$$= 1.4 \times 20 + 1.6 \times 5.4$$

$$= 28 + 8.64 = 36.64\,\text{kN/m} \tag{12.1}$$

$$\text{stress} = (36.64 \times 10^3)/(102.5 \times 10^3) = 0.357\,\text{N/mm}^2 \tag{12.2}$$

(ii) Dead and wind loads

- Windward side

$$\text{dead} + \text{wind} = 0.9\,G_k + 1.4\,W_k \tag{12.3}$$

$$\text{stress} = (0.9 \times 20 \times 10^3)/(102.5 \times 10^3) - 1.4 \times 0.01$$

(from Table 12.3)

$$= 0.176 - 0.014 = +0.162\,\text{N/mm}^2 \tag{12.4}$$

No tension develops, hence safe.

- Leeward side

$$\text{dead} + \text{wind} = 1.4\,G_k + 1.4\,W_k \tag{12.5}$$

$$\text{stress} = (28 \times 10^3)/(102.5 \times 10^3) + 0.014 \quad \text{(from above)}$$

$$= 0.273 + 0.014 = 0.287\,\text{N/mm}^2 \tag{12.6}$$

(iii) Dead, live and wind loads

$$\text{dead} + \text{live} + \text{wind} = 1.2\,G_k + 1.2\,Q_k + 1.2\,W_k \tag{12.7}$$

$$\text{stress} = (0.273 \times 1.2)/1.4 + (8.64 \times 1.2)/(1.6 \times 102.5)$$

$$\pm 1.2 \times 0.01 \text{ (proportionately reduced from (12.6))}$$

$$= 0.234 + 0.0632 \times 0.012 = 0.31 \text{ or } 0.285\,\text{N/mm}^2 \tag{12.8}$$

No tension developing, hence safe.

The load combination which produces the severe condition is (12.1), and therefore, the design load = 36.64 kN/m.

(b) Fifth floor

(i) Dead and imposed loads

$$\text{dead} + \text{imposed} = 1.4\,G_k + 1.6\,Q_k$$

$$= 1.4 \times 44.68 + 1.6 \times 9.72$$

$$= 62.55 + 15.55 = 78.10\,\text{kN/m} \tag{12.9}$$

$$\text{stress} = (78.10 \times 10^3)/(102.5 \times 10^3) = 0.76\,\text{N/mm}^2 \tag{12.10}$$

(ii) Dead and wind loads

- Windward side

$$\text{dead} + \text{wind} = 0.9\,G_k + 1.4\,W_k \tag{12.11}$$

$$\text{stress} = (0.9 \times 44.68 \times 10^3)/(102.5 \times 1000) - 1.4 \times 0.04$$

$$= 0.39 - 0.056 = 0.334\,\text{N/mm}^2 \tag{12.12}$$

No tension develops, hence safe.

- Leeward side

$$\text{dead} + \text{wind} = 1.4\,G_k + 1.4\,W_k \tag{12.13}$$

$$\text{stress} = (62.55 \times 10^3)/(102.5 \times 10^3) + 0.056$$

$$= 0.61 + 0.056 = 0.67\,\text{N/mm}^2 \tag{12.14}$$

(iii) Dead, live and wind loads

$$\text{dead} + \text{live} + \text{wind} = 1.2\,G_k + 1.2\,Q_k + 1.2\,W_k \tag{12.15}$$

$$\text{stress} = (0.61 \times 1.2)/1.4 + (15.55 \times 1.2)/(1.6 \times 102.5)$$

$$\pm 1.2 \times 0.04$$

$$= 0.52 + 0.11 + 0.048$$

$$= 0.68 \text{ or } 0.58\,\text{N/mm}^2 \tag{12.16}$$

No tension developing, hence safe.

Hence the load combination which produces the severe condition is (12.9) and the load is 78.10 kN/m.

(c) Fourth floor

(i) Dead and imposed loads

$$\text{dead} + \text{imposed} = 1.4\,G_k + 1.6\,Q_k$$

$$= 1.4 \times 69.36 + 1.6 \times 12.96$$

$$= 97.10 + 20.74\,\text{kN/m} \tag{12.17}$$

$$\text{stress} = (97.10 \times 10^3)/(102.5 \times 10^3) + (20.74 \times 10^3)(102.5 \times 10^3)$$

$$= 0.95 + 0.20 = 1.15\,\text{N/mm}^2 \tag{12.18}$$

(ii) Dead and wind loads

- Windward side

$$\text{dead} + \text{wind} = 0.9\,G_k + 1.4\,W_k \tag{12.19}$$