main reinforcement, as shown in Figure 3.26. This is called distribution steel and its purpose is to ensure distribution of the loading on to the main reinforcement.

The minimum area of distribution steel that must be provided is the same as for the main reinforcement. Normally the size of bars used in a slab should not be less than 10 mm diameter or more than 20 mm diameter.

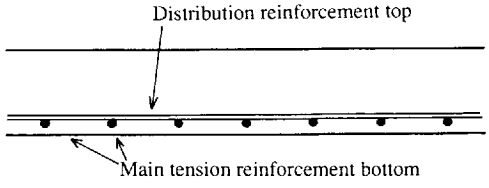

Figure 3.26 *Cross-section through a one-way spanning slab showing the position of the reinforcement*

3.10.3 Minimum spacing of reinforcement

The requirements for minimum spacing of reinforcement are the same as those for beams given in Section 3.9.5. However, for practical reasons the spacing of bars in a slab should usually be not less than 150 mm.

3.10.4 Maximum spacing of reinforcement

The clear distance between bars in a slab should never exceed the lesser of three times the effective depth ($3d$) or 750 mm.

Furthermore, unless crack widths are to be checked by direct calculation, the following rules must be complied with to ensure that crack widths do not exceed the maximum acceptable limit of 0.3 mm:

(a) No further check is required on bar spacing if:
  (i) Either grade 250 steel is used and $h \geqslant 250$ mm
  (ii) Or grade 460 steel is used and $h \geqslant 200$ mm
  (iii) Or the percentage reinforcement provided ($100A_s/bd$) is less than 0.3 per cent.

(b) If none of the conditions (i)–(iii) applies, then the bar spacing given in Table 3.14 should be used where the percentage of reinforcement contained in the slab is greater than 1 per cent. Table 3.14 is based on BS 8110 Part 1 Table 3.30.

Table 3.14 Clear distance between bars in slabs when percentage steel content is greater than 1 per cent

Steel characteristic strength f_y	250 N/mm^2	460 N/mm^2
Maximum clear distance between bars	300	160

(c) Where the percentage of steel contained in the slab is greater than 0.3 per cent but less than 1 per cent the spacing values given in Table 3.14 may be divided by the actual percentage figure. Thus if a slab contained 0.5 per cent steel with a yield stress $f_y = 250\,\text{N/mm}^2$ then the maximum clear distance between bars, permitted by the code, would be $300/0.5 = 600\,\text{mm}$. However, for practical reasons, the spacing of bars in a slab should not usually be more than 300 mm.

3.10.5 Bending ULS

Since a slab may be considered for design purposes to be a series of 1 m wide beams, its design ultimate resistance moment may be obtained by the same methods described for beams in Section 3.9.7, taking the breadth b as $1\,\text{m} = 1000\,\text{mm}$.

3.10.6 Cracking SLS

The rules relating to minimum bar areas and maximum spacing given in Sections 3.10.2 and 3.10.4 will ensure that crack widths do not exceed the general limit of 0.3 mm. However, when it is necessary to calculate specific crack width values, reference should be made to the guidance given in BS 8110 Part 2.

3.10.7 Deflection SLS

The deflection requirements for slabs are the same as those for beams given in Section 3.9.9.

3.10.8 Shear ULS

For practical reasons BS 8110 does not recommend the inclusion of shear reinforcement in solid slabs less than 200 mm deep. Therefore if no shear reinforcement is to be provided, the design shear stress v should not exceed the design ultimate shear stress v_c given in Table 3.12 of this manual. Thus for solid slabs up to 200 mm thick,

$$v = \frac{V}{bd} \not> v_c$$

This requirement will cater for the majority of one-way spanning slabs. However, for slabs thicker than 200 mm, where v is greater than v_c, shear reinforcement in the form recommended in BS 8110 Table 3.17 should be provided.

Let us now look at some examples on the design of simply supported one-way spanning slabs.