FEASIBLITY STUDY ON UTILISATION OF RED SOIL AS REPLACEMENT OF FINE AGGREGATE IN CONCRETE

[1]S.BHARATHI, [2]N.VIVEK KUMAR, [3]M.S.SESHAMAHALINGAM, [4]A.YAHYA
[1]Assistant professor, Department of Civil Engineering, Sethu Institute of Technology, Kariyapatti.
[234]Student, Department of Civil Engineering, Sethu Institute of Technology, kariyapatti, Virudhunagar.

ABSTRACT

Numerous analysts are managing different sorts of admixtures to enhance the mechanical and sturdiness properties of cement. In this present examination, red soil is taken as an admixture to upgrade the execution of cement. An exploratory examination is completed to contemplate the conduct of cement by supplanting the fine total with locally accessible red soil. It includes a specific tests to locate the quality change of solid when red soil is added to it. The incomplete supplanting of sand with red soil has been finished by the particular blend extent to increase great quality in concrete and to figure the impenetrability of red soil and furthermore to locate the unique highlights of red soil. Compressive Strength tests and Split Tensile Strength test has been completed for red soil blended concrete and plain cement to separate the quality. The red soil is of uniform size thus it is reviewed as inadequately evaluated soil yet the stream sand isn't better when contrasted with the red soil. The substitution of sand in concrete has been finished utilizing red soil in a blend extent M20 of 1:1.5:3

INTRODUCTION

In May 6 2017 All sand quarries in Tamil Nadu would be shut down in three years and the legislature would attempt mining, putting away and offering of sand at less expensive rates, Tamil Nadu Chief Minister Edapaddi K. Palaniswami, has said the legislature would encourage manufacturers to utilize a contrasting option to sand. Unlawful sand mining has not just prompted a fall in the water level in stream informal lodging, yet additionally influenced the stream of waterways over the state. To overcoming of this issue is extremely basic to look into the elective materials. Keeping in mind the end goal to satisfy the prerequisite of the fine totals, some elective material must be found. Consequently, in this undertaking it is wanted to convey a test work by getting ready cement with completely substitution of sand by accessible common red soil.

PROPERTIES OF RED SOIL

1. Chemical Properties of Red Soil:

Composition	Percentage by weight (%)
Iron	3.61
Aluminum	2.92
Organic matter	1.01
Magnesium	0.70
Lime	0.56
Potash	0.24
Soda	0.12
Phosphorus	0.09
Nitrogen	0.08

B. Properties to be studied:

Compressive strength, fineness modulus, specific gravity of red soil, water content, and the fully replacement of sand with red soil is done in this subject.

MATERIALS USED

A. Cement:

A fine substance made with calcined lime and dirt. It is blended with water and sand to frame mortar and blended with sand, rock, and water to make concrete. In assembling of Concrete shapes and barrels PPC – 43 was utilized.

B. Red soil:

Red soil content used in this study is a replacement of fine aggregate. Red soil is sieved through 4.75mm I.S sieve for using it in concrete mix. According to the mix proportion of fine aggregate is 1.5.

C. Coarse Aggregate:

The aggregates used for production of Concrete is free from sound and honeycombed practices. Those particles that are predominantly retained on the 4.75mm I.S Sieve are called coarse aggregate. The nominal size of coarse aggregate with 20mm is used in this work.

A) CEMENT

B) RED SOIL

C) COARSE AGGREGATE

D. Mixing:

For all the specimens which is to be mixed and casted by mechanically or manually at M20 mix proportion is used for it. In the mix proportion of 1:1.5:3. 1-cement, 1.5-fine aggregate, & 3. is coarse aggregate.

METHODOLOGY

A. Specific gravity test:

The Specific gravity of the aggregates that are used is tested by following the Indian Standards specification by following IS 2386 (Part III) – 1963**.** The pycnometer is thoroughly cleaned and dried, its empty weight is taken (W1). Take about 150g of dry soil & put it in the bottle and find its weight (W2). The density bottle is filled with water up to the mark & its weight as (W3). The bottle is now emptied completely fill with water up to the mark & its weight (W4).

Calculation:

$$\text{Specific Gravity of red soil (G)} = \frac{[(W2-W1)]}{[(W2-W1) - (W3-W4)]}$$

$$\mathbf{G = 2.6}$$

Specific gravity of red soil is 2.6 and as per the standard specific gravity of zone II sand in between 2.3 to 2.7 hence red soil is used for fully replacement.

B. Sieve Analysis test:

Sieve analysis is done for both sand and red soil as per IS 2386 (Part I)-1963. Take suitable quantity (1000gms) of oven dried soil retained in 75µ sieve. Sieve the soil through 4.75mm, 2.36mm, 1.18mm, 1mm, 600µ, 300µ, 150µ and pan using a mechanical sieve shaker for 2 minutes. Each sieve and pan with soil retained on them is weighted carefully and note it in observation. The sum of the retained soil is checked against the original mass of soil taken.

Calculation:

Fineness modulus = $\frac{\text{total sum of cumulative \% retained}}{1000}$

$= \frac{253}{1000} =$ **0.253**

The red soil is suitable for replacement of fine aggregate in this experiment.

A. Pycnometer

B. Sieve shaker

C. Water absorption test:

The example ought to be altogether washed to expel better particles and clean, depleted and then put in the wire bushel and submerged in water at temperature between 220c – 320c. The crate and test ought to remain submerged for a time of 24 hrs. The totals ought to be spread on the fabric and presented to the air far from coordinate daylight till it gives off an impression of being totally surface dry. The total ought to be weighted at A. The total should then be put in a stove at a temperature of 1000 to 1100 c for 24hrs. It ought to be expelled from the stove, cooled and weighted at B.

Calculation:

Water absorption of Coarse aggregate = [(A-B)/B] X 100%

= 2.79 %

Water absorption of Coarse aggregate **= 2.79%.**

D. Compressive Strength test: (Cube)

The compressive quality of a material is controlled by the shattering crack of the material under these powers. The pressure test on solid 3D square at 7, 14, and 28 days to decide the quality of 3D shapes. Pick three examples, estimate at 15cm x 15cm x 15cm to test at determined days. Expel the case from water after demonstrated curing time and wipe out wealth water from the surface. Clear the bearing case of the testing machine. Place the case in the machine in such a path, to the point that the stack may be associated with the opposite sides of the strong shape cast. Adjust the example halfway on the base plate of the machine. Apply the heap bit by bit without stun and constantly till the example falls flat. Record the most extreme load and note any abnormal highlights in the sort of disappointment.

Calculation:

1) Compressive Strength Test (7days)

Load = 326.8×10^3 N

Area = $22500\ mm^2$

Strength = $\frac{\text{load}}{\text{area}}$

$$= \frac{326.8 \times 10^3}{22500}$$

$$P = 14.52 \text{ N/mm}^2$$

Sample no	Area in mm^2	Maximum Crushing Load N	Compressive Strength in 7days N/mm^2	Mean in N/mm^2
1	22500	326.8×10^3	14.52	14.16
2	22500	308.8×10^3	13.72	
3	22500	316.4×10^3	14.06	

Average Compressive strength Of Concrete in 7days curing = **14.16 N/mm^2.**
Concrete occurs **65%** of design strength in 7days curing process.

2) Compressive Strength Test (14days)

Load = 365.8×10^3 N
Area = 22500 mm^2
Strength = load / area

$$= \frac{365.8 \times 10^3}{22500}$$

$$P = 16.25 \text{ N/mm}^2$$

Sample no	Area in mm^2	Maximum Crushing Load N	Compressive Strength in 7days N/mm^2	Mean in N/mm^2
1	22500	365.8×10^3	16.25	16.67
2	22500	379.8×10^3	16.88	
3	22500	380.4×10^3	16.90	

Concrete occurs **90%** of design strength in 14 days curing process.

3) Compressive Strength Test (28days)

Load = 365.8×10^3 N

Area = 22500 mm^2

Strength = $\frac{\text{load}}{\text{area}}$

= $\frac{365.8 \times 10^3}{22500}$ P = 16.25 N/mm^2

Sample no	Area in mm^2	Maximum Crushing Load N	Compressive Strength in 28days N/mm^2	Mean in N/mm^2
1	22500	431.4×10^3	19.17	19.24
2	22500	434.6×10^3	19.31	
3	22500	433.4×10^3	19.26	

Concrete occurs **99%** of design strength in 28 days curing process.

D. Compressive Strength Test

E. Split Tensile Strength Test

E. Split Tensile Strength test: (Cylinder)

The split tensile strength test of cylinder is similar to the above compression strength test. The split tensile strength test on concrete cylinder at 7, 14, & 28 days to determine the strength of cylinders. Choose that same three specimens, size at 15cm diameter & 30cm height to test at specified days. Take the specimen from water & wipe out the water from the specimen surface. Place the specimen in compression testing machine at perpendicular of the machine. Bring down the upper plate to touch the specimen. Apply the load continuously without shock till the specimen fails. Note down the breaking load (P).

calculation:

1) Split Tensile Strength Test (7days)

Load = 84.2 x 103 N

πDL value = 141.37 x 103mm^2

Strength = $2P/\pi DL$

$$= \frac{2 \times (84.2 \times 103)}{(141.37 \times 103)}$$

= 1.19 N/mm^2

Sample no	πDL value in mm^2	Maximum Ultimate Load N	Split Tensile Strength in 7days N/mm^2	Mean in N/mm^2
1	141.37 x10^3	84.2 x10^3	1.19	

2	141.37 x10^3	94.5 x10^3	1.33	1.30
3	141.37 x10^3	99.3 x10^3	1.40	

As per IS456, split tensile strength of concrete = 0.75 Fck

2) Split tensile strength test (14days)

Load = 101.10 x 103 N
πDL value = 141.37 x 103mm^2
Strength = **2P/ πDL**

$$= \frac{2 \times (101.10 \times 103)}{(141.37 \times 103)}$$

= 1.43 N/mm2.

Sample no	πDL value in mm^2	Maximum Ultimate Load N	Split Tensile Strength in 14days N/mm^2	Mean in N/mm^2
1	141.37 x10^3	101.10 x10^3	1.43	1.54
2	141.37 x10^3	111.4 x10^3	1.57	
3	141.37 x10^3	115.7 x10^3	1.63	

In split tensile strength of cylindrical concrete is **L/8 to L/12** of cube strength.

2) Split tensile strength test (28days)

Load = 128.6 x 10^3 N
πDL value = 141.37 x 10^3mm^2
Strength = **2P/ πDL**

$$= \frac{2 \times (128.6 \times 10^3)}{(141.37 \times 10^3)}$$

= 1.81 N/mm^2

CONCLUSION

- The above test consequences of different tests clarifies that the Red soil blended cement is similarly higher than plain cement in quality and impenetrability.
- In porosity, in red soil blended solid, porosity is higher than plain concrete however the penetrability is low in red soil contrasted with the plain concrete. Due to little pores in fine soil it can hold water more tightly in little pores so it is low in porousness, It opposes the liquid section. Subsequently it is impenetrable.
- If this solid is utilized as a part of RCC, at that point there will be no consumption in steel.
- Red soil can be utilized as a part of RCC and in addition prestressed concrete.

Sample no	πDL value in mm^2	Maximum Ultimate Load N	Split Tensile Strength in 28days N/mm2	Mean in N/mm^2
1	141.37 $x10^3$	128.6 $x10^3$	1.81	1.81
2	141.37 $x10^3$	127.3 $x10^3$	1.80	
3	141.37 $x10^3$	128.8 $x10^3$	1.82	

- Follow of activity is to be done in inquire about for shell structures, prestress and RCC to affirm that red soil can be utilized as a part of multi storied building.

REFERENCES

[1] Ashok Raajiv.v.s, Augustine Maniraj Pandian "Experimental investigation on the effects of using soil as a replacement of sand in concrete"ICETSH-2015, page: 66-69.

[2] Sunkarayashwant, Someswara Rao b., Venkata Rao G. "Experimental studies on laterite soil stabilized with cement and aggregate", Indian Journal of Research Engineering and Technology" Vol. 04, August 2015.

[3] Joshua, Amusan, Fagbenle O.I & kukoyi P.O, "Effects of partial replacement of sand with lateritic soil in sandcrete blocks", Covenant Journal of Research in Built Environment" vol.1, March 2014.

[4] Prakash.S, Rajeshkumar.K, Sakthi.S & Shembiang Marthong, Kumutha & Vijai k., "Feasibility study on utilisation of laterite soil for stabilized earth blocks", Research Desk 2013, Jul-Sep (2)3.229-236 .

[5] TarhReema, Ajanta Kalita, "Strength characteristics of red soils blended with fly ash and lime" , International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4(3), March 2014.