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RESEARCH ON AN ALTERNATIVE SOLUTION TO TRADITIONAL BRICKWORK

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Abstract: As India is developing country and major population belongs to middle class or lower middle class category, the costing of the residential houses or apartments makes a huge impact on the family, hence government of India is promoting low cost housing schemes under "Pant Pradhan Awas Yojna". The rise in demand of conventional burnt brick and less availability of the same has increased the rates of conventional burnt clay bricks. This had ultimately affected the costing of the houses and structures. To mitigate this issue, a new technology has been developed recently, known as Concre wall Pannels.

In this paper comparison of conventional brick work and concre wall is done to find out whether concre wall is economical as compare to convitional brick work or not.

Index Terms **- Concre wall, Polystyrene panels, Shotcrete, Conventional Brick, Low Cost Housing Scheme**

I. INTRODUCTION

The Concrewall system is made of shaped polystyrene panels that are contained between two sheets of galvanised welded meshes.The welded mesh fabric connected piercing polystyrene with truss of steel wire, welded to the welded fabric at an angle. It gives a rigidity spatial structure, and simultaneously prevents polystyrene core shifting.

This technique has been used successfully to reinforce historic or artistic buildings. The above wires are bound to each other by the mesh' horizontal wires and joined orthogonally by the links which keep the two meshes together. Joint twisting is prevented by welding; in other words, as these joints are all welded, all transversal and longitudinal motion is prevented resulting in absolute in deformable panelsin leading journals to complete their grades.

1.1 SOME OF THE ADVANTAGES OF THE CONCRE WALL PANEL SYSTEMS ARE AS FOLLOWS:

1. Reduce the cost of construction
2. Reduce Construction period
3. Reduce transport cost. Light weight panels: do not requires cranes and other heavy construction equipment. (A Standard panel of size (1.2×3) m without shotcrete weighs 20 kg).
4. The installation does not need heavy construction equipment.
5. Ensure high levels of thermal insulation, sound insulation, as well as sanitary and fire safety.
6. Concrewall 3-D panels allow no additional cost to erect buildings in areas with moving soil, especially heaving, subsidence, frozen ground, and remote areas.

7 Strength and durability - used extruded polystyrene virtually inert and does not absorb moisture, is durable and resistant to decay.

1.2 SOME OF THE LIMITATIONS OF THE CONCREWALL PANEL SYSTEM:

- Concrewall Panel construction system may only be used in the construction of foundation walls supporting 4 storeys or less, unless designed by a professional engineer.
- Concrete must be applied by either the "shotcrete dry" or "shotcrete wet" process in accordance with ACI 506 R-85, "Guide to Shotcrete," by the American Concrete Institute.
- Compressive strength of concrete shall not be less than 20 MPa.
- The steel reinforcement shall have a minimum allowable stress (fy) of 415 MPa.

The Concrewall panel system is environment friendly and aesthetically appealing. It can be constructed quickly resulting in savings in construction time and money. The technology has been in use successfully in many African as well as European countries with involvement of different agencies.

II. MATERIAL AND METHODOLOGY

Material- The material used is Concre wall of Size as required at site. The Thickness of the panel varies from 75 mm to 100mm mm. The density of the panel shall be 15 to 35 kg/cubic mtr. (IS 4671: 1984).

2.1 METHODOLOGY

- The design shall satisfy the standards of IS 456, IS 1905, IS 11447, IS 875 (Part 1-5), IS 1893 (Part 1), IS 4326, IS 13920.
- Cutting drawings shall be prepared with clarity to facilitate the cutting at the manufacturing plant of the various wall or floor panels to appropriate sizes. In case of wall panels opening for doors, windows etc. shall be suitably marked in the respective panels.
- When the panels are to be cut at the factory in accordance with the cutting joints, these shall be suitably marked on the surfaces beforehand to facilitate correct identification for proper placement during erection at the construction site.
- In construction using panels as load-bearing structural walling, the walls in the ground floor shall be typically founded on the reinforced concrete (RC) plinth beam.
- Appropriate starter bars shall be embedded at the locations in a staggered way to a minimum specified distance. This ensures the connections of the super structure with the foundation spread over the entire wall length over the network of RC plinth beams.
- Plinth beams shall be supported on appropriate foundations, typically comprising spread footings or raft foundations suitably designed.
- In the case of multi-storey buildings in high seismic zone, the design and detailing shall ensure proper transfer of base shear at the interface of the foundation and the super structure.
- Concre wall panels used as walls or floors shall be shotcrete with a concrete of grade not less than M20 using aggregate of size less than 5mm.
- The insulation core of expanded polystyrene (EPS) must comply with ASTM C578 and IS 4671: 1984.
- With 40 mm of shotcrete applied to both sides, each panel achieves a fire rating of 90 minutes [EVG].
- Reinforcement mesh with steel wires shall be used in accordance with ASTM A185 [EVG].
- The diagonal truss wires, as well as the wire used in the manufacture of welded wire fabric, must be in conformity with ASTM A82 [EVG].
- In case of cantilever projections such as balconies, suitable RC beams (Concealed within EPS forms) may be designed and detailed as required.
- Special care shall be taken during construction to ensure proper connections at the junction such as plinth to wall panels, wall panel to wall panel, wall panels to slab panel etc.

2.2 INSTALLATION-

Foundations

Foundations for the concrewall Panel system whether strip or raft is conventional. If strip foundations are used, they should be level and stepped as this makes panel positioning easier. For concrewal panels, parallel sided timber or metal template of the width of panel shall be required to mark the position of the wall panels on the foundation and the spacing of the starter bar holes.

Wall start up

I. Line wall positions shall be marked and profiled.
II. A timber or metal template of the exact width of panel (from wire to wire) shall be used to mark the position of the panels with chalk or pencil lines
III. On the panel lines, positions shall be marked to drill the starter bar holes.
These should be in a zig-zag pattern at 600mm centres on each side of the panels. Starter bars should be at all panel joints and on the opposite side in mid panel plus at all wall corners and joints.
IV. Starter bars should be either 6mm or 8mm dia. 500mm long with 100mm drilled into the foundations and 400mm above.
V. Drill bits shall be used to give a tight fit with the starter bars.
VI. Once starter bars are in position, place the concrewall panels between the starter bars starting from a corner. Starter bars shall be wire-tied to the panel mesh and the panels to each other on the overlapping mesh.

Wall construction

I. All corners and wall joints shall be reinforced with right angled wire mesh to the full height of the walls.
II. To cut panels to fit for door & window openings, wire should be cut with a wire cutter or angle grinder. Measure and mark the cut lines before starting to cut.
III. After the wire mesh has been cut, panel shall be cut with a hacksaw blade or stiff blade hand saw.
IV. Added steel mesh reinforcement (U type meshes) shall be required around door and window openings to ensure that no plaster cracks form in these areas. Mesh reinforcement strips shall be tied diagonally with wire around openings before plastering.
V. Once wall panels are in place and tied together, bracing shall be required to hold them vertical before plastering. This shall be done only on one side of the panels.

VI. Once the panels are plastered on one side, the wall bracing shall be removed after 24 hours. Plastering on other side can be done without bracing.

Door and Window fittings

I. Fix a metal angle iron or hollow tube sub frame into the openings before plastering. Fix and plaster these in place and then secure the frames to the sub frame.

II. In order to secure heavy door/window frames, it is advisable to burn or cut away the EPS where the fixing bolts are to be secured to the wall and to fill this space with mortar or concrete to hold the bolts.

Roof/floor panel

I. After the vertical panels are assembled, verticality of the walls shall be checked and the bending meshes positioned on all the corners. Thereafter, horizontal bending meshes shall be placed to connect the floor/roof to the vertical panels. The bending meshes shall be fixed throughout the perimeter of the floor/roof, at the level of intrados.

II. When the horizontal bending meshes are fixed and checked, floor/roof panel shall be placed on these. The lower mesh of the panel shall be fixed by steel wire to the bending meshes.

III. Between the edges of floor/roof panel and vertical panel, gap of 35 mm should be left to ensure structural continuity. The plaster applied on the walls shall be continued from one level to another level.

IV. Placing of the Panel elements for the floor and/or roof should be done before the application of the external layer of plaster on the walls. Casting of concrete on the floor/roof panels (after placing the additional reinforcing bars, if required) should be done after the walls are plastered and a number of props shall be put to limit the deformation of the panel.

Plastering

I. Plastering shall be done by machine or hand. The indicative quantity of each material per cum. should conform to relevant Indian Standards and shall be:

(i) Cement: 350kg

(ii) Sand with mixed granulometry: 1600kg. Sand should be without clay or any organic substance and totally washed.

(iii) Water – 160litres. The quantity of water may be different according to the natural sand humidity. The parameters that should be constant are: W/C = 0.52 and I/C = 4.50.

III. Any problem of workability should be solved without adding water. The retraction cracks formation may be avoided by adding polypropylene fibres in the mix (1kg/m3).In order to control the final plaster thickness, some guides should be used. These shall be removed as soon as the plaster 'sets up' and the spaces are filled and are smoother before the plaster gets dry.

IV. Spray application should be done in two steps with a first layer covering the mesh applied on both the sides of the wall and the finishing layer as soon as the first layer gets dry.

Plumbing and electrical fittings

I. Plumbing and electrical conduits shall be behind the panel wire mesh before plastering.

II. The space behind the wire mesh shall be opened up by using a blow torch to partially melt the panel along the lines of the conduits.

III. As the EPS used in the panels is fire retardant, it will melt under the flame but not burn.

IV. The wire mesh shall be cut with wire clippers to make space for DB boards, switches and plug boxes.

V. For the installation of HVAC suitable strengthening measures (in form of mess size and no.) should be provided as and when required.

VI. At the time of installation of HVAC suitable additional reinforcement mess should be provided to take care of HVAC unit as per the strength requirement. of the panel.

Tools required

I. Parallel side timber or metal template to mark portion of the wall panel on the foundation.

II. Electric drill and extension cord with connect drill bits (6 or 8m) for drilling holes for the starter bar.

III. Tape to measure, dimension.

V. Level and or plumb lines to ensure panels are plumb and straight.

VI. Heavy duty wire cutters.

VII. Hand hold blow torch.

VIII. Normal plaster tools.

III. STUDIES AND FINDINGS

Above data shows that comparison between conventional brick work ,& concrewall formwork . now days about 5-8% cost of construction involve in formwork .

Table 3.1 COMPARISION BETWEEN CONVENTIONAL BRICK WORK AND FORMWORK & CONCREWALL

SR NO	FACTOR	CONVENTIONAL	MIVIN FORMWORK	CONCREWALL
1	Quality	Normal	Superior quality available in aluminum form	Depends upon polystyrene panels
2	Speed of construction	Very slow rate due to step by step construction activity	Walls and floor cast together one continuous operation it also a fast process	Wall ,floor are placed separately very fast process
3	Cost	About 10-15% of total cost of project	20-25% of cost of project	5-10% of cost of project very economical

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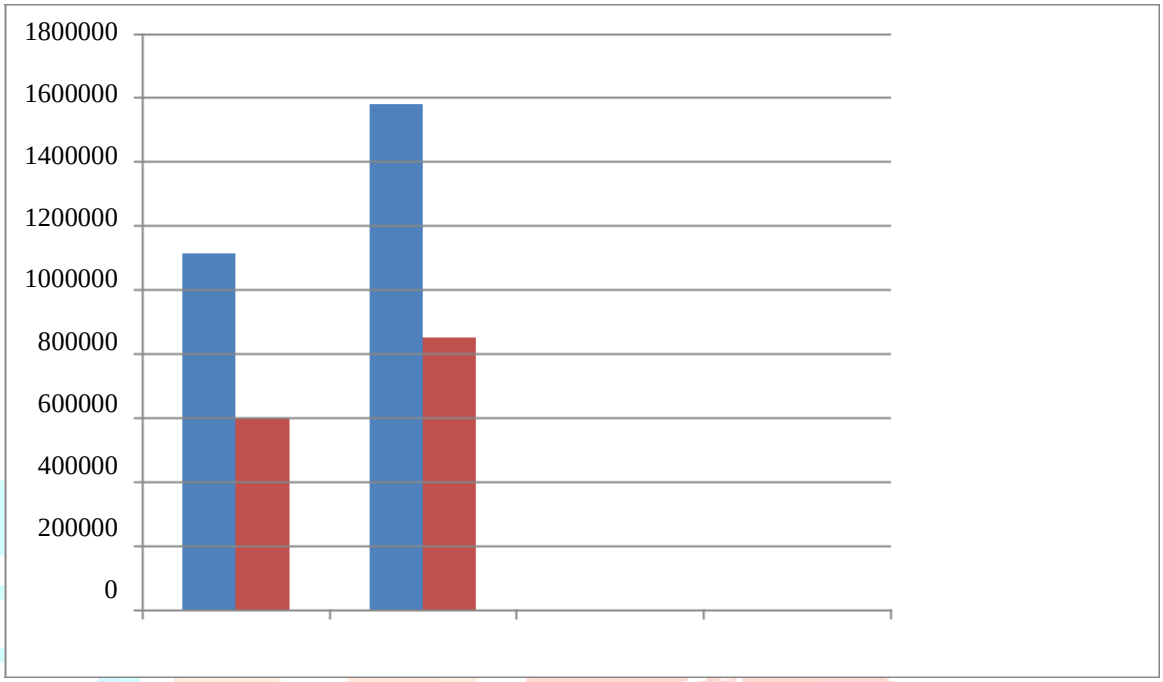
TABLE NO 3.2 – COMPARISION CONCREWALL VS BRICK

Comparison of some characteristics of CONCREWALL &BRICK .		
TYPE	CONCREWALL	BRICK
Moisture absorption	5% to 20%	5% to 10%
Thermal conductivity	Brick have lover heat transfer better insulation than concewall.	Higher heat transfer but once they embedded in cement mortar the difference is minimum.
Dimensional stability	It can be vary considerably size shape and texture	Concrewall are true in size and texture

Above table shows that comparison of concrewall and brickwork structure.by application of concrewall structure cost of construction definitely reduce.



PLAN 1

This is a graphical representation of RCC structure and concrewall structure regarding there cost of construction from above table.

Table 3.4 Following are the different activity which are involve in concrewall structure.

Activity code	Activity description	Immediate Predecessors	Estimated Duration
A	Site clearing	-	1Days
B	Foundation	A	2days
C	Panel Laying	B	3 day
D	Wire mesh fixing	B	1day
E	Opening door &window	C,D	1 day
F	Slab fixing	E	2 day
G	Internal Plastering	F	1 day
H	External plastering	F	1 day
I	flooring	F	2 day
J	finishing	G,H,I	2day
K	Interior Fixtures	J	1 day
L	Exterior fixtures	J	1 day
M	landscaping	J	3 day

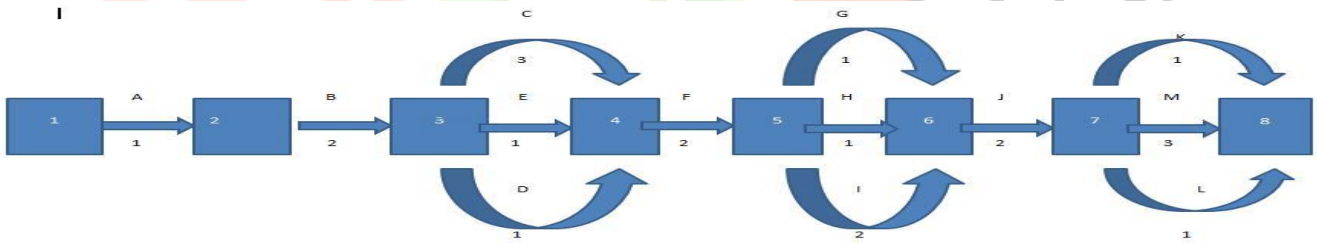


FIG 3.1 NETWORK DIAGRAM

Table 3.5 .The earliest start, earliest finish, latest start, latest finish times of a building construction project

ACTIVITY	DURATION	TEi	TEj	TLi	TEj	EST	EFT	LST	LFT	TF
1-2	1	0	0	1	1	0	1	0	1	0
2-3	2	1	1	3	3	1	3	1	3	0
3-4	3	3	3	6	6	3	6	3	6	0
3-4	1	3	3	6	6	3	4	5	6	2
3-4	1	3	3	6	6	3	4	5	6	2
4-5	2	6	6	8	8	6	8	6	8	0
5-6	1	6	6	8	8	6	7	7	8	1
5-6	1	6	6	8	8	6	7	7	8	1
5-6	2	8	8	10	10	8	10	8	10	0
6-7	2	10	8	12	12	10	12	10	12	0
7-8	1	12	10	15	15	12	13	14	15	2
7-8	1	12	12	15	15	12	13	14	15	2
7-8	3	12	12	15	15	12	15	12	15	0

Table 3.6 Comparison between Brick Work and concrewall building

Sr No	Materials	Convectional Building	Concrewall Method	Saving in %
1	cement	10 tons	3tons	70%
3	River sand	43m3	12m3	72%
4	bricks	1973 NOS	32 nos	-
5	Water	150000L	50000L	66%
6	Built-up area	112.51 m2	112.51m2	-
7	labour	25-30 Per day	15-20 Per day	40%
8	Construction time	27-30 day	10-15 days	50%
9	Total weight of structure	182 tons	86 tons	52%
10	Construction cost	1115184	597210	46%

IV CONCLUSION

- Tthe use of Concrewall sheets or different panels in the Construction of building it is very economical.by adopting this methodology the construction work is fast and save in construction time .
- Also by adopting this new technology upto 40-50% cost of construction save also provide affordable hoses to the poor people or lower economical people. TheIndia's largest new problem is that common people does not afford high prices of house. now a days cost of construction are very high and this method is adopted by government agencies to sole that high rise cost problem.
- And result of concrewall construction building was really good so there is no problem to adopt this technology.
- Finally Selection of Concrewall structure construction is depending on the project type and project requirements.
- concrewall structure is very economical to construct low cost housing project.
- Concrewall construction is rapid construction technique in which construction at high speed.
- concrewall structure construction is offering high quality of construction and low maintenance at the minimum cost.

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