MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Gwalior, Madhya Pradesh - 474005

A MINI SKILLS PROJECT REPORT

ON

"EFFECT ON INCLUSION OF WASTE RUBBER TYRE PIECES ON THE IMPACT VALUE OF AGGREGATES"

Submitted by

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Madhav Institute of Technology & Science

2022

CERTIFICATE

Madhav Institute of Technology & Science
Gwalior

This is to certify that the project entitled " **Effect on the inclusion of waste rubber tire pieces on the impact value of aggregates**" presented by the students of the group- in incomplete satisfaction of the necessity of the recompense of Bachelor of Technology degree in Civil Engineering at Madhav Institute of Technology & Science, Gwalior is a genuine work completed by the students under my watch and direction.

To the best of my insight, the matter epitomized in the theory has not been submitted to any other college/Institute for the recompense of any Degree or Diploma

Under the Guidance of-

Guide Name: Dr. Jaywant Chaudhary
Department of Civil Engineering

ACKNOWLEDGEMENT

It offers us a great pleasure to thank and offer appreciation to every one of those people who have specifically or by implication helped us through the course of this study. This undertaking would have never been finished without the commitment of those individuals.

Unfortunately, the long list of acknowledgments, regardless of how extensive is constantly fragmented and lacking. To be sure this page of notice should never have the capacity to touch the generousness of the individuals who tendered their assistance to us.

As a matter of first importance, I wish to express my profound feeling of appreciation and obligation to **Dr. M.K.Trivedi**, Department of Civil Engineering – MITS, Gwalior for appointing me the undertaking " **EFFECT ON INCLUSION OF WASTE RUBBER TYRE PIECES ON THE IMPACT VALUE OF AGGREGATES** " and for his motivating direction, helpful feedback and significant proposal all through this venture. We also want to extend our appreciation to every one of our companions and senior understudies who have constantly empowered and bolstered us in doing this work. We want to thank all the individuals from the Department of Civil Engineering who have dependably been agreeable with us.

Last however not the slightest we want to thank the writers of different examination articles and books that we alluded to throughout this undertaking.

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CONTENTS:

Introduction :

Widespread automobile use has increased the number of discarded rubber tires, and the low recovery rate of waste tires has aggravated environmental pollution. Burning, burying, or piling up waste tires in landfills is not only wasteful but also harmful to the environment. Given the dense connection among concrete aggregates, wastes such as rubber, plastic, broken ceramic, broken glass, and recycled aggregate can be added to the concrete

Among concrete materials, rubberized concrete exhibits good tenacity and energy absorption properties. Although rubberized concrete is not recommended for high-strength structures, its high tenacity, impact resistance, and sound absorption features have prompted studies on its application in sidewalk pavements, railway subgrades, sleepers road construction barriers, and sound absorption structures [Similarly, rubber can also be added to a brick masonry structure. Al-Fakih et al. studied the addition of rubber and fly ash to a masonry structure to meet the requirements of ASCE C90-09.

The fluidity and strength of concrete decrease as rubber content increases Eldin and Senouci found that when all coarse aggregates in concrete are replaced with rubber, up to 85% of compressive strength and up to 50% of splitting tensile strength are decreased; furthermore, when all fine aggregates in concrete are replaced with rubber, up to 65% of compressive strength and up to 50% of splitting tensile strength are decreased. Khatib and Bayomy summarized previous studies and developed the characteristic function SRF, which quantifies the reduction in strength for rubberized concrete mixes and is useful in describing the strength of concrete with high rubber content. Khatib also suggested that rubber contents must not exceed 20% of the total aggregate volume. Notably, although a large reduction in the strength of rubberized concrete is observed, such concrete shows good tenacity. Gerges et al. and Atahan and Yücel [examined the properties of rubberized concrete at failure and found that the rubberized concrete does not demonstrate brittle failure but rather a ductile failure with good impact resistance.

The cause of the strength decreases of rubberized concrete is the weak bond between rubber and cement, which limits the development of concrete with high rubber content. Therefore, methods that limit the strength decreased of concrete while increasing rubber content have been explored. Xue and Cao and Chen et al. studied the impact of polyvinyl alcohol (PVA) solution on improving the connection between rubber and cement in concrete. Findings indicate that the strength of modified rubber concrete was not improved by adding PVA solution, but good tenacity and impact resistance of the concrete was achieved. Nano silica, silica fume, and slag have been used to remedy the negative effect of rubber by improving the interfacial transition zone between rubber and cement

paste Adamu et al. and Mohammed and Adamu found that nano-silica could improve the refinement of pore structure, strengthen the interface transition zone (ITZ), and enhance the bonding effect, thereby partially reducing the strength loss of rubber concrete. Silica fume is the best choice for economic and practical considerations. Gupta et alfound that the use of silica fume in rubberized concrete mixtures not only reduces the amount of cement but also increases compressive strength and dynamic and static moduli. The use of silica fume also in these instances reduces water permeability and chloride ion diffusivity.

The impact resistance of concrete added with plastic fiber and steel fiber is increased by 10–15 times Ramakrishna and Sundararajan tested cement mortar slabs reinforced with natural fibers, such as coir, sisal, jute, and hibiscus, and showed that the addition of such fibers increases the impact resistance of the slabs by 3–18 times. Gupta et al. found that the impact resistance of concrete with 25% rubber content is increased by five times. Zongcai et al. improved the test method for determining the impact resistance of fiber-reinforced concrete beams to dynamic loads and showed that the layered steel fiber-reinforced concrete exhibits impact resistance, which was measured as the number of blows from first cracking to failure, six times that of the reference concrete. In Zhang's test, impact energy was unchanged and the impact energy of steel fiber-reinforced concrete beams decreased with an increased falling height of the ball and increased with the increased weight of the falling ball.

As mentioned above, the addition of silica fume limits the strength decrease of rubberized concrete. This feature prompts further study on the impact resistance and energy absorption properties of rubberized concrete with high rubber content. In this study, the water-cement ratio of concrete was maintained at 0.5. The fine aggregates in the concrete mixes were partially replaced with 0%, 20%, 40%, and 60% of rubber by volume, and the cement in the concrete mixes was replaced with 0%, 5%, and 10% of silica fume by mass. Three basic mechanical properties of concrete—unit weight, compressive strength, and splitting tensile strength—were tested. The relationship between compressive strength and splitting tensile strength was established, and the failure modes under compression were analyzed. The impact resistance of concrete beams was measured in the falling ball impact test, and the energy absorption ability of concrete test cubes was measured in the rebound test. The developing course and mechanism of beam cracks were elaborated, and the relationship between impact resistance and energy absorption ability was analyzed and established.

Objectives of the Study :

The primary objectives of this study are to:

• Examine the effects of increasing the coarse aggregate replacement percentage with recycled tire chips on concrete fresh properties, compressive strength, split-tension, flexural strength, permeability, and freeze/thaw resistance, and determine an optimum replacement percentage of coarse aggregate with recycled tire flap chips for concrete mixtures.

• Provide recommendations for the use of recycled tire flap chips as a coarse aggregate replacement in a concrete mixture designed for field implementation.

• The main benefit of the research is to find an alternative to recycling waste tire flaps in concrete. If tire flap chips can successfully replace the coarse aggregate in concrete mixes, the people of Colorado will benefit from the value gained in extending natural resources, reducing land space needed for waste products, and potentially decreasing costs associated with the product development and construction.

PROCEDURE :

- Take 350 gm of oven-dried aggregate (100-105 degrees Celsius) which through a 12.5mm sieve and is retained in a 10 mm sieve.
- Fill the mold with aggregate after replacing 10%of aggregate with waste tire rubber. Tamping each layer 25 times. After filling the cylinder use the tamping rod with a straight edge to remove excess aggregate.
- Note the empty cylinder (w1), then transfer the aggregate from the measuring cylinder to the cylinder steel cup and note the combined weight of the steel cylinder and aggregate (w2).
- Replace the hammer to apply impact load 15 blows are given at the interval of not less than 1 second.
- After 1st blow remove the cylindrical cup and transfer the aggregate over a 2.36 sieve.
- Sieve the aggregate through a 2.36 mm sieve for 10 minutes and note the weight of aggregate panning through a 2.36mm sieve (which returns on the pan).

calculate the Aggregate impact value by formula.

$$(B/A)*100$$

B = Weight of the aggregate panning through a 2.36 mm sieve.

A = weight of the dry aggregate in the cylindrical cup.

- Repeated the procedure up to 5 times and not the observation up to 50% replacement of waste tire rubber.

OUTCOMES :

Wt. of dry Agg.	induction of rubber	Total wt. of sample	wt. of agg. passing 2.36 mm	Impact value.
315	10 %	350	50 gm	14.28
280	20 %	350	30	8.57
245	30 %	350	15	4.28
210	40 %	350	7.6	2.22
175	50 %	350	4.6	1.314

10% rubber → $\frac{50}{350} \times 100 = .1428 \times 100$

impact value = 14.28 %.

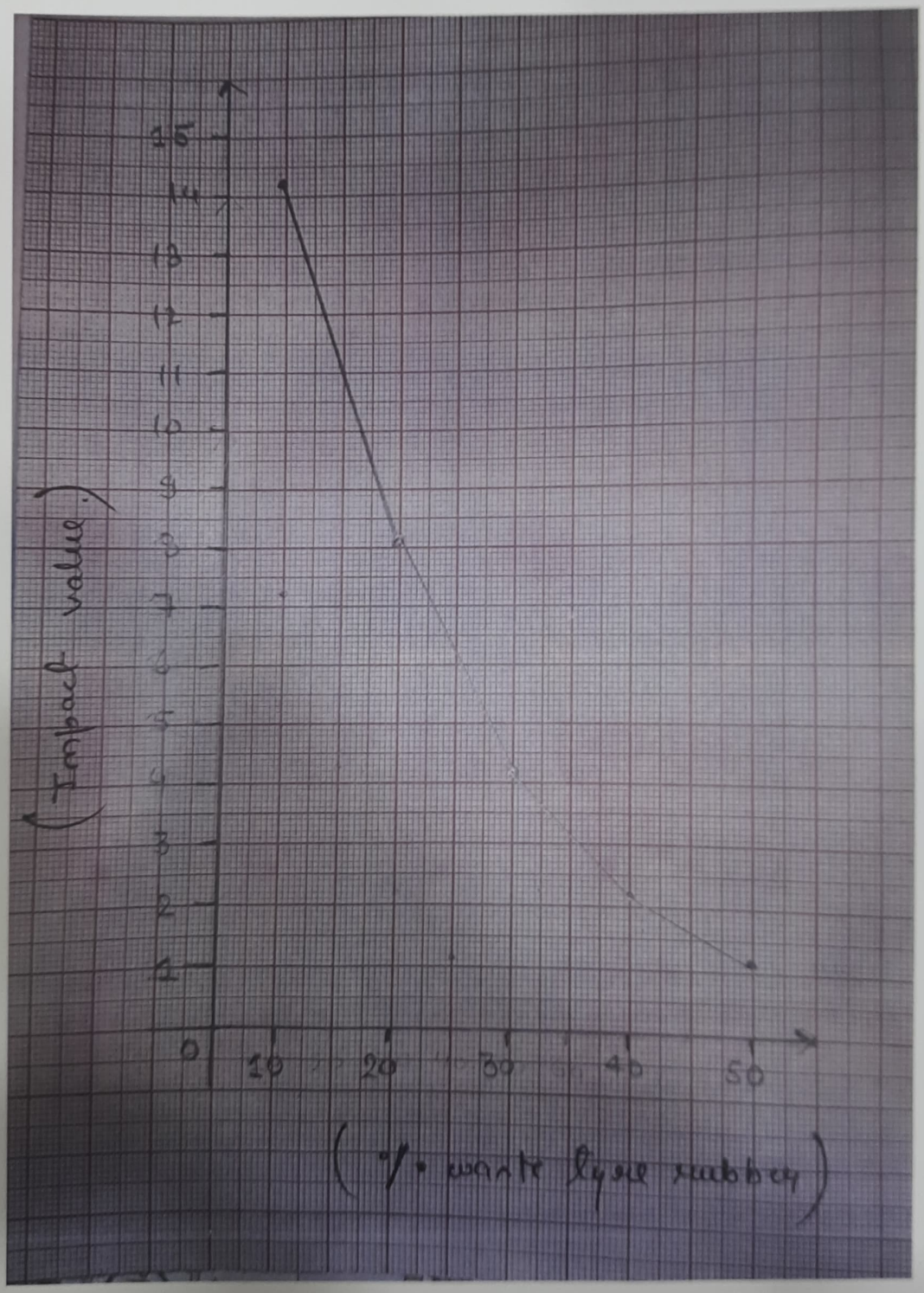
20% rubber → $\frac{30}{350} \times 100 = 8.57.$

30% rubber → $\frac{15}{350} \times 100 = 4.28$

40% rubber → $\frac{7.6}{350} \times 100 = 2.22$

50% rubber → $\frac{4.6}{350} \times 100 = 1.314$

RESULT :


(Impact value)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
10
20
30
40
50
(% waste tyre rubber)

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