(b) Design tie force (table 13, BS 5628)

- Peripheral ties: Tie force, F_t =48kN.

  As required: $(48\times10^3)/250=192\ \text{mm}^2$

  Provide one 16mm diameter bar as peripheral tie (201mm^2) at roof and each floor level uninterrupted, located in slab within 1.2m of the edge of the building.
- Internal ties: Design tie force F_t or $[F_t(G_k + Q_k)/7.5\ ] \times L_a/5$ whichever is greater in the direction of span. Tie force

$$F_t = 48\,\text{kN/m} > 48\,\frac{4.8+1.5}{7.5}\times\frac{3}{5} = 24.2\,\text{kN/m}$$

  (For the roof the factor G_k is 3.5.) Therefore F_t=48kN/m. (Also note L_a<5×clear height=5×2.85=14.25m.) Span of corridor slab is less than 3m, hence is not considered. Tie force normal to span, F_t=48kN/m.

$$\text{Required}\quad A_s = \frac{(48\times1000)}{250} = 192\,\text{mm}^2$$

  Provide 10mm diameter bar at 400mm centre to centre in both directions. Area provided 196mm^2 (satisfactory).

Internal ties should also be provided at each floor level in two directions approximately at right angles. These ties should be uninterrupted and anchored to the peripheral tie at both ends. It will be noted that reinforcement provided for other purposes, such as main and distribution steel, may be regarded as forming a part of, or whole of, peripheral and internal ties (see section 12.10).

(c) Ties to external walls

Consider only loadbearing walls designated as B.

$$\begin{aligned}\text{design tie force} &= 2F_t \text{ or } (h/2.5)\,F_t \quad \text{(whichever is less)}\\ &= 2\times48 \text{ or } (2.85/2.5)\times48\,\text{kN/m}\\ &= 96 \text{ or } 54\,\text{kN/m}\end{aligned}$$

Therefore

design tie force=54kN/m

(d) Tie connection to masonry (Fig. 12.11)

Ignoring the vertical load at the level under consideration, the design characteristic shear stress at the interface of masonry and concrete is

$$\text{shear stress} = \frac{54 \times 10^3 \times \gamma_{mv}}{2 \times 102.5 \times 1000}$$

where

$$\gamma_{mv} = 1.25 \quad \text{(clause 27.4, BS 5628)}$$

$$= \frac{54 \times 10^3 \times 1.25}{2 \times 102.5 \times 1000} = 0.33\,\text{N/mm}^2 < 0.35\,\text{N/mm}^2$$

Hence it is satisfactory, and there is no need to provide external wall ties at any floor level. Further, the vertical load acting at any joint will increase the shear resistance as explained in section 9.5.2(d).

12.9.5 Vertical elements

The designer needs to be satisfied that removal of wall type A, B or C, one at a time, will not precipitate the collapse of the structure beyond specified limits.

To illustrate a method (Sinha and Hendry, 1971), it is assumed that an interior wall type A has been removed from the ground floor of the building. As a result of this incident, the first floor slab will not only

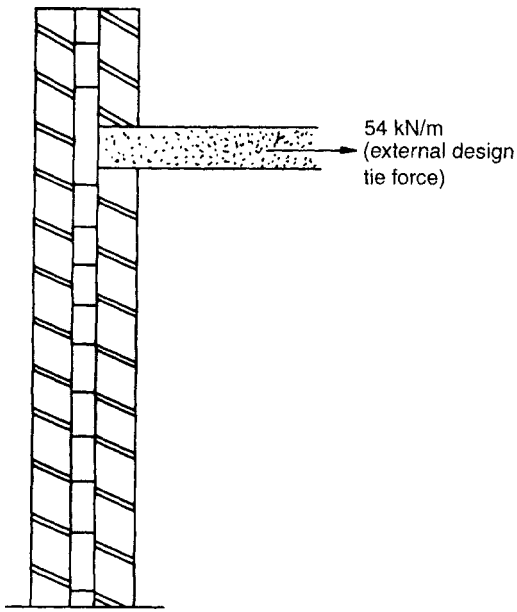

Fig. 12.11 Tie connection.