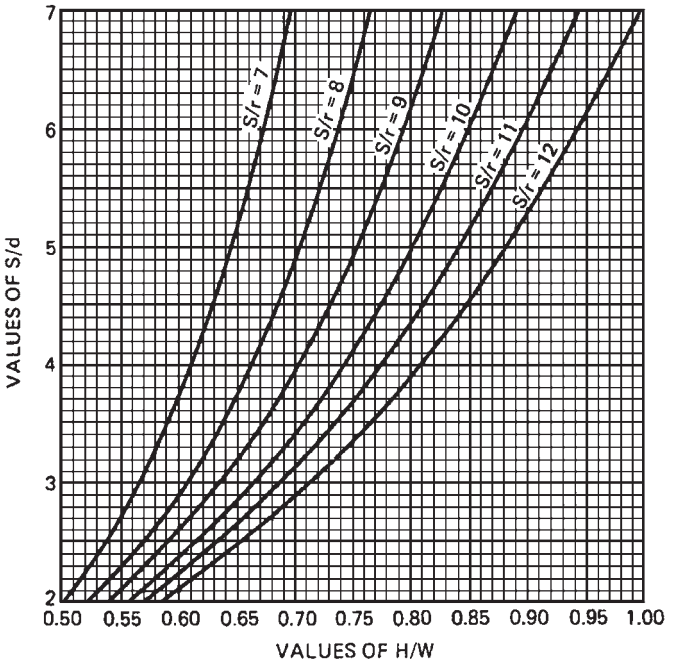

Figure 11-17 Thrust coefficients for segmental arches. (*From BIA* Technical Note 31A.)

For uniform loading over full span:

$$H = \frac{3WS}{8d} \tag{11.3}$$

For triangular loading over full span:

$$H = \frac{WS}{2d} \tag{11.4}$$

Maximum compressive stress may be determined by the formulas

$$f_m = \frac{2H}{6d} \tag{11.5}$$

For uniform loading over full span:

$$f_m = \frac{3WS}{4bd} \tag{11.6}$$

For triangular loading:

$$f_m = \frac{WS}{6d} \tag{11.7}$$

11.2.6 Thrust Resistance

The horizontal thrust resistance developed by an arch is provided by the adjacent mass of the masonry wall. Where the area of the adjacent wall is substantial, thrust is not generally a problem. However, at corners and openings where the resisting mass is limited, it may be necessary to check the

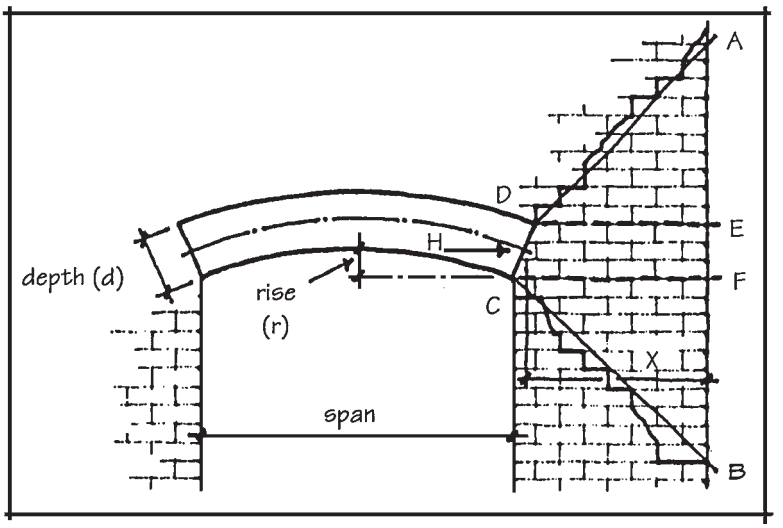

Figure 11-18 Horizontal thrust resistance in masonry arches. (*From BIA* Technical Note 31A.)

resistance of the wall to this horizontal force. The diagram in *Fig. 11-18* shows how the resistance is calculated. It is assumed that the arch thrust attempts to move a volume of masonry enclosed by the boundary lines *ABCD*. For calculating purposes, the area *CDEF* is equivalent in resistance. The thrust is thus acting against two planes of resistance, *CF* and *DE*. Resistance is determined by the formula

$$H_1 = v_m nxt \tag{11.8}$$

where H_1 = resisting thrust, lb
v_m = allowable shearing stress in the masonry wall, psi
n = number of resisting shear planes
x = distance from the center of the skewback to the end of the wall, in.
t = wall thickness, in.

By using this principle, the minimum distance from a corner or opening at which an arch may be located is easily determined. To do so, write the formula to solve for x, substituting actual arch thrust for resisting thrust:

$$x = \frac{H}{v_m nt} \tag{11.9}$$

11.2.7 Major Arch Design

Major arches are those with spans greater than 6 ft or rise-to-span ratios of more than 0.15 (*see Figs. 11-19 and 11-20*). The design of these elements is a much more complicated structural problem than minor arches because of increased loading and span conditions. Leontovich's book, *Frames and Arches,* gives formulas for arches with rise-to-span ratios (f/L) ranging from 0.0 to 0.6. These are straightforward equations by which redundant moments and forces in arched members may be determined. The equations are based