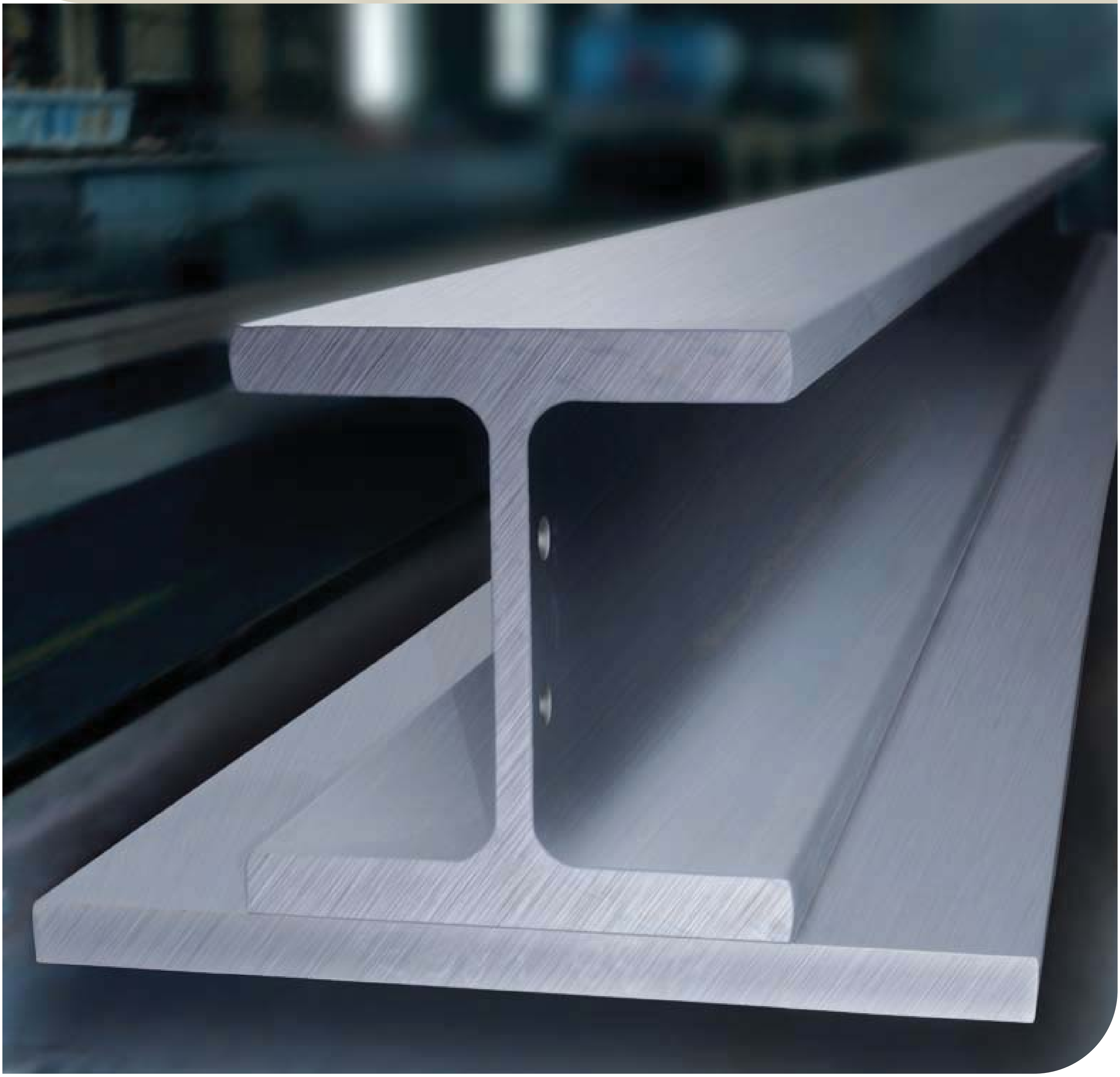
ArcelorMittal Europe - Long Products
Sections and Merchant Bars

ArcelorMittal

Slim Floor

An innovative concept for floors

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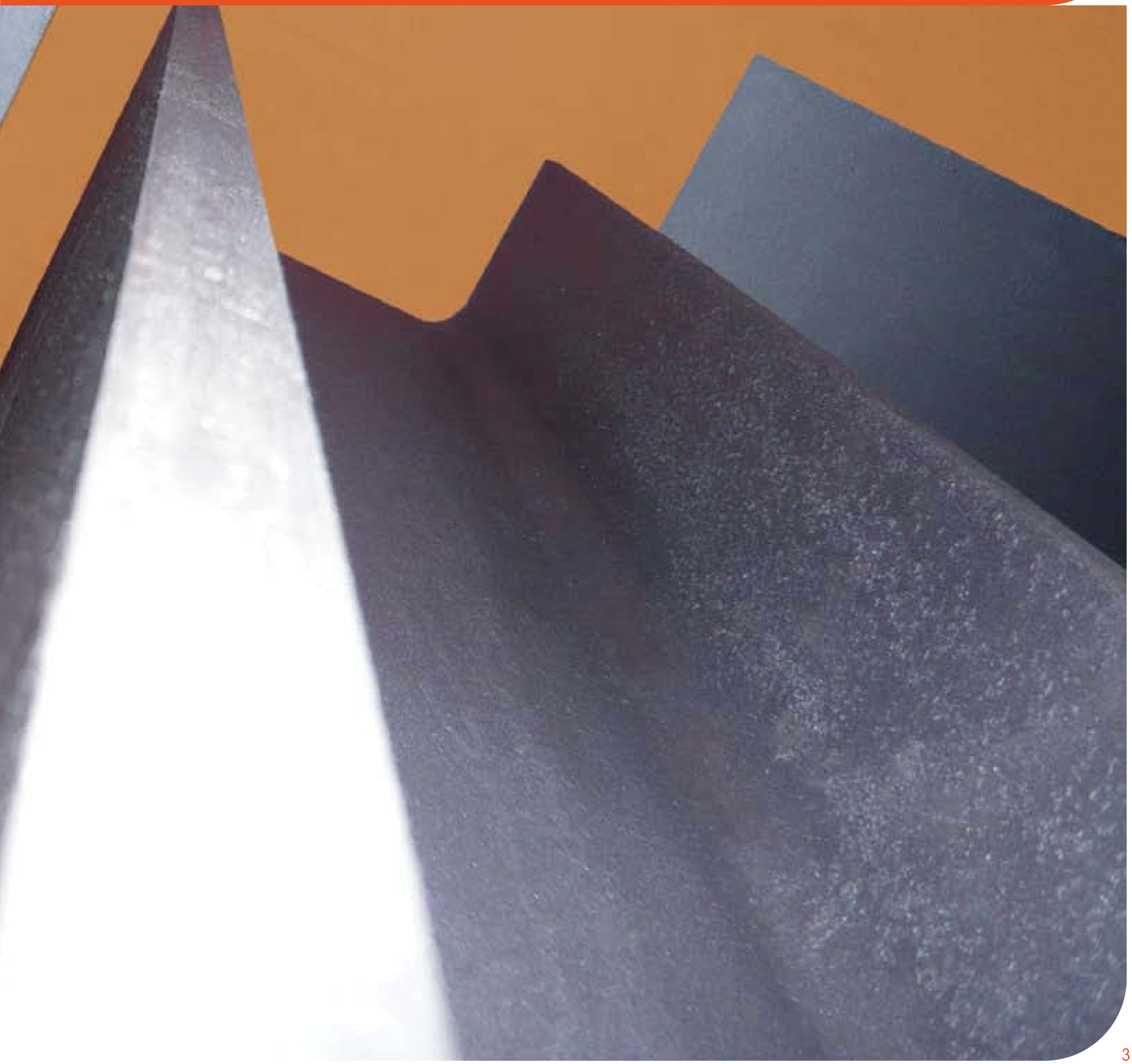
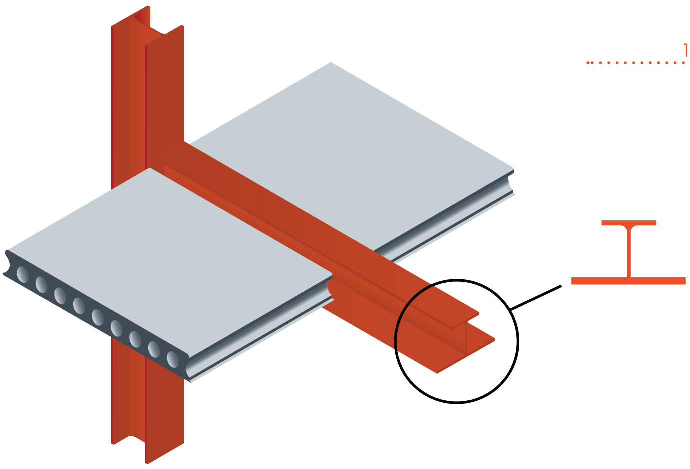
Fire resistant
Integrated
Flexible

Contents

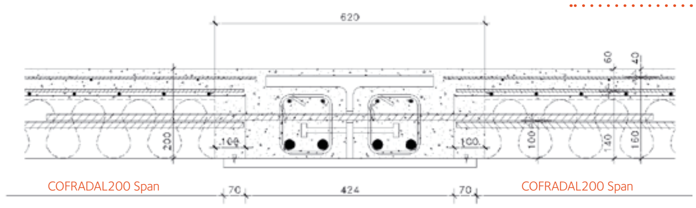
1. PRIORITY TO ARCHITECTURAL EXPRESSION



1.1.1



1.1.2



Developed and offered by the ArcelorMittal group, the "Slim Floor" system is a fast, innovative and economical solution which marries cellular concrete slabs with built-in steel beams.

The secret of the design is a special kind of girder with a lower flange which is wider than the upper flange. This arrangement makes it possible to fit the floor slabs directly onto the lower flange plate of the beam, so that the two constituents thus make up the floor.

Created to eliminate beam downstands at the level of the floor slabs, this reliable and economic prefabricated component unit gives the architect new scope for imagination and guaranteed economy for working spans of up to 8 metres.

The reduced height of the slabs and the advantage of a considerable degree of fire resistance make for maximum freedom in creativity.

A good alternative to the concrete slab would be the use of a floor on a **Cofradal® 200** steel tray.

1.1.3

1.1.1 IFB beam perfectly incorporated into the concrete floor.
1.1.2 IFB beam and Cofradal® flooring system
1.1.3 Car park made of IFB beams (Nantes, France)

2. THE TEN ADVANTAGES OF "SLIM FLOOR"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Successfully used for twenty years in Scandinavia, the "Slim Floor" process optimises the effective volume of the building and offers a number of advantages.

1. Floor thickness reduction

This design gives a total flooring thickness reduction of between 25 and 40 centimetres according to the structure.

Depending on the limitations of the project, this means that the room can be higher, extra floors can be added or the total height of the building can be reduced, which is often required by town planning requirements (e.g. very tall building classification). This degree of flexibility as regards height allows great freedom in the design of the façade and the roofing and savings can be made.

2. Constructing floors of variable thicknesses

Should the span of the floor on either side of the supporting steel beam be important, up to 10 centimetres of difference in floor thickness could result.

In situations like this, the "Slim Floor" beam provides a practical and elegant solution for dealing with the interface between the 2 floors.


2.1.1

3. Incorporating under-floor technical equipment

The integrated beams make it easier to build in under-floor technical equipment (air-conditioning, piping, electrical and ICT networks, etc), and simplify the fitting of false ceilings.

The under-surfaces of the prefabricated slabs may also be left exposed on the soffit as long as some prefabrication precautions are taken and certain handling techniques are used.

4. Freeing-up working space

The structural characteristics of the components, with up to 8 metres of bearing length for the steel beams and up to 10 or 12 metres for the slabs, means that open working spaces can be created, with a reduced number of intermediate columns. The spaces can be organised according to the aesthetic or operational requirements that may evolve over time.

5. Creating vertical movement space

- Openings can be designed at the outset in the prefabricated floors depending on the possibilities offered by the slab manufacturers.
- Where a slab is poured on site, provision can be made for pouring partitions or cavities to be made at a later date.

6. Built-in fire resistance

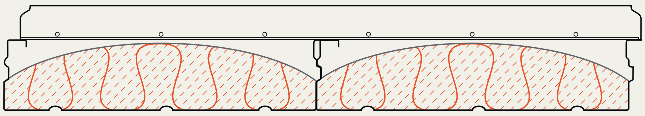
The incorporation of the upper flange plates and cores of the beams in the thickness of the concrete slabs provides structural protection which meets most regulatory requirements, so that no fire protection is required (see section 5).


2.1.2

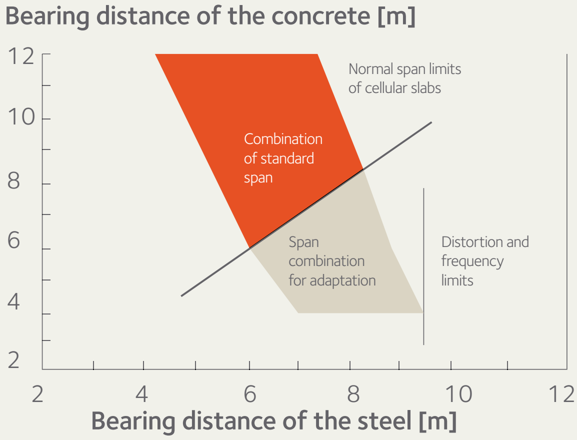
2.1.1 Reduced floor thickness (Clinique d'Eich, Luxembourg)
2.1.2 Built-in under-floor technical equipment (Petrusse Building, Luxembourg)
2.1.3 Prefabricated components being easily assembled
2.1.4 Section through a Cofradal® 200 floor
2.1.5 Application of area of the IFB system

2.1.3

2.1.4



2.1.5



7. Competitive pricing

The amount of steel per square metre of floor is relatively low (generally from 15 to 25 kg/m^2 for beam spans from 5 to 7.5 meters). Cellular slabs are easily available on the market at competitive prices. The marriage of these two items results in very competitive prices throughout the whole span range covered by the system.

8. Easy to build

The fast and simple assembly of the pre-fabricated components is almost entirely unaffected by atmospheric conditions. This makes it easier to meet site deadlines and to reduce construction costs to a minimum.

9. Environmentally-sensitive construction

The metal structure is 100% recyclable and reduces the number of transportation trips to the site and building site nuisance.

10. Lighter structures

The steel structure is composed of elements which are all lighter than structural elements of concrete.

If a floor type **Cofradal® 200** is used, the actual weight of the floor is decreased to 200kg/m^2.

3. ASYMMETRICAL GIRDERS - AN INTELLIGENT SOLUTION

3.1 Different Slim Floor beam models

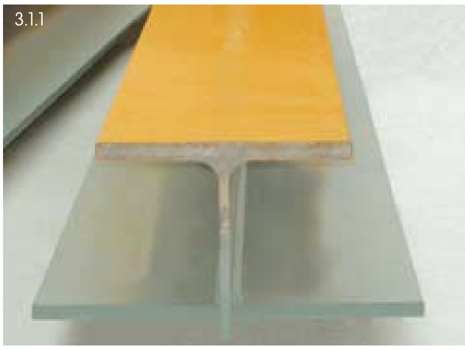
IFBs (Integrated Floor Beams) and SFBs (Slim Floor Beams) are reconstituted from hot-rolled profiles and welded steel plates. They feature a lower flange plate (between 28 and 51 centimetres wide) which acts as a support for the floor slab.

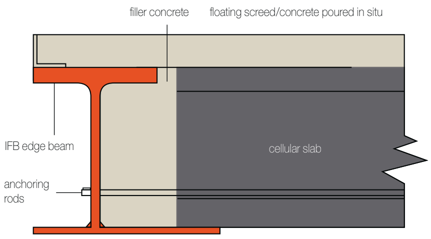
These beams are available with spans of 5 to 8 metres and for effective heights of 14 to 30 centimetres.

They can be cambered to offset the permanent load deflection. They may be designed as composite beams by welding shear studs onto the upper flange. This solution takes advantage of the participation of the extra concrete poured onto the slabs and increases the rigidity and robustness of the system.

Where a rectangular frame is used, the span of the beams generally coincides with the smallest direction.

The edge beams may be partly or completely integrated into the floor (picture 3.1.2). This will require several anchoring rods being provided and temporary propping during erection to avoid torsion. A more economical solution is the use of conventional beams with under the slab (picture 3.1.3).

3.1.1


3.1.2


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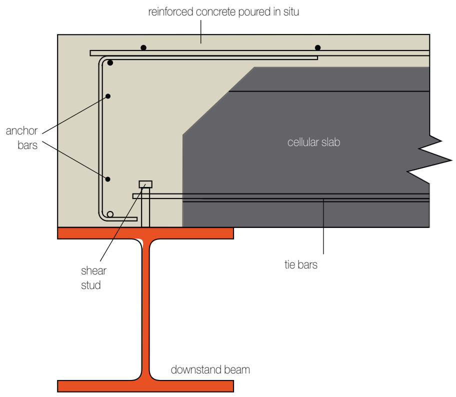
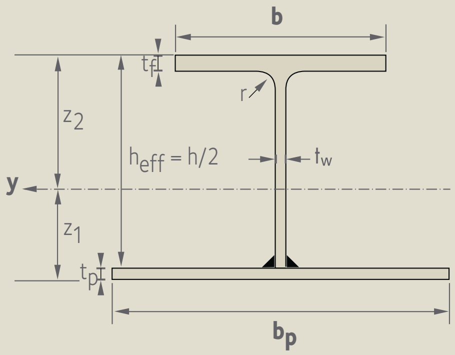


3.1.4


3.1.1 Section through an IFB girder
3.1.2 Built-in edge beam
3.1.3 Downstand edge beam
3.1.4 Cambered IFB and sloping beam, Nantes car park (France)
3.1.5 IFB type A and B and SFB
3.1.6 With steel plates, it is possible to make 2x IFB type A or 2x IFB type B or 1x SFB.

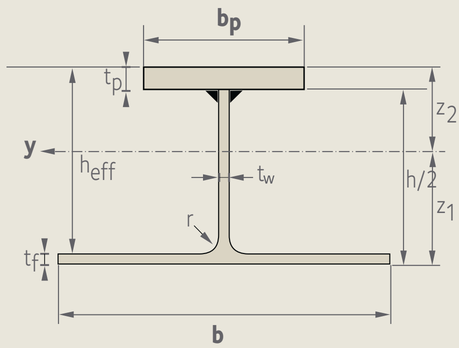


3.1.5
IFB type A

There are three types of asymmetrical girders (see the facing section):

IFB TYPE A:

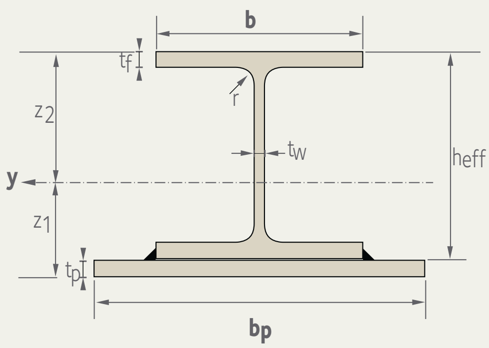
A lower flange plate welded onto a half HE or IPE. For example, the upper 'T' may be made from an IPE 500 or 600 cut in two, that is, a beam height of 250 or 300 millimetres. The bp figure must be at least equal to b+200 mm to guarantee minimum support on both sides of the 'T' of 70 mm for the slabs. In fact, the support width must be determined in accordance with the specific requirements of the slab manufacturer.



3.1.5
IFB type B

IFB TYPE B:

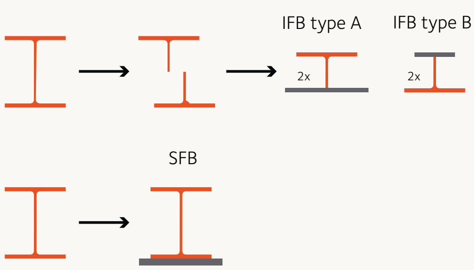
A cut HE and a welded upper flange plate. These are suitable for small spans, since the maximum height of the web, obtained by cutting an HP or HD 400 in two, is about 200 millimetres.



3.1.5
SFB

SFB:

A plate is welded under an HE or an IPE. The SFB manufacturing cost is lower than for an IFB. This solution is appropriate for small-scale standard projects where materials are immediately available.



3.1.6

3.2 Column-beam connection

The beams are bolted on steel "H" columns in the conventional manner, either by endplates, or by cleats, directly supported by columns or walls.

Quick erect systems may also be used. By means of cut-outs in the end plates the beams are fitted directly onto threaded rods passing through the columns.

3.3 Beam-slab connection

The slabs are placed on the lower flange of the beams and the assembly is made solid with filler concrete and tie bars.

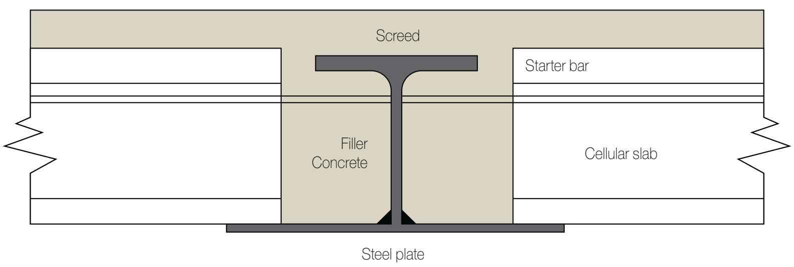
In order to increase the strength of the floor, the slab elements being faced are to connect to each other by reinforcement which cross or overpass the beams in the direction of the slabs. The bars are anchored in the joints or in the open cells of the slab elements.

A concrete screed of a minimum of 5 centi-metres is recommended to increase the rigidity and strength of the system. This is required to transmit horizontal forces by diaphragm effect and to increase fire-resistance of the floor.

Slab elements are available with a length from 6 to 12 metres. An ideal grid leads to similar slab and beam heights.

Prefabricated elements type **Cofradal® 200** may also be used.

3.3.2



3.2.1 Column-beam connection
3.3.1 Flooring before concrete-work, Nantes car park
3.3.2 Section of a slab floor in a type A IFB

4. ERECTION

© Michel Denancé


4.1.1


4.1.2

The flooring is erected floor by floor to facilitate slab handling and the concrete pouring.

The columns, often continuous through two or three floors, are stabilised with temporary or permanent bracing during erection. In most cases these are bolted onto the columns.

The steel beams are fixed to the columns and the slabs are installed. The edge beams and those under asymmetrical loading are propped to avoid torsional effects. After the pouring and the hardening of the concrete the propping can be removed.

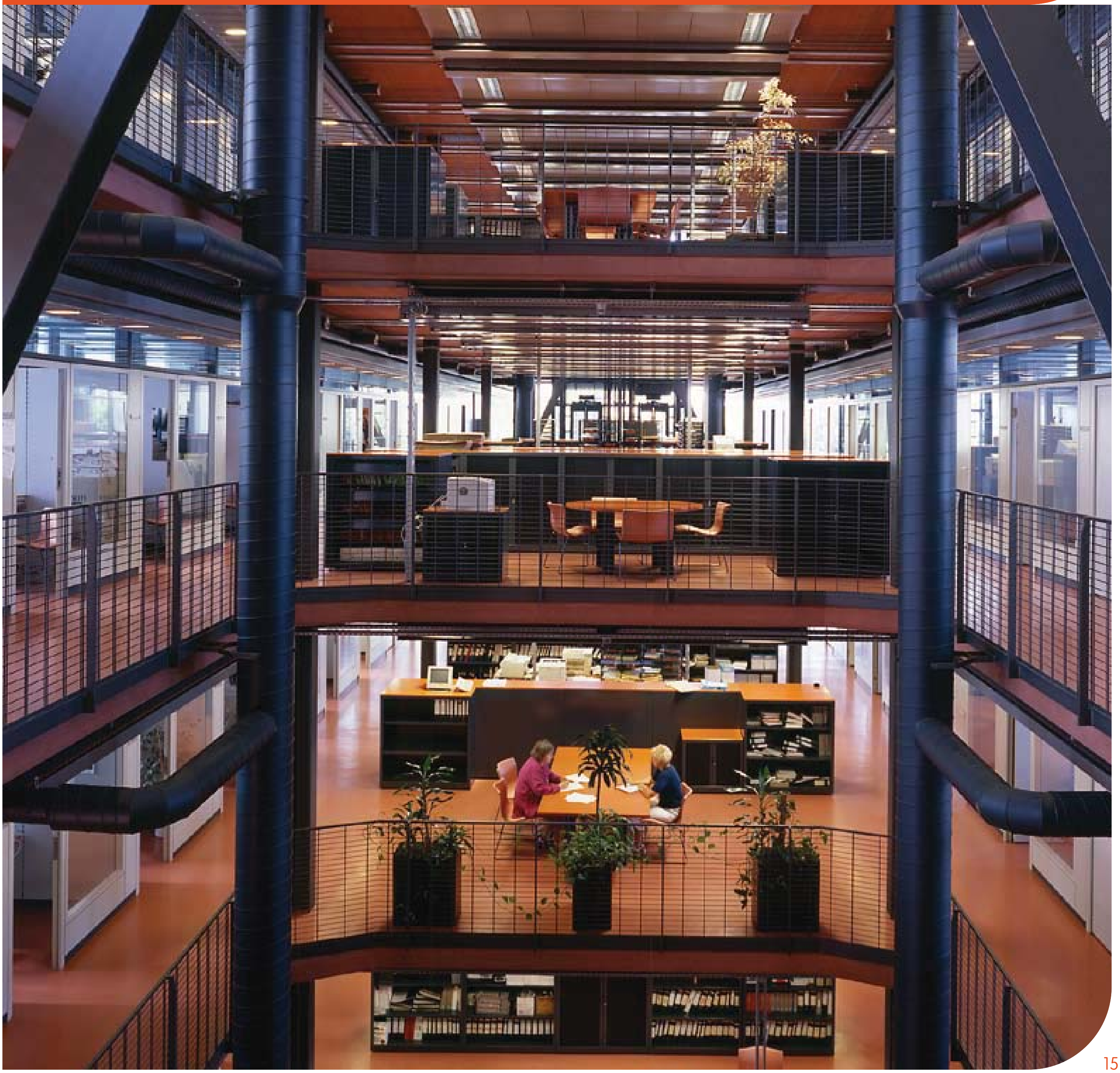
Usually the structures are simple, isostatic and braced by Saint-Andrew's crosses or reinforced concrete cores (staircases, etc).

To increase the strength of the system the connection of the beams to each other using devices which will resist accidental traction effects is recommended (shocks, etc., see EN 1991-1-7).

This connection can be achieved using metal parts or frames (H or T) reduced in height embedded in the thickness of the floor. The advantage of this solution is that it provides an effective connection during assembly and reduces the number of temporary struts.

4.1.1 Temporary Propping
4.1.2 Underside of a finished floor

5. TECHNICAL ADVANTAGES



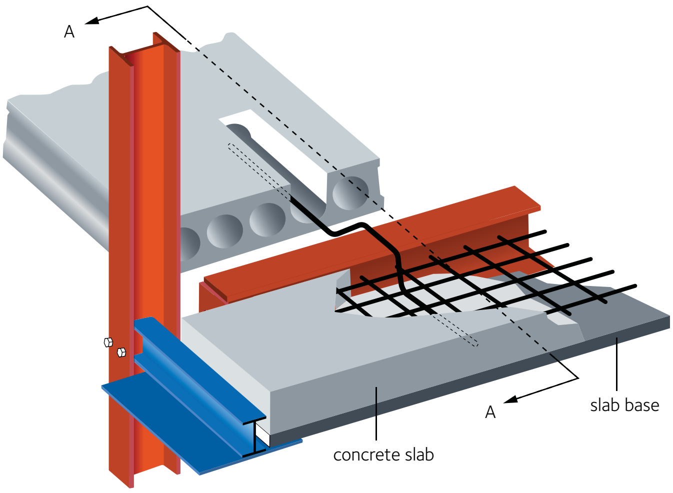
5.1 Fire protection

Ensuring the fire resistance of the beams is easy, since only the lower flange is directly exposed to fire. 60-minute resistance can easily be reached, without any protection of the lower flange, with additionnal reinforcement in the beam chambers. More than 60 minutes fire resistance can be ensured by cladding, spayed protection or intumescent paint.

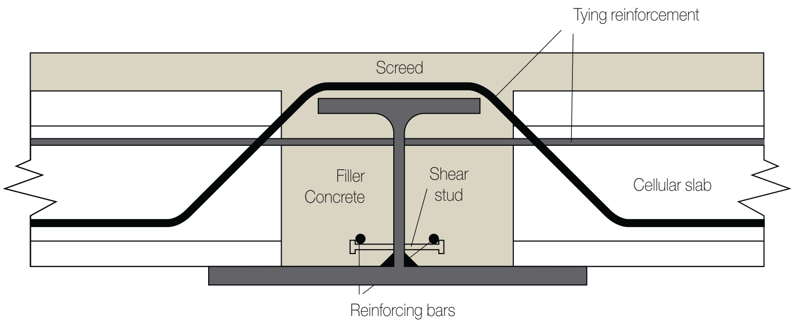
The fire resistance of the overall system depends on the fire resistance of the slabs (which can be delivered up to R120) and on their capacity to adapt to the beam deformation. Overall resistance is increased by longitudinal reinforcement supported by shear studs in the beam chambers, by reinforcement between the slabs and by a reinforced screed.

The use of **Cofradal® 200** allows fire resistance up to 120 minutes.

5.1.1



Section A-A



5.2 Protection against corrosion

Normally the lower flange of the beams is protected by SA 2.5 shot blasting and the application of a conventional paint.

Surfaces embedded in the concrete do not need treatment.

Generally it is not necessary to treat steel surfaces if they are inside buildings.

5.2.1

5.3 Heat and sound insulation

Thanks to the volume of air they contain, cellular slabs provide better heat insulation than solid concrete slabs of the same thickness. The effect of the beams is negligible. The beams don't affect noticeably the heat and sound insulation characteristics of the cellular slabs.

The light **Cofradal®200** flooring system meets current standards without an additional insulating layer.

5.4 Expansion joints in the flooring

- Expansion joint in beam direction:

  This is realised by splitting the load-bearing beam in 2 edge beams one symmetrical to the other.

  The expansion joint is made in the concrete screed by using an elastic sealing tape according to the standard rules for concrete floors.

- Expansion joint in slab direction:

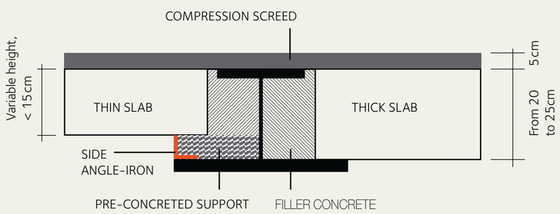
  An expansion joint may be made between two cellular slabs. Usually two sealing tapes are used to seal the joint.

5.5 Beam spacing

A regular beam spacing is recommended to provide symmetrical loaded beams which are not subject to torsion.

In the case of unequal concrete spans the beam or the whole floor is propped to avoid torsion. Differences in floor height can be adjusted by concreting a support for the thinner floor or by steel shims on the lower flange.

5.5.1



5.1.1 Integrated fire protection
5.2.1 Column-beam connection
5.3.1 Slab Cofradal®200
5.5.1 Adjustment of the height difference of the floors

6. SLIM FLOOR: A SOLUTION FOR SUSTAINABLE DEVELOPMENT

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The ArcelorMittal Group's environmental policy aims at sustainable development and the establishment of a long-term balance between the environment, social well-being and the economy.

The long product mills of ArcelorMittal operate according to the criteria of the environmental management system as defined in the standard EN ISO 14001:1996.

Most of ArcelorMittal's long product mills use the electric arch process, the starting material for which is 100% recycled scrap.

This new steel production technology has made it possible to make a considerable reduction in emissions and primary energy consumption.

By the use of the "Slim Floor" process it is possible to:

- reduce the quantity of construction materials by using high resistance steels,
- reduce the number of transportation trips because the structures are lighter, and thus reduce building site nuisance,
- speed up building work through prefabrication,
- meet environmental requirements by 100% recycled and 90% recyclable products.

Cité Internationale, Lyon, France

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7. PRE-DESIGN TABLES

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IFB

Design parameters

L span of the IFB in meters

G Dead Load in kN/m^2

P Live Load in kN/m^2

q_d design load in kN/m

$q_d = 1.35 * \Sigma G_i + 1.5 * \Sigma P_i$

Validity criteria

- Steel Grade S355
- Simple supported beam
- Symmetrically loaded Beam
- Support length of the hollow core slabs = 70 mm
- Load ratio G/P ≈ 60/40
- Beam weight included in Dead Load G_i
- Deflection under Live Load P ≤ L / 300
- Transverse deflection of the bottom flange ≤ 1,50 mm
- Elastic-plastic design
- Ideal elastic-plastic material behaviour
- Global partial safety factor $\gamma_{m0} = 1{,}00$

Application example

prescribed

grid:	6,5 m x 10,0 m
live load P:	5,0 kN/m^2
dead load G:	1,2 kN/m^2
slab thickness:	approximately 26cm

users choice

IFB beam span:	6,5 m
slab span:	10,0 m (= beam distance)
depth of the HC slab:	26,5 cm (G_0 = 3,8 kN/m^2)

calculated

line load from G:	g = 10,0 * (3,8 + 1,2) = 50 kN/m
line load from P:	p = 10,0 * 5,0 = 50 kN/m
design load q_d:	q_d = 1,35 * 50 + 1,5 * 50 = 142,5 kN/m

derived from the design table IFB-Slab < 300 mm:

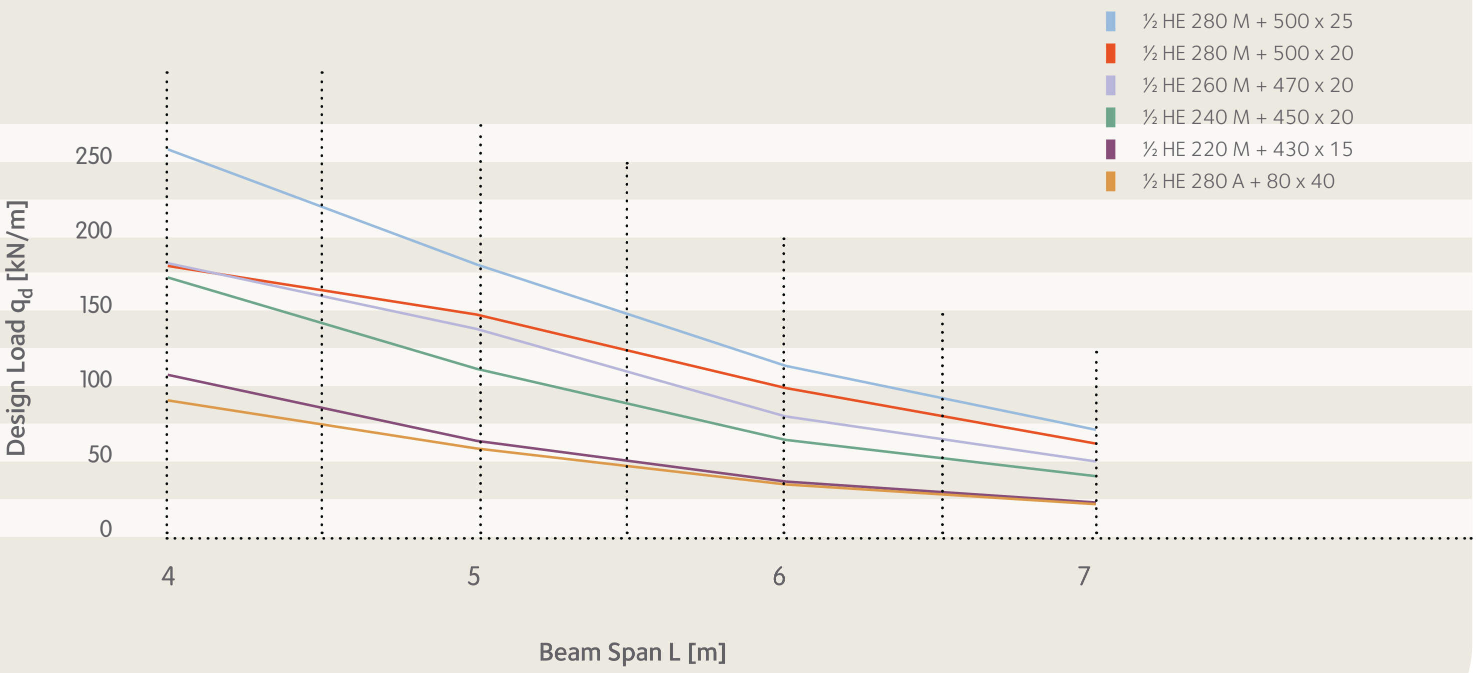
1/2 HEA 550 + 500x20 (g = 161,6 kg/m)

N.B.: Please observe the minimum tonnage required for section delivery!
(The sections retained for diagram drawing are printed in **bold** characters!)

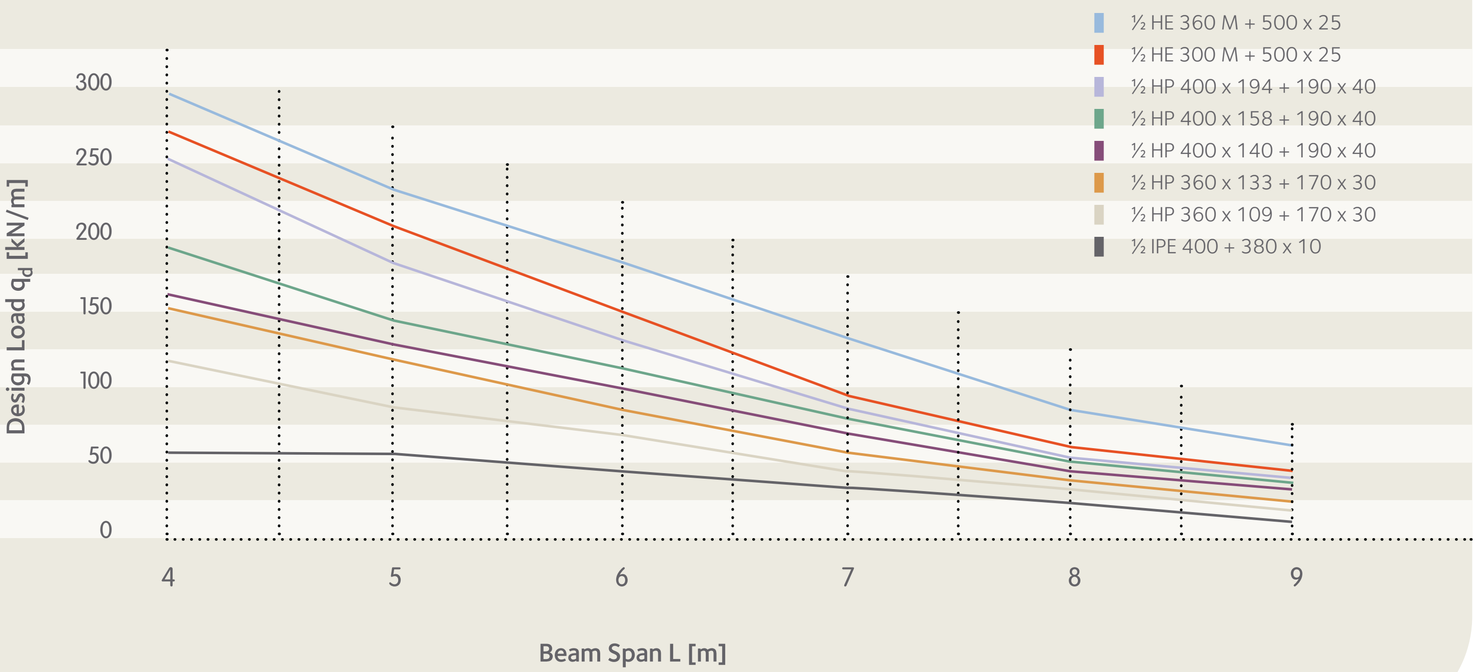
	Section	Plate B x t	Type	G kg/m	H mm	h mm	b mm	t_w mm	t_f mm	r mm	A cm^2	I_y cm^4	W_y cm^3	y_1 cm	y_2 cm
½	IPE 400	380 x 10	A	63,0	200,0	400,0	180,0	8,6	13,5	21,0	80,3	6558	543	8,9	12,1
½	IPE O 400	390 x 12	A	74,6	202,0	404,0	182,0	9,7	15,5	21,0	95,0	7893	627	8,8	12,6
½	IPE 450	390 x 12	A	75,5	225,0	450,0	190,0	9,4	14,6	21,0	96,2	9857	707	9,8	13,9
½	IPE O 450	400 x 12	A	84,0	228,0	456,0	192,0	11,0	17,6	21,0	107,0	11230	834	10,5	13,5
½	IPE 500	400 x 12	A	83,2	250,0	500,0	200,0	10,2	16,0	21,0	106,0	13332	897	11,3	14,9
½	IPE O 500	410 x 15	A	102,1	253,0	506,0	202,0	12,0	19,0	21,0	130,0	16702	1072	11,2	15,6
½	IPE 550	410 x 15	A	100,9	275,0	550,0	210,0	11,1	17,2	24,0	128,5	19499	1143	11,9	17,1
½	IPE O 550	420 x 15	A	110,7	278,0	556,0	212,0	12,7	20,2	24,0	141,0	21826	1317	12,7	16,6
½	IPE 600	420 x 15	A	110,7	300,0	600,0	220,0	12,0	19,0	24,0	141,0	25375	1419	13,6	17,9
½	IPE O 600	430 x 15	A	128,0	305,0	610,0	224,0	15,0	24,0	24,0	163,0	29831	1749	14,9	17,1
½	IPE O 600	430 x 20	A	144,8	305,0	610,0	224,0	15,0	24,0	24,0	184,5	34207	1817	13,7	18,8
½	HE 220 M	430 x 15	A	109,3	120,0	240,0	226,0	15,5	26,0	18,0	139,2	4209	581	6,2	7,3
½	HE 240 M	450 x 20	A	149,0	135,0	270,0	248,0	18,0	32,0	21,0	189,8	7323	872	7,1	8,4
½	HE 260 B	460 x 12	A	89,8	130,0	260,0	260,0	10,0	17,5	24,0	114,4	4252	553	6,5	7,7
½	HE 260 M	470 x 20	A	160,0	145,0	290,0	268,0	18,0	32,5	24,0	203,8	9088	1036	7,7	8,8
½	HE 280 M	500 x 20	A	172,8	155,0	310,0	288,0	18,5	33,0	24,0	220,1	11219	1217	8,3	9,2
½	HE 280 M	500 x 25	A	192,4	155,0	310,0	288,0	18,5	33,0	24,0	245,1	12854	1274	7,9	10,1
½	HE 300 B	500 x 15	A	117,4	150,0	300,0	300,0	11,0	19,0	27,0	149,6	7483	820	7,4	9,1
½	HE 300 M	500 x 25	A	217,1	170,0	340,0	310,0	21,0	39,0	27,0	276,6	17045	1672	9,3	10,2
½	HE 320 B	500 x 15	A	122,2	160,0	320,0	300,0	11,5	20,5	27,0	155,7	8806	931	8,0	9,5
½	HE 320 M	500 x 25	A	220,6	179,5	359,0	309,0	21,0	40,0	27,0	281,0	19209	1809	9,8	10,6
½	HE 320 M	500 x 30	A	240,2	179,5	359,0	309,0	21,0	40,0	27,0	306,0	21544	1883	9,5	11,4
½	HE 340 B	500 x 15	A	126,0	170,0	340,0	300,0	12,0	21,5	27,0	160,5	10173	1033	8,7	9,8
½	HE 340 M	500 x 25	A	222,1	188,5	377,0	309,0	21,0	40,0	27,0	282,9	21299	1925	10,3	11,1
½	HE 340 M	500 x 30	A	241,7	188,5	377,0	309,0	21,0	40,0	27,0	307,9	23849	2001	9,9	11,9
½	HE 360 B	500 x 15	A	129,8	180,0	360,0	300,0	12,5	22,5	27,0	165,3	11661	1140	9,3	10,2
½	HE 360 M	500 x 25	A	223,3	197,5	395,0	308,0	21,0	40,0	27,0	284,4	23467	2036	10,7	11,5
½	HE 360 M	500 x 30	A	242,9	197,5	395,0	308,0	21,0	40,0	27,0	309,4	26234	2113	10,3	12,4
½	HE 400 B	500 x 20	A	156,1	200,0	400,0	300,0	13,5	24,0	27,0	198,9	17420	1407	9,6	12,4
½	HE 400 M	500 x 25	A	226,0	216,0	432,0	307,0	21,0	40,0	27,0	287,9	28311	2271	11,6	12,5
½	HE 400 M	500 x 30	A	245,6	216,0	432,0	307,0	21,0	40,0	27,0	312,9	31559	2352	11,2	13,4
½	HE 450 B	500 x 20	A	164,1	225,0	450,0	300,0	14,0	26,0	27,0	209,0	22963	1707	11,0	13,5
½	HE 450 M	500 x 25	A	229,8	239,0	478,0	307,0	21,0	40,0	27,0	292,7	35066	2575	12,8	13,6
½	HE 450 M	500 x 30	A	249,4	239,0	478,0	307,0	21,0	40,0	27,0	317,7	38978	2661	12,3	14,6
½	HE 500 A	500 x 20	A	156,0	245,0	490,0	300,0	12,0	23,0	27,0	198,8	25945	1721	11,4	15,1
½	HE 500 B	500 x 20	A	172,2	250,0	500,0	300,0	14,5	28,0	27,0	219,3	29448	2034	12,5	14,5
½	HE 500 M	500 x 25	A	233,3	262,0	524,0	306,0	21,0	40,0	27,0	297,2	42530	2876	13,9	14,8
½	HE 500 M	500 x 30	A	252,9	262,0	524,0	306,0	21,0	40,0	27,0	322,2	47155	2968	13,3	15,9
½	HE 550 A	500 x 20	A	161,6	270,0	540,0	300,0	12,5	24,0	27,0	205,9	32357	1990	12,7	16,3
½	HE 550 B	500 x 20	A	178,2	275,0	550,0	300,0	15,0	29,0	27,0	227,1	36480	2334	13,9	15,6
½	HE 550 B	500 x 25	A	197,9	275,0	550,0	300,0	15,0	29,0	27,0	252,1	40972	2406	13,0	17,0
½	HE 550 M	500 x 25	A	237,2	286,0	572,0	306,0	21,0	40,0	27,0	302,2	51214	3203	15,1	16,0
½	HE 550 M	500 x 30	A	256,9	286,0	572,0	306,0	21,0	40,0	27,0	327,2	56660	3301	14,4	17,2
½	HE 550 M	500 x 35	A	276,5	286,0	572,0	306,0	21,0	40,0	27,0	352,2	61669	3387	13,9	18,2
½	HE 600 A	500 x 20	A	167,4	295,0	590,0	300,0	13,0	25,0	27,0	213,3	39636	2275	14,1	17,4
½	HE 600 B	500 x 20	A	184,5	300,0	600,0	300,0	15,5	30,0	27,0	235,0	44424	2652	15,2	16,8
½	HE 600 B	500 x 25	A	204,1	300,0	600,0	300,0	15,5	30,0	27,0	260,0	49851	2733	14,3	18,2
½	HE 600 M	500 x 30	A	260,5	310,0	620,0	305,0	21,0	40,0	27,0	331,9	66995	3629	15,5	18,5
½	HE 600 M	500 x 35	A	280,1	310,0	620,0	305,0	21,0	40,0	27,0	356,9	72792	3720	14,9	19,6
½	HE 650 A	500 x 20	A	173,3	320,0	640,0	300,0	13,5	26,0	27,0	220,8	47826	2577	15,4	18,6
½	HE 650 B	500 x 25	A	210,5	325,0	650,0	300,0	16,0	31,0	27,0	268,2	59792	3076	15,6	19,4
½	HE 650 M	500 x 25	A	244,8	334,0	668,0	305,0	21,0	40,0	27,0	311,9	71098	3860	17,5	18,4
½	HE 650 M	500 x 30	A	264,4	334,0	668,0	305,0	21,0	40,0	27,0	336,9	78375	3971	16,7	19,7
½	HE 650 M	500 x 35	A	284,1	334,0	668,0	305,0	21,0	40,0	27,0	361,9	85035	4068	16,0	20,9
½	HE 280 A	80 x 40	B	63,3	162,0	270 ,0	280,0	8,0	13,0	24,0	80,7	4004	396	7,4	10,1
½	HE 300 A	100 x 30	B	67,7	161,0	290 ,0	300,0	8,5	14,0	27,0	86,3	4375	417	7,0	10,5
½	HP 360 x 109	170 x 20	B	81,2	180,3	346,4	371,0	12,8	12,9	15,2	103,5	6739	606	8,2	11,1
½	HP 360 x 109	170 x 30	B	94,6	190,3	346,4	371,0	12,8	12,9	15,2	120,5	8716	832	9,8	10,5
½	HP 360 x 133	170 x 20	B	93,0	180,3	352 ,0	373,8	15,6	15,7	15,2	118,5	7527	634	7,7	11,9
½	HP 360 x 133	170 x 30	B	106,4	190,3	352 ,0	373,8	15,6	15,7	15,2	135,5	9795	866	9,3	11,3
½	HP 360 x 152	170 x 30	B	116,2	190,3	356,4	376,0	17,8	17,9	15,2	148,0	10585	895	9,0	11,8
½	HP 360 x 152	170 x 40	B	129,5	200,3	356,4	376,0	17,8	17,9	15,2	165,0	12909	1117	10,3	11,6
½	HP 400 x 122	190 x 20	B	91,1	180,0	348,0	390 0	14,0	14,0	15,0	116,0	7597	678	8,2	11,2
½	HP 400 x 122	190 x 30	B	106,0	190,0	348,0	390,0	14,0	14,0	15,0	135,0	9837	932	9,8	10,6
½	HP 400 x 140	190 x 30	B	115,0	190,0	352,0	392,0	16,0	16,0	15,0	146,5	10658	960	9,5	11,1
½	HP 400 x 140	190 x 40	B	129,9	200,0	352,0	392,0	16,0	16,0	15,0	165,5	12931	1194	10,8	10,8
½	HP 400 x 158	190 x 30	B	123,6	190,0	356,0	394,0	18,0	18,0	15,0	157,5	11435	983	9,2	11,6
½	HP 400 x 158	190 x 40	B	138,6	200,0	356,0	394,0	18,0	18,0	15,0	176,5	13926	1230	10,5	11,3
½	HP 400 x 176	190 x 30	B	132,7	190,0	360,0	396,0	20,0	20,0	15,0	169,0	12179	1009	8,9	12,1
½	HP 400 x 176	190 x 40	B	147,6	200,0	360,0	396,0	20,0	20,0	15,0	188,0	14874	1261	10,2	11,8
½	HP 400 x 194	190 x 30	B	142,1	190,0	364,0	398,0	22,0	22,0	15,0	181,0	12899	1037	8,8	12,4
½	HP 400 x 194	190 x 40	B	157,0	200,0	364,0	398,0	22,0	22,0	15,0	200,0	15786	1293	10,0	12,2

IFB

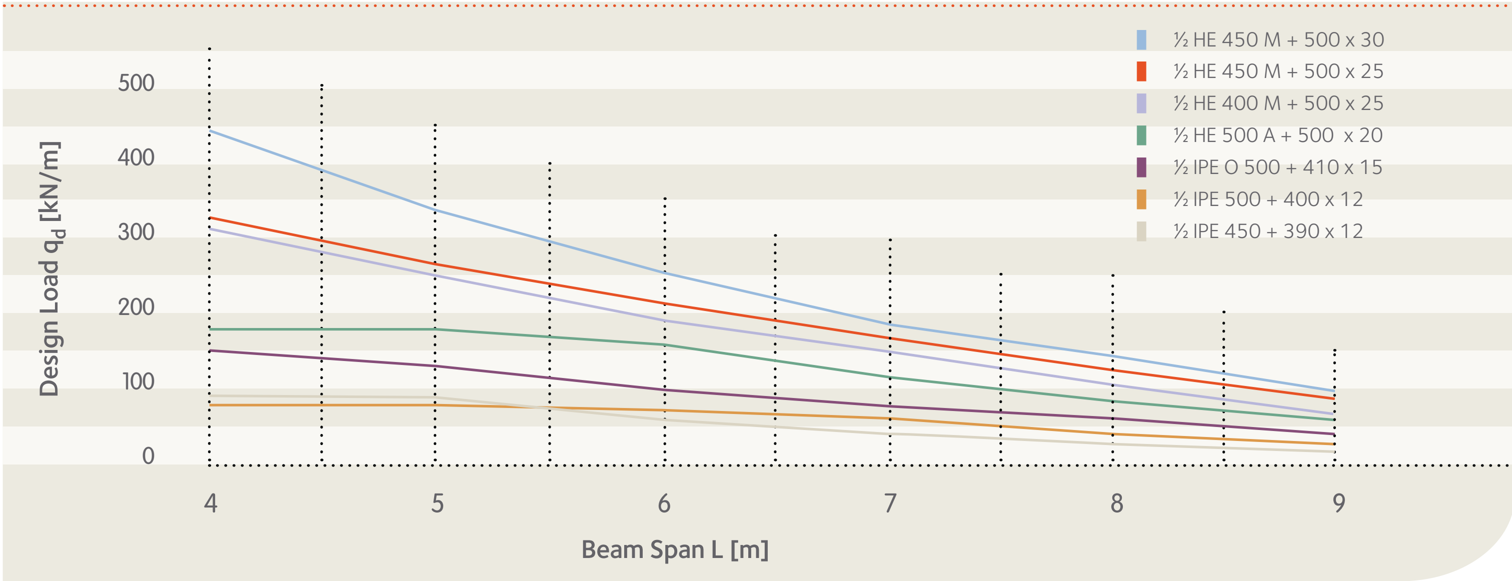
IFB – Slab thickness < 160 mm



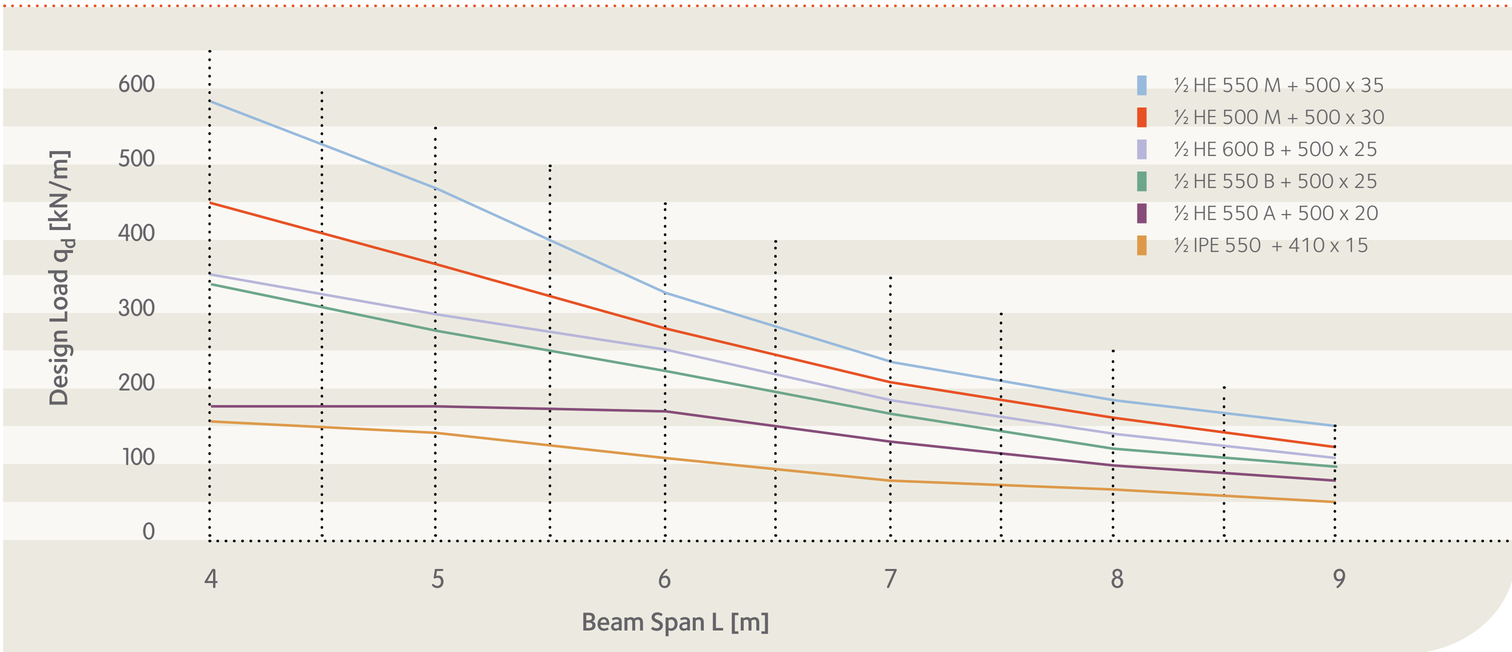
IFB – Slab thickness < 200 mm



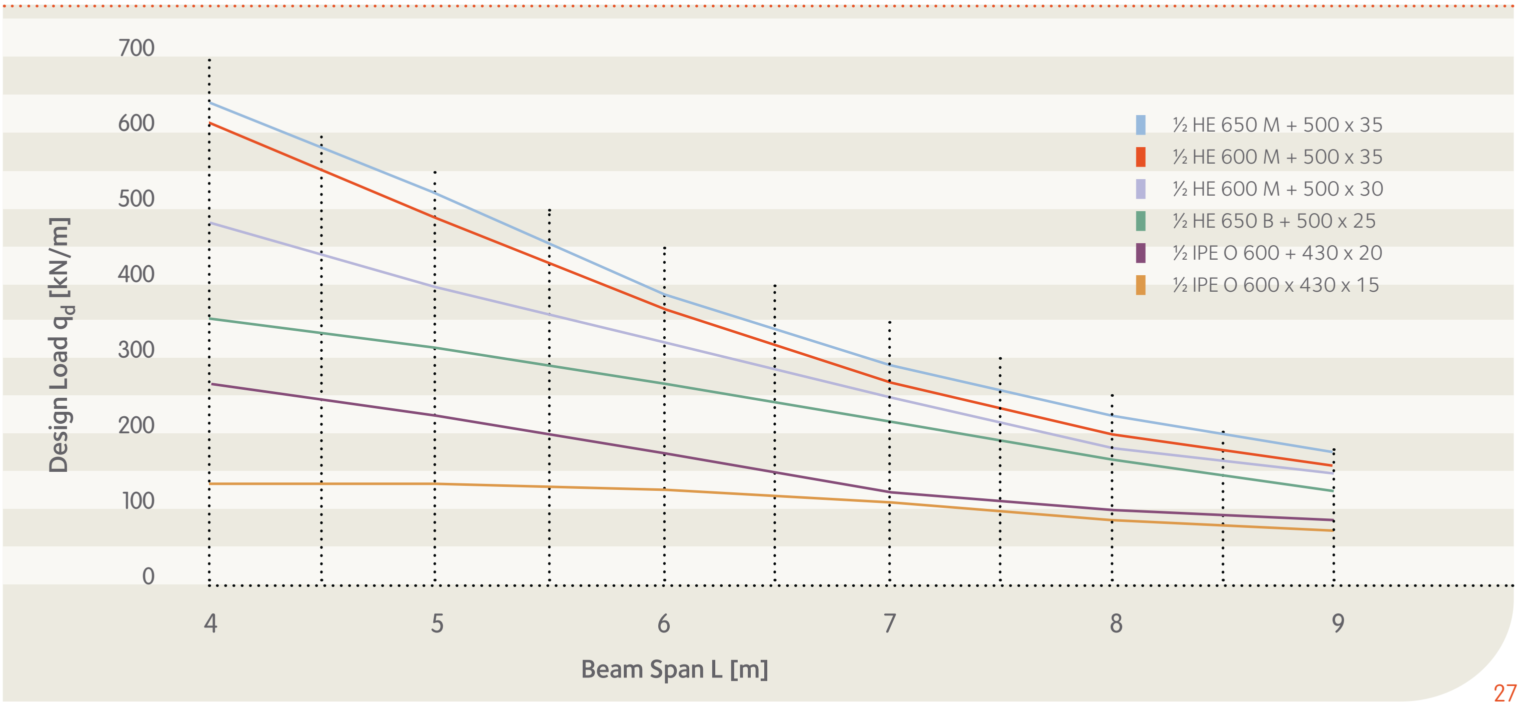
IFB – Slab thickness < 260 mm



IFB – Slab thickness < 300 mm



IFB – Slab thickness < 340 mm



SFB

Design parameters :

L	span of the SFB in meters
G	Dead Load in kN/m^2
P	Live Load in kN/m
q_d	Design load in kN/m

$q_d = 1.35 * \Sigma G_i + 1.5 * \Sigma P_i$

Validity criteria :

- Steel Grade S355
- Simple supported beam
- Symmetrically loaded Beam
- Support length of the hollow core slabs = 70 mm
- Load ratio G/P ≈ 60/40
- Beam weight included in Dead Load G_i
- Deflection under Live Load P ≤ L / 300
- Transverse deflection of the bottom flange ≤ 1,50 mm
- Elastic-plastic design
- Ideal elastic-plastic material behaviour
- Global partial safety factor γ_{m0} = 1,00

Application example :

prescribed

grid:	6,0 m x 8.5 m
live load P:	5,0 kN/m^2
dead load G:	1,2 kN/m^2
slab thickness:	approximately 26 cm

users choice

SFB beam span:	6,0 m
slab span:	10,0 m (= beam distance)
depth of the HC slab:	26,5 cm (G_0 = 3,8 kN/m^2)

calculated

line load from G:	g = 8.5 * (3,8 + 1,2) = 42.5 kN/m
line load from P:	p = 8.5 * 5,0 = 42.5 kN/m
design load q_d:	q_d = 1,35 * 42.5 + 1,5 * 42.5 = 121,1 kN/m

derived from the design table SFB-Slab < 260 mm:

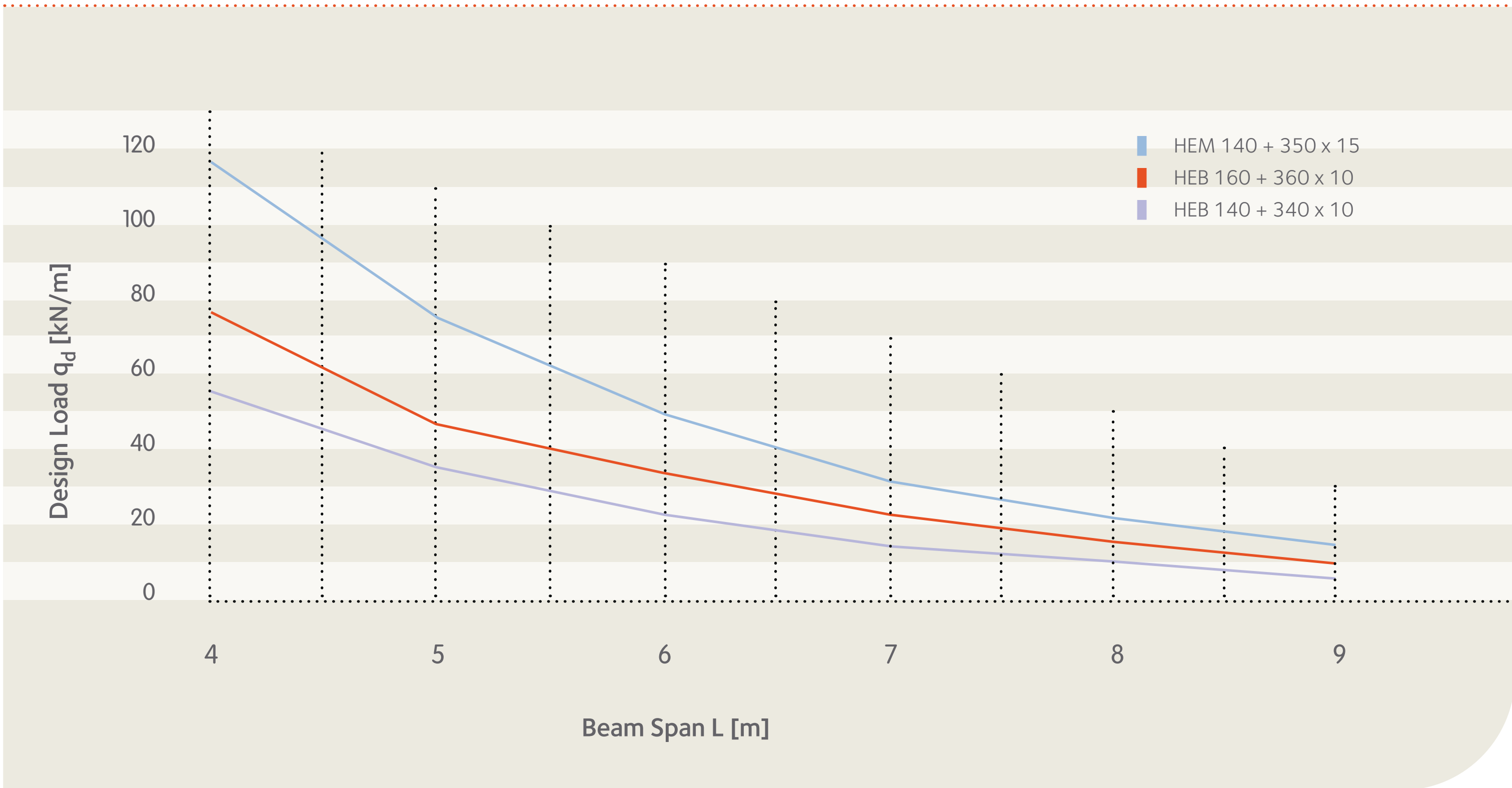
HEB 260 + 460 x 20 (g = 165,2 kg/m)

N.B.: Please observe the minimum tonnage required for section delivery!
(The sections retained for diagram drawing are printed in **bold** characters!)

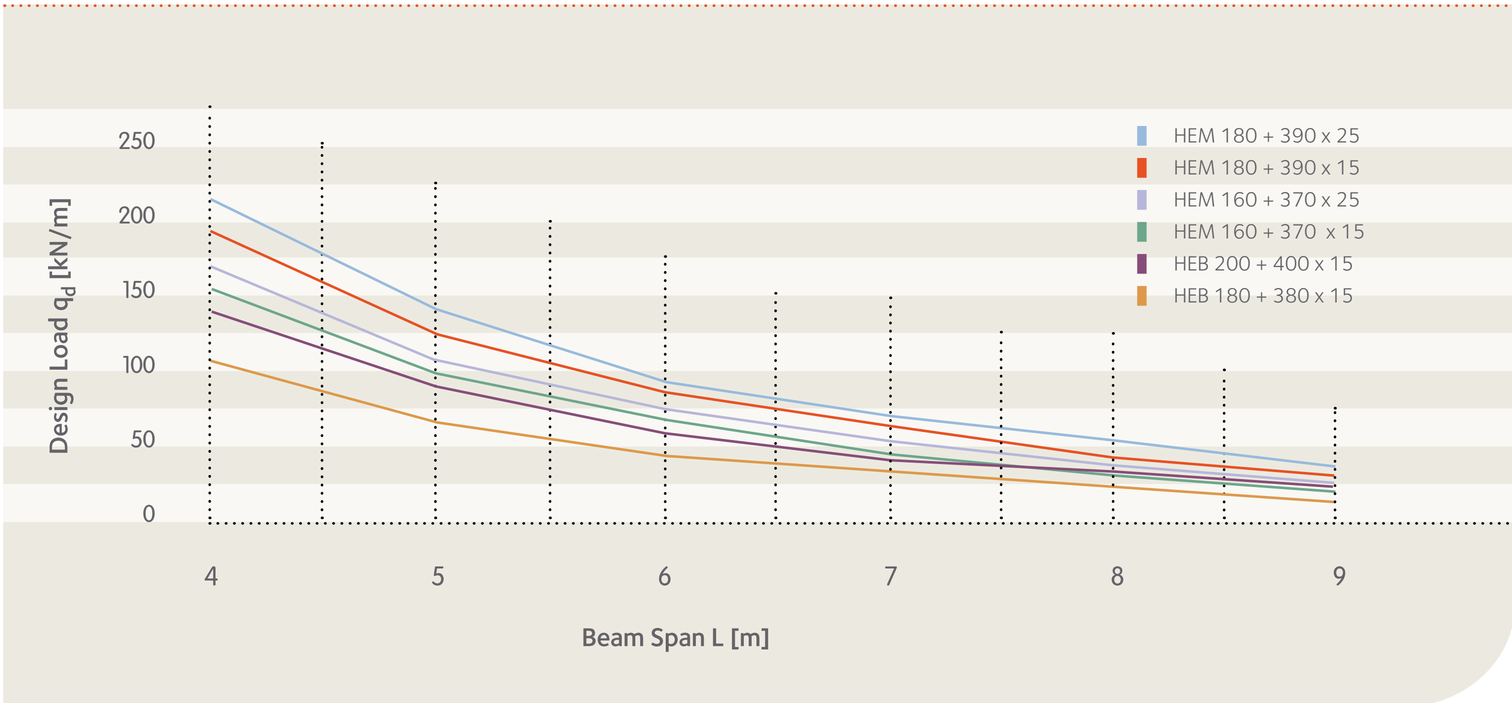
Section	Plate B x t	G kg/m	h mm	b mm	t_w mm	t_f mm	r mm	A cm^2	I_y cm^4	W_y cm^3	y_1 cm	y_2 cm
HEB 140	340 x 10	60,4	140,0	140,0	7,0	12,0	12,0	77,0	2580	250	4,7	10,3
HEM 140	350 x 10	90,7	160,0	146,0	13,0	22,0	12,0	115,6	5057	478	6,4	10,6
HEM 140	350 x 15	104,5	160,0	146,0	13,0	22,0	12,0	133,1	5735	501	6,0	11,5
HEM 140	350 x 20	118,2	160,0	146,0	13,0	22,0	12,0	150,6	6349	521	5,8	12,2
HEB 160	360 x 10	70,9	160,0	160,0	8,0	13,0	15,0	90,3	4059	356	5,6	11,4
HEM 160	370 x 10	105,3	180,0	166,0	14,0	23,0	15,0	134,1	7519	647	7,4	11,6
HEM 160	370 x 15	119,8	180,0	166,0	14,0	23,0	15,0	152,6	8466	675	7,0	12,5
HEM 160	370 x 20	134,3	180,0	166,0	14,0	23,0	15,0	171,1	9322	700	6,7	13,3
HEM 160	370 x 25	148,8	180,0	166,0	14,0	23,0	15,0	189,6	10123	723	6,5	14,0
HEB 180	380 x 10	81,1	180,0	180,0	8,5	14,0	15,0	103,3	6002	480	6,5	12,5
HEB 180	380 x 15	96,0	180,0	180,0	8,5	14,0	15,0	122,3	6735	497	6,0	13,5
HEM 180	390 x 10	119,6	200,0	186,0	14,5	24,0	15,0	152,3	10685	842	8,3	12,7
HEM 180	390 x 15	134,9	200,0	186,0	14,5	24,0	15,0	171,8	11952	875	7,8	13,7
HEM 180	390 x 20	150,2	200,0	186,0	14,5	24,0	15,0	191,3	13099	904	7,5	14,5
HEM 180	390 x 25	165,5	200,0	186,0	14,5	24,0	15,0	210,8	14166	932	7,3	15,2
HEB 200	400 x 10	92,7	200,0	200,0	9,0	15,0	18,0	118,1	8616	636	7,4	13,6
HEB 200	400 x 15	108,4	200,0	200,0	9,0	15,0	18,0	138,1	9629	656	6,8	14,7
HEM 200	410 x 10	135,3	220,0	206,0	15,0	25,0	18,0	172,3	14775	1076	9,3	13,7
HEM 200	410 x 15	151,3	220,0	206,0	15,0	25,0	18,0	192,8	16434	1114	8,8	14,7
HEM 200	410 x 20	167,4	220,0	206,0	15,0	25,0	18,0	213,3	17936	1149	8,4	15,6
HEM 200	410 x 25	183,5	220,0	206,0	15,0	25,0	18,0	233,8	19331	1181	8,1	16,4
HEM 200	410 x 30	199,6	220,0	206,0	15,0	25,0	18,0	254,3	20655	1212	8,0	17,0
HEB 220	420 x 10	104,4	220,0	220,0	9,5	16,0	18,0	133,0	11895	813	8,4	14,6
HEB 220	420 x 15	120,9	220,0	220,0	9,5	16,0	18,0	154,0	13243	838	7,7	15,8
HEB 220	420 x 20	137,4	220,0	220,0	9,5	16,0	18,0	175,0	14409	860	7,2	16,8
HEM 220	430 x 10	151,0	240,0	226,0	15,5	26,0	18,0	192,4	19821	1340	10,2	14,8
HEM 220	430 x 15	167,9	240,0	226,0	15,5	26,0	18,0	213,9	21936	1384	9,7	15,8
HEM 220	430 x 20	184,8	240,0	226,0	15,5	26,0	18,0	235,4	23853	1424	9,3	16,7
HEM 220	430 x 25	201,7	240,0	226,0	15,5	26,0	18,0	256,9	25632	1461	9,0	17,5
HEM 220	430 x 30	218,5	240,0	226,0	15,5	26,0	18,0	278,4	27313	1496	8,7	18,3
HEB 240	440 x 10	117,8	240,0	240,0	10,0	17,0	21,0	150,0	16122	1029	9,3	15,7
HEB 240	440 x 15	135,0	240,0	240,0	10,0	17,0	21,0	172,0	17885	1059	8,6	16,9
HEB 240	440 x 20	152,3	240,0	240,0	10,0	17,0	21,0	194,0	19415	1085	8,1	17,9
HEM 240	450 x 10	192,0	270,0	248,0	18,0	32,0	21,0	244,6	31491	1959	11,9	16,1
HEM 240	450 x 15	209,7	270,0	248,0	18,0	32,0	21,0	267,1	34545	2020	11,4	17,1
HEM 240	450 x 20	227,3	270,0	248,0	18,0	32,0	21,0	289,6	37362	2075	11,0	18,0
HEM 240	450 x 25	245,0	270,0	248,0	18,0	32,0	21,0	312,1	40002	2126	10,7	18,8
HEM 240	450 x 30	262,7	270,0	248,0	18,0	32,0	21,0	334,6	42511	2174	10,4	19,6
HEM 240	450 x 35	280,3	270,0	248,0	18,0	32,0	21,0	357,1	44924	2221	10,3	20,2
HEM 240	450 x 40	298,0	270,0	248,0	18,0	32,0	21,0	379,6	47269	2267	10,2	20,8
HEB 260	460 x 10	129,1	260,0	260,0	10,0	17,5	24,0	164,4	20962	1249	10,2	16,8
HEB 260	460 x 15	147,1	260,0	260,0	10,0	17,5	24,0	187,4	23175	1283	9,4	18,1
HEB 260	460 x 20	165,2	260,0	260,0	10,0	17,5	24,0	210,4	25098	1313	8,9	19,1
HEM 260	470 x 10	209,3	290,0	268,0	18,0	32,5	24,0	266,6	40025	2335	12,9	17,1
HEM 260	470 x 15	227,7	290,0	268,0	18,0	32,5	24,0	290,1	43734	2402	12,3	18,2
HEM 260	470 x 20	246,2	290,0	268,0	18,0	32,5	24,0	313,6	47156	2463	11,9	19,1
HEM 260	470 x 25	264,6	290,0	268,0	18,0	32,5	24,0	337,1	50359	2519	11,5	20,0
HEM 260	470 x 30	283,1	290,0	268,0	18,0	32,5	24,0	360,6	53398	2573	11,2	20,8
HEM 260	470 x 35	301,5	290,0	268,0	18,0	32,5	24,0	384,1	56313	2624	11,0	21,5
HEM 260	470 x 40	320,0	290,0	268,0	18,0	32,5	24,0	407,6	59136	2675	10,9	22,1
HEB 280	480 x 10	140,8	280,0	280,0	10,5	18,0	24,0	179,4	26666	1491	11,1	17,9
HEB 280	480 x 15	159,7	280,0	280,0	10,5	18,0	24,0	203,4	29403	1530	10,3	19,2
HEB 280	480 x 20	178,5	280,0	280,0	10,5	18,0	24,0	227,4	31783	1563	9,7	20,3
HEM 280	500 x 10	227,8	310,0	288,0	18,5	33,0	24,0	290,2	50149	2747	13,7	18,3
HEM 280	500 x 15	247,4	310,0	288,0	18,5	33,0	24,0	315,2	54656	2822	13,1	19,4
HEM 280	500 x 20	267,1	310,0	288,0	18,5	33,0	24,0	340,2	58806	2890	12,6	20,4
HEM 280	500 x 25	286,7	310,0	288,0	18,5	33,0	24,0	365,2	62682	2952	12,3	21,2
HEM 280	500 x 30	306,3	310,0	288,0	18,5	33,0	24,0	390,2	66348	3011	12,0	22,0
HEM 280	500 x 35	325,9	310,0	288,0	18,5	33,0	24,0	415,2	69854	3068	11,7	22,8
HEM 280	500 x 40	345,6	310,0	288,0	18,5	33,0	24,0	440,2	73238	3123	11,5	23,5
HEB 300	500 x 10	156,3	300,0	300,0	11,0	19,0	27,0	199,1	34170	1809	12,1	18,9
HEB 300	500 x 15	175,9	300,0	300,0	11,0	19,0	27,0	224,1	37562	1853	11,2	20,3
HEB 300	500 x 20	195,5	300,0	300,0	11,0	19,0	27,0	249,1	40526	1892	10,6	21,4
HEB 300	500 x 25	215,2	300,0	300,0	11,0	19,0	27,0	274,1	43190	1927	10,1	22,4
HEM 300	500 x 10	277,2	340,0	310,0	21,0	39,0	27,0	353,1	72348	3714	15,5	19,5
HEM 300	500 x 15	296,8	340,0	310,0	21,0	39,0	27,0	378,1	78157	3809	15,0	20,5
HEM 300	500 x 20	316,4	340,0	310,0	21,0	39,0	27,0	403,1	83596	3894	14,5	21,5
HEM 300	500 x 25	336,1	340,0	310,0	21,0	39,0	27,0	428,1	88742	3974	14,2	22,3
HEM 300	500 x 30	355,7	340,0	310,0	21,0	39,0	27,0	453,1	93655	4050	13,9	23,1
HEM 300	500 x 35	375,3	340,0	310,0	21,0	39,0	27,0	478,1	98383	4123	13,6	23,9
HEM 300	500 x 40	394,9	340,0	310,0	21,0	39,0	27,0	503,1	102965	4194	13,4	24,6
HEB 320	500 x 10	165,9	320,0	300,0	11,5	20,5	27,0	211,3	41216	2071	13,1	19,9
HEB 320	500 x 15	185,5	320,0	300,0	11,5	20,5	27,0	236,3	45198	2120	12,2	21,3
HEB 320	500 x 20	205,1	320,0	300,0	11,5	20,5	27,0	261,3	48693	2164	11,5	22,5
HEB 320	500 x 25	224,7	320,0	300,0	11,5	20,5	27,0	286,3	51841	2203	11,0	23,5

SFB

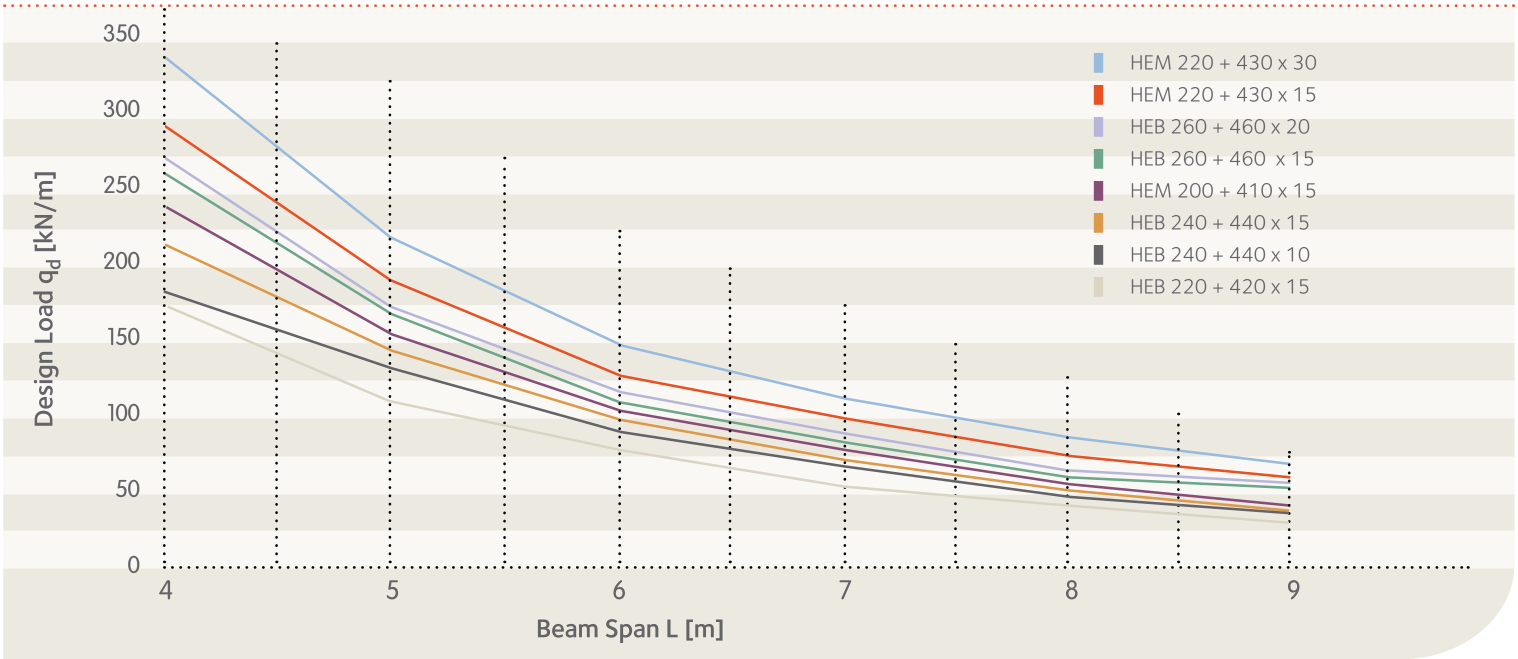
SFB – Slab thickness < 160 mm



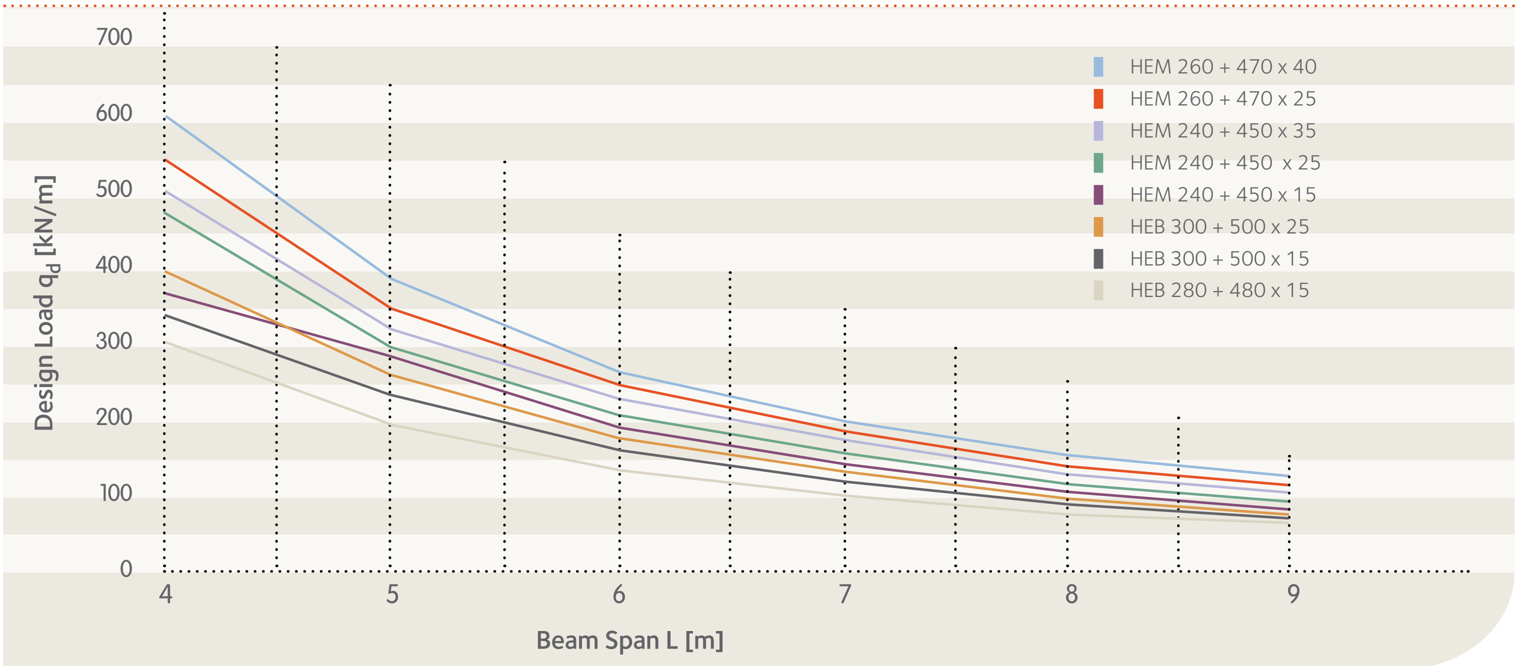
SFB – Slab thickness < 200 mm



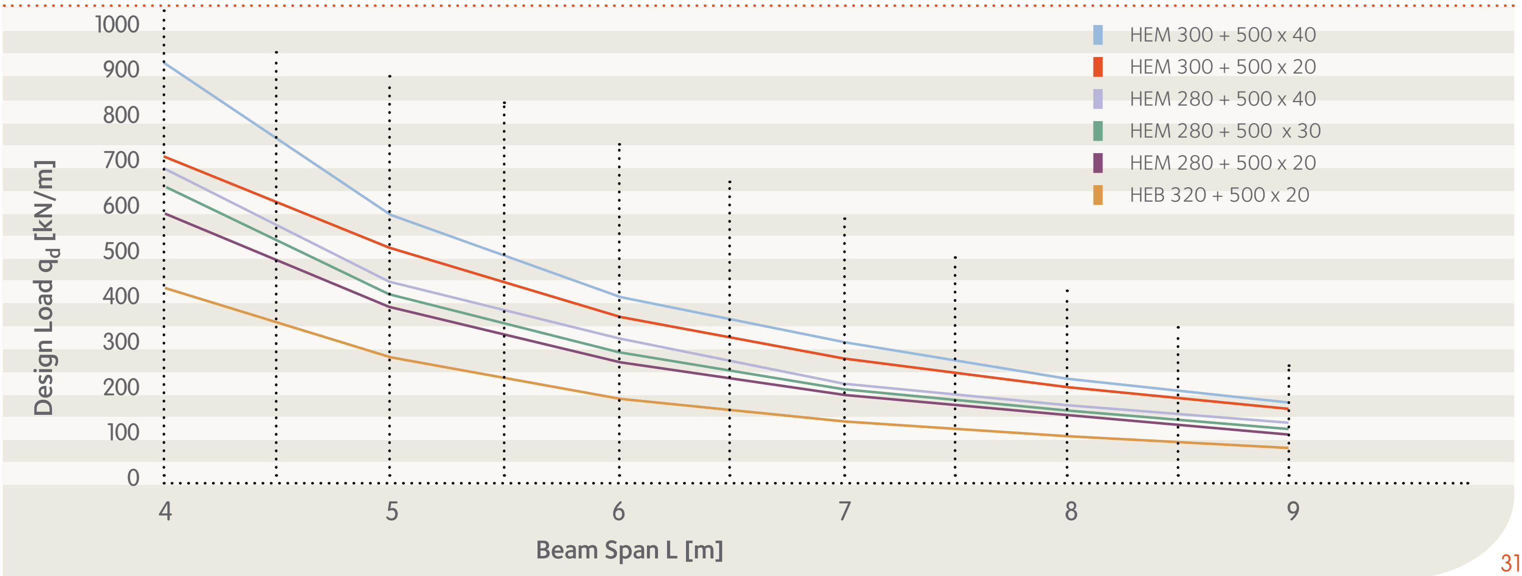
SFB – Slab thickness < 260 mm



SFB – Slab thickness < 300 mm



SFB – Slab thickness < 340 mm



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