HOLLOW CONCRETE BLOCKS

Chaure A.P[1], Shinde P.A[2], Raut H.M[3], Dudhal P.D[4] , Khotkar R.G[5]

[1] *HOD, CIVIL ENGINEERING, M.S POLYTECHNIC BEED, MAHARASHTRA, INDIA*
[2] *LECTURER, CIVIL ENGINEERING, M.S POLYTECHNIC BEED, MAHARASHTRA, INDIA*
[3] *LECTURER, CIVIL ENGINEERING, M.S POLYTECHNIC BEED, MAHARASHTRA, INDIA*
[4] *LECTURER, CIVIL ENGINEERING, M.S POLYTECHNIC BEED, MAHARASHTRA, INDIA*
[5] *LECTURER, CIVIL ENGINEERING, M.S POLYTECHNIC BEED, MAHARASHTRA, INDIA*

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.

Precast concrete is advantageous for several reasons: shrinkage and creep can be reduced, dead-load deflections can be controlled, quality control is improved, material availability can be improved and erection methods are similar to that for steel and thus total construction time is significantly reduced. One of the key properties of concrete that makes precasting economically feasible is its ability, under the proper conditions, to gain compressive strength extremely rapidly. The focus of this paper is a description of the various methods currently available for accelerating the curing of concrete, particularly for precast concrete applications.

1. 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.

As building development throughout the world continues, the desire to construct cheaper structures on sites that are more difficult to build on, in shorter periods of time, all while providing improved performance will always be desirable in order to maximize both product economy and quality. As such, the construction industry is constantly searching for ways to improve their product. One means to this end is, rather than relying on improving construction implementation mechanisms such as scheduling, installation techniques, and quality control, is focusing on the industry's improved knowledge and development of materials and their behavior.

The hollow blocks are made of cement, stone chips, stone dust and sand are not only cheaper than bricks but have other specialities as well. These blocks have more tensile strength, the walls constructed from these blocks act as thermal insulaters because of their hollowness.

2. MARKET DEMAND

As the construction activity is growing day by day, there is a good demand for hollow blocks. These blocks find wide applicability and construction cost is largely reduced. It requires mainly by Govt. Departments and industries.

As the construction activity is growing day by day, there is a good demand for hollow and cement concrete bricks. These blocks find wide applicability and construction cost is largely reduced. It is also observed that there is good demand for housing activity among tribals.

Fig. 1 Placing Hollow Concrete Blocks

3. MANUFACTURING PROCESS

Cement concrete blocks can be solid (dense) or hollow. Besides different sizes and designs can be given to the blocks. The blocks are made in the sizes of 12x8x4"; 12x8x3"; 12x8x6", etc. Firstly cement, stone chips, sand, etc are mixed in the ratio of 1:6 or 1:12. This mixture is put in vibrator machine. This is then poured into the desired size mould. After 24 hours of drying, the blocks are put in water tank for curing. The process of curing continues for two to three weeks to give the blocks compression strength. The blocks are used in construction process after drying.

It is easy to make a concrete block. The successful block yard must however make blocks of uniform quality and sell them at a price high enough to cover costs and make a reasonable profit.

Fig. 2 Movable Concrete Automatic Machine

4. SIZE

The site should be big enough for aggregate stockpiles, cement storage, production (slab or stationary machine), block stacking, staff facilities, an office and on-site access.

Provided concrete masonry units complying with requirements indicated below for size are manufactured to specified face dimensions within tolerances specified in applicable referenced ASTM specification. A. Manufacture concrete masonry units specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths.

Provide special shapes where indicated and as follows:

A. For Lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions

B. Square-edged units for outside corners except where bullnose units are indicated.

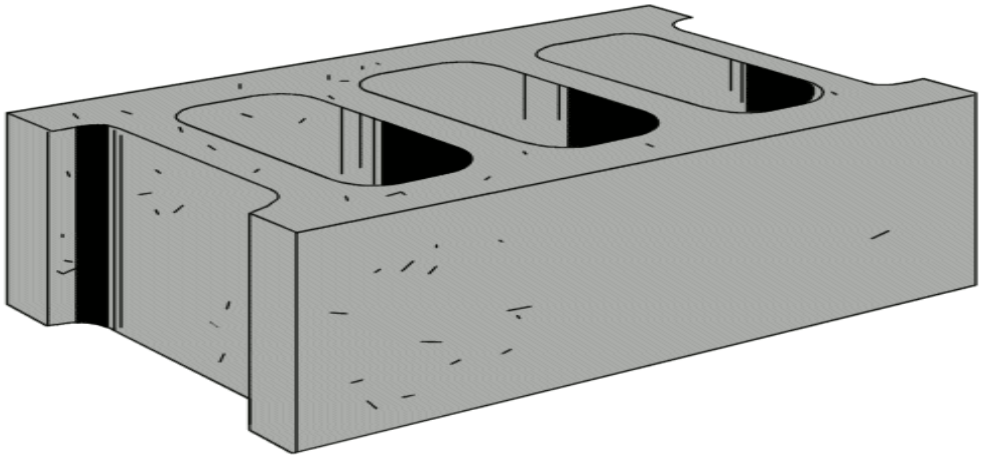

Fig. 3 Hollow Concrete Block

5. Materials for block making

5.1 Cement

Cement should comply with SANS 50197-1. Strength class should be 42,5N or higher because the concrete must develop strength as rapidly as possible. Note that it is illegal to sell common cement in South Africa without a regulatory Letter of Authority (LOA) number which indicates compliance with SANS 50197-1 or EN 197-1.

5.2 Aggregates

Sand and stone are fragments of rock and differ only in size. Sand particles will pass through a sieve with 4,75-mm square openings. Stone particles will not because they are too large. It can be seen that strength depends on a number of interrelated factors. It is therefore not possible to design a mix in a laboratory. Instead, a trial-and-error process, using the equipment of the block yard, is followed. This process aims to arrive at the best combination of aggregates and the right aggregate: cement ratio.

5.3 Aggregate: cement ratio

Try 6:1, 8:1 and 10:1 by loose volumes (230, 300 and 380-*l* of aggregate respectively per 50-kg bag of cement).

6. Production

To minimize breakages in cold weather, increase the cement content of the mix or the curing period before moving blocks.

7. Mixing

Hand mixing with the use of shovels should be done on a level concrete slab or steel plate. First spread the sand out 50 to 100 mm thick. Then distribute the cement, and stone if any, evenly over the sand. Mix aggregate and cement until the color is uniform.

Spread the mixture out, sprinkle water over the surface and mix. Continue with this process until the right amount of water has been mixed in. For machine mixing, first mix aggregate and cement then add water gradually while mixing until water content is correct.

8. Moulding

The mould of a powered machine should be filled until approximately six to eight cycles of compaction are required to bring the compacting head to its stops. Too little or poor compaction should be avoided as it results in greatly reduced strengths.

Demoulding or removal of the mould should be done carefully so that the fresh blocks are not damaged. Fresh blocks should be protected from rain (with plastic sheets or any suitable covering) and from the drying effects of the sun and wind until curing starts.

Fig. 4 Block Mould

In some cases it may be necessary to protect blocks from frost damage. Covering with plastic sheeting with the edges held down is normally sufficient.

To minimise breakages in cold weather it may be necessary to increase the cement content of the mix, or the curing period before moving blocks.

9. Curing

In order to maximize the efficiency of the curing process of concrete for precast applications, a general understanding of the hydration reaction is necessary. When combined with water, portland cement undergoes a chemical reaction known as hydration, the process responsible for the hardening of concrete. This process can be divided into three distinct stages.

Stage one of the curing process begins immediately upon the addition of water to the cement and aggregate that make up the dry concrete mix, and lasts until the onset of initial set, as determined by ASTM C403. Some manufacturers designate the end of this phase as being coincidental with the achievement of a compressive strength of 500 psi (Corcoran, 2004). During stage one, the chemical reaction between the Portland cement and the water begins; however, the
development of measurable compressive strength gain is minimal. Depending on the particular mix design characteristics, this stage usually lasts for 3-4 hours.

- High-Pressure Steam Curing (Autoclaving).
- Low-Pressure Steam Curing.
- Electrical Resistance Curing.
- Conduction/Convection Used for Accelerated Curing.

Fig. 5 Concrete Block Machine

10. ADVANTAGES OF HOLLOW CONCRETE BLOCKS.

Highly Durable: The good concrete compacted by high pressure and vibration gives substantial strength to the block. Proper curing increase compressive strength of the blocks.

- Low Maintenance, Color and brilliance of masonry withstands outdoor elements.
- Load Bearing, strength can be specified as per the requirement.
- Fire Resistant
- Provide thermal and sound insulation: The air in hollow of the block, does not allow outside heat or cold in the house. So it keeps house cool in summer and warm in winter.
- Economical
- Environment Friendly, fly ash used as one of the raw materials.
- Low insurance rates

10.1 Structural Advantages

In this construction system, structurally, each wall and slab behaves as a shear wall and a diaphragm respectively, reducing the vulnerability of disastrous damage to the structure/building, during the natural hazards.

10.2 Constructional Advantages

- No additional formwork or any special construction machinery is required for reinforcing the hollow block masonry.
- Only semi-skilled labour is required for this type of construction.

- It is a faster and easier construction system, when compared to the other conventional construction systems.
- It is also found to be a cost-effective disaster resistant construction system, as explained in the next section.

10.3 Architectural and Other Advantages

- This system is durable and maintenance free.
- Reduction in Dead Load
- Reduced Air Conducting Load: - Approx.50% saving.
- No salt peter or leaching: - Reduction in maintenance.
- Increased carpet area: - Due to smaller in size.
- Faster construction: - Easy to work with bigger in size.
- Assured Quality: - Fully automatic block plant.
- Better sound absorption: - Being hollow in nature.
- Load bearing walls: - Due to higher strength of blocks.
- Recommended for earth quake resistance.
- Environmental Eco-Friendly
- Reduce in total cost of project: - Being less dead load of walls.

11. Properties

11.1 Thermal properties

Concrete blocks have an excellent thermal property, comparable to other masonry blocks. The cavities in the blocks provide better thermal protection and also do not need external or internal plastering. The performance of these blocks increases with the increase in the number of hollow cores, which may or may not be filled in with some insulating materials.

11.2 Sound insulation

Concrete blocks provide an acceptable degree of sound insulation.

11.3 Fire and vermin resistance

Concrete blocks will not burn. They are readily incorporated into fire resistant rated construction. It has no problems of vermin attacks or infestation.

11.4 Durability and moisture resistance

They are very popular as a long lasting, low maintenance masonry unit, with good compressive strengths. They have a general life's span of about 60yrs although may extend up to 80yrs or more. They are robust and durable even if wetted. It water absorption is less than 10% of weight of block, after just 24hrs, and may need a weatherproof coating to keep the moisture out.

11.5 Applicability

Concrete blocks have various types like; solid, hollow, paving, tree-guard blocks, and each of them are available in various shapes and sizes. This vast range of products offers a large market for application.

• In load bearing structures - low rise residential and office buildings, bungalows, shelter units for rural housing, highway constructions, institutional buildings, godowns and warehouses etc

• In frame structures – High rise residential apartments, office buildings, market complexes, hospitals and hotels etc
• As ground laying units – interlocking paving blocks for roadside walkways, garden pathways, curb stones, exhibition grounds, fuel pumping stations, movement corridors, high traffic movement areas like: bus and train stations etc.
• Specific usage areas: tree guard blocks for roadside and garden tree plantations.

Fig. 6 Hollow Concrete Block Wall

12. Strength

Quality of blocks should be controlled so that strengths are adequate (to avoid breakages and rejection by customers) and mixes are as economical as possible. Ideally, blocks should be regularly tested for strength and mixes and production processes modified if necessary.

If testing is impracticable or unaffordable, block strength should be continually assessed by noting whether corners and edges, or even whole blocks, tend to break in handling.

Strength can also be assessed by knocking two mature bricks together.

Fig. 7 Block for Load Structure

13. CONCLUSIONS

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 proportion 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 Blocks manufactured in this experimental program with granite fine particles as an additive ensures effective packing and large dispersion of cement particles which resulted in a good degree of surface finish and edges.

It is evident from the results obtained that the compressive strength and the performance of the Hollow concrete blocks can be increased with proper compaction techniques. When compared to compaction with machine vibration the blocks manufactured with uniform hand compaction gives higher compressive strength.

It is seen from the experimental data the optimum replacement of fine aggregates by granite fines is 25% and further increase in granite fines reduces the strength of Hollow concrete blocks.

14. REFERENCES

- IS-10262-1982, Recommended guide lines for concrete Mix Desing, I.S.I. New Delhi.
- IS-2572-1967, Hollow cement concrete blocks.
- IS-2572-1963, code of practice for construction of hollow concrete block masonry.
- IS-456-1978, code of practice for plain and reinforced concrete (Third revision), Tenth Reprint, 1988.
- IS-269-1976, Ordinary and low heat protland cement.
- IS: 383-1970 Indian Standard Specification for Coarse and fine Aggregates from Natural Source for Concrete (Second Revision).