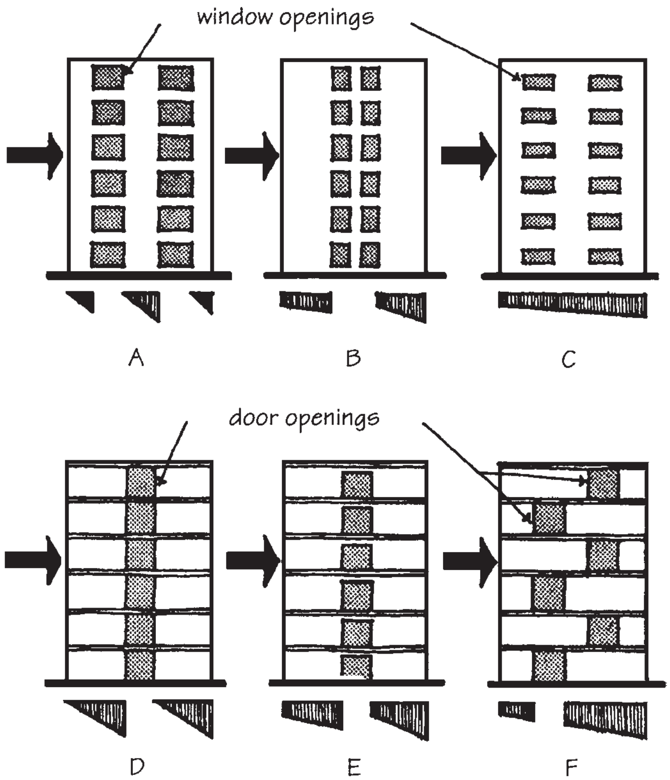

Figure 12-6 Shear walls resist lateral load applied parallel to plane of wall. (*From BIA* Technical Note 24C.)

overturning and shearing resistance. The location of shear walls in relation to the direction of the applied force is critical. Since ground motion may occur in perpendicular directions, the location of resisting elements must coincide with these forces. Shear walls may be either loadbearing or non-loadbearing elements. It is best to combine the functions of such members and, whenever possible, design the building with both transverse and longitudinal loadbearing shear walls. Designing all the loadbearing walls to resist lateral forces improves overall performance because the increased number of shear walls distributes the load and lowers unit stresses. Shear walls that are also loadbearing have greater resistance to seismic forces because of the stability provided by increased axial loads.

If loadbearing walls also function as shear walls, then general building layout becomes a very important aspect of seismic design. The building shear wall layout should be symmetrical to eliminate torsional action. Several compartmented floor plans are shown in *Figs. 12-7 and 12-8.* The regular bay spacing lends itself to apartment, hotel, hospital, condominium, and nursing home occupancies, where large building areas are subdivided into smaller areas. By changing the span direction of the floor, shear walls in two or more directions can become loadbearing. The radial walls of the round building can actually absorb seismic shocks from any direction and dissipate the earthquake energy with very low levels of stress. In skeleton frame buildings, elevator and stair cores of concrete or masonry are often used as shear walls even though they may not have axial loadbearing capacity.

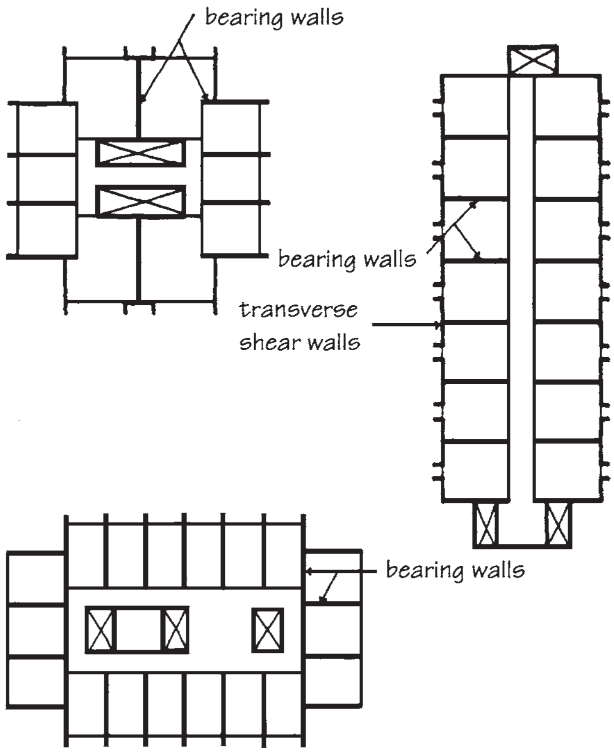

Figure 12-7 Examples of loadbearing walls oriented in two directions and functioning as shear walls to resist lateral loads in those directions.

Providing a good balance between the amount of shear wall along each of the principal building axes will provide greatest economy and best performance. It is also best to design wall lengths that are uniform between openings, and to provide wall returns or flanges wherever possible so that variations in relative rigidity are minimized and maximum shear is decreased.

One method of increasing the stiffness of shear walls as well as their resistance to bending is the use of intersecting walls or flanges (*see Fig. 12-9*). Although the effective length of flanges is limited, walls with L, Z, I, or C shapes have better flexural resistance for loads applied perpendicular to their flange surface. Shear stresses at the intersection of the walls are dependent on the type of bonding used to tie the two elements together.

Another method that may be used to increase the stiffness of a bearing wall building is the coupling of co-planar shear walls. The illustrations in *Fig. 12-6* indicate the effect of coupling on stress distribution from forces parallel to the wall. In parts A and D, a flexible connection between the walls is assumed so that they act as independent vertical cantilevers in resisting the lateral loads. Walls B and E assume the elements to be connected with a more rigid member, capable of shear and moment transfer, so that a frame-type action results. This connection may be made with a steel, reinforced concrete, or reinforced masonry section. The plate action in parts C and F assumes an extremely rigid connection between walls, such as full-story-height sections or deep rigid spandrels.

The type of floor-to-wall connection also influences the transfer of stress, and many seismic failures in masonry buildings occur because of