International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072

Investigation and Analysis of Effect of Admixtures over the Strength of Cement

Priyanka Deshmukh[1], Prathamesh Ghanellu[2], Abhishek Jain[3], Deepali Parab[4], Ankita Pawar[5]

[1]Assistant Professor, Mechanical Engineering Department, MCT's Rajiv Gandhi Institute of Technology, Maharashtra, India
[2,3,4,5]Student, Mechanical Engineering Department, MCT's Rajiv Gandhi Institute of Technology, Mumbai, Maharashtra, India

---

Abstract - *Concrete is one of the most consumed materials in construction industry. Due to improper ways of disposing tyres, there is increase in pollution. In order to curb pollution, we have devised a conventional method of recycling waste tyres (rubber).This project study represents the effect of partial replacement of cement (OPC Grade-53) with scrap tyre rubber and flyash. Rubber can be replaced in cement in two forms viz. chipped rubber and crumb rubber. Among which we have used granulated rubber which is a sub type of crumb rubber. The concrete used in this study is of grade M-40. Electricity is the key for development of any country. Coal is a major source of fuel for production of electricity in many countries in the world. In the process of electricity generation large quantity of fly ash get produced and becomes available as a by-product of coal-based power stations. It is a fine powder resulting from the combustion of powdered coal - transported by the flue gases of the boiler and collected in the Electrostatic Precipitators (ESP). The pozzolanic property of fly ash makes it a resource for making cement and other ash based products this amalgamation of rubber and flyash results in variation of properties of concrete like compressive strength, workability and density. Here we have replaced cementitious with 2.5% and 5% of rubber we have examined the properties on fresh and hardened concrete.*

Key Words: Scrap tyre rubber, compressive strength, water permeability, workability

1. INTRODUCTION

Due to increase in urbanization there has been high demand in the automobile sector. This results in the increased production of tyres which takes about average span of 3 – 5 years. The current methods of recycling tires are less effective and cause more pollution. So alternative methods are employed for overcoming this problem, one such method is to use them in materials where life of the product is considerably large than tyres viz. roads, pavement blocks, concrete blocks and other non – structural uses.

2. MATERIAL USED

A. Cement
B. Flyash
C. Machine Sand
D. Water
E. Admixture
F. Aggregates
G. Rubber Crush

3. METHODOLOGY

3.1 Concrete Mix Design:

Concrete is set to attain compressive strength of 40N/mm ^{2} (i.e. M 40 concrete). The quantity of material used for construction of 6 cubes for each mix.

Table -1: Materials used and their composition

Materials	Bharti Cement (kg)	MachineSand (kg)	Metal NO1 and NO2(kg)	Rubber (kg)
(Normal)	4	24.3	48.6	0
(2.5% rubber) (Batch size 0.045m^3)	4.985	8.721	12.71	0.15498
(5% rubber) (Batch size 0.03m^3)	2.214	3.8574	5.66	0.13

3.2 Formation of Concrete Cubes

The cubes were held in usual curing conditions for 3 days, 7 days, 10 days and 28 days in water.

3.3 Slump Cone Test:

The slump test is the utmost and modest workability check for concrete, contains low cost and provides instantaneous results

3.4 Calculating Mass of Cubes:

The mass of each concrete cube was determined with the help of electronic weighing machine.

3.5 Analysis of Compressive Strength:

The concrete cubes were investigated over compressive strengths after the completion of their setting test.

3.6 Comparison of Results:

Comparing workability, water permeability and compressive strength result between mix designs.

Fig -1: Tested brick

Fig -2: Casted cylinder

4. TESTS PERFORMED

4.1 Slump Test:

A concrete mix (M40) by weight with suitable water/ cement ratio is prepared in the laboratory required for casting 6 cubes and then Slump test is conducted.

Table -2: Observations from slump test

Rubber Content	Time Required(min) for Slump(150mm)
0%	180
2.5%	90
5%	120

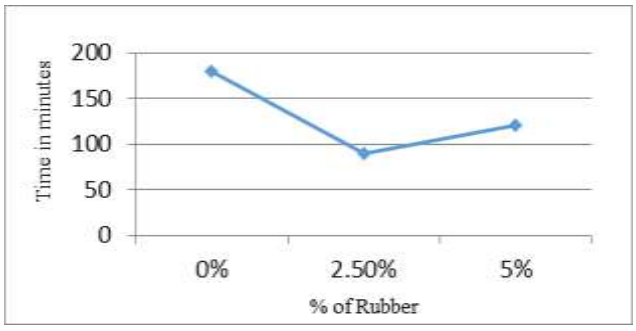

Chart -1: Slump test results

4.2 Compression Test:

The most important parameter on which we compare various mix design of concrete is its compressive strength. In our study, we have varied the proportion of rubber content and tabulated the results as follows

Table -3: Percentage rubber v/s Strength

% of Rubber	0%	2.5%	5%
No. of Days	Strength in N/mm^2		
3	26.66	21.5	19.75
7	36.75	36.06	27.09
10	40.12	45.13	35.12
28	52.45	58.62	40.15

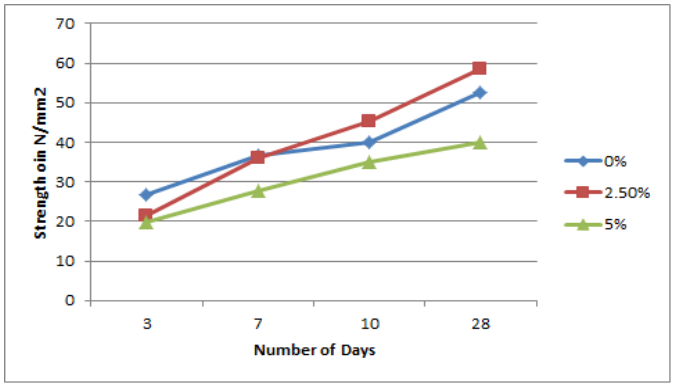

Chart -2: Strength v/s No. of days

4.3 Water Permeability Test:

Water Permeability is the property of a material that lets fluids (such as water or water vapor) to diffuse through it to another medium without being chemically or physically affected.

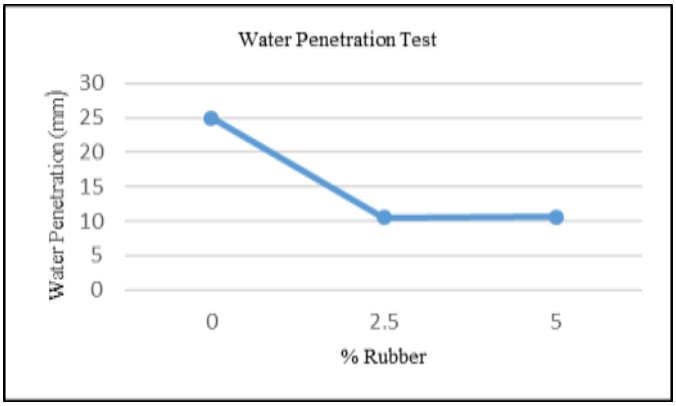

Chart -3: Water Penetration Test

5. APPLICATIONS

1 Concrete can be used in Architectural applications such as nailing concrete, stone backing, false facades and interior construction because of its light unit weight, crash barriers around bridges and similar structures because of its high toughness.

2 Rubberized concrete can be used in non-load bearing members i.e. lightweight concrete walls, other light architectural units, thus rubberized concrete mixes could give a viable alternative to where the requirements of normal loads, low unit weight, Medium strength, high toughness etc.

3 The road construction industry uses rubberized concrete and offer as substantial economy in the traditional aggregates.

4 The above uses mentioned are for high percentage of rubber (strength is medium).

5 We have also concluded that, partial replacement of rubber with cementetious up to 2.5 percentage increase the strength, so we can use this concrete in applications where we require supplementary strength.

6. CONCLUSIONS

1. Compressive strength of concrete mixture increases upto 2.5% rubber replacement and with further increment strength decreases.
2. Density decreases as the percentage of crumb rubber increases with various composition of concrete.
3. Water penetration decreased partially as waste crumb rubber increased.
4. Slump test and workability are inter – related, with an increase in rubber percentage workability goes on increasing upto 2.5% and further it reduces slightly.

7. RECOMMENDATIONS

1. With an increase in crumb rubber percentage the compressive strength of composite mixture decreases, however due to its increased flexibility it is recommended for using where vibrations damping is needed, such as foundation pad for machinery and in railway stations, for trench filling and pipe bending, pile heads and paving slabs, railway buffers, bunkers.
2. It is recommended to use composition in the vicinity of 2.5% for mixtures, since compressive strength is in an acceptable range.
3. Different compositions of crumb rubber can be used to develop more efficient material.

8. REFERNCES

1. Zeineddine Boudaoud and Miloud Beddar, "Effect of recycled tires rubber aggregates on characterstics of cement concrete", Open Journal of Civil Engineering,2, 2012, 193-197."
2. C. Vigneshkumar, N. Polmanar and B. Sunantha, Effect of rubber tyre waste in concrete, International Journal of Applied Research, 4(11), November 2014, 302-304.
3. Z. K. Khatib and F. M. Bayomy, Rubberized Portland cement concrete, Journal of Materials in Civil Engineering, 1998, 206-213.
4. Sulagno Banerjee, Aritra Mandal and JessyRooby, "Studies on Mechanical Properties of Tyre Rubber Concrete" , SSRG International Journal of Civil Engineering (SSRG – IJCE) – Volume 3 Issue 7 – July 2016
5. Nabeel Hamid Shah,Dr. B.K. Singh,Ms Yati Aggarwal, " Use of tyre rubber crumb as replacement of fine aggregate in cement concrete" , September 2016 | IJIRT | Volume 3 Issue 4 | ISSN: 2349-6002
6. Nikhil Ramchandra Pardeshi1, Digvijay P. Singh2, Sakshi Ramesh Patil3, Pravin J. Gorde4 ,Prachity P.Janrao5, " Performance and Evaluation Of Rubber As Concrete Material " , (IRJET) e-ISSN: 2395 -0056 Volume: 04 Issue: 01 | Jan -2017
7. M. Deepika Sree, G.Gowthama Raja, K.Kamesh Kumar, R.Prabhakaran , "Experimental Investigation on Replacement of Course Aggregate by Shredded Rubber Tyre", International Journal of ChemTech Research
8. MOHAMMED MUDABHEER AHMED SIDDIQUI, "STUDY OF RUBBER AGGREGATES IN CONCRETE AN EXPERIMENTAL INVESTIGATION" , (IJLRET) ISSN: 2454-5031
9. Sourav Dey, Mukesh Pandey , "Waste Management By Utilization Of Tire Rubber Aggregate In Concrete " , (IRJET) Volume: 04 Issue: 06 | June -2017