(γ_f=1, clause 20.3.1 BS 5628: Part 2)

dead load of the wall=$\gamma_f G_k$=2.6kN/m^2

(γ_f=1, clause 20.3.1 BS 5628: Part 2 and see section 12.2.1)

design dead load/metre length of wall=2.6×3.6=9.1×10^{3}N

compressive stress at the base of wall=9.1×10^3/ area of the wall

=9.1×10^3/1000×102.5

=0.089N/mm^2

The wall will be treated as a cantilever, which is a safe assumption. Thus

bending moment (BM) at the base of the wall

$$= \frac{1.0 \times 3.6^2}{2} + \frac{1.8 \times 1.0 \times 3.6}{2}$$

$$= 6.5 + 3.3 = 9.8\,\text{kNm/m}$$

Since both walls have the same stiffness,

$$\text{BM/wall} = 9.8/2 = 4.9\,\text{kNm/m}$$

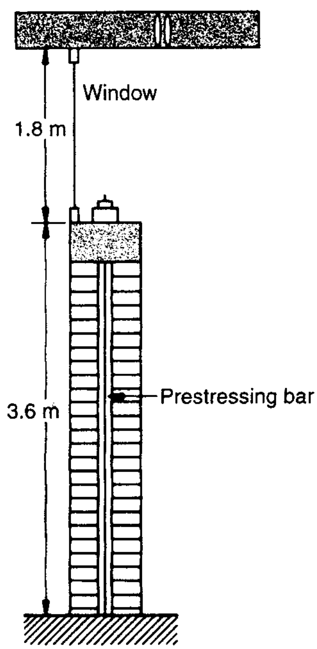

Fig. 11.3 Panel for example 1.

$$\text{stress due to wind loading} = \pm\frac{M}{Z} = \pm\frac{4.9\times 10^6\times 6}{1000\times 102.5^2} = \pm 2.8\,\text{N/mm}^2$$

combined stress=0.089-2.8=(-)2.71N/mm² (tension)

The tension has to be neutralized by the effective prestressing force. Assuming 20% loss of prestress

$$P_e/A = 0.8\times P_0/A = 2.71$$

Therefore

$$P_0 = (2.71\times 1000\times 102.5)/0.8 = 347.2\,\text{kN}$$

$$\text{area of steel required} = (347.2\times 10^3)/(0.7\times f_y)$$

$$= (347.2\times 10^3)/(0.7\times 1030) = 481.5\,\text{mm}^2$$

Provide one bar of 25mm diameter (A_s=490.6mm²).

Alternative solution: If the space is not premium, a diaphragm or cellular wall can be used. The cross-section of the wall is shown in Fig. 11.4. The second moment of area is

$$I_{XX} = 2\times 615\times\frac{(102.5)^3}{12} + 2\times 615\times 102.5\times(163.75)^2 + \frac{225^3\times 100}{12}$$

$$= 110.4\times 10^6 + 3380\times 10^6 + 94.9\times 10^6$$

$$= 3695.7\times 10^6\,\text{mm}^4$$

$$I_{XX}/\text{m} = \frac{3695.7\times 10^6}{615}\times 1000 = 6000\times 10^6\,\text{mm}^4$$

$$\text{area} = 615\times 2\times 102.5 + 100\times 225$$

$$= 126\times 10^3 + 22.5\times 10^3$$

$$= 148.5\times 10^3$$

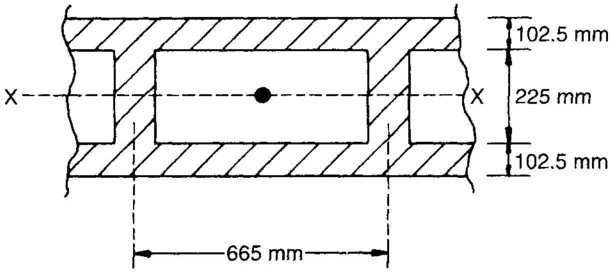

Fig. 11.4 Section of the diaphragm wall for example 1.