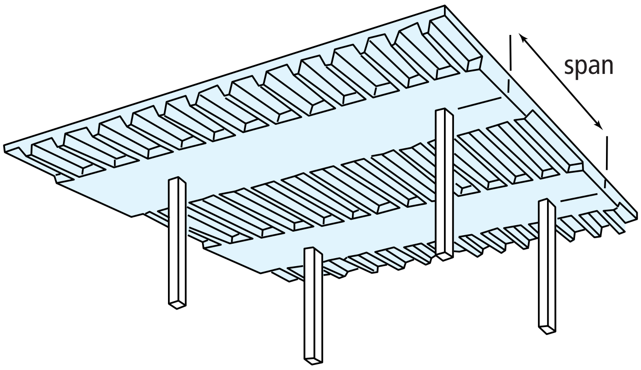
Troughed slabs

(Ribbed slabs with integral beams and level soffits, troughed flat slabs, one-way joist floors)



Troughed slabs are popular in spans up to 12 m as they combine the advantages of ribbed slabs with level soffits.

Economic depths depend on the widths of beams used. Deflection is usually critical to the design of the beams, which, therefore, tend to be wide and heavily reinforced. The chart and data assume internal beam widths of beam span/3.5, perimeter beam width of beam span/9 plus column width/2. They include an allowance for an edge loading of 10 kN/m. *(See also Ribbed slabs).*

In rectangular panels, the ribbed slab should usually span the longer direction.

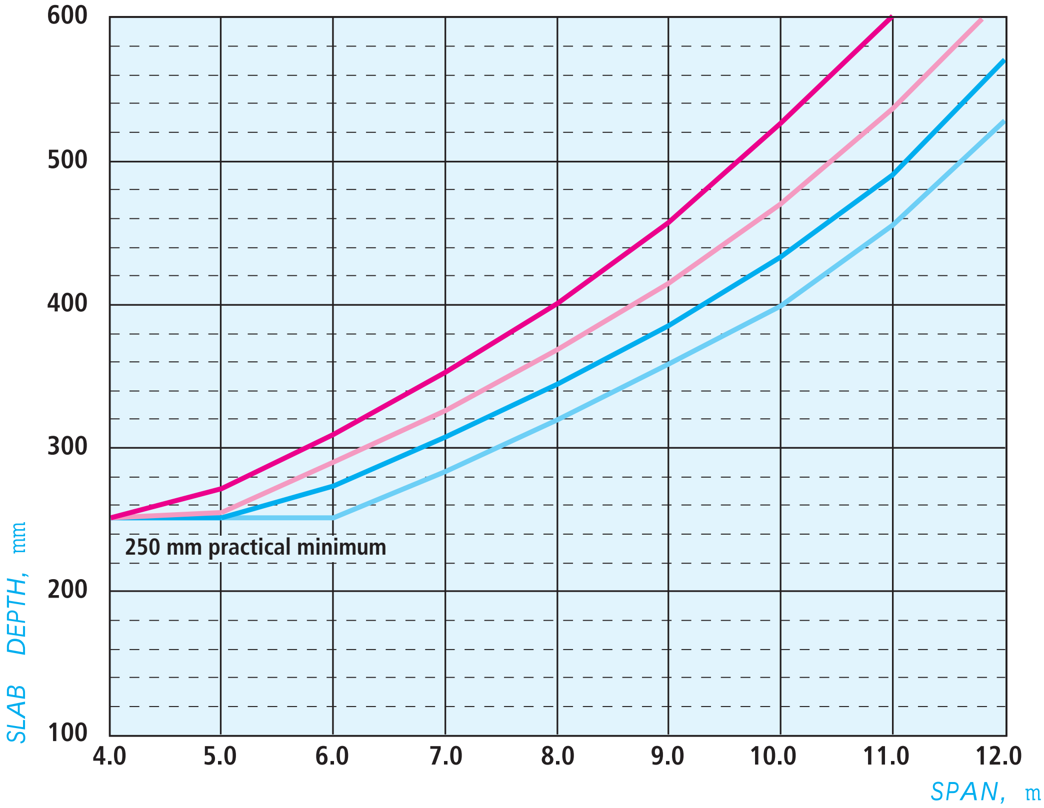
ADVANTAGES

- Longer spans than one-way solid or flat slabs
- Lightweight
- Level soffit
- Profile may be expressed architecturally, or used for heat transfer
- Holes in ribbed slab areas cause little or no problem

DISADVANTAGES

- Higher formwork costs than plain soffits

SPAN:DEPTH CHART



KEY **Characteristic imposed load (IL)**

= 2.5 kN/m² = 5.0 kN/m² = 7.5 kN/m² =10.0 kN/m²

DESIGN ASSUMPTIONS

SUPPORTED BY	COLUMNS. Refer to column charts and data to estimate sizes, etc.
DIMENSIONS	Square panels, minimum of two rib spans x two beam spans. Ribs 150 mm wide @ 750 mm cc. Topping 100 mm. Moulds variable depth. Internal beams span/3.5 wide. Edge beams, span/9 + edge column width/2 wide. Edges flush with columns. Level soffits.
REINFORCEMENT	Max. bar sizes, ribs: 2T25B, 2T20T (in top of web) and R8 links; beams: T32 T & B, T8 links. 25 mm allowed for A142 mesh (@ 0.12%) in topping. 10% allowed for wastage, etc. To comply with deflection criteria, service stress, f_s, may have been reduced.
LOADS	SDL of 1.50 kN/m² (finishes) and perimeter load of 10 kN/m included. Ultimate loads to beams from slabs assume erfs of 1.2 internally and 0.46 at ends. Ultimate loads to columns assume erfs of 1.0 and 0.5. Self weight used accounts for 10 degree slope to ribs and solid ends as described above.
CONCRETE	C35, 24 kN/m³, 20 mm aggregate.
FIRE & DURABILITY	Fire resistance 1 hour; mild exposure.

MULTIPLE SPAN, m	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**10.0**	**11.0**	**12.0**
THICKNESS, mm									
IL = 2.5 kN/m²			250	282	318	356	396	452	524
IL = 5.0 kN/m²		250	272	306	342	382	430	486	566
IL = 7.5 kN/m²		254	288	324	366	412	466	532	610
IL = 10.0 kN/m²		270	308	350	398	454	522	596	720
ULTIMATE LOAD TO SUPPORTING COLUMNS, INTERNAL (EDGE) PER STOREY, MN									
IL = 2.5 kN/m²			0.4 (0.4)	0.6 (0.5)	0.8 (0.7)	1.1 (0.8)	1.4 (1.0)	1.8 (1.3)	2.3 (1.6)
IL = 5.0 kN/m²		0.4 (0.4)	0.6 (0.5)	0.8 (0.6)	1.1 (0.8)	1.4 (1.0)	1.8 (1.3)	2.3 (1.6)	3.0 (2.0)
IL = 7.5 kN/m²		0.5 (0.4)	0.7 (0.6)	1.0 (0.8)	1.4 (1.0)	1.8 (1.3)	2.3 (1.6)	2.9 (2.0)	3.7 (2.4)
IL = 10.0 kN/m²		0.6 (0.5)	0.9 (0.7)	1.2 (0.9)	1.7 (1.2)	2.1 (1.5)	2.8 (1.9)	3.5 (2.3)	4.5 (2.9)
REINFORCEMENT, kg/m² (kg/m³)									
IL = 2.5 kN/m²			29 (114)	33 (119)	39 (127)	40 (114)	41 (106)	41 (92)	46 (88)
IL = 5.0 kN/m²		30 (127)	32 (118)	36 (120)	38 (112)	45 (122)	50 (122)	48 (99)	49 (86)
IL = 7.5 kN/m²		32 (125)	34 (118)	37 (114)	41 (111)	46 (112)	46 (100)	49 (91)	50 (82)
IL = 10.0 kN/m²		37 (138)	35 (113)	41 (118)	44 (110)	46 (105)	47 (90)	50 (86)	49 (68)
DESIGN NOTES *a = q_k > 1.25 g_k* *b = q_k > 5 kN/m²* *e = designed links in ribs. NB check punching shear at all columns*									
IL = 2.5 kN/m²									
IL = 5.0 kN/m²						e	e	e	e
IL = 7.5 kN/m²		ab	abe	abe	abe	abe	abe	be	be
IL = 10.0 kN/m²		abe	abe	abe	abe	abe	abe	abe	abe
LINKS, %AGE BY WEIGHT OF REINFORCEMENT									*Links in ribs and beams*
IL = 2.5 kN/m²		36%	29%	24%	18%	14%	13%	11%	11%
IL = 5.0 kN/m²		34%	25%	20%	15%	13%	11%	9%	9%
IL = 7.5 kN/m²		28%	20%	17%	13%	11%	10%	9%	9%
IL = 10.0 kN/m²		25%	19%	15%	12%	9%	10%	9%	10%

VARIATIONS TO DESIGN ASSUMPTIONS: differences in slab thickness for a characteristic imposed load (IL) of 5.0 kN/m²

Fire resistance	2 hours, 150 rib & 115 topping	+5 mm	4 hours, 150 rib & topping	see below
Exposure	Moderate	+20 mm	Severe, C40 concrete	see below
Cladding load	No cladding load	-0 mm	20 kN/m cladding load	+25 mm
Dimensions	125 mm ribs @ 600	+0 mm	Beam widths:	
	125 mm ribs @ 750	+0 mm	Internal L/5, edge L/12 + col/2	see below
	150 mm ribs @ 900	+0 mm	Internal L/4, edge L/10 + col/2	+10 mm
	200 mm ribs @ 1200	+0 mm	**Internal L/3.5, edge L/9 + col/2**	**as original**
	250 mm ribs @ 1500	+0 mm	Internal L/3, edge L/8 + col/2	-10 mm
Other	25 mm cover	+10 mm	Rectangular beams (cf 'T' & 'L')	+0 mm
Single spans	Single slab span	see below	Single spine beam span	see below

Thickness, mm	**Span, m**	**6.0**	**7.0**	**8.0**	**9.0**	**10.0**	**11.0**	**12.0**
	4 hrs,150 rib & topping	290	354	460	602	804		
	Severe, C40 concrete	290	320	350	412	524	672	888
	Beams L/5 & L/12 wide	296	332	368	410	496	544	624
	1-span slab	282	320	364	420	482	578	748
	1-span spine beam	304	354	410	470	532	632	748

Rectangular panels: equivalent spans, m — Use an equivalent square span, below, to derive thickness

Ribbed slab span, m	**6.0**	**7.0**	**8.0**	**9.0**	**10.0**	**11.0**	**12.0**
Beam span = 5.0 m	5.4	6.2	6.5	7.7	9.0		
Beam span = 6.0 m	6.0	6.3	6.8	7.8	9.0	10.6	11.4
Beam span = 7.0 m	6.6	7.0	7.3	7.9	9.1	10.6	11.5
Beam span = 8.0 m	7.1	7.6	8.0	8.4	9.2	10.6	11.5
Beam span = 9.0 m	8.0	8.3	8.6	9.0	9.4	10.6	11.5
Beam span = 10.0 m	9.0	9.3	9.6	9.8	10.0	10.5	11.5
Beam span = 11.0 m	10.2	10.5	10.5	10.7	10.9	11.0	11.6
Beam span = 12.0 m	10.9	11.1	11.3	11.5	11.6	11.9	12.0