Virbhadra Yojna, Rishikesh -- A step to propagate use of local materials

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Introduction

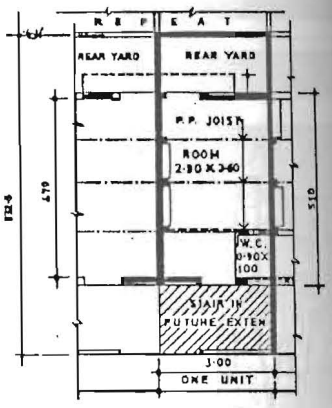
U.P. Housing & Development Board, is a State Corporation working to meet the housing need of the people in the State of Uttar Pradesh. It is undertaking development and construction jobs throughout the State and some times it is required to transport the building materials from far off distances due to their non-availability locally. It adds to the cost of building and the buildings so constructed some times do not attract clientele as it goes beyond their reach, especially where economically weaker sections of the society are involved. The use of local materials can help save in the cost by saving transportation charges as well as being cheaper than the materials arranged from other far off places.

With this in view, the Superintending Engineer, U.P. Housing & Development Board, Meerut, approached the Central Building Research Institute, Roorkee, to suggest use of local materials alongwith other economical specifications for the semi-hilly area of Rishikesh so as to restrict the cost of project to the minimum possible. The traditional construction practice in area involves transportation of bricks which are not manufactured locally and are required to be brought from other far off places to meet the building requirements at Rishikesh. In order to contain the overall cost, economical specifications were suggested partly making use of CBRI developed construction techniques along with others to save cost. The planning of houses constructed, specifications adopted and brief description of the CBRI developed techniques used in the project are covered here.

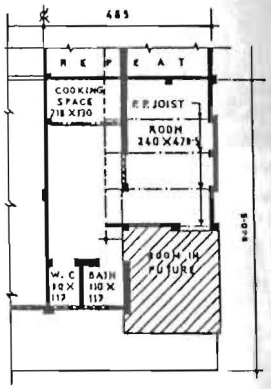
Planning

The normal plans being adopted by the U.P. Housing and Development Board throughout the State were adopted with minor modifications to suit the use of CBRI developed techniques at Rishikesh. The new technique of stone masonry block walling was suggested keeping in view the use of locally available stone aggregate and stone boulders which are comparatively cheaper in cost. The other new technique suggested was the prefab brick panel roofing. Both these techniques are simple and labour-oriented and make use of locally quarried materials. They also help in curtailing the consumption of bricks to the bare minimum which need to be transported from far off places. To try these techniques two types of EWS houses (type 15/25(S) and type 18/40) were selected by the U.P. Housing Board. The plans of both the types of houses are shown in Fig. 1.

As could be seen from the plans adopted, the staggered walling 10cm thick with 20cm x 20cm columns at intervals to support the PP joists was adopted to further save in the cost of walling. The columns are considered to be supporting the roof structure and transfer the roof load to the foundations. The balance portion of wall (10cm thick) works as a party wall and is constructed simultaneously with columns by providing proper bond with the columns for its stability. This has resultd in use of local material (stone aggregate and stone boulders) and simultaneously saved in the cost



Type 15/25, S



Type 18/40

Fig. 1

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of walling. A comparison of cost with the traditional 9" thick brick wall being adopted in the region as a normal practice is projected in the table below (Table 1).

TABLE 1

Comparison of cost of 23cm thick brick wall in cement sand mortar 1:6 with stone masonry block walling in cement sand mortar 1:6

Type of walling	Cost/M² of wall
(i) 23cm Brick wall in cement sand mortar 1:6	Rs.139.38
(ii) 20 cm stone masonry block walling in cement sand mortar 1:6	Rs.97.70
(iii) Staggered stone masonry block walling in cement sand mortar 1:6 (10cm thick wall with 20cm x 20cm columns at intervals)	Rs.61.34
(iv) Staggered brick wall in cement sand mortar 1:4	Rs.86.65

Note : Comparison of cost has been worked out on the basis of a full length wall in a house actually constructed at site.

As is clear, the saving on account of adopting staggered stone masonry block walling in comparison to brick walling works out to nearly 56% in walling only. Thus overall economising in the cost of construction. The staggered stone masonry block walling is also economical than the staggered brick walling be nearly 30%. A brief description of the new techniques (non-traditional) used is given in the paragraphs that follow.

CBRI Techniques Adopted

The following non-traditional techniques developed at the Central Building Research Institute, Roorkee, were adopted in the construction of these houses.

Stone Masonry Blocks

Stone masonry blocks are the rectangular blocks of nominal size, 300mm x 200mm x 150mm and are cast with the help of battery type of moulds, Fig. 2. After keeping the stone pieces of 100mm to 150mm size, the space around them is filled with lean concrete of mix 1:5:8 (cement : sand : coarse aggregate). If the shape and size of lower layer stones permit, another layer of stones is placed, ensuring that there is a minimum 20mm concrete between the two stones and the stones and mould sides. The concrete is filled upto 40 to 50mm above the moulds and is compacted by using plate/pan vibrator. These blocks are water cured for 14 days and air cured for the next 14 days before use at site and have an average compressive strength of 70 to 75 kg/cm² at the age of 28 days. For non-load bearing and partition walls, 30mm x 100mm x 150mm nominal size blocks are used retaining the wall thickness of 100mm, whereas the load-bearing walls are generally 200mm thick. The casting of these blocks is similar to the 300mm x 200mm x 150mm blocks.

Casting of Stone Blocks

Mould

Casting

View of Casting Yard

Fig. 2

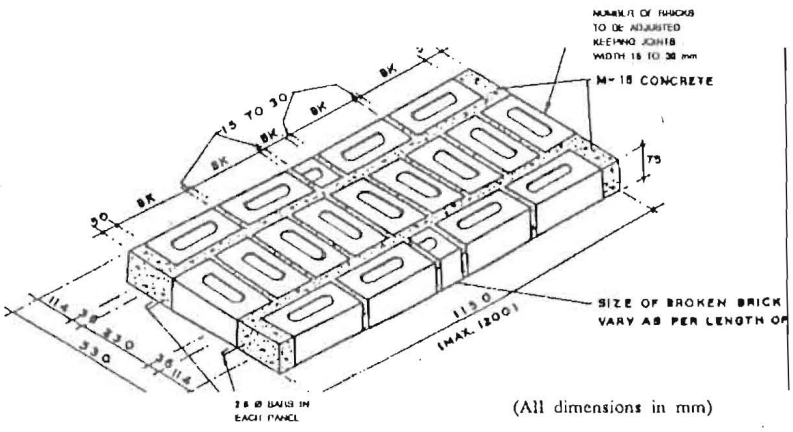
The masonry was carried out using such blocks for the columns and party walls using 1:6 (cement : sand) mortar. The progress of the masonry with use of stone masonry blocks is quite appreciable in comparison to the brick masonry due to larger size of the units of masonry (blocks). All the precautions while laying traditional brick masonry would also be needed in case of block masonry. The main precaution other than the brick masonry is that the blocks should not be saturated at the time of use in masonry but only need surface wetting by sprinkling water. The curing of the masonry may thereafter be required as for the brick masonry.

Prefab Brick Panel Roof

The system comprises of prefab brick-based components and the partially precast RC joists. Panels are cast by arranging bricks in rectangular moulds (Fig. 3) and joints are filled with 1:2:4 concrete. 6mm diameter mild steel bars, two in number, are placed in the longitudinal joints after placing concrete below the bars to provide sufficient cover, and form the only reinforcement of the panel. The partially-precast joists are 130mm x 100mm in section and their reinforcement will depend upon the span (Fig. 4). At the time of roof assembly, partially precast joists are kept propped till the deck concrete and the concrete over PP joists have attained strength. The thickness of deck concrete over the panels is kept 30mm and is laid after placing 6mm diameter mild steel bars, one bar on each panel in both directions. The savings in materials and cost as compared to the traditional RC slab are of the order of 25% to 30%.

Specifications Adopted

The general specifications adopted for the construction of the houses are given in Table 2 indicating the various traditional techniques and the



(All dimensions in mm)

Fig. 3

Isometric view of Prefab Brick Panel

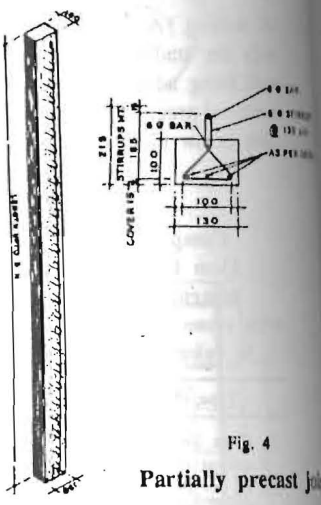


Fig. 4

Partially precast joi

TABLE 2

Specifications adopted

Foundations	-- Width as per design, 45cm below ground level for load bearing walls and 30cm below ground level for the non-load bearing walls.
Foundation Concrete	-- Cement concrete 1:5:10 with 40mm aggregate.
D.P.C.	-- 18mm thick cement plaster in 1:4 cement and coarse sand with water proofing compound and covered by 2 coats of hot bitumen @ 1.7 kg/m².
Masonry	-- (a) R.R. masonry in foundation in 1:6 cement and sand mortar upto the ground level, and (b) masonry with S.M. Blocks in 1:2:9 (cement : lime : sand)/1:6 (cement : sand) mortar in plinth and superstructure.
Lintels	-- Prefab thin R.C.C. lintels/lintel-cum-chhajas.
Roofing	-- Prefab brick panel roof covered with 30mm screed concrete 1:2:4 with cement : coarse sand : 12mm stone aggregate.
Plastering/ Pointing	-- 12mm thick 1:2:9 (cement:lime:sand) or 1:6 (cement:sand) plaster/cement pointing 1:1/2:4.5 composite mortar or cement sand mortar (1:3).
Door & Window	-- Angle/Tee iron frame fixed with appropriate holdfasts in C.C. blocks embedded in Jambs. Shutters of seasoned country wood.

Balance items of work like painting, w.wash/colour wash etc. as per traditional practice.

CBRI developed techniqu alongwith other economical specifi cations suggested for the houses.

Conclusion

The economy achieved in th project after the construction of 4 houses of two categories mentione above has attracted the Housin Board authorities in the use o prefab. brick panel roofing in othe areas and they have started makin use of the same in their mor projects. The trial use of ston masonry block is likely to attrac the attention of U.P. Housing Boar authorities for their use in hill region constructions in the future, a well as it is likely to be popular i the areas where bricks need to b transported from long distances.

Acknowledgement

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