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COMPARATIVE ANALYSIS OF COMPRESSIVE STRENGTH OF CONCRETE WITH WASTE TYRE RUBBER POWDER

RUCHIT PATEL[1], YASH PATEL[2], VIRAJ PATEL[3], KARAN PATEL[4], SURAJ PATEL[5], GOVIND TIVADI[6]

[1,2,3,4,5]*Students, Civil Engineering, Gujarat, India*
[6]*Professor Govind Tivadi, Dept. Civil Engineering, M.S.C.E.T., Gujarat, India*

ABSTRACT - *Rubber in the present day construction industry consumes large amount of concrete and cement is the binding material used for making concrete. That are makes concrete a non eco-friendly material. The compressive strength of those cubes was determinate after 7 , 14 ,28 days of curing period. Compositions of above raw materials are taken that is 1:1.5:3 and the compressive strength were determined adopting conventional testing procedure. To find out the effect of curing period on the compressive strength the samples were cured for 7, 14 and 28 days and tested. The original aim of this research was to evaluate the durability of concrete made with rubber powder. There are study presents result of experimental investigations carried out to evaluate effects of replacing sand with various concrete properties. In the present study M-20 grade of concrete each having two types of concrete mix C:S:A C:RS:A and the compressive strength are determined adopting conventional testing procedure.*

KEY WORDS: Compressive Strength, Waste Tyre Rubber, Rubberized Concrete, Junk Rubber, Crumb Rubber.

1. INTRODUCTION:-

Rubber concrete is a promising new material on the construction scene. Created by replacing sand with rubber particles when mixing concrete, the material promises to significantly reduce certain environmental impacts, yet its structural properties are still relatively unexplored. For uses in infrastructure, residential buildings and industry. The day by day increase the use of vehicles, Due this increase the production of Tyres. It is estimated that by 2019, 3 billion tires will be to be sold globally every year. Car tyres are a major global waste problem. Collectively we drive 1.5 billion tyres to the end of their useful lives every year. After the utility period of tyre, they can be recycle but not all. Hence they produce the scrap tyre and after that they convert in waste and pollute the world.

The easiest and worst thing to do with waste tyre is put them in landfill or Buried in land. The vehicle tyres which are disposed to landfills constitute one important part of solid waste. Stockpiled tyres also present many types of, health, environmental and economic risks through air, water and soil pollution. The trouble with tyres in landfill is that they leach toxins into soil and water. In tropical countries they fill with water and become a paradise for breeding mosquitoes, making them a serious health risk. Even if you're tempted to ignore both of these issues because you're dumping them in the desert, say they're also dangerous. For this issue, the easiest and cheapest way of stale of the rubber is by burning it. This creates smoke pollution & other toxic emission and also it create global warming. Pollution and energy consumption both are reduced when tires are recycled which is one of the many benefits of recycling tires. The production of rubber crumb and its use to manufacture a wide range of construction products, recreational surfaces, and modified rubber and plastic products. It is used in many works such as road construction, light weight construction, flooring etc in the form of rubber concrete. The replacement of sand by fine scrap rubber.

Figure 1 Waste Tyre Rubber Powder

2. PROBLEM SUMMARY:-

Only a small amount of tyres is truly recycled, According to Professor Veena Sahajwalla, Director, Centre for Sustainable Materials Research and Technology at University of New South Wales (UNSW) Australia, globally around only 7% of waste tyres are recycled on site, 11% are burned for fuel, 5% are exported for processing elsewhere. The remaining 77% were sent to landfills, stockpiled, or illegally dumped. the equivalent of some 765 million tyres a year wasted. Due to burning of waste tyre produce Black smoke and other substances such as volatile organic compounds, dioxins and polycyclic aromatic hydrocarbons are released into the atmosphere.

Tires take up landfill space and as land is becoming more and more scarce, it will lead towards illegal dumping. This drives down home values and causes socio-economic segregation as tires typically are dumped in low income areas. The landfill waste is biodegradable. This waste rots and decomposes, and produces harmful gases (CO2 and Methane) which are both greenhouse gases and contribute to global warming. Landfills also pollute the local environment, including the water and the soil.

3. AIM:-

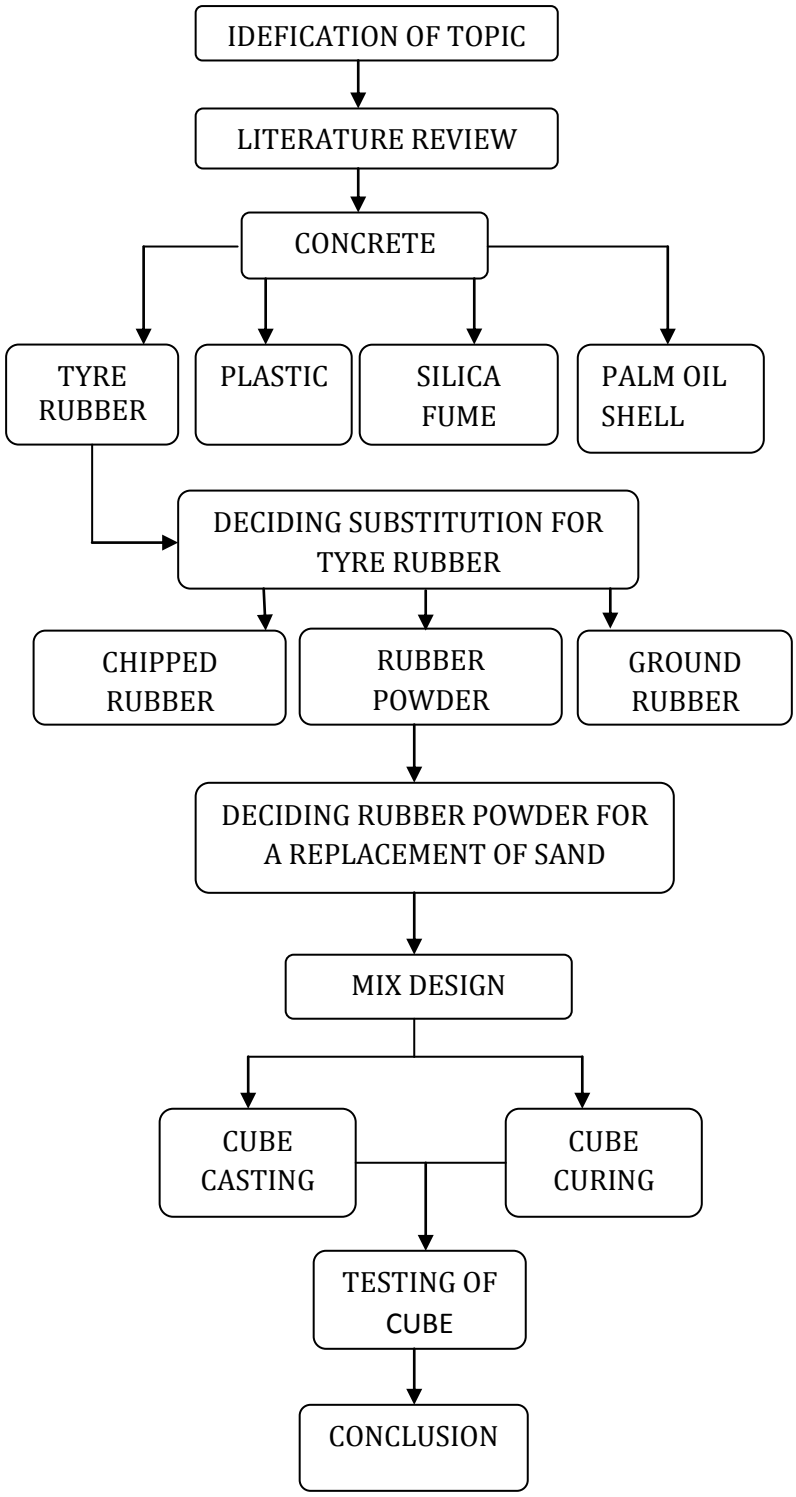
To study the strength behavior of compressive strength of rubber concrete. And also analysis comparative strength of normal concrete M_{20} grade and rubber added concrete M_{20} grade.

4. OBJECTIVES:-

- To study the strength behavior of compressive strength of rubber concrete
- To test of raw material of standard concrete.
- To make a mix design of standard concrete and rubber concrete.
- To testing of concrete cube.

5. METHODOLOGY:-

- Perform tests of cement, aggregate, concrete test.
- Determination of setting time of standard cement paste.
- Soundness test of cement.
- Determination of aggregate impact value, determination workability of fresh concrete by slump cone test.
- Determination of compressive strength of concrete.


IDEFICATION OF TOPIC
LITERATURE REVIEW
CONCRETE
TYRE RUBBER
PLASTIC
SILICA FUME
PALM OIL SHELL
DECIDING SUBSTITUTION FOR TYRE RUBBER
CHIPPED RUBBER
RUBBER POWDER
GROUND RUBBER
DECIDING RUBBER POWDER FOR A REPLACEMENT OF SAND
MIX DESIGN
CUBE CASTING
CUBE CURING
TESTING OF CUBE
CONCLUSION

6. TEST:-

First we made 27 cube of normal m20 concrete grade. and. conducted test at 7,14,28 days.

RESULT:-

Sr.no	Age of cube	Cross sectional Area (m^2)	Load (KN)	Compressive strength (KN/m^2)	AVG. Compressive strength (KN/m^2)
1	7 days	22.5	326.9	14.52	
2	7 days	22.5	316.4	14.06	14.29
3	7 days	22.5	322.5	14.31	
4	14 days	22.5	420.3	18.68	
5	14 days	22.5	406.8	18.08	18.38
6	14 days	22.5	414	18.4	
7	28 days	22.5	467	20.75	
8	28 days	22.5	452	20.08	20.42
9	28 days	22.5	460	20.44	

7. TEST OF RUBBER CONCRETE:-

In this test we study the behavior of compressive strength in rubber concrete. We used crumb rubber Powder in concrete by replacing sand. In rubber concrete, crumb rubber Powder add 5% , 10%,15 by replace sand. We made 9 rubber concrete cube of 5% crumb rubber Powder by replace sand. Similar we made 10% and 15% of rubber concrete cube. And test conducted at 7,14,28 days.

7.1 RESULTS OF RUBBER CONCRETE CUBES OF 5% CRUMB RUBBER POWDER BY REPLACE SAND:-

Sr.no	Age of cube	Cross sectional Area (m^2)	Load (KN)	Compressive strength (KN/m^2)	AVG. Compressive strength (KN/m^2)
1	7 days	22.5	319.5	14.20	
2	7 days	22.5	305.5	13.58	14.03
3	7 days	22.5	322.2	14.32	
4	14 days	22.5	432.2	18.81	
5	14 days	22.5	446.4	19.84	19.45
6	14 days	22.5	443.7	19.72	
7	28 days	22.5	495.9	22.04	
8	28 days	22.5	497.8	21.86	21.59
9	28 days	22.5	470.0	20.89	

7.2 RESULTS OF RUBBER CONCRETE CUBES OF 10% CRUMB RUBBER POWDER BY REPLACE SAND:-

Sr.no	Age of cube	Cross sectional Area (m^2)	Load (KN)	Compressive strength (KN/m^2)	AVG. Compressive strength (KN/m^2)
1	7 days	22.5	274.5	12.20	
2	7 days	22.5	290.9	12.93	12.72
3	7 days	22.5	293.6	13.05	
4	14 days	22.5	378.0	16.80	
5	14 days	22.5	406.5	18.07	17.59
6	14 days	22.5	402.75	17.90	
7	28 days	22.5	422.32	18.77	
8	28 days	22.5	447.0	19.87	19.57
9	28 days	22.5	452.8	20.08	

7.3 RESULTS OF RUBBER CONCRETE CUBES OF 15% CRUMB RUBBER POWDER BY REPLACE SAND:-

Sr.no	Age of cube	Cross sectional Area (m^2)	Load (KN)	Compressive strength (KN/m^2)	AVG. Compressive strength (KN/m^2)
1	7 days	22.5	283.05	12.58	
2	7 days	22.5	248.85	11.06	12.10
3	7 days	22.5	285.07	12.67	
4	14 days	22.5	397.8	17.42	
5	14 days	22.5	344.5	15.32	16.78
6	14 days	22.5	394.8	17.55	
7	28 days	22.5	431.10	19.66	
8	28 days	22.5	379.12	16.85	18.60
9	28 days	22.5	434.25	19.30	

8. COMPARISON BETWEEN NORMAL CONCRETE AND RUBBER CONCRETE:-

FOR A 7 DAYS:-

Sr no	Normal M20 concrete	Average (KN/m^2)	Rubber concrete with 5% rubber by replace sand.	Average (KN/m^2)	Rubber concrete with 10% rubber by replace sand.	Average (KN/m^2)	Rubber concrete with 15% rubber by replace sand.	Average (KN/m^2)
1	14.52		14.20		12.20		12.58	
2	14.06	14.29	13.58	14.03	12.93	12.72	11.06	12.10
3	14.31		14.32		13.05		12.67	

FOR A 14 DAYS:-

Sr no	Normal M20 concrete	Average (KN/m²)	Rubber concrete with 5% rubber by replace sand.	Average (KN/m²)	Rubber concrete with 10% rubber by replace sand.	Average (KN/m²)	Rubber concrete with 15% rubber by replace sand.	Average (KN/m²)
1	18.09		18.81		16.80		17.42	
2	18.82	18.37	19.84	19.45	18.07	17.59	15.32	16.78
3	18.20		19.72		17.90		17.55	

FOR A 28 DAYS:-

Sr no	Normal M20 concrete	Average (KN/m²)	Rubber concrete with 5% rubber by replace sand.	Average (KN/m²)	Rubber concrete with 10% rubber by replace sand.	Average (KN/m²)	Rubber concrete with 15% rubber by replace sand.	Average (KN/m²)
1	20.75		22.04		18.77		19.66	
2	20.08	20.42	21.86	21.59	19.87	19.57	16.85	18.80
3	20.44		20.89		20.08		19.30	

8.1 COMPARSION WITH GRAPH:-

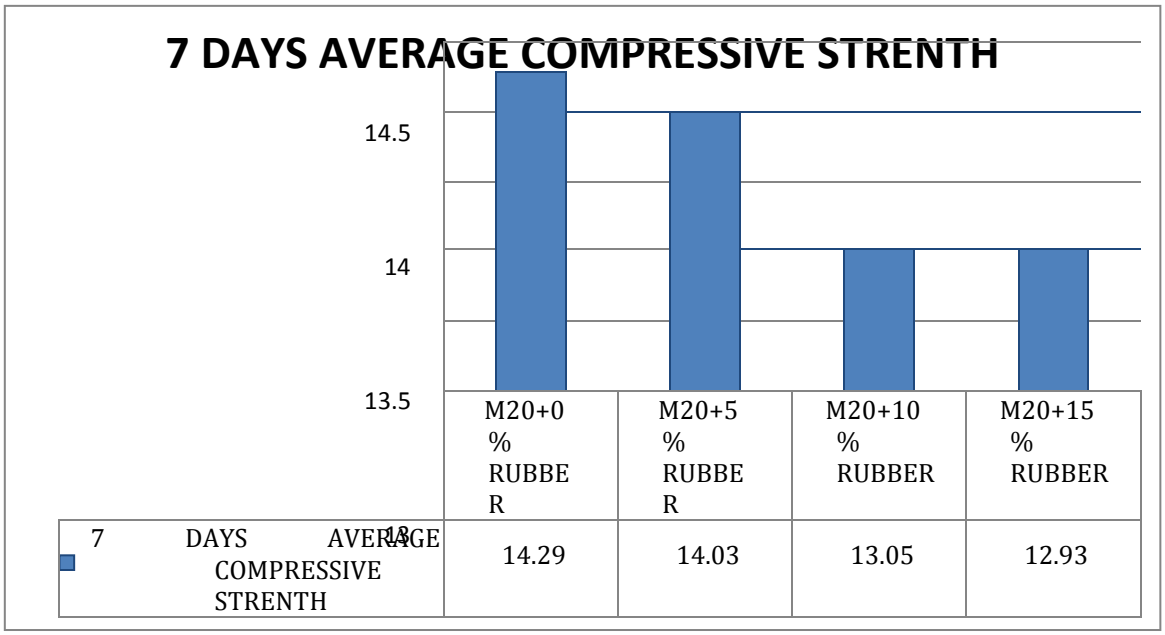
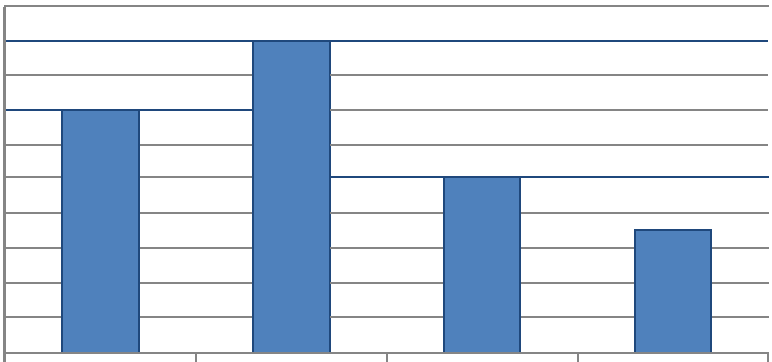
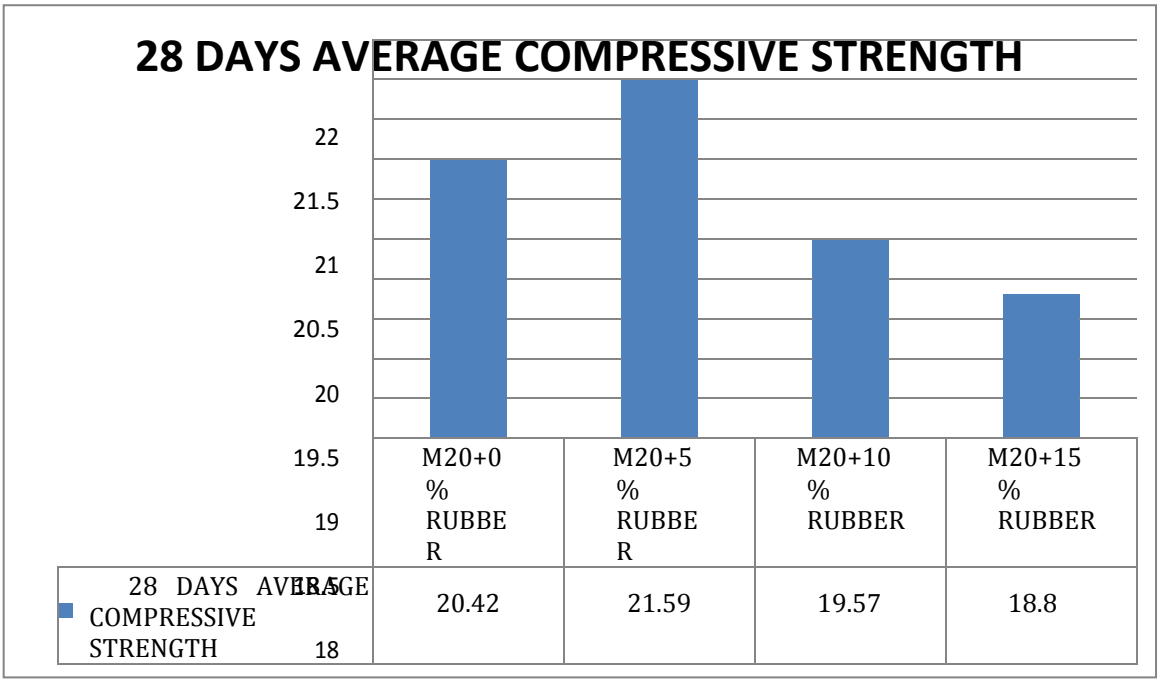


Table 16 COMPARSION OF 7 DAYS WITH GRAPH



	M20+0 % RUBBER	M20+5 % RUBBER	M20+10 % RUBBER	M20+15 % RUBBER
14 DAYS AVERAGE COMPRESSIVE STRENGTH	18.37	19.45	17.59	16.76

Table 17 COMPARSION OF 14 DAYS WITH GRAPH



	M20+0 % RUBBER	M20+5 % RUBBER	M20+10 % RUBBER	M20+15 % RUBBER
28 DAYS AVERAGE COMPRESSIVE STRENGTH	20.42	21.59	19.57	18.8

Table 18 COMPARSION OF 28 DAYS WITH GRAPH

9. CONCLUSIONS:-

- As per observation, the concrete has medium workability and the pattern of slump is shown as shear slump. The workability indicates the concrete flow and improperly mix design.
- The effect of replacing rubber powder with sand on concrete compressive strength shown in Graph. as per comparison smaller reduction in compressive strength(2% to 10%) was observed when sand was replace by rubber powder.
- The compressive strength of M20 grade of rubber concrete for 5 % and 10 % sand replace by rubber Powder are near equal to the normal M20 concrete. And the compressive strength for 15% sand Replace by rubber Powder is slightly decrease.

10. REFERENCES:-

10.1 Reference books:-

M.S. Shetty, (2005)Concrete Technology Theory and Practices published by S.Chand and Company Ltd. Ram Nagar, New Delhi.

P. C. Varghese fourth edition "Building materials" text book may 2009.

10.2 IS CODES:-

IS: 8112-1989 - This code is use for method of testing of cement for determining initial and final setting time of cement.

IS: 516-1959 - This code is use for methods of test for strength of concrete.

IS: 10262-2009 - For mix design.

IS: 2386 (part 2) - This code is use for method of testing of sand for determining of Specific gravity of sand.

IS: 2386 (part 3 & 4) - This code is use for method of testing of coarse aggregate for determining of Specific gravity and Crushing value.

IS: 2720 (part 3) - This code is use for method of testing of soil for determining of Specific gravity.

IS: 5816 – 1970 - This code is use for method of testing for splitting tensile strength of concrete cylinders.

10.3 RESEARCH PAPER:-

1. Acoustic Properties of Concrete Panels with Crumb Rubber as a Fine Aggregate Replacement. (Niall Holmes, Alex Browne, Christopher Montague) (2014)
2. Use of tire rubber particles as addition to cement paste. (N. Segre, I. Joekes)(17 July 2000)
3. Use of Rubber as Aggregate in Concrete.(Ishtiaq Alam) (02, April 2015)
4. Rubber tyre particles as concrete aggregate (Nell N. Eldin, Ahmed B. Senouci) (1987)
5. Scrap-tyre-rubber replacement for aggregate and filler in concrete (Ganjian, E. , Khorami, M. and Maghsoudi) (2012)
6. Use of tyre waste in concrete (Vidat Choudhary, Abhay Choudhary)
7. A study of the durability properties of waste tire rubber applied to self-compacting concrete (Wang her yung lee hsienhuab) (2013)
8. Strength and deformability of waste tyre rubber-filled reinforced concrete columns (Ki SangSonaKyprosPilakoutasb) (2011)
9. Analysis of rubberized concrete as a composite material (Nuri Avcular) (1997)
10. Use of crumb rubber to improve thermal and sound properties of pre-cast concrete panel (Piti Sukontasukkul) (2009)