Concrete Block Wall Construction without Mortar

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***Abstract*— Use of interlocking block/light weight concrete block masonry has increasing day by day due to good earthquake or lateral force resistance capacity due to their shape and light weight in many countries as a better replacement to conventional bricks for sustainable structures. Making interlocking concrete blocks with light weight is being always challenging for researchers at low cost and improves the performance against aggressive environment and great fire resisting capacity. In this study we tried to make interlocking light weight blocks as light as possible with higher lateral force resistance capacity. The experimental results are compared with ordinary burnt clay brick and interlocking brick found durable in aggressive environments and have 30-40% lateral resistance capacity and 200% more compressive strength for their use in sustainable building construction.**

***IndexTerms* - light weight blocks, Interlocking blocks, concrete blocks, bonding**

I. INTRODUCTION

Interlocking block masonry is one of the building system which almost full fills all the requirements of being a sustainable masonry. Interlocking blocks are made with locally available light weight material. This light weight & higher compressive strength it is possible to use this blocks in multistoried building compare to normal brick masonry. Light weight material like flyash cannot be easily disposable so it can be used as light weight material by replacing and reducing use of cement. And also for reducing price and increasing the strength many natural and manmade reinforcing material like, sisal, bamboo, coconut fibre, jute, used in the production of light weight blocks. Light weight concrete block having density less than 1800 Kg/m_3 and greater than 400 kg/m_3 which is much less than regular concrete block. Light weight concrete block having low weight, less amount of dead load and easy to place. So the overall cost of construction work with interlocking and light weight blocks reduces.

II. MATERIALS

Sand

Local river sand was used as a fine aggregate in the concrete mixtures.

Cement

Cement is used for binder material in concrete. Here, we used ordinary Portland cement for making concrete, which is a combination of cement, sand, light weight expanded clay aggregates and normal aggregate to form a strong building material.

Water

Ordinary tap water was used for mixing of the materials and for curing of light weight concrete blocks.

Normal Aggregates

Locally available crushed stones of 10 mm and 20 mm aggregates were used as coarse aggregates.

Light Weight Expanded Clay Aggregates (LWECA)

Lightweight expanded clay aggregate (LECA) is a light weight aggregate which is obtained from heating clay at 1200 ºC to 1500 ºC in rotary kiln. And by heating they converted into small bubbles. They are approximately round shape. They are available in different size.

Fig. – 1 Light Weight Expanded Clay Aggregate

Aluminum Powder

Aluminum powder is powdered aluminum. Aluminum powder is used for air entreating agent in light weight concrete blocks.

Fig. – 2 Aluminum powder

Super Plasticizer

Super plasticizer is used as water reducing agent and to increase workability of the light weight concrete blocks.

III. TESTING

a. Compression Test

Light weight concrete block samples were made by using Cement, local river sand, Normal Aggregates and Light weight expanded clay aggregates. Moulds with dimensions of 200 mm × 200 mm × 300 mm. After casting, all moulds were placed in a normal temperature of room with a relative humidity of more than 90% for a period of 24h. After de-moulding, the specimens were placed for the curing up to testing time. After it Compression test was carried out at 7th, 14th and 28th day.

b. **Lateral Vibration Force Test**

Wall having size of 1000 mm X 1000 mm was constructed using concrete blocks was placed on shake table for testing. We have applied different frequencies and displacement to measure lateral vibration force resistance capacity and we have compared it with normal brick masonry wall.

Fig. -3 Compression Test

Results

Table – 1 Compression Test Results

Day	Average Compressive strength (N/mm^2)
7^{th} Days	**8.05**
14^{th} Days	**17.22**
28^{th} Days	**22.386**

Lateral force resistance test

Fig – 4 Lateral force resistance test

Sr. No.	Frequency (Hz)	Displacement (mm)	Interlocking Bricks without mortar (min)	Normal Bricks with mortar (min)
1	5	10	5 Min 00 Seconds	5 Min 00 Seconds
2	10	10	5 Min 00 Seconds	5 Min 00 Seconds
3	15	10	5 Min 00 Seconds	5 Min 00 Seconds
4	20	10	5 Min 00 Seconds	4 Min 23 Seconds
5	25	10	5 Min 00 Seconds	4 Min 07 Seconds
6	30	10	4 Min 40 Seconds	3 Min 49 Seconds
7	35	10	4 Min 02 Seconds	2 Min 44 Seconds
8	40	10	3 Min 36 Seconds	1 Min 57 Seconds
9	45	10	3 Min 10 Seconds	1 Min 17 Seconds
10	50	10	2 Min 00 Seconds	0 Min 58 Seconds
11	5	20	5 Min 00 Seconds	5 Min 00 Seconds

12	10	20	5 Min 00 Seconds	5 Min 00 Seconds
13	15	20	5 Min 00 Seconds	4 Min 46 Seconds
14	20	20	4 Min 55 Seconds	4 Min 07 Seconds
15	25	20	4 Min 31 Seconds	3 Min 52 Seconds
16	30	20	4 Min 12 Seconds	3 Min 11 Seconds
17	35	20	3 Min 49 Seconds	2 Min 50 Seconds
18	40	20	2 Min 55 Seconds	1 Min 48 Seconds
19	45	20	2 Min 26 Seconds	1 Min 12 Seconds
20	50	20	1 Min 57 Seconds	0 Min 48 Seconds

Table – 2 Lateral force resistance test

IV. CONCLUSION

We studied that most of the people used glue instead of using mortar as a binding material. If Interlocking blocks are not light in weight they are difficult to place but if they are light in weight then they are easy to place. Even it has low maintenance. Expanded clay aggregates are easily available so they can be used as light weight material. Interlocking is not only effective in modern terms but in traditional way also. Use of interlocking concrete blocks the cost of labor is also negligible. With interlocking of concrete blocks we can improve the aesthetic view of building. And also the failure at joint is reduced. Due to good interlocking of concrete blocks, it has 40-50% higher Earthquake resistance capacity. To carry heavy load on the building.

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