

Use of Waste Rubber Tyres in Construction of Bituminous Road – An Overview

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ABSTRACT

The use of four wheeler, two wheeler vehicles etc. is increasing day by day. As a result amount of waste tyres also increasing. Waste tyres in India are categorized as solid or hazardous waste. It is estimated that about 60 per cent of waste tyres are disposed via unknown routes in the urban as well as rural areas. This leads to various environmental problems which include air pollution associated with open burning of tyres (particulates, odor, visual impacts, and other harmful contaminants such as polycyclic aromatic hydrocarbon, dioxin, furans and oxides of nitrogen) and aesthetic pollution. Therefore, it is necessary to utilize the wastes effectively with technical development in each field. The waste tyres can be used as well sized aggregate in the various bituminous mixes if it is cut in the form of aggregate and can be called as rubber aggregate. This not only minimizes the pollution occurred due to waste tyres but also minimizes the use of conventional aggregate which is available in exhaustible quantity.

Keywords: Rubber aggregate, flexible pavements, crumb rubber, modified bitumen, quieter roads

1. INTRODUCTION:

Now-a-days disposal of different wastes produced from different Industries is a great problem. These materials pose environmental pollution in the nearby locality because many of them are non-biodegradable. Traditionally soil, stone aggregate, sand, bitumen, cement etc. are used for road construction. Natural material being exhaustible in nature, its quantity is declining gradually. Also, cost of extracting good quality of natural material is increasing. Concerned about this, the scientists are looking for alternative materials for highway construction, by which the pollution and disposal problems may be partly reduced. Keeping in mind the need for bulk use of these solid wastes in India, it was thought expedient to test these materials and to develop specifications to enhance the use of waste tyres in road making in which higher economic returns may be possible. The possible use of these materials should be developed for construction of low volume roads in different parts of our country. The necessary specifications should be formulated and attempts are to be made to maximize the use of solid wastes in different layers of the road pavement.

Post construction pavement performance studies are to be done for these waste materials for construction of low volume roads with two major benefits (i) it will help clear valuable land of huge dumps of wastes: (ii) it will also help to preserve the natural reserves of aggregates, thus protecting the environment. Rubber tyres are user friendly but not eco-friendly as they are non-biodegradable generally. The practice of disposing waste tyres in landfills and open burning is becoming unacceptable because of rapid depletion of available landfill sites and clear environment respectively.

The conventional bituminous mix includes stone aggregate and 3 to 5 percent bitumen by weight of the aggregate. The scrap tyre rubber can be incorporated into bitumen, often abbreviated as modified bitumen and granulated or ground rubber or crumb rubber can be used as a portion of the fine stone aggregate. The use of waste in hot bituminous mixes enhances pavement performance, protect environment and provide low cost and quieter roads.

2. LITERATURE REVIEW:

Prof. Justo et al (2002), at the Centre for Transportation Engineering of Bangalore University compare the properties of the modified bitumen with ordinary bitumen. It was observed that the penetration and ductility values of the modified bitumen decreased with the increase in proportion of the plastic additive, up to 12 percent by weight. Therefore the life of the pavement surfacing using the modified bitumen is also expected to increase substantially in comparison to the use of ordinary bitumen.

Shankar et al (2009), crumb rubber modified bitumen (CRMB 55) was 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 (60/70) also. This has resulted in much improved characteristics when compared with straight run bitumen and that too at reduced optimum modified binder content (5.67 %).

Mohd. Imtiyaz (2002) concluded that the mix prepared with modifiers shows: - Higher resistance to permanent deformation at higher temperature.

3. METHODOLOGY:

Waste rubber tyres were collected from roads sides, dumpsites and waste-buyers. The collected waste tyres were sorted as per the required sizes for the aggregate. The waste tyres were cut in the form of aggregate of sizes ranging from 22.4 mm to 6.00 mm (as per IRC-SP20) in the tyre cutting machine which is shown in picture 1.



Picture 1

The waste rubber tyres can be managed as a whole tyre, as slit tyre, as shredded or chopped tyre, as ground rubber or as a crumb rubber product. The rubber of tyre usually employed in bituminous mix, in the form of rubber particles are subjected to a dual cycle of magnetic separation, then screened and recovered in various sizes and can be called as Rubber aggregate. It was cleaned by de-dusting or washing if required. The rubber pieces (rubber aggregate) were sieved through 22.4 mm sieve and retained at 5.6 mm sieve as per the specification of mix design and these were added in bituminous mix, 10 to 20 percent by weight of the stone aggregate. These rubber aggregate were mixed with stone aggregate and bitumen at temperature between 160⁰c to 170⁰c for proper mixing of bituminous mix. As the waste rubber tyres are thermodynamically set, they are not supposed to melt in the bitumen, at the time of mixing of rubber aggregate, stone aggregate and bitumen in hot mix plant.

4. RESULT:

The possible use of rubber particles from scrap tyres into concrete mix have already given better result in sub-bases for highway pavements, highway medians, sound barriers and other transportation structures. The addition of rubber aggregate in bituminous mix decreases the quantity of stone aggregate by volume and increases the flexibility and flexural strength of the carpet layer of the highways. Aggregate is the granular material used in bitumen concrete mixtures, which makes up 90 to 95 percent of mixture weight and provide most of the load bearing characteristics of the mix. Due to which the quantity of aggregate is gradually decreasing which will need the alternative material as aggregate for the highway construction.

5. SIGNIFICANCES:

The Rubber aggregate can be the better option for conventional aggregate for the surface layer for highway. The rubber aggregate solves the problem of permanent deformation and thermal cracking. When used for road construction it can withstand higher temperature. Hence it is suitable for tropical regions. It can also resist the effect of water. With all these, it is a good saving too. No toxic gas is produced. Disposal of waste tyres will no longer be a problem. The use of waste tyres on the road has helps to provide better place for buying the used tyres waste without causing disposal problem. At the same time, a better road is also constructed. It also helps to avoid the general disposal technique of waste tyres namely land-filling and open burning, which have certain burden on ecology.

6. CONCLUSION :

- Addition of waste tyres as rubber aggregate modifies the flexibility of surface layer.
- Optimum content of waste rubber tyres to be used is between the range of 5% to 20%.
- Problem like thermal cracking and permanent deformation are reduce in hot temperature region.
- Rubber has property of absorbing sound, which also help in reducing the sound pollution of heavy traffic roads.
- Waste rubber tyres thus can be put to use and it ultimately improves the quality and performance of road.
- Conventional stone aggregate can be saved to a certain quantity.

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