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PARIAL REPLACEMENT OF CEMENT WITH BENTONITE CLAY IN CONCRETE

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ABSTRACT:

The concept of addition of the other materials to the concrete was started in early ninety's. The Concrete replacement with similar materials is not possible to the great extend but can be replaced to some percentage. Bentonite is the material used to be added in the concrete. The understanding of the strength is the main objective of the study carried out. The testing results were studied and presented in this paper.

KEYWORDS: Split tensile strength, bentonite clay, compressive strength, flexural strength etc.

INTRODUCTION:

Replacing the concrete with the other material is the need of time as we are facing very severe problems of global warming. The researchers are working for the sustainable development of the construction industry. The several materials are selected for the partial replacement of the concrete and the results are studied by various authors in recent years. The bentonite is one of the materials to be added to improve the present scenario. The use of 100 percent concrete cannot be suggested at the same time the strength characteristics of the concrete are very important. The structure development is not only about to satisfy the required strength characteristics but also to be cost effective. The aim of this paper is to replace the part of concrete with other material. It has been observed as the proportion contribution of 95% cement to the 5% bentonite is satisfying the result from the point of view of the strength and the cost.

I. EXPERIMENTAL INVESTIGATION:

When grade 53 KCP cement was used the results are as below:

A. TEST RESULTS OF CEMENT:

Table-1 Test results of cement

S.No.	Test Conducted	Test Result
1	Fineness	3%
2	Consistency	28.5%
3	Initial Setting Time	55 min
4	Final Setting Time	5 hr
5	Specific gravity of cement	2.936
6	Compressive Strength	53 MPa

B. TEST RESULTS OF FINE AGGREGATE:

The fineness modulus of fine aggregates experimental results are tabulated given below, these results are satisfied the IS code provisions.

Table – 2: Test Results of Fine Aggregate

IS sieve size (mm)	Weight retained (gm)	Cumulative weight retained (gm)	Cumulative % weight retained	Cumulative % passing
4.74	2.99	2.98	0.298	99.79
2.35	4.78	7.75	0.775	99.225
1.17	22.12	28.81	2.968	97.019
0.6	83.71	112.64	11.353	88.565
0.3	817.10	931.34	92.054	6.944
0.16	56.65	977.20	98.76	1.290
Pan	17.52	998.45	99.97	0

C. SIEVE ANALYSIS OF COARSE AGGREGATES:

Table – 3: Sieve Analysis of Coarse Aggregates

IS sieve size (mm)	Weight retained (gm)	Cumulative weight retained (gm)	Cumulative % weight retained	Cumulative % passing
80	0	0	0	99.99
40	0	0	0	99.99
20	1698	33.89	33.98	66.02
10	3302	66.22	99.99	0
4.75	0	0	99.99	0
2.36	0	0	99.99	0
1.18	0	0	99.99	0
600 micron	0	0	99.99	0
300 micron	0	0	99.99	0
150 micron	0	0	99.99	0

II. MIX DESIGN:

Following are the details when mixture is used.

Table – 4: Mix Design

W	C	FA	CA
187	395.6	640.17	1185.18
0.47	1	1.62	2.99

III. RESULTS AND DISCUSSIONS :

A. CONCRETE CUBES (COMPRESSIVE STRENGTH):

Table – 5: Test Results for Compressive Strength of Concrete Cubes

S. No	W/C Ratio	% cement	% bentonite	Compressive strength at 7 days MPa	Compressive strength at 28 days MPa
1	0.48	100	0	21.32	24.92
2	0.48	95	5	22.95	26.69
3	0.48	90	10	22.40	25.00
4	0.48	85	15	21.70	25.03
5	0.48	80	20	21.03	24.26

B. SPLIT TENSILE STRENGTH:

Table – 6: Test Results for Split Tensile Strength of Cylinder

S. No.	W/C ratio	% cement	% bentonite	Split tensile strength at 7 days (MPa)	Split tensile strength at 28 days (MPa)
1	0.48	100	0	2.47	3.47
2	0.48	95	5	2.95	3.81
3	0.48	90	10	2.74	3.66
4	0.48	85	15	2.64	3.36
5	0.48	80	20	2.49	3.27

C. FLEXURAL STRENGTH OF BEAM:

Table – 7: Test Results for Flexural Strength of Beam

S. No	W/C ratio	% cement	% bentonite	Flexural strength at 7 days	Flexural strength at 28 days
1	0.48	100	0	12.36	20.12
2	0.48	95	5	17.84	25.12
3	0.48	90	10	14.67	20.27
4	0.48	85	15	13.78	17.49
5	0.48	80	20	12.49	15.29

D. STRENGTHS VARIATION CHARTS:

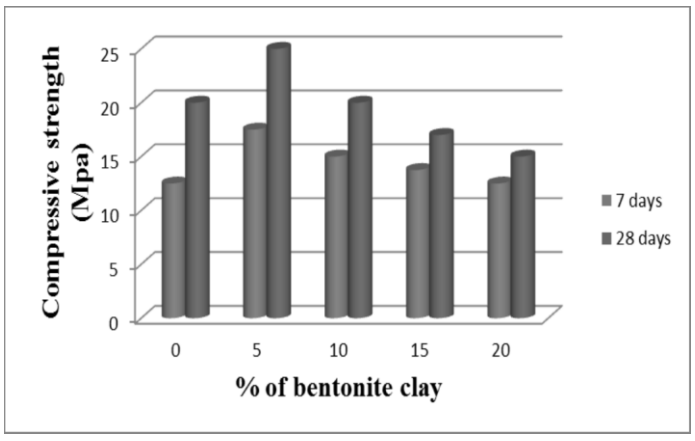

Fig. 1: compressive strength variation for 7 and 28 days

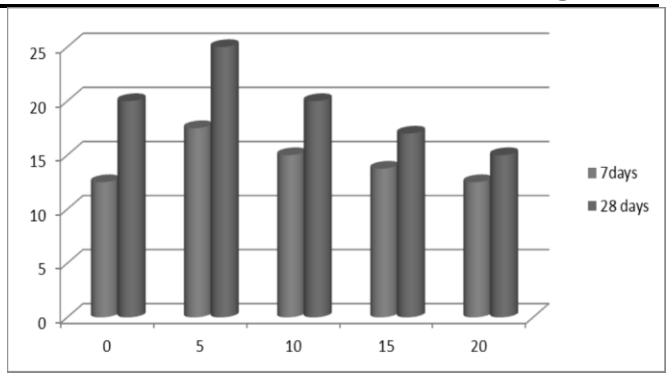

Fig. 2: Split tensile strength variation for 7 and 28 days

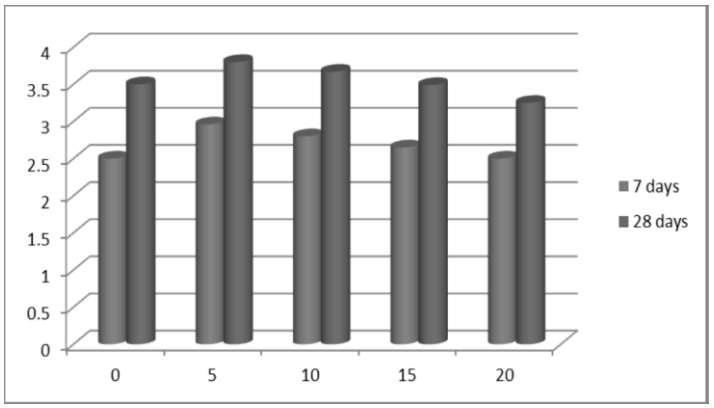

Fig. 2: Flexural strength variation for 7 and 28 days

IV. CONCLUSIONS:

The bentonite clay is added to the cement in order to reduce the percentage of the cement in the concrete without changing the properties. The mixture is made with the difference proportion and finally the best results are achieved at the 5% addition of the bentonite clay. The developments in the construction industries are based on the innovative ideas. The addition of the other material is one of the initiatives to reduce the use of the cement.

REFERENCES:

1) "Influence of Curing Conditions on Water Loss and Hydration in Cement Pastes with and without Fly Ash Substitution," NISTIR 6886, U.S. Dept. Commerce, July 2002.
2) Bentz, D.P., "Protected Paste Volume in Concrete: Extension to Internal Curing Using Saturated Lightweight Fine Aggregates," Cement and Concrete Research. 29, 1863-1867, 1999.
3) Stutzman, P.E., "Curing, Hydration, and Microstructure of Cement Paste," ACI Materials Journal, 103 (5), 348-356, 2006.
4) Bentz, D.P., Halleck, P.M., Grader, A.S., and Roberts, J.W., "Direct Observation of Water Movement during Internal Curing Using X-ray Microtomography," Concrete International, 28 (10), 39-45, 2006.

5) Lura, P., and Roberts, J.W., "Mixture Proportioning for Internal Curing," Concrete International, 27 (2), 35-40, 2005.
6) Bilek, B et al, "The possibility of self-curing concrete Proc Name Innovations and developments in concrete materials and construction." Proc. Intl Conf. University of Dundee, UK. 9-11 September 2002.
7) Hoogeveen, T., "Internally-Cured High-Performance Concrete under Restrained Shrinkage and Creep," CONCREEP 7 Workshop on Creep, Shrinkage and Durability of Concrete and Concrete Structures, Nantes, France, Sept. 12-14, 2005, pp. 579-584.
8) Geiker, M.R., Bentz, D.P., and Jensen, O.M., "Mitigating Autogenous Shrinkage by Internal Curing," High Performance Structural Lightweight Concrete, SP-218, J.P. Ries and T.A. Holm, eds., American Concrete Institute, Farmington Hills, MI, 2004, pp. 143-154.
9) D.P.; Jensen, O.M., "Mitigating autogenous shrinkage by internal curing, High-performance structural lightweight concrete." ACI fall convention, Arizona, October 30, 2002. ACI SP 218.
10) Hammer, T.A.; Bjontegaard, O.; Sellevold, E.J., "Internal curingrole of absorbed water in aggregates, High-performance structural lightweight concrete." ACI fall convention, Arizona, October 30, 2002. ACI SP 218.
11) Kewalramani, M.A.; Gupta, R, "Experimental study of concrete strength through an eco-friendly curing technique," Advances in concrete technology and concrete structures for the future. Dec 18-19, 2003. Annamalainagar
12) Hoff, G.C., "The Use of Lightweight Fines for the Internal Curing of Concrete," Northeast Solite Corporation, Richmond, Va., USA, August 20, 2002, 37pp.
13) Concrete Technology by M.S. Shetty
14) Concrete Technology by M.L. Gambhir
15) Soil Mechanics and Foundation Engineering by K.R. Arora
16) Indian Standard codes

- For Mix Design IS:10262-1982
- For Zoning of Sand IS:383-1970
- For Bentonite Clay IS:2911(part I/sec 2)-1972