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Load Carrying Capacity Of Hollow Concrete Block Masonry Wall

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ABSTRACT

Economy of structure is one of the basic aspect upon which any design is based .stability plays an important role .but best designer is one who comes out with a design which gives the stable and economic structure .the development of construction technology is closely related to the development of adequate mechanization and handling technology. Hollow concrete block is an important addition to the types of masonry units available to the builder and its use for masonry is a constantly increases. An investigation on construction of hollow concrete block masonry emphasizing in the present to study the crack patterns developed in the structural elements such as wall. Though the strength of wall constructed with hollow concrete block give the less strength as compared to crick masonry but cost of construction is very less.

Key words: masonry, hollow concrete block, strength of masonry, brick masonry.

1.0 INTRODUCTION

Shelter is one of the three basic requirements of human being. Initially ancient man started living in caves excavated below ground level on near the hill ends .thereafter, they started constructing walls from mud, and in due course of time, the developed the techniques of burnt clay brick masonry to form the structural part of the shelter.

The desire for search of new structural materials paved the way for hollow concrete blocks due to following advantages

1. Adequate strength and structural stability.
2. Superior thermal insulation and acoustic characteristics.
3. Sound control.
4. Resistance to fire.
5. Light weight.
6. Speedy work.
7. Economy

Building construction is a multi disciplined technology. It involves an exchange of thoughts, experience and ideas among those engaged in the various disciplined of the construction activity in order to achieve overall economy and proper serviceability of the construction project at hand. It should also make use of innovative methods in the field of material technology by the use of improved materials resulting in the production of economical, aesthetically acceptable and durable structure.

The resistance to any change comes not only from the artisans and makers but even from engineers, contractors, owners and public in general. It is a human attitude of unwillingness to come out of a well established route.

The modern recommended practice is to dispense with several 'on the spot' operations and replace them with the manufactured materials. The at site operation are often left to workers who do not have the skills to the desirable extent and cannot be adequately supervised, resulting in such work often being sheddy and expensive. Economical and efficient construction techniques demand excellent micro-planning, determining as to which of the building materials should be manufactured on a mass scale, setting out and promoting such manufacturing facilities and popularizing their use.

The development of construction technology is closely related to the development of adequate mechanization and handling technology, the latter involves both the provisions of equipment as well as the handling dexterity.

Load bearing wall is one of the oldest structural systems. Man has laid one stone upon another and built walls to support roof or floor. This system was then replaced by frame structures for economy, as the load bearing walls being thick; require a large quantity of materials.

Hollow concrete block is an important addition to the types of masonry units available to the builders and its use for masonry a constant increases, some of the advantages of hollow concrete block construction are reduced mortar consumption, light weight and greater speed of masonry work. Work compared with brick masonry. Since may builders are yet to become familiar with the use of hollow concrete blocks, this will help them to appreciate the essential constructional details and adopt hollow concrete block masonry in a large scale wherever it is economical.

2.0 BLOCK TERMINOLOGY:-

1.
lock:- Block is a walling exceeding in length, width or height of the dimension specified for a brick. The height of the block shall not exceed either its length of six times its thickness to avoid confusion with slabs or panels.

2. Cellular block:- It is block having one or more moulded holes or cavities which do not pass right through, so that the should material is between 50 to 75% of the total volume of the block calculated from the overall dimensions.
3. Hollow block:- It is block having one or more large holes or cavities with pass through the block and having solid material between 50 to 75% of the total volume of block calculated from overall dimensions.

3.0 EXPERIMENTAL PROGRAM

This project is a study of construction of hollow concrete block masonry. The emphasis in the present study is given to study the crack patterns developed in the structural elements such as walls, columns constructed with hollow concrete blocks, and to the load carrying capacity of the hollow concrete block individually and when used in the masonry work.

Three sets of wall of size 0.2 meter width, 0.8 meter length and 1.8 meter height constructed with different mortar 1:3, 1:4, 1:5 proportion were tested in the compression testing machine. Each set consists of three walls made up of same proportion of mortar. Because of the concrete of being homogeneous, the structure gives different results when tested under the same conditions. The walls were kept hollow inside. The load carrying capacity of the walls and the crack patterns developed due to the load were studied.

The hollow concrete blocks are tested in compression testing machine. The bearing surfaces of the compression testing machine are wiped clean and any dry loose or other materials are removed. The hollow concrete blocks taken out from the curing and are allowed to dry for 24 hours in open air. The dimensions of the hollow blocks are measured to the nearest 0.2 mm and their weighs are noted before testing.

The two surfaces of each block that would normally be placed horizontally in the wall are termed as faces. The load is applied in these bed faces. The axis of the bed face is carefully aligned with the centre of spherically seated plate. No packing is used between the faces of the test specimen and the steel plate of the testing machine. As the spherically seated block is brought to bear on the specimen, the movable portion is rotated gently by hand so that uniform seating may be obtained. The load is applied without shock and increased continuously at a rate of approximately 140 kg/sq.cm/min until the resistance of hollow concrete blocks to the increasing load breaks down and greater load can be sustained. The load applied to block and any unusual features in the type and failure are noted. The maximum load in kilograms supported by the block before failure on square centimeter will be taken as the compressive strength of the block. The mean of the compressive strength of the three blocks will be taken as the compressive strength of batch compressive strength less than 75% of the mean value so obtained.

4.0 RESULTS AND DISCUSSION

The basic objective of present study is to know the load bearing capacity of the hollow concrete blocks when used in the construction of walls, columns and other such elements in any construction project. Beside this, the crack pattern at initial and final failure is also of importance. So in the present study, to have an idea of the load carrying capacity and cracks pattern the hollow concrete blocks manufactured already at site were used for the construction of structure.

The hollow concrete blocks were tested in the compression testing machine. A number of blocks were tested and then by knowing the load carrying of capacity of a single unit **(Table 1.0)** we constructed different types of structure. While constructing the structure special care was taken to see that the concrete block unit used in a particular structure is of consistent strength. Because in the hand operating machines this is one of measure disadvantage than we don't get the hollow concrete blocks of consistent strength.

TABLE 1.0 COMPRESSIVE STRENGTH OF HOLLOW BLOCK

Sr no.	Size of hollow concrete block	Average compressive load of 10 reading	Stress in N/mm^2 on net area
1.	400 X 200 X 200	9.0	2.2
2.	200 X 200 X 200	10.0	8.8

For lifting the walls and columns and to put on the compression machine we had to have some steel or concrete plate upon which the structures could have been constructed and then after curing the structure along with the plate had to be put on the compression testing machine. Considering the overall weight of the concrete structure we opted to cast the concrete plate for each structure.

For the wall of dimension 0.2 x 0.8 x 1.8 m^3 we casted concrete plate of size 0.4 x 1.0 x 0.1 m^3. The hooks were made while putting the edge bars of the steel provided in the mesh of the concrete plate. For the column of the size 0.4 x 0.4 x 1.8 m^3 the concrete plated casted was of dimension 0.6 x 0.6 x 0.1 m^3.

The plates were cased simultaneously and then allowed to cure for 28 days so as to get the enough strength of plates. After the plates got cured the structures were constructed on it.

For the present study we constructed total nine walls and three columns. Three walls of mortar (i.e. cement and fine aggregate), proportion 1:3, three with mortar proportion 1:4 and three walls with mortar proportion 1:5 were constructed. The mortar for joining the different block units was also 1:3 ratios. The horizontal alignment was checked by the spirit level while the vertical alignment was ensured with the help of plumb bob. For joining each unit properly with the other the mortar is placed in between then in proper quantity. For joining each layer with the other layer of blocks the mortar placed in between the layers was kept in proper quantity. Usually a mortar layer of 10 mm is placed in between the two layers to ensure the proper bonding between the layers. The blocks were placed so as to get the staggered joint. For this in each alternate layer the outer block placed were a single hollow block of size 20 x20 x 20 cm in the wall. While no such concrete block was needed for the column. In the column in each alternate layer two concrete hollow blocks were placed perpendicular to the previous layer thus forming the staggered joint instead of one complete vertical joint.

After constructing the structure the outer face of the joint were filled by the mortar so as to get the smooth flatter face of the structure. By this way joint strength is also increased by achieving compacted joints. After the complete construction is finished the structure is cured for 14 days. For curing the structure is always kept in wet condition. After the structure is cured and achieved enough strength those were tested on the compression testing machine.

5.0 WALL TEST

Test on another three walls of same size i.e. 0.2 metre width, 0.8 metre length and 1.8 mertre height constructed with mortar A total number of nine walls, three each of different mortar (cement-sand) 1:5, 1:4, 1:3 respectively were casted and tested in the compression testing machine. The compressive load at initial cracks and compressive load at final cracks i.e. final load i.e. ultimate load is observed.

TABLE 2.0 TESTS ON WALL CONSTRUCTED WITH MORTAR 1:5

Sr. No.	Load at initial cracks in tonne	Loads at final cracks in tonne	Stress at initial cracks in N/mm^2	Stress at initial cracks in N/mm^2
1	12	12.5	1.46	1.52
2	11.6	12.8	1.41	1.56
3	11.7	12.3	1.43	1.50

TABLE 3.0 TESTS ON WALL CONSTRUCTED WITH MORTAR 1:4

Sr. No.	Load at initial cracks in tonne	Load at final cracks in tonne	Stress at initial cracks in N/mm^2	Stress at final cracks in N/mm^2
1	11	12	1.34	1.46
2	10	12	1.22	1.46
3	10	13	1.22	1.49

TABLE 4.0 TESTS ON WALL CONSTRUCTED WITH MORTAR 1:3

Sr. No.	Load at initial cracks in tonne	Load at final cracks in tonne	Stress at initial cracks in N/mm^2	Stress at final cracks in N/mm^2
1	6.5	7.0	0.79	0.85
2	11.5	12.4	1.4	1.51
3	12.5	13.5	1.52	1.65

6.0 CONCLUSION:-

The hollow concrete blocks of sizes 400 x 200 x 200 mm made with the concrete grade 1:3:6 proportion gives the average compressive strength of 11.25 kg/cm2 considering the gross area. Considering the net cross sectional area the hollow concrete blocks of size 400 x 200 x 200 mm made with the concrete grade 1:3:6 proportions gives the average compressive strength of 22kg/cm2. The hollow concrete blocks of size 200 x 200 x 200 mm made with the concrete grade 1:3:6 proportion gives the average compressive strength of 45 kg/cm2 considering the gross area and 87.8 kg/cm2 considering the net cross sectional area.

The cost of hollow concrete block size 400 x 200 x 200 mm made with concrete grade 1:3:6 proportions are Rs. 9/-. When the admixture is mixes, the cost increases by 2% approximately. The cost of hollow concrete block of size 400 x 200 x 200mm made with concrete grade 1:2:4 proportions and 1:4:8 proportions are respectively Rs. 10.80/- and Rs. 8.10/-.

Walls of size 0.2m width, 0.8m length and 1.8 meter height made with mortar 1:5 proportion gives. When the net cross sectional area of the wall is considered the strength at initial cracks is increased to 14.3 kg/cm2. The ultimate failure or final cracks of the same wall occurs at net cross sectional area give the compressive stress of 8.1 kg/cm2 and 15.8 kg/cm2 respectively.

It is seen that in the strength of the wall the mortar used in wall construction does not play vital role as strength in all the three sets of walls are nearly same or these values are not having in a significant values.

The cost of the hollow concrete block of size 400 x 200 x200 made with concrete grade 1:3:6 proportions come to Rs. 9/- when calculated theoretically. This value comes to Rs.10.00/- when calculated practically. Means the way the manufacture calculates it comes to Rs. 10.00/-

Though the strength of wall constructed with hollow concrete blocks give the less strength as compared to brick masonry. But the cost of wall constructed with hollow concrete blocks is very much less than that of brick masonry. As the cost of brick wall of width 0.23 meter per square meter without plaster is equal to Rs. 143/-. With plaster the cost of this wall per squares meter is Rs. 221/-. The cost of hollow concrete wall of width 0.2 meter per square meter without plaster is equal to Rs. 135.5/-. With plaster the cost of this wall per square meter is Rs. 179.5/-. Hence the hollow concrete wall is more economical and speedy.

REFERENCES

1. Chemistik, Building products, summary catalog, chemisol Agencies Provate Limited, Bombay.
2. Childe H.L., Concrete Products and cast stone.
3. Dutta N.D., Estimation and costing.
4. IS-10262-1982, Recommended guide lines for concrete Mix Desing, I.S.I. New Delhi.
5. IS-2572-1967, Hollow cement concrete blocks.
6. IS-2572-1963, code of practice for construction of hollow concrete block masonry.
7. IS-456-1978, code of practice for plain and reinforced concrete (Third revision), Tenth Reprint, 1988.
8. IS-269-1976, Ordinary and low heat protland cement.
9. Journal on use of soil cement hollow concrete and others precast cement concrete component and others precast cement concrete components by Indian institute of Engineers (India).
10. Krishna Raju N., Design of concrete Mixes, CBS publishers and Distributors,485,Jain Bhavan, Bholanath Nagar, shandra,Delhi,1985.
11. National seminar on concrete for housing by Indian Concrete Institution.
12. Neville A.M., Properties of concrete, pitman publishing, 1973.
13. Orchard D.F., Concrete Technology volume-I, applied science publishers limited, Third Edition, 1973.
14. Shetty M.S., Concrete Technology, S. Chand & Company Ltd., Ramnagar, New delhi, Second Edition, 1986.
15. Rixom M.R.,Concrete Admixtures use and applications, cement admixtures association,1977.
16. S.P. – 23,Handbook of concrete mixes, Based in Indian standards, Indian Standards Institution, Nanak Bhavan, 9-Bahandurshah Zafar Marg., New Delhi,1983.
17. The Indian Concrete Journal, july 1992.
18. White G.R., concrete Technology, Van Nostrand Company, New York, 1977.