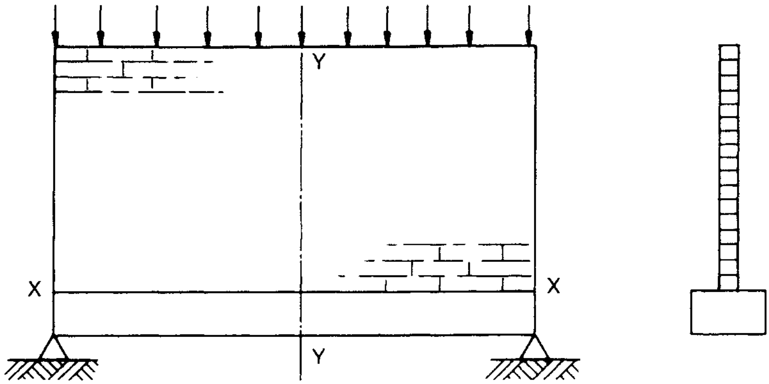

Fig. 8.1 Simply supported wall-beam.

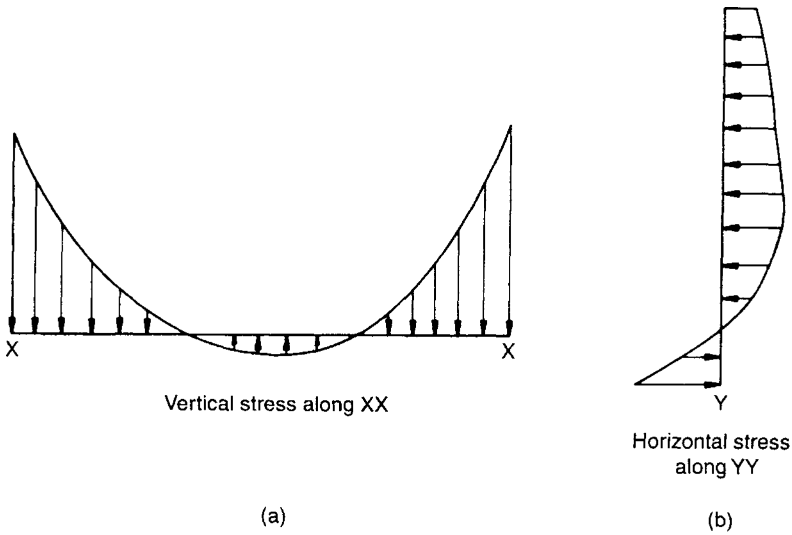

Fig. 8.2 Stress distribution.

stresses in the beam may be tensile throughout the depth so that the beam acts as a tie.

Composite action cannot be achieved unless there is sufficient bond between the wall and the beam to allow for the development of the required shearing forces. The large compressive stresses near the supports result in large frictional forces along the interface, and it has been shown that if the depth/span ratio of the wall is >0.6 then the frictional forces developed are sufficient to supply the required shear capacity.

8.1.2 Development of design methods

For design purposes the quantities which must be determined are:

- The maximum vertical stress in the wall.
- The axial force in the beam.
- The maximum shear stress along the interface.
- The central bending moment in the beam.
- The maximum bending moment in the beam and its location.

Methods which allowed for arching action were developed by Wood (1952) for determining the bending moment and axial force in the beams. The panels were assumed to have a depth/span ratio greater than 0.6 so that the necessary relieving arch action could be developed and moment coefficients were introduced to enable the beam bending moments to be determined. These were:

- $PL/100$ for plain walls or walls with door or window openings occurring at centre span.
- $PL/50$ for walls with door or window openings occurring near the supports.

An alternative approach, based on the assumption that the moment arm between the centres of compression and tension was 2/3×overall depth with a limiting value of 0.7×the wall span (Fig. 8.3) was also suggested (Wood and Simms, 1969). Using this assumption, the tensile force in the beam can be calculated using

$$T \times 2h/3 = PL/8 \tag{8.1}$$

and the beam designed to carry this force.

Following this early work of Wood and Simms, the composite wall-beam problem was studied by a number of researchers who considered not only the design of the beam but also the stresses in the wall. The characteristic parameter K introduced by Stafford-Smith and Riddington (1977) to express the relative stiffness of the wall and beam was shown to be a useful parameter for the determination of both the compressive stresses in the wall and the bending moments in the beam. The value of K is given by

$$K = (E_w tL^3/E_{bm}I_b)^{1/4} \tag{8.2}$$

where E_w, E_{bm}=Young's moduli of the wall and beam respectively, I_b=second moment of area of the beam and t, L=wall thickness and span. The parameter K does not contain the variable h since it was considered