7.3 APPROXIMATE THEORY FOR LATERAL LOAD ANALYSIS OF WALLS SUBJECTED TO PRECOMPRESSION WITH AND WITHOUT RETURNS

7.3.1 Wall without returns

Having taken into consideration all the factors contributing to the lateral strength of the wall, an approximate analysis (Hendry *et al.*, 1971) can be developed based on the following assumptions:

- Elastic deflections of the wall supports are negligible.
- Failure occurs by horizontal cracking at the top, centre and bottom of the wall, causing rotation about horizontal lines through A, B and C (Fig. 7.4).

The forces acting on the top half of the wall at the point of failure are shown in Fig. 7.4. By taking moments about A

$$\sigma t L\,(t-a) = q_0 h \frac{L}{2}\frac{h}{4} \tag{7.1}$$

$$q_0 = 8\sigma t(t-a)/h^2 \tag{7.2}$$

where σ=precompressive stress, t=thickness of the wall which is subject to precompression (in the case of a cavity wall with inner leaf loaded, thickness should be equal to the thickness of inner leaf only), L=length of wall, h=height of wall, q_0=transverse or lateral pressure and a=horizontal distance through which centre of the wall has moved.

If the compressive stress is assumed constant throughout the uplift of the wall at failure, the maximum pressure resisted by the wall is equal to

$$q_0 = 8\sigma t^2/h^2 \quad \text{when} \quad a = 0 \tag{7.3}$$

If the precompression increases on the wall with uplift of the building, as explained above, it is possible for the moment of resistance, $\sigma tL\,(t\text{-}a)$, to increase, even though the moment arm $(t\text{-}a)$ decreases—thus resulting in an increase in the maximum lateral pressure resisted by the wall.

7.3.2 Wall with returns

In the case of a wall with returns, part of the lateral pressure is transmitted to the return, thus causing axial and bending stresses in the return.

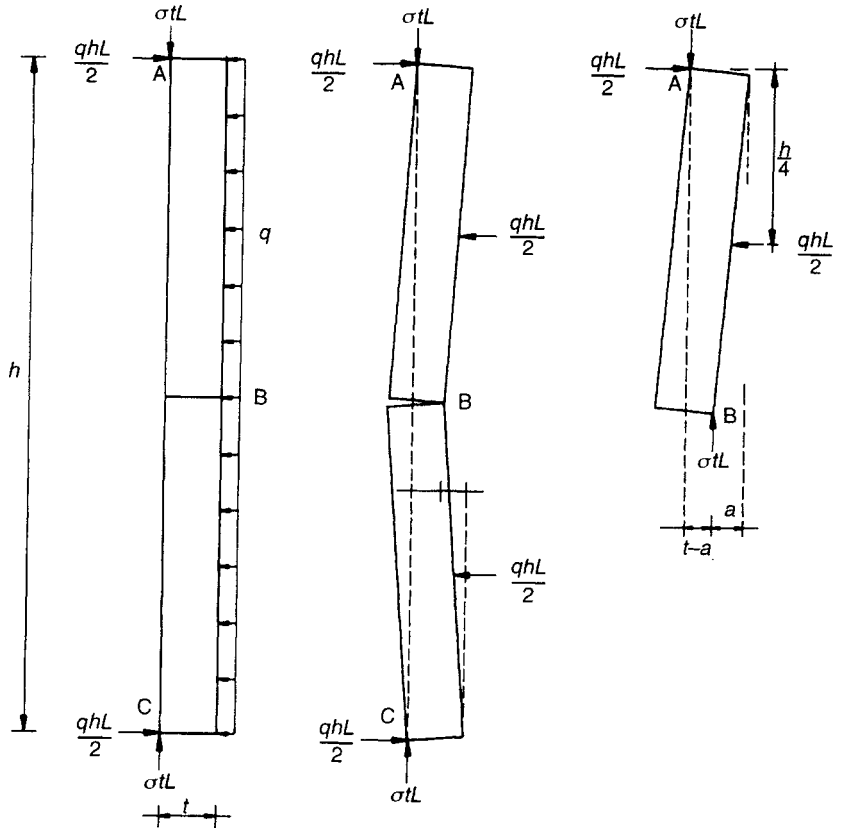

Fig. 7.4 Simplified failure mechanism of walls supported top and bottom. q=lateral pressure; σ=precompressive stress; L=length of wall.

In simplified analysis, however, the return is assumed not to fail. The lateral pressure transmitted to the return is assumed to be distributed over the height of the wall at 45° (Fig. 7.5).

Considering a wall with one return and taking the moment of all the forces acting on the top half of the wall (Fig. 7.5) about the top:

$$\sigma t^2 L = q_1 \frac{h}{2} L \frac{h}{4} - q_1 \frac{h^2}{8} \frac{h}{3} \tag{7.4}$$

Therefore

$$q_1 = \frac{8\sigma t^2}{h^2} \frac{1}{1 - 1/(3\alpha)} \quad \text{where} \quad \alpha = L/h \geq 0.5 \tag{7.5}$$