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Experimental Investigation of Concrete by Partial Replacement of Fine Aggregate with Red Soil

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Abstract
In this paper the experimental program is done for overall investigation of compressive strengthening and split tensile strengthening of total seventy two reinforced concrete cubes and cylinders for partial replacement of red soil for 0 4 8 10 percent respectively. The casting of cubes having size 150 x 150 x 150 mm and cylinders having size 150 x 300 mm has done with use of M 20 grade of concrete as per IS 456 2000 and IS 10262 2019.Compressive strength and split tensile strength is improved at 4 percent replacement of red soil.

Keywords: Red Soil, Partial Replacement, Compressive Strength, Split Tensile Strength.

1. Introduction

Concrete is mixture of water, cement, fine aggregate and coarse aggregate. Sand is used as fine aggregate in concrete mixture. It plays a major role in concrete mix design. Consumption of natural sand is high for the concrete construction process. Large amount of sand extraction from river bodies causes problem to river environment. Using various materials for sand can reduce environmental imbalance. River sand extraction leads to construction damages near river side. Sand is now an expensive material due to large amount of extraction from river bodies. So for future needs an alternative material is needed. Red soil can be the material for replacement of sand. Requirement of sand can be reduced by adding red soil in mix proportion of concrete. The partial replacement of fine aggregate was done by using red soil in a mix proportion M20 of 1:2.5:4.

2. Objectives

The investigation has been carried out with following objectives.
1. To determine compressive strength and split tensile strength of concrete at normal 0 percent.
2. To determine compressive strength and split tensile strength at 4, 8, 10 percent.
3. To compare between compressive strength and split tensile strength for 0, 4, 8, 10 percent.

3. Scope of study

We will check compressive strength and split tensile strength for various percentage of red soil. Also in addition with compressive strength and split tensile strength can be check flexural strength of concrete.

4. Material and methodology

1. Cement

Ordinary Portland cement of 53 grade was used throughout the project work.

Table 1: Physical characteristics of cement

Sr. no	Tests	Results
1.	Standard consistency	34.66
2.	Initial setting time	162 minutes
3.	Final setting time	291 minutes
4.	Specific gravity	3.15
5.	Fineness	3 %

2. Fine aggregate

Artificial sand is used throughout the project work.

Table 2: Physical characteristics of fine aggregate

Sr. no	Tests	Results
1.	Specific gravity	2.90
2.	Apparent specific gravity	3.06
3.	Water absorption	1.8 %

3. Coarse aggregate

The coarse aggregate with nominal size of 20 mm is used throughout the project work.

Table 3: Physical characteristics of coarse aggregate

Sr. no	Tests	Results
1.	Specific gravity	3.08
2.	Apparent specific gravity	3.20
3.	Water absorption	1.21 %

4. Red soil

Locally available red soil is used throughout the project work.

Table 4: Physical characteristic of red soil

Sr. no	Test	Result
1.	Specific gravity	2.18

5. Water

Water plays important role in concrete mixing and curing throughout the project work.

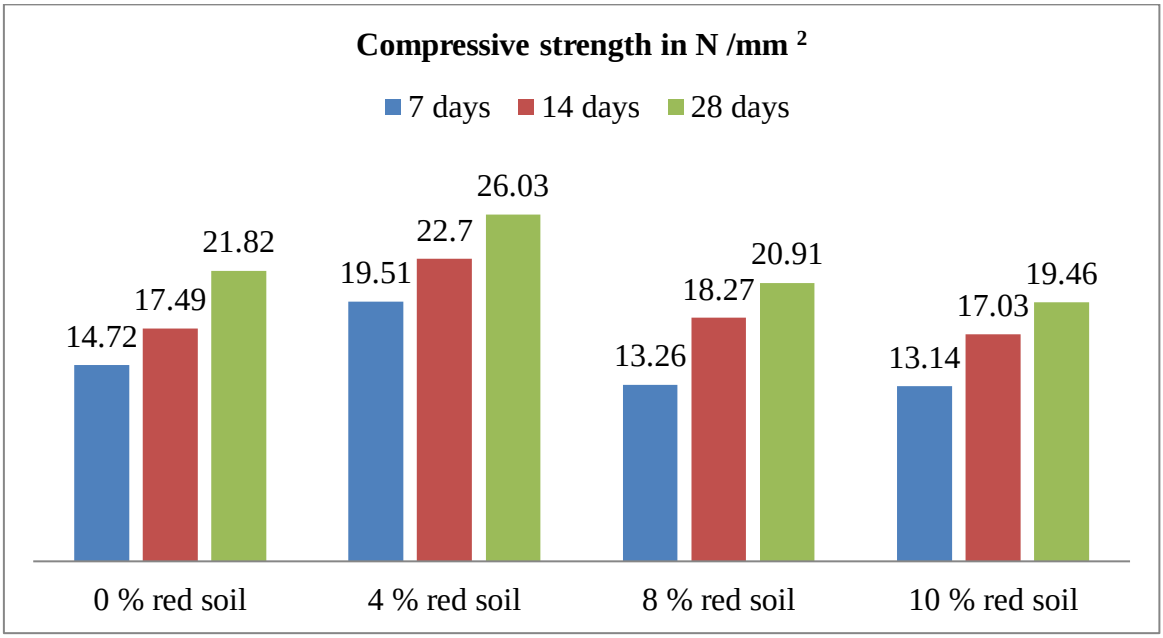
5. Result and discussion

1. Compressive strength of concrete cubes

Total 36 specimens where casted. After curing period of 7, 14, 28 days tested respectively.

Table 5: Compressive strength in N / mm ^{2}

Sr. no	0 %			4 %			8 %			10 %		
	7 days	14 days	28 days	7 days	14 days	28 days	7 days	14 days	28 days	7 days	14 days	28 days
1.	13.98	17.34	21.78	19.24	22.16	26.22	13.28	18.18	20.45	13.05	16.55	18.86
2.	14.50	17.46	21.69	19.11	23.34	25.74	13.12	18.24	21.08	13.13	16.96	19.10
3.	15.69	17.69	22.01	20.20	22.60	26.14	13.40	18.40	21.22	13.24	17.59	20.42
average	14.72	17.49	21.82	19.51	22.70	26.03	13.26	18.27	20.91	13.14	17.03	19.46

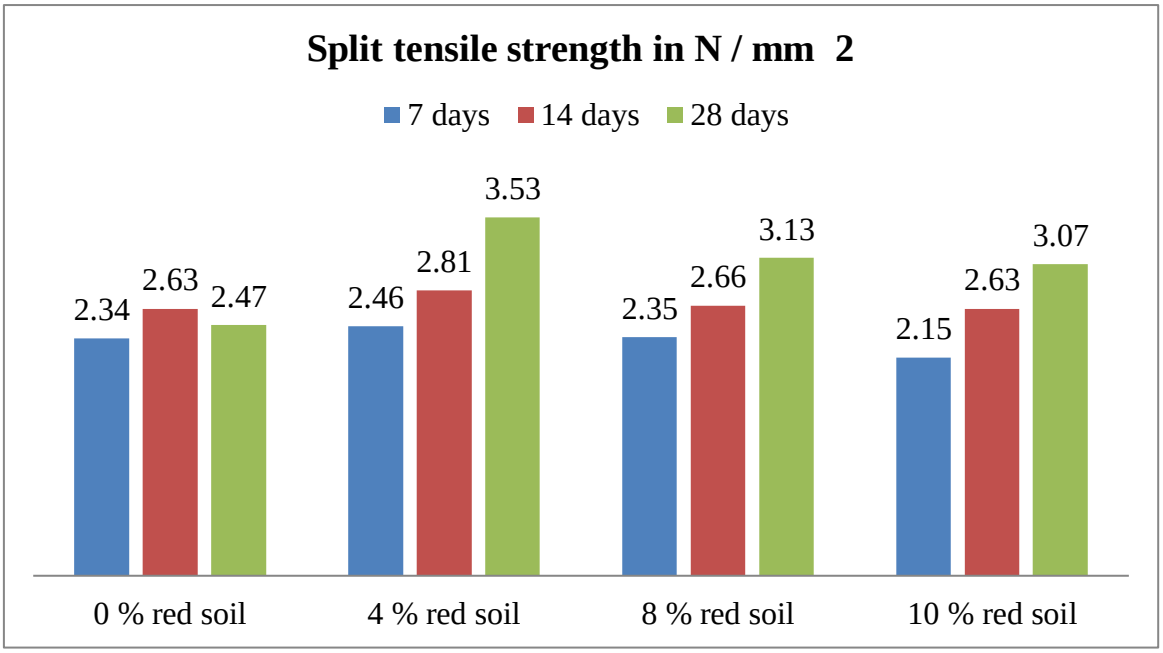


Compressive strength of concrete is improved by 4 percent at 4 % replacement of fine aggregate with red soil and then it is reduced.

2. Split tensile strength of concrete cylinders
Total 36 specimens where casted. After curing period of 7, 14, 28 days tested respectively.

Table 6: Split tensile strength in N / mm ^{2}

Sr. no	0 %			4 %			8 %			10%		
	7 days	14 days	28 days	7 days	14 days	28 days	7 days	14 days	28 days	7 days	14 days	28 days
1.	2.21	2.60	3.70	2.61	2.79	3.63	2.23	2.63	3.73	1.86	2.69	2.95
2.	2.35	2.69	2.89	2.32	2.76	3.74	2.34	2.72	2.94	2.38	2.42	2.91
3.	2.47	2.61	2.70	2.45	2.88	3.22	2.50	2.64	2.74	2.22	2.78	3.37
average	2.34	2.63	3.09	2.46	2.81	3.53	2.35	2.66	3.13	2.15	2.63	3.07



Split tensile strength of concrete is improved by almost by 1 % at 4 % replacement of fine aggregate with red soil and then it is reduced.

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7. Conclusion
Compressive strength and split tensile strength of concrete is improved at replacement of fine aggregate with 4 % of red soil. After increasing percentage of red soil compressive strength and split tensile strength goes on reducing.

8. Reference

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