The horizontal forces should be calculated in accordance with the provision of clause 2.6(*e*), and the in-plane moments should be calculated for each lift of wall on the assumption that the walls act as cantilevers. The moment to be resisted by any one wall should be in the same ratio to the total cantilever moment as the ratio of its stiffness to the sum of the total stiffnesses of all the walls resisting the horizontal forces in that direction.

4.6.3.2 Bending at right-angles to the walls
The axial loads and in-plane moments should be determined as in clause 4.6.3.1. In addition, the moments from horizontal forces acting at right-angles on the walls and from beams and slabs spanning monolithically on to the walls should be calculated assuming full continuity at the intersection with the floor slab.

4.6.4 Section design

4.6.4.1 Walls resisting in-plane moments and axial loads
The stresses on the walls from the loads and moments should be obtained from the following expression:

$$\text{extreme fibre stresses, } f_f = \frac{N}{Lh} \pm \frac{M}{hL^2/6} \text{N/mm}^2$$

where N = ultimate axial load in N
M = ultimate in-plane moment in Nmm
L = length of wall in mm
h = thickness of wall in mm

The ultimate compressive load per unit length equals hf_f N/mm. This should be equal to or less than the ultimate load capacity

$$0.35f_{cu} A_c + 0.67f_y A_{sc}$$

where f_{cu} = characteristic concrete cube strength in N/mm^2
A_c = area of concrete in mm^2 per mm length of wall
A_{sc} = area of vertical reinforcement in mm^2 per mm length of wall
f_y = characteristic strength of reinforcement in N/mm^2

The area of tension reinforcement if required should be obtained by calculating the total tensile force from the following expression:

$$\text{total tension} = 0.5f_tL_th$$

where f_t is the extreme fibre stress in tension in N/mm^2 and L_t is the length of the wall in mm where tension occurs.

The area of tension reinforcement should be placed within $0.5L_t$ from the end of the wall where the maximum tensile stress occurs.

The section should generally be designed on the assumption that the in-plane moments can act in both directions and should be reinforced accordingly.

4.6.4.2 Walls resisting in-plane moments, axial loads and transverse moments
The section should firstly be designed for the case in clause 4.6.4.1. The section should then be checked for the transverse moments, treating each unit length as a column and additional reinforcement provided if necessary.

4.6.4.3 Intersecting walls
Where two walls intersect to form a core the interface shear may need to be checked.

4.6.5 Reinforcement

The minimum area of vertical reinforcement in the wall should be 0.4% of the gross cross-sectional area of the concrete on any unit length, and should be equally divided between the two faces of the wall.

The maximum area of vertical reinforcement should not exceed 4% of the gross cross-sectional area of the concrete in a metre length.

When the vertical reinforcement does not exceed 2% of the gross cross-sectional area, the area of horizontal reinforcement should not be less than 0.3% for steel of f_y = 250 N/mm^2 and 0.25% for f_y = 460 N/mm^2.

The vertical bars should not be less than size 10, and the horizontal bars should not be less than size 6* or one-quarter of the size of the vertical bars, whichever is the greater.

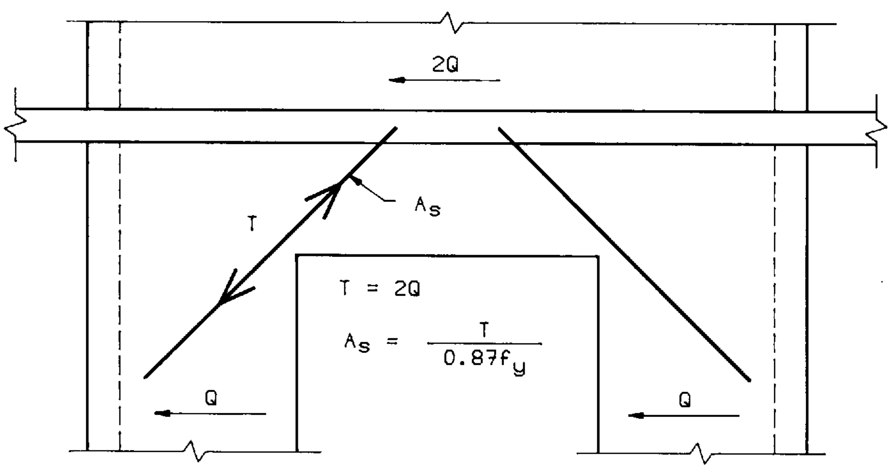
The maximum spacing of vertical bars should not exceed 250mm for steel of f_y = 250 N/mm^2 and 200mm for f_y = 460 N/mm^2.

The maximum spacing of horizontal bars should not exceed 300mm.

For walls with vertical reinforcement exceeding 2% of the gross cross-sectional area the recommendations in BS 8110[1] should be used.

4.6.6 Openings in shear and core walls

Door and service openings in shear walls introduce weaknesses that are not confined merely to the consequential reduction in cross-section. Stress concentrations are developed at the corners, and adequate reinforcement needs to be provided to cater for these. This reinforcement should take the form of diagonal bars positioned at the corners of the openings as illustrated in Fig. 15. The reinforcement will generally be adequate if it is designed to resist a tensile force equal to twice the shear force in the vertical components of the wall as shown, but should not be less than two size 16 bars across each corner of the opening.



15 Reinforcement at openings in walls

*This bar size may not be freely available.