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Study on Manufacture of First Class Bricks using Controlled low strength Materials

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ABSTRACT: Materials used to be cement, Fly Ash, M- sand and Laterite soil with 0.7 w/c ratios. Some parameter tested such as Strength, flow table test, compressive strength test, water absorption, soundness test, impact test, durability test and brick pillar test. In Compressive strength test result Out of 16 trials based on two load bearing and two non-loading bricks were casted and tested. Brick having 20% cement shows high strength and all the bricks of different mixes satisfying IS standards and recommendable.

KEYWORDS:CLSM, Compression Strength, Floatable, Soundness, Impact, Durability Test

I. INTRODUCTION

In order to increase the strength of CLSM the ingredient materials are varied and tested using compressive strength test method. CLSM mixes having high compressive strength are selected and bricks were casted to 20cm*10cm*10cm size. All mixes having more workability because of its water cement ratio 0.7. Out of four mixes two mixes were load bearing and remaining two mixes are non-load bearing. Compressive strength of the bricks of different mixes satisfies the IS codes standards i.e., 3.5N/mm2 and water absorption of bricks are less than 3%. CLSM bricks are also durable in marine structures, because they are giving more compressive strength when it is cured in salt water for 7days cured bricks in normal water.

II. OBJECTIVE OF THE STUDY

- To determine the geotechnical properties of lateritic soil such as sieve analysis, moisture content, Atterbergs limits and particle size distribution.
- To determine the properties of cement and Fly Ash
- To study the strength of bricks by varying the material percentages.
- To investigate the compressive strength of bricks made of cement, Fly Ash, M-sand and Laterite soil.
- To determine the water absorption, soundness, impact test, brick pillar test and durability of the CLSM bricks.

III. MATERIALS USED

Cement

Cement Ordinary Portland cement of 53 grades confirming the Indian standard IS 8112-1989 was used. The various physical properties of cement are given in the Table 1

Table1PhysicalProperties ofOrdinaryPortlandcement

SL. No	Properties		Testresults
1	SpecificGravity		3.14
2	NormalConsistency		31%
3	InitialSettingTime		66min
4	FinalSettingTime		5.5hrs
5	Compressive Strength	3Days	30N/mm^2
		7Days	40N/mm^2
		28Days	56N/mm^2

Fly Ash

It is bought from Hassan, Karnataka; it is used for replacement material for cement.

Table2PropertiesofOrdinaryPortlandcement

SL No	CharacteristicsChemical Requirements	TestResults
1	Fineness(m^2/kg)	506
2	Specificgravity	2.66

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3	45Micron(residue)(%)	5.8
4	Insolubleresidue(%)	0.55
5	Magnesiacontent(%)	8.82
6	Sulphidecontent(%)	0.59
7	Sulphitecontent(%)	0.49
8	Lossonignition(%)	0.45
9	Manganesecontent(%)	0.15
10	Chloridecontent(%)	0.006
11	Glasscontent(%)	95
12	Moisturecontent(%)	0.14
13	Chemicalmodulus	
a	Cao+Mgo+Sio2	87.01
b	(Cao+Mgo)/Sio2	1.00
c	Cao/Sio2	1.16

Laterite Soil

Laterite soil from locally available Laterite block manufacturing yard which is collected from Hassan

Table3:Properties oflateritesoil

Properties	Value
Gravel(%)	9.2%
Sand(%)	10.2 %
SiltAndClay(%)	63.6%
LiquidLimit(%)	37.2%
PlasticLimit(%)	22.15%
ShrinkageLimit(%)	14%
PlasticityIndex(%)	12.44%
SpecificGravity	2.56
MaximumDryDensity(g/cc)	2.2
OptimumMoistureContent(%)	15.2%

M Sand

Manufacture sand taken from a quarry near Hassan. Sand passing through 4.75sieve is used in manufacturing of bricks.

Water

Potable water confirming to IS 456-2000 is used

IV. RESULTS AND DISCUSSION

Flow Table

The flow-table test is generally conducted to determine the flow ability of the given mix. It generally involves mould of size 6.5mm dia placed on horizontal plate which is oiled before for both mould and plate. By fixing the W/C as 0.7, we got flow value in between 14.5 – 16.5 cm.

Compressive Strength Test

Following below test results are carried to 7.07cm*7.07cm*7.07cm mould having a 50cm^2 area. The different mixes are casted and tested for 7days.

Table 4: Flow Table

TrialNo	Cement(%)	FlyAsh (%)	M-Sand (%)	L-Soil(%)	W/Cratio	InitialDiameter In Cm	FlowValue=(FinalDia-InitialDia)/InitialDia	Stress 7 Days(Mpa)
1	5	25	40	30	0.7	6.5	1.23	1.54
2	5	25	35	35			1.26	2.32
3	5	25	30	40			1.29	1.47
4	5	25	25	45			1.33	1.56
5	10	20	40	30			1.29	6.9
6	10	20	35	35			1.38	5.47
7	10	20	30	40			1.47	5.15
8	10	20	25	45			1.43	4.42
9	15	15	40	30			1.26	11.38
10	15	15	35	35			1.23	7.19
11	15	15	30	40			1.38	5.94
12	15	15	25	45			1.43	7.26
13	20	10	40	30			1.47	10.74
14	20	10	35	35			1.53	7.83
15	20	10	30	40			1.51	6.63
16	20	10	25	45			1.53	10.7

Table5:CompressiveStrengthTest Results

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TrialNo	Cement(%)	FlyAsh (%)	M-Sand (%)	L-Soil(%)	W/Cratio	Stress 7 Days(Mpa)
1	5	25	40	30		1.63
2	5	25	35	35		2.12
3	5	25	30	40		1.68
4	5	25	25	45		1.55
5	10	20	40	30		6.49
6	10	20	35	35		5.57
7	10	20	30	40		5.17
8	10	20	25	45	0.7	4.52
9	15	15	40	30		11.78
10	15	15	35	35		7.29
11	15	15	30	40		5.92
12	15	15	25	45		7.36
13	20	10	40	30		10.64
14	20	10	35	35		7.93
15	20	10	30	40		6.65
16	20	10	25	45		10.79

Mix Design

Mix Designs selected to manufacture of bricks

Table 6: Mix Designed

Name	MixProportion(%)	Cement (%)	FlyAsh (%)	M-Sand(%)	L-Soil(%)	w/cratio	Stress7 days(mpa)
BrickA	15:15:40:30	15	15	40	30		9.87
BrickB	20:10:25:45	20	10	25	45	0.7	11.83
BrickC	10:20:40:30	10	20	40	30		6.44
BrickD	10:20:25:45	10	20	25	45		5.32

Water Absorption Test

Table7:WaterAbsorptionTestResults

Name	Mix-proportionC:G:M-S:LS	Waterabsorption(%)
BrickA	15:15:40:30	2.06
BrickB	20:10:25:45	1.79
BrickC	10:20:40:30	1.97
BrickD	10:20:25:45	2.70

The water absorption test is one of the important tests which decide the strength and stability parameter with time. In this test water absorption test is conducted for different proportions for 24hrs gave 2.06%, 1.79%, 1.97%, 2.703%, which is less than 20%.so it satisfies the I.R.C standards, so it is advisable to use for construction.Table7:WaterAbsorptionTestResults

Impact Test

The impact test involves falling of bricks which are held in perpendicular to each other is allowed to fall from a height of 1m. There is no effect on bricks as no cracks or edge breakage is not occurred. This indicates good strength property of bricks.

Soundness Test

The soundness test involves tamping of two bricks face to face. During this process a good ringing sound was obtained. This indicates good brick property.

Brick Piller Test

Brick Pillar consist of 3 bricks of dimension L*B*W::20*10*32.5 are used for masonry with 1:3 mortar Proportion. All bricks types satisfy I.R.C standards. Hence it advisable to use for load bearing walls

Table8:DurabilityTestResults

Name	Weight (kg)	Load (kN)	Stress@14days(Mpa)
BrickA	14.04	187.5	9.87
BrickB	13.34	217.7	11.83
BrickC	13.57	109.8	6.44
BrickD	13.47	98.1	5.32

Durability

Compressive strength after 14days curing in Salt water (NaCl)

Table9:DurabilityTestResults

Name	Weight(kg)	Load(KN)	Stress in(Mpa)
BrickA	4.42	239.96	12.92
BrickB	4.32	228.76	12.47
BrickC	4.43	134.6	8.23
BrickD	4.20	97.9	5.32

V. CONCLUSION

- Water absorption test is conducted for different proportions which is less than 20%. so it is advisable to use for construction
- The impact test involves falling of bricks which are held in perpendicular to each other is allowed to fall from a height of 1m. There is no effect on bricks as no cracks or edge

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breakage is not occurred. This indicates good strength property of bricks.

- The soundness test involves tamping of two bricks face to face. During this process a good ringing sound was obtained. This indicates good brick property.
- In Brick pillar test all bricks types >6.5Mpa except Brick D which is a non loading wall brick >3.5Mpa. Hence it advisable to use for load and non load bearing

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