Study on Characteristics Strength of Concrete by Partial Replacement of Coarse Aggregate

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ABSTRACT

In general concrete has good strength in compression and less strength in tensile strength and low energy absorption. Concrete also tends to shrink and strengthen during the hardening and curing process. The objective of this research is to test the properties of concrete. Coarse aggregate is partially replacing with rubber tyres. Rubber tyre is pretreating with a Diethanolamine solution it reacts that rubber surface to become better binding with cement paste. For this research unused tyres with solution & without solution were partially replaced with aggregate in concrete for its slump and compressive strength.

KEY WORDS: Rubber tyre, Coarse Aggregate, Fine Aggregate, Diethanolamine solution.

1. INTRODUCTION

Concrete is a mixture of cement, fine aggregate, crushed stone rock and water. These ingredients are abundantly available and are cheap in price to process and hence they are widely used. Further they produce good concrete due to their physical properties such as shape, gradation, etc. The formation of these natural deposits occurred over millions of years, these deposits are overexploited. It is used as construction materials and gives more advantages than steel. The easiness with which it can be molded to any shape, its durability, easy availability of the raw materials required for its making and relatively cheap cost make it the first choice for construction of a variety of structures including buildings, bridges, towers, dams, etc.

It is difficult to point out another material of construction which is as versatile as concrete. It is the material choice where a strength permanence durability, impermeability, fire resistance and abrasion resistance are required. It is closely associated with every human activity that it touches every human being in his day to day living. Nowadays dams are constructed in every river. So these resources are eroding very fast. Good aggregate is not readily available transportation cost is more if good sand is to be transported for a long distance. The waste product obtained from the crusher industry is dumped into the environment and creating pollution.

2. MATERIALS USED AND METHODS

Concrete is a mixture of cement, sand, pebbles (or) crushed stone rock and water. In this project, an attempt has been made to partial replacement of coarse aggregate by tyres using Diethanolamine solution. Hence the properties of material have been arrived by conducting laboratory tests and the results.

Materials Used:

Cement: Cement is a binding material in concrete, which binds the materials to form a compact mass. Cement is obtained by a mixture of calcareous and argillaceous material with high temperature. Portland Pozzolona Cement is look like greenish gray and free from dust. It should be free from lumps. It is a bonding material.

Fine Aggregate: A concrete with better quality can be made with fine aggregate consisting of angular grains rather than rounded grains. Fine aggregate is conforming to zone III. Specific gravity of Fine aggregate is 2.65. By conducting Sieve Analysis, and compared with grading table from IS 383-1970.

Coarse Aggregate: Aggregate must be angular in shape and free from impurities. The Coarse aggregate used in this project is of the size 20mm. Specific gravity of coarse aggregate = 2.8. Aggregate are the important constituents in concrete as a filling materials. The give body of the concrete reduces shrinkage and effect economic. The aggregate most of which are retained on the 4.75mm IS sieve as coarse aggregate .The Impact value of coarse aggregate is 12%. The graded coarse aggregate is described by its nominal size i.e. 40mm, 20mm, 16mm, 12.5mm etc.

Tyre (With Solution): Rubber tyres are used as filling material offer outstanding long-term performance benefits and are less expensive than many alternatives. Rubber tyre cuts into small pieces in square shape. Rubber tyre is pretreating with a Diethanolamine solution it reacts that rubber surface to become better binding with the cement paste. For this research unused tyres were surface dipped with a Diethanolamine saturated aqueous solution for 30 minutes then washed under water and left to dry.

Properties of Materials:

Table.1.Test on Cement

Properties	Value
Specific Gravity	3.15
Initial Setting Time	30min
Final setting Time	10hrs
Consistency	26%
Fineness	7.33%

Table.2.Test on Tyre

Properties	Value
Specific Gravity	1.21
Particle Size	Passing through
Bulk Density	0.92

Fineness Modulus of Fine Aggregate: Total weight of fine aggregate = 1000g

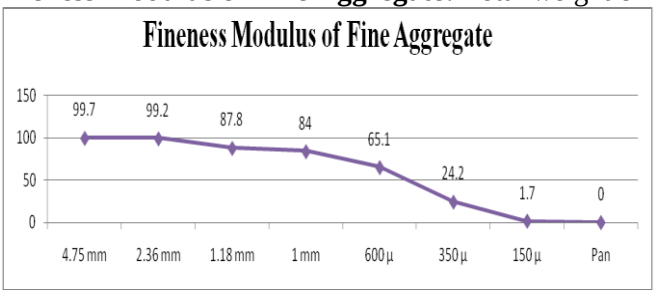

Figure.1. Line chart of Particle Size Distribution – 100% fine aggregate

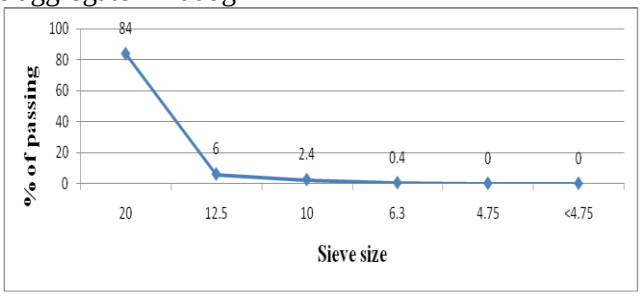

Figure.2. Line chart of Particle Size Distribution – 100% Coarse aggregate

Water Absorption Test: For Fine Aggregates = 1.00%, For Coarse Aggregates = 0.5%.

Table.3. Mix Proportion Ratio

Water	Cement	Fine Aggregate	Coarse Aggregate
191.61 kg	383Kg	583kg	1205.85kg
0.5	1	1.42	3.1

We were made six concrete cubes of 15 x 15 x 15cm, three cubes with tyre and three cubes without tyres.

Table.4. Mix Proportion for Various % of Tyres

Percentage of Tyres	Specific Gravity	Water Kg/m^3	Cement Kg/m^3	FA* Kg/m^3	CA* Kg/m^3	Tyre Kg/m^3
0	2.59	191.61	383	544.0	1205.85	0
5	1.21	191.61	383	544.0	1145.56	60.29
10	1.1	191.61	383	544.0	1085.27	114.55
15	0.9	191.61	383	544.0	1024.97	162.79

FA*- fine aggregate, CA*- coarse aggregate

Slump Test: Slump cone test was carried out for with and without solution concrete. Thus the rubber contents of 20% by total aggregate volume, slump was almost zero, and concrete was not workable manually.

Table.5. Slump Cone Test without Solution

Percentage of Tyres	Water Cement ratio	Slump in mm
0	0.5	30
5	0.53	29
10	0.56	27.5
15	0.59	26

Table.6. Slump Cone Test with Solution

Percentage of Tyres	Water Cement ratio	Slump in mm
0	0.5	30
5	0.52	28.5
10	0.54	27
15	0.56	25.5

3. RESULTS AND DISCUSSION

The tests were conducted on 48 cubes of compressive strength of concrete by of tyre by with and without solutions. Compressive strength is one of the important properties of concrete. Concrete cubes of size 150 x 150 x 150mm were cast with Diethanolamine and without adding of Diethanolamine (control). The test results were given in table.7, 8, 9 it compares the relationship of concrete by partial replacement of coarse aggregate with solution and without solution. After 24hrs the specimen were remolded and subjected to water curing for 3, 14, and 28 days in table 7 observed that 15% replacement in without solution is higher than with solution. In table.8 observe that without solution is slightly higher than with solution and 5 % and 15% are similar ratio only. In table 9were observed that both with solution and without solution are similar at 28 days.

Table.7. Compressive strength for 3 days with & without solution

Percentage of Aggregate	Percentage of Tyre	Maximum Load KN	3 days Compressive Strength (N/mm^2) Without solution	3 days Compressive Strength (N/mm^2) With solution
100	0	332	14.75	14.75
95	5	140	6.22	6.05
90	10	152	6.76	6.49
85	15	148	6.58	5.00

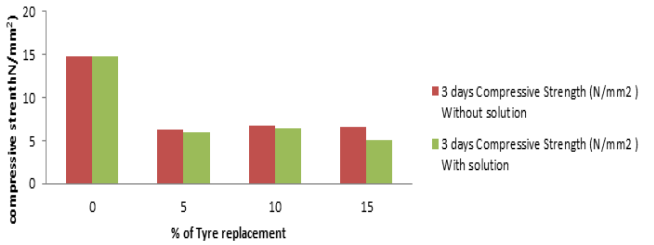

Figure.3. Compressive strength for 3 days with & without solution

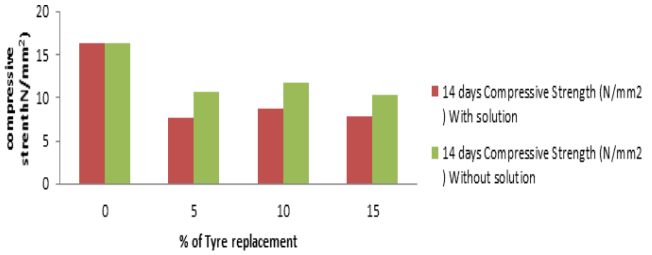

Figure.4. Compressive strength for 14 days with & without solution

Table.8. Compressive strength for 14 days with & without solution

% of Aggregate	% of Tyre	14 days Compressive Strength (N/mm^2) With solution	14 days Compressive Strength (N/mm^2) Without solution
100	0	16.27	16.27
95	5	7.64	10.67
90	10	8.71	11.73
85	15	7.84	10.31

Table.9. Compressive strength for 28 days with & without solution

% of Aggregate	% of Tyre	Maximum Load KN	28 days Compressive Strength (N/mm^2) Without solution	28 days Compressive Strength (N/mm^2) With solution
100	0	402	17.87	17.87
95	5	208	9.24	10.93
90	10	212	9.42	11.91
85	15	182	8.09	10.49

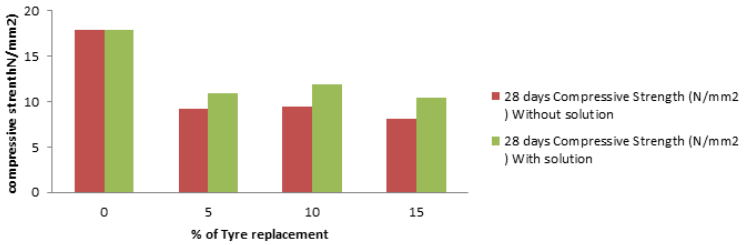

Figure.5. Compressive strength for 28 days with & without solution

4. CONCLUSION

The value of slump is decreased by increasing rubber content in concrete. In table 5% replacement of coarse aggregate in both solution in tyre and without solution in tyre is decreased. After conducting all the test it is observed that 10% replacement of aggregate is good in compression. Compressive strength dropped by 15% replacement of coarse aggregate .In both the proportions replacement of tyre will be similar in strength of concrete. In compression strength whereas in the concrete properties with equal proportion of tyre and conventional aggregate confirmed to be inefficient Alternative to coarse aggregate to recycle tyres helping the conservation of the environment.

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