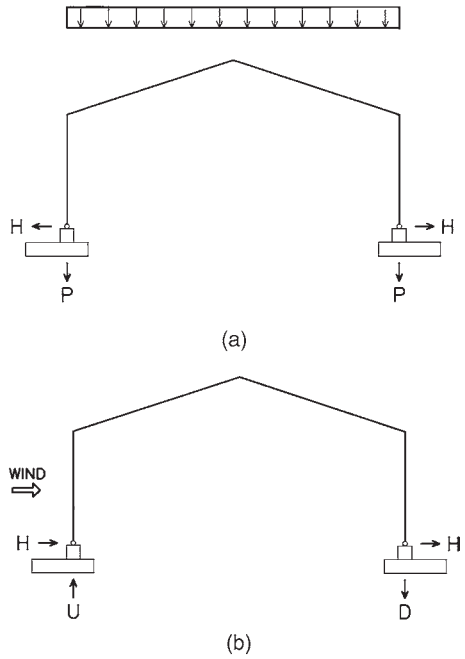

FIGURE 12.15 Column reactions for Example 12.1: (*a*) from gravity loads; (*b*) from wind loads.

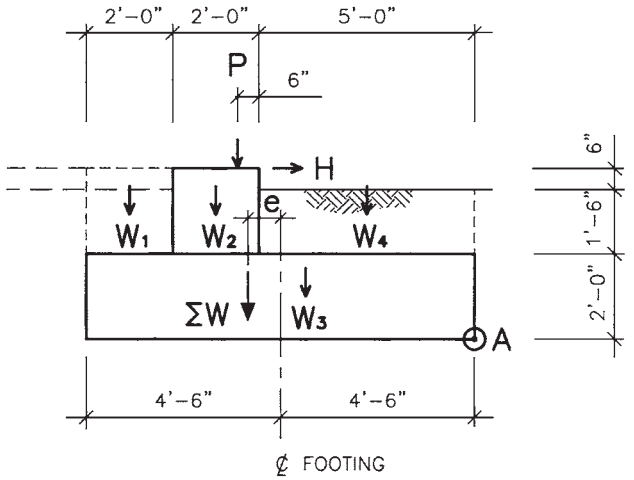

FIGURE 12.16 Weights and forces for Case 1 of Example 12.1.

Weight		Distance to point A	M_R
$W_1 = (0.50 \times 0.15 + 1.5 \times 0.12)\ 2 \times 4$	= 2.04 kip	× 8 ft	= 16.32 kip-ft
$W_2 = 2 \times 2 \times 2\ (0.15 + 0.12)$	= 2.16	× 6	= 12.96 kip-ft
$W_3 = 9 \times 4 \times 2 \times 0.15$	= 10.8	× 4.5	= 48.60 kip-ft
$W_4 = 5 \times 1.5 \times 4 \times 0.12$	= 3.6	× 2.5	= 9.00 kip-ft
P	= 37	× 5.5	= 203.5 kip-ft
	ΣW = 55.6 kip		ΣM_R = 290.38 kip-ft

$$\text{Overturning moment } M_{OT} = 30 \text{ kip} \times 4 \text{ ft} = 120 \text{ kip-ft} < \Sigma M_R \qquad \text{OK}$$

$$\text{Factor of safety against overturning} = \frac{290.38}{120} = 2.42 > 1.5 \qquad \text{OK}$$

Find the location of the resultant measured from point *A:*

$$\bar{x}_{\text{c.g.}} = \frac{290.38 \text{ kip-ft}}{55.6 \text{ kip}} = 5.22 \text{ ft}$$

The resultant of vertical loads acts with an eccentricity with respect to the footing centerline of:

$$e = 5.22 - 4.5 = 0.72 \text{ (ft) left of footing centerline}$$

Then the overall eccentricity of load is

$$e_o = \frac{M_{OT}}{\Sigma W} - e = \frac{120}{55.6} - 0.72 = 1.44 \text{ (ft)}$$

The kern limit of the footing is

$$\frac{9 \text{ ft}}{6} = 1.5 > 1.44 \text{ (ft)}$$

Therefore, the resultant is within the kern limit of the footing, which means that the soil pressure can be determined by formula:

$$f_{p,\ \text{max, min}} = \frac{P}{A} \pm \frac{M}{S}$$

where $P = 55.6$ kip (ΣW)
$A = 9 \text{ ft} \times 4 \text{ ft} = 36$ sq ft (area of footing)
$M = 55.6 \text{ kip} \times 1.44 \text{ ft}$
$S = \dfrac{4 \times 9^2}{6} = 54 \text{ ft}^3$ (section modulus of footing)

$$f_{p,\ max} = 3.02 \text{ ksf}$$
$$f_{p,\ min} = 0.06 \text{ ksf}$$

The footing is designed below.

Resistance to sliding is provided by a combination of soil friction and passive pressure on the footing (see Fig. 12.12). Assume