iJRASET
International Journal For Research in Applied Science and Engineering Technology

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 12 **Issue:** III **Month of publication:** March 2024

**DOI:** https://doi.org/10.22214/ijraset.2024.59017

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538*
*Volume 12 Issue III Mar 2024- Available at www.ijraset.com*

# Performance and Evaluating the Characteristics of Flexible Pavements by Using Shredded Aggregate

B.Ramya[1], V.Kinnera[2], P.Mahima[3], Shaik Subhani[4], P.Yugandhar[5], J.Raja Sri Vardhani[6]
[1]*Assistant Professor* [2, 3, 4, 5, 6]*UG Students, Department of Civil Engineering, Dr. Lankapalli Bullayya College of Engineering, Visakhapatnam-530014, Andhra Pradesh, India*

***Abstract:*** ***Now-a-days it is necessary to utilize the wastes effectively with technical development in each field. The old abandoned tyres from cars, trucks, farm and construction equipment and off road vehicles are stockpiled throughout the country. This leads to various environmental problems which include air pollution associated with open burning of tyres and other harmful contaminants like (polycyclic aromatic hydrocarbon, dioxin, furans and oxides of nitrogen) and aesthetic pollution. They are non biodegradable; The waste rubber tyre has become a problem of disposal. Due to increase in demand of automobiles in our daily lives, rubber tyre waste is also increasing simultaneously which results in disposal of rubber waste in landfill. The rubber takes more time to decompose and also leads to land pollution. So in this project the waste rubber can be reused in road construction works by partially replacing with coarse aggregate with bitumen in percentage (5, 10, 15, 20, 25 and 30) and carried out different test result based on it. This is not only to minimize the pollution occurred due to waste tyres but also minimizes the use of conventional aggregate which is available in exhaustible quantity. The addition of rubber tyre in flexible pavements enhances the properties of road surfaces as well as it reduces the rubber tyre waste from the land and decreases the self-weight of the bitumen mix.***

***Keywords: Shredded rubber tyre pieces, bitumen, conventional aggregate i.e. coarse aggregate and Marshall stability test.***

## I. INTRODUCTION

Due to large increase in automobiles day by day in India during recent years, the demand of tyres as original equipment and its replacements is also increased. While producing every new tyre there is a lot of waste stream is going on. Timely action regarding recycling of used tyres is necessary to solve this problem by keeping in view about the increasing of raw material, resources constraints and environmental pollution. Thus the reuse of tyre rubber concept have been developed.

Generally the world generates about 1.5 billion of waste tyre manually, 40% of them are emerging markets in India, China and South America. While we observe in India mostly new vehicles will have radial tyres. Analysis indicates that 0.6 million tons of tyre scrap is generated in the country annually. These stockpiles are great loss to the environment. And the main constituent of tyre is rubber and the largest single application of rubber is vehicle tyres. And also the requirement of tyre is completely directly related to growth of automobiles.

## II. RESEARCH ON WASTE RUBBER TYRE

RUBBER FROM RECYCLE TYRES

In this study rubber chunks from shredded tyres are reused as aggregates in cold mixes of the road construction. This research was directed towards the development of the rubber bituminous concrete mix design for less volume roads. These roads were constructed using aggregates, shredded rubber tyre chunks and bitumen. These mixes by using different combinations of rubber content, emulsion contents were tested. Marshall stability test values got optimum of 20% replacement of shredded tyre aggregate. The Marshall stability value decreases when rubber content increases. This application can minimize the scrap tyre waste of rural communities.

## III. METHODOLOGY

Shredded rubber can be used as bitumen modifiers or as substitutes for natural aggregate. The crumb rubber particles are added to the mixes as a partial replacement by volume of some part of natural coarse aggregate. In order to assess the effect of rubber particles, maximum 10 cubes will be prepared with different contents of crumb rubber: 5, 10, 15, 20, 25 and 30 percentage respectively.

 

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These cubes are compared to conventional bitumen concrete cubes by conducting Marshall stability test on them. The strengths are taken from conventional bitumen concrete cube and also to the rubber shredded aggregate bitumen concrete cubes. Where the maximum strength is obtained that content of crumb rubber percentage will be taken as the effective percentage of shredded rubber aggregate in the bitumen mix.

## IV. MATERIALS USED:

Bitumen, coarse aggregate and shredded rubber tyre pieces.


## V. TESTS ON MATERIALS

| S.No. | TESTS IN AGGREGATE | TESTS ON BITUMEN |
|---|---|---|
| 1 | Specific gravity | Penetration test |
| 2 | Crushing test | Ductility test |
| 3 | Los angles Abrasion and Attrition test | Softening point (by using Ring and Ball) |
| 4 | Impact test | |

## VI. TEST RESULTS ON BITUMEN

| S.No. | TESTS ON BITUMEN | OBTAINED RANGE | STANDARD RANGE | RESULT |
|---|---|---|---|---|
| 1. | Penetration test | 11.83mm | 2 to 22.5mm | Usable |
| 2. | Ductility test | 57cm | 5 to 100cm | Usable |
| 3. | Softening point (by using ring and ball) | 99.5 °C | 30 – 157 °C | Usable |

## VII. TEST RESULTS ON AGGREGATE

| S.No. | TESTS ON AGGREGATE | OBTAINED RANGE | STANDARD RANGE | RESULT |
|---|---|---|---|---|
| 1. | Specific Gravity test | 2.96 | 2.5 to 3.0 | Usable |
| 2. | Crushing test | 25.67% | 20 to 40% | Usable |
| 3. | Impact test | 14.01% | 10 to 30% | Usable |
| 4. | Los Angles Abrasion and Attrision test | 8.33%<br>6.5% | 30% | Usable |

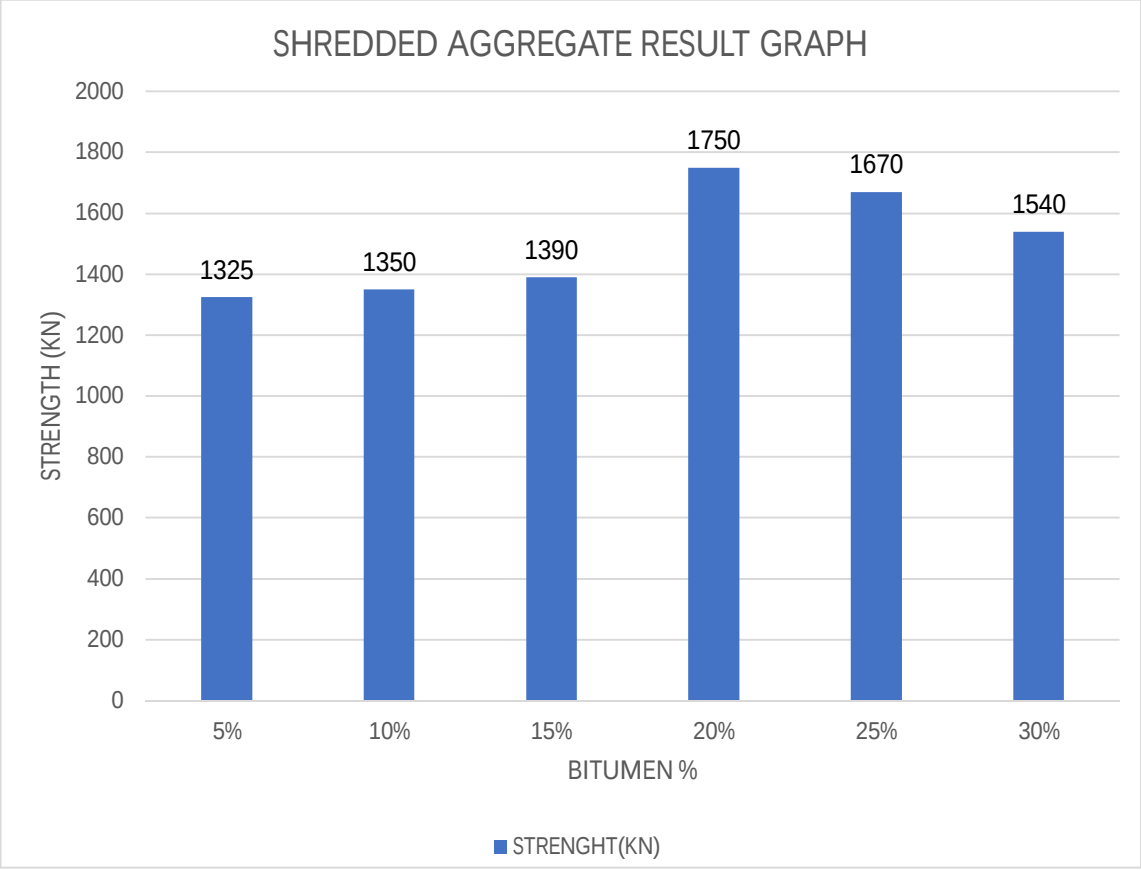
## VIII. MARSHALL STABILITY TEST READINGS FOR CONVENTIONAL AND CONTENTS OF CRUMB RUBBER PERCENTAGE CUBES

| S.No. | WEIGHT OF AGGREGATE IN GRAMS | PERCENTAGE OF BITUMEN | PERCENTAGE OF SHREDDED RUBBER ADDED | MARSHALL STABILITY (READING ON MACHINE) | FLOW RATE (BREAKING HEAD READING) |
|---|---|---|---|---|---|
| 1 | 1200 | 10% | Conventional cube (0%) | 1150KN | 2.5mm |
| 2 | 1140 | 10% | 5% | 1325KN | 3.0mm |
| 3 | 1080 | 10% | 10% | 1350KN | 3.7mm |
| 4 | 1020 | 10% | 15% | 1390KN | 4.0mm |
| 5 | 960 | 10% | 20% | 1750KN | 4.4mm |
| 6 | 900 | 10% | 25% | 1670KN | 5.6mm |
| 7 | 840 | 10% | 30% | 1540KN | 6.0mm |

## IX. RESULT

Casting of cubes using shredded aggregate with different percentages like 5%, 10%, 15%, 20%, 25% and 30%. But we got more strength in 20%.

## X. GRAPH



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## XI. CONVENTIONAL BITUMEN CUBE


## XII. ADVANTAGES

1) Environmental: Discarded tyres provide a source for the rubber granules used in rubber asphalt. It is estimated that the annual amount of rubber available from discarded tyres is lakh tons, an amount sufficient to modify the pavements on 4000 kilometer of two lane.
2) Noise Reduction: Reduction of up to 10dB in noise level in comparison with noise level of conventional pavement surface.
3) Skid Resistance: The surface texture and protruding rubber granules gives the pavement improved skid resistance during dry, wet and icy conditions.
4) Hydroplaning and Water Spray: The high content of coarse aggregate in this produce results in course surface texture with good surface drainage, which reportedly eliminates hydroplaning and reduces water spray.
5) Vibration attenuation property will be increased.
6) Decreases maintenance cost of road pavement.

## XIII. SCENARIO OF OUR PROJECT

From all this research papers we are concluding that the use of rubber waste tyre only in between aggregate, we are using that rubber waste in aggregate mix, by proper binding of this mixes which gives greater strength than the normal bitumen and by mixing it which is economical as well as it reduces the pollution occurred due to waste tyre. Alos we are conducting different tests on aggregate and different tests on bitumen and then with different content of shredded rubber percentage (5, 10, 15, 20, 25 and 30) cubes were casted and Marshall stability test was conducted on them. Strengths obtained after conducting Marshall stability test are noted, but we got more strength in 20% and the result graph is plotted.

## XIV. CONCLUSION

*1)* By replacing the rubber shredded with aggregate in bitumen mix the strength at 20% is maximum.
*2)* The waste rubber tyre are used in road construction, so improved the quality of road.
*3)* Waste shredded rubber tyre pieces is used with aggregate of different contents mixed with bitumen in percentage (5, 10, 15, 20, 25 and 30) by replacing it with coarse aggregate which increases its properties of bitumen as well as aggregate and minimizes the pollution occurred due to waste tyre and also use of rubber waste is economical as compared to other materials.
*4)* Addition of waste tyre in rubber aggregate modifies the flexibility of surface layer.
*5)* The permanent deformation and thermal cracking are reduced in hot temperature region.
*6)* The main property of rubber is sound absorbing, so reduces the noise pollution on heavy traffic roads.

## XV. ACKNOWLEDGEMENT

I am profoundly thankful to Mrs. B. Ramya, Assistant Professor in the Department of Civil Engineering, Dr.Lankapalli Bullayya College of Engineering, Visakhapatnam, India, who has served as my mentor and guide, advising me on how to accomplish my goals.

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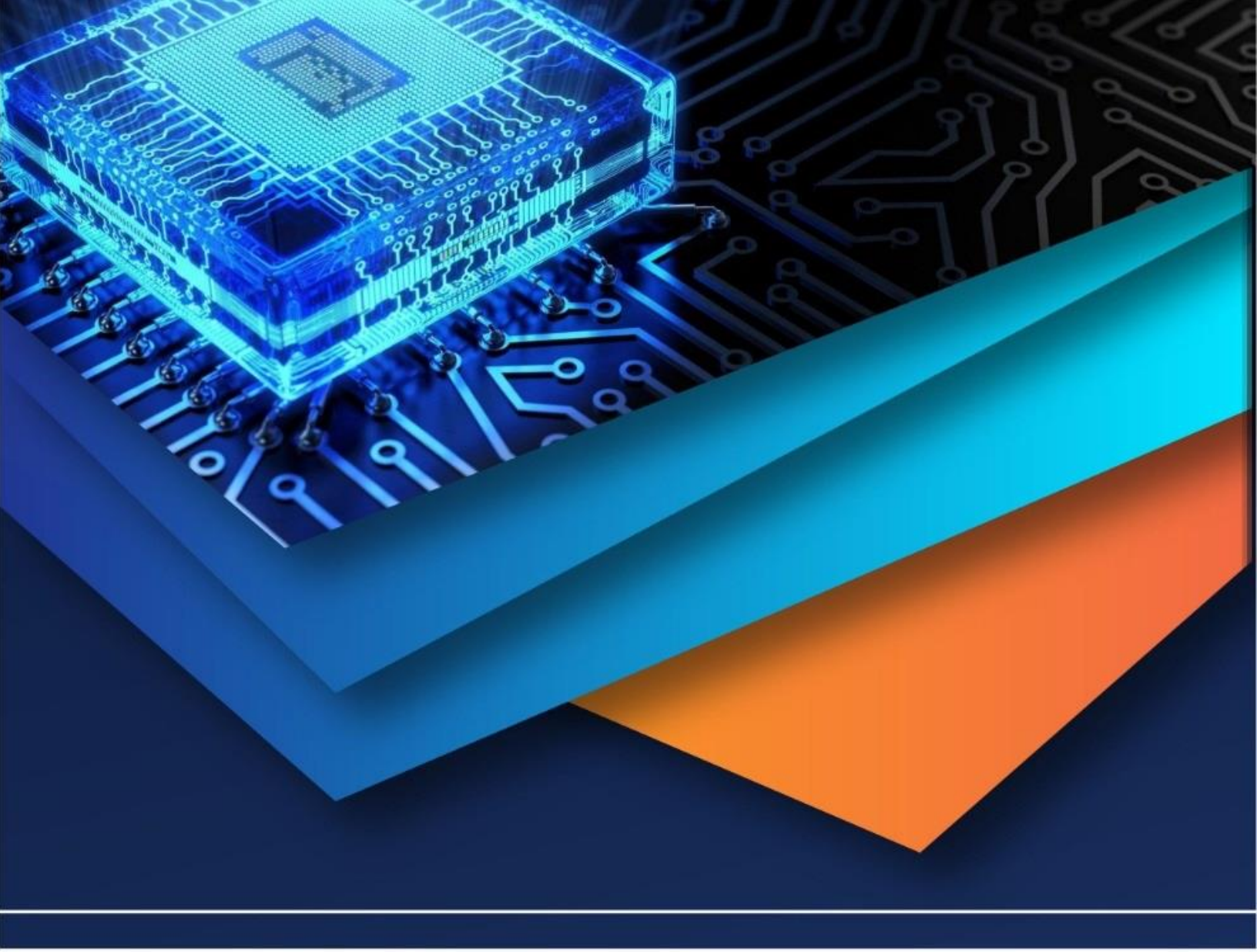

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