CENTRAL BUILDING RESEARCH INSTITUTE, ROORKEE-247667 (INDIA)

BUILDING RESEARCH NOTE

B.R.N. 51

CHIMNEY DESIGN FOR DOMESTIC KITCHENS

Smoke produced by burning of coal, cowdung or firewood in domestic kitchens is a source of soot formation on the interiors of kitchens, vitiating their aesthetic appearance and indoor illumination levels. In addition, it is a health hazard for housewives and is particularly harmful for their eyes. Therefore, adequate provision for extraction of smoke is very important for the design of efficient kitchens. A survey conducted in kitchens of various categories of houses has revealed that provision of large size wall openings is not necessarily conductive to good ventilation. Chimneys are undoubtedly an advantage but with their present design devoid of scientific basis, their performance is not upto the mark. Hence, studies on design of chimneys were undertaken and an efficient design, has been envolved. Chimneys with this optimised design, have been installed in a few houses where cowdung and firewood are used as fuel. Their functioning has been found to be satisfactory. Details of the design of such a chimney are presented in this Note.

DESIGN OF CHIMNEY

The chimney consists of four components, viz., (i) hood, (ii) flue (iii) protecting cap, and (iv) wire mesh grating.

Hood

Trapping of smoke at the source is the primary requisite for prevention of its spread inside a kitchen. The function is best performed by constructing a hood above the chullah. The design of hood is based on three considerations:

(i) The hood should be kept as close to the source of smoke as possible without causing obstruction to normal cooking activities. Therefore, hood should be mounted about 0.9 m above the cooking platform.

(ii) The smoke spreading out of the chullah should be contained well within the hood. To accomplish this, the brim of the hood should be projected around the chullah upto a distance equal to 0.2 H, where H is the distance between the hood and the cooking platform.

(iii) The hood should offer small resistance to the flow of smoke and be made of minimum material for economy.

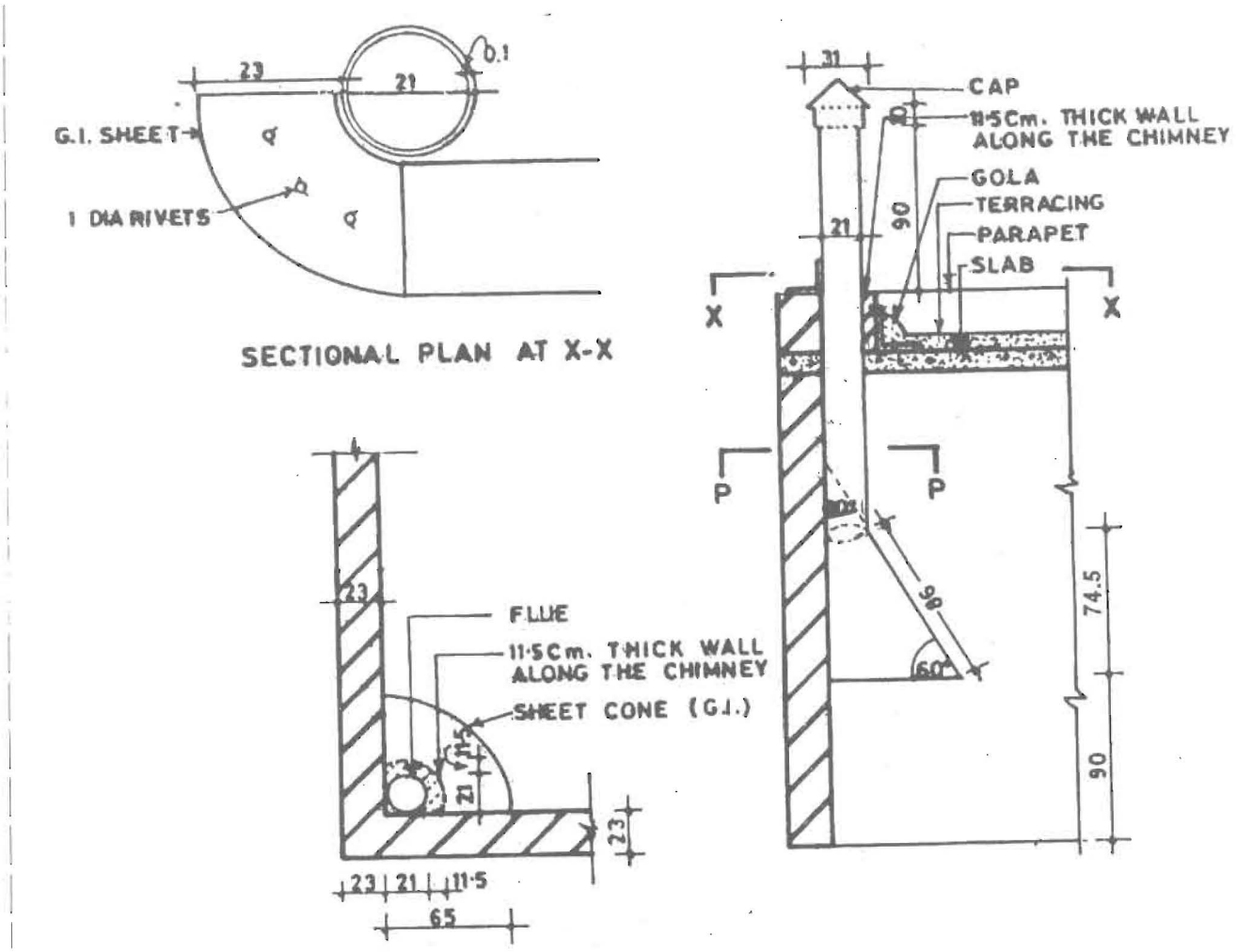
For chullahs located in the corners an optimum shape consistent with the above requirements is a quarter of a cone with the radius of base equal to 0.65 m and angle of apex 60°. The hood may be made of G.I. sheet or R.C.C. keeping inside angle of inclination of the wall (of hood) with horizontal equal to 60°.

Flue

The smoke trapped inside the hood is carried outside through a duct mounted atop the hood and projecting upto about 0.9 m above and roof. As the flue is required to offer minimum resistance to the flow of smoke, its inner surface should be as smooth as possible. Also the size of the flue should not be less than a minimum value which depends upon the material used. A 0.21 m diameter cylindrical G.I. or A.C. or C.C. or R.C.C. pipe or a 0.23 × 0.23 m^2 smoothly plastered rectangular masonry duct are recommended for efficient flues. The masonry duct may be supported on 7.5 × 7.5 × 40 cm long R.C.C. beams projecting from the two walls.

Projecting Cap

To prevent direct rain from getting into the



SECTION PLAN AT P-P SECTION

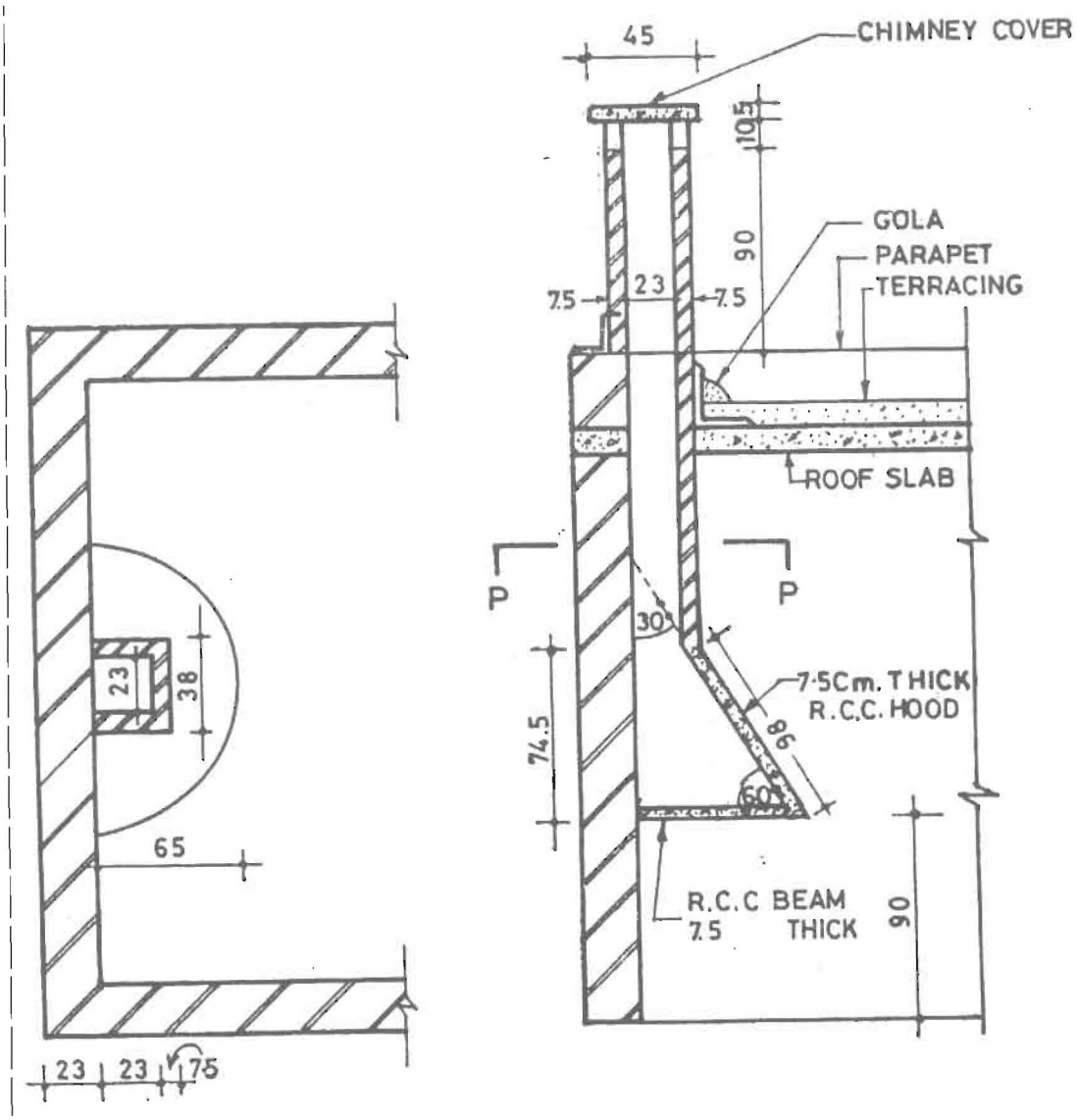
ALL THE DIMENSIONS ARE IN Cms.

SKETCH OF G.I. SHEET CHIMNEY

chimney, a cover should be mounted at about 0.10 m above the flue, projecting 0.05 m all around the flue. For cylindrical flues the lid may be conical in shape with base diameter equal to 0.31 m, whereas for masonry ducts a 0.45 × 0.45 m^2 R.C.C. slab meets the aforesaid requirement.

Wire Mesh Grating

Falling of soot and lizards etc., through the chimneys are some of the common problems in the use of chimneys. A simple remedy is occasional cleaning of the chimney. However, to safeguard against falling of lizards or accumulated soot, a wire mesh grating may be used during cooking operations. The grating made of stretched piece of ordinary fly screen on thin m.s. frame is inserted at the joint of hood and flue. The shape and size of the grating should be such as to fit into the flue without falling by itself. Such a grating can be easily removed for



SECTION PLAN AT P-P SECTION

ALL THE DIMENSIONS ARE IN Cms.

SKETCH OF MASONRY CHIMNEY WITH R.C.C. HOOD

occasional cleaning.

Cost

The cost of construction of the chimney obviously depends upon the material used. A G.I. sheet chimney at the present rates may cost around Rs. 150/- whereas a masonry one about Rs. 100/-. However, the use of cheaper materials like clay pipes, or mass scale prefabrication of chimneys may help to bring down the cost.

Distinctive features of the proposed chimney

- Easy to construct
- Easy to clean
- Absence of reverse flow of smoke
- Total extraction of smoke
- Full protection against rain

CONCLUDING REMARKS

To recapitulate the salient features of the design of an efficient chimney, following points are worth noting;

1. The height of the hood above the cooking platform should be kept around 0.9 m.
2. The hood should be part of a cone with radius of base equal to 0.65 m and inside angle of inclination of the wall of cone with horizontal as 60°.
3. A 0.21 m dia. smooth pipe should be mounted atop the hood. However, for ease of availability two 0.15 m dia. ordinary A.C. pipes may also be used in place of the single pipe of 0.21 m diameter. Alternatively, a smoothly plastered 0.23×0.23 m^2 masonry duct may serve as flue.
4. The flue should be projected by about 0.9 m above the highest point of the roof or the parapet.
5. A clear gap of at least 0.10 m should be provided between the top of the flue and the protecting cap.
6. A free flow of wind across the flue top should be ensured, and obstructions, if any, in the vicinity of flue-outlet should be removed.
7. All the joints should be leakproof.

Note :-

As the thickness of chimney masonry is only 7.5 cm (3 in), its courses will be 11.5 cm (4 ½ in) apart. This will cause a difficulty of interlocking the chimney with the walls. To overcome this problem vertical grooves may be cut in the walls to accommodate the chimney masonry for proper jointing. This will avoid formation of cracks at the walls and chimney joints which is very necessary to keep the chimney leakproof for proper functioning. As far as possible, joints should be broken in alternate courses of chimney masonry by using part bricks wherever required.

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