bending deflection and the second is that due to shear. The shear deflection is normally neglected if the height:width ratio is greater than 5.

6.3.1 Coupled shear walls

Shear walls with openings present a much more complex problem. Openings normally occur in vertical rows throughout the height of the wall, and the connection between the wall sections is provided either by beams forming the part of the wall or by floor slabs or by a combination of both. Such walls are described as 'coupled shear walls', 'pierced shear walls' or 'shear walls with openings'. Figure 6.3(a) shows a simple five-storey high coupled shear wall structure.

There are five basic methods of analysis for the estimation of wind stresses and deflection in such shear walls, namely: (i) cantilever approach, (ii) equivalent frame, (iii) wide column frame, (iv) continuum, and (v) finite element. Figures 6.3(b) to (f) show the idealization of shear walls with openings for each of these methods.

6.3.2 Cantilever approach

The structure is assumed to consist of a series of vertical cantilever walls which are made to deflect together at each level by the floor slabs. That is, the slabs transmit direct forces only, bending being neglected. The wind moment is divided amongst the walls in proportion to their flexural rigidities. This is the most commonly used method for the design of masonry structures. The deflection of the wall is given by

$$\Delta = \frac{w_1}{EI_1}\left(\frac{x^4}{24} - \frac{h^3 x}{6} + \frac{h^4}{8}\right) \tag{6.5}$$

$$\Delta = \frac{w_2}{EI_2}\left(\frac{x^4}{24} - \frac{h^3 x}{6} + \frac{h^4}{8}\right) \tag{6.6}$$

where

$$w_1 = \frac{w}{I_1 + I_2} I_1 \qquad \text{and} \qquad w_2 = \frac{w}{I_1 + I_2} I_2$$

w=total uniformly distributed wind load/unit height, h=height of building, x=distance of section under consideration from the top, and I_1, I_2=second moments of areas (Fig. 6.3(b)).

6.3.3 Equivalent frame

In this method, the walls and slabs are replaced by columns and beams having the same flexural rigidities as the walls and floor slabs respectively. The span of the beams is taken to be the distance between

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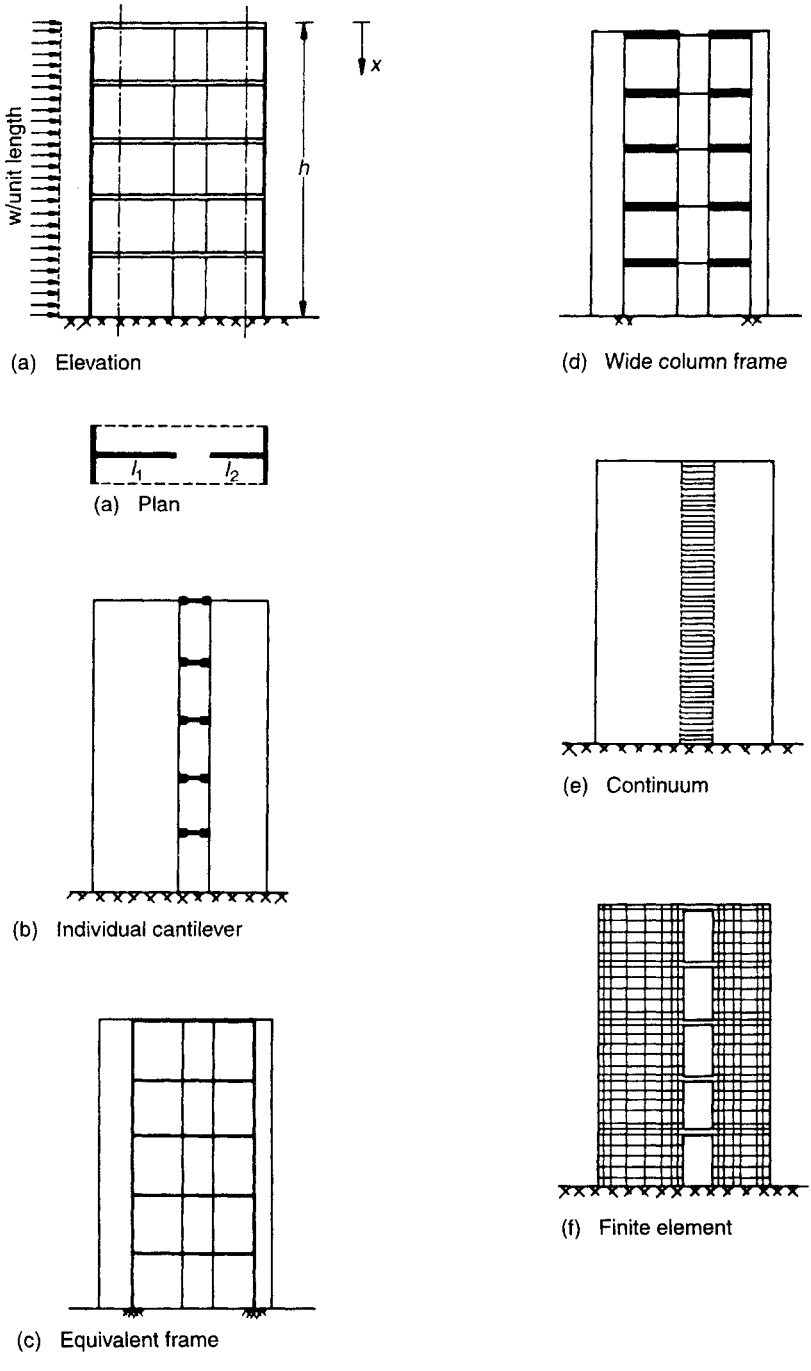

Fig. 6.3 Idealization of shear walls with opening for theoretical analysis.

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