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Investigation of Fiber Reinforce Rubberized Concrete

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Abstract: ***It is well known that world's natural resources are depleting .To face such problem, there is a need to find out alternative materials which can replace a traditional building material to some extent. The production of rubber increases every year. crumb rubber is used as partial replacement of fine aggregate in the concrete. In this paper crumb rubber is used as a substitute material as a replacement of sand in the percentage of 0% ,5% ,10% ,15% ,20% replacement and various mechanical property such as properties compressive strength, split tensile strength, flexural tensile strength . were investigated and compared with control concrete. Use of Crumb rubber reduces the strength and stiffness of concrete but enhances other parameters such as ductility, toughness, impact resistance, energy dissipation, damping of concrete, durability and sustainability.***
Keyword: Crumb rubber; energy dissipation ; damping of concrete ;durability ; sustainability.

I. INTRODUCTION

Natural construction materials are decreasing due to increase in construction activity. There is a need to find the new alternate materials which can replace the traditional construction materials. Which can replace the tradition materials too partially or fully but they are not costlier than the traditional materials. Such materials include silica fume, fly ash, tyre rubber, glass , wood pieces ,coconut shell, .the most recent materials which are available in large extend and cheaper is cost is crumb rubber .the crumb rubber is obtain from the use vehicle tire .which cannot be use for unless we give heavy tyre.disposing result in uncontrolled fire, producing complex mixture of chemical which are harm to living thing and environment and contamination of soil ,agriculture ,vegitation . Burning of tyre result in air pollution which causes respiratory disease.
In the below literature review few alternative materials are use as a aggregate in concrete

A. Nagraj T.S et.al (1996).[8], reported that rock dust which have higher surface area consumes more cement in with respect to sand which increases workability. He studied to effect of rock dust and pebble as aggregate in cement and concrete and found that crushed stone dust could be used to replace the natural sand in concrete.

B. Shukla et al. (1998) [9], investigated the behavior of concrete made by partial or full replacement of sand by crushed stone dust as fine aggregate and reported that 40 percent sand can be replaced by crushed stone dust without effecting the strength of concrete.

C. Venugopal (1999) et al.[11], examined the effect of rock dust as fine aggregate in cement and concrete mixes. They have suggested a method to proportion the concrete using rock dust as fine aggregate.

D. A.K Sahu et al. (2003)[1] investigated the basic properties of conventional concrete and concrete made using quarry dust have compared. They have studied M20 and M30 concretes. Equivalent mixes are obtained by replacing stone dust partially/fully. Test results shows the effective usage of stone dust with same compressive strength, comparable tensile strength and modulus of rupture. Workability of 40percentage replacement of stone dust with 2percentage Superplasticizer is equal to the workability of conventional concrete. Workability is increased by the addition of perplasticizer.as replaced materials to natural sand has become beneficial and is common in the world. Stone dust is manufactured by crushing larger stones of quarry to particular size of sand. Its chemical & physical properties such as color, size & shape, surface texture up particles depend upon types of stone & its source .Use of crushed sand has become a good substitute for natural sand and it has become essential keeping in view of technical, commercial & environmental requirements. Proper quality control while using crushed sand/ manufactured sand can result in better results. Different researchers have carried out research to study the effect of use of crushed sand on properties of mortar.

E. Hadassa Baum and Amnon Katzl.[4], studied the percentage of fines in crushed sand and its effects on the concrete mixes. They pointed out that the addition of fine filler (mesh 0.075mm) has a positive potential on the properties of the mortar. But, at the

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same time, the fraction of less than 5 microns of the fine filler used for plastering may have a bad effect on the concrete. They also studied the effect of the composition of water reducing agent on mixes containing crushed sand that exhibited the lowest properties. They noted that Compressive strength improved, chlorides permeability and the shrinkage reduced.

F. Divakar et al. (2012).[12], have experimented on the behavior of M20 grade concrete with the use of granite fines as a partial replacement for sand in 5percentage, 15percentage, 25percentage, 35percentage and 50percentage; and based on the results obtained for compressive, split-tensile and flexural tests, it was recommended that 35percentage of sand can be replaced by granite fines.

G. Toutanji,H.A (1996).[10], "The use of rubber tyre particles in concrete to replace mineral aggregates" Cement concrete investigated the effect of replacement of mineral coarse aggregate by rubber tyre aggregate. Shredded rubber tyres used had a maximum size of 12.7mm and a specific gravity of about 0.61. The incorporation of these rubber tyre chips in concrete exhibited a reduction in compressive and flexural strength. The specimens which contained rubber tyre aggregate exhibited ductile failure and underwent significant displacement before fracture. The toughness of flexural specimens was evaluated for plain and rubber tyre concrete specimens. The test revealed that high toughness was displayed by specimens containing rubber tyre chips as compared to control specimens.

H. Khatib Z.K and Bayon F.M (1999).[13], has developed "Rubberized Portland cement concrete" to conduct experimental program in which two types of rubber fine Crumb Rubber and coarse tyre chips were used in Portland cement concrete (PCC) mixtures. Rubberized PCC mixes were developed by partially replacing the aggregate with rubber and tested for compressive and flexural strength in accordance to ASTM standards. Tyre chips were elongated particles that ranged in size from about 10 to 50mm. Results show that rubberized PCC mixes can be made and are workable to a certain degree with the tyre rubber content being as much as 57percentage of the total aggregate volume. However, strength results show that large reductions in strength would prohibit the use of such high rubber constant. It is suggested that rubber contents should not exceed 20percentage of the total aggregate volume.

I. Mohammed Mustafa Al Bakari. A. Syed Nuzul Fazl S.A, Abu Bakar M. [2]"Comparison of rubber as aggregate and rubber as filler in concrete" this research will attempt to use rubber waste replacement of coarse aggregates to produce early age concrete. It carry out two different type of concrete which are rubberized concrete and rubber filler in concrete. In rubberized concrete, rubbers were used to replace coarse aggregates and sand as fine aggregate. Coarse aggregate usually gravel or crushed stone and shredded rubber as filler in concrete. The compressive strength was reduced in rubberized concrete for several reasons including the inclusion of the waste tyres rubber aggregate acted like voids in the matrix. This is because of the weak bond between the waste tyres rubber aggregate and concrete matrix. With the increase in void content of the concrete, there will be a corresponding decrease in strength. Portland cement concrete strength is dependent greatly on the coarse aggregate, density, size and hardness. Since the aggregates are partially replaced by the rubber, the reduction in strength is only natural.

J. Mavroulido.M and Figueiredo.J (2010).[7], "Discarded tyre rubber as concrete aggregate: a possible outlet for used tyres" it can be concluded that despite the observed lower values of the mechanical properties of concrete there is a potential large market for concrete products in which inclusion of rubber aggregate would be feasible. These can also include nonprime structural applications of the medium to low strength requirements, benefiting from other features of this type of concrete. Even if the rubber tyre aggregate was used at relatively low percentages in concrete, the amount of waste tyre rubber could be greatly reduced due to the very large market for concrete products worldwide. Therefore the use of discarded tyre rubber aggregates in concrete shows promise for developing an additional route for used

Methodology Thise paper is aim to study the property of alternative materials is use as a aggregate in concrete .In thise study sand is replaced by crumb rubber with a patical size of 2mm to 4.75 mm in the percentage by weight of 0%,5%,10%,15%,20% and find the compressive ,flexural and split tensile strength of concrete . with M 25 grade concrete.

materials	Cement	sand	Aggregate	water
ratio	1	1.47	2.86	0.45

Table mix ratio

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II. EXPERIMENTAL PROCEDURE

A. *Study of Material Use*

1) *Crumb Rubber:* Crumb rubber is produced by grinding the used tyre of car, truck,buses and other transporter.it grinding in the size of 2 mm to 4.75 mm and scrap steel is separated from crumb rubber by magnetic separater

Sr.No	Property	Value
1	Partical size	2 mm to 4.75mm
2	Sp.gravity	0.626
3	Density	430 kg/m^3

Table 2 physical property crumb rubber

2) *Cement:* It is a binding materials which consist of calcarious and argillaceous material.it is having a property of both cohesion and adhesion

Sr.No	Property	Value
1	Type	53 grade ppc
2	finess	1%
3	Sp gravity	3.15
4	Normal consistency	32 %
5	Initial setting time	50 minutes
6	Final setting time	580 minutes
7	Grade	53

Table 3 physical property cement

3) *Water:* According to IS 456: 2000 water used for mixing and curing shall be clean and free from injurious amount of oils, acid, alkalis, salts, sugar, organic materials . p^H shall not be less than 6

Sr.No	Property	Value
1	p^H	7.435
2	Temperature	21.8^0 c

Table 4 physical property water

4) *Sand:* According to IS 383 define as aggregate most of which will pass through 4.75mm sieve and 75µ sieve is called as sand. Function of sand to reduce the shrinkage ,fill void and prevent cracks

Sr. No	Property	Value
1	Partical size	75µ to 4.75mm
2	Finess modulus	3.1
3	Bulking of sand	21.4
4	Bulk density	1720 kg/m^3
5	Water absorption	1.1%
6	Sp.gravity	2.66

Table 5 physical property sand

5) *Coarse Aggregate:* According to IS code coarse aggregate is retained on 4.75 mm sieve and passing to 80 mm sieve is called as coarse aggregate.having crushing strengthd not be lea than 200 mpa

Sr.No	Property	Value
1	Partical size	10 to 20 mm
2	Sp.gravity	2.86
3	Impact value	15.5
4	Water absorption	0.8%
5	Fineness Modulus	7

Table 6 physical property coarse aggregate

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B. Test on Specimens

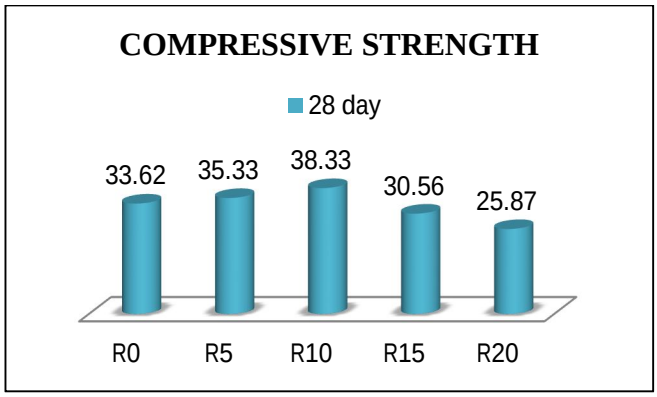
1) *Compressive Strength:* As per IS 516:1959 , 150*150*150 mm.cubes, cured for 28 days, crushing strength determined on universal compression testing machine . Grades are classified based on 28 day strength . Cylinders of 15cm dia and 30cm height are also used. Cube strength equal 1.25 x cylinder strength. Compressive strength = load/area of cube
2) *Modulus of Rupture:* Flexure test using a prism of section 10 cm × 10cm and 50 cm long. It gives Flexural Tensile strength of concrete The load shall be applied without shock and increasing continuously at a rate such that the extreme fibre stress increases at approximately 7 kg/sq cm/min, that is, at a rate of loading of at a rate of 180 kg/min for the 10.0 cm specimens .using two point load. Modulus of Rupture = P*L/B*D
3) *Split Tensile Strength:* As per IS: 10086-1982 a compressive (udl) load is applied 150 mm dia and 300mm long cylinder along the dia through out its length and failure load is notic

Split tensile strength = 2*P/3.14*D*L

III. RESULTS AND DISCUSSION

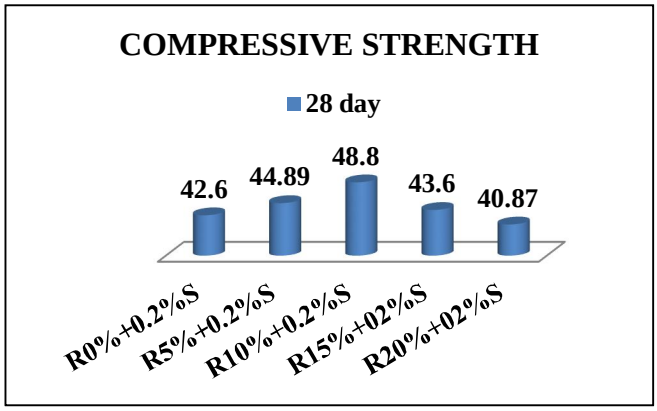
1) *Effect on workability:* Increase in rubber content in concrete slump is decreases **.** but it gives workable mix
2) *Effect on Unit weight:* As rubber content increases the unit weight is decreases
3) *Effect on Compressive Strength:* In the compressive test at the 0% to 10% rubber content compressive strength is increases after 10% there is a reduction in strength

A. Compressive Strength



Graph 1.1 compressive strength of 28 days cube

1) From the above graph we can see that highest compressive strength obtain at 10 % rubber content . The increase in strength was 14% as compare to control mix.

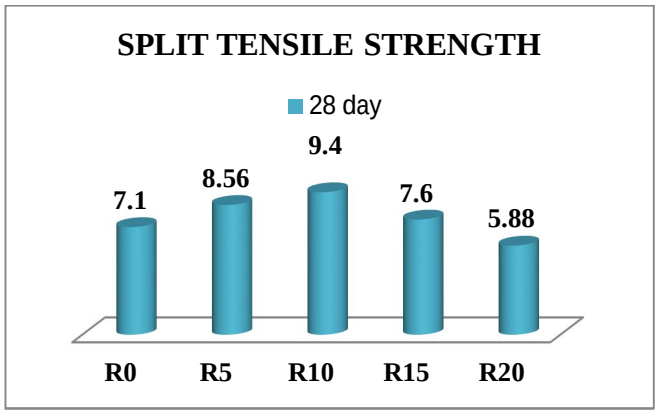


Graph 1.2 compressive strength of 28 days cube

2) From the above graph we can see that highest compressive strength obtain at 10 % rubber content . The increase in strength was 14.55 % as compare to control mix.

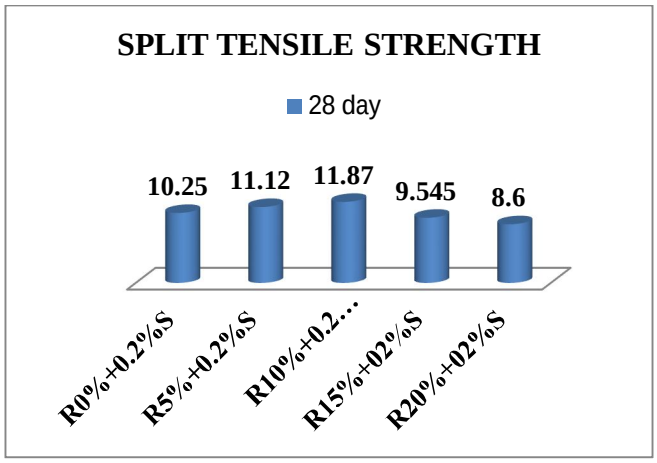
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B. Split Tensile Strength



Graph 2.1 split tensile strength of 28 days cube

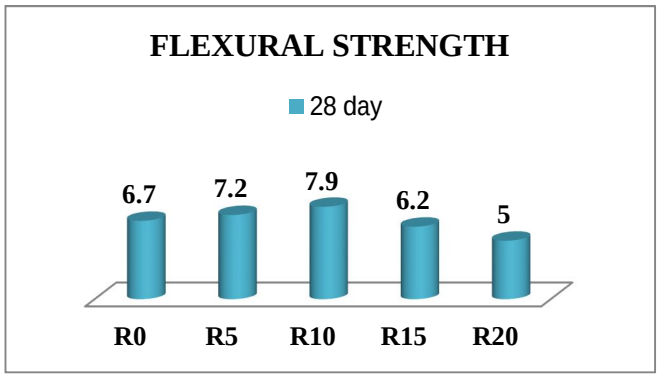
1) From the above graph we can see that highest split tensile strength obtain at 10 % rubber content . The increase in strength was 32.39 % as compare to control mix



Graph 2.2 split tensile strength of 28 days cube

2) From the above graph we can see that highest split tensile strength obtain at 10 % rubber content . The increase in strength was 15.80 % as compare to control mix

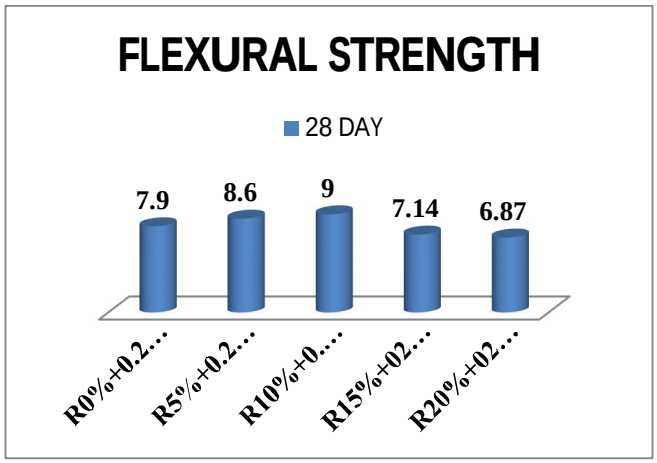
C. Flexural Strength



Graph 3.1 flexural tensile strength of 28 days cube

1) From the above graph we can see that highest flexural tensile strength obtain at 10 % rubber content . The increase in strength was 17.91 % as compare to control mix .

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Graph 3.2 flexural tensile strength of 28 days cube

2) From the above graph we can see that highest flexural tensile strength obtain at 10 % rubber content . The increase in strength was 13.92 % as compare to control mix.

IV. CONCLUSION

A. The workability of rubberized concrete decrease with increase in rubber content which could be compensated by increasing the dosage of the admixtures

B. With increase in the rubber as a fine aggregates content in rubberized concrete.

C. The decrease in compressive strength may be due to weak bonding between rubber particles and cement paste .

D. The reduction of compressive and tensile strength can be increased by adding some super plasticizers and fiber as a additive

E. The permissible replacement of crumb rubber is upto 10 %, with further replacement i.e. 15 % &20% , reduction in strength was observed.

REFERENCES

[1] A.K. Shau, Sunil Kumar and A.K. Sachan (2003) “crushed stone waste as fine aggregate for concrete” the Indian concrete journal, pp 845848.

[2] Bakri, A. M. M. A., Fadli, S. A. S. N., Bakar, M. D. A., and Leong, K. W. (2007). Comparison of rubber as aggregate and rubber as filler in concrete, First International Conference on Sustainable Materials 2007, Penang.

[3] E. Ganjian, M. Khorami and A. A. Maghsoudi, “Scrap- Tire-Rubber Replacement Foraggregate and Filler in Concrete,” Construction and Building Materials, Vol. 23, No. 5, 2009, pp. 1828-1836. doi:10.1016/j.conbuildmat.2008.09.020

[4] Hadassa Baum and Amnon Katzl Environmental Implications of Alternative Materials in Construction and Treatment of Waste February 2011, Pages 353–358 Vol-31, Issue 2

[5] Humphrey -Standard Practice for Use of Scrap Tires in Civil Engineering Applications,” ASTM D6270-98, Am. Soc. ... 51-65.

[6] Kallol (San Jose, CA, US). Application Number: ... 20080178402, TIRE- SHINE SYSTEM AND METHOD, July, 2008, Martines et al

[7] M. MAVROULIDOU and J. FIGUEIREDO * Department of Urban Engineering, Global NEST Journal, Vol 12, No 4, pp 359-367, 2010 Copyright© 2010 Global NEST Printed in Greece.

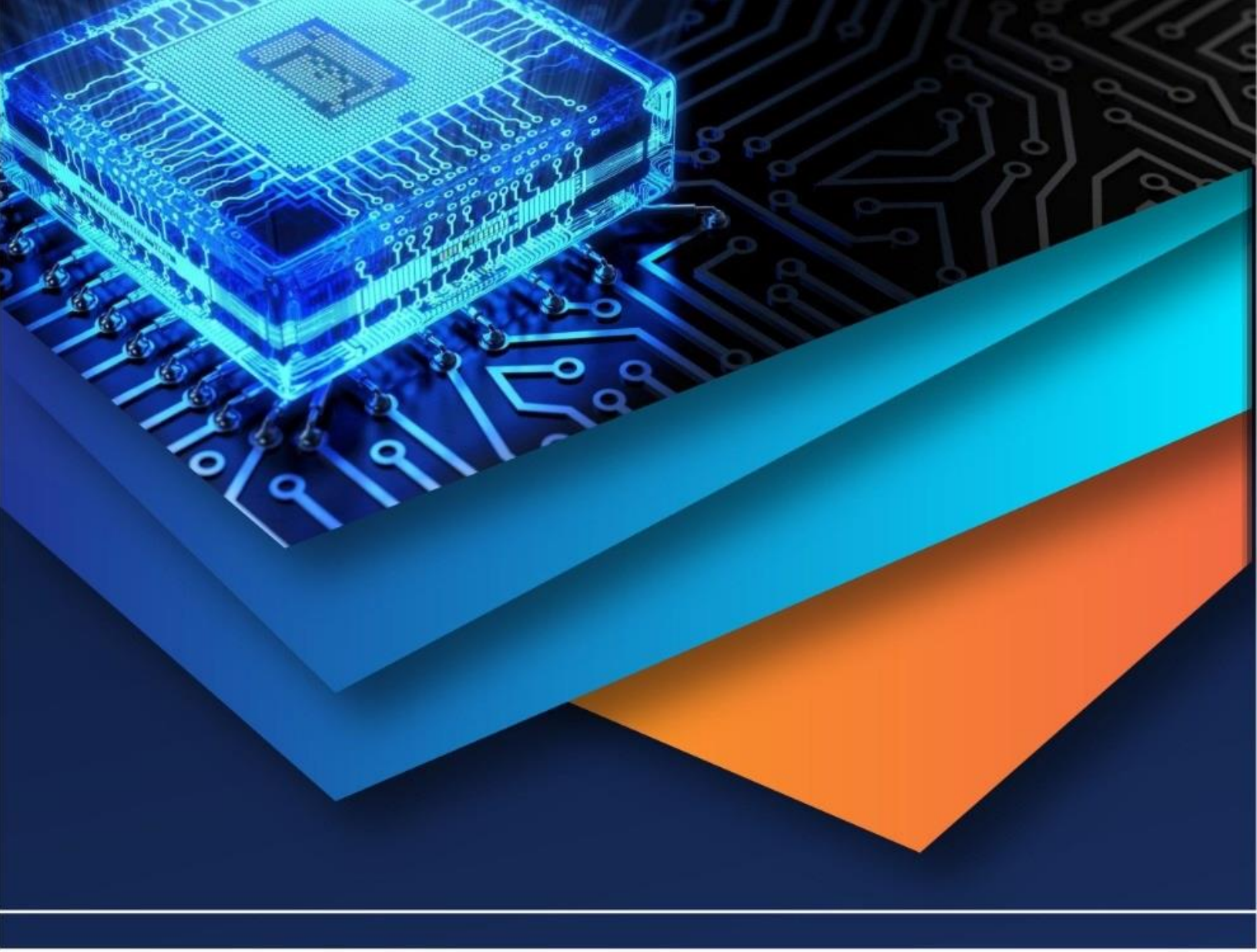
[8] Nagaraj. T.S and Zahida Banu, (1996) “Efficient utilization of rocks dust and pebbles as aggregate in Portland cement concrete”, The Indian concrete journal, Vol 70, No.1, PP14.

[9] Shukla M, Shau A.K and Sachan A.K., (1998) “Performance of stone dust as fine aggregate in Portland replacing Sand on concrete and mortar”, National seminar on advances in special concretes, Indian concrete institute, banglore, India, pp 241248.

[10] Toutanji,H.A.,1996. The use of rubber tyre particles in concrete to replace mineral aggregates. Cement Concrete 18: 135-139

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