TABLE 6.6 APPROXIMATE MAGNITUDES OF MOVEMENTS REQUIRED TO REACH MINIMUM ACTIVE AND MAXIMUM PASSIVE EARTH PRESSURE CONDITIONS.

	Values of Δ/H[a]	
Type of Backfill	*Active*	*Passive*
Dense sand	0.001	0.01
Medium-dense sand	0.002	0.02
Loose sand	0.004	0.04
Compacted silt	0.002	0.02
Compacted lean clay	0.01[b]	0.05[b]
Compacted fat clay	0.01[b]	0.05[b]

[a] Δ = movement of top of wall required to reach minimum active or maximum passive pressure, by tilting or lateral translation. H = height of wall.
[b] Under stress conditions close to the minimum active or maximum passive earth pressures, cohesive soils creep continually. The movements shown would produce active or passive pressures only temporarily. With time, the movements will continue if pressures remain constant. If movement remains constant, active pressures will increase with time and passive pressures will decrease with time.

conditions of maximum passive and minimum active earth pressures are reached. If the movements continue after the maximum passive or minimum active pressures are reached, the earth pressures remain constant. Eventually, with sufficiently large movements, the pressure would change further as a result of the altered geometric conditions. The movements required to reach the minimum active or maximum passive pressures, however, do not result in appreciable changes in geometry.

The amount of movement required to reach the limiting conditions has been investigated experimentally, and by means of the finite-element method. A number of these investigations are summarized in Table 6.6. The results in Table 6.6 show:

- The movements required to reach the extreme pressures are proportional to the height of the wall, at least to a first approximation.
- The movement required to reach the maximum passive earth pressure is of the order of ten times as large as the movement required to reach the minimum active earth pressure.
- The movements required to reach the extreme pressures are larger for loose, compressible soils than for dense, incompressible soils. For any cohesionless backfill the movement required to reach the minimum active condition is no more than about 1 inch in 20 feet ($\Delta/H = 0.004$). The movement required to reach the maximum passive conditions is no more than about 1 inch in 2 feet ($\Delta/H = 0.04$). These criteria (1 inch in 20 feet and 1 inch in 2 feet) provide simple, easy-to-remember guidelines for the amounts of movement required to reach the pressure extremes, and in most cases they are conservative.

Variations of the value of the earth pressure coefficient k with wall movement are shown in Figure 6.20 for dense and loose sand. The figure is drawn for the ideal condition where the backfill begins from at-rest pressures, with $K_0 = 1 - \sin\phi'$. This would be the case for a wall or a backfill that was "wished" into place.

Beginning from the at-rest condition, with $K_0 = 0.5$ for the loose sand and $K_0 = 0.29$ for the dense sand, the pressures increase as the wall moves toward the backfill and decrease as the wall moves away. Because the dense sand is stiffer than the loose sand, the pressures change more rapidly with wall movement for the dense sand.

A similar diagram is shown in Figure 6.21 for a compacted-sand backfill behind a wall. The figure applies to a backfill compacted to a medium-dense condition with no movement of the wall. The average value of K_0 after compaction, which would vary with compaction procedure and wall height, has been assumed to be 1.00 in Figure 6.21. Because the value of K_0 is increased as compared to the conditions shown in Figure 6.20, the movement required to reach the minimum active earth pressure condition is increased, and the movement required to reach the maximum passive pressure is decreased. Even though compaction has an effect on the amount of movement required to reach the extremes, the rules of thumb of 1 inch in 20 feet for active and 1 inch in 2 feet for passive still provide reasonable estimates of the movements required to reach the extreme pressure conditions.

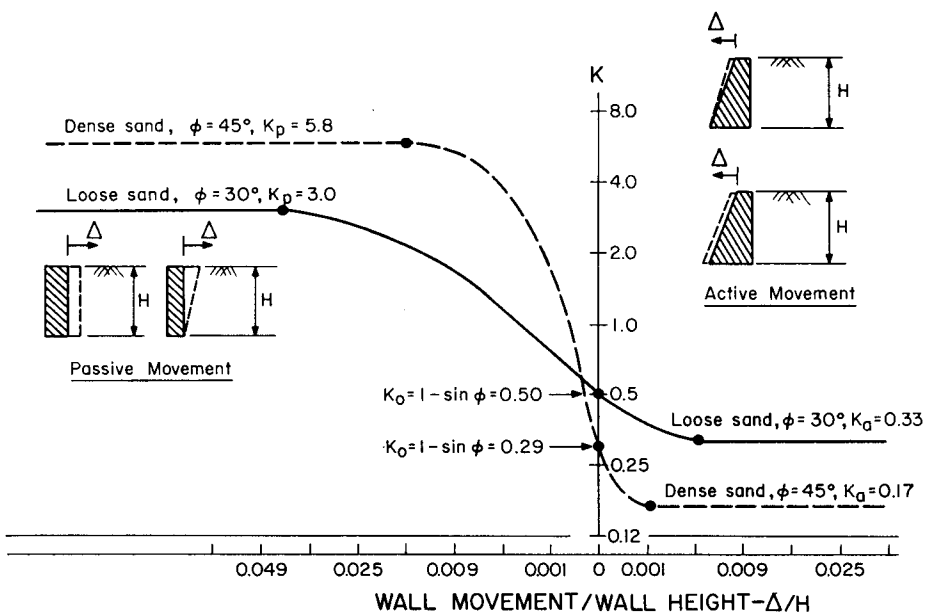

Fig. 6.20 Relationship between wall movement and earth pressure for ideal cases of walls that are "wished" into place.