

## "A Study On The Properties Of Bitumen & Aggregate By Replacing Waste Tyre Rubber With Bitumen & Aggregate Construction Of Road Pavement"

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**ABSTRACT**-Thae various environment problem are created due to increasing day by day two wheeler & four wheeler vehicle due to its waste tyre. It is estimated that 60% waste tyre are disposed different routes in the urban as well as rural area. Waste tyre are categorized as solid or hazardous waste this leads to create various problem on human being as well as aquatic life. Due to its burning & dumping the tyre in sea shore. There fore it is necessary to replaced the bitumen & aggregate with the percentage of ( 7,8,9,10,11,12 ) & carried out the different test on bitumen & aggregate to finding out the difference between normal & rubber pavement to increase the strength of road pavement & rubber is cheaper than bitumen & aggregate they have large amount of waste tyre.

**Keywords:** Modified Bitumen, Rubber Aggregate, Economical, bitumen, pavement

### 1] INTRODUCTION

The world generate about 1.5 billion waste tyre annually. In india all new vehicle have radial tyre and that type of radial tyre become piles. And annually 0.6 tonnes of tyre scrap generated in the country annually. There is no government agencies that monitors tyre disposal in the country. The waste tyre are disposal problem. This waste tyre or stock piles tyre annually. Environmental & health hazards due to burning of tyre effects of aquatic life & insufficient land to dropped on the land increasing pollution. There fore used of waste tyre rubber in construction of road pavement to replacement of aggregate & bitumen with rubber adding some percentage. Rubber from waste tyre have light weight & thermal insulation properties & hydraulic conductivity. To achive the strength of road pavement & to minimize the disposal problem of waste tyre.

The amount of waste tyre dumped in an open area leading to increase in the area covered under waste land waste tyre not recycled is either land filled where prove to be harmful to environment burning leads to air pollution where as dumping of waste tyre open areas cause contamination of water bodies & soil tyre an alternatives for treatment of waste tyre are used in construction of road pavement to replacing the bitumen & aggregate with the percentage of (7,8,9,10,11,12 )

finding through the result to give proper strength of bitumen & aggregate to taken the various test like penetration test, softening point test, viscosity test, marshall stability test & aggregate test like water absorption test, impact test, crushing test, abrasion value test, specific gravity test.

### 2] PREVIOUS HISTORY OF TYRE

With phenomenal increasing population directly related to the growth of automobiles in india during recent years. The use new tyre and replacement of tyre demand increases. the number of use tyre being discarded is going to increase significantly. There are approximately 270 million are waste tyre generated annually in state of these 230 million are passenger car tyre and 40 million truck tyre according to the 800 million scrap tyre currently stock piles through out the country

A scrsb tyre passenger car weight approximately 9 kg and will provide 60% rubber 20% steel and 20% fiber and other waste product .

### 3] STUDY ON WASTE TYRE FROM PREVIOUS RESERCH PAPER

#### A] Laboratory Evaluation And Usage Of Waste Tyre Rubber In Bituminious Road

In the above research paper give the idea about the different mixes of bitumen and crumb tyre rubber with varying properties with aggregate has been tested with the help of marshall test Different properties of bitumen and aggregate have been tested. Then prepare different mixes of bitumen and crumbof waste tire rubber with varying proportions by using wet process

After careful evaluation of the properties and taking various tests as per standards the results shown by 10% addition of rubber crumbs has best suitability for blending it with bitumen. This will help to dispose the waste tire rubber in a proper way and solve the problem of environmental concerns up to a certain extent.

## B) Use Of Waste Plastics And Waste Rubber Tyers

Worldwide, sustainability is the pressing need of the hour in the construction industry and towards this end use of waste material in road construction is being increasingly encouraged so as to reduce environmental impact. In the highway infrastructure, a large number of originate materials and technologies have been invented to determine their suitability for the design, construction and maintenance of these pavements. Plastics and rubbers are one of them. Also considering the environmental approach, due to excessive use of polythenes in day to day business, the pollution to the environment is enormous. The use of plastic materials such as carry bags, cups, etc. is constantly increasing day by day. Since the polythenes are not biodegradable, the need of the current hour is to use the waste polythene in some beneficial purposes. The main aim of this study is to focus on using the available waste/recycled plastic materials and waste rubber tyres present in abundant which can be used economically and conveniently. The use of these materials as a road construction proves ecofriendly, economical and use of plastic will also give strength in the sub-base course of the pavement

## C) Use of Waste Tyres Rubber In Flexible Road Pavement

For this research on , Large no of waste tyre collected. These waste tyre cut to the crushing plant invarious sizes (80 mm to micron).The waste rubber use notonly in bitumen but also aggregate in percentages of 5, 10, 15by using wet process. The different test conduct on aggregate(Impact, Crushing, Abrasion, specific Gravity & WaterAbsorption Test) as well as on bitumen (Penetration Ductility,Softening, Viscosity & Marshall Stability Test)

After carefully performing the above test on aggregateand bitumen it is concluded that as per IRC specificationthe results of replacing 10% of rubber has gives a betterstrength and stability also reduces the problem of disposalof waste tyre and help to make a helthy environment. Addition of waste tyre in rubber aggregate modifies theflexibility of surface layer.The permanent deformation and thermal cracking arereduced in hot temperature region.The main properties of rubber is sound absorbing, soreduced the noise pollution of heavy traffic roads Conventional stone aggregate can be saved to the certain quantitiesThe waste rubber tyre are used in road construction ,so improved the quality of road By replacing the rubber in bitumen the strength will be increased.

## D)Waste Rubber Tyres In Construction Of Bituminous Road

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 permanen.

## E) Properties Of Crumb Rubber Of Modified Asphalt

Based on the results of the experimental investigations conducted on normal and crumb rubber modified asphalt mixes, the following conclusions can be drawn. The results indicate that the increase in stiffness is 72% and 79% for the base bitumen at both temperatures of 20°C and 40°C, respectively. The crumb rubber modified bitumen shows an increase of 21 % and that the effect of aging is small in the modified mixtures as compared to normal binders. Thus, modified mixes are expected to yield longer lives due to better ageing. The data of creep stiffness indicate the unaged samples CRI1 mixtures with an improved 56% increase, while the increase of 16% and PMA-D showed an improvement of 63% of control mix at 40°C.



**Fig.No.-1 Rubber Cutting Mchine**

### F) Addition Of Rubber Aggregate

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. 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 as shown in Figure.2. 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.

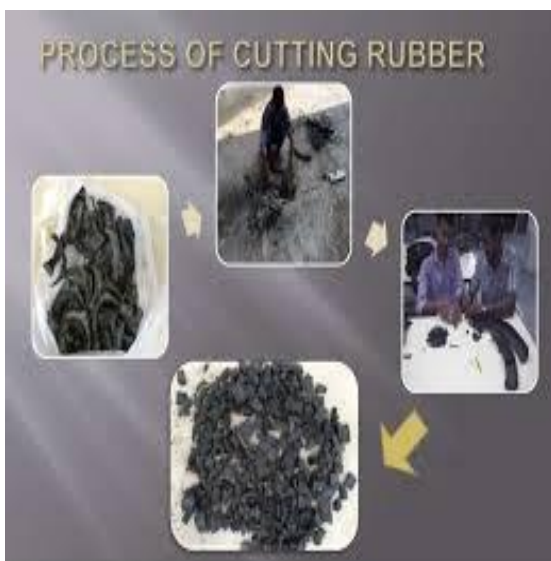


Fig.No.-2 Process Of Cutting Rubber

bitumen in percentage of 7,8,9,10,11,12 to find the accurate strength of above percentage finding through test on bitumen aggregate and compaire normal aggregate and normal bitumen test. With the help of various test on aggregate and bitumen taken.

### MOLDED AND PLASTIC PRODUCTS

Recycled rubber is also being used in molded products. Here the material plastic or as filler. The table below shows the cradle-to-gate carbon footprints for some of the more common plastic resins. Carbon Footprint of Virgin Resins Virgin Plastic Resins.

### METHODOLOGY

For this research on, large no of waste tyre collected. These waste tyre cut to the crushing plant in various sizes (80mm to micron ). The waste rubber use not only in bitumen but also aggregate in percentage of 7,8,9,10,11,12 by using wet process. The different test conduct on aggregate (Impact, Crushing, Abrasion, Specific Gravity & Water Absorption test ) as well as on bitumen ( Penetration, Ductility, & Marshall Stability Test Softening, Viscosity,).There are a large number of ways to manage the waste rubber tyres. It can be in the form of whole tyre or slit tyre, chopped tyre, ground rubber or as a crumb rubber product. The rubber tyre employed in bituminous mix in the form of rubber particles, when subjected to a dual cycle of magnetic separation are then screened and recovered in various sizes, thus giving rise to the product called "Rubber Aggregate". Various processes like de-dusting and washing are used to clean the waste rubber-tyre. All the rubber pieces are sieved through 22.4 mm sieve and retained through 5.6 mm sieve as per the specifications of mix design. These clear pieces are added in bituminous mix, 5 to 15% by weight of stone aggregate. Then, these well - sieved and cleaned rubber aggregate is mixed well with stone aggregate and bitumen at temperature of about 160°C-170°C for the proper mixing of bituminous mix. The waste rubber tyres are thermodynamically set, thus they are not melted in bitumen at the time of mixing altogether in a mix plant. Large quantities of waste rubber tyres are collected from road sides, dumpsites and waste - buyers. The collected waste tyres are sorted as per the required sizes for the mixing purposes. The waste tyres are cut in the form of aggregate size usually ranging from 22.4mm to 6.00mm (as per IRC:SP20) in the tyre cutting machine shown in the figure below Selection Criteria For PMB And CRMB Based On Atmospheric Temperature

### 6] ADVANTAGES

- A) It decreases maintainance cost of road pavement.
- B) The replacement of aggregate with rubber the natural stone are save.To achive the economy



- C) To reduce the noise pollution due to the main property of rubber.
- D) As compare to wste rubber bitumen is costlier by replacing this waste tyre in bitumen we can reduces the cost , hence economy can be achievd.
- E) To reduce the cost bitumen due to the replacement of rubber tyre.
- F) Waste tyre rubberis easily available in large quantity.
- G) Increases the drainage properties of road pavement.
- H) There is a no compression takes place due to continuous loading of traffic.
- I) Vibration attenuation property will be increase.

## 7 ] HAZARDS OF TYRE WASTE

- 1) Due to open burning of tyre, which pollute the air with large quantities of carbon smoke, hydrocarbons and residue.
- 2) Due to increase in population large no of vehicle available that's vehicle large no of waste tyre are produce, this tyre are dispose many problem due to lack of land available.
- 3) These fires are virtually impossible to extinguish once started Aside from the persistent annoyance, mosquitoes have been shown to spread various dangerous diseases.
- 4) This waste tyres are produces carbon by burning process
- 5) Not only are these tyre mounds eyesores, they are also environmental and health hazards.
- 6) The little pools of water retained by whole waste tyres create an ideal breeding ground for mosquitoes.
- 7) Potentially harmful substances were found exposed to highly acidic solutions.

## 8] CONCLUSION

- 1 Replacement of waste tyre in aggregate improve the quility of road.
- 2 The thermal cracking are reduced in hot temperature region.
- 3 To reduce the noise pollution due to the properties of bitumen.
- 4 Conventional stone aggregate can be saved to the certain quantities
- 5 To protect the environment to use of stock pile waste tyre.

- 6 Waste tyre rubber is used with aggregate in different layer and on the top surface layer mixed with bitumen in percentage (7,8,9,10,11,12) by replacing it which increases its properties of bitumen as well as aggregate & minimizes the pollution occurred due to waste tyre and also use of rubber waste is economical as compared to other material.
- 7 To use waste tyre rubber in road construction achive economy due to its low cost of rubber.

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