



FELIZ

COMPOSITE SLAB

H60 DECK PROFILE





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COMPANY

Where we come from, who we are and what we do.

Headquartered in Braga and with more than 6 decades of experience in its field, O FELIZ - Metalomecânica is a company specialized in metallic construction, sheet profiling, cutting and bending of sheets, construction of lighting columns and communication towers, metalworking in stainless steel and laser cutting.

A policy of continuous investment in state of the art equipment and a focus on highly qualified and competent staff allows the company to maintain a production capacity and an immediate response to the market's demands and requests, making it a reference in its fields of action.

With a portfolio of well-known projects and clients, the company has the required knowledge and means to serve in the global market, with solutions starting at the conception and elaboration of the project, all the way to the construction and final assembly.

By focusing on the efficiency of the procedures and keeping a strong market orientation, the company has been able to establish itself in an extremely competitive market, conquering its customer's trust due to the quality of the final product and the ability to follow through within the deadlines.

With a growth strategy aimed at internationalization, O FELIZ - Metalomecânica exports to several countries and has an industrial unit in Angola which has production capacity and the ability to offer solutions for the market's needs and requests.

QUALITY POLICY

Being successful is being happy.

Working in an extremely competitive market, where clients are more and more demanding, the Administration of O FELIZ believes that only with a real involvement, a strong market orientation, the optimization of all resources and a reduction of the activities which do not add value, as well as a strict compliance with the legal and statutory requirements applicable to the product, a sustained growth can be possible.

We are committed to this goal, believing that together we will improve the performance of our organization and we will stand as a reference company.

INTRODUCTION

Definition of Composite Slab.

A composite slab is a slab made with profiled steel sheeting as permanent shuttering, capable of sustaining the weight of the wet concrete, the reinforcement steel and the construction imposed loads in the construction phase. Afterwards, the same sheeting is structurally combined with the concrete to create part of, or even the entire traction frame.

The use of composite slabs in buildings has significantly grown in Europe in the last 20 years. This is mostly due to the high structural performance and financial attractiveness of this solution, as well as the development of the steel and concrete composite structures design European support standards.

Being a fairly recent solution, it is important to define design, construction and safety rules to support its implementation in buildings. The main advantages in using this solution are the ease of production and assembly, as well as the fact that the traditional shuttering is not required.

O Feliz presents the H60 deck profile as a solution for application in composite slab. In order to make the right design of composite slabs with this profile, several studies have been developed – both static and dynamic – which have led to the creation of direct calculation tables and the H60 Calculator software, available for free download at www.ofeliz.pt.

O Feliz is committed to encourage the investigation to develop this type of structural solution.

REGULATORY FRAMEWORK

The design of this type of slab is currently determined in the standard EN 1994-1-1: Design of Composite Steel and Concrete Structures – General Rules and Rules for Building. We present in this regulation the calculation models to verify the resistance to flexure, shear stress and puncture, as well as the service conditions: deformations, vibrations and cracking. However, the verification of resistance to longitudinal shear, which is the most conditioning rupture mode in running spans, requires that the m and k parameters are obtained through experiment.

The safety verifications of the H60 deck profile in the construction phase were made in accordance with the standard EN 1993-1-3 Design of Steel Structures – Supplementary rules for cold-formed members and sheeting. In this phase, the metallic sheeting, possibly with some temporary propping, is the only resistant element.

The tests for characterization of the steel-concrete connection were made in accordance with Annex B.3 of the standard NP EN 1994-1-1, at the Materials and Structures Test Lab of the Civil Engineering Department of the University of Coimbra, under coordination of Professor Rui Simões.

The dynamic behavior (vibrations) of composite slabs with the H60 deck profile was also evaluated, based in tests. This work was developed in the Science and Technology Faculty of the University of Coimbra, under coordination of Professor Carlos Rebelo.

The vibration limit state is the guarantee of comfort levels compatible with the use intended for the floor. The dynamic actions considered in this verification are exclusively the resulting actions of the movement of people during the normal use of the floor. For the verification of the vibration limit state, the method used was the one mentioned in 'Design Guide for Floor Vibrations'. This method uses the OS-RMS90 (One Step Root Mean Square) parameter, corresponding to the harmonic vibration induced in the pavement by the representative step of people circulation.

H60 PROFILE

Characteristics.

The H60 profile is made by cold form profiling. It is manufactured from hot-dip zinc galvanized metal coils class S320GD+Z, in accordance with the standard EN 10346:2009. The steel properties are listed in Table 1.

Table 1 – Steel properties

Yield Strength	$f_{yb} \geq 320 \text{ N/mm}^2$
Ultimate Tensile Strength	$f_u \geq 390 \text{ N/mm}^2$
Post Rupture Elongation	$\delta \geq 17\%$

The H60 profile's geometry is represented in Image 1 (dimensions in millimeters).



Image 1 – Geometry of H60 profile

The mechanical characteristics of the H60 profile are listed in Table 2 (gross section) and Table 3 (effective section in positive flexion).

Table 2 – Mechanical characteristics of the H60 profile – gross section

Sheeting thickness [mm]	Weight [kN/m ²]	A_{nominal} [cm ² /m]	A_{pe} [cm ² /m]	h [mm]	y_G [mm]	I_p [cm ⁴ /m]
0.7	0.078	9.90	9.17	60	34	56.10
0.8	0.089	11.37	10.59	60	34	64.59
1.0	0.111	14.20	13.34	60	34	81.61
1.2	0.134	17.02	16.15	60	34	98.59

Where:

A_{pe} - equivalent area, with reduced core thickness in order to consider the reduction of the yield strength in those areas;

y_G - gravity center referring to the base of the profiled sheeting;

h - height of the H60 deck profile;

I_p - inertia moment.

Table 3 – Mechanical characteristics of the H60 deck profile – effective section in positive bending

Sheeting thickness [mm]	A_{ef} [cm ² /m]	$y_{G,\text{ef}}$ [mm]	$V_{\text{Rd,ef}}$ [kN/m]	I_{ef} [cm ⁴ /m]	W_{eLef} [cm ³ /m]	$M_{\text{Rd,ef}}$ [kNm/m]	EI_{ef} [kNm ² /m]
0.7	7.82	29.8	48.09	45.98	15.2	4.9	96.56
0.8	9.07	30.0	63.77	53.49	17.8	5.7	112.33
1.0	11.59	30.3	101.75	68.60	22.6	7.2	144.06
1.2	14.12	30.6	132.18	83.84	27.4	8.8	176.06

Where:

$A_{\text{ef}}, y_{G,\text{ef}}, I_{\text{ef}}, W_{\text{eLef}}$ - effective area, position of the gravity center, inertia moment and elastic flexion module of the effective section in positive bending, respectively;

$V_{\text{Rd,ef}}, M_{\text{Rd,ef}}$ - shear stress and resistant bending moment of the sheeting's effective section, respectively;

EI_{ef} - flexure rigidity of the effective section in positive bending.

In Table 4 are listed the parameters for evaluating the resistance to longitudinal shear, obtained by tests.

Table 4 – Parameters of longitudinal shear

m [N/mm ²]	98.32
k [N/mm ²]	0.080

COMPOSITE SLABS

Characteristics.

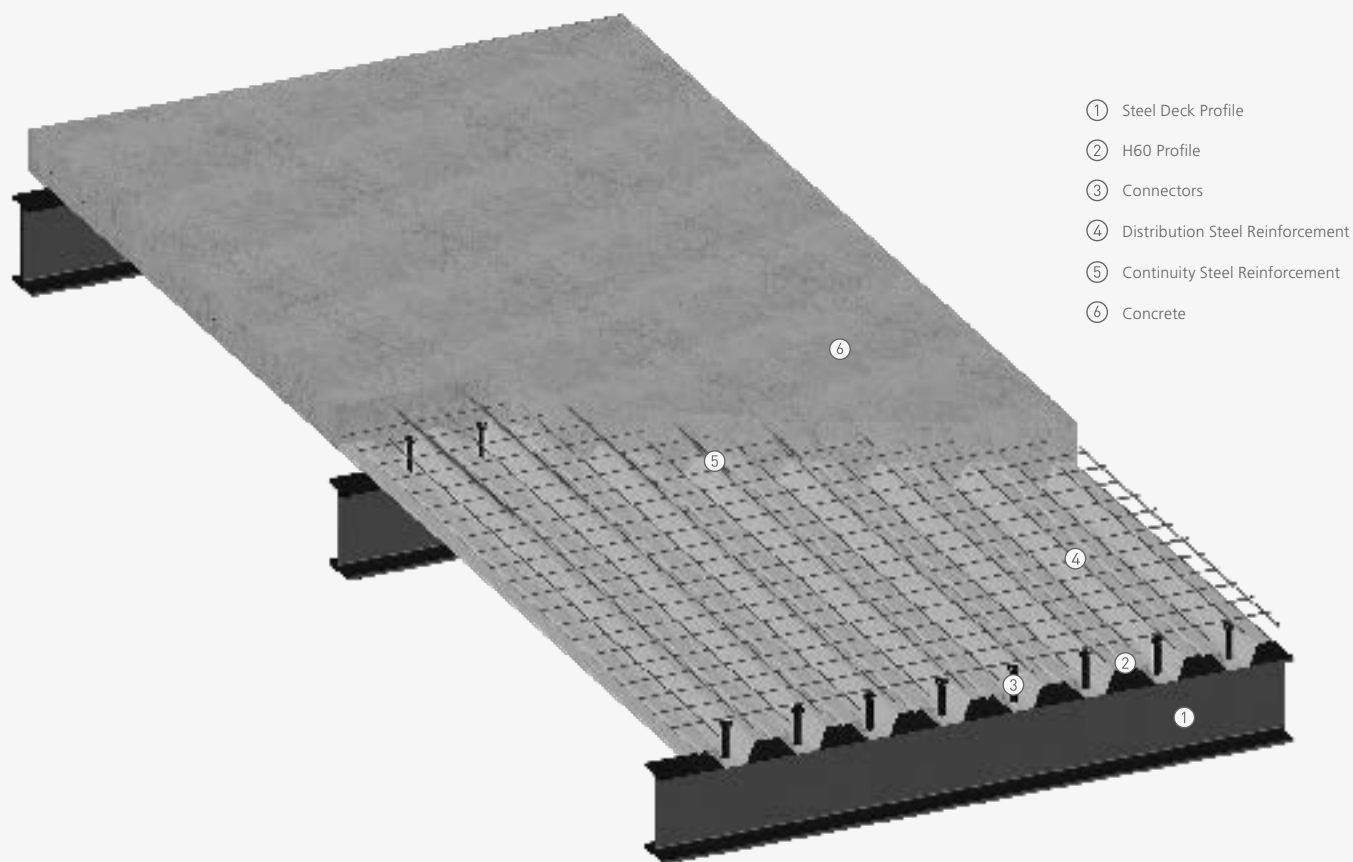


Image 2 – Assembling scheme for a Mixed Slab

When creating this document, we considered the use of concrete in accordance with the standard NP EN 206-1. The reinforcement steel and the electrowelded mesh were considered to be made with type A400 and A500 steel, whose properties verify what is laid down by the standard EN Specification LNEC.

In Table 5 are listed the volumes and weights of reinforced concrete per square meter of slab, for the various heights, considering $\gamma_{\text{concrete}} = 25 \text{ kN/m}^3$.

Table 5 – Volume and weight of concrete

h_f [cm]	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Volume [m ³ /m ²]	0.064	0.074	0.084	0.094	0.104	0.114	0.124	0.134	0.144	0.154	0.164	0.174	0.184	0.194	0.204	0.214
Weight [kN/m ²]	1.60	1.85	2.10	2.35	2.60	2.85	3.10	3.35	3.60	3.85	4.10	4.35	4.60	4.85	5.10	5.35

In Tables 6 to 8 are listed the values of inertia moments, for long term effects, relevant to the 3 most common classes of concrete: C20/25, C25/30 and C30/37. When calculating the inertia for hogging bending, we considered a continuity steel reinforcement built with $\phi 10$ mm reinforcing bars set 0.15 m apart, for about 5.24 cm²/m. In this area we have not included the distribution steel reinforcement, since, according to clause 5.5.1 (6) of the standard NP EN 1994-1-1, it may not have enough ductility, especially when built with plain electrowelded mesh.

Table 6 – Inertia moments for composed slabs with H60 sheeting and C20/25 concrete

Concrete	Deck Profile [mm]	Inertia [cm ⁴ /m]	Slab Thickness [cm]																
			10	11	12	13	14	15	16	17	18	18	20	21	22	23	24	25	
C20/25	0.70	Bending +	Cracked	2393	11	3964	95	6087	34	875	1030	1199	1383	1581	1795	2023	2266	2525	2798
			Uncracked	4756	25	8051	020	1273	1568	1908	2297	2739	3237	3795	4416	5105	5863	6696	7606
		Medium	3574	68	6017	57	940	1151	1391	1663	1969	2310	2688	3106	3564	4065	4610	5202	
	0.80	Bending +	Cracked	89	1251	69	2192	77	3434	16	4975	86	6837	88	901	1022	1152	1290	1436
			Uncracked	2653	45	4395	49	6748	15	972	1145	1334	1540	1763	2003	2259	2532	2823	3131
		Medium	4916	44	8291	049	1308	1610	1958	2356	2807	3315	3883	4515	5215	5986	6832	7757	
	1.00	Bending +	Cracked	89	1251	69	2192	77	3434	16	4975	86	6837	88	901	1022	1152	1290	1436
			Uncracked	3124	05	5166	46	7949	61	1148	1355	1581	1828	2095	2382	2690	3020	3370	3741
		Medium	5206	81	8751	105	1376	1691	2053	2467	2935	3462	4050	4704	5427	6223	7095	8046	
	1.20	Bending +	Cracked	4165	43	6968	76	1085	1326	1601	1911	2258	2645	3073	3543	4059	4621	5232	5893
			Uncracked	89	1251	69	2192	77	3434	16	4975	86	6837	88	901	1022	1152	1290	1436
		Medium	3554	60	5867	33	903	1094	1308	1545	1805	2089	2397	2729	3086	3467	3872	4303	
1.20	Bending +	Cracked	5497	16	9181	159	1441	1768	2145	2574	3059	3604	4212	4887	5632	6451	7348	8326	
		Uncracked	4525	88	7529	46	1172	1431	1726	2059	2432	2846	3304	3808	4359	4959	5610	6315	
	Medium	89	1251	69	2192	77	3434	16	4975	86	6837	88	901	1022	1152	1290	1436		

Table 7 – Inertia moments for composed slabs with H60 sheeting and C25/30 concrete

Concrete	Deck profile (mm)	Inertia [cm ⁴ /m]	Slab thickness (cm)																
			10	11	12	13	14	15	16	17	18	18	20	21	22	23	24	25	
C25/30	0.70	Bending +	Cracked	241	314	400	500	613	740	882	1038	1208	1394	1593	1808	2038	2283	2542	2817
			Uncracked	488	641	826	1047	1307	1611	1961	2361	2816	3328	3903	4542	5251	6032	6889	7827
		Medium	365	478	613	773	960	1176	1421	1700	2012	2361	2748	3175	3644	4157	4716	5322	
	0.80	Bending +	Cracked	90	127	171	222	280	347	421	502	592	690	795	909	1031	1162	1300	1447
			Uncracked	267	348	443	554	680	822	981	1155	1346	1553	1777	2018	2276	2552	2844	3153
		Medium	503	661	851	1077	1343	1653	2011	2420	2884	3406	3991	4641	5362	6155	7026	7978	
	1.00	Bending +	Cracked	385	504	647	815	1012	1238	1496	1787	2115	2480	2884	3330	3819	4353	4935	5566
			Uncracked	90	127	171	222	280	347	421	502	592	690	795	909	1031	1162	1300	1447
		Medium	315	409	522	653	802	971	1159	1368	1596	1844	2114	2403	2714	3045	3398	3771	
	1.20	Bending +	Cracked	533	698	897	1133	1411	1735	2107	2532	3013	3554	4159	4831	5575	6393	7290	8268
			Uncracked	424	554	709	893	1107	1353	1633	1950	2304	2699	3136	3617	4144	4719	5344	6020
		Medium	90	127	171	222	280	347	421	502	592	690	795	909	1031	1162	1300	1447	
1.20	Bending +	Cracked	359	465	593	742	912	1106	1322	1561	1824	2110	2421	2755	3114	3498	3907	4341	
		Uncracked	562	734	941	1187	1476	1812	2199	2639	3137	3697	4321	5015	5781	6623	7545	8550	
	Medium	460	599	767	964	1194	1459	1760	2100	2480	2903	3371	3885	4448	5061	5726	6446		
1.20	Bending +	Cracked	90	127	171	222	280	347	421	502	592	690	795	909	1031	1162	1300	1447	
		Uncracked	359	465	593	742	912	1106	1322	1561	1824	2110	2421	2755	3114	3498	3907	4341	
	Medium	562	734	941	1187	1476	1812	2199	2639	3137	3697	4321	5015	5781	6623	7545	8550		

Table 8 – Inertia moments for composed slabs with H60 sheeting and C30/37 concrete

Concrete	Sheet metal (mm)	Inertia [cm ⁴ /m]	Slab thickness (cm)																
			10	11	12	13	14	15	16	17	18	18	20	21	22	23	24	25	
C30/37	0.70	Bending +	Cracked	246	319	407	508	623	752	896	1054	1227	1414	1616	1833	2066	2313	2576	2854
			Uncracked	513	674	869	1102	1376	1696	2066	2489	2969	3510	4117	4793	5542	6368	7276	8268
		Medium	379	497	638	805	1000	1224	1481	1771	2098	2462	2867	3313	3804	4341	4926	5561	
	0.80	Bending +	Cracked	92	130	175	227	286	354	429	512	603	702	809	925	1048	1180	1321	1470
			Uncracked	272	354	451	564	692	836	997	1174	1367	1577	1804	2049	2310	2588	2884	3197
		Medium	528	694	894	1132	1413	1739	2117	2548	3037	3588	4206	4893	5654	6493	7414	8420	
	1.00	Bending +	Cracked	400	524	673	848	1052	1288	1557	1861	2202	2583	3005	3471	3982	4540	5149	5808
			Uncracked	92	130	175	227	286	354	429	512	603	702	809	925	1048	1180	1321	1470
		Medium	321	418	532	665	818	989	1181	1392	1624	1876	2149	2443	2758	3093	3450	3829	
	1.20	Bending +	Cracked	558	732	940	1189	1482	1822	2214	2661	3168	3738	4376	5085	5869	6733	7679	8713
			Uncracked	440	575	736	927	1150	1406	1697	2027	2396	2807	3262	3764	4313	4913	5565	6271
		Medium	92	130	175	227	286	354	429	512	603	702	809	925	1048	1180	1321	1470	
1.20	Bending +	Cracked	366	475	605	757	931	1128	1348	1591	1858	2149	2465	2805	3169	3559	3973	4413	
		Uncracked	588	768	985	1244	1548	1901	2307	2770	3294	3882	4540	5270	6077	6965	7937	8997	
	Medium	477	621	795	1000	1239	1514	1827	2180	2576	3016	3502	4037	4623	5262	5955	6705		
1.20	Bending +	Cracked	92	130	175	227	286	354	429	512	603	702	809	925	1048	1180	1321	1470	
		Uncracked	366	475	605	757	931	1128	1348	1591	1858	2149	2465	2805	3169	3559	3973	4413	
	Medium	588	768	985	1244	1548	1901	2307	2770	3294	3882	4540	5270	6077	6965	7937	8997		

DIRECT DESIGN TABLES

Assumptions and explanations about the use of the tables.

GENERAL ASSUMPTIONS

These tables were created with the following assumptions:

- evenly distributed loads in the definitive phase (composite phase);
- the permanent loads in the composite phase only include the slab's weight; the remaining permanent loads are added to the imposed loads;
- maximum admissible deflection for the definitive phase equals $L/300$;
- the long term fluency of the concrete is taken into account considering a reduced elasticity module given by $E_{cm}/2$;
- minimum steel reinforcement of $80 \text{ mm}^2/\text{m}$ in each direction at the top side;
- in the continuous composite slabs, we considered a maximum redistribution of hogging bending moments of 30%;
- the continuity frame in continuous mixed slabs is made of $\varnothing 10 \text{ mm} // 0.15 \text{ m}$ in S500 steel;
- where the composite slab is designed as continuous, it is permitted to use an equivalent isostatic span. In that case it should be considered a longitudinal steel reinforcement in the middle supports (at the top side), for a crackling control of 0.4% or 0.2% of the area of the concrete's cross section above the ribs, whether the slab is respectively unpropping or not during the construction phase. With continuous slabs, this frame should be calculated in accordance with clause 7.3 of the standard EN 1992-1-1;
- the values for m and k obtained through the tests made with C25/30 concrete are valid for all the classes above C25/30 and also for class C20/25;
- the sheet cores, due to the presence of humps and the "harmonica" effect, were considered through a reduced thickness.

ADDITIONAL ASSUMPTIONS REGARDING THE CONSTRUCTION PHASE

In the construction phase, we always consider the sheeting to be simply supported between any support or props:

- the sheeting was verified for ultimate limit states and serviceability limit states; to verify the serviceability limit state we considered as limit a maximum deflection of $L/240$;
- in the construction phase, we considered the actions indicated in Image 3;
- load 1 represents the weight of the sheeting plus the wet concrete. Load 2 represents a constructive imposed load with a maximum acting width of 3 meters; and load 3 also represents a constructive imposed load that should be applied in the exceeding area, when the width is larger than 3 meters.

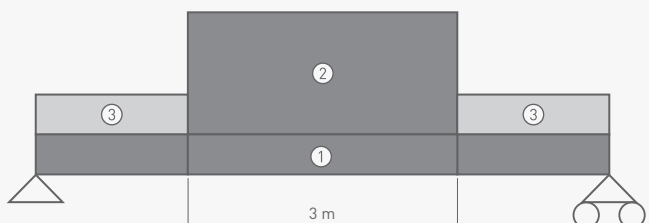


Image 3 – Actions in the construction phase

DIRECT DESIGN TABLES

Assumptions and explanations about the use of the tables.

We considered the puddle effect, which consists on the increase of the concrete's thickness due to the deformation of the sheeting. This effect must be included every time the midspan deflection for service conditions is larger than 1/10 of the final overall thickness of the composite slab. The thickness increase was considered to be 0.7 times the midspan deflection, in order to calculate the acting efforts and the maximum deflection.

The verification of the construction phase is assured as long as the limit values for the distance between the propping elements, as indicated in the following calculation tables, are respected.

FIRE RESISTANCE

According to clause 4.3.2 of the standard EN 1994-1-2, the non-protected composite slabs with structural framing have a fire resistance of, at least, 30 minutes without the need for additional reinforcement. In case you need a longer fire resistance than 30 minutes, please contact our company's Technical Department.

EXPLANATORY NOTE ABOUT THE USE OF THE TABLES

All the presented tables have in common: the sheeting thickness, the class of the concrete and the type of support (continuous or simple support slab).

The tables have two entries: the first column refers to the spans, in meters, while the first line refers to the total height of the composite slab, in centimeters.

The values listed on the table refer to of the characteristic value of the overall sum of the acting loads (imposed loads, linings, walls, etc) that the composite slab can take, on top of its own weight. In this scenario, we added $\gamma_g = 1.35$ to the weight of the slab and $\gamma_q = 1.50$ to the remaining loads (overloads, linings, walls, etc.).

$$1.35 P_{Laje} + 1.50 P$$




Where P is the value mentioned in the direct calculation tables.

When verifying the deformations in the definite state (Serviceability Limit States) the rare combination of actions was used.

The maximum admissible loads in the table are conditioned by one of the following modes:

- i) vertical shear;
- ii) longitudinal shear;
- iii) deformation.

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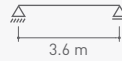
-  Vertical shear;
-  Longitudinal shear;
-  Deformation.

EXAMPLE

Slab design using the direct design tables.

The goal is the sizing of a slab with the following characteristics:

- Structural scheme of the slab:
- distance between supports: $L = 3.6 \text{ m}$
 - structural scheme: simple support



Actions in the slab (characteristic values):

- Weight of the concrete slab
- Linings: 0.50 kN/m^2
- Partition walls: 1.50 kN/m^2
- Imposed loads: 3.00 kN/m^2

The solicitation of the slab's calculation, done according to what was described in the general assumptions, is:

$$P_{Ed} = 0.50 + 1.50 + 3.00 = 5.00 \text{ kN/m}^2.$$

By consulting the tables it can be verified that, for a C25/30 concrete and a H60 sheeting with a thickness of 1.0 mm, the slab needs to have a total height of 16 cm.

CONCRETE C25/30

H60 | 1.0 mm

Simple support.

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
3.0	4.42	5.78	7.13	8.48	9.83	11.19	12.54	13.69
3.2	4.05	5.29	6.53	7.77	9.01	10.25	11.49	12.54
3.4	3.53	4.61	5.70	6.78	7.86	8.94	10.03	11.11
3.6	3.07	4.01	4.96	5.90	6.85	7.79	8.73	9.68
3.8	2.46	3.50	4.33	5.15	5.98	6.80	7.62	8.45
4.0	-	3.06	3.78	4.50	5.22	5.95	6.67	7.39
4.2	-	2.68	3.31	3.94	4.57	5.20	5.83	6.47
4.4	-	2.28	2.89	3.44	4.00	4.55	5.10	5.66

Verification: $P_{Ed} = 5.00 \text{ kN/m}^2 \leq P_{Rd} = 5.90 \text{ kN/m}^2$ OK

Slab's height [cm]	10	12	14	16	18	20	22	24
Span _{max} [m]	3.0	2.8	2.6	2.6	2.4	2.4	2.2	2.2

For a slab with a total height of 16 cm, the sheeting needs propping during the casting of the concrete, since, according to the propping table, the maximum span without propping during the casting of the concrete is of 2.6 m.

With this verification, we also guarantee that the slab will have a maximum deflection non greater than $L/300$, i.e., $3600/300 = 12 \text{ mm}$. We can still conclude that the sizing of this slab is conditioned by the longitudinal shear.

For intermediate span values, you should use the value corresponding to the span which is just above.

CONCRETE C20/25

H60 | 0.7 mm

 *Simple support.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	9.88	12.88	15.89	18.89	21.90	24.90	27.91	30.52
1.6	8.45	11.02	13.60	16.17	18.74	21.32	23.89	26.12
1.8	7.34	9.58	11.82	14.05	16.29	18.53	20.77	22.70
2.0	6.46	8.42	10.39	12.36	14.33	16.30	18.27	19.96
2.2	5.73	7.48	9.23	10.98	12.73	14.47	16.22	17.72
2.4	5.13	6.69	8.26	9.82	11.39	12.95	14.52	15.86
2.6	4.61	6.02	7.43	8.85	10.26	11.67	13.08	14.28
2.8	3.98	5.20	6.42	7.64	8.86	10.08	11.30	12.51
3.0	3.40	4.44	5.48	6.52	7.56	8.61	9.65	10.69
3.2	2.91	3.80	4.70	5.59	6.49	7.38	8.28	9.17
3.4	2.50	3.27	4.04	4.81	5.58	6.35	7.12	7.89
3.6	2.15	2.82	3.48	4.15	4.81	5.48	6.14	6.81
3.8	-	2.43	3.00	3.58	4.15	4.73	5.30	5.87
4.0	-	2.09	2.59	3.08	3.58	4.07	4.57	5.07
4.2	-	-	2.22	2.65	3.08	3.50	3.93	4.36
4.4	-	-	-	2.27	2.64	3.00	3.37	3.74
4.6	-	-	-	-	2.25	2.56	2.87	3.19
4.8	-	-	-	-	-	2.17	2.43	2.70
5.0	-	-	-	-	-	-	2.04	2.26

CONCRETE C25/30

H60 | 0.7 mm

 *Simple support.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	11.22	14.64	18.05	21.46	24.88	28.29	31.70	34.68
1.6	9.63	12.56	15.49	18.42	21.35	24.28	27.21	29.76
1.8	8.39	10.94	13.50	16.05	18.61	21.16	23.72	25.93
2.0	7.40	9.65	11.91	14.16	16.41	18.67	20.92	22.87
2.2	6.59	8.59	10.60	12.61	14.62	16.63	18.64	20.37
2.4	5.88	7.78	9.99	12.09	14.39	16.69	18.80	20.50
2.6	5.29	7.13	9.16	11.20	13.24	15.28	17.31	18.94
2.8	4.81	6.52	8.23	9.94	11.65	13.36	15.07	16.51
3.0	4.33	5.84	7.35	8.86	10.37	11.88	13.39	14.69
3.2	3.91	5.20	6.61	8.02	9.43	10.84	12.25	13.45
3.4	3.50	4.77	6.04	7.35	8.66	9.97	11.28	12.39
3.6	3.15	4.32	5.48	6.64	7.80	8.96	10.12	11.13
3.8	-	3.93	4.90	5.87	6.84	7.81	8.78	9.65
4.0	-	3.59	4.46	5.33	6.20	7.07	7.94	8.71
4.2	-	-	4.22	5.09	5.96	6.83	7.70	8.47
4.4	-	-	-	4.27	5.14	6.01	6.88	7.65
4.6	-	-	-	-	4.25	5.12	5.99	6.76
4.8	-	-	-	-	-	4.17	5.04	5.81
5.0	-	-	-	-	-	-	4.04	4.76

CONCRETE C30/37

H60 | 0.7 mm

 *Simple support.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	12.44	16.22	20.00	23.78	27.57	31.35	35.13	38.43
1.6	10.69	13.95	17.20	20.45	23.71	26.96	30.21	33.05
1.8	9.34	12.18	15.02	17.86	20.70	23.54	26.38	28.85
2.0	8.14	10.62	13.10	15.58	18.06	20.54	23.02	25.50
2.2	6.70	8.74	10.78	12.82	14.86	16.91	18.95	20.99
2.4	5.58	7.28	8.99	10.69	12.39	14.09	15.80	17.50
2.6	4.69	6.13	7.56	9.00	10.43	11.87	13.31	14.74
2.8	3.98	5.20	6.42	7.64	8.86	10.08	11.30	12.51
3.0	3.40	4.44	5.48	6.52	7.56	8.61	9.65	10.69
3.2	2.91	3.80	4.70	5.59	6.49	7.38	8.28	9.17
3.4	2.50	3.27	4.04	4.81	5.58	6.35	7.12	7.89
3.6	2.15	2.82	3.48	4.15	4.81	5.48	6.14	6.81
3.8	-	2.43	3.00	3.58	4.15	4.73	5.30	5.87
4.0	-	2.09	2.59	3.08	3.58	4.07	4.57	5.07
4.2	-	-	2.22	2.65	3.08	3.50	3.93	4.36
4.4	-	-	-	2.27	2.64	3.00	3.37	3.74
4.6	-	-	-	-	2.25	2.56	2.87	3.19
4.8	-	-	-	-	-	2.17	2.43	2.70
5.0	-	-	-	-	-	-	2.04	2.26

CONCRETE C20/25

H60 | 0.7 mm

 *Continuous - 2 spans.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	8.72	11.37	14.02	16.67	19.32	21.97	24.62	26.86
1.6	7.48	9.72	11.95	14.19	16.43	18.77	21.00	22.93
1.8	6.45	8.37	10.40	12.33	14.26	16.18	18.21	19.93
2.0	5.72	7.34	9.06	10.78	12.50	14.22	15.94	17.45
2.2	5.00	6.51	8.03	9.54	11.05	12.57	14.08	15.39
2.4	4.48	5.79	7.20	8.51	9.92	11.22	12.63	13.73
2.6	4.07	5.27	6.48	7.68	8.88	10.09	11.29	12.39
2.8	3.66	4.76	5.86	6.85	7.95	9.05	10.15	11.15
3.0	3.24	4.24	5.13	6.13	7.13	8.12	9.12	10.01
3.2	2.73	3.62	4.41	5.20	6.09	6.88	7.78	8.57
3.4	-	3.10	3.79	4.48	5.16	5.95	6.64	7.33
3.6	-	2.59	3.27	3.86	4.44	5.02	5.71	6.29
3.8	-	2.28	2.76	3.34	3.82	4.30	4.88	5.36
4.0	-	-	2.34	2.82	3.30	3.68	4.16	4.64
4.2	-	-	2.03	2.41	2.79	3.16	3.54	3.92
4.4	-	-	-	-	2.37	2.65	3.02	3.30
4.6	-	-	-	-	-	2.23	2.51	2.78
4.8	-	-	-	-	-	-	2.09	2.37

CONCRETE C25/30

H60 | 0.7 mm

 *Continuous - 2 spans.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	9.96	12.92	15.98	18.94	21.90	24.97	28.03	30.68
1.6	8.51	11.06	13.61	16.26	18.80	21.35	24.00	26.24
1.8	7.48	9.61	11.85	14.09	16.32	18.56	20.90	22.83
2.0	6.55	8.48	10.40	12.43	14.36	16.39	18.32	20.04
2.2	5.83	7.55	9.27	10.99	12.81	14.53	16.25	17.87
2.4	5.21	6.72	8.34	9.85	11.47	12.98	14.60	15.90
2.6	4.48	5.89	7.20	8.51	9.92	11.22	12.63	14.04
2.8	3.86	4.96	6.06	7.27	8.37	9.57	10.67	11.87
3.0	3.24	4.24	5.13	6.13	7.13	8.12	9.12	10.12
3.2	2.73	3.62	4.41	5.20	6.09	6.88	7.78	8.57
3.4	2.42	3.10	3.79	4.48	5.16	5.95	6.64	7.33
3.6	-	2.59	3.27	3.86	4.44	5.02	5.71	6.29
3.8	-	2.28	2.76	3.34	3.82	4.30	4.88	5.36
4.0	-	-	2.34	2.82	3.30	3.68	4.16	4.64
4.2	-	-	2.03	2.41	2.79	3.16	3.54	3.92
4.4	-	-	-	-	2.37	2.65	3.02	3.30
4.6	-	-	-	-	-	2.23	2.51	2.78
4.8	-	-	-	-	-	-	2.09	2.37

CONCRETE C30/37

H60 | 0.7 mm

 *Continuous - 2 spans.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	8.72	11.37	14.02	16.67	19.32	21.97	24.62	26.86
1.6	7.48	9.72	11.95	14.19	16.43	18.77	21.00	22.93
1.8	6.45	8.37	10.40	12.33	14.26	16.18	18.21	19.93
2.0	5.72	7.34	9.06	10.78	12.50	14.22	15.94	17.45
2.2	5.00	6.51	8.03	9.54	11.05	12.57	14.08	15.39
2.4	4.48	5.79	7.20	8.51	9.92	11.22	12.63	13.73
2.6	4.07	5.27	6.48	7.68	8.88	10.09	11.29	12.39
2.8	3.66	4.76	5.86	6.85	7.95	9.05	10.15	11.15
3.0	3.24	4.24	5.13	6.13	7.13	8.12	9.12	10.01
3.2	2.73	3.62	4.41	5.20	6.09	6.88	7.78	8.57
3.4	-	3.10	3.79	4.48	5.16	5.95	6.64	7.33
3.6	-	2.59	3.27	3.86	4.44	5.02	5.71	6.29
3.8	-	2.28	2.76	3.34	3.82	4.30	4.88	5.36
4.0	-	-	2.34	2.82	3.30	3.68	4.16	4.64
4.2	-	-	2.03	2.41	2.79	3.16	3.54	3.92
4.4	-	-	-	-	2.37	2.65	3.02	3.30
4.6	-	-	-	-	-	2.23	2.51	2.78
4.8	-	-	-	-	-	-	2.09	2.37

Maximum span without propping for a sheet of 0.7 mm in thickness.

Slab's Height [cm]	10	12	14	16	18	20	22	24
Span _{max} [m]	2.4	2.2	2.2	2.0	2.0	1.8	1.8	1.6

CONCRETE C20/25

H60 | 0.8 mm

 *Simple support.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	9.88	12.88	15.89	18.89	21.90	24.90	27.91	30.52
1.6	8.45	11.02	13.60	16.17	18.74	21.32	23.89	26.12
1.8	7.34	9.58	11.82	14.05	16.29	18.53	20.77	22.70
2.0	6.46	8.42	10.39	12.36	14.33	16.30	18.27	19.96
2.2	5.73	7.48	9.23	10.98	12.73	14.47	16.22	17.72
2.4	5.13	6.69	8.26	9.82	11.39	12.95	14.52	15.86
2.6	4.61	6.02	7.43	8.85	10.26	11.67	13.08	14.28
2.8	4.17	5.45	6.73	8.01	9.29	10.56	11.84	12.92
3.0	3.79	4.96	6.12	7.28	8.44	9.61	10.77	11.75
3.2	3.31	4.32	5.34	6.35	7.37	8.38	9.40	10.41
3.4	2.85	3.73	4.61	5.48	6.36	7.24	8.12	8.99
3.6	2.47	3.23	3.99	4.75	5.51	6.27	7.03	7.79
3.8	2.10	2.80	3.46	4.12	4.77	5.43	6.09	6.75
4.0	-	2.42	2.99	3.57	4.14	4.71	5.29	5.86
4.2	-	2.10	2.59	3.09	3.59	4.08	4.58	5.08
4.4	-	-	2.24	2.67	3.10	3.53	3.96	4.39
4.6	-	-	-	2.30	2.67	3.04	3.42	3.79
4.8	-	-	-	-	2.29	2.61	2.93	3.25
5.0	-	-	-	-	-	2.22	2.50	2.77
5.2	-	-	-	-	-	-	2.11	2.34

CONCRETE C25/30

H60 | 0.8 mm

 *Simple support.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	11.22	14.64	18.05	21.46	24.88	28.29	31.70	34.68
1.6	9.63	12.56	15.49	18.42	21.35	24.28	27.21	29.76
1.8	8.39	10.94	13.50	16.05	18.61	21.16	23.72	25.93
2.0	7.40	9.65	11.91	14.16	16.41	18.67	20.92	22.87
2.2	6.59	8.59	10.60	12.61	14.62	16.63	18.64	20.37
2.4	5.91	7.71	9.52	11.32	13.12	14.93	16.73	18.28
2.6	5.30	6.91	8.53	10.15	11.77	13.38	15.00	16.51
2.8	4.50	5.88	7.25	8.63	10.01	11.38	12.76	14.13
3.0	3.85	5.03	6.21	7.39	8.56	9.74	10.92	12.10
3.2	3.31	4.32	5.34	6.35	7.37	8.38	9.40	10.41
3.4	2.85	3.73	4.61	5.48	6.36	7.24	8.12	8.99
3.6	2.47	3.23	3.99	4.75	5.51	6.27	7.03	7.79
3.8	2.08	2.80	3.46	4.12	4.77	5.43	6.09	6.75
4.0	-	2.42	2.99	3.57	4.14	4.71	5.29	5.86
4.2	-	2.10	2.59	3.09	3.59	4.08	4.58	5.08
4.4	-	-	2.24	2.67	3.10	3.53	3.96	4.39
4.6	-	-	-	2.30	2.67	3.04	3.42	3.79
4.8	-	-	-	-	2.29	2.61	2.93	3.25
5.0	-	-	-	-	-	2.22	2.50	2.77
5.2	-	-	-	-	-	-	2.11	2.34

H60 | 0.8 mm

CONCRETE C30/37

H60 | 0.8 mm

 *Simple support.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	12.44	16.22	20.00	23.78	27.57	31.35	35.13	38.43
1.6	10.69	13.95	17.20	20.45	23.71	26.96	30.21	33.05
1.8	9.34	12.18	15.02	17.86	20.70	23.54	26.38	28.85
2.0	8.25	10.76	13.27	15.79	18.30	20.81	23.32	25.50
2.2	7.36	9.60	11.85	14.09	16.33	18.58	20.82	22.76
2.4	6.29	8.20	10.12	12.04	13.95	15.87	17.79	19.71
2.6	5.30	6.91	8.53	10.15	11.77	13.38	15.00	16.62
2.8	4.50	5.88	7.25	8.63	10.01	11.38	12.76	14.13
3.0	3.85	5.03	6.21	7.39	8.56	9.74	10.92	12.10
3.2	3.31	4.32	5.34	6.35	7.37	8.38	9.40	10.41
3.4	2.85	3.73	4.61	5.48	6.36	7.24	8.12	8.99
3.6	2.47	3.23	3.99	4.75	5.51	6.27	7.03	7.79
3.8	2.14	2.80	3.46	4.12	4.77	5.43	6.09	6.75
4.0	-	2.42	2.99	3.57	4.14	4.71	5.29	5.86
4.2	-	2.10	2.59	3.09	3.59	4.08	4.58	5.08
4.4	-	-	2.24	2.67	3.10	3.53	3.96	4.39
4.6	-	-	-	2.30	2.67	3.04	3.42	3.79
4.8	-	-	-	-	2.29	2.61	2.93	3.25
5.0	-	-	-	-	-	2.22	2.50	2.77
5.2	-	-	-	-	-	-	2.11	2.34

CONCRETE C20/25

H60 | 0.8 mm

 *Continuous - 2 spans.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	8.82	11.37	14.02	16.67	19.32	21.97	24.72	26.96
1.6	7.48	9.72	11.95	14.29	16.53	18.77	21.11	23.03
1.8	6.55	8.48	10.40	12.33	14.36	16.29	18.32	19.93
2.0	5.72	7.44	9.16	10.88	12.60	14.32	16.04	17.56
2.2	5.10	6.62	8.13	9.64	11.16	12.67	14.18	15.49
2.4	4.48	5.89	7.20	8.61	9.92	11.33	12.63	13.84
2.6	4.07	5.27	6.48	7.68	8.88	10.09	11.39	12.39
2.8	3.66	4.76	5.86	6.96	8.06	9.16	10.26	11.15
3.0	3.35	4.34	5.34	6.23	7.23	8.33	9.33	10.12
3.2	3.02	3.93	4.82	5.72	6.61	7.50	8.40	9.19
3.4	2.15	3.52	4.41	5.20	5.99	6.78	7.67	8.36
3.6	-	3.10	3.79	4.48	5.16	5.85	6.64	7.33
3.8	-	2.59	3.27	3.86	4.44	5.02	5.71	6.29
4.0	-	-	2.76	3.34	3.82	4.40	4.88	5.47
4.2	-	-	2.45	2.82	3.30	3.78	4.26	4.64
4.4	-	-	2.03	2.41	2.79	3.27	3.64	4.02
4.6	-	-	-	2.10	2.37	2.75	3.13	3.40
4.8	-	-	-	-	2.06	2.34	2.61	2.88
5.0	-	-	-	-	-	-	2.20	2.47
5.2	-	-	-	-	-	-	-	2.06

H60 | 0.8 mm

CONCRETE C25/30

H60 | 0.8 mm

 *Continuous - 2 spans.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	9.96	13.02	15.98	18.94	22.01	24.97	28.03	30.68
1.6	8.62	11.16	13.71	16.26	18.80	21.45	24.00	26.24
1.8	7.48	9.72	11.85	14.09	16.43	18.66	20.90	22.83
2.0	6.55	8.48	10.51	12.43	14.36	16.39	18.42	20.14
2.2	5.83	7.55	9.27	11.09	12.81	14.53	16.35	17.87
2.4	5.21	6.72	8.34	9.85	11.47	13.08	14.60	16.01
2.6	4.69	6.10	7.51	8.92	10.33	11.74	13.15	14.35
2.8	4.28	5.48	6.79	8.09	9.40	10.60	11.91	13.01
3.0	3.66	4.76	5.86	7.06	8.16	9.26	10.36	11.46
3.2	3.14	4.14	5.03	6.03	6.92	7.92	8.91	9.81
3.4	2.64	3.52	4.31	5.20	5.99	6.78	7.67	8.46
3.6	-	3.00	3.79	4.48	5.16	5.85	6.54	7.33
3.8	-	2.59	3.27	3.86	4.44	5.02	5.71	6.29
4.0	-	2.28	2.76	3.34	3.82	4.40	4.88	5.47
4.2	-	-	2.45	2.82	3.30	3.78	4.16	4.64
4.4	-	-	2.03	2.41	2.79	3.27	3.64	4.02
4.6	-	-	-	2.10	2.37	2.75	3.13	3.40
4.8	-	-	-	-	2.06	2.34	2.61	2.88
5.0	-	-	-	-	-	-	2.20	2.47
5.2	-	-	-	-	-	-	-	2.06

CONCRETE C30/37

H60 | 0.8 mm

 *Continuous - 2 spans.*

Vão [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	11.10	14.47	17.74	21.11	24.38	27.76	31.13	34.09
1.6	9.55	12.40	15.26	18.12	20.97	23.83	26.79	29.23
1.8	8.31	10.75	13.30	15.74	18.29	20.83	23.28	25.51
2.0	7.38	9.51	11.75	13.88	16.12	18.35	20.59	22.52
2.2	6.55	8.48	10.40	12.43	14.36	16.29	18.32	20.04
2.4	5.83	7.65	9.37	11.09	12.91	14.63	16.46	17.97
2.6	5.10	6.62	8.23	9.75	11.26	12.77	14.39	15.90
2.8	4.38	5.69	6.89	8.20	9.50	10.81	12.22	13.53
3.0	3.76	4.86	5.96	7.06	8.16	9.26	10.36	11.56
3.2	3.14	4.14	5.03	6.03	7.02	7.92	8.91	9.91
3.4	2.73	3.52	4.41	5.20	5.99	6.78	7.67	8.46
3.6	2.06	3.10	3.79	4.48	5.16	5.85	6.64	7.33
3.8	-	2.59	3.27	3.86	4.44	5.02	5.71	6.29
4.0	-	2.28	2.76	3.34	3.82	4.40	4.88	5.47
4.2	-	-	2.45	2.82	3.30	3.78	4.26	4.64
4.4	-	-	2.03	2.41	2.79	3.27	3.64	4.02
4.6	-	-	-	2.10	2.37	2.75	3.13	3.40
4.8	-	-	-	-	2.06	2.34	2.61	2.88
5.0	-	-	-	-	-	-	2.20	2.47
5.2	-	-	-	-	-	-	-	2.06

Maximum span without propping for a sheet of 0.8 mm in thickness.

Slab's Height [cm]	10	12	14	16	18	20	22	24
Span _{max} [m]	2.6	2.4	2.2	2.2	2.0	2.0	1.8	1.8

CONCRETE C20/25

H60 | 1.0 mm

 *Simple support.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	9.88	12.88	15.89	18.89	21.90	24.90	27.91	30.52
1.6	8.45	11.02	13.60	16.17	18.74	21.32	23.89	26.12
1.8	7.34	9.58	11.82	14.05	16.29	18.53	20.77	22.70
2.0	6.46	8.42	10.39	12.36	14.33	16.30	18.27	19.96
2.2	5.73	7.48	9.23	10.98	12.73	14.47	16.22	17.72
2.4	5.13	6.69	8.26	9.82	11.39	12.95	14.52	15.86
2.6	4.61	6.02	7.43	8.85	10.26	11.67	13.08	14.28
2.8	4.17	5.45	6.73	8.01	9.29	10.56	11.84	12.92
3.0	3.79	4.96	6.12	7.28	8.44	9.61	10.77	11.75
3.2	3.46	4.52	5.59	6.65	7.71	8.77	9.83	10.72
3.4	3.17	4.14	5.11	6.09	7.06	8.03	9.01	9.82
3.6	2.91	3.80	4.70	5.59	6.48	7.38	8.27	9.01
3.8	2.38	3.50	4.32	5.14	5.97	6.79	7.61	8.29
4.0	-	3.06	3.78	4.50	5.22	5.95	6.67	7.39
4.2	-	2.68	3.31	3.94	4.57	5.20	5.83	6.47
4.4	-	2.19	2.89	3.44	4.00	4.55	5.10	5.66
4.6	-	-	2.52	3.01	3.49	3.98	4.46	4.94
4.8	-	-	2.20	2.62	3.04	3.47	3.89	4.31
5.0	-	-	-	2.28	2.64	3.01	3.38	3.75
5.2	-	-	-	-	2.29	2.60	2.92	3.24
5.4	-	-	-	-	-	2.24	2.51	2.79
5.6	-	-	-	-	-	-	2.14	2.38
5.8	-	-	-	-	-	-	-	2.00

CONCRETE C25/30

H60 | 1.0 mm

 *Simple support.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	11.22	14.64	18.05	21.46	24.88	28.29	31.70	34.68
1.6	9.63	12.56	15.49	18.42	21.35	24.28	27.21	29.76
1.8	8.39	10.94	13.50	16.05	18.61	21.16	23.72	25.93
2.0	7.40	9.65	11.91	14.16	16.41	18.67	20.92	22.87
2.2	6.59	8.59	10.60	12.61	14.62	16.63	18.64	20.37
2.4	5.91	7.71	9.52	11.32	13.12	14.93	16.73	18.28
2.6	5.34	6.97	8.60	10.23	11.86	13.49	15.12	16.51
2.8	4.85	6.33	7.81	9.29	10.77	12.26	13.74	15.00
3.0	4.42	5.78	7.13	8.48	9.83	11.19	12.54	13.69
3.2	4.05	5.29	6.53	7.77	9.01	10.25	11.49	12.54
3.4	3.53	4.61	5.70	6.78	7.86	8.94	10.03	11.11
3.6	3.07	4.01	4.96	5.90	6.85	7.79	8.73	9.68
3.8	2.46	3.50	4.33	5.15	5.98	6.80	7.62	8.45
4.0	-	3.06	3.78	4.50	5.22	5.95	6.67	7.39
4.2	-	2.68	3.31	3.94	4.57	5.20	5.83	6.47
4.4	-	2.28	2.89	3.44	4.00	4.55	5.10	5.66
4.6	-	-	2.52	3.01	3.49	3.98	4.46	4.94
4.8	-	-	2.20	2.62	3.04	3.47	3.89	4.31
5.0	-	-	-	2.28	2.64	3.01	3.38	3.75
5.2	-	-	-	-	2.29	2.60	2.92	3.24
5.4	-	-	-	-	-	2.24	2.51	2.79
5.6	-	-	-	-	-	-	2.14	2.38
5.8	-	-	-	-	-	-	-	2.00

CONCRETE C30/37

H60 | 1.0 mm

 *Simple support.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	12.44	16.22	20.00	23.78	27.57	31.35	35.13	38.43
1.6	10.69	13.95	17.20	20.45	23.71	26.96	30.21	33.05
1.8	9.34	12.18	15.02	17.86	20.70	23.54	26.38	28.85
2.0	8.25	10.76	13.27	15.79	18.30	20.81	23.32	25.50
2.2	7.36	9.60	11.85	14.09	16.33	18.58	20.82	22.76
2.4	6.62	8.64	10.66	12.68	14.69	16.71	18.73	20.47
2.6	5.99	7.82	9.65	11.48	13.31	15.14	16.97	18.54
2.8	5.46	7.12	8.79	10.45	12.12	13.79	15.45	16.88
3.0	4.72	6.16	7.60	9.05	10.49	11.93	13.38	14.82
3.2	4.07	5.32	6.57	7.81	9.06	10.31	11.55	12.80
3.4	3.53	4.61	5.70	6.78	7.86	8.94	10.03	11.11
3.6	3.07	4.01	4.96	5.90	6.85	7.79	8.73	9.68
3.8	2.61	3.50	4.33	5.15	5.98	6.80	7.62	8.45
4.0	-	3.06	3.78	4.50	5.22	5.95	6.67	7.39
4.2	-	2.68	3.31	3.94	4.57	5.20	5.83	6.47
4.4	-	2.34	2.89	3.44	4.00	4.55	5.10	5.66
4.6	-	-	2.52	3.01	3.49	3.98	4.46	4.94
4.8	-	-	2.20	2.62	3.04	3.47	3.89	4.31
5.0	-	-	-	2.28	2.64	3.01	3.38	3.75
5.2	-	-	-	-	2.29	2.60	2.92	3.24
5.4	-	-	-	-	-	2.24	2.51	2.79
5.6	-	-	-	-	-	-	2.14	2.38
5.8	-	-	-	-	-	-	-	2.00

CONCRETE C20/25

H60 | 1.0 mm

 *Continuous - 2 spans.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	8.82	11.47	14.02	16.67	19.32	22.07	24.72	27.06
1.6	7.48	9.72	12.06	14.29	16.53	18.77	21.11	23.03
1.8	6.55	8.48	10.40	12.33	14.36	16.29	18.32	19.93
2.0	5.72	7.44	9.16	10.88	12.60	14.32	16.04	17.56
2.2	5.10	6.62	8.13	9.64	11.16	12.67	14.18	15.49
2.4	4.48	5.89	7.20	8.61	9.92	11.33	12.63	13.84
2.6	4.07	5.27	6.48	7.68	8.88	10.19	11.39	12.39
2.8	3.66	4.76	5.86	6.96	8.06	9.16	10.26	11.15
3.0	3.35	4.34	5.34	6.34	7.33	8.33	9.33	10.12
3.2	3.04	3.93	4.82	5.72	6.61	7.50	8.50	9.19
3.4	2.73	3.62	4.41	5.20	6.09	6.88	7.67	8.36
3.6	2.18	3.31	4.00	4.79	5.58	6.26	7.05	7.64
3.8	-	3.00	3.69	4.37	5.06	5.75	6.43	7.02
4.0	-	2.76	3.38	3.96	4.65	5.33	5.92	6.40
4.2	-	2.10	3.07	3.65	4.23	4.82	5.40	5.88
4.4	-	-	2.65	3.24	3.72	4.20	4.78	5.26
4.6	-	-	-	2.82	3.20	3.68	4.16	4.54
4.8	-	-	-	2.41	2.79	3.16	3.54	4.02
5.0	-	-	-	2.10	2.37	2.75	3.13	3.40
5.2	-	-	-	-	2.06	2.34	2.61	2.88
5.4	-	-	-	-	-	2.03	2.20	2.47
5.6	-	-	-	-	-	-	-	2.06

CONCRETE C25/30

H60 | 1.0 mm

 *Continuous - 2 spans.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	10.06	13.02	15.98	19.05	22.01	25.07	28.13	30.78
1.6	8.62	11.16	13.71	16.26	18.91	21.45	24.10	26.34
1.8	7.48	9.72	11.95	14.19	16.43	18.66	20.90	22.93
2.0	6.55	8.58	10.51	12.43	14.46	16.39	18.42	20.14
2.2	5.83	7.55	9.37	11.09	12.81	14.63	16.35	17.87
2.4	5.21	6.82	8.34	9.95	11.47	13.08	14.70	16.01
2.6	4.69	6.10	7.51	8.92	10.33	11.74	13.25	14.46
2.8	4.28	5.58	6.79	8.09	9.40	10.71	12.01	13.11
3.0	3.86	5.07	6.17	7.37	8.57	9.67	10.88	11.87
3.2	3.55	4.65	5.65	6.75	7.85	8.85	9.95	10.84
3.4	2.98	4.24	5.24	6.13	7.13	8.12	9.12	9.91
3.6	2.24	3.83	4.72	5.61	6.51	7.40	8.29	9.19
3.8	-	3.31	4.10	4.89	5.68	6.47	7.26	8.05
4.0	-	2.84	3.58	4.27	4.96	5.64	6.33	7.02
4.2	-	2.16	3.17	3.75	4.34	4.92	5.50	6.09
4.4	-	-	2.76	3.24	3.72	4.30	4.78	5.26
4.6	-	-	2.34	2.82	3.20	3.68	4.16	4.64
4.8	-	-	-	2.41	2.79	3.16	3.54	4.02
5.0	-	-	-	2.10	2.37	2.75	3.13	3.40
5.2	-	-	-	-	2.06	2.34	2.61	2.99
5.4	-	-	-	-	-	2.03	2.30	2.47
5.6	-	-	-	-	-	-	-	2.06

CONCRETE C30/37

H60 | 1.0 mm

 *Continuous - 2 spans.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	11.10	14.47	17.84	21.11	24.49	27.86	31.23	34.19
1.6	9.55	12.40	15.26	18.12	21.08	23.93	26.79	29.34
1.8	8.31	10.85	13.30	15.84	18.29	20.83	23.38	25.51
2.0	7.38	9.51	11.75	13.98	16.12	18.35	20.59	22.52
2.2	6.55	8.48	10.51	12.43	14.36	16.39	18.32	20.04
2.4	5.93	7.65	9.37	11.19	12.91	14.74	16.46	17.97
2.6	5.31	6.93	8.44	10.06	11.67	13.29	14.91	16.32
2.8	4.79	6.31	7.72	9.13	10.64	12.05	13.56	14.77
3.0	4.38	5.69	6.99	8.40	9.71	11.02	12.32	13.53
3.2	3.97	5.17	6.27	7.47	8.68	9.88	11.08	12.29
3.4	3.11	4.45	5.44	6.44	7.54	8.54	9.53	10.63
3.6	2.35	3.83	4.72	5.61	6.51	7.40	8.29	9.19
3.8	-	3.31	4.10	4.89	5.68	6.47	7.26	8.05
4.0	-	2.90	3.58	4.27	4.96	5.64	6.33	7.02
4.2	-	2.29	3.17	3.75	4.34	4.92	5.50	6.09
4.4	-	-	2.76	3.24	3.72	4.30	4.78	5.26
4.6	-	-	2.34	2.82	3.30	3.68	4.16	4.64
4.8	-	-	2.03	2.41	2.79	3.16	3.64	4.02
5.0	-	-	-	2.10	2.48	2.75	3.13	3.40
5.2	-	-	-	-	2.06	2.34	2.61	2.99
5.4	-	-	-	-	-	2.03	2.30	2.47
5.6	-	-	-	-	-	-	-	2.06

Maximum span without propping for a sheet of 1.0 mm in thickness.

Slab's Height [cm]	10	12	14	16	18	20	22	24
Span _{max} [m]	2.8	2.6	2.4	2.4	2.2	2.2	2.0	2.0

CONCRETE C20/25

H60 | 1.2 mm

 *Simple support.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	9.88	12.88	15.89	18.89	21.90	24.90	27.91	30.52
1.6	8.45	11.02	13.60	16.17	18.74	21.32	23.89	26.12
1.8	7.34	9.58	11.82	14.05	16.29	18.53	20.77	22.70
2.0	6.46	8.42	10.39	12.36	14.33	16.30	18.27	19.96
2.2	5.73	7.48	9.23	10.98	12.73	14.47	16.22	17.72
2.4	5.13	6.69	8.26	9.82	11.39	12.95	14.52	15.86
2.6	4.61	6.02	7.43	8.85	10.26	11.67	13.08	14.28
2.8	4.17	5.45	6.73	8.01	9.29	10.56	11.84	12.92
3.0	3.79	4.96	6.12	7.28	8.44	9.61	10.77	11.75
3.2	3.46	4.52	5.59	6.65	7.71	8.77	9.83	10.72
3.4	3.17	4.14	5.11	6.09	7.06	8.03	9.01	9.82
3.6	2.91	3.80	4.70	5.59	6.48	7.38	8.27	9.01
3.8	2.67	3.50	4.32	5.14	5.97	6.79	7.61	8.29
4.0	2.10	3.22	3.98	4.74	5.50	6.26	7.02	7.64
4.2	-	2.98	3.68	4.38	5.08	5.78	6.49	7.06
4.4	-	2.55	3.40	4.05	4.70	5.35	6.00	6.52
4.6	-	-	3.12	3.71	4.31	4.90	5.50	6.04
4.8	-	-	2.74	3.27	3.79	4.32	4.84	5.37
5.0	-	-	2.34	2.87	3.34	3.80	4.26	4.72
5.2	-	-	-	2.52	2.92	3.33	3.74	4.14
5.4	-	-	-	2.20	2.56	2.91	3.27	3.62
5.6	-	-	-	-	2.22	2.53	2.84	3.15
5.8	-	-	-	-	-	2.19	2.46	2.73
6.0	-	-	-	-	-	-	2.11	2.34

CONCRETE C25/30

H60 | 1.2 mm

 *Simple support.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	11.22	14.64	18.05	21.46	24.88	28.29	31.70	34.68
1.6	9.63	12.56	15.49	18.42	21.35	24.28	27.21	29.76
1.8	8.39	10.94	13.50	16.05	18.61	21.16	23.72	25.93
2.0	7.40	9.65	11.91	14.16	16.41	18.67	20.92	22.87
2.2	6.59	8.59	10.60	12.61	14.62	16.63	18.64	20.37
2.4	5.91	7.71	9.52	11.32	13.12	14.93	16.73	18.28
2.6	5.34	6.97	8.60	10.23	11.86	13.49	15.12	16.51
2.8	4.85	6.33	7.81	9.29	10.77	12.26	13.74	15.00
3.0	4.42	5.78	7.13	8.48	9.83	11.19	12.54	13.69
3.2	4.05	5.29	6.53	7.77	9.01	10.25	11.49	12.54
3.4	3.72	4.86	6.00	7.15	8.29	9.43	10.57	11.53
3.6	3.43	4.48	5.54	6.59	7.64	8.69	9.75	10.63
3.8	2.81	4.14	5.12	6.09	7.06	8.04	9.01	9.82
4.0	2.17	3.70	4.57	5.43	6.30	7.17	8.04	8.91
4.2	-	3.25	4.02	4.78	5.55	6.32	7.08	7.85
4.4	-	2.64	3.54	4.21	4.89	5.56	6.24	6.92
4.6	-	2.04	3.12	3.71	4.31	4.90	5.50	6.10
4.8	-	-	2.74	3.27	3.79	4.32	4.84	5.37
5.0	-	-	2.41	2.87	3.34	3.80	4.26	4.72
5.2	-	-	-	2.52	2.92	3.33	3.74	4.14
5.4	-	-	-	2.20	2.56	2.91	3.27	3.62
5.6	-	-	-	-	2.22	2.53	2.84	3.15
5.8	-	-	-	-	-	2.19	2.46	2.73
6.0	-	-	-	-	-	-	2.11	2.34

H60 | 1.2 mm

CONCRETE C30/37

H60 | 1.2 mm

 *Simple support.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	12.44	16.22	20.00	23.78	27.57	31.35	35.13	38.43
1.6	10.69	13.95	17.20	20.45	23.71	26.96	30.21	33.05
1.8	9.34	12.18	15.02	17.86	20.70	23.54	26.38	28.85
2.0	8.25	10.76	13.27	15.79	18.30	20.81	23.32	25.50
2.2	7.36	9.60	11.85	14.09	16.33	18.58	20.82	22.76
2.4	6.62	8.64	10.66	12.68	14.69	16.71	18.73	20.47
2.6	5.99	7.82	9.65	11.48	13.31	15.14	16.97	18.54
2.8	5.46	7.12	8.79	10.45	12.12	13.79	15.45	16.88
3.0	4.99	6.52	8.04	9.57	11.09	12.62	14.14	15.44
3.2	4.58	5.98	7.39	8.79	10.19	11.59	12.99	14.18
3.4	4.21	5.49	6.78	8.07	9.36	10.64	11.93	13.07
3.6	3.67	4.80	5.93	7.05	8.18	9.30	10.43	11.56
3.8	2.97	4.21	5.20	6.18	7.17	8.16	9.15	10.14
4.0	2.31	3.70	4.57	5.43	6.30	7.17	8.04	8.91
4.2	-	3.25	4.02	4.78	5.55	6.32	7.08	7.85
4.4	-	2.82	3.54	4.21	4.89	5.56	6.24	6.92
4.6	-	2.20	3.12	3.71	4.31	4.90	5.50	6.10
4.8	-	-	2.74	3.27	3.79	4.32	4.84	5.37
5.0	-	-	2.41	2.87	3.34	3.80	4.26	4.72
5.2	-	-	2.04	2.52	2.92	3.33	3.74	4.14
5.4	-	-	-	2.20	2.56	2.91	3.27	3.62
5.6	-	-	-	-	2.22	2.53	2.84	3.15
5.8	-	-	-	-	-	2.19	2.46	2.73
6.0	-	-	-	-	-	-	2.11	2.34

CONCRETE C20/25

H60 | 1.2 mm

 *Continuous - 2 spans.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	8.82	11.47	14.12	16.77	19.42	22.07	24.72	27.06
1.6	7.58	9.82	12.06	14.29	16.53	18.87	21.11	23.14
1.8	6.55	8.48	10.40	12.43	14.36	16.39	18.32	20.04
2.0	5.72	7.44	9.16	10.88	12.60	14.32	16.04	17.56
2.2	5.10	6.62	8.13	9.64	11.16	12.67	14.18	15.59
2.4	4.48	5.89	7.20	8.61	9.92	11.33	12.74	13.84
2.6	4.07	5.27	6.48	7.68	8.99	10.19	11.39	12.39
2.8	3.66	4.76	5.86	6.96	8.06	9.16	10.26	11.25
3.0	3.35	4.34	5.34	6.34	7.33	8.33	9.33	10.12
3.2	3.04	3.93	4.82	5.72	6.61	7.61	8.50	9.29
3.4	2.73	3.62	4.41	5.20	6.09	6.88	7.78	8.46
3.6	2.44	3.31	4.00	4.79	5.58	6.26	7.05	7.74
3.8	-	3.00	3.69	4.37	5.06	5.75	6.43	7.02
4.0	-	2.79	3.38	4.06	4.65	5.33	5.92	6.50
4.2	-	2.36	3.07	3.65	4.23	4.92	5.50	5.98
4.4	-	-	2.86	3.44	3.92	4.51	4.99	5.47
4.6	-	-	2.65	3.13	3.61	4.09	4.68	5.05
4.8	-	-	2.11	2.93	3.30	3.78	4.26	4.64
5.0	-	-	-	2.62	3.10	3.47	3.95	4.23
5.2	-	-	-	2.31	2.68	3.06	3.44	3.81
5.4	-	-	-	-	2.37	2.65	3.02	3.30
5.6	-	-	-	-	2.06	2.34	2.61	2.88
5.8	-	-	-	-	-	2.03	2.20	2.47
6.0	-	-	-	-	-	-	-	2.06

H60 | 1.2 mm

CONCRETE C25/30

H60 | 1.2 mm

 *Continuous - 2 spans.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	10.06	13.02	16.09	19.05	22.11	25.17	28.13	30.78
1.6	8.62	11.16	13.71	16.36	18.91	21.56	24.10	26.44
1.8	7.48	9.72	11.95	14.19	16.43	18.77	21.00	22.93
2.0	6.55	8.58	10.51	12.54	14.46	16.49	18.42	20.24
2.2	5.83	7.65	9.37	11.09	12.91	14.63	16.46	17.97
2.4	5.21	6.82	8.34	9.95	11.57	13.08	14.70	16.01
2.6	4.69	6.10	7.51	8.92	10.43	11.84	13.25	14.46
2.8	4.28	5.58	6.89	8.09	9.40	10.71	12.01	13.11
3.0	3.86	5.07	6.27	7.37	8.57	9.78	10.88	11.87
3.2	3.55	4.65	5.65	6.75	7.85	8.95	9.95	10.84
3.4	3.24	4.24	5.24	6.23	7.13	8.12	9.12	10.01
3.6	2.50	3.93	4.82	5.72	6.61	7.50	8.40	9.19
3.8	2.10	3.62	4.41	5.20	6.09	6.88	7.78	8.46
4.0	-	3.15	4.10	4.79	5.58	6.37	7.16	7.74
4.2	-	2.43	3.79	4.48	5.16	5.85	6.64	7.22
4.4	-	-	3.38	3.96	4.65	5.23	5.92	6.60
4.6	-	-	2.84	3.55	4.03	4.61	5.19	5.78
4.8	-	-	2.19	3.13	3.61	4.09	4.57	5.05
5.0	-	-	-	2.72	3.10	3.58	3.95	4.43
5.2	-	-	-	2.31	2.68	3.06	3.44	3.81
5.4	-	-	-	-	2.37	2.65	3.02	3.30
5.6	-	-	-	-	2.06	2.34	2.61	2.88
5.8	-	-	-	-	-	2.03	2.20	2.47
6.0	-	-	-	-	-	-	-	2.06

CONCRETE C30/37

H60 | 1.2 mm

 *Continuous - 2 spans.*

Span [m]	Slab's Height [cm]							
	10	12	14	16	18	20	22	24
1.4	11.20	14.47	17.84	21.22	24.59	27.96	31.34	34.30
1.6	9.55	12.40	15.26	18.22	21.08	23.93	26.89	29.44
1.8	8.31	10.85	13.30	15.84	18.39	20.94	23.38	25.62
2.0	7.38	9.61	11.75	13.98	16.22	18.46	20.69	22.62
2.2	6.55	8.48	10.51	12.43	14.46	16.39	18.42	20.14
2.4	5.93	7.65	9.37	11.19	12.91	14.74	16.56	18.07
2.6	5.31	6.93	8.54	10.06	11.67	13.29	14.91	16.32
2.8	4.79	6.31	7.72	9.23	10.64	12.05	13.56	14.77
3.0	4.38	5.69	7.10	8.40	9.71	11.02	12.43	13.53
3.2	4.07	5.27	6.48	7.68	8.88	10.09	11.39	12.39
3.4	3.43	4.86	5.96	7.06	8.16	9.26	10.46	11.36
3.6	2.62	4.45	5.44	6.54	7.54	8.54	9.64	10.53
3.8	-	4.03	5.03	5.92	6.92	7.81	8.81	9.70
4.0	-	3.30	4.41	5.20	5.99	6.88	7.67	8.57
4.2	-	2.56	3.89	4.58	5.27	6.06	6.74	7.53
4.4	-	-	3.38	4.06	4.65	5.33	5.92	6.60
4.6	-	-	2.96	3.55	4.13	4.61	5.19	5.78
4.8	-	-	2.33	3.13	3.61	4.09	4.57	5.05
5.0	-	-	-	2.72	3.10	3.58	3.95	4.43
5.2	-	-	-	2.31	2.68	3.06	3.44	3.81
5.4	-	-	-	-	2.37	2.65	3.02	3.40
5.6	-	-	-	-	2.06	2.34	2.61	2.88
5.8	-	-	-	-	-	2.03	2.20	2.47
6.0	-	-	-	-	-	-	-	2.06

Maximum span without propping for a sheet of 1.2 mm in thickness.

Slab's Height [cm]	10	12	14	16	18	20	22	24
Span _{max} [m]	3.0	2.8	2.6	2.4	2.4	2.2	2.2	2.2

CONSTRUCTION DETAILS

Regulatory construction provisions.

The standard NP EN 1994-1-1 sets some project requirements in order to apply the design rules that it includes.

SLAB'S HEIGHT

The slab's height must not be less than 80 mm and the thickness of the concrete blade placed above the ribs of the steel sheeting must be equal or greater than 40 mm (NP EN 1994-1-1 clause 9.2.1(1)).

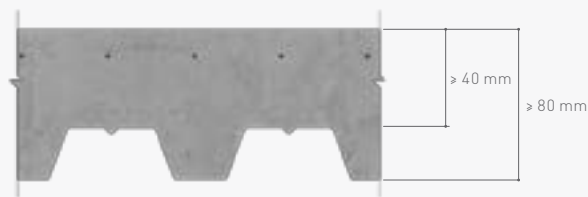


Image 4 – Cross section of the slab

In case the composed slab works as a diaphragm or as a rib for a composite beam, the values on the last subparagraph should be increased by 10 mm (NP EN 1994-1-1 clause 9.2.1(2)).



Image 5 – Cross section of the slab

DIMENSION OF THE AGGREGATES

The dimension of the aggregates used when producing concrete shouldn't be larger than the smallest of: $0.4h_c$, $b_0/3$ and 31.5 mm (NP EN 1994-1-1 cl. 9.2.2(1)).

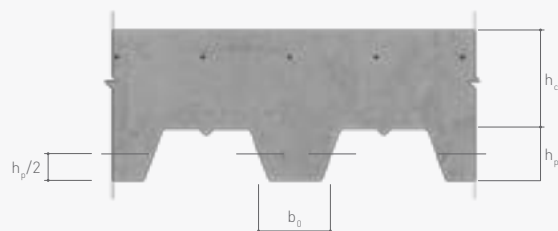


Image 6 – Cross section of the slab

CONSTRUCTION DETAILS

Regulatory construction provisions.

ORDINARY STEEL REINFORCEMENT

The ordinary steel reinforcement should be placed in the concrete blade above the ribs. Its area shouldn't be less than $80 \text{ mm}^2/\text{m}$ (NP EN 1994-1-1 cl. 9.2.1(3) and (4)).

The percentage of minimum steel reinforcement for a composite slab acting as a diaphragm shouldn't be less than 0.2% in both directions. This reinforcement should be added to the main frame. The spacing between bars shouldn't exceed the following values: $2 \times h_{\text{total}}$ of the slab or 350 mm (Image 7).

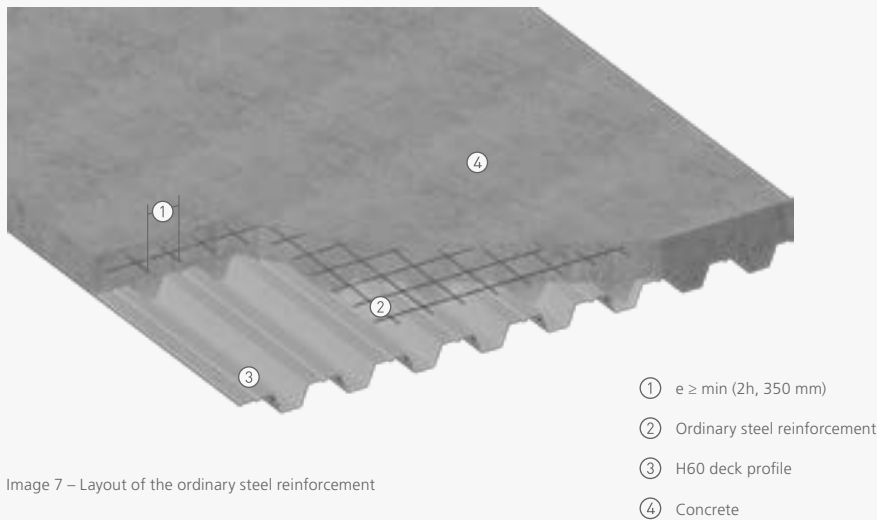


Image 7 – Layout of the ordinary steel reinforcement

DETAIL OF THE SHEET ON THE SUPPORTS

The support length for any profiled sheeting in the definitive supports should be equal or larger than:

$l_{bc} = 75 \text{ mm}$ e $l_{bs} = 50 \text{ mm}$ in steel or concrete supports;

$l_{bc} = 100 \text{ mm}$ e $l_{bs} = 70 \text{ mm}$ in supports made of other materials.

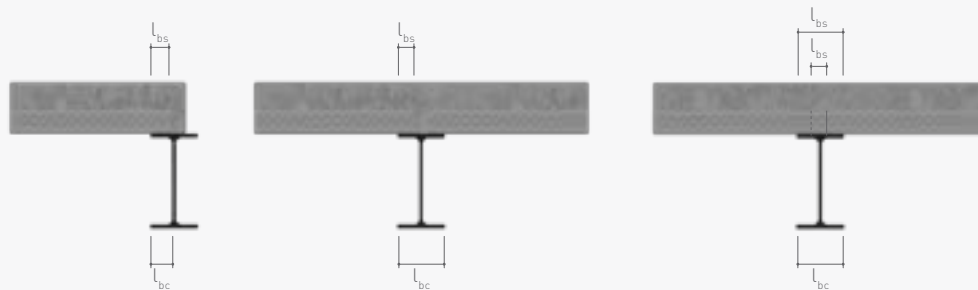


Image 8 – Details of the sheeting support

CONSTRUCTION DETAILS

Safety recommendations and rules for a good construction.

HANDLING / STORING THE SHEETING IN SITE

The sheeting is normally sent in batches of approximately 1 m of height and 0.6 m of depth. Each batch weighs an average of 2 tons.

The batches must not be stored at the construction site for too long. A maximum in site storage period of 1 month is recommended.

The batches should be identified and its distribution in site should be verified in advance.

POSITIONING THE SHEETING

Before starting to position the sheeting, you should verify that the sheeting support area is clean and dry, especially when you intend to weld the connectors.

When you predict that the welding of the connectors to the steel profile will be done through the sheeting, its surface should only be pickled with no further treatment.

No activity should be permitted under the area where the sheeting are being applied.

Guardrails should be installed in the work platform's limits and in openings.

The sheeting should be fixed only to definitive elements and to adjacent sheeting.

SHEETING FIXING

The fixing of the sheeting should be assured by screwing to the steel beams through self-drilling screws in the amount indicated in Table 9.

Table 9 – Amount of fixings

Supports		
End*	Middle**	Longitudinal
3 per sheet	2 per sheet	each 600 mm

* If there are any welded connectors, this number can be reduced to 2 fixings per sheeting.

** If there are any welded connectors, this number can be reduced to 1 fixing per sheeting.

CONSTRUCTION DETAILS

Safety recommendations and rules for a good construction.

CONSTRUCTION PROPPING

The designer should clearly highlight the need for slab propping during the casting of the concrete. In order to do this, the performing party should receive sketches with the exact location of the propping system (Image 9).

The propping should guarantee a distribution of the loads during the casting of the concrete, as well as its conveyance to the vertical walers.

The propping should be kept until the concrete has a minimum resistance of 75% of the 28 days resistance (which should be, in average, 14 days after the casting of the concrete).

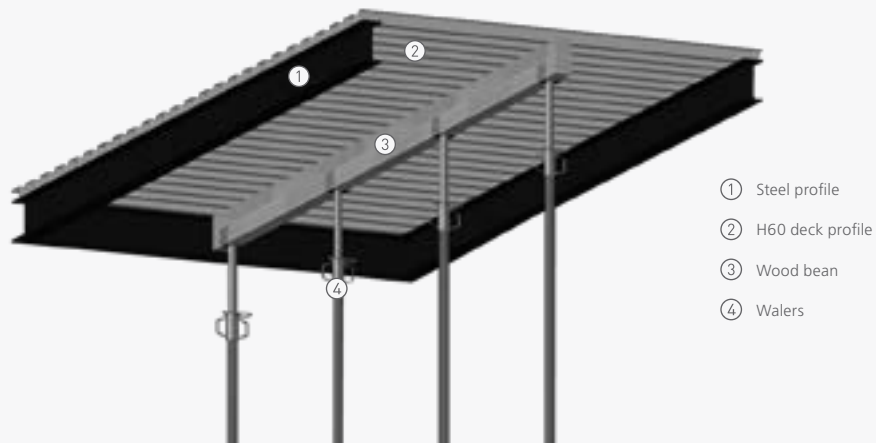


Image 9 – Scheme of construction propping

CONSTRUCTION DETAILS

Safety recommendations and rules for a good construction.

EDGE BORDER

The edge border should be made of galvanized sheeting, in the position indicated in Image 10. This element should be correctly positioned and fixed, so that it doesn't present excessive deformation during the casting of the concrete.

There are 2 types of edge borders: when the border goes along the edge beam and when the border stays in cantilever, comparatively to the beam. This cantilever length should never go over 600 mm comparatively to the axis of the edge beam.

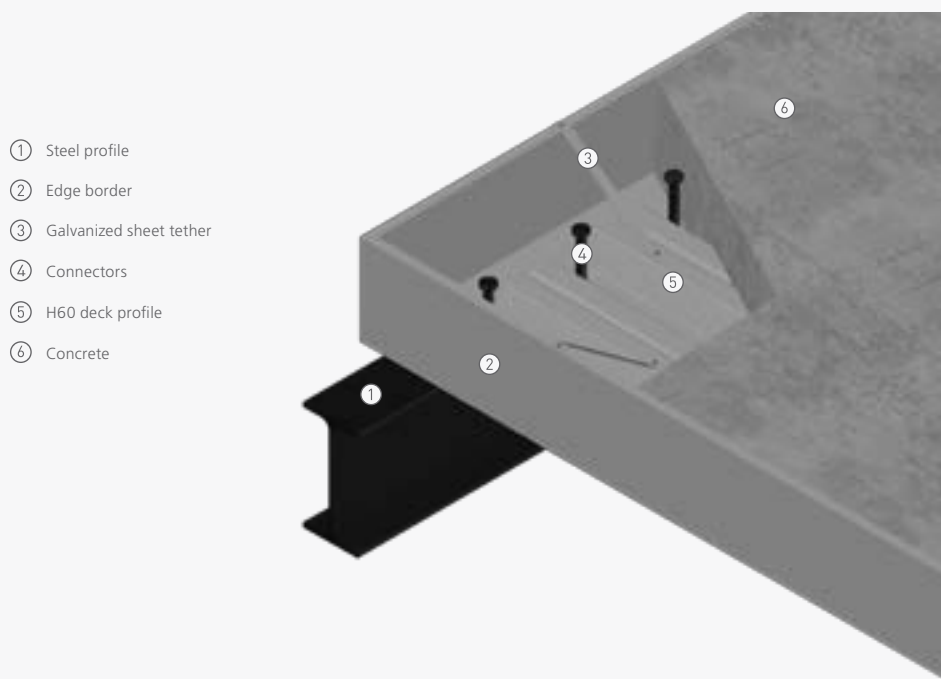


Image 10 – Assembling scheme for an edge border

CONSTRUCTION DETAILS

Safety recommendations and rules for a good construction.

WELDING OF CONNECTORS

The connectors can be welded to the beam through the sheeting. However, this situation should be avoided whenever possible. For an efficient welding in the above mentioned conditions, the sheeting thickness should be less than 1.5 mm and the zinc lining less than 0.03 mm per side.

The connectors should preferably be factory welded.

The connectors should be separated by no less than 95 mm in the direction of the longitudinal sectioning tensions and 76 mm in the transversal direction.

The space between the connectors should be no more than 450 mm.

CONCRETING OF SLABS

The sheeting surface should be clean, free of oil and debris, so that the concreting can take place. The sheet joints should guarantee the sealing of the wet concrete. This sealing can be assured by placing adhesive tape on the joints.

The concreting team should be limited to a maximum of 4 elements.

The concrete should be deposited as close as possible to the pavement and excessive accumulations should be avoided.



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