The code states that this simplified method is not suitable for timber floor joists and proposes that for this case the eccentricity be taken as $\geqslant 0.4t$. Also, since the results obtained from the equation tend to be conservative the code allows the use of a reduction factor ($1-k/4$) if the design vertical stress is greater than 0.25 N/mm². The value of k is given by

$$k = (k_3 + k_4)/(k_1 + k_2) \tag{5.9}$$

where each k is the stiffness factor defined by EI/h.

5.5.3 Frame analysis

If the wall bending moment and axial load are calculated for any joint in a multi-storey framed structure then the eccentricity can be determined by dividing the moment by the axial load. The required moment and axial load can be determined using a normal rigid frame analysis. This approach is reasonable when the wall compression is high enough to contribute to the rigidity of the joints, but would lead to inaccuracies when the compression is small.

The complete frame analysis can be avoided by a partial analysis which assumes that the far ends of members (floors and walls) attached to the joint under consideration are pinned (Fig. 5.11).

The wall bending moments for the most unfavourable loading conditions can now be determined using moment-distribution or slope-deflection methods.

More sophisticated methods which allow for the relative rotation of the wall and slab at the joints and changing wall stiffness due to tension cracking in flexure are being developed.

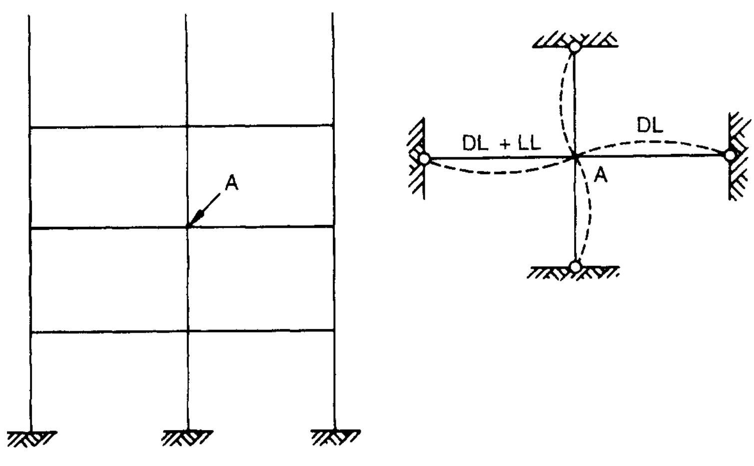

Fig. 5.11 Multi-storey frame and typical joint.

5.6 VERTICAL LOAD RESISTANCE

The resistance of walls or columns to vertical loading is obviously related to the characteristic strength of the material used for construction, and it has been shown above that the value of the characteristic strength used must be reduced to allow for the slenderness ratio and the eccentricity of loading. If we require the *design* vertical load resistance, then the characteristic strength, which is related to the strength at failure, must be further reduced by dividing by a safety factor for the material.

As shown in Chapter 4 the British code introduces a capacity reduction factor *ß* which allows simultaneously for effects of eccentricity and slenderness ratio. It should be noted that these values of *ß* are for use with the assumed notional values of eccentricity given in the code, and that if the eccentricity is determined by a frame type analysis which takes account of continuity then different capacity reduction factors should be used.

As shown in section 5.3 the Eurocode introduces the capacity reduction factor Φ which is similar to, but not identical with, the factor *ß* used in BS 5628.

If tensile strains are developed over part of a wall or column then there is a reduction in the effective area of the cross-section since it can be assumed that the area under tension has cracked. This effect is of importance for high values of eccentricity and slenderness ratio, and the Swedish code allows for it by introducing the ultimate strain value for the determination of the reduction factor.

5.6.1 Design vertical load resistance of walls

Using the principles outlined above the design vertical load resistance per unit length of wall is given in BS 5628 as $(\beta t f_k)/\gamma_m$ where γ_m is the partial safety factor for the material and *ß* is obtained from Fig. 4.4. In the Eurocode the design vertical load resistance per unit length of wall is given as $(\Phi t f_k)/\gamma_m$ where Φ is determined either at the top (or bottom), Φ_i, or in the middle fifth of the wall, Φ_m.

The procedure for calculating the design vertical load resistance in BS 5628 can be summarized as follows:

1. Determine e_x at the top of the wall using the method illustrated in Figs 5.7 to 5.9.
2. Determine e_a, the additional eccentricity, using equation (4.2) and the total eccentricity e_t using equation (4.3).
3. If $e_x > e_t$ then e_x governs the design. If $e_t > e_x$ then e_t (the eccentricity at mid-height) governs.
4. Taking e_m to represent the larger value of e_x and e_t, then if e_m is $\leqslant 0.05t$ the design load resistance is given by $(\beta t f_k)/\gamma_m$, with $\beta = 1$, and if e_m