



# Experimental Study on use of Waste Rubber Tyres in Road Pavement

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## Abstract:

Pneumatic tires are used on many types of vehicles, including cars, bicycles, motorcycles, buses, trucks, heavy equipment, and aircraft. Metal tires are still used on locomotives and railcars, and solid rubber (A tire or tyre is a ring shaped component that surrounds a wheel's rim to transfer a vehicle's load from the axle through the wheel to the ground and to provide traction on the surface travelled over. Most tires, such as those for automobiles and bicycles, are pneumatically inflated structures, which also provide a flexible cushion that absorbs shock as the tire rolls over rough features on the surface. Tires provide a footprint that is designed to match the weight of the vehicle with the bearing strength of the surface that it rolls over by providing a bearing pressure that will not deform the surface excessively.

**Key words:** Coarse Aggregate, Bitumen, Rubber Aggregate

## 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.

## 2. MATERIAL SPECIFICATION:

### 2.1 Materials:

#### Cement:

Any of various calcined mixtures of clay and limestone, Usually mixed with water and sand, gravel, etc., to form concrete, that are used as a building material. A powdery substance made by calcining lime and clay, mixed with water to form mortar or mixed with sand, gravel, and water to make concrete.

#### Coarse aggregate:

Those particles that are predominantly retained on the 4.75mm sieve and will pass through 3-inch screen. Larger pieces offer less surface area of the particles than an equivalent volume of small pieces. That allows the area below to become a void, or at best, to become filled with finer particles of sand and cement only and results in a weakened area.

#### Fine aggregate:

Fine aggregate generally consist of natural sand or crushed stone with most particles passing through a 3/8-inch sieve. For increased workability and for economy as reflected by use of less cement, the fine aggregate should have a rounded shape. The purpose of the fine aggregate is to fill the voids in the coarse aggregate and to act as a workability agent.

#### Rubber:

Rubber compounds are one of the most complex and universally used materials and flexibility of the compounds and their ability to absorb particle filler like carbon black, silica and clay in amounts more than their own weight results in a wide range of properties, possible to achieve. Quite often, rubber and elastomer compounds are used where resistance to impact, or toughness is desired.

#### Bitumen:

Bitumen is defined as "A viscous liquid, or a solid, consisting essentially of hydrocarbons and their derivatives, which is soluble in trichloro-ethylene and is substantially non-volatile and softens gradually when heated". It is black or brown in colour & possesses waterproofing and adhesive properties. A substance produced through the distillation of crude oil and known for its waterproofing and adhesive properties.

#### Specific Gravity:

| S.NO | MATERIALS        | SPECIFIC GRAVITY |
|------|------------------|------------------|
| 1.   | Coarse Aggregate | 2.69             |
| 2.   | Rubber Aggregate | 1.194            |

### Properties of Rubber

| S.NO | DESIGNATION      | TEST RESULT |
|------|------------------|-------------|
| 1.   | Specific Gravity | 1.194       |
| 2.   | Water Absorption | 2.82        |

### Water absorption test:

#### Test of an Aggregate

| Properties Tested      | Test Methods | Results |
|------------------------|--------------|---------|
| Aggregate Impact value | IS:2386      | 18%     |
| Absorption Value       | IS:2386      | 0.25%   |
| Specific Gravity       | IS:2386      | 2.5%    |

### Property Tests for Bitumen

| Property Tested             | Test Methods    | Permissible Limits as per IS 73:2013 | Results |
|-----------------------------|-----------------|--------------------------------------|---------|
| Specific gravity of bitumen | IS: 1202 – 1978 | 0.99 min                             | 1.02    |
| Softening point of bitumen  | IS: 1205 – 1978 | 47 °C (min)                          | 46°C    |
| Bitumen Penetration Test    | IS: 1203 – 1978 | 45 (min)                             | 67      |
| Ductility test              | IS: 1208 – 1978 | 100                                  | 94cm    |

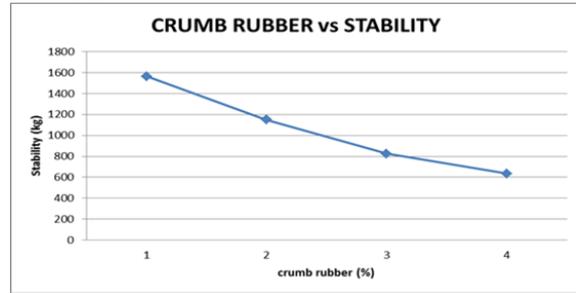
### Characteristics values of Bitumen and Stability

| Mould no | Bitumen content (%) | Stability (kg) | Average stability (kg) |
|----------|---------------------|----------------|------------------------|
| 1        |                     | 780.2          |                        |
| 2        | 4.25                | 922            | 851.1                  |
| 3        |                     | 780.1          |                        |
| 4        | 4.50                | 997.3          | 888.7                  |

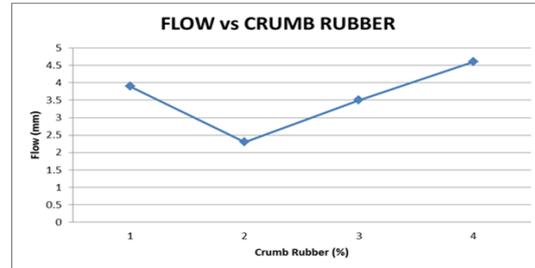
### Characteristics value of Rubber Content and Stability

| Mould No | Rubber Content(%) | Stability(kg) |
|----------|-------------------|---------------|
| 1        | 0                 | 1564.7        |
| 2        | 1                 | 1150.56       |
| 3        | 2                 | 826.86        |
| 4        | 3                 | 635.36        |

### 3. RESULT:



**GRAPH FOR PERCENTAGE OF RUBBER AND STABILITY**



**Characteristics of Flow and Crumb Rubber**

### 4. 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 reduced in hot temperature region. Rubber has property of absorbing sound, which also helps 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 the certain quantities. The waste rubber tyre is used in road construction, so improved the quality of road. Waste tyre rubber is used with aggregate in different layers and on the top surface layer mixed with bitumen in percentage (5,10,15) 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. By replacing the rubber in bitumen the strength will be increased.

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