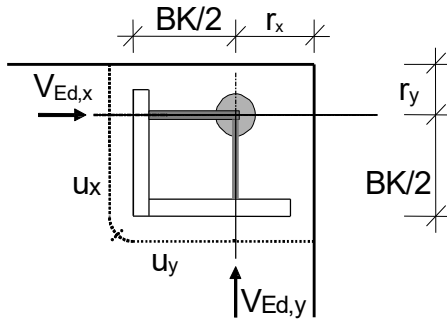


Corner shear heads in flat slabs

(For foundation slabs please contact our design team)

For more information about how to use
the pre-dimensioning tables please
refer to the last pages.



Verification:

$$V_{Ed,Total} \leq V_{Rd,Total} = V_{Rd,x} + V_{Rd,y}$$

Design value of the shear resistance $V_{Rd,Total}$ [kN] with a distance to edge of $r_x \approx r_y \approx 10$ cm

(as a simplification $r_x \approx r_y \approx 0$ and $V_{Ed,x} \approx V_{Ed,y} \approx V_{Ed,Total} / 2$ are used)

and with an average reinforcement percentage ρ of

Slab thickness h [cm]	Avg. effective depth d [cm]	0.50%		0.75%		1.00%		1.25%		
		Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	
Concrete grade: C20/25										
$f_{ck} = 20 \text{ N/mm}^2$										
20	16.0	59	118	67	134	74	148	80	160	
21	17.0	68	136	78	156	86	172	92	184	
22	17.5	75	150	86	172	95	190	102	204	
23	18.5	85	170	98	196	108	216	116	232	
24	19.0	93	186	107	214	117	234	126	252	
25	20.0	105	210	120	240	132	264	142	284	
26	21.0	115	230	132	264	145	290	156	312	
27	22.0	126	252	145	290	159	318	172	344	
28	23.0	138	276	158	316	174	348	187	374	
29	24.0	150	300	172	344	189	378	204	408	
30	25.0	163	326	186	372	205	410	221	442	
31	26.0	172	344	197	394	217	434	234	468	
32	27.0	182	364	209	418	230	460	247	494	
33	28.0	193	386	220	440	243	486	261	522	
34	29.0	203	406	232	464	256	512	276	552	
35	30.0	214	428	245	490	269	538	290	580	
36	31.0	225	450	257	514	283	566	305	610	
37	31.5	232	464	266	532	293	586	315	630	
38	32.0	240	480	275	550	302	604	325	650	
39	33.0	251	502	288	576	317	634	341	682	
40	34.0	263	526	301	602	332	664	357	714	
41	35.0	275	550	315	630	347	694	374	748	
42	36.0	288	576	329	658	363	726	391	782	
43	37.0	300	600	344	688	378	756	408	816	
44	38.0	313	626	358	716	395	790	425	850	
45	39.0	326	652	373	746	411	822	443	886	
46	40.0	340	680	389	778	428	856	461	922	
47	41.0	353	706	404	808	445	890	479	958	
48	42.0	367	734	420	840	462	924	498	996	
49	43.0	381	762	436	872	480	960	517	1,034	
50	44.0	395	790	453	906	498	996	537	1,074	
51	44.5	405	810	464	928	510	1,020	550	1,100	
52	45.0	415	830	475	950	523	1,046	563	1,126	
53	46.0	430	860	492	984	541	1,082	583	1,166	
54	47.0	445	890	509	1,018	560	1,120	604	1,208	
55	48.0	460	920	527	1,054	580	1,160	624	1,248	
56	49.0	476	952	545	1,090	599	1,198	646	1,292	
57	50.0	492	984	563	1,126	619	1,238	667	1,334	
58	51.0	508	1,016	581	1,162	640	1,280	689	1,378	
59	52.0	524	1,048	600	1,200	660	1,320	711	1,422	
60	53.0	541	1,082	619	1,238	681	1,362	734	1,468	

Revision date 11/2016

These results constitute only indicative information in order to pre-dimension the slabs. They cannot be used as the definitive structural design. The definitive structural design is to be carried out by spannverbund. Without a previous contractual arrangement with spannverbund, we assume no liability derived from the misuse of these indications.

Contact us:

Worldwide (replace + by local international call prefix)

Telephone:

(+800 0000100

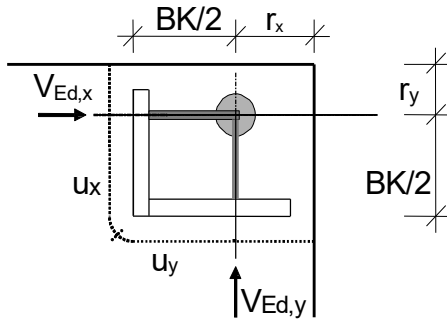
Email:

info@spannverbund.com

Corner shear heads in flat slabs

(For foundation slabs please contact our design team)

For more information about how to use
the pre-dimensioning tables please
refer to the last pages.



Verification:

$$V_{Ed,Total} \leq V_{Rd,Total} = V_{Rd,x} + V_{Rd,y}$$

Design value of the shear resistance $V_{Rd,Total}$ [kN] with a distance to edge of $r_x \approx r_y \approx 10$ cm

(as a simplification $r_x \approx r_y \approx 0$ and $V_{Ed,x} \approx V_{Ed,y} \approx V_{Ed,Total} / 2$ are used)

and with an average reinforcement percentage ρ of

Slab thickness h [cm]	Avg. effective depth d [cm]	0.50%		0.75%		1.00%		1.25%		1.50%	
		Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.
Concrete strength: C25/30											
$f_{ck} = 25 \text{ N/mm}^2$											
20	16.0	63	126	72	144	80	160	86	172	91	182
21	17.0	73	146	84	168	92	184	99	198	105	210
22	17.5	81	162	93	186	102	204	110	220	117	234
23	18.5	92	184	105	210	116	232	125	250	133	266
24	19.0	100	200	115	230	126	252	136	272	145	290
25	20.0	113	226	129	258	142	284	153	306	163	326
26	21.0	124	248	142	284	156	312	169	338	179	358
27	22.0	136	272	156	312	172	344	185	370	196	392
28	23.0	149	298	170	340	187	374	202	404	214	428
29	24.0	162	324	185	370	204	408	219	438	233	466
30	25.0	175	350	200	400	221	442	238	476	252	504
31	26.0	186	372	212	424	234	468	252	504	268	536
32	27.0	196	392	225	450	247	494	266	532	283	566
33	28.0	207	414	237	474	261	522	281	562	299	598
34	29.0	219	438	250	500	276	552	297	594	315	630
35	30.0	230	460	264	528	290	580	313	626	332	664
36	31.0	242	484	277	554	305	610	329	658	349	698
37	31.5	250	500	286	572	315	630	340	680	361	722
38	32.0	258	516	296	592	325	650	351	702	373	746
39	33.0	271	542	310	620	341	682	368	736	391	782
40	34.0	284	568	325	650	357	714	385	770	409	818
41	35.0	297	594	340	680	374	748	403	806	428	856
42	36.0	310	620	355	710	391	782	421	842	447	894
43	37.0	324	648	370	740	408	816	439	878	467	934
44	38.0	337	674	386	772	425	850	458	916	487	974
45	39.0	351	702	402	804	443	886	477	954	507	1,014
46	40.0	366	732	419	838	461	922	496	992	528	1,056
47	41.0	380	760	435	870	479	958	516	1,032	549	1,098
48	42.0	395	790	453	906	498	996	537	1,074	570	1,140
49	43.0	410	820	470	940	517	1,034	557	1,114	592	1,184
50	44.0	426	852	488	976	537	1,074	578	1,156	614	1,228
51	44.5	436	872	499	998	550	1,100	592	1,184	629	1,258
52	45.0	447	894	511	1,022	563	1,126	606	1,212	644	1,288
53	46.0	463	926	530	1,060	583	1,166	628	1,256	667	1,334
54	47.0	479	958	548	1,096	604	1,208	650	1,300	691	1,382
55	48.0	496	992	567	1,134	624	1,248	673	1,346	715	1,430
56	49.0	512	1,024	587	1,174	646	1,292	696	1,392	739	1,478
57	50.0	530	1,060	606	1,212	667	1,334	719	1,438	764	1,528
58	51.0	547	1,094	626	1,252	689	1,378	742	1,484	789	1,578
59	52.0	564	1,128	646	1,292	711	1,422	766	1,532	814	1,628
60	53.0	582	1,164	667	1,334	734	1,468	790	1,580	840	1,680

Revision date 11/2016

These results constitute only indicative information in order to pre-dimension the slabs. They cannot be used as the definitive structural design. The definitive structural design is to be carried out by spannverbund. Without a previous contractual arrangement with spannverbund, we assume no liability derived from the misuse of these indications.

Contact us:

Worldwide (replace + by local international call prefix)

Telephone:

(+800 0000100

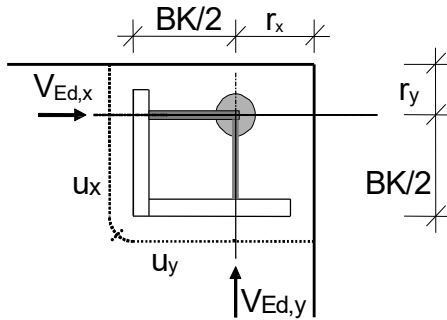
Email:

info@spannverbund.com

Corner shear heads in flat slabs

(For foundation slabs please contact our design team)

For more information about how to use
the pre-dimensioning tables please
refer to the last pages.



Verification:

$$V_{Ed,Total} \leq V_{Rd,Total} = V_{Rd,x} + V_{Rd,y}$$

Design value of the shear resistance $V_{Rd,Total}$ [kN] with a distance to edge of $r_x \approx r_y \approx 10$ cm

(as a simplification $r_x \approx r_y \approx 0$ and $V_{Ed,x} \approx V_{Ed,y} \approx V_{Ed,Total} / 2$ are used)

and with an average reinforcement percentage ρ of

Slab thickness h [cm]	Avg. effective depth d [cm]	0.50%		0.75%		1.00%		1.25%		1.50%	
		Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.
Concrete strength: C30/37											
$f_{ck} = 30$ N/mm²											
20	16.0	67	134	77	154	85	170	91	182	97	194
21	17.0	78	156	89	178	98	196	105	210	112	224
22	17.5	86	172	98	196	108	216	117	234	124	248
23	18.5	98	196	112	224	123	246	133	266	141	282
24	19.0	107	214	122	244	134	268	145	290	154	308
25	20.0	120	240	137	274	151	302	163	326	173	346
26	21.0	132	264	151	302	166	332	179	358	190	380
27	22.0	145	290	166	332	182	364	196	392	209	418
28	23.0	158	316	181	362	199	398	214	428	228	456
29	24.0	172	344	197	394	216	432	233	466	248	496
30	25.0	186	372	213	426	234	468	252	504	268	536
31	26.0	197	394	226	452	248	496	268	536	284	568
32	27.0	209	418	239	478	263	526	283	566	301	602
33	28.0	220	440	252	504	278	556	299	598	318	636
34	29.0	232	464	266	532	293	586	315	630	335	670
35	30.0	245	490	280	560	308	616	332	664	353	706
36	31.0	257	514	295	590	324	648	349	698	371	742
37	31.5	266	532	304	608	335	670	361	722	383	766
38	32.0	275	550	314	628	346	692	373	746	396	792
39	33.0	288	576	329	658	363	726	391	782	415	830
40	34.0	301	602	345	690	380	760	409	818	435	870
41	35.0	315	630	361	722	397	794	428	856	455	910
42	36.0	329	658	377	754	415	830	447	894	475	950
43	37.0	344	688	394	788	433	866	467	934	496	992
44	38.0	358	716	410	820	452	904	487	974	517	1,034
45	39.0	373	746	428	856	471	942	507	1,014	539	1,078
46	40.0	389	778	445	890	490	980	528	1,056	561	1,122
47	41.0	404	808	463	926	509	1,018	549	1,098	583	1,166
48	42.0	420	840	481	962	529	1,058	570	1,140	606	1,212
49	43.0	436	872	499	998	550	1,100	592	1,184	629	1,258
50	44.0	453	906	518	1,036	570	1,140	614	1,228	653	1,306
51	44.5	464	928	531	1,062	584	1,168	629	1,258	669	1,338
52	45.0	475	950	543	1,086	598	1,196	644	1,288	685	1,370
53	46.0	492	984	563	1,126	620	1,240	667	1,334	709	1,418
54	47.0	509	1,018	583	1,166	641	1,282	691	1,382	734	1,468
55	48.0	527	1,054	603	1,206	664	1,328	715	1,430	760	1,520
56	49.0	545	1,090	623	1,246	686	1,372	739	1,478	785	1,570
57	50.0	563	1,126	644	1,288	709	1,418	764	1,528	812	1,624
58	51.0	581	1,162	665	1,330	732	1,464	789	1,578	838	1,676
59	52.0	600	1,200	687	1,374	756	1,512	814	1,628	865	1,730
60	53.0	619	1,238	708	1,416	780	1,560	840	1,680	892	1,784

Revision date 11/2016

These results constitute only indicative information in order to pre-dimension the slabs. They cannot be used as the definitive structural design. The definitive structural design is to be carried out by spannverbund. Without a previous contractual arrangement with spannverbund, we assume no liability derived from the misuse of these indications.

Contact us:

Worldwide (replace + by local international call prefix)

Telephone:

(+800 0000100

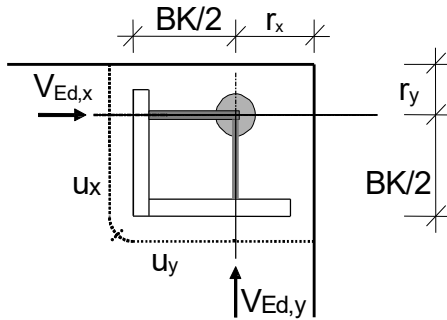
Email:

info@spannverbund.com

Corner shear heads in flat slabs

(For foundation slabs please contact our design team)

For more information about how to use
the pre-dimensioning tables please
refer to the last pages.



Verification:

$$V_{Ed,Total} \leq V_{Rd,Total} = V_{Rd,x} + V_{Rd,y}$$

Design value of the shear resistance $V_{Rd,Total}$ [kN] with a distance to edge of $r_x \approx r_y \approx 10$ cm

(as a simplification $r_x \approx r_y \approx 0$ and $V_{Ed,x} \approx V_{Ed,y} \approx V_{Ed,Total} / 2$ are used)

and with an average reinforcement percentage ρ of

Slab thick- ness h [cm]	Avg. effective depth d [cm]	0.50%		0.75%		1.00%		1.25%		1.50%	
		Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.
Concrete strength: C35/45											
$f_{ck} = 35$ N/mm²											
20	16.0	71	142	81	162	89	178	96	192	102	204
21	17.0	82	164	94	188	103	206	111	222	118	236
22	17.5	90	180	103	206	114	228	123	246	130	260
23	18.5	103	206	118	236	130	260	140	280	148	296
24	19.0	112	224	129	258	142	284	152	304	162	324
25	20.0	126	252	144	288	159	318	171	342	182	364
26	21.0	139	278	159	318	175	350	189	378	200	400
27	22.0	152	304	174	348	192	384	207	414	220	440
28	23.0	166	332	190	380	210	420	226	452	240	480
29	24.0	181	362	207	414	228	456	245	490	261	522
30	25.0	196	392	224	448	247	494	266	532	282	564
31	26.0	208	416	238	476	262	524	282	564	299	598
32	27.0	220	440	251	502	277	554	298	596	317	634
33	28.0	232	464	266	532	292	584	315	630	335	670
34	29.0	245	490	280	560	308	616	332	664	353	706
35	30.0	258	516	295	590	325	650	350	700	372	744
36	31.0	271	542	310	620	341	682	368	736	391	782
37	31.5	280	560	320	640	353	706	380	760	404	808
38	32.0	289	578	331	662	364	728	392	784	417	834
39	33.0	303	606	347	694	382	764	411	822	437	874
40	34.0	317	634	363	726	400	800	431	862	458	916
41	35.0	332	664	380	760	418	836	450	900	479	958
42	36.0	347	694	397	794	437	874	471	942	500	1,000
43	37.0	362	724	414	828	456	912	491	982	522	1,044
44	38.0	377	754	432	864	475	950	512	1,024	544	1,088
45	39.0	393	786	450	900	495	990	534	1,068	567	1,134
46	40.0	409	818	468	936	516	1,032	555	1,110	590	1,180
47	41.0	426	852	487	974	536	1,072	578	1,156	614	1,228
48	42.0	442	884	506	1,012	557	1,114	600	1,200	638	1,276
49	43.0	459	918	526	1,052	579	1,158	623	1,246	662	1,324
50	44.0	476	952	545	1,090	600	1,200	647	1,294	687	1,374
51	44.5	488	976	559	1,118	615	1,230	662	1,324	704	1,408
52	45.0	500	1,000	572	1,144	630	1,260	678	1,356	721	1,442
53	46.0	518	1,036	593	1,186	652	1,304	703	1,406	747	1,494
54	47.0	536	1,072	614	1,228	675	1,350	727	1,454	773	1,546
55	48.0	554	1,108	635	1,270	699	1,398	753	1,506	800	1,600
56	49.0	573	1,146	656	1,312	722	1,444	778	1,556	827	1,654
57	50.0	592	1,184	678	1,356	746	1,492	804	1,608	854	1,708
58	51.0	612	1,224	700	1,400	771	1,542	830	1,660	882	1,764
59	52.0	631	1,262	723	1,446	796	1,592	857	1,714	911	1,822
60	53.0	651	1,302	746	1,492	821	1,642	884	1,768	939	1,878

Revision date 11/2016

These results constitute only indicative information in order to pre-dimension the slabs. They cannot be used as the definitive structural design. The definitive structural design is to be carried out by spannverbund. Without a previous contractual arrangement with spannverbund, we assume no liability derived from the misuse of these indications.

Contact us:

Worldwide (replace + by local international call prefix)

Telephone:

(+800 0000100

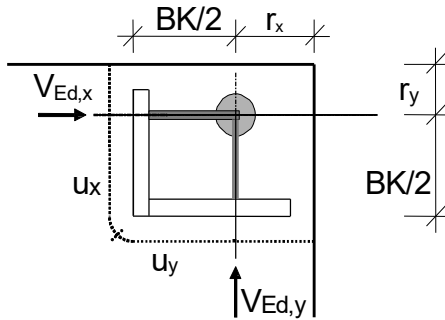
Email:

info@spannverbund.com

Corner shear heads in flat slabs

(For foundation slabs please contact our design team)

For more information about how to use
the pre-dimensioning tables please
refer to the last pages.



Verification:

$$V_{Ed,Total} \leq V_{Rd,Total} = V_{Rd,x} + V_{Rd,y}$$

Design value of the shear resistance $V_{Rd,Total}$ [kN] with a distance to edge of $r_x \approx r_y \approx 10$ cm

(as a simplification $r_x \approx r_y \approx 0$ and $V_{Ed,x} \approx V_{Ed,y} \approx V_{Ed,Total} / 2$ are used)

and with an average reinforcement percentage ρ of

Slab thickness h [cm]	Avg. effective depth d [cm]	0.50%		0.75%		1.00%		1.25%		1.50%	
		Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.
Concrete strength: C40/50											
$f_{ck} = 40$ N/mm²											
20	16.0	74	148	85	170	93	186	100	200	107	214
21	17.0	86	172	98	196	108	216	116	232	123	246
22	17.5	95	190	108	216	119	238	128	256	136	272
23	18.5	108	216	123	246	135	270	146	292	155	310
24	19.0	117	234	134	268	148	296	159	318	169	338
25	20.0	132	264	151	302	166	332	179	358	190	380
26	21.0	145	290	166	332	183	366	197	394	210	420
27	22.0	159	318	182	364	201	402	216	432	230	460
28	23.0	174	348	199	398	219	438	236	472	251	502
29	24.0	189	378	216	432	238	476	257	514	273	546
30	25.0	205	410	234	468	258	516	278	556	295	590
31	26.0	217	434	248	496	273	546	295	590	313	626
32	27.0	230	460	263	526	289	578	312	624	331	662
33	28.0	243	486	278	556	306	612	329	658	350	700
34	29.0	256	512	293	586	322	644	347	694	369	738
35	30.0	269	538	308	616	339	678	366	732	389	778
36	31.0	283	566	324	648	357	714	384	768	409	818
37	31.5	293	586	335	670	369	738	397	794	422	844
38	32.0	302	604	346	692	381	762	410	820	436	872
39	33.0	317	634	363	726	399	798	430	860	457	914
40	34.0	332	664	380	760	418	836	450	900	478	956
41	35.0	347	694	397	794	437	874	471	942	500	1,000
42	36.0	363	726	415	830	457	914	492	984	523	1,046
43	37.0	378	756	433	866	477	954	514	1,028	546	1,092
44	38.0	395	790	452	904	497	994	536	1,072	569	1,138
45	39.0	411	822	471	942	518	1,036	558	1,116	593	1,186
46	40.0	428	856	490	980	539	1,078	581	1,162	617	1,234
47	41.0	445	890	509	1,018	561	1,122	604	1,208	642	1,284
48	42.0	462	924	529	1,058	583	1,166	628	1,256	667	1,334
49	43.0	480	960	550	1,100	605	1,210	652	1,304	692	1,384
50	44.0	498	996	570	1,140	628	1,256	676	1,352	718	1,436
51	44.5	510	1,020	584	1,168	643	1,286	693	1,386	736	1,472
52	45.0	523	1,046	598	1,196	658	1,316	709	1,418	754	1,508
53	46.0	541	1,082	620	1,240	682	1,364	735	1,470	781	1,562
54	47.0	560	1,120	641	1,282	706	1,412	761	1,522	808	1,616
55	48.0	580	1,160	664	1,328	730	1,460	787	1,574	836	1,672
56	49.0	599	1,198	686	1,372	755	1,510	813	1,626	864	1,728
57	50.0	619	1,238	709	1,418	780	1,560	841	1,682	893	1,786
58	51.0	640	1,280	732	1,464	806	1,612	868	1,736	922	1,844
59	52.0	660	1,320	756	1,512	832	1,664	896	1,792	952	1,904
60	53.0	681	1,362	780	1,560	858	1,716	924	1,848	982	1,964

Revision date 11/2016

These results constitute only indicative information in order to pre-dimension the slabs. They cannot be used as the definitive structural design. The definitive structural design is to be carried out by spannverbund. Without a previous contractual arrangement with spannverbund, we assume no liability derived from the misuse of these indications.

Contact us:

Worldwide (replace + by local international call prefix)

Telephone:

(+800 0000100

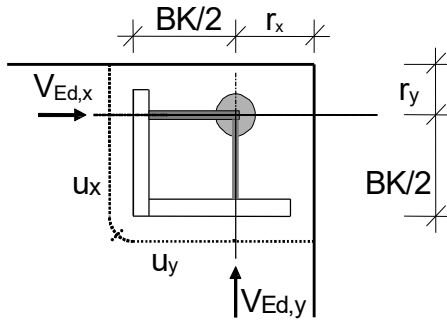
Email:

info@spannverbund.com

Corner shear heads in flat slabs

(For foundation slabs please contact our design team)

For more information about how to use
the pre-dimensioning tables please
refer to the last pages.



Verification:

$$V_{Ed,Total} \leq V_{Rd,Total} = V_{Rd,x} + V_{Rd,y}$$

Design value of the shear resistance $V_{Rd,Total}$ [kN] with a distance to edge of $r_x \approx r_y \approx 10$ cm

(as a simplification $r_x \approx r_y \approx 0$ and $V_{Ed,x} \approx V_{Ed,y} \approx V_{Ed,Total} / 2$ are used)

and with an average reinforcement percentage ρ of

Slab thick- ness h [cm]	Avg. effective depth d [cm]	0.50%		0.75%		1.00%		1.25%		1.50%	
		Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.
Concrete strength: C45/55											
$f_{ck} = 45 \text{ N/mm}^2$											
20	16.0	77	154	88	176	97	194	104	208	111	222
21	17.0	89	178	102	204	112	224	121	242	128	256
22	17.5	98	196	113	226	124	248	133	266	142	284
23	18.5	112	224	128	256	141	282	152	304	161	322
24	19.0	122	244	140	280	154	308	166	332	176	352
25	20.0	137	274	157	314	173	346	186	372	198	396
26	21.0	151	302	173	346	190	380	205	410	218	436
27	22.0	166	332	190	380	209	418	225	450	239	478
28	23.0	181	362	207	414	228	456	245	490	261	522
29	24.0	197	394	225	450	248	496	267	534	284	568
30	25.0	213	426	244	488	268	536	289	578	307	614
31	26.0	226	452	258	516	284	568	306	612	326	652
32	27.0	239	478	273	546	301	602	324	648	344	688
33	28.0	252	504	289	578	318	636	342	684	364	728
34	29.0	266	532	305	610	335	670	361	722	384	768
35	30.0	280	560	321	642	353	706	380	760	404	808
36	31.0	295	590	337	674	371	742	400	800	425	850
37	31.5	304	608	348	696	383	766	413	826	439	878
38	32.0	314	628	360	720	396	792	426	852	453	906
39	33.0	329	658	377	754	415	830	447	894	475	950
40	34.0	345	690	395	790	435	870	468	936	498	996
41	35.0	361	722	413	826	455	910	490	980	520	1,040
42	36.0	377	754	432	864	475	950	512	1,024	544	1,088
43	37.0	394	788	450	900	496	992	534	1,068	568	1,136
44	38.0	410	820	470	940	517	1,034	557	1,114	592	1,184
45	39.0	428	856	489	978	539	1,078	580	1,160	617	1,234
46	40.0	445	890	509	1,018	561	1,122	604	1,208	642	1,284
47	41.0	463	926	530	1,060	583	1,166	628	1,256	667	1,334
48	42.0	481	962	550	1,100	606	1,212	653	1,306	694	1,388
49	43.0	499	998	572	1,144	629	1,258	678	1,356	720	1,440
50	44.0	518	1,036	593	1,186	653	1,306	703	1,406	747	1,494
51	44.5	531	1,062	608	1,216	669	1,338	720	1,440	765	1,530
52	45.0	543	1,086	622	1,244	685	1,370	738	1,476	784	1,568
53	46.0	563	1,126	644	1,288	709	1,418	764	1,528	812	1,624
54	47.0	583	1,166	667	1,334	734	1,468	791	1,582	841	1,682
55	48.0	603	1,206	690	1,380	760	1,520	818	1,636	870	1,740
56	49.0	623	1,246	714	1,428	785	1,570	846	1,692	899	1,798
57	50.0	644	1,288	737	1,474	812	1,624	874	1,748	929	1,858
58	51.0	665	1,330	761	1,522	838	1,676	903	1,806	959	1,918
59	52.0	687	1,374	786	1,572	865	1,730	932	1,864	990	1,980
60	53.0	708	1,416	811	1,622	892	1,784	961	1,922	1,022	2,044

Revision date 11/2016

These results constitute only indicative information in order to pre-dimension the slabs. They cannot be used as the definitive structural design. The definitive structural design is to be carried out by spannverbund. Without a previous contractual arrangement with spannverbund, we assume no liability derived from the misuse of these indications.

Contact us:

Worldwide (replace + by local international call prefix)

Telephone:

(+800 0000100

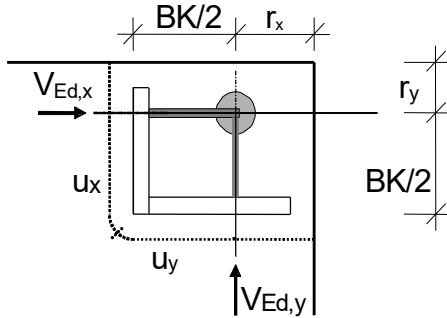
Email:

info@spannverbund.com

Corner shear heads in flat slabs

(For foundation slabs please contact our design team)

For more information about how to use
the pre-dimensioning tables please
refer to the last pages.



Verification:

$$V_{Ed,Total} \leq V_{Rd,Total} = V_{Rd,x} + V_{Rd,y}$$

Design value of the shear resistance $V_{Rd,Total}$ [kN] with a distance to edge of $r_x \approx r_y \approx 10$ cm

(as a simplification $r_x \approx r_y \approx 0$ and $V_{Ed,x} \approx V_{Ed,y} \approx V_{Ed,Total} / 2$ are used)

and with an average reinforcement percentage ρ of

Slab thickness h [cm]	Avg. effective depth d [cm]	0.50%		0.75%		1.00%		1.25%		1.50%	
		Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.
Concrete strength: C50/60											
$f_{ck} = 50$ N/mm²											
20	16.0	80	160	91	182	100	200	108	216	115	230
21	17.0	92	184	105	210	116	232	125	250	133	266
22	17.5	102	204	117	234	128	256	138	276	147	294
23	18.5	116	232	133	266	146	292	157	314	167	334
24	19.0	126	252	145	290	159	318	172	344	182	364
25	20.0	142	284	163	326	179	358	193	386	205	410
26	21.0	156	312	179	358	197	394	212	424	226	452
27	22.0	172	344	196	392	216	432	233	466	247	494
28	23.0	187	374	214	428	236	472	254	508	270	540
29	24.0	204	408	233	466	257	514	276	552	294	588
30	25.0	221	442	252	504	278	556	299	598	318	636
31	26.0	234	468	268	536	295	590	317	634	337	674
32	27.0	247	494	283	566	312	624	336	672	357	714
33	28.0	261	522	299	598	329	658	355	710	377	754
34	29.0	276	552	315	630	347	694	374	748	397	794
35	30.0	290	580	332	664	366	732	394	788	419	838
36	31.0	305	610	349	698	384	768	414	828	440	880
37	31.5	315	630	361	722	397	794	428	856	455	910
38	32.0	325	650	373	746	410	820	442	884	469	938
39	33.0	341	682	391	782	430	860	463	926	492	984
40	34.0	357	714	409	818	450	900	485	970	515	1,030
41	35.0	374	748	428	856	471	942	507	1,014	539	1,078
42	36.0	391	782	447	894	492	984	530	1,060	563	1,126
43	37.0	408	816	467	934	514	1,028	553	1,106	588	1,176
44	38.0	425	850	487	974	536	1,072	577	1,154	613	1,226
45	39.0	443	886	507	1,014	558	1,116	601	1,202	639	1,278
46	40.0	461	922	528	1,056	581	1,162	626	1,252	665	1,330
47	41.0	479	958	549	1,098	604	1,208	651	1,302	691	1,382
48	42.0	498	996	570	1,140	628	1,256	676	1,352	718	1,436
49	43.0	517	1,034	592	1,184	652	1,304	702	1,404	746	1,492
50	44.0	537	1,074	614	1,228	676	1,352	728	1,456	774	1,548
51	44.5	550	1,100	629	1,258	693	1,386	746	1,492	793	1,586
52	45.0	563	1,126	644	1,288	709	1,418	764	1,528	812	1,624
53	46.0	583	1,166	667	1,334	735	1,470	791	1,582	841	1,682
54	47.0	604	1,208	691	1,382	761	1,522	819	1,638	871	1,742
55	48.0	624	1,248	715	1,430	787	1,574	848	1,696	901	1,802
56	49.0	646	1,292	739	1,478	813	1,626	876	1,752	931	1,862
57	50.0	667	1,334	764	1,528	841	1,682	905	1,810	962	1,924
58	51.0	689	1,378	789	1,578	868	1,736	935	1,870	994	1,988
59	52.0	711	1,422	814	1,628	896	1,792	965	1,930	1,026	2,052
60	53.0	734	1,468	840	1,680	924	1,848	996	1,992	1,058	2,116

Revision date 11/2016

These results constitute only indicative information in order to pre-dimension the slabs. They cannot be used as the definitive structural design. The definitive structural design is to be carried out by spannverbund. Without a previous contractual arrangement with spannverbund, we assume no liability derived from the misuse of these indications.

Contact us:

Worldwide (replace + by local international call prefix)

Telephone:

(+800 0000100

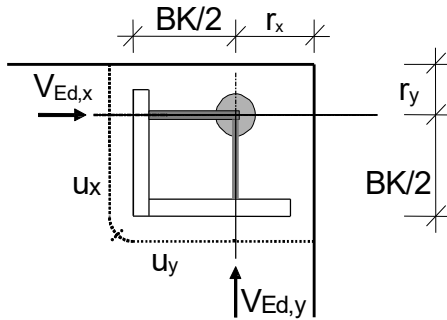
Email:

info@spannverbund.com

Corner shear heads in flat slabs

(For foundation slabs please contact our design team)

For more information about how to use
the pre-dimensioning tables please
refer to the last pages.



Verification:

$$V_{Ed,Total} \leq V_{Rd,Total} = V_{Rd,x} + V_{Rd,y}$$

Design value of the shear resistance $V_{Rd,Total}$ [kN] with a distance to edge of $r_x \approx r_y \approx 10$ cm

(as a simplification $r_x \approx r_y \approx 0$ and $V_{Ed,x} \approx V_{Ed,y} \approx V_{Ed,Total} / 2$ are used)

and with an average reinforcement percentage ρ of

Slab thick- ness h [cm]	Avg. effective depth d [cm]	0.50%		0.75%		1.00%		1.25%		1.50%	
		Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.	Without shear reinf.	With shear reinf.
Concrete strength: C55/67											
$f_{ck} = 55 \text{ N/mm}^2$											
20	16.0	82	164	94	188	104	208	112	224	119	238
21	17.0	95	190	109	218	120	240	129	258	137	274
22	17.5	105	210	120	240	132	264	143	286	152	304
23	18.5	120	240	137	274	151	302	162	324	172	344
24	19.0	131	262	149	298	165	330	177	354	188	376
25	20.0	147	294	168	336	185	370	199	398	211	422
26	21.0	162	324	185	370	204	408	219	438	233	466
27	22.0	177	354	203	406	223	446	240	480	255	510
28	23.0	193	386	221	442	244	488	262	524	279	558
29	24.0	210	420	241	482	265	530	285	570	303	606
30	25.0	228	456	261	522	287	574	309	618	328	656
31	26.0	241	482	276	552	304	608	328	656	348	696
32	27.0	255	510	292	584	322	644	347	694	368	736
33	28.0	270	540	309	618	340	680	366	732	389	778
34	29.0	284	568	326	652	358	716	386	772	410	820
35	30.0	300	600	343	686	377	754	407	814	432	864
36	31.0	315	630	361	722	397	794	428	856	454	908
37	31.5	325	650	373	746	410	820	442	884	469	938
38	32.0	336	672	385	770	423	846	456	912	485	970
39	33.0	352	704	403	806	444	888	478	956	508	1,016
40	34.0	369	738	422	844	465	930	501	1,002	532	1,064
41	35.0	386	772	442	884	486	972	524	1,048	556	1,112
42	36.0	403	806	461	922	508	1,016	547	1,094	581	1,162
43	37.0	421	842	482	964	530	1,060	571	1,142	607	1,214
44	38.0	439	878	502	1,004	553	1,106	595	1,190	633	1,266
45	39.0	457	914	523	1,046	576	1,152	620	1,240	659	1,318
46	40.0	476	952	545	1,090	599	1,198	646	1,292	686	1,372
47	41.0	495	990	566	1,132	623	1,246	672	1,344	714	1,428
48	42.0	514	1,028	589	1,178	648	1,296	698	1,396	742	1,484
49	43.0	534	1,068	611	1,222	673	1,346	725	1,450	770	1,540
50	44.0	554	1,108	634	1,268	698	1,396	752	1,504	799	1,598
51	44.5	567	1,134	650	1,300	715	1,430	770	1,540	818	1,636
52	45.0	581	1,162	665	1,330	732	1,464	789	1,578	838	1,676
53	46.0	602	1,204	689	1,378	758	1,516	817	1,634	868	1,736
54	47.0	623	1,246	713	1,426	785	1,570	846	1,692	899	1,798
55	48.0	645	1,290	738	1,476	812	1,624	875	1,750	930	1,860
56	49.0	667	1,334	763	1,526	840	1,680	905	1,810	961	1,922
57	50.0	689	1,378	788	1,576	868	1,736	935	1,870	993	1,986
58	51.0	711	1,422	814	1,628	896	1,792	965	1,930	1,026	2,052
59	52.0	734	1,468	840	1,680	925	1,850	996	1,992	1,059	2,118
60	53.0	757	1,514	867	1,734	954	1,908	1,028	2,056	1,092	2,184

Revision date 11/2016

These results constitute only indicative information in order to pre-dimension the slabs. They cannot be used as the definitive structural design. The definitive structural design is to be carried out by spannverbund. Without a previous contractual arrangement with spannverbund, we assume no liability derived from the misuse of these indications.

Contact us:

Worldwide (replace + by local international call prefix)

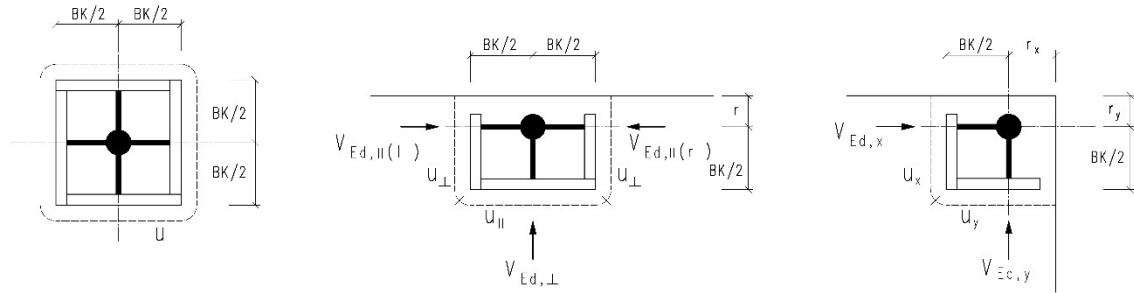
Telephone:

(+800 0000100

Email:

info@spannverbund.com

Europilz® shear head How to use the pre-dimensioning tables



The tables are valid for homogeneously loaded solid concrete slabs in concrete C20/25 to C55/67 with slab thicknesses between 20.0 and 60.0 cm and longitudinal reinforcement percentage between 0.5 and 1.75% (1.5% in interior Europilz®). In flat concrete slabs, the bottom flange of the Europilz® is 2.0 cm above the bottom formwork.

The punching shear resistance is calculated according to our technical approval (Z-15.1-234) as well as to BS EN 1992-1-1+NA.

The table values V_{Rd} are design values of the maximal possible punching shear resistance for a specific slab thickness. The width of the Europilz® (BK) varies and will be optimized by us depending on the slab thickness and the boundary conditions. The thicker the slab is and the higher the reinforcement grade is, the smaller and consequently cheaper is the Europilz®. The maximum width of the shear head for a specific slab thickness is limited to a fixed value for structural and constructive reasons.

In edge and corner Europilz® only a verification of the shear resistance instead of a verification of the punching shear will be conducted. The punching shear load can be determined as the addition of the loads in every quadrant with no additional β . For this reason, if the spans and the shear force distribution in the critical section are homogeneous, the total support reaction determined with FE software can be used with factor $\beta=1$.

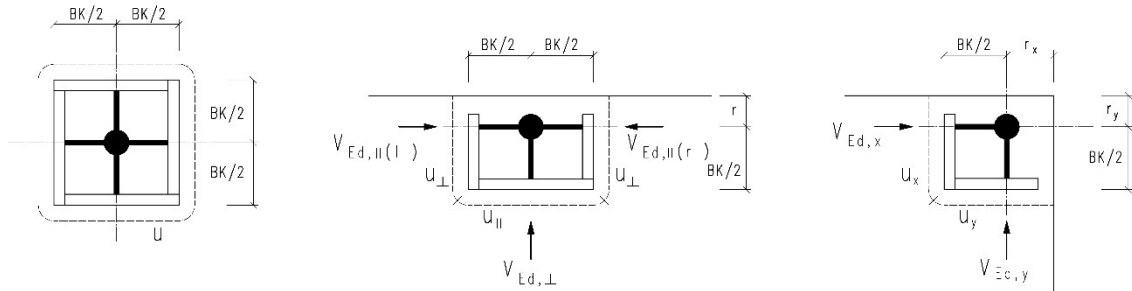
Furthermore, for the calculation of the edge and corner Europilz®, the distances r , r_x and r_y are not considered in the calculation (safe estimation).

Besides the results of this calculation, further requirements regarding the minimum slab thickness due to deflection criteria as well as the minimum slab reinforcement must be considered.

If your data deviates from the assumptions in this pre-dimensioning, i.e., other slab thicknesses, effective depths, loads, percentage of slab reinforcement, concrete grades, wall or wall corner situations, heterogeneously distributed loads (i.e., line or concentrated loads), bigger distances to edge or heterogeneous span widths in edge and corner Europilz® as well as **Europilz® in slab foundations**, please contact us.

Slab openings also in the interior of the Europilz®, are possible. Their location, sizes and the effect on the design results can be discussed in detail with our technical team.

Europilz® shear head Pre-dimensioning examples



Examples of interior shear head:

Parameter: Flat slab in C30/37 with punching shear load: $V_{Ed} = 1,220 \text{ kN}$, $\beta = 1.10$, thus: $\beta \cdot V_{Ed} = 1,342 \text{ kN}$

Desired: Min. slab thickness with $\rho_l = 1.0\%$, without additional shear/punching shear reinforcement

Result: $h = 30 \text{ cm}$ ($d = 25 \text{ cm}$) with $V_{Rd} = 1,349 \text{ kN} > 1,342 \text{ kN}$

Or:

Parameter: Flat slab in C30/37 with punching shear load: $V_{Ed} = 1,220 \text{ kN}$, $\beta = 1.10$, thus: $\beta \cdot V_{Ed} = 1,342 \text{ kN}$

Desired: Min. slab thickness with $\rho_l = 0.75\%$, **with** additional shear/punching shear reinforcement.

Result: $h = 27 \text{ cm}$ ($d = 22 \text{ cm}$) with $V_{Rd} = 1,395 \text{ kN} > 1,342 \text{ kN}$

Example of edge shear head: (Punching shear load = Addition of quadrant loads without β)

Parameter: Flat slab in C30/37 with punching shear load: $V_{Ed, \text{total}} = 410 \text{ kN}$, $L_{x1} \approx L_{x2} \approx L_y$, $r = \text{very small}$

Desired: Min. slab thickness with $\rho_l = 0.75\%$, without additional shear/punching shear reinforcement

Result: $h = 30 \text{ cm}$ ($d = 25 \text{ cm}$) with $V_{Rd, \text{total}} = 426 \text{ kN} > 410 \text{ kN}$

Example of corner shear head: (Punching shear load = Addition of quadrant loads without β)

Parameter: Flat slab in C30/37 with punching shear load: $V_{Ed, \text{total}} = 210 \text{ kN}$, $L_x \approx L_y$, $r_x \approx r_y = \text{very small}$

Desired: Min. slab thickness with $\rho_l = 0.75\%$, without additional shear/punching shear reinforcement

Result: $h = 30 \text{ cm}$ ($d = 25 \text{ cm}$) mit $V_{Rd, \text{total}} = 213 \text{ kN} > 210 \text{ kN}$