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A STUDY ON CEMENT BLENDED WITH LOCALLY AVAILABLE CLAY MATERIAL

Vengatesh. G[1], Mr. Jeyasankar. S[2], Dr. Dhanalakshmi. G[3]

[1]*M.E. (Structural Engineering), Department of Civil Engineering, Oxford Engineering College, Tiruchirappalli, Tamilnadu , India*

[2]*Assistant Professor, Dept of Civil Engineering, Oxford Engineering College, Tiruchirappalli, Tamilnadu , India*

[3]*Professor & Head, Dept of Civil Engineering, Oxford Engineering College, Tiruchirappalli, Tamilnadu , India*

Abstract - *Nowadays building construction work is going faster and leads to demand in construction material. So we are in an intense need to use the locally available materials for construction work. Clay an available material mostly prevails in Southern India. In this study clay is acting as a blending material with respect to cement and also compare the strength of conventional concrete with blended clay concrete by partially adding of clay with cement as a percentage of 5%, 10%, 15% & 20% in a normal concrete mix. The investigations are to be carried out using compressive test, split tensile and flexural test.*

Key Words: **OPC, Clay, Compressive strength, Split Tensile strength and Flexural strength.**

1. INTRODUCTION

Clay a good blending material easily combines with concrete with respect to cement. As clay tiny porous material easily stick together with cement. It easily fillips the gap between the cement and makes strong bond. Clay has the important property of shape stability and shape holding property. Clay particles are smaller than 0.004mm. If the clay is immersed in saline water, the clay particles flocculate and settle easily. Clay can easily mould to any form when dry and hard and lose its plasticity when heat. Clay has the ability to withhold greater load with respect to its size and shape. Greater its dimension, greater it's holding capacity.

2. MATERIALS USED

2.1 Cement

The Cement used for this experimental study is 43 grade Ordinary Portland Cement. All properties of cement are tested by referring IS 12269-1987.

2.2 Clay

Clay (Fig-1) is a natural material composed of fine-grained minerals, which show plasticity nature with a variable range of water content, and hard when it dried. The size of clay is less than 0.004mm. Because of its smaller size it fills up the gap between the larger particles. The usage of clay is tremendous and researches are going on to check any unique properties might be found out.

2.3 Sand

Good quality natural river sand is used as fine aggregate. The sand is sieved in 2.36mm sieve as the sand passing through this sieve is use as fine aggregate. Zone of the fine aggregate used in this work is zone II.

Fig- 1: Clay

2.4 Coarse Aggregate

The coarse aggregate used in this investigation is 20mm size crushed aggregate conforming to the requirements of IS: 2386.

2.5 Water

Clean water conforming to IS 456-2000 was used in preparation of the concrete. pH of water lies between 6 to 8 and the water is must be free of all acids, based and other dissolved salts.

3. PROPERTIES OF MATERIALS

Table -1: Properties of Cement

S.NO.	Property	Result
1	Initial setting time	42 minutes
2	Final setting time	454 minutes
3	Consistency	30%
4	Specific Gravity	3.15
5	Fineness	8.5%

Table -2: Properties of Clay

S.NO.	Property	Result
1	specific gravity	2.48
2	physical state	rough
3	Colour	Dark orange
4	Water absorption	1.5%

Table -3: Properties of Sand

S.NO.	Property	Result
1	Fineness modulus	2.58
2	Specific gravity	2.44
3	Grading zone	II
4	Water absorption	1.0%

Table -4: Properties of Coarse aggregate

S.NO.	Property	Result
1	Fineness modulus	3.44
2	Specific gravity	2.98
3	Water absorption	0.5%

4. TEST SPECIMENS AND TESTING PROCEDURE

The concrete cubes and cylinders and beams were casted in the size of 150mm × 150mm, 150mm × 300mm and 100mm x 100mm x 500mm. According to the mix proportion of M25 grade were thoroughly mixed. The cubes, cylinders and beams were properly compacted and casted. All the concrete cubes, cylinders and beams were de-molded within 24 hours after casting. The de-molded test specimens were appropriately cured in water available in the laboratory at an age of 28 days. After 7 and 28 days the specimens were tested. Compressive test was carried out according to the IS: 516-1959 and split tensile test was carried out according to the ASTM C496 and flexural test was carried out according to the ASTM C348

5. RESULTS AND DISCUSSIONS

5.1 Compressive strength test

The 7th day and 28th day of compressive strength of concrete is given in Table 5.The specimens were casted and tested as per IS: 516-1959 -11.

Table -5: The compressive strength results

S.NO.	Specimen details	Compressive strength (MPa)	
		7 Days	28 Days
1	Conventional mix	15.48	23.74
2	5% Clay	16.75	25.94
3	10% Clay	16.67	26.79
4	15% Clay	14.82	22.80
5	20% Clay	11.41	21.56

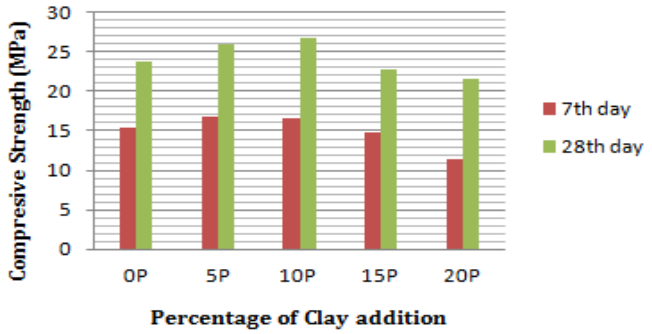

Chart -1: Comparison of Compressive strength of cubes on 28 days.

12.8% increment in the compressive strength is found at 10% replacement of sand by Clay at 28 days when compared to normal concrete.

5.2 Split Tensile strength test

The split tensile strength of concrete was tested as per specimens were casted and tested as per ASTM C496 -13. The results are given in Table 6.

Table -6: The split tensile strength results

S.NO.	Specimen details	Split Tensile Strength (MPa)	
		7 Days	28 Days
1	Conventional mix	1.37	2.39
2	5% Clay	1.47	2.41
3	10% Clay	1.36	2.37
4	15% Clay	1.24	2.25
5	20% Clay	1.18	2.15

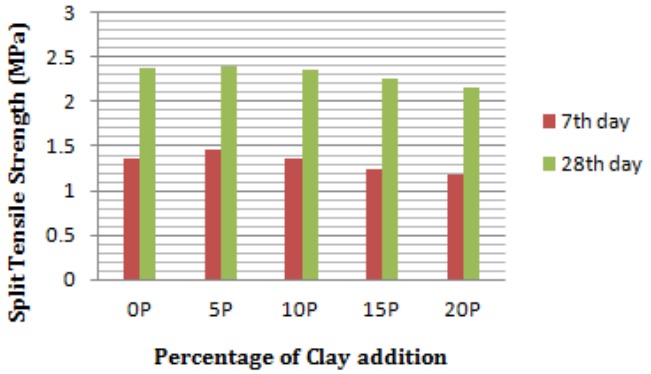

Chart -2: Comparison of Split tensile strength of cylinders on 28 days

0.84% increment in the split tensile strength is found at 10% replacement of sand by Clay at 28 days when compared to normal concrete.

5.3 Flexural strength test

The flexural strength of concrete was tested as per specimens were casted and tested as per ASTM C348 -14. The results are given in Table 7.

Table -7: The flexural strength results

S.NO.	Specimen details	Flexural Strength (MPa)
		28 Days
1	Conventional mix	5.24
2	5% Clay	5.36
3	10% Clay	5.48
4	15% Clay	5.40
5	20% Clay	5.36

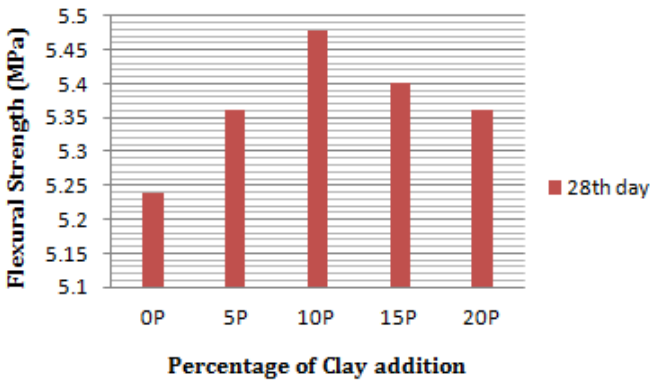

Chart -3: Comparison of Flexural strength of beams on 28 days

4.5% increment in the flexural strength is found at 10% replacement of sand by Clay at 28 days when compared to normal concrete.

6. CONCLUSION

The following results are obtained.

1. The compressive strength of concrete increases upto 10% and the percentage increase was 12.8% at the age of 28day by addition of clay when compared to conventional concrete
2. The split tensile strength of concrete increases upto 5% and the percentage increase was 0.84% at the age of 28day by addition of clay when compared to conventional concrete
3. The flexural strength of concrete increases upto 10 % and the percentage increase was 4.5% at the age of 28day by addition of clay when compared to conventional concrete
4. The optimum additive percentage of clay by cement is 10%. The compressive, split tensile and flexural strength were reduced if the replacement percentage of clay will be increased.

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