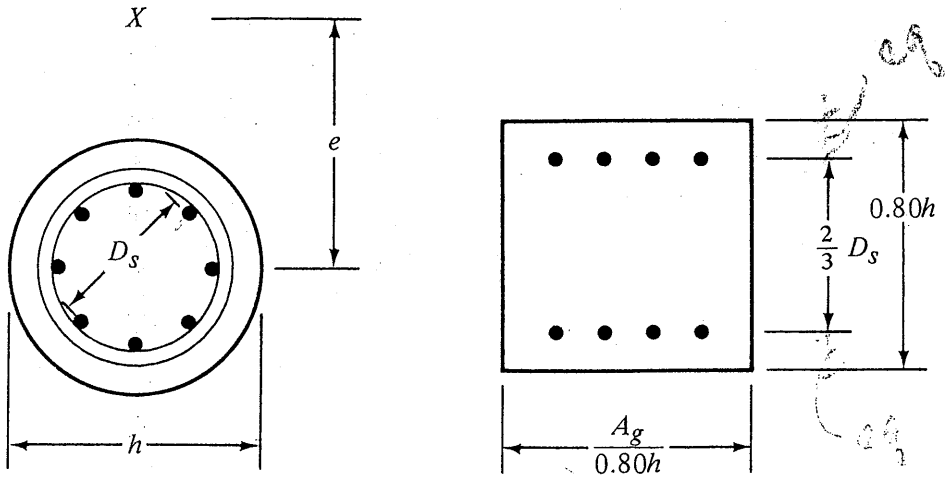

actual circular column equivalent rectangular column

Figure 8.11

greatly simplify the mathematics. Perhaps the best known of these is the one proposed by Whitney, in which equivalent rectangular columns are used to replace the circular ones.[5] This method gives results that correspond quite closely with test results.

In Whitney's method the area of the equivalent column is made equal to the area of the actual circular column and its depth in the direction of bending is 0.80 times the outside diameter of the real column. One-half the steel is assumed to be placed on one side of the equivalent column and one-half on the other. The distance between these two areas of steel is assumed to equal two-thirds of the diameter (D_s) of a circle passing through the center of the bars in the real column. These values are illustrated in Figure 8.11. Once the equivalent column is established, the calculations for P_n and other values are made as for rectangular columns.

PROBLEMS

8.1 to **8.6** Design columns for axial load only. Include the design of ties or spirals and a sketch of the cross sections selected, including bar arrangements. All columns are assumed to be short and are not exposed to the weather.

8.1 Square tied column; $P_D = 200^k$, $P_L = 300^k$, $f_c' = 4{,}000$ psi, and $f_y = 60{,}000$ psi. Assume $\rho_g = 2\%$.

8.2 Repeat Problem 8.1 if ρ_g is to be 5%.

8.3 Round spiral column; $P_D = 160^k$, $P_L = 250^k$, $f_c' = 3{,}500$ psi, and $f_y = 50{,}000$ psi. Assume $\rho_g = 3\%$.

8.4 Round spiral column; $P_D = 200^k$, $P_L = 300^k$, $f_c' = 5{,}000$ psi, $f_y = 60{,}000$ psi, and $\rho_g = 4\%$.

[5] Whitney, Charles S., 1942, "Plastic Theory of Reinforced Concrete Design," *Transactions ASCE*, 107, pp. 251–326.