusions from studying this market may include:

1. Crumb rubber production is an environmentally economical sound method of waste tire reduction,

2. Asphalt Rubber has proven long term performance, cost effectiveness, and sustainable market growth, and

3. Asphalt Rubber paving programs are key components to acceptable and successful waste tire management programs.

All options must be considered to reduce the build up of waste tires. It is far better to remove tires from the waste stream, regardless of disposal method, than to allow the continuation of uncontrollable and disastrous waste tire stockpile fires throughout the world. Without question, the emissions from equipment and facilities that process waste tires will always be lower than the emissions from a waste tire fire burning out of control.

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