BUILDING DIGEST

CENTRAL BUILDING RESEARCH INSTITUTE, INDIA

GUIDELINES FOR DESIGNING AIRY BUILDINGS

Air motion is an important contributor to man's thermal sensation. The level of acceptable air motion depends upon climatic conditions. In hot humid climates, high rates of air motion are desired for comfort and prime importance is given to good ventilation in the design of buildings. This necessitates the knowledge of the mechanism of air flow in buildings and also of the influence of basic architectural features of buildings on the indoor air motion. Such data have been reported in Building Digests No. 62 and No. 100. The information covered therein provides a simple approach which helps the designers in assessing probable indoor air motion for a given design. This in conjunction with the results of investigations conducted for wide span buildings have led to some simple design solutions which enable the designers make the best possible use of outdoor wind. A summarized version of these guidelines is reported in the present digest.

1. For achieving maximum benefit from natural wind, buildings need not necessarily be oriented perpendicular to the prevailing outdoor wind; it may be oriented at any convenient angle between 0^0 and 30^0 without losing any beneficial aspect of the breeze. If the prevailing wind is from East or West, buildings can be oriented at 45^0 to the incident wind for diminishing the solar heat without affecting the air motion indoors.

2. Atleast one window should be provided on the windward wall and the other on the leeward wall.

3. Maximum air movement at a particular plane is achieved by keeping the sill height at 85 per cent of the height of the plane.

4. In rooms of normal size having identical windows on opposite walls the average indoor air speed increases rapidly by increasing the width of window up to about 2/3 of the wall width; beyond that the increase is in much smaller proportion than the increase of the window width.

5. The everage indoor wind speed in the work zone is maximum when window height is 1.1 m. Further increase in window height promotes air motion at the top level of window, but does not contribute additional benefits as regards air motion in the occupancy zone in buildings.

6. For a total fenestration area (inlet plus outlet) of 20 to 30 per cent of floor area, the average indoor wind velocity is around 27 per cent of outdoor velocity. Further increase in window size increases the available velocity but not in the same proportion. In fact, even under ideal conditions the maximum average indoor wind velocity does not exceed 40 per cent of the outdoor velocity.

7. In regions having fairly constant wind direction, the size of the inlet should be kept within 30 to 50 per cent of the total area of fenestration and building should be oriented perpendicular to the incident wind. Since inlets smaller than outlets are more sensitive to change in wind direction, openings of equal sizes are preferred in the regions having frequent changes in wind direction.

8. In the case of a room with only one wall exposed to outside, provision of two windows is preferred to that of a single window.

9. Windows located diagonally opposite to each other, with the windward window near the upstream corner, give performance better than other window arrangements for most of the building orientations.

10. Horizontal louver, i.e., a sunshade, atop a window deflects the incident wind upward and reduces air motion in the zone of occupancy. A horizontal slot between the wall and horizontal louver prevents upward deflection of air in the interior of rooms.

Provision of L-type louvers (Fig. 1) increases the room air motion provided that the vertical projection does not obstruct the incident wind.

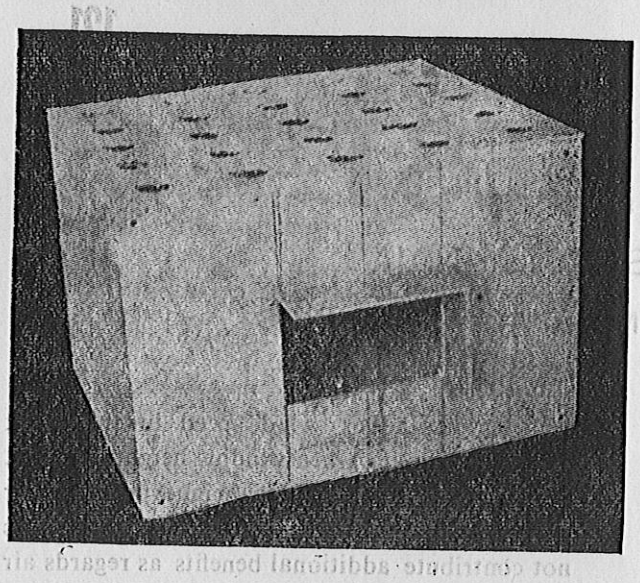


Fig. 1. L-Shape louver

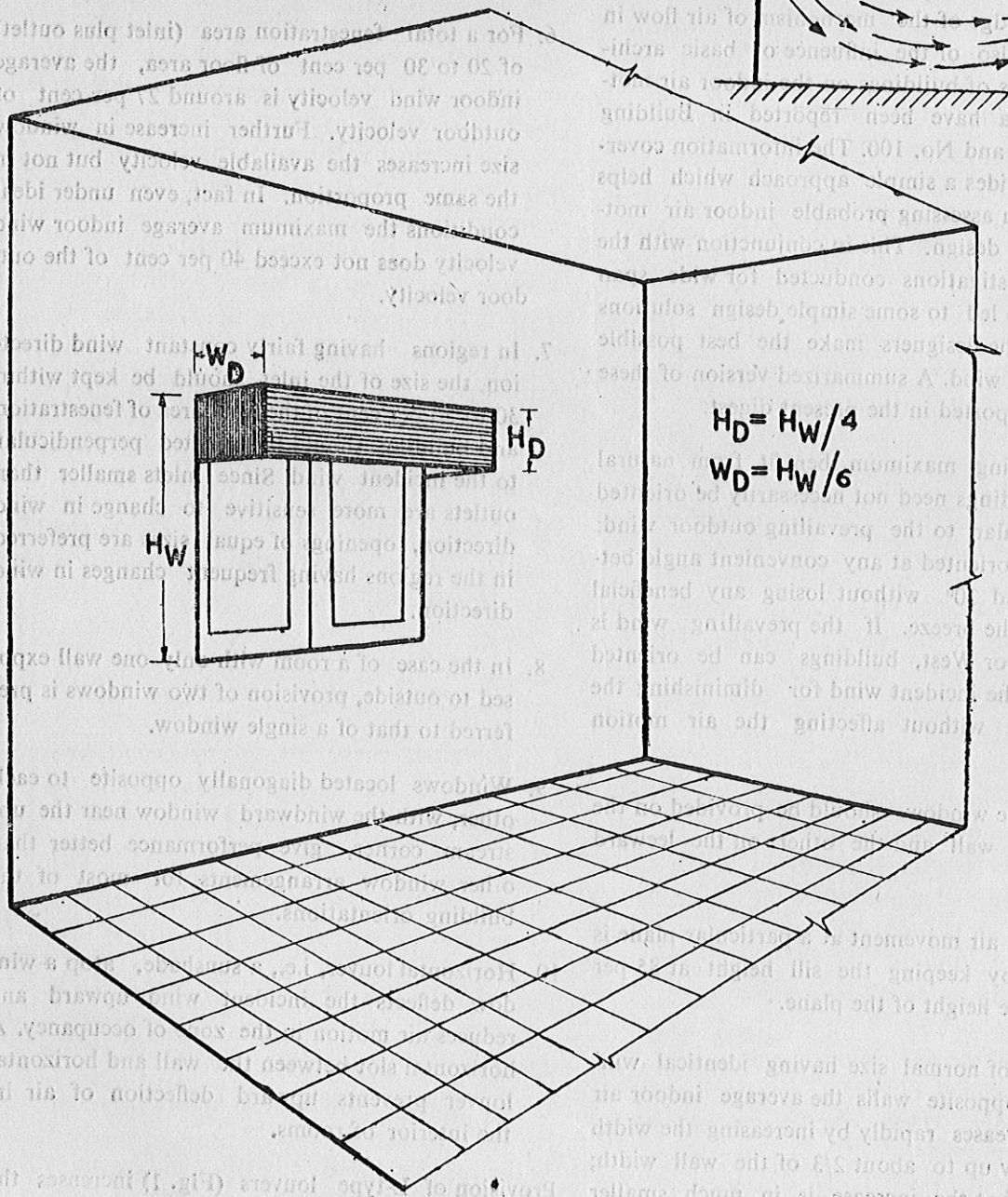


Fig. 2. Sketch of a pelmet type wind deflector

11. Provision of horizontal sashes inclined at an angle of 45° in appropriate direction helps to promote the air motion inside rooms. Sashes projecting outward are more effective than projecting inward.

12. Air movement at working plane 0.4 m above the floor can be enhanced by 30 per cent using a plemet type wind deflector (Fig. 2).

13. Roof overhangs help promoting air motion in the working zone inside buildings.

14. Verandah open on three sides is to be preferred since it causes an increase in the room air motion for most of the orientations of building with respect to the incident wind.

15. A partition placed parallel to the incident wind, has little influence on the pattern of air flow; but when located perpendicular to the mainflow, the same partition creates a wind shadow. Provision of a partition with spacing of 0.3 m underneath, helps augmenting air motion near floor level in the leeward compartment of wide span buildings.

16. Air motion in a building unit having windows tangential to the incident wind is accelerated when another unit is located at end-on position on downstream side (Fig. 3).

17. Air motion in two wings oriented parallel to the prevailing breeze is promoted by connecting them with a block on the downstream side.

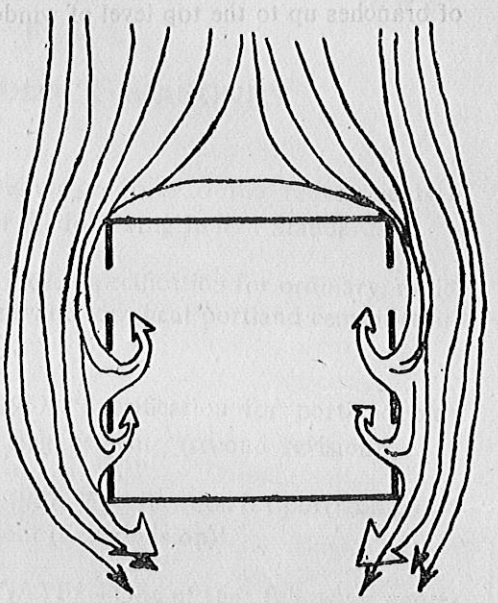
18. Air motion in a building is not affected by constructing another building of equal or smaller height on the leeward side; but it is slightly reduced if the leeward building is taller than the windward block.

19. Air motion in a shielded building is less than that in an unobstructed building. To minimise shielding effect, the distance between the two rows should be about 8 H for semidetached houses and 10 H for a long rows houses. However, the shielding effect is diminished by raising the height of the shielded building.

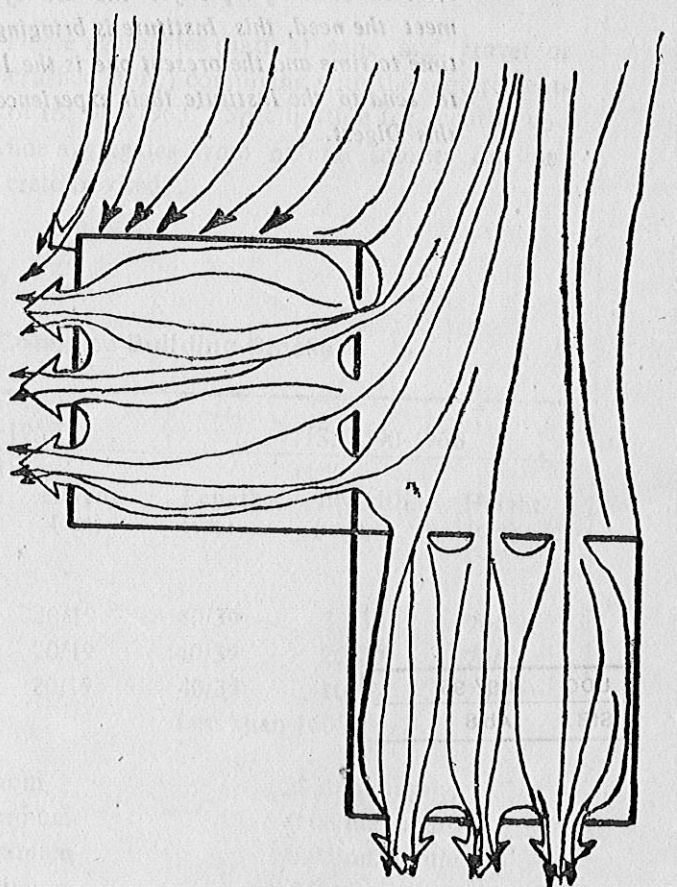
20. Hedges and shrubs deflect the air away from the inlet openings and cause a reduction in air motion indoors. These elements should not be planted at a distance of about 8m from the building because the induced air motion is redu-

PLAN FORM

Air motion in a building unit having windows tangential to the incident wind is accelerated when another unit is located at end-on position on downstream side.



Isolated building unit



Two units located at end-on position

Fig. 3. Air flow patterns in two building units located on end-on position

ced to minimum in that case. However, air motion in the leeward part of the building can be enhanced by planting a low hedge at a distance of 2 m from the building.

21. Trees with large foliage mass having trunk bare of branches up to the top level of window, deflect the outdoor wind downwards and promotes air motion in the occupancy zone inside the buildings.

22. Ventilation conditions indoors can be ameliorated by constructing buildings on earth mound having a slant surface with a slope of 10^0 on upstream side.

There is a demand for short notes summarising available information on selected building topics for the use of Engineers and Architects in India. To meet the need, this Institute is bringing out a series of Building Digests from time to time and the present one is the 121st in the series. Readers are requested to send to the Institute their experience of adopting the suggestions given in this Digest.

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Prepared by : Dr. Ishwar Chand
and P. K. Bhargava
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