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CHAPTER 11

INFILTRATION AND VENTILATION

Causes of Infiltration, Infiltration Due to Wind Pressure, Infiltration Due to Temperature Difference, Sealing of Vertical Openings, Infiltration Measurement, Natural Ventilation, Wind Forces, Temperature Difference Forces, Heat Removal, Effect of Unequal Openings, Combined Wind and Temperature Forces, Types of Openings, General Ventilation Rules, Ventilation of Animal Shelters, Garage Ventilation

Infiltration is the air leakage through cracks and interstices, around windows and doors, and through floors and walls. Its magnitude depends on the structural design, workmanship, and condition of the building. The rate of infiltration cannot be controlled by the inhabitants of the building to any considerable extent. Natural ventilation is the controlled displacement of air through openings, such as windows, doors and ventilators as well as through combustion heating devices.

CAUSES OF INFILTRATION

The air leakage which takes place through various apertures in buildings must be estimated in heating and cooling calculations and enough heating or cooling capacity provided to offset the heat lost or gained by the air leakage. The rate of air flow into and out of a building depends on the magnitude of the pressure difference between the inside and outside of the structure and on the resistances presented to this pressure difference. The pressure difference exerted on the building walls by the air may be caused either by wind or by a difference in density of the air inside and outside the building. The effect of the wind depends on the interrelation of the speed and direction of the wind and the exposure of the building. The effect of the difference in the density of the air depends on the magnitude of the inside-outside temperature difference, the height of the rooms, the shape of the openings, and their elevation in the room or building. The effect of the difference in density is often referred to as the chimney or stack effect. The pattern of air flow through any part of the structure depends on both the pressure difference and the openings. In general, when the pressure difference is the result of wind pressure, air will enter the building through openings in the windward walls and leave through openings in the leeward walls or through ventilating ducts in the roof. When the pressure difference is caused by the inside-outside temperature difference the flow will be along the path of least resistance from inlets at lower levels to outlets at higher levels in a heated building or in the opposite direction for an air-conditioned building.

An exact estimate of the amount of infiltration under design conditions is difficult to make. The complicating factors include (1) variations in building construction, particularly as to width of crack or size of openings through which air leakage takes place; (2) the variations in wind velocity and direction; (3) the exposure of the building with respect to air leakage openings, and with respect to adjoining buildings; (4) the