

- *Elastic and creep movements.* Elastic modulus of masonry, 2100N/mm<sup>2</sup>. Creep deformation, 1.5×elastic deformation. Elastic and creep deformations, due to self-weight, at each storey level are tabulated in [Table 13.2](#).
- *Thermal movement.* Coefficient of thermal expansion, 10×10<sup>-6</sup> per °C. Assumed temperature at construction, 10°C. Minimum mean temperature of wall, -20°C. Maximum mean temperature of wall, 50°C. Range in service from 10°C, -10°C to +40°C Overall contraction of wall

$$30 \times 10 \times 10^{-6} \times 24 \times 10^3 = 7.2 \text{ mm}$$

Overall expansion of wall

$$40 \times 10 \times 10^{-6} \times 24 \times 10^3 = 12.8 \text{ mm}$$

The maximum movement at the top of the wall due to the sum of these effects is as follows:

	<i>Outer wall</i>	<i>Inner wall</i>
Irreversible moisture movement	- 1.3	+ 9.6
Reversible moisture movement	- 4.8	-
Elastic deformation	- 5.0	- 0.8
Creep	- 7.7	- 1.2
Thermal movement	- 7.2	+ 4.8
	- 26.0 mm	+ 12.4 mm

Shown in the right-hand column are comparable figures for a clay brickwork inner wall which would show irreversible moisture expansion rather than contraction and would reach a stable moisture state after construction so that irreversible moisture movement has been omitted in this case. The wall would also experience a rise in temperature when the building was brought into service and thus thermal expansion would take place. In this example there would be a possible differential movement at the top of the wall of 38.7mm but as movements are cumulative over the height of the wall it is of interest to calculate the relative movements at storey levels.

This calculation is set out in detail for the outer wall in [Table 13.3](#). The corresponding figures for the inner wall and the relative movements which would have to be accommodated at each storey level are also shown in the table and graphically in [Fig. 13.2](#). Note that if the walls are built at the same time the differential movement due to elastic compression is reduced since the compression below each level will have taken place before the ties are placed. Thus the relative wall tie movement due to elastic compression at the top level will be zero.

**Table 13.3** Masonry outer wall—clay brickwork inner wall: relative wall tie movements at storey levels

<i>Storey</i>	8	7	6	5	4	3	2	1
Shrinkage	-1.3	-1.1	-1.0	-0.8	-0.6	-0.5	-0.3	0
Rev. moisture movement	-4.8	-4.2	-4.0	-3.0	-2.4	-1.8	-1.2	-0.6
Elastic compression	0	-0.3	-0.4	-0.6	-0.8	-0.9	-1.1	-1.2
Creep	-7.4	-6.7	-5.9	-5.2	-4.5	-3.8	-3.0	-2.3
Thermal	-7.2	-6.2	-5.3	-4.3	-3.4	-2.4	-1.5	-0.5
Total	-20.7	-18.6	-16.6	-14.9	-11.7	-9.4	-7.1	-4.6
Total movement in brickwork inner wall	+14.4	+12.5	+10.5	+8.6	+6.7	+4.8	+2.8	+0.9
Movement across wall ties	35.1	31.1	27.1	23.3	18.4	14.2	9.9	5.3