PARTIAL REPLACEMENT OF COARSE AGGREGATE BY WASTE TIRES AND FINE AGGREGATE BY RED SOIL IN CEMENT CONCRETE

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Abstract- *This project deals with the evaluation of strength of concrete with the use of Rubber tyres and red soil.Nowdays due to rapid urbanization quantity of vehicles on road increase day by day as a result tyres are accumulated in large quantity. As a reusing mechanism rubber tyres are used as a replacement for coarse aggregate and to avoid the scarcity of fine aggregate red soil is used as a replacement for river sand. The aim of the project is to develop strength in M20 grade concrete by partially replacing the coarse and fine aggregate in (5%,10%,15%) conventional concrete. Properties of coarse aggregate, fine aggregate, fresh concrete, hardened concrete are studied. This experimental study comprises the mix calculation of the admixtures of concrete. By using rubber tyres and red soil as a partial replacement concrete is made more economical and beneficial.*

Keywords- coarse aggregate, Rubber Tyres, Fine aggregate, red soil, concrete, hardened properties.

I. INTRODUCTION

Concrete is a composite material consist of mainly water, aggregate, and cement. The physical properties desired for the finished material can be attained by adding additives and reinforcements to the concrete mixture. A solid mass that can be easily molded into desired shape can be formed by mixing these ingredients in certain proportions Concrete is a major construction material and it has been used for centuries.Moreover,it would even be of high application with the increase in industrialization and urbanization. So for concrete is mainly based on the virgin natural resources. Meanwhile conservation of natural resources is very essential and we have to take different alternatives. In this project, the waste material scrap tyre and abundant red soil is used as a partial replacement for aggregates.

We collected and sized rubber tyre into size of 20 mm aggregate and we collected red soil passing through 4.75 mm sieve.The rubber tyre is used as a partial replacement for coarse aggregate and red soil is used as a partial replacement for fine aggregate It has been reported that 1 billion automobile tyres has been created each year globally and also the reusability of scrap tyres in country like India is very less so it creates one of the major impact in environmental challenges. Also scarcity for sand is also one of the major threats in construction industry many alternatives are used for sand. Since red soil is abundantly available in our country it is considered as an replacement for sand which reduces the use of sand and also be economical.

II. MATERIAL USED

The basic material of concrete e.g. cement, sand, aggregate, red soil and scrap tyre rubber are used

Scrap Tyre Rubber

Tyres are of two types they are light motor vchicles tyre and heavy motor vechicles tyres LMV tyres are different from HMV tyres with regard to constituent materials (e.g. Natural and synthetic rubber). Chipped, crumb and ground rubber are the main categories of tyres. The production of this rubber is in done in two stages, in first stage the rubber has length of 300 – 430 mm long and width of 100 -230 mm wide. In the next stage its dimension changes to 100 -150 mm by cutting.

Particles of about 13 – 76 mm in dimension are produced by continuous shreddinng.Sand is replaced by crumb tyres. This rubber is manufactured by special mills where big rubbers change into smaller particles. smaller dimensions of about 0.425 - 4.75 mm in dimension are produced.

Fig.1 Rubber tyres

Cement

Cement is a binder material substance which generally hardens independently. It is fine grey powder cement is mixed with water and materials such as sand, gravel and crushed stone to make concrete. The cement and water form as a paste that binds the other materials together as the concrete hardens. There are variable grades of cement available in our market, for this project Puzzuolona Portland Cement is used.

Fig.2 Cement

Aggregates

Segregation is promotoed to maximum by gap graded aggregates.As with conventional concrete construction, the maximum size of the coarse aggregate depends upon the type of construction. Typically, the maximum size of coarse aggregate used varies from 10mm to 20mm .In present investigations, fine aggregate is natural sand obtained from nearby locations. The physical properties of fine aggregate are determined. The infrastructure development such as express highway projects, power projects and industrial development have started now.Availablity of sand is getting depleted and also it becoming costlier.

Concrete industry now will have to go for artificial sand or crushed sand or what is called manufactured sand. Advantages of natural sand are the particles are round or cubical with smooth surface texture. The grading of natural fine aggregate is always no ideal. It depends upon place to place..

Fig.3 Aggregates

Table 1 Physical Properties of the Coarse Aggregate.

Description	Test Result
Moisture content	1.37 %
Unit weight of coarse aggregate	1532.25 kg/m^3
Specific gravity	2.73

Table 1 Physical Properties of the Fine Aggregate.

Description	Test Result
Moisture content	2.37 %
Unit weight of coarse aggregate	1732.25 kg/m^3
Specific gravity	2.63

Redsoil

Major advantage of using Red soil is its availability and highly effective for usage in concrete as a partial replacement and cement consumption is minimum when red soil is mixed, consumption of cement is minimum depending upon the variety of mix proportions. Red soil present is in all kind of areas and it has unlimited resources in all areas which can be effectively used as a admixture of concrete in constructing buildings. Red soil is produced by weathering of igneous and metamorphic rocks.

Fig.4 Red soil

Water

The quality of the water plays a major role in concrete production. Impurities in water may interfere with the setting of the cement, may affect the strength of the concrete or cause cracks of its surface, and may also lead to corrosion of the reinforcement,so the quality of water is maintained and the pH of water doesn't allowed to exceed 6

III. TESTING ARRANGEMENT

The following tests were performed on the different concrete samples produced in this study.

1) Slump test for workability:

Slump cone of height 300 mm base diameter 200 mm and top dia 100 mm is used to study the slump characteristics of the concrete.

Table-2:SlumpTest

No.	Specimen	Grade	Red soil%	% rubber	Slump (mm)
1	20M1	M20	0	0	45
2	20M2	M20	5	5	50
3	20M3	M20	10	10	52
4	20M4	M20	15	15	55

2) Compressive strength test:

Compression testing machine operated mannualy with a constant loading of 150kN/m3 is used for testing the cubes.

Table-3: Compressive Test Result

No.	Spec.	Grade	% red soil	% Rubber	Compressive Strength (N/mm^2) 28 Days
1	20M1	M20	0	0	23.34
2	20M2	M20	5	5	21.11
3	20M3	M20	10	10	20.09
4	20M4	M20	15	15	19.87

IV. CONCLUSION

The general objective of this research was to evaluate the fresh and hardened properties of a concrete produced by replacing part of the natural coarse aggregates with an aggregate produced from locally available recycled waste tire and subjected to local conditions. From the test results of the samples, as compared to the respective conventional concrete properties, the following conclusions are drawn out.

1. The introduction of red soil and rubber tyres into concrete significantly increased the slump and workability. It was noted that the slump has increased as the percentage replacement was increased in all samples.

2. From the results, it was found out that a reduction of unit weight up to 10 % was observed when 15% by volume of the coarse aggregate was replaced by rubber aggregate in sample 20M3 and and 5% in 20M2 and 2% in 20M1.

3. So from the results it is found that use of rubber tyres and red soil in cement concrete reduces the weight of concrete.

4. The test result shows that there is a gradual increase in attaining the charactrestic compressive strength,but the strength equals the strength of the normal concrete.

5. The use of rubber aggregates from recycled tires addresses many issues. These include; reduction of the environmental threats caused by waste tires, introduction of an alternative source to aggregates in concrete, enhancing of the weak properties of concrete by the introduction of different ingredients other than the conventionally used natural aggregates and ultimately leading to the conservation of natural resources. In addition to meeting recycling and sustainability objectives, it aims is to produce products with enhanced properties in specific applications.

6. The use of red soil have reduced the consumtion fo sand to a greater precentage,but shows a deviation in strength when added in higher quantities.

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