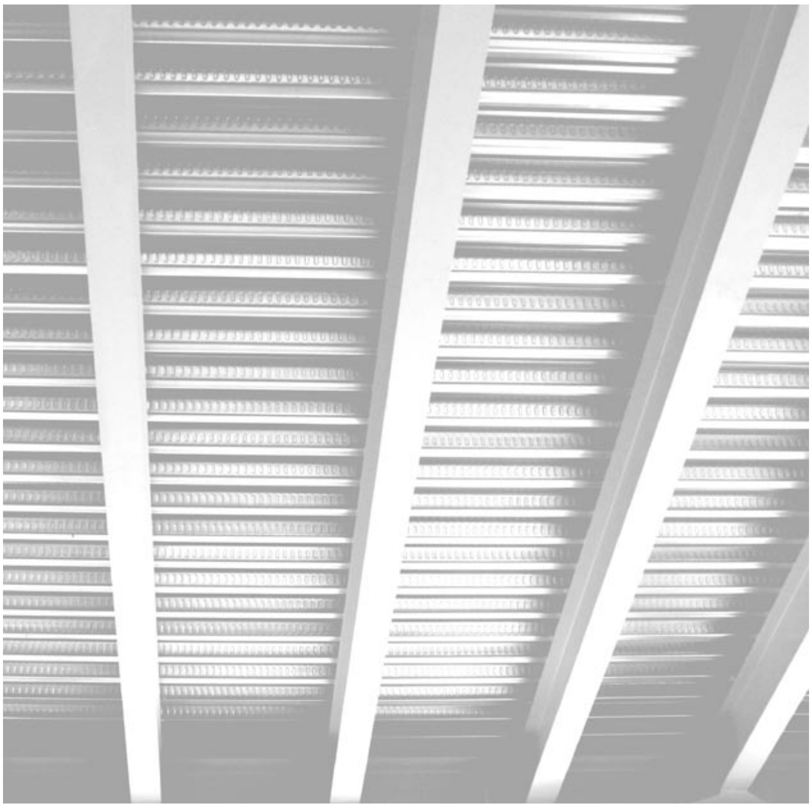

isobau
polyurethane panels

composite slabs
BAUDECK 65

design

of a composite slab comprising trapezoidal BAUDECK 65 steel sheeting produced by ISOBAU

Technical manual dealing with the design of composite slabs comprising trapezoidal BAUDECK 65 steel sheeting produced by ISOBAU, in accordance with Eurocodes 3 and 4. For the design in question, a number of experiments were performed by the National

Workgroups from the National Technical University of Athens and Computer Control Systems S.A. took part in the performance of experiments and the development of software on behalf of ISOBAU.

Project implementation group:

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description & use of composite slabs

The ever increasing use of structural steel in building and other types of construction has led to the use of composite slab, comprising steel sheeting and concrete.

In composite structures, composite structural elements are used. These are structural members whose individual cross sections and parts are inseparably linked to one another and are able to function together methodically. The aim of that combination is to form the cross section that will ensure optimum utilization of the special properties of the structural materials. For example, an effort is being made to ensure that concrete takes up crushing stresses and steel takes up tensile stresses. The use of composite structures is a state-of-the-art construction method.

The basic ingredient of composite slabs is trapezoidal steel sheeting which, takes up concreting loads during the construction phase, thus functioning as metallic formwork (figure 1), and then participates in the composite function of the slab during the operating phase (figure 2), that is, after the concrete has set.

The final result of a composite slab, in addition to the characteristics of traditional reinforced concrete, ensures certain additional advantages summarized as follows:

- fast erection;
- reduced structural weight;
- financial and environmental benefits;
- reduced construction site costs, since erection is not dependent upon weather conditions;
- variety of internal layouts and changeability of use.

figure 1

Typical layout of a composite slab – construction phase

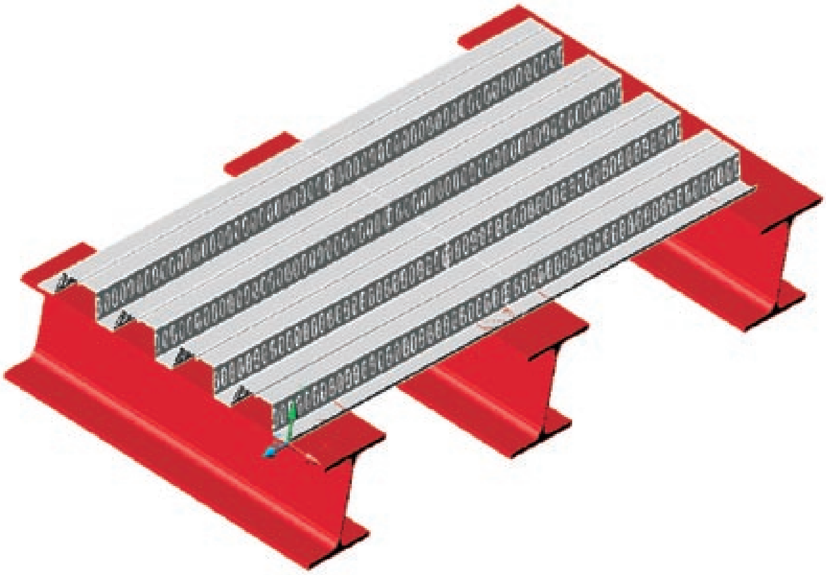
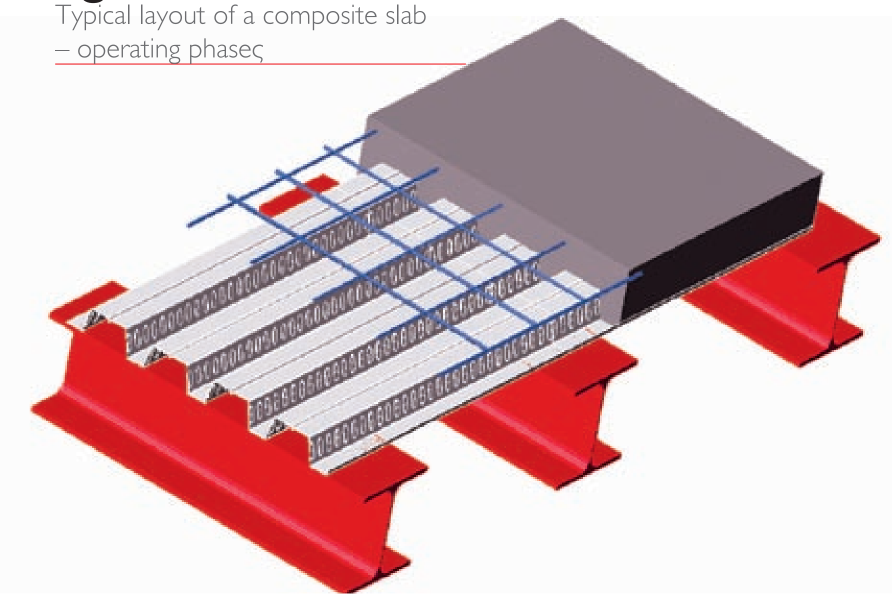


figure 2

Typical layout of a composite slab – operating phaseς

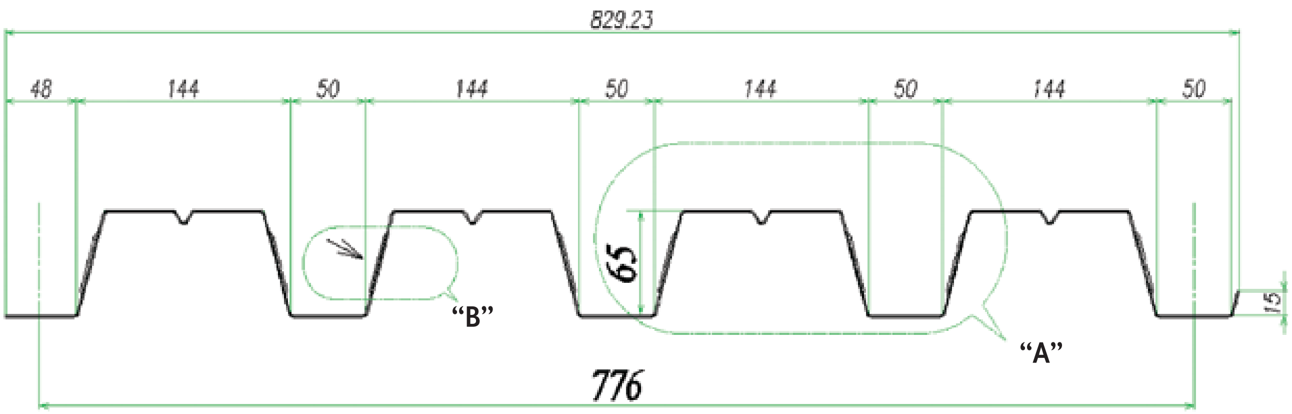


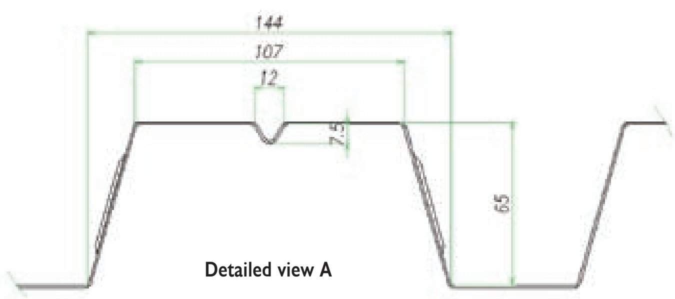
characteristics

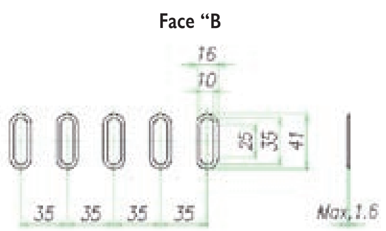
of the BAUDECK 65 steel sheeting

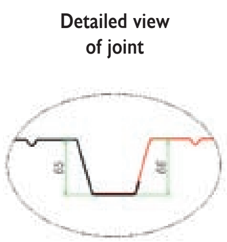
figure 3

BAUDECK 65 geometrical characteristics









The steel sheeting features a trapezoidal cross section with an especially designed profile for ensuring its perfect cooperation with concrete. The composite behavior of the BAUDECK 65 steel sheeting and the concrete is ensured through a mechanical connection created by means of appropriate ribs both on the foot blocks and the body of the steel sheeting.

The static height (65 mm) makes the BAUDECK 65 cross section a golden mean that combines high mechanical strength and ergonomics, as it can be used in slabs featuring large spans, while at the same time increasing the working height of the structure.

The top quality steel sheeting is produced in thicknesses ranging from 0.75 to 1.50 mm. The steel used is FeE320G quality in accordance with Eurocode 3, galvanized or/and colored.

The geometrical and inertia-related characteristics of the profile are shown in figure 3 and table 1.

table 1

BAUDECK 65 geometrical and inertia-related characteristics

Thickness (mm)	Design Thickness	Own weight (kgr/m^2)	Surface (mm^2/m)	Neutral axis (mm)	Inertia (cm^4/m)	Mpl+ (kNm/m)	Mpl- (kNm/m)
0.75	0.71mm	9.48	1093.24	39.31	73.31	5.64	6.30
1.00	0.96mm	12.64	1478.19	39.31	99.13	7.83	11.07
1.25	1.21mm	15.80	1863.14	39.31	124.95	10.06	13.95
1.50	1.46mm	18.96	2248.08	39.31	150.76	12.32	17.61

design
of composite slabs

The design of composite slabs refers to concrete slabs with BAUDECK 65 steel sheeting produced by ISOBAU, which are properly configured so as to ensure the complete shear connection between steel and concrete. The connection depends on the steel sheeting and concrete interface, whereas ordinary adhesion is not considered adequate. The Regulation defines the following types of shear connections:

a) mechanical connection, which is ensured through sheeting deformation (notches or projections);

b) friction connection, which is ensured by using steel sheeting of appropriately formed cross sections;

c) anchoring on the edges, which is ensured by welding shearing nails through the sheeting at the support points;

d) end anchorage, which is ensured through appropriate formation of the troughs at the support points.

Loads are transferred in the direction of the troughs, towards the main beams and girders upon which the slabs are placed. The slab includes a beam whose cross section comprises a complete steel sheeting circle, that is, from top to top of a trapezium. The slabs can be supported at both ends or can be continuous, and there can be cantilever beams.

All construction requirements relating to the nominal size of aggregates and the length of the slab base upon load carrying elements are considered as satisfied.

Construction Phase

In the Construction Phase the beam cross section comprises only the steel sheeting, from trapezium top to trapezium top. The inertia values of the steel sheeting are calculated accurately using the software. The steel sheeting is examined in the construction phase, where it is used as metallic formwork, that is, prior to the setting of concrete. Temporary supports will be taken into account, if any. The vertical loads which can be taken up automatically are:

- the own weight of the steel sheeting g_p;
- the own weight of the concrete g_c;
- the construction loads during the concrete spreading phase q_{con1} and q_{con2}.

Own weights are determined based on the nominal dimensions of the elements. If the maximum distortion δmax of the slab under its own weight and the own weight of the wet concrete are higher than 10% of the height of the solid part of the slab, the thickness of the slab will be increased appropriately.

The own weight of the wet concrete γc,wet is taken as higher than that of the set concrete by 1kN/m^3.

The loads created by the spreading of concrete are:

- an evenly distributed load on all the surface of the slab;
- an evenly distributed load on a 3x3m surface. This load should be placed at the location where it causes the least favorable results. In the case of automatic loads, it is placed in the middle of the largest span. If the span is smaller than 3m, the load is taken between the support points, that is, its length is equal to the span length.

During the construction phase, the design is done based on the marginal states of failures and functionality. During the construction phase, a bending test (1994-1-1 § 9.7.2) and a vertical shear test (1994-1-1 § 9.7.5) are performed. In addition, the bending distortions created are checked to ensure that they are within the limits laid down in Eurocode 4.

Operating Phase

In the Operating Phase, the beam acts as a composite one. In that case, the calculation of inertia values is done using the equivalent cross section method, that is, by dividing the modulus of elasticity of the steel by the modulus of elasticity of the concrete, without taking into account the reinforcing steel. In calculating the plastic neutral axis and then the plastic section modulus, the thickness of the steel sheeting is considered negligible. In calculating the positive section modulus, the participation of the steel sheeting is ignored, since it is compressed, and in calculating the negative section modulus, the steel sheeting behavior in general is ignored for the sake of simplicity. The compressed reinforcing steel is ignored. The own weight is taken in the same way as in the construction phase, taking into account the increased thickness of the slab and the special gravity of dry concrete. The own weight of the steel sheeting is ignored.

During the operating phase of the composite slab, a bending test (1994-1-1 § 9.7.2) and a vertical shear test (1994-1-1 § 9.7.5) are performed, along with punching, fire and longitudinal shear tests.

experimental
layout

The experiments were carried out as part of the tests performed in the Metallic Constructions Laboratory of the National Technical University of Athens (figure 4). The vertical load is applied by a 300 kN hydraulic press, IMMG type, using a rigid metallic plate (figure 5) upon a central HEA 400 beam, which transfers the load onto two HEA 140 beams placed at one quarter of the span and then upon the test specimen. Between the HEA 140 beams and the test specimen, there is a sheet of toughened polyurethane, 100 mm in width, to ensure the even distribution of the load (figure 6). The articulated support of the test specimen is effected through a Ø16 reinforcing bar (figure 7).

The load is applied in a quasi static fashion with controlled deformation. To that end, an electronic flexigraph is attached to press, which is linked to a computer. The computer is used to program the loading history and give the required orders for applying the deformation

figure 4
General layout

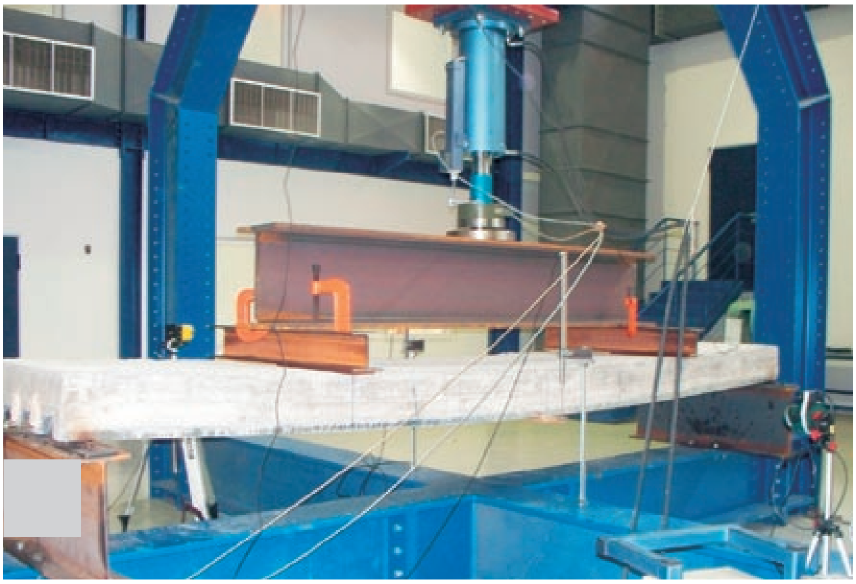


figure 5
Press, load cell and load application plate

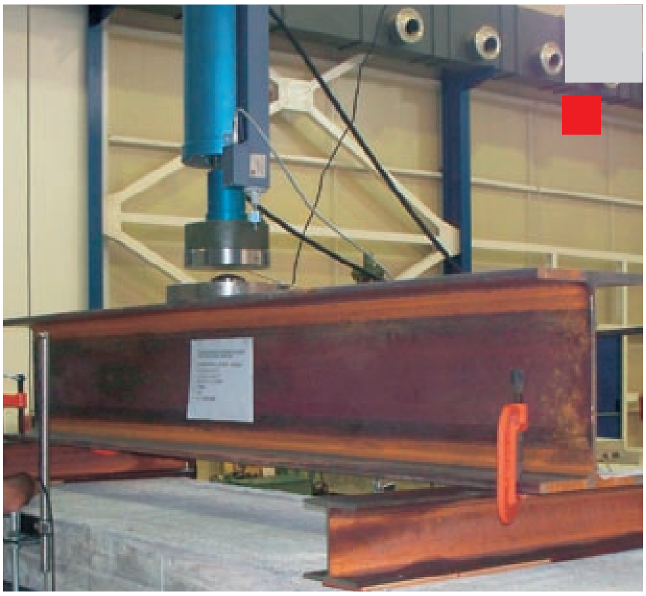
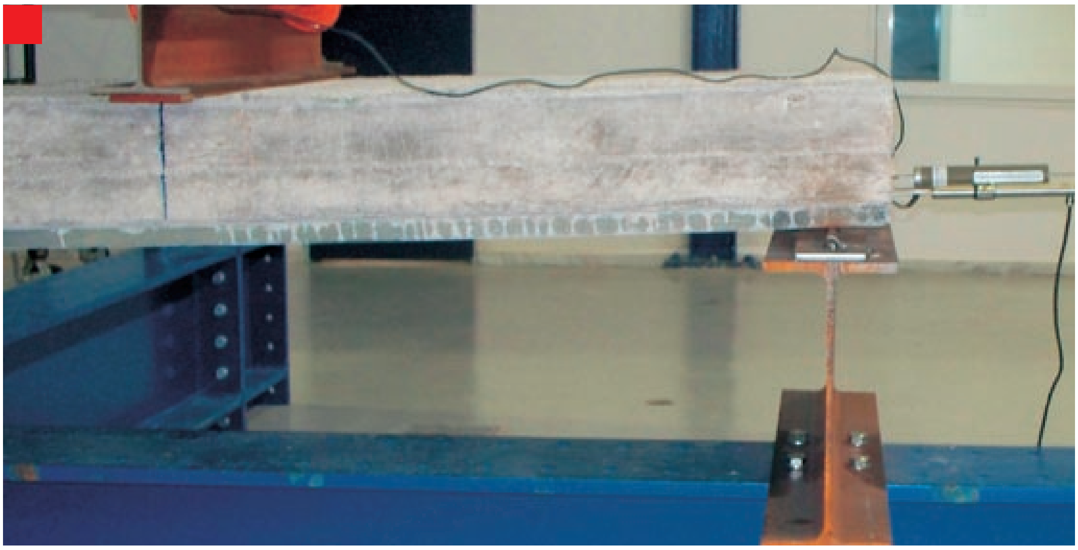


figure 6
Test specimen loading with an intermediate sheet of polyurethane

experimental
layout

figure 7
Implementation of the articulated support



The measuring device includes:

- A load cell of a sensitivity level of 5 N attached to the press to measure the applied force.
- Two electronic LVDT flexigraphs used for measuring the middle distortion on the left (W) and on the right (E) of the test specimen.
- Two electronic LVDT flexigraphs and two electric flexigraphs used for measuring the relevant sliding between the concrete and the sheeting. The measurement is taken at the location of the two central ribs (W, E) at the two ends of the test specimen (N, S). The four measurements are designated as (NW, NE, SW, SE).

All the instruments are linked to a computer to ensure automatic logging and storage of measurements (figure 8).

figure 8
Computer used for control, logging and storage

types of failure

of composite slabs

One of the following types of failure may occur in composite slabs:

- Bending failure
- Longitudinal shear failure
- Vertical shear failure

The steel sheeting plays a major role as regards the behavior and forms of failure of composite slabs. This is what determines the type of shear connection with the concrete. The determination of the resistance of the composite slab to longitudinal shear, in accordance with Eurocode 4, depends on the characteristic parameters m, k (figure 9) which are determined through an appropriate experimental procedure. The procedure is specific and is described in detail in Eurocode 4. The procedure was followed for the determination of the m, k values of the BAUDECK 65 steel sheeting produced by ISOBAU.

Determination of the m, k values

The test specimens used for the determination of the m, k values are described below:

The experimental test specimens were composite slabs comprising ISOBAU steel sheeting. Two series of test specimens were used, the B series and the A series, with slab lengths of 2.0 m and 4.0 m respectively. In each series, two slab thicknesses, 15 cm and 20 cm, were examined. The nominal dimensions of the test specimens are given in table 2. The actual dimensions were determined through onsite measurements and are given for each test specimen separately.

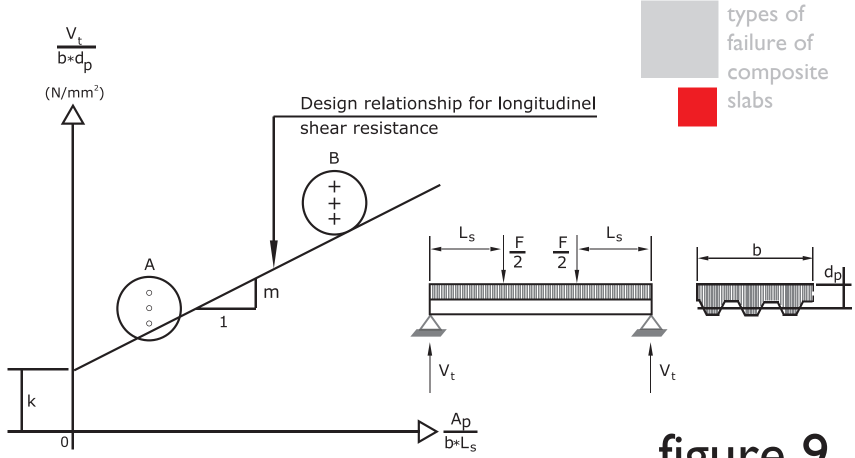


figure 9

Method for calculating the m, k coefficients

table 2

Nominal dimensions of test specimens

Set of test specimens	Total thickness ht [cm]	Length L [m]	Length b [mm]
B	15	2,0	825
B	20	2,0	825
A	15	4,0	825
A	20	4,0	825

Remarks

A) Total length of test specimens Ltot = L + 0.18 m

B) Longitudinal and transverse reinforcing steel on the upper face Ø8/20, S 500 with a 2 cm coating

The test specimens are divided into four sets (table 2). Three test specimens have been constructed for each set. One of the three test specimens in each set is subjected to a static test under an increasing load until it fails. This test is used to determine the failure load Wt (=applied load + slab weight + loading device weight). The failure load is defined as the maximum load of the experiment or the load for which the maximum distortion is over L/50, whichever is lower. The load is applied for no less than one hour.

The other two test specimens are subjected to two loading cycles as follows:

a) repeated loading in 5000 cycles between loads of 0.20Wt and 0.60Wt..

b) Then an increasing load is applied until failure occurs, for no less than one hour. In this test, the load can be applied either with force control or with deformation control.

The loading procedure and the names of the test specimens is given in table 3

table 3

Name of test specimens and loading procedure

Name of specimen	Length	Thickness	Type of load
B 15 1	2 m	15 cm	Static
B 15 2	2 m	15 cm	Cyclic
B 15 3	2 m	15 cm	Cyclic
B 20 1	2 m	20 cm	Static
B 20 2	2 m	20 cm	Cyclic
B 20 3	2 m	20 cm	Cyclic
A 15 1	4 m	15 cm	Static
A 15 2	4 m	15 cm	Cyclic
A 15 3	4 m	15 cm	Cyclic
A 20 1	4 m	20 cm	Static
A 20 2	4 m	20 cm	Cyclic
A 20 3	4 m	20 cm	Cyclic

m – k graphs

figure 10(a)

Slabs 15 cm

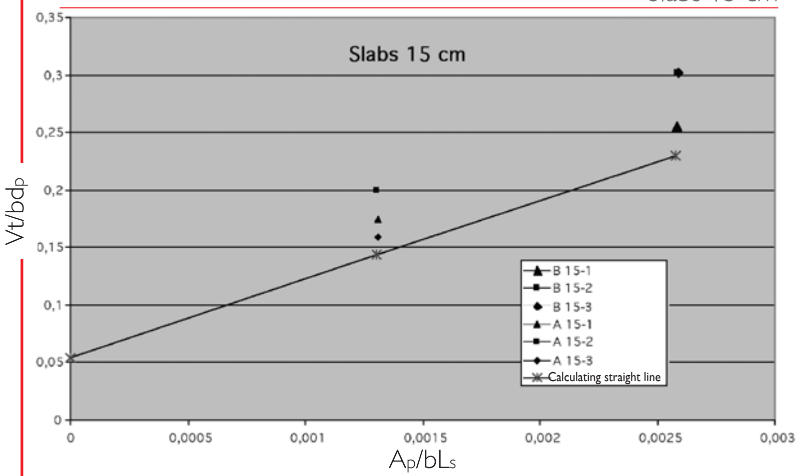
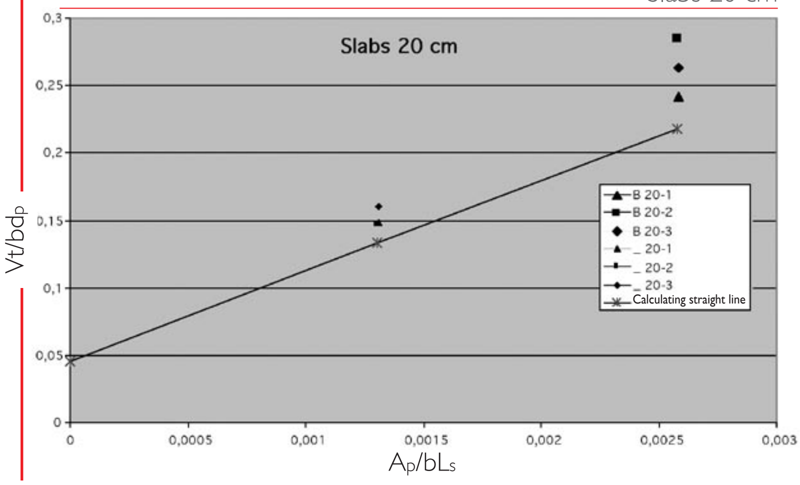


figure 10(b)

Slabs 20 cm



From test specimens A15 and B15, of a slab thickness of 15 cm, we take the load Wt = 0.5Wt. Then, we mark the experiment points in the following graph and we draw the straight line whose value is reduced by 10% compared to the lowest strength of each set. The m-k values are the tilt of the straight line and its section with the vertical axis. A similar straight line is drawn for a slab thickness of 20 cm from test specimens A20 and B20. It should be noted that all the test specimens have a ductile behavior, and thus there is no need to reduce the load Vt. The graphs are given in figure 10 (a, b).

The following values arise from the graphs:

Slabs 15 cm
m= 67,8 MPa k= 0,05493 MPa

Slabsς 20 cm
m= 67,5 MPa k= 0,04372 MPa

The final calculated values are m= 67.5 MPa k= 0.04372 MPa.

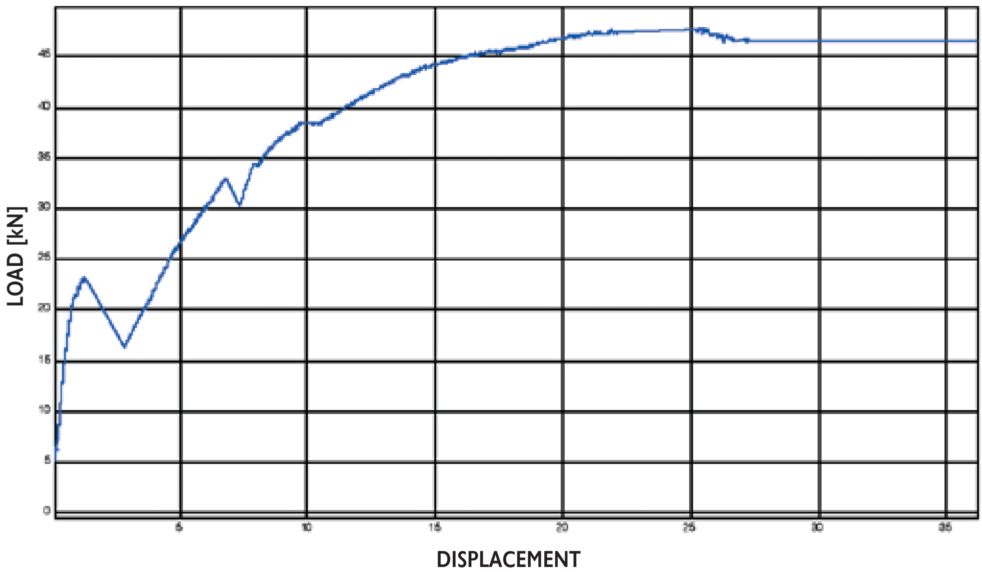
Such values cover composite slabs with the following characteristics:

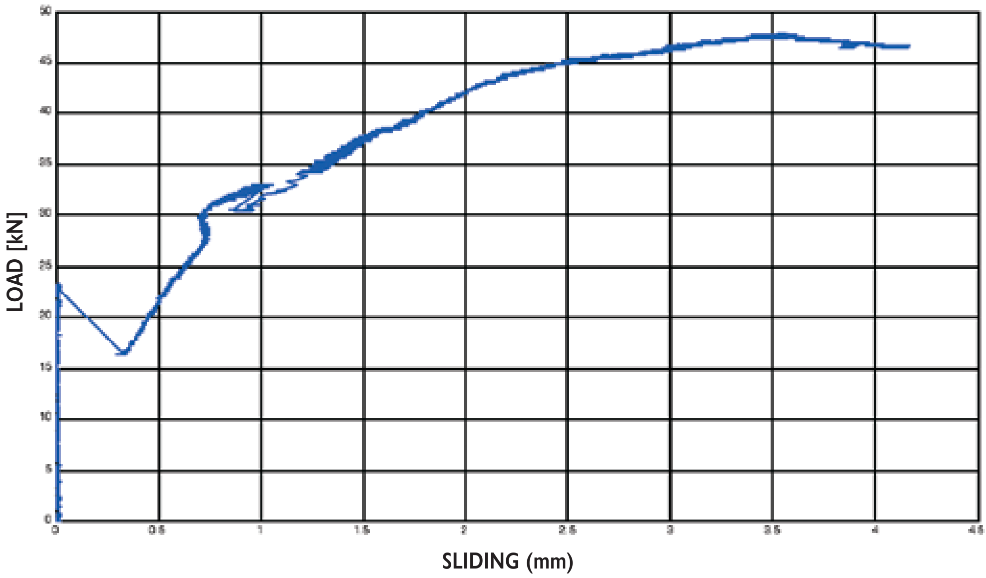
- Slab thickness ≤ 20 cm
- BAUDECK 65 steel sheeting of a thickness of ≥ 0.75 mm
- Concrete of a nominal cube strength fck ≥ 25 MPa
- Steel sheeting of a nominal yield point fyp ≥ 298 MPa.

For thinner slabs of a thickness of ≤ 15 cm, the following more favorable values can be used: **m= 67,8 MPa k= 0,05493 MPa.**

Figure 11

Indicative experiment graphs





dimensioning tables

of composite slabs with BAUDECK 65 trapezoidal steel sheeting

The following tables lay down the characteristic values of the maximum workload which a composite slab can take up, depending on the thickness of the BAUDECK 65 steel sheeting and the thickness of the concrete. The tables include the static systems of the composite slab supported at both ends and of a continuous slab with two or more spans. Taking into account the slab thickness and the span length, we are able to calculate the maximum load that the system can take up.

Furthermore, taking into account only the span length or the slab thickness, we are able to calculate the corresponding slab thickness or span length that meets a specific load requirement.

In addition, the tables point to a possible need for using temporary support for the steel sheeting during the concreting phase, if the distortions that arise due to the concrete spreading loads are higher than the limits set out in the regulation.

The preparation of the dimensioning tables was based on the EC4-ISOBAU software, which was used for the determination of both the need for temporary support in the spans which was considered necessary during the construction phase and the marginal workload which a composite slab can take up during the operating phase. The software simulates the existence and subsequent removal of temporary support, taking into account the actual function of the structure, transferring the distortions and stress values that arose during the construction and operating phases.

Slab Material Characteristics

Material qualities

Steel sheeting	**FeE 320G**	
Reinforcing steel	**S500**	
Concrete	**C20/25**	
	2400 kg/m² (23,544 kN/m²), fresh	
	2350 kg/m² (23,044 kN/m²), dry	

Concrete Characteristics

Steel sheeting thickness (mm)	Slab height (mm)	Volume (m^3/m^2)	Own weight (fresh) kN/m^2	Own weight (dry) kN/m^2
t=0.75	130	0.116	2.73	2.67
	140	0.125	2.94	2.88
	150	0.134	3.15	3.09
	160	0.143	3.37	3.30
	170	0.152	3.58	3.50
	180	0.161	3.79	3.71
	190	0.170	4.00	3.92
	200	0.178	4.19	4.10
t=1.00	130	0.111	2.61	2.56
	140	0.119	2.80	2.74
	150	0.128	3.01	2.95
	160	0.136	3.20	3.14
	170	0.145	3.41	3.34
	180	0.153	3.60	3.53
	190	0.162	3.81	3.73
	200	0.170	4.00	3.92
t=1.25	130	0.106	2.50	2.44
	140	0.114	2.68	2.63
	150	0.122	2.87	2.81
	160	0.13	3.06	3.00
	170	0.138	3.25	3.18
	180	0.146	3.44	3.37
	190	0.155	3.65	3.57
	200	0.163	3.84	3.76
t=1.50	130	0.100	2.35	2.31
	140	0.109	2.57	2.51
	150	0.116	2.73	2.67
	160	0.124	2.92	2.86
	170	0.132	3.11	3.04
	180	0.14	3.30	3.23
	190	0.147	3.46	3.39
	200	0.155	3.65	3.57

Fire resistance

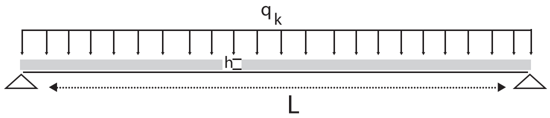
Slab height h (mm)	130	140	150	160	170	180	190	200
Resistance to time (min)	75	91	106	122	137	153	168	184

Slab supported at both ends

Material qualities

Steel FeE320G

Concrete C20/25



qk (kN/m²) characteristic workload value

Steel sheeting thickness 0.75 mm

Span L (mm)	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500
Slab thickness h (mm) 130	24.20	18.96	15.47	12.57	9.50	7.35	5.67	4.61	3.71	3.00	2.41	1.94	1.55	1.22	0.94	0.70	0.49	0.31	0.15
140	25.54	19.99	16.30	13.65	10.53	8.16	6.42	5.12	4.11	3.31	2.68	2.15	1.71	1.34	1.04	0.77	0.54	0.33	0.16
150	26.85	20.99	17.09	14.30	11.57	8.96	7.05	5.62	4.51	3.64	2.93	2.36	1.87	1.47	1.13	0.84	0.59	0.36	0.17
160	28.11	21.96	17.86	14.92	12.62	9.76	7.68	6.12	4.91	3.95	3.19	2.56	2.05	1.60	1.23	0.91	0.63	0.39	0.18
170	29.34	22.90	18.60	15.53	13.23	10.56	8.31	6.62	5.32	4.29	3.45	2.76	2.21	1.73	1.32	0.98	0.68	0.41	0.19
180	30.55	23.82	19.33	16.12	13.72	11.37	8.94	7.12	5.72	4.61	3.70	2.98	2.37	1.86	1.42	1.05	0.73	0.44	0.20
190	31.73	24.72	20.04	16.70	14.20	12.17	9.58	7.63	6.12	4.92	3.97	3.19	2.53	1.99	1.52	1.12	0.77	0.47	0.21
200	32.88	25.60	20.74	17.27	14.66	12.64	10.20	8.13	6.52	5.26	4.24	3.39	2.70	2.11	1.62	1.19	0.82	0.50	0.21

Steel sheeting thickness 1.00 mm

Span L (mm)	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500
Slab thickness h (mm) 130	24.20	18.96	15.47	12.98	11.11	9.66	7.78	6.13	5.09	4.17	3.43	2.83	2.33	1.91	1.56	1.25	0.99	0.76	0.56
140	25.54	19.99	16.29	13.65	11.67	10.13	8.63	6.80	5.64	4.62	3.80	3.13	2.58	2.11	1.72	1.38	1.09	0.83	0.61
150	26.85	20.99	17.09	14.30	12.21	10.58	9.28	7.63	6.20	5.06	4.17	3.44	2.82	2.31	1.88	1.51	1.19	0.91	0.68
160	28.11	21.96	17.86	14.93	12.73	11.02	9.65	8.31	6.75	5.53	4.54	3.74	3.08	2.52	2.05	1.64	1.29	0.99	0.73
170	29.34	22.90	18.60	15.53	13.23	11.44	10.00	8.84	7.31	5.98	4.91	4.04	3.32	2.73	2.22	1.78	1.40	1.06	0.78
180	30.55	23.82	19.33	16.13	13.72	11.85	10.36	9.13	7.86	6.42	5.28	4.35	3.58	2.93	2.38	1.90	1.50	1.15	0.84
190	31.73	24.71	20.04	16.70	14.20	12.25	10.69	9.42	8.36	6.88	5.66	4.65	3.83	3.13	2.54	2.04	1.60	1.22	0.89
200	32.88	25.60	20.74	17.27	14.66	12.64	11.17	9.69	8.59	7.33	6.04	4.96	4.08	3.33	2.71	2.17	1.70	1.30	0.95

Steel sheeting thickness 1.25 mm

Span L (mm)	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500
Slab thickness h (mm) 130	24.20	18.96	15.47	12.98	11.11	9.66	8.49	7.54	6.33	5.34	4.44	3.72	3.11	2.59	2.17	1.80	1.48	1.21	0.97
140	25.54	20.00	16.29	13.65	11.67	10.13	8.89	7.89	7.05	5.93	4.93	4.11	3.44	2.88	2.40	1.99	1.64	1.34	1.07
150	26.84	20.99	17.09	14.30	12.21	10.58	9.28	8.21	7.33	6.51	5.41	4.51	3.77	3.15	2.63	2.18	1.80	1.47	1.17
160	28.11	21.96	17.86	14.92	12.73	11.02	9.65	8.53	7.60	6.81	5.88	4.91	4.11	3.44	2.86	2.38	1.96	1.59	1.27
170	29.34	22.90	18.60	15.53	13.23	11.44	10.00	8.84	7.86	7.04	6.33	5.32	4.45	3.71	3.09	2.57	2.11	1.72	1.37
180	30.55	23.82	19.33	16.12	13.72	11.85	10.36	9.16	8.11	7.28	6.51	5.73	4.78	4.00	3.33	2.76	2.27	1.85	1.48
190	31.73	24.72	20.04	16.70	14.20	12.25	10.75	9.42	8.36	7.54	6.84	6.03	5.12	4.27	3.57	2.95	2.43	1.97	1.57
200	32.88	25.60	20.74	17.27	14.67	12.64	11.02	9.70	8.59	7.67	6.97	6.29	5.44	4.55	3.79	3.14	2.59	2.01	1.68

Steel sheeting thickness 1.50 mm

Span L (mm)	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500
Slab thickness h (mm) 130	24.20	18.96	15.47	12.98	11.11	9.66	8.49	7.54	7.54	6.07	5.46	4.60	3.88	3.29	2.78	2.35	1.98	1.66	1.38
140	25.54	19.99	16.29	13.65	11.67	10.13	8.90	7.88	7.88	6.34	5.72	5.01	4.30	3.64	3.08	2.60	2.19	1.83	1.53
150	26.85	20.99	17.09	14.30	12.21	10.58	9.28	8.21	8.21	6.67	5.94	5.38	4.73	3.99	3.38	2.86	2.41	2.01	1.67
160	28.11	21.96	17.86	14.93	12.73	11.02	9.65	8.53	8.53	6.81	6.13	5.57	5.04	4.34	3.68	3.10	2.61	2.19	1.82
170	29.34	22.90	18.60	15.53	13.23	11.44	10.01	8.84	8.84	7.04	6.33	5.71	5.18	4.71	3.99	3.36	2.83	2.37	1.96
180	30.55	23.82	19.33	16.12	13.72	11.85	10.36	9.13	9.13	7.25	6.51	5.98	5.31	4.82	4.29	3.62	3.04	2.55	2.12
190	31.73	24.72	20.04	16.70	14.20	12.25	10.69	9.42	9.42	7.46	6.77	6.02	5.43	4.92	4.46	3.87	3.26	2.71	2.26
200	32.88	25.59	20.74	17.27	14.66	12.64	11.02	9.70	9.70	7.79	6.85	6.16	5.61	5.02	4.56	4.12	3.46	2.89	2.40

Notes:

- The results are in light blue background when one temporary support is needed
- The results are in light green background when two temporary supports are needed
- Reinforcing steel in all tests: Ø12 at 30 mm from the upper fiber of the slab and of a surface of 0.131 mm²/mm
- Steel safety coefficient 1.1 and concrete safety coefficient 1.5

qk = characteristic workload value (no safety coefficients)

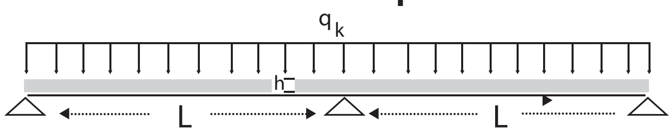
Continuous slab with 2 or more spans

Material qualities

Steel FeE320G

Concrete C20/25

Reinforcing steel S500



Reinforcing steel layout								
h (mm)	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00
	Ø8/20	Ø8/20	Ø8/15	Ø8/15	Ø10/20	Ø10/20	Ø10/15	Ø10/15
Surfac (mm²/mm)	0.250	0.250	0.333	0.333	0.395	0.395	0.527	0.527

qk (kN/m²) characteristic workload value

Steel sheeting thickness 0.75 mm

Span L	(mm)	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500
Slab thickness h (mm)	130	24.20	18.96	15.47	12.57	9.50	8.48	7.43	6.33	5.13	4.19	3.42	2.81	2.30	1.87	1.43	1.08	0.78	0.53	0.30
	140	25.54	19.99	16.30	13.65	10.53	8.83	7.73	6.82	5.69	4.64	3.80	3.11	2.55	2.07	1.62	1.22	0.89	0.60	0.35
	150	26.85	20.99	17.09	14.30	11.57	9.17	8.00	7.06	6.24	5.09	4.17	3.42	2.79	2.27	1.83	1.46	1.13	0.85	0.60
	160	28.11	21.96	17.86	14.92	12.62	9.76	8.28	7.29	6.46	5.54	4.54	3.72	3.04	2.47	1.99	1.58	1.23	0.92	0.65
	170	29.34	22.90	18.60	15.53	13.23	10.56	8.54	7.51	6.64	5.91	4.91	4.02	3.29	2.67	2.15	1.71	1.33	0.99	0.70
	180	30.55	23.82	19.33	16.12	13.72	11.37	8.94	7.72	6.81	6.05	5.28	4.33	3.53	2.87	2.31	1.83	1.42	1.07	0.75
	190	31.73	24.72	20.04	16.70	14.20	12.17	9.58	7.92	6.98	6.19	5.51	4.63	3.78	3.07	2.47	1.96	1.52	1.14	0.80
	200	32.88	25.60	20.74	17.27	14.66	12.64	10.20	8.13	7.14	6.32	5.62	4.93	4.03	3.27	2.63	2.09	1.62	1.21	0.85

Steel sheeting thickness 1.00 mm

Span L	(mm)	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500
Slab thickness h (mm)	130	24.20	18.96	15.47	12.98	11.11	9.66	7.78	6.58	5.70	4.56	3.66	2.94	2.34	1.91	1.56	1.25	0.99	0.76	0.56
	140	25.54	19.99	16.29	13.65	11.67	10.13	8.63	6.82	6.07	5.12	4.11	3.30	2.63	2.11	1.72	1.38	1.09	0.83	0.61
	150	26.85	20.99	17.09	14.30	12.21	10.58	9.28	7.63	6.27	5.60	5.03	4.53	4.09	3.47	2.90	2.42	1.93	1.52	1.17
	160	28.11	21.96	17.86	14.93	12.73	11.02	9.65	8.31	6.75	5.76	5.16	4.64	4.18	3.78	3.16	2.63	2.14	1.69	1.31
	170	29.34	22.90	18.60	15.53	13.23	11.44	10.00	8.84	7.31	5.98	5.28	4.74	4.26	3.84	3.42	2.85	2.35	1.92	1.55
	180	30.55	23.82	19.33	16.13	13.72	11.85	10.36	9.13	7.86	6.42	5.40	4.83	4.33	3.90	3.51	3.06	2.53	2.07	1.67
	190	31.73	24.71	20.04	16.70	14.20	12.25	10.69	9.42	8.36	6.88	5.66	4.92	4.40	3.95	3.54	3.18	2.70	2.21	1.78
	200	32.88	25.60	20.74	17.27	14.66	12.64	11.17	9.69	8.59	7.33	6.04	5.00	4.47	4.00	3.58	3.20	2.86	2.35	1.89

Steel sheeting thickness 1.25 mm

Span L	(mm)	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500
Slab thickness h (mm)	130	24.20	18.96	15.47	12.98	11.11	9.66	8.49	7.54	6.33	5.34	4.44	3.72	3.11	2.59	2.17	1.80	1.48	1.21	0.97
	140	25.54	20.00	16.29	13.65	11.67	10.13	8.89	7.89	7.05	5.93	4.93	4.11	3.44	2.88	2.40	1.99	1.64	1.34	1.07
	150	26.84	20.99	17.09	14.30	12.21	10.58	9.28	8.21	7.33	6.51	5.41	4.53	4.09	3.59	2.95	2.40	1.92	1.52	1.17
	160	28.11	21.96	17.86	14.92	12.73	11.02	9.65	8.53	7.60	6.81	5.88	4.91	4.18	3.78	3.42	2.66	2.14	1.70	1.31
	170	29.34	22.90	18.60	15.53	13.23	11.44	10.00	8.84	7.86	7.04	6.33	5.32	4.45	3.84	3.47	3.13	2.83	2.56	2.01
	180	30.55	23.82	19.33	16.12	13.72	11.85	10.36	9.16	8.11	7.28	6.51	5.73	4.78	4.00	3.51	3.16	2.85	2.56	2.31
	190	31.73	24.72	20.04	16.70	14.20	12.25	10.75	9.42	8.36	7.54	6.84	6.03	5.12	4.27	3.57	3.18	2.86	2.56	2.29
	200	32.88	25.60	20.74	17.27	14.67	12.64	11.02	9.70	8.59	7.67	6.97	6.29	5.44	4.55	3.79	3.20	2.86	2.56	2.28

Steel sheeting thickness 1.50 mm

Span L	(mm)	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500
Slab thickness h (mm)	130	24.20	18.96	15.47	12.98	11.11	9.66	8.49	7.54	7.54	6.07	5.46	4.60	3.88	3.29	2.78	2.35	1.98	1.66	1.38
	140	25.54	19.99	16.29	13.65	11.67	10.13	8.90	7.88	7.88	6.34	5.72	5.01	4.30	3.64	3.08	2.60	2.19	1.83	1.53
	150	26.85	20.99	17.09	14.30	12.21	10.58	9.28	8.21	8.21	6.67	5.94	5.38	4.73	3.99	3.38	2.86	2.41	2.01	1.67
	160	28.11	21.96	17.86	14.93	12.73	11.02	9.65	8.53	8.53	6.81	6.13	5.57	5.04	4.34	3.68	3.10	2.61	2.19	1.82
	170	29.34	22.90	18.60	15.53	13.23	11.44	10.01	8.84	8.84	7.04	6.33	5.71	5.18	4.71	3.99	3.36	2.83	2.56	2.10
	180	30.55	23.82	19.33	16.12	13.72	11.85	10.36	9.13	9.13	7.25	6.51	5.98	5.31	4.82	4.29	3.62	3.04	2.56	2.31
	190	31.73	24.72	20.04	16.70	14.20	12.25	10.69	9.42	9.42	7.46	6.77	6.02	5.43	4.92	4.46	3.87	3.26	2.71	2.29
	200	32.88	25.59	20.74	17.27	14.66	12.64	11.02	9.70	9.70	7.79	6.85	6.16	5.61	5.02	4.56	4.12	3.46	2.89	2.40

Notes:

- The results are in light blue background when one temporary support is needed
- The results are in light green background when two temporary supports are needed
- The lengths correspond to the length of each span
- Steel safety coefficient 1.1 and concrete safety coefficient 1.5
- The temporary supports pertain to each span

qk=characteristic workload value (no safety coefficients)

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