



# INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

## Utilization of Waste Rubber Tire as a Fine Aggregate in Road pavement

**Prof. Nilesh Pal**

J D College of Engineering and Management  
Nagpur

**Ms. Aishwarya Barsagade**

J D College of Engineering and Management  
Nagpur

**Ms. Roshni Dakhare**

J D College of Engineering and Management  
Nagpur

**Ms. Sonali Dhoke**

J D College of Engineering and Management  
Nagpur

**Mr. Harshal Gaidhane**

J D College of Engineering and Management  
Nagpur

**Mr. Nikhil Shende**

J D College of Engineering and Management  
Nagpur

**Mr. Himanshu Ramtekkar**

J D College of Engineering and Management  
Nagpur

### Abstract

The use of waste material like crumb rubber in road construction is being increasingly encouraged, so to reduce the environmental impact. The rubber tyre waste increasing rapidly due to rise in automobiles/vehicles. Tyres from vehicles is made up of synthetic crumb rubber. Disposal of these rubber is a serious environmental problem. This waste rubber can be used to partially replaced the conventional material which is lead to improve the mechanical characteristics of road.

Concrete is a composite material consist of cement, water, fine aggregate and coarse aggregate. High strength concrete was prepared of w/c 0.55.

In this present study a comparison is carried out between the conventional concrete blocks and the advanced concrete blocks which is made-up of partially replacing fine aggregate with crumb rubber, i.e., 10% and 20% of unit weight of sand and analyse them.

### Keywords:

Concrete block, crumb rubber, compressive strength.

**Introduction:**

The rapid increase in the number of vehicles in last decades is accompanied by rapid growing amount of rubber tyre waste of 1.5 plus billion waste tyre that are generated every year worldwide, 6% are in India. India is the world third largest producer and fourth largest consumer of natural rubber. Within the country the automobile industries are the largest consumer, according to the report. business standard reported that India produces 6.5 lakh tyres per year.

Several studies on the effect of incorporation of shredded rubber tyre as aggregate on concrete performance have been reported in the literature. this research consists of analysis the effect of addition of rubber particles on physical and mechanical properties of concrete.

In order to produce new material which can satisfy some technical application and to help decision maker to make solutions for management for rubber waste. The use of shredded rubber may reduce the cost and help to preserve natural resources.

The aim of the present work is to study the possibility of crumb rubber in road pavement. The crumb rubber particles are used to partially replace fine aggregate in concrete. As partial substitution by unit weight of fine aggregate at a rate varying of 10% and 20% And compare between the conventional block and advanced block size of 150 mm x150 mm x 150 mm cubic mould. The effect of adding crumb rubber as partially replaced fine aggregate is evaluated by laboratory test.

**Objective:**

1. To compare workability of designed concrete pavement block to conventional concrete pavement block.
2. To achieve comparable compressive strength & tensile strength as compared to conventional concrete block.
3. To obtain comparable proportion for use of rubber in design concrete to achieve the maximum compressive strength.
4. To make the concrete block cost effective & light weight as compared to conventional concrete blocks.

**Methodology:****1) Fineness test on cement** (IS: 269-1989 and IS: 4031-1988)

1. Weight accurately 100 gm of cement and place it on a standard 90-micron sieve.
2. Breakdown any air set lumps in the cement sample with fingers.
3. Continuously sieve the sample giving circular and vertical motions for a period of 15-20 minutes.  
And if the percentage of residue of a given sample is less than 10% of taken sample is adequately fine as per IS: 269-1976.

**2) Soundness of cement** (IS: 269-1989 and IS: 4031-1988)

1. Placed the lightly oiled mould on lightly oiled glass sheet and fill it with cement paste formed by gauging cement with 0.78 times the water required to give a paste of standard consistency.
2. The paste shall be gauged in the manner and under the condition proscribed in determination of consistency of standard cement paste, taking care to keep the edges of the mould gently together.
3. While this operation is being performed cover the mould with another piece of glass sheet, place a small weight on this covering glass sheet and immediately submerge the whole assembly in water at a temperature of 27 degrees Celsius and keep there for 24 hours.
4. Measure the distance separating the indicator points.
5. Submerge the mould again in water at a temperature prescribe above.

6. the water to boiling, with the mould kept submerged for 25-30 minutes and kept it boiling for 3 hours.
7. Remove the mould from the water allows it to cool and measure the distance between the indicator points.
8. The difference between these two measurements represents the expansion of the cement.
9. For good quality cement this expansion should not be more than 10 mm.

### 3) Workability by slump cone:- (BIS req. IS:2386 (part 2)-1963 req.)

1. Mix the dry get a uniform constituent thoroughly to Colour and then add water.
2. The internal surface of mould is to be thoroughly cleaned and placed on a smooth horizontal, rigid and non- absorbent surface.
3. Placed the mix concrete in the cleaned. Sump cone in 4 layers catch approx. 1/4 in height of the mould Tamp each layer 25 times. with tamping rod.
4. Remove the cone immediately, rising it slowly and carefully in the vertical direction.
5. AS soon as the. Concrete settlement Comes to a stop, measure the subsistence of the Concrete in cm, which gives the Slump value.

### 4) Fineness modulus of aggregate: -

1. Take a 1kg sand from sample by quartering in the plane dryer plate.
2. Arrange the sieve in order 4.75, 2.36, 1.18(600, 300,150 micron) pan
3. Fixing them in sieve shaking machine with the pan at the bottom and coves at the top.
4. Keep the sand in the top sieve, carry-out the sieving in the set of sieves and arranged before not less than 10 min.
5. Find the weight retained in each sieve.

### 5) Fineness modulus of course aggregate: -

1. take 5 kg of course aggregate (nominal size) for the sample by quartering.
2. carry out sieving by handshakes each sieve in order (80, 40, 20 ,10, -4.75, 2.36, 1.18 mm 600,300 micron) over a clean dry tray for a period of not less than 2min.
3. the shaking is done with a varied motion backward and forward, left to right, circular - clockwise or anticlockwise and with frequent varying.
4. so that material is kept moving over the sieve surface in frequently changing direction.
5. find the weight retained on each sieve take in order.

Fineness modulus of Coarse aggregate =  $\text{Sum (cumulative \% retained)} / 100$

### 6) Standard consistency of cement paste (IS: 269-1989 and IS: 4031-1988)

1. Prepare a paste of weighed quantity of cement (300 gm) with the weighed quantity of portable or distilled water, started with 26% water of 300 gm of cement.
2. Take care that the time of gauging is not less than 3 minutes, not more than 5 minutes and the gauging shall be completed before setting occurs.
3. The gauging time shall be counted from the time of adding the water to the dry cement until commencing to fill the mould.
4. Fill the vacant mould with this paste the mould resting upon a porous plate
5. After completely filling the mould, trim off the surface of the paste, making it in level with the top of the mould. The mould may slightly be shaken to expel the air.
6. Place the test block with the mould together with the non- porous testing plate, under the rod bearing the plunger (10 mm dia.) lower the plunger gently to touch the surface of the test block and quickly release, allowing it to penetrate into the paste.

7. This operation shall be carried-out immediately after filling the mould.
8. Prepare trial paste with varying percentage of water and test as described above until the amount of water necessary for making the standard consistency as defined above is obtained.
9. Express the amount of water as a percentage by weight of the dry cement.

#### 7) Abrasion test (IS: 2386- part 4- 1963)

1. Take the sample of 10-20mm sized aggregate, placed it in L. A abrasion machine and rotate it for 30-33 rpm.
2. Removed the sample from the machine and placed it on 1.70mm sieve.
3. Placed the sample in an oven to dry.
4. The percentage loss or the difference between the original mass and final mass is calculated.
5. And L.A abrasion loss value of 40 indicates that 40% of the original sample mass passed through the sieves.

#### Method: -

Collection of crumb rubber as per designed mix requirements. Perform the lab test on material and concrete which gives the idea about fineness of aggregate, soundness of cement, setting time, etc. Find out the mix design ratio in which rubber is partially substitute the fine aggregate. After that make the concrete block (which is 150mm x 150mm x150mm in dimension) with 10% and 20% partially replaced sand with crumb rubber by unit weight of sand. Fill the mould with varying percentage of mixes. Let it cure for 3 days, 7 days and 21 days respectively. After that compare the properties of designed concrete blocks with conventional concrete blocks.

#### Conclusion/Expected Result:

1. Comparing workability of designed/ advanced concrete pavement block to conventional pavement block found up to the mark.
2. Designed concrete blocks achieved comparable compressive strength as compared to conventional concrete blocks.
3. We found that the cost of designed concrete block is less as compared to conventional concrete blocks.

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