The bearing strength for concrete foundations may be taken as $0.4f_{cu}$, where f_{cu} is the characteristic concrete cube strength at 28 days as indicated in Table 5.13. This enables the area of baseplate to be calculated and suitable plan dimensions to be determined. The baseplate thickness is then determined from the following expression:

$$t = \left[\frac{2.5}{p_{yp}} w(a^2 - 0.3b^2)\right]^{1/2}$$

but t must not be less than the flange thickness of the column. In this expression,

- a greater projection of the plate beyond the column (see Figure 5.42)
- b lesser projection of the plate beyond the column (see Figure 5.42)
- w pressure on the underside of the plate assuming a uniform distribution (N/mm^2)
- p_{yp} design strength of the plate, which may be taken as p_y given in Table 5.1, but not greater than 270 N/mm^2

Table 5.13 Bearing strength for concrete foundations

Concrete grade	Characteristic cube strength at 28 days f_{cu} (N/mm^2)	Bearing strength $0.4 f_{cu}$ (N/mm^2)
C30	30	12.0
C35	35	14.0
C40	40	16.0
C45	45	18.0
C50	50	20.0

Example 5.15

Design a suitable slab baseplate for a 203 × 203 × 86 kg/m UC supporting an ultimate axial load of 1400 kN if the foundation is formed from grade 30 concrete. It should be noted that this is the column for which the steel section was originally designed in Example 5.11.

Grade 30 concrete $f_{cu} = 30$ N/mm^2

Bearing strength from Table 5.13 = 12 N/mm^2

$$\text{Area of slab baseplate required} = \frac{\text{axial load}}{\text{bearing strength}} = \frac{1400 \times 10^3}{12} = 116\,667\ \text{mm}^2$$

Since the column section is basically square, provide a square baseplate. The baseplate side = $\sqrt{(116\,667)}$ = 342 mm. For practical reasons use a 350 mm square baseplate, for which the plan configuration taking into account the actual dimensions of the UC will be as indicated in Figure 5.43.

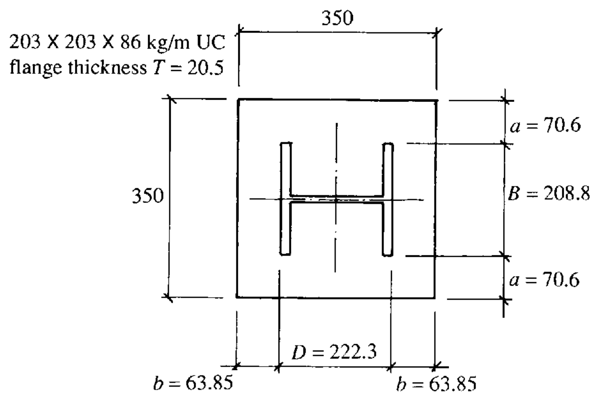

Figure 5.43 *Plan on baseplate*

The baseplate thickness is determined using the BS 5950 empirical expression:

$$t = \left[\frac{2.5}{p_{yp}} w(a^2 - 0.3b^2)\right]^{1/2}$$

where a and b are the dimensions shown in Figure 5.43. The bearing pressure is given by

$$w = \frac{1400 \times 10^3}{350 \times 350} = 11.43\,\text{N/mm}^2$$

The design strength of the plate for grade 43 steel is obtained from Table 5.1, but must not be greater than 270 N/mm^2. Since the flange thickness T of the UC column is 20.5 mm and the baseplate thickness t must not be less than this, the design strength from Table 5.1 will be 265 N/mm^2. Therefore

$$t = \left[\frac{2.5}{265} \times 11.43(70.6^2 - 0.3 \times 63.85^2)\right]^{1/2}$$

$$= 20.14\,\text{mm} < 20.5\,\text{mm UC flange thickness}$$

Use a 25 mm thick baseplate. Thus finally:

Adopt a 350 × 350 × 25 baseplate.

5.13 Connections

The design of connections usually follows the design of the principal components of a steel framed structure, and is normally regarded as part of the detailing process.

Connections may be bolted, welded or a combination of both. They must be proportioned with proper regard to the design method adopted for the structure as a whole. Therefore the bolts or welds making up a connection must be capable of transmitting all direct forces and resisting any bending moments.