International Journal of Advance Research in Engineering, Science & Technology(IJAREST),
ISSN(O):2393-9877, ISSN(P): 2394-2444,
Volume 2, Issue 10, October-2015, Impact Factor: 2.125

COMPARATIVE STUDY ON COMPRESSIVE STRENGTH OF BLOCKS MADE BY LIGHTWEIGHT AGGREGATE CONCRETE

Chudasama Shaktisinh H.[1], Sudani Dharmesh M.[2], Badi Urvesh Y.[3], Prof. Jigar Zala[4]

[1]Student of final year, B.E. Civil department, Arham Veerayatan Institute of Engineering, Technology & Research, Haripar, Mandvi-kutch. Shaktisinhchudasama987@gmail.com
[2]Student of final year, B.E. Civil department, Arham Veerayatan Institute of Engineering, Technology & Research, Haripar, Mandvi-kutch. dharmesh12348@gmail.com
[3]Student of final year, B.E. Civil department, Arham Veerayatan Institute of Engineering, Technology & Research, Haripar, Mandvi-kutch. badiurvesh786@gmail.com
[4]Assist. Prof., B.E. Civil department, Arham Veerayatan Institute of Engineering, Technology & Research, Haripar, Mandvi-kutch. jigar.zala@hotmail.com

Abstract

Due to the increase of world population shortage of lands are measure problem for civil engineering to manage all the facilities requirements of peoples. So it is necessary to make high-rise building as well as skyscrapers. For this kind of high-rise building dead load is too large and measure difficulties building and other structures. To solve this problem it is necessary to reduced weight of concrete by adding lightweight aggregate.

For present study we have chosen 'sintagg' sintered type of lightweight aggregate and perform test on it like Bulk density, Specific gravity, Water absorption etc and compare test result with normal aggregate. We have design M20 grade of normal concrete and replacing natural aggregate with lightweight aggregate by proportion of 10%, 30%, 60% and 100% respectively. Then compare weight and compressive strength of normal concrete blocks and lightweight aggregate concrete (LWAC) blocks after 7 days, 14 days and 21 days of curing by graph.

Keywords- *Lightweight aggregate concrete, Sintagg type of lightweight aggregate, LWAC Blocks, Normal Concrete Blocks, Compressive Strength.*

I. INTRODUCTION

Normal weight aggregate of normal concrete are natural stone such that granite and lime a stone. With the concrete used, resources and natural environmental are exploited. Synthetic light-weight aggregate generated from (environmental waste) surround area waste like, fly ash, is a viable new source of structural aggregate material.

Use of light weight concrete permits greater design substantial cost savings and flexibility lower foundation costs, less reinforcing steel, smaller size structural members, thinner sections, better fire ratings, longer spans, structural response improved cyclic loading, reduced dead load. Light weight aggregate improved cyclic loading and reduced dead load.

Other instinctive advantage of the material is its transport costs and lower creation, low coefficient of thermal expansion, low thermal conductivity and of the greater fire resistance for prefabricated member.

Basically, there are four types of lightweight aggregate namely; 1) naturally available lightweight aggregate like clay shale and slate vermiculite 2) industrial products like sintered fuel ash and blast furnace slag 3) expanded clay lightweight aggregate 4) pumice aggregate.

In present study we have used "sintagg" sintered type of lightweight aggregate which has lower density compare to normal aggrete.

All Rights Reserved, @IJAREST-2015

II. MATERIAL SPECIFICATION & BLOCK DIMENSIONS

2.1. Cement

The most common cement used is an ordinary Portland cement. The Ordinary Portland cement of 53 grades conforming to (IS: 12269 1987) is use. Many tests were conducted on cement; some of them are standard consistency tests, Initial Setting Time (43 min) &Final Setting Time (5 h: 4 min). Specific gravity of cement is taken 3.15.

2.2. Sand

Sand used throughout the work comprised of clean river sand size of 0.425mm to 2.0mm. Suitable zone II as per IS383-1970 with specific gravity (G) of 2.65 and Bulk Density is 1690 kg/m^3.

2.3. Coarse Aggregate

Coarse aggregate is required to give bulk in the concrete. We have used 10 mm size of coarse aggregate (grit) with specific gravity of 2.8 and bulk density is 1590 kg/m^3.

2.4. Water

The water used in the manufacture of LWAC Blocks is potable water.

2.4. Sintagg Sintered Lightweight Aggregate

The 'sintered' type lightweight aggregate made in rotary kiln at temperature of 900 to 1080 temperature by using municipal solid waste. The temperature various to produced it also affect its strength and durability.

If the chosen temperature value are between the 150 to 750 for compressive strength will increase and then after 750 temperature it will reduce automatically. The densities of sintagg aggregate are available 200 kg/m^3 to 800 kg/m^3.

During the mixing of concrete it will give the good workability for fresh concrete and there is no requirement to give more vibration for compaction. But it's main drawbacks is that consume more water that is why more water required and gives low strength compare to normal aggregate concrete.

Figure 1: Sintagg type of lightweight aggregate

The properties of sintagg type of lightweight aggregates are:

1) Specific gravity: 1.25
2) Bulk density: 800 kg/m^3
3) Water absorption: 15.84 %

2.5. Size of LWAC Blocks

We have prepared a mould as same size of the conventional brick. The standard size of conventional brick is 19cm x 9cm x 9cm. So we have casted same size of LWAC blocks and check its compressive strength after 21 days of curing in lab.

Figure 2: Wooden formwork

III. MANUFACTURING PROCESS

3.1. Casting of LWAC blocks

In this paper, we have casted total 45 blocks including normal concrete blocks and LWAC blocks. The method of casting of LWAC blocks is same as like normal concrete block. The standard size of the brick is 19cm x 9cm x 9cm, therefore same size of blocks are casted for comparison of compressive strength in different blocks after 7days, 14 days and 21 days of curing.

All Rights Reserved, @IJAREST-2015

3.2. Quantity of materials

Here the volume of one block is 1.539 x 10-3 m^3, therefore the volume of nine blocks is 0.013851 m^3. The quantity of lightweight aggregate as replacement with normal coarse aggregate in percentage of 10%, 30%, 60% and 100% is given in blow table.

We have used the Mix Proportions of 1: 1.3: 2.35 and w/c ratio is 0.5.

Table 1: Quantity of materials for volume of blocks 0.01385 m^3

Lightweight aggregate replacement in (%)	Water content (lit)	Cement (kg)	Sand (kg)	Coarse aggregate (kg)	Extra Water (lit)		
0	4.4	5.9	7.9	13.5	0		
10	4.4	5.9	7.9	1.35	0.7		
30	4.4	5.9	7.9	4.05	1.5		
60	4.4	5.9	7.9	8.10	1.8		
100	4,4	5.9	7.9	13.5	2		

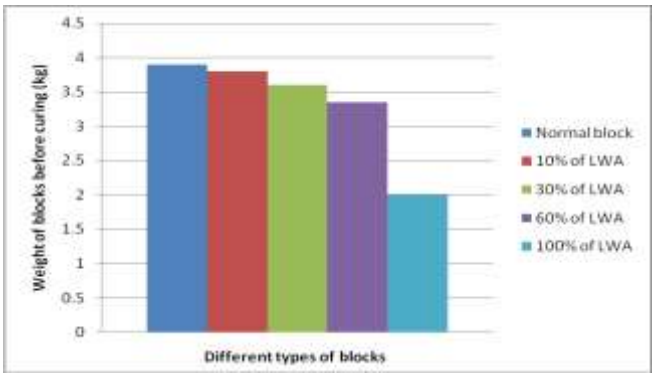

Figure 3: Weight of dry blocks

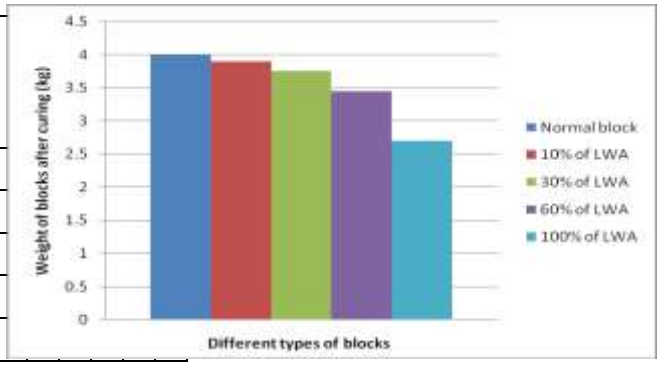

Figure 4: Weight of wet blocks

IV. TEST RESULTS

4.1. Weight of blocks

This test is represents the comparison between normal concrete block and lightweight aggregate concrete (LWAC) blocks. The bases of this comparison are weight and compressive strength of normal concrete blocks and LWAC blocks.

Table 2: Weight comparison

Sr. No.	Types of Blocks	Weight before Curing (Kg)	Weight after curing (Kg)
1	Normal concrete block	3.90	4.0
2	Blocks with 10% LWA	3.80	3.90
3	Blocks with 30% LWA	3.60	3.75
4	Blocks with 60% LWA	3.35	3.45
5	Blocks with 100% LWA	2.90	3.10

Table 3: Average Compressive Strength of different blocks after 7 days of curing

Sr. No.	Types of blocks	Average Compressive Strength (N/mm²)
1	Normal concrete blocks	28.45
2	Blocks with 10% LWA	26.91
3	Blocks with 30% LWA	23.30
4	Blocks with 60% LWA	18.00
5	Blocks with 100% LWA	16.55

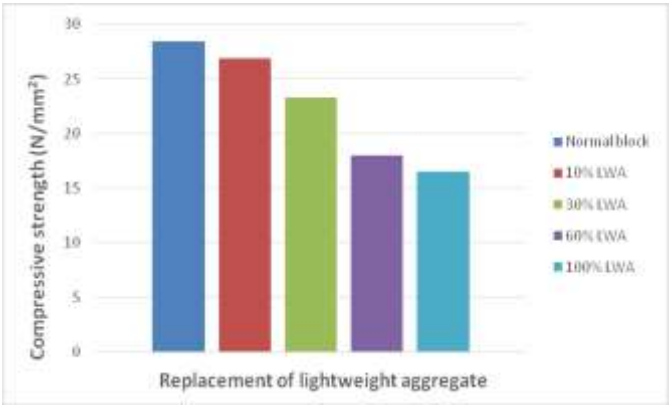

Figure 5: Strength of blocks after 7 days of curing

All Rights Reserved, @IJAREST-2015

Table 5: Average Compressive Strength of different blocks after 14 days of curing

Sr. No.	Types of blocks	Average Compressive Strength (N/mm²)
1	Normal concrete blocks	26
2	Blocks with 10% LWA	20.29
3	Blocks with 30% LWA	17
4	Blocks with 60% LWA	16.57
5	Blocks with 100% LWA	12.39

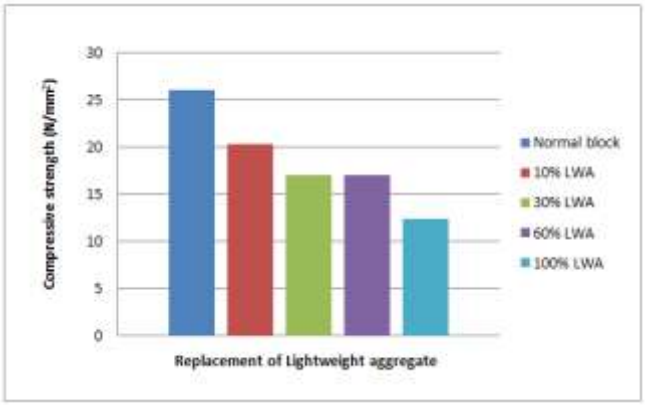

Figure 6: Strength of blocks after 14 days of curing

Table 6: Average Compressive Strength of different blocks after 21 days of curing

Sr. No.	Types of blocks	Average Compressive Strength (N/mm²)
1	Normal concrete blocks	25.23
2	Blocks with 10% LWA	23.30
3	Blocks with 30% LWA	18.12
4	Blocks with 60% LWA	15.51
5	Blocks with 100% LWA	12.60

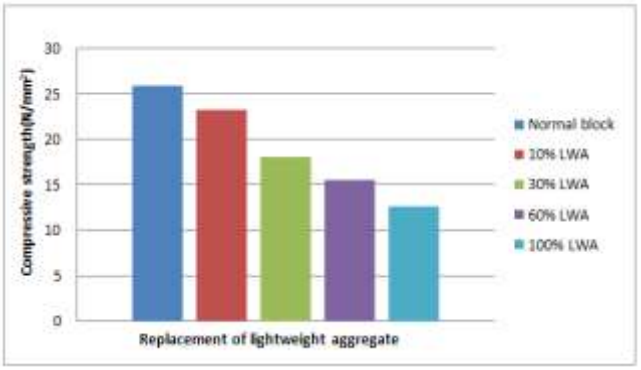

Figure 7: Strength of blocks after 21 days of curing

Table 7: Average Compressive Strength of different blocks after 7, 14 and 28 days of curing

Types of blocks	7 days (N/mm²)	14 days (N/mm²)	28 days (N/mm²)
Normal concrete blocks	28.45	26	25.23
Blocks with 10% LWA	26.91	20.29	23.30
Blocks with 30% LWA	23.30	17	18.12
Blocks with 60% LWA	18.00	16.57	15.51
Blocks with 100% LWA	16.55	12.39	12.60

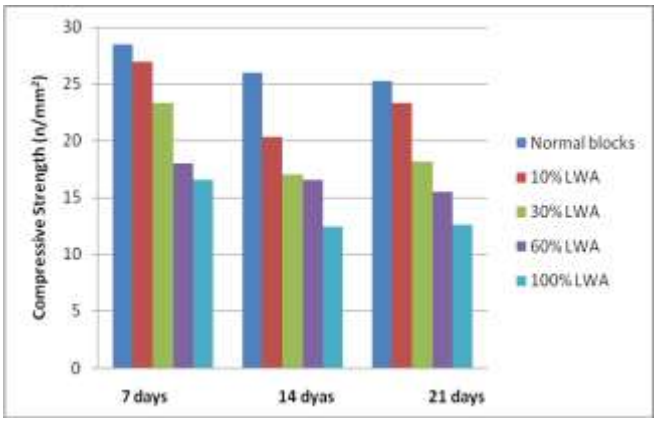

Figure 8: Strength of blocks after 7, 14 and 21 days of curing

All Rights Reserved, @IJAREST-2015

CONCLUSION

The following conclusions are obtained from above study:

1) Lightweight aggregate concrete blocks give the higher compressive strength in short duration (within 7 days) as compare to normal concrete blocks.

2) Normal concrete blocks compressive strength increase with the increase in curing duration, but in lightweight aggregate concrete it's in reversal process.

3) The C_3S chemical compound present in cement which is responsible for initial strength and we have used sintered lightweight aggregate which is made by industrial solid waste and it's also contain C_3S, that's why lightweight aggregate concrete blocks gives higher compressive strength in short duration.

4) Sintagg sintered lightweight aggregate is a porous materials which consume more water so after more curing time it will reduced compressive strength.

REFERENCES

[1] Khandakaker M.Anwar Hossain, Cement and concrete research, 34(2004)283-2, Department of civil engineering, Ryerson University, 350 street Toronto ON, Canada M5B, 2K3.

[2] C.R Cheesemano, A.Makinde, S.Bethanis, Properties of lightweight aggregate concrete produced by rapid sintering of of incinerator bottom ash.

[3] Guide for structural lightweight-Aggregate concrete ACI213R-03.John P.Rise, Michael Robinson. October 2012

[4] Compressive strength of lightweight aggregate concrete exposed to high temperatures.A ferhat Bingol&, AtaturkUniversity,Erzurum, turkey.

[5] Experimental study on lightweight aggregate concrete as partial replacement of coarse aggregate.ISSN; 2319-8753, IJIRSET, Lakshmi Kumar Minapu and Dr.U Rangaraju.

All Rights Reserved, @IJAREST-2015