

EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF BITUMEN BY RECYCLED RUBBER FROM TYRE ON ASPHALT PAVEMENT

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ABSTRACT

The objective of this research is to find a good mix proportion for the rubberized bitumen. Flexible pavements with bituminous surfacing are widely used in India. The high traffic intensity in terms of commercial vehicles, over loading of trucks and significant variations in daily and seasonal temperature of the pavement have been responsible for earlier development of failure of the pavement. Investigations in India and abroad have revealed that the properties of bitumen and bituminous mixes can be improved to meet the basic requirements.

Use of Crumb Rubber i.e. the rubber obtained from the waste tyres of vehicles, is used in the construction of flexible pavement. In the present study, an attempt has been made to use crumb rubber modified bitumen which is blended at specified temperatures. Marshall's mix design was carried out by changing the modified bitumen content at constant optimum rubber content and subsequent tests have been performed to determine the different mix design characteristics and for conventional bitumen.

INTRODUCTION

India is one of the biggest developing countries in the world. Transportation is the important criteria to be considered. Generally, Road transport is the cheapest way of transport in comparison by maintenance and design period. And economy of our country mainly depends on this. Essential requirements of the people are mostly done through road way transport. Minor imports and exports are also carried on through the roadways. Due to the rapid rise in transport through roads the usage of automobiles is greatly increased. Hence the usage of rubber tyres is rapidly increased. Replacement of vehicle tyres is necessary for approximately 20000 km – 60000 km of transportation depending on the type of vehicle. Due to this excess quantity of waste tyres are produced. It has been estimated that more or less 1.2 billion tons of waste tyres are produced globally every year.

OBJECTIVE

The objectives of the trial were to

compare the performance of dense graded bituminous overlay incorporating crumb rubber modified bitumen with a similar overlay but using conventional bitumen pavement. Our main objective is to develop a bituminous pavements with the help of crumb rubber as a partial replacement of bitumen in different mix proportions and we are going to test the characteristic strength of the bituminous pavement.

DIFFERENCE BETWEEN TAR - BITUMEN - ASPHALT

Tar:

Produced from the destructive distillation (burning in specific condition of temperature, without Presence of Oxygen) of Bituminous Coal.

Bitumen:

Obtained from refining process (fractional distillation) of crude oil (a petroleum product).

Asphalt:

Asphalt is a paving material. (Asphalt = Aggregates + Bitumen)

NEED FOR RUBBERIZED BITUMEN

Increasingly aggressive traffic conditions. Severe climatic conditions with daily and seasonal variation of temperature. Need to maintain roads at higher service ability level. Increased fatigue resistance of bituminous mixes under repeated loading and higher degree of flexibility. Improved cohesion which assists resistance to weathering and adhesion to reduce risks of binder being

stripped by water. Achieve higher stiffness modulus to minimize thickness of resurfacing in urban areas and to avoid milling. Resistance to cracking, raveling, deformation and creep failure.

ADVANTAGES OF RUBBERIZED BITUMEN OVER PLAIN BITUMEN

Rubberized bitumen has higher softening point, giving more stability to the pavement during hot months. Much improved Elastic Recovery over 60, giving resistance to fatigue. Improved resistance to stripping due to water repellent properties. Lower susceptibility to daily and seasonal temperature variation. Better age resistance properties. Much improved Elastic Modulus increases load carrying capacity. Delays oxidization of mixes thus enhanced pavement life.

MATERIAL COLLECTION

1. Collection of tyre rubber:

This involves the collection waste tyre rubber from available sources like recycling plants, junk yards, etc.,

Types of tyres:



Fig. 1

Fig. 2

Tyres are broadly classified into two types: i) nylon tyres ii) radial tyres
Nylon tyres:

Nylon tyres are the type of tyres which are composed of nylon threads inside without steel reinforcement as shown in fig. 1.

Radial tyres:

Radial tyres are the type of tyres which are made with steel reinforcement inside as shown in fig. 2.

Collection process:

In case of large scale requirements, the rubber powder or crumb rubber is collected from tyre processing plants, where the End Life Tyres (ELTs) are shredded into smaller pieces and the pieces are then converted to powder form.



Fig. 3



Fig. 4

The tyre requirement for process is in small scale,

so we collect waste tyres from tyre re-trading companies. In those companies, the outer surface of the ELTs are rubbed with steel nails so that the surface becomes more adhesiveness to the surface for laying a new pattern on the outer layer of tyres as we shown in fig 3 & 4



Fig. 5



Fig. 6

Fig. 5 & 6 shows the different sizes of waste rubber sample we collected for our study.

2. Collection of bitumen:



Fig. 7

In case of small scale construction of bituminous roads, the bitumen is transported in barrels to the required area. At that particular area, the bitumen is processed at different temperatures depending on the nature of work.

While in case of large scale purposes, the aggregates and bitumen are stored near some ready mix bituminous plant and then they can be mixed desired mix proportion at suitable temperatures.

We went to a bitumen processing plant at Arputhapuram near Tanjore for material collection for our study as shown in Fig.7



Fig. 8

We collected the bituminous material from the plant at a temperature of around 100°C. The grade of the bitumen we collected is VG – 30 as shown in Fig. 8

3. Collection of Aggregates:



Fig. 9

The above image shows the different sizes of aggregates we collected for our process. We collect the materials from an aggregate quarry near Vallam near Tanjore.

After collection of aggregates, we perform some tests to evaluate the quality standard of aggregates.

TESTS TO BE CONDUCTED

Tests on aggregates:

- Sieve analysis
- Impact value test
- Crushing value test
- Abrasion test

Tests on bitumen:

- Penetration value test
- Ductility test
- Softening point test
- Marshal stability test

RESULTS

Table.1: Tests results for aggregates

S. No	Properties	IS Specifications	Obtained values
1	Impact value	27%	19%
2	Crushing value	30%	26.2%
3	Abrasion value	30%	28.1%

Table.2: Tests results for our

CONCLUSION

We concluded that the modified bitumen showing better results compared to the normal bitumen. This method contributes for improved disposal of waste tyres. Decrease in penetration point, increases load – bearing capacity of the road. The Marshall Stability value is high hence increases life of the road. While using crumb rubber, the melting point of bitumen will be increased. Waste tyre modified bituminous surface of road increases their life period especially the pavement by 35% and it requires low maintenance costs.

REFERENCES

- i. “A Technical and Economical Assessment of Replacement of Coarse Aggregate by Waste Tyre Rubber in Construction”, Warudkar A.A & Valekar N.S, IJRITCC Vol: 3 Issue: 2, ISSN: 2321-8169.
- ii. “Experimental Assessment of Properties of Crumb Rubber Modified Bitumen Mix (CRMB 55) With and Without Application of Nanotechnology Additive”, Bala Raju Teppala , Prof. C.B. Mishra, Alok Sinha, Dinesh Kumar, Egis India Consulting Engineers Pvt. Ltd., India, ISIRSET, Vol. 3, Issue 10, October 2014, ISSN: 2319-8753.
- iii. “A Review Literature on the Use of Waste Plastics and Waste Rubber Tyres in Pavement”, Rishi Singh Chhabra & Supriya Marik, IJCEM Vol: 1, Issue 1, April 2014, ISSN: 2348 9510.
- iv. “Experimental Investigation on Strength Characteristics of Concrete using Tyre Rubber as Aggregates in Concrete”, Neela Deshpande, S.S. Kulkarni, Tejaswinee Pawar & Vijay Gunde, Vishwakarma IIT, Pune, Maharashtra, India, IJAERD, Vol: 4, Issue 2, April 2014, 97-108, ISSN(P): 2250-1584; ISSN(E): 2278-9383.
- v. “Review Paper on Use of Different Types of Additives in DBM(Dence Bitumen Macadam)”, Nayeem Ahmad Mir & O.P. Mittal, SRMIET, Haryana, India, IJARET, Vol: 3, Issue 2 (April – June 2016), ISSN : 2394-6814.