Where: $k = 1 + \sqrt{\frac{200}{d}} \leq 2$ and $\rho = \frac{A_{sl}}{b_w d} \leq 0.02$

Where: A_{sl} is the area of tensile reinforcement, which extends beyond the section considered taking account of the 'shift rule' (see Section 5.12.6).

For heavy point loads the punching shear stress should be checked using the method for shear around columns in flat slabs.

Flat slabs

The shear stress at the column perimeter should be checked first:

$$v_{Ed} = \frac{1000 V_{eff}}{u_0 d} MPa \leq 0.2\left(1 - \left(\frac{f_{ck}}{250}\right)\right) f_{ck}$$

Where: V_{eff} is the effective shear force in kN (the shear force magnified by the effect of moment transfer, see Section 5.2.3.4)

d is the average of the effective depth of the tension reinforcement in both directions

u_0 is the column perimeter in mm.
For an interior column u_0 = length of the column perimeter
For an edge column $u_0 = c_2 + 3d \leq c_2 + 2c_1$
For a corner column $u_0 = 3d \leq c_2 + c_1$.

The shear stresses should then be checked at the basic control perimeter, $2d$ from the column perimeter:

$$v_{Ed} = \frac{1000 V_{eff}}{u_1 d} \text{ MPa}$$

Where: u_1 isthe length of the basic control perimeter in mm as defined in Figure 5.7 (columns close to a free edge), Figure 5.8 or Figure 5.9 (openings close to columns).

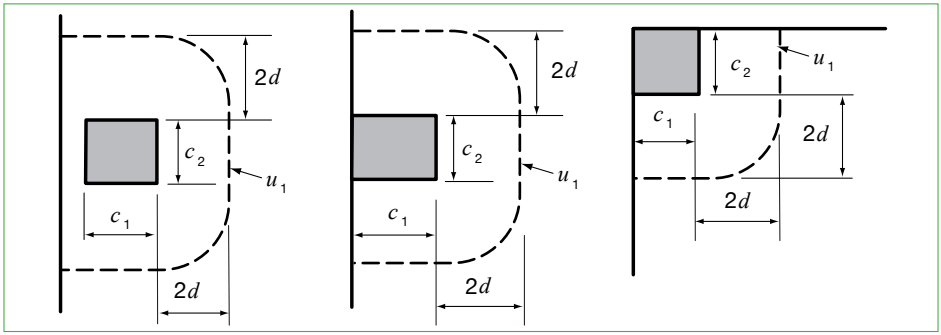

Fig 5.7 Basic control perimeters for loaded areas close to or at an edge