**1–1.** The floor of a classroom is made of 125-mm thick lightweight plain concrete. If the floor is a slab having a length of 8 m and width of 6 m, determine the resultant force caused by the dead load and the live load.

## SOLUTION

$F_D = 0.015\ \text{kN/m}^2/\text{mm})(125\ \text{mm})(8\text{m})(6\text{m})$
$= 90\ \text{kN}$ **Ans**

$F_L = (1.92\ \text{kN/m}^2)(6\ \text{m})(8\ \text{m})$
$F_{Live} = 92.16\ \text{kN} = 92.2\ \text{kN}$ **Ans**

$F = F_D + F_L = 90\ \text{kN} + 92.16\ \text{kN} = 182.16\ \text{kN} = 182.2\ \text{kN}$ **Ans**

**1–2.** The interior wall of a building is made from 51 × 102 mm wood studs, plastered on two sides. If the wall is 4 m high, determine the load in kN/m of length of wall that it exerts on the floor.

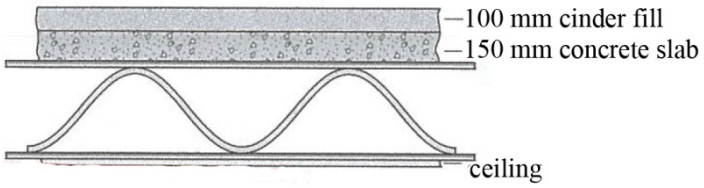
## SOLUTION

From Table 1–3,

$w = (0.96\ \text{kN/m}^2)\ (4\ \text{m}) = 3.84\ \text{kN/m}$ **Ans.**

**Ans.**
$w = 3.84$ kN/m

**1–3.** The second floor of a light manufacturing building is constructed from a 150-mm.-thick stone concrete slab with an added 100-mm. cinder concrete fill as shown. If the suspended ceiling of the first floor consists of metal lath and gypsum plaster, determine the dead load for design in kilo newton per square meter of floor area.



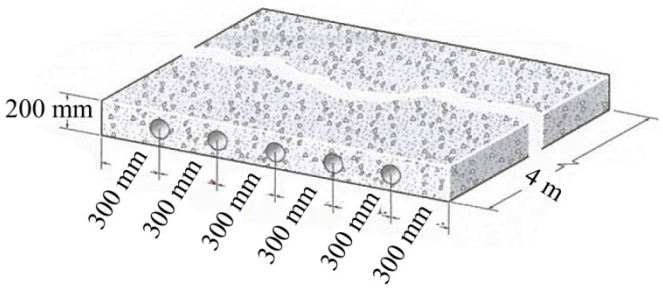

## SOLUTION

From Table 1–3,

| | |
|---|---|
| 150-mm stone concrete slab | $= (0.023\ \text{kN/m}^2.\text{mm})\ (150\ \text{mm}) = 3.45\ \text{kN/m}^2$ |
| 100-mm cinder fill | $= (0.017\ \text{kN/m}^2.\text{mm})\ (100\ \text{mm}) = 1.70\ \text{kN/m}^2$ |
| Metal lath & plaster | $= 0.48\ \text{kN/m}^2$ |
| Total dead load | $= 5.63\ \text{kN/m}^2$ **Ans.** |

**Ans.**
$DL = 5.63\ \text{kN/m}^2$

***1–4.** The hollow core panel is made from plain stone concrete. Determine the dead weight of the panel. The holes each have a diameter of 100 mm.



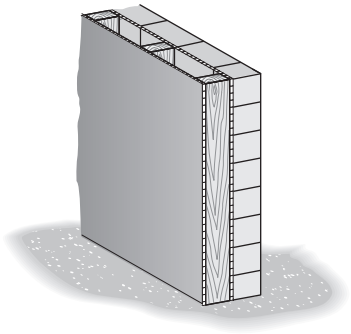

## SOLUTION

From Table 1–2, $\tau_c = 22.6\ \text{kN/m}^3$

$$W = (22.6\ \text{kN/m}^3)\left[(1.8\ \text{m})(0.2\ \text{m}) - 5\left(\frac{\pi}{4}\right)(0.1\ \text{m})^2\right](4\ \text{m}) = 28.99\ \text{kN} = 29.0\ \text{kN}$$ **Ans.**

**Ans.**
$W = 29.0$ kN

**1–5.** The wall is 5 m high and consists of 51 × 102 mm studs, plastered on one side. On the other side there is 102-mm clay brick. Determine the average load in kN/m of length of wall that the wall exerts on the floor.



## SOLUTION

Using the data tabulated in Table 1–3,

102-mm. clay brick: (1.87 kN/m$^2$) (5 m) = 9.35 kN/m

51 × 102mm. studs plastered on one side: (0.57 kN/m$^2$) (5 m) = 2.85 kN/m

$w_D$ = 12.2 kN/m **Ans.**

**Ans.**
$w_D$ = 12.2 kN/m

**1–6.** The floor of a light storage warehouse is made of 150-mm.-thick cinder concrete. If the floor is a slab having a length of 4 m and width of 3 m, determine the resultant force caused by the dead load and that caused by the live load.

## SOLUTION

From Table 1–3,

$DL = (0.017\ \text{kN/m}^2 \cdot \text{mm})\ (150\ \text{mm})\ [(4\ \text{m})\ (3\ \text{m})] = 30.6\ \text{kN}$ **Ans.**

From Table 1–4,

$LL = (6.00\ \text{kN/m}^2)\ [(4\ \text{m})\ (3\ \text{m})] = 72.0\ \text{kN}$ **Ans.**

**Ans.**
$DL = 30.6$ kN
$LL = 72.0$ kN

**1–7.** A building wall consists of 305-mm clay brick and 13 mm fiberboard on one side. If the wall is 4 m high, determine the load in kilonewton per meter that it exerts on the floor.

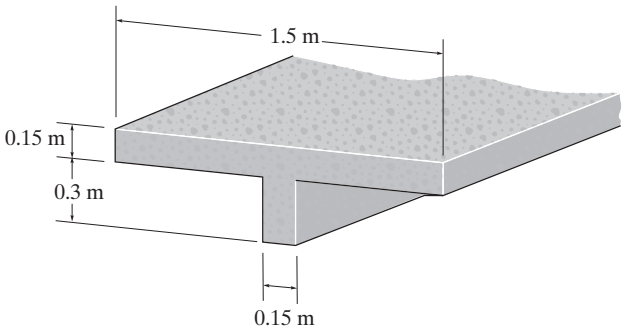
## SOLUTION

From Table 1–3,

| | |
|---|---|
| 305-mm. clay brick: | $(5.51\ \text{kN/m}^2)\ (4\ \text{m}) = 22.04\ \text{kN/m}$ |
| 13-mm. fiberboard: | $(0.04\ \text{kN/m}^2)\ (4\ \text{m}) = 0.16\ \text{kN/m}$ |
| Total: | $22.20\ \text{kN/m} = 22.2\ \text{kN/m}$ **Ans.** |

**Ans.**
$w = 22.2$ kN/m

*1–8. The precast floor beam is made from concrete having a specific weight of 23.6 kN/m$^3$. If it is to be used for a floor of an office building, calculate its dead and live loadings per foot length of beam.




## SOLUTION

The dead load is caused by the self-weight of the beam.

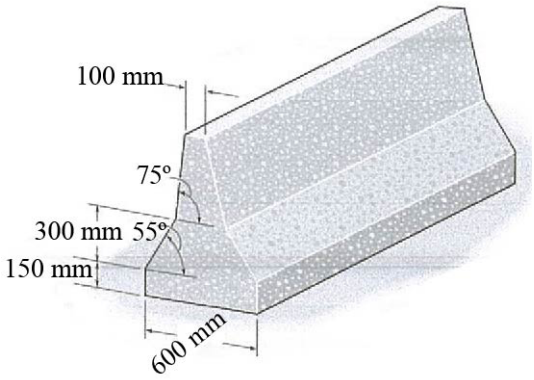
$$w_D = [(1.5\text{ m})(0.15\text{ m}) + (0.15\text{ m})(0.3\text{ m})](23.6\text{ kN/m}^3)$$
$$= 6.372\text{ kN/m} = 6.37\text{ kN/m} \quad \textbf{Ans.}$$

For the office, the recommended line load for design in Table 1–4 is 2.4 kN/m$^2$. Thus,

$$w_L = (2.40\text{ kN/m}^2)(1.5\text{ m}) = 3.60\text{ kN/m} \quad \textbf{Ans.}$$

**Ans.**
$w_D = 6.37\text{ kN/m}$
$w_L = 3.60\text{ kN/m}$

**1–9.** The "New Jersey" barrier is commonly used during highway construction. Determine its weight per meter of length if it is made from plain stone concrete.



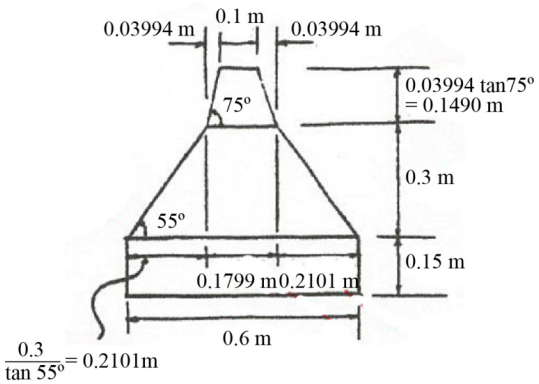

## SOLUTION

$$\text{Cross-sectional area} = 0.6\,(0.15) + \frac{1}{2}\,(0.6 + 0.1799)\,(0.3) + \frac{1}{2}(0.1799 + 0.1)\,(0.1490)$$

$$= 0.2278\ \text{m}^2$$

Use Table 1–2.

$w = (22.6\ \text{kN/m}^3)\,(0.2278\ \text{m}^2) = 5.149\ \text{kN/m} = 5.15\ \text{kN/m}$ **Ans.**




**Ans.**
$w = 5.15$ kN/m

**1–10.** The floor of a light storage warehouse is made of 150-mm-thick lightweight plain concrete. If the floor is a slab having a length of 7 m and width of 3 m, determine the resultant force caused by the dead load and the live load.

## SOLUTION

From Table 1–3,

$DL = [0.015\ \text{kN/m}^2 \cdot \text{mm}\ (150\ \text{mm})](7\ \text{m})(3\ \text{m}) = 47.25\ \text{kN}$

From Table 1–4,

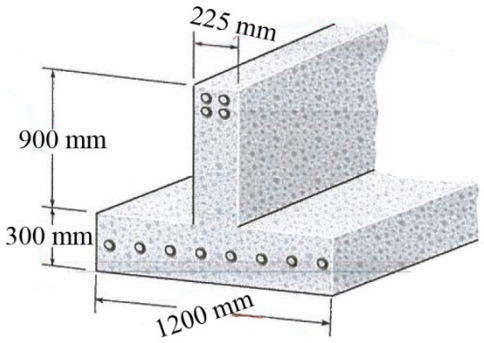
$LL = (6.00\ \text{kN/m}^2)(7\ \text{m})(3\ \text{m}) = 126\ \text{kN}$

Total Load:

$F = 126\ \text{kN} + 47.25\ \text{kN} = 173\ \text{kN}$ **Ans.**

**Ans.**
$F = 173\ \text{kN}$

**1–11.** The precast inverted T-beam has the cross section shown. Determine its weight per meter of length if it is made from reinforced stone concrete and twelve 20-mm.-diameter cold-formed steel reinforcing rods.




## SOLUTION

From Table 1–2, the specific weight of reinforced stone concrete and the cold-formed steel are $\gamma_C = 22.6\ \text{kN/m}^3$ and $\gamma_H = 77.3\ \text{kN/m}^3$, respectively.

Reinforced stone concrete: $[(0.225\ \text{m})(0.9\ \text{m}) + (1.2\ \text{m})(0.3\ \text{m}) - 12\left(\frac{\pi}{4}\right)(0.02\ \text{m})^2](22.6\ \text{kN/m}^3)$

$= 12.6273\ \text{kN/m}$

Cold-formed steel: $12\left[\frac{\pi}{4}(0.02\,\text{m})^2\right](77.3\ \text{kN/m}^3) = 0.2914\ \text{kN/m}$

$w_D = 12.6273\ \text{kN/m} + 0.2914\ \text{kN/m} = 12.92\ \text{kN/m} = 12.9\ \text{kN/m}$ **Ans.**

**Ans.**
$w_D = 12.9\ \text{kN/m}$

***1–12.** Wind blows on the side of the fully enclosed hospital located on open flat terrain where $V$ = 200 km/h. Determine the external pressure acting on the leeward wall, if the length and width of the building are 60 m and the height is 9.1 m. Take $K_e$ =1.0.

## SOLUTION

$$V = \left(200\frac{\text{km}}{\text{h}}\right)\left(\frac{1000\,\text{m}}{1\,\text{km}}\right)\left(\frac{1\,\text{h}}{3600\,\text{s}}\right) = 55.56\,\text{m/s}$$

$K_{zt}$ = 1.0 (Flat terrain)

$K_d$ = 1.0 (wind load only)

$K_e$ = 1.0

$q_h = 0.613\,K_z K_{zt}\,K_d\,K_e V^2$

$= 0.613K_z\,(1.0)\,(1.0)\,(1.0)\,(55.56)^2$

$= 1891.98\,K_z$

From Table 1–5, for $z = h$ = 9.1 m, $K_z$ = 0.98

$$q_h = 1891.98(0.98) = 1854.14$$

From the text,

$\frac{L}{B} = \frac{60}{60} = 1$ so that $C_p$ = –0.5

$p = qGC_p - q_h(GC_{pi})$

$p = 1854.14(0.85)\,(-0.5) - 1854.14(\pm 0.18)$

$p$ = –1122 N/m$^2$ or –454 N/m$^2$ **Ans.**

**Ans.**
$p$ = –1122 N/m$^2$ or –454 N/m$^2$

**1–13.** Wind blows on the side of a fully enclosed 9.1 m high hospital located on open flat terrain where V = 200 km/h. Determine the design wind pressure acting over the windward wall of the building at the heights 0–4.6 m, 6.1 m, 7.6 m and 9.1 m. The roof is flat. Take $K_e = 1.0$.

## SOLUTION

$$V = \left(200\frac{\text{km}}{\text{h}}\right)\left(\frac{1000\,\text{m}}{1\,\text{km}}\right)\left(\frac{1\,\text{h}}{3600\,\text{s}}\right) = 55.56\ \text{m/s}$$

$K_{zt} = 1.0$ (Flat terrain)

$K_d = 1.0$ (Wind load only)

$K_e = 1.0$

$q_z = 0.613\, K_z K_{zt} K_d K_e V^2$

$= 0.613 K_z\,(1.0)\,(1.0)\,(1.0)\,(55.56^2)$

$= 1891.98\, K_z$

From Table 1–5,

| $z$ | $K_z$ | $q_z$ |
|---|---|---|
| 0–4.6 | 0.85 | 1608.18 |
| 6.1 | 0.90 | 1702.78 |
| 7.6 | 0.94 | 1778.46 |
| 9.1 | 0.98 | 1854.14 |

Thus,

$$p = qGC_p - q_h(GC_{pi})$$

$$= q\,(0.85)\,(0.8) - 1854.14\,(\pm 0.18)$$

$$= 0.68q \mp 333.74$$

$p_{0\text{-}4.6} = 0.68(1608.18) \mp 333.74 = 760\ \text{N/m}^2$ or $1427\ \text{N/m}^2$ **Ans.**

$p_{6.1} = 0.68(1702.78) \mp 333.74 = 824\ \text{N/m}^2$ or $1492\ \text{N/m}^2$ **Ans.**

$p_{7.6} = 0.68(1778.46) \mp 333.74 = 876\ \text{N/m}^2$ or $1543\ \text{N/m}^2$ **Ans.**

$p_{9.1} = 0.68(1854.14) \mp 333.74 = 927\ \text{N/m}^2$ or $1595\ \text{N/m}^2$ **Ans.**

**Ans.**

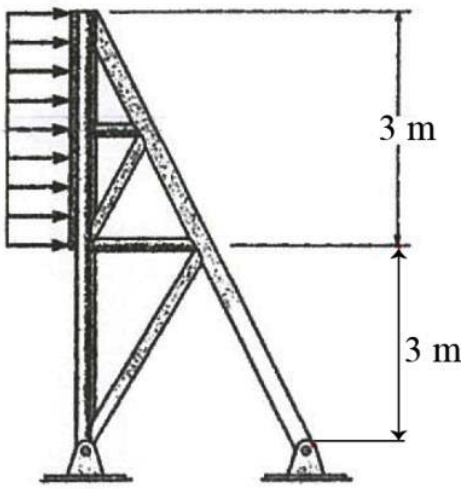
$p_{0\text{-}4.6} = 760\ \text{N/m}^2$ or $1427\ \text{N/m}^2$

$p_{6.1} = 824\ \text{N/m}^2$ or $1492\ \text{N/m}^2$

$p_{7.6} = 876\ \text{N/m}^2$ or $1543\ \text{N/m}^2$

$p_{9.1} = 927\ \text{N/m}^2$ or $1595\ \text{N/m}^2$

**1–14.** Determine the resultant force acting on the face of the truss-supported sign if it is located on open flat terrain where $V = 38$ m/s. The sign has a width of 12 m and a height of 3 m as indicated.




## SOLUTION

$V = 38$ m/s

Here, $h = 6\text{ m} \simeq 6.1\text{ m}$

$K_z = 0.90$

$K_{zt} = 1.0\ K_e = 1.0$

$K_d = 1.0$

$q_z = 0.613\ K_z\ K_{zt}\ K_d\ K_e\ v^2$

$q_h = 0.613(0.9)\ (1.0)\ (1.0)\ (1.0)\ (38^2) = 796.65\ \text{N/m}^2$

$F = q_h G C_f A_s$

$G = 0.85$

For $\frac{B}{S} = \frac{12\,\text{m}}{3\,\text{m}} = 4$ and $\frac{s}{h} = \frac{3}{6} = 0.5$, table 1.6 gives $C_f = 1.70$.

$A_s = 12\ (3) = 36\ \text{m}^2$

$F = 796.65\ (0.85)\ (1.70)\ (36)$

$= 41.44\ (10^3)\ \text{N} = 41.4\ \text{kN}$

**Ans.**
$F = 41.4$ kN

**1–15.** An urban hospital located in central Illinois has a flat roof. Determine the snow load in $kN/m^2$ that is required to design the roof.

## SOLUTION

In central Illinois, $p_g = 0.96\ kN/m^2$. Because the hospital is in an urban area, $C_e = 1.2$.

$p_f = 0.7C_eC_tI_sp_g$

$p_f = 0.7(1.2)(1.0)(1.20)(0.96)$

$= 0.968\ kN/m^2$ **Ans.**

**Ans.**
$p_f = 0.968\ kN/m^2$