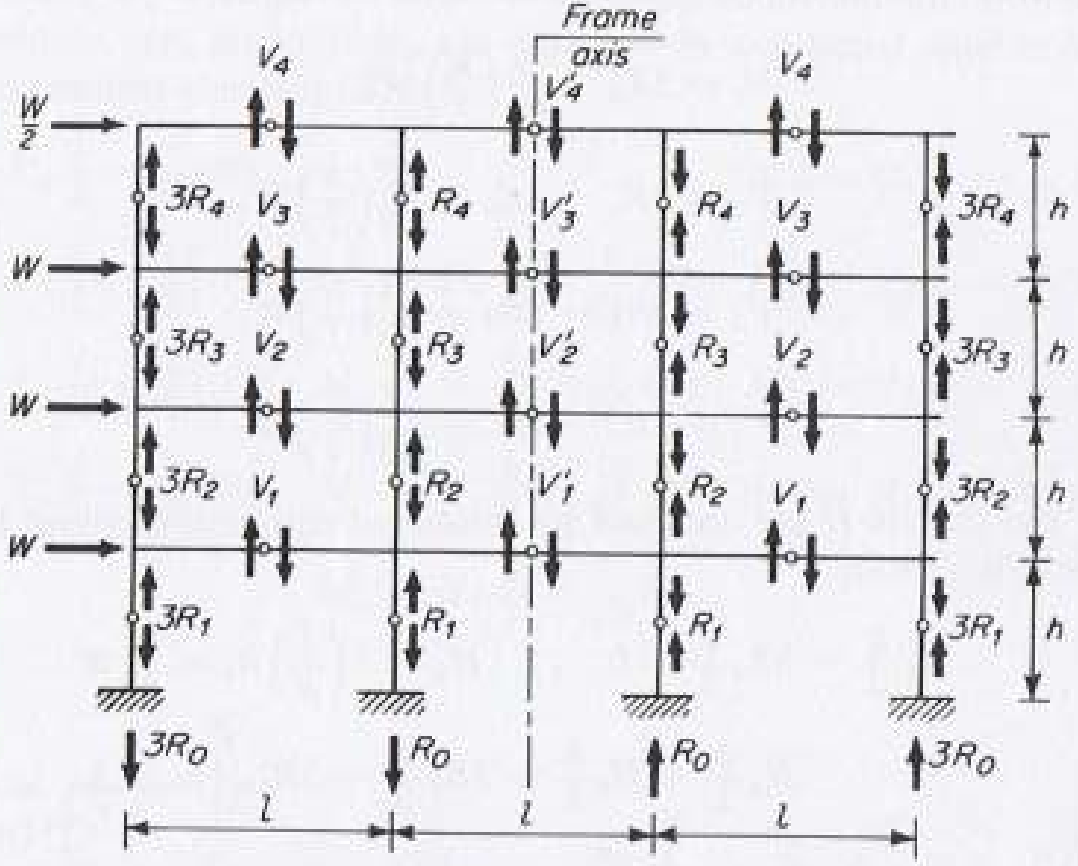

FIGURE 7.5.2

tions, the frame is statically determinate and the direct forces R, the shears V, and the moments M are determined by equilibrium considerations, as will be shown for the frame of Fig. 7.5.2 that has columns of equal area.

By rotational equilibrium, taking moments about the frame axis at the level of the column hinges, we obtain the forces R in the columns:

Level 4:

$$\frac{W}{2}\frac{h}{2} = 2\left(R_4\frac{l}{2} + 3R_4\frac{3l}{2}\right) \quad \therefore \quad R_4 = \frac{1}{40}\left(\frac{h}{l}\right)W,$$

Level 3:

$$\frac{W}{2}\frac{3h}{2} + W\frac{h}{2} = 2\left(R_3\frac{l}{2} + 3R_3\frac{3l}{2}\right) \quad \therefore \quad R_3 = \frac{5}{40}\left(\frac{h}{l}\right)W,$$

Level 2:

$$\frac{W}{2}\frac{5h}{2} + W\frac{3h}{2} + W\frac{h}{2} = 2\left(R_2\frac{l}{2} + 3R_2\frac{3l}{2}\right) \quad \therefore \quad R_2 = \frac{13}{40}\left(\frac{h}{l}\right)W,$$

Level 1:

$$\frac{W}{2}\frac{7h}{2} + W\frac{5h}{2} + W\frac{3h}{2} + W\frac{h}{2} = 2\left(R_1\frac{l}{2} + 3R_1\frac{3l}{2}\right) \quad \therefore \quad R_1 = \frac{25}{40}\left(\frac{h}{l}\right)W$$

By vertical equilibrium at level 0:

$$R_0 = R_1.$$