Flat slabs The title of such slabs is descriptively something of a misnomer. It is intended to describe slabs which have been designed to act in conjunction with columns as a structural frame without the necessity for beams, and hence have a flat soffit (Figure 3.22). They can however have thickened sections where the soffit is dropped to form a stiffening band running between the columns (Figure 3.23). The top of the columns may also be enlarged locally by the formation of a column head to give support to the slab over a larger area (Figure 3.24). Flat slabs may be solid or may have recesses formed in the soffit to give a series of two-directional ribs, in which case they are often referred to as waffle or coffered slabs.

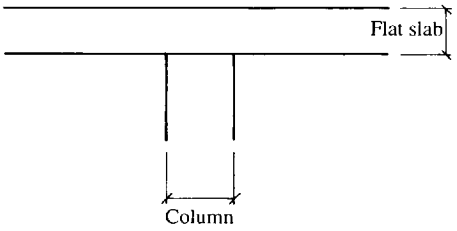

Figure 3.22 *Section through a flat slab*

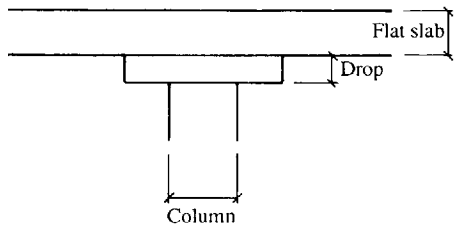

Figure 3.23 *Section through a flat slab with drops*

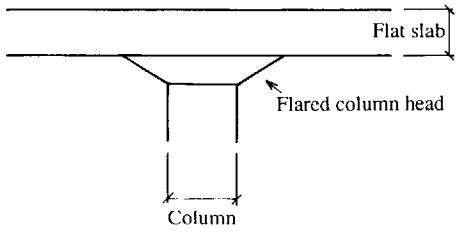

Figure 3.24 *Section through a flat slab with enlarged column heads*

The most commonly encountered suspended slabs are those used for the floors and roofs of buildings. However, sloping slabs are also used to form ramps, and concrete staircases are in fact a type of cranked slab.

For the purpose of this manual only the design of solid slabs spanning in one direction will be studied. Their design will be examined under the following headings, and where relevant a comparison will be made with the considerations for beams given in Section 3.9:

(a) Dimensional considerations
(b) Reinforcement areas
(c) Minimum spacing of reinforcement
(d) Maximum spacing of reinforcement
(e) Bending ULS
(f) Cracking SLS
(g) Deflection SLS
(h) Shear ULS.

Therefore let us consider how each of these influences the design of slabs.

3.10.1 Dimensional considerations

The two principal dimensional considerations for a one-way spanning slab are its width and its effective span.

For the purpose of design, reinforced concrete slabs spanning in one direction are considered as a series of simply supported beams having some convenient width, usually taken to be 1 m as shown in Figure 3.25. Their effective span or length is the same as that for beams given in Section 3.9.1.

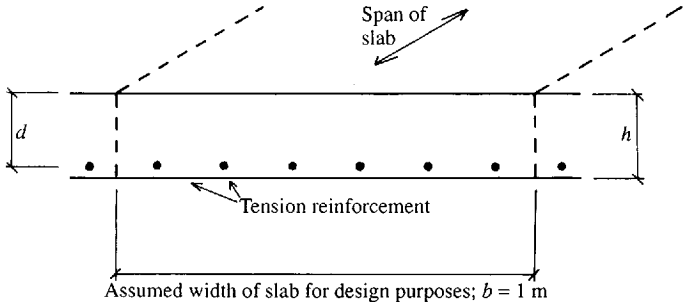

Figure 3.25 *Typical cross-section through a one-way spanning solid slab*

3.10.2 Reinforcement areas

The requirements for minimum and maximum areas of main reinforcement are the same as those for beams given in Section 3.9.4.

It should be appreciated that since one-way spanning slabs are designed as a series of 1 m wide beams, the area of steel calculated is that required per metre width. The areas of round bar reinforcement spaced at various centres per metre width are given in Table 3.13.

Whilst for the purpose of design a slab may be considered as a series of 1 m wide beams, these will in fact be cast monolithically. Therefore additional reinforcement is included on top of and at right angles to the

Table 3.13 Areas of round bar reinforcement spaced at various centres (mm^2 per 1 m width)

Diameter (mm)	Spacing (mm)									
	75	100	125	150	175	200	225	250	275	300
6	377	283	226	188	162	141	126	113	103	94
8	670	503	402	335	287	251	223	201	183	168
10	1047	785	628	524	449	393	349	314	286	262
12	1508	1131	905	754	646	565	503	452	411	377
16	2681	2011	1608	1340	1149	1005	894	804	731	670
20	4189	3142	2513	2094	1795	1571	1396	1257	1142	1047
25	6546	4909	3927	3272	2805	2454	2182	1963	1785	1636
32	—	8042	6434	5362	4596	4021	3574	3217	2925	2681
40	—	—	10053	8378	7181	6283	5585	5027	4570	4189