TECHNICAL BROCHURE

WILLY NAESSENS
Industriebouw • Bâtiments Industriels

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TECHNICAL BROCHURE WX

SLABS IN PRE-STRESSED CONCRETE (WX)

APPLICATIONS

WX slabs are prefabricated, pre-stressed hollow floor elements that are used in a large number of architectural projects where large spans, heavy loads or limited construction heights are required.

These include, for example, car park buildings, mezzanine floors for industry/logistics, hospitals, laboratories, high-rise buildings, all kinds of office applications, sports stadiums and shopping centres. On the other hand, this product is also ideal for applications in residential construction, bearing on two supporting (masonry) walls or on strip foundations for the application of a crawl space (with or without insulation material).

In addition, pre-stressed slabs do not require temporary underbracing, which considerably speeds up the construction process.

PRODUCTS/TYPES

All WX profiles have a smooth underside and profiled sides. The top can be given a smooth finish or roughened (for good adhesion of the topping).

WX slabs are produced according to the extrusion process, with pre-stressing strands with a characteristic tensile strength f_{pk} of 1860 N/mm^2 and with grey industrial concrete with a minimum C50/60 concrete strength class.

The production is under the permanent control of various monitoring bodies and all WX elements can be provided with the BENOR, KOMO and NF quality mark and produced in accordance with the following profile thicknesses:

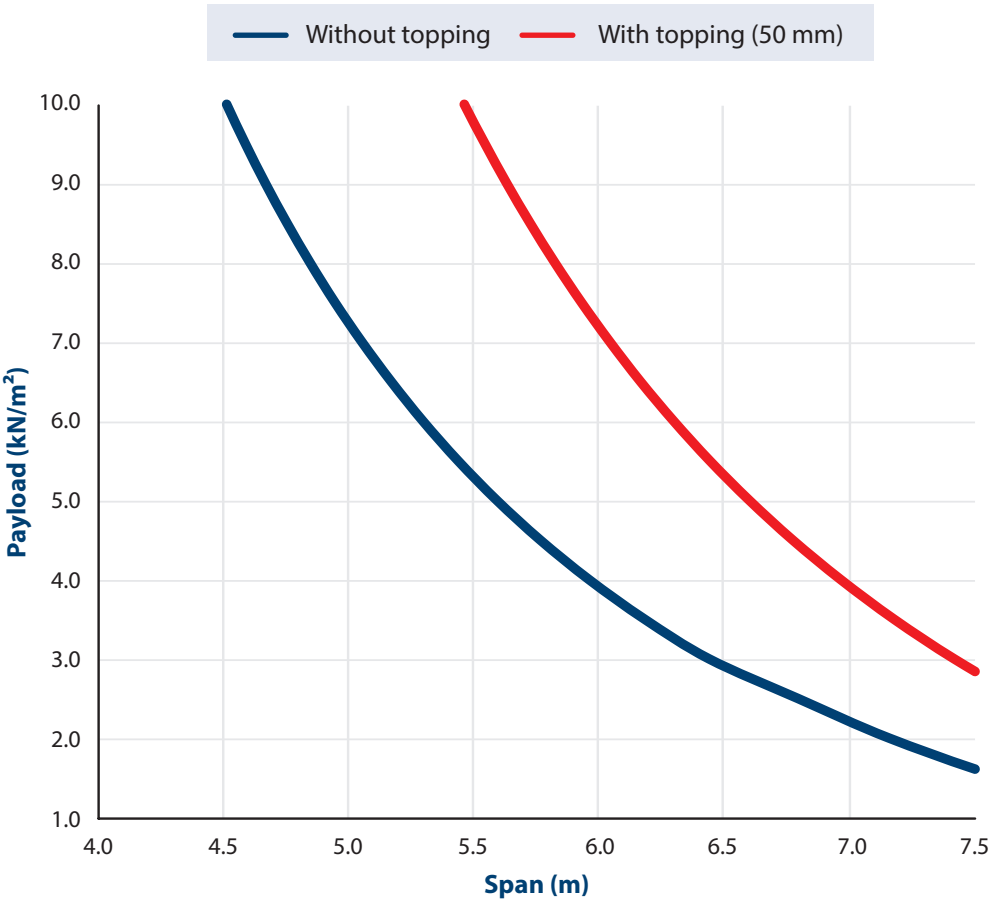
- WX 150
- WX 200
- WX 265
- WX 320
- WX 400
- WX 500

WX 150

MANIPULATION WEIGHT: 234 kg/m²
JOINT FILLING: 4.51 l/m
STANDARD FIRE RESISTANCE:: R60 minutes
STANDARD ENVIRONMENTAL CLASS: XC1

WXT150

CC2/XC1/R60



OPTIONAL: WXTD150

Fire resistance:
R90 & R120 minutes

Environmental classes:
other than XC1 possible

CROSS-SECTIONAL PROPERTIES

WXT 150/1200

A = 1144.87 x10² mm²

I = 29259.98 x10⁴ mm⁴

Centre of gravity top = 75.68 mm

Centre of gravity bottom = 74.32 mm

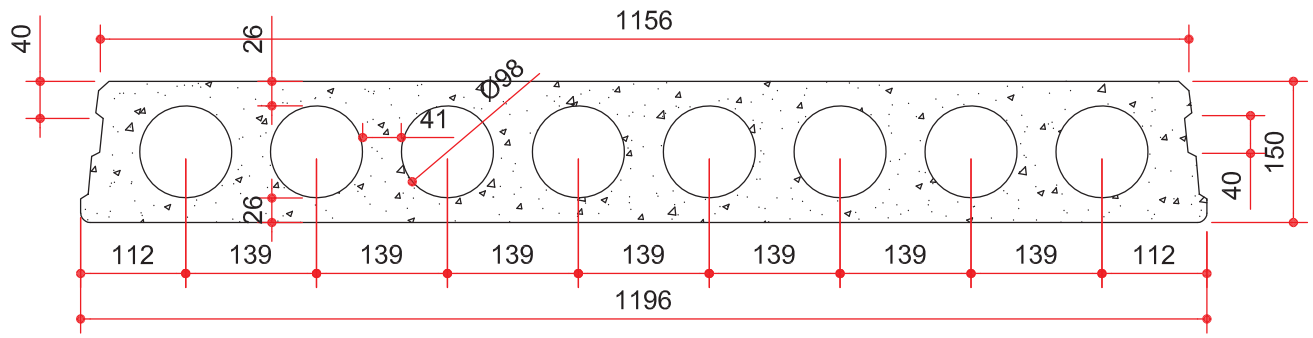
WXT 150/1200 + 50 mm topping

A = 1744.92 x10² mm²

I = 70414.30 x10⁴ mm⁴

Centre of gravity top = 91.06 mm

Centre of gravity bottom = 108.94 mm

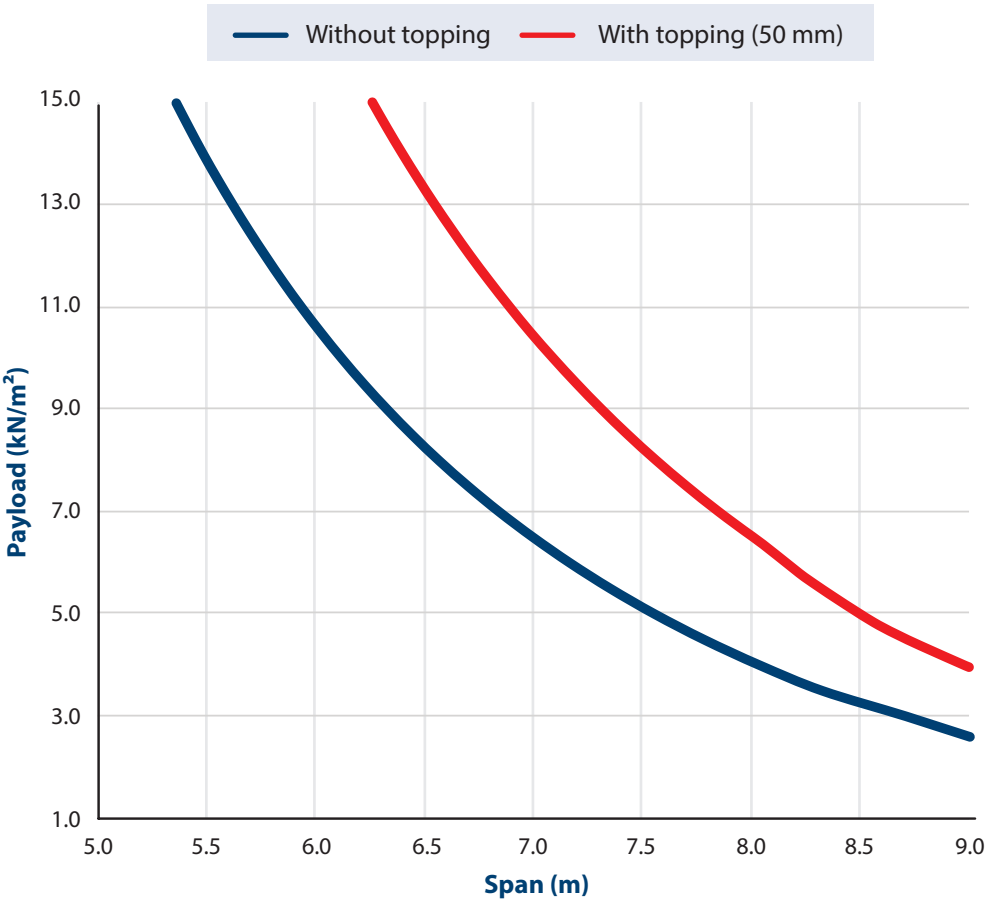


WX 200

MANIPULATION WEIGHT: 298 kg/m²
JOINT FILLING: 6.98 l/m
STANDARD FIRE RESISTANCE:: R60 minutes
STANDARD ENVIRONMENTAL CLASS: XC1

WXT200

CC2/XC1/R60



OPTIONAL: WXTD200

Fire resistance:
R90 & R120 minutes

Environmental classes:
other than XC1 possible

CROSS-SECTIONAL PROPERTIES

WXT 200/1200

A = 1419.98 x10² mm²

I = 66923.16 x10⁴ mm⁴

Centre of gravity top = 101.10 mm

Centre of gravity bottom = 98.90 mm

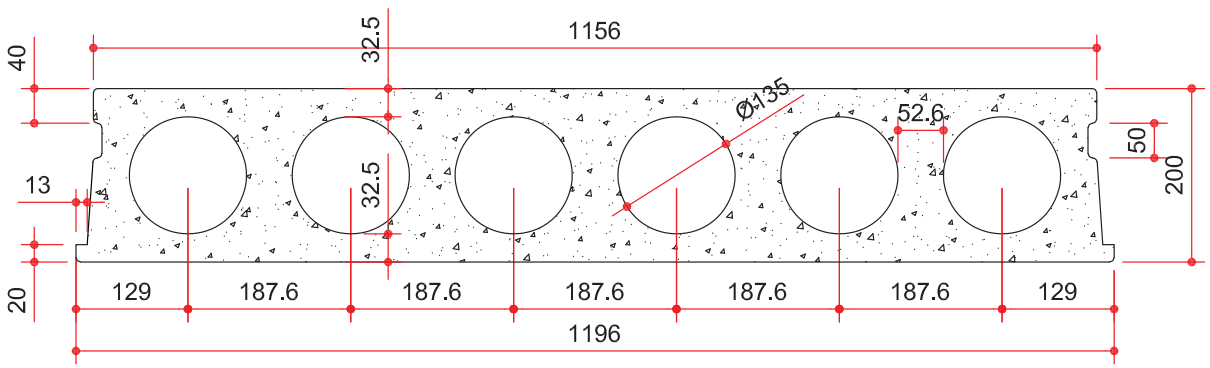
WXT 200 /1200 + 50 mm topping

A = 2019.97 x10² mm²

I = 135236.04 x10⁴ mm⁴

Centre of gravity top = 113.64 mm

Centre of gravity bottom = 136.36 mm

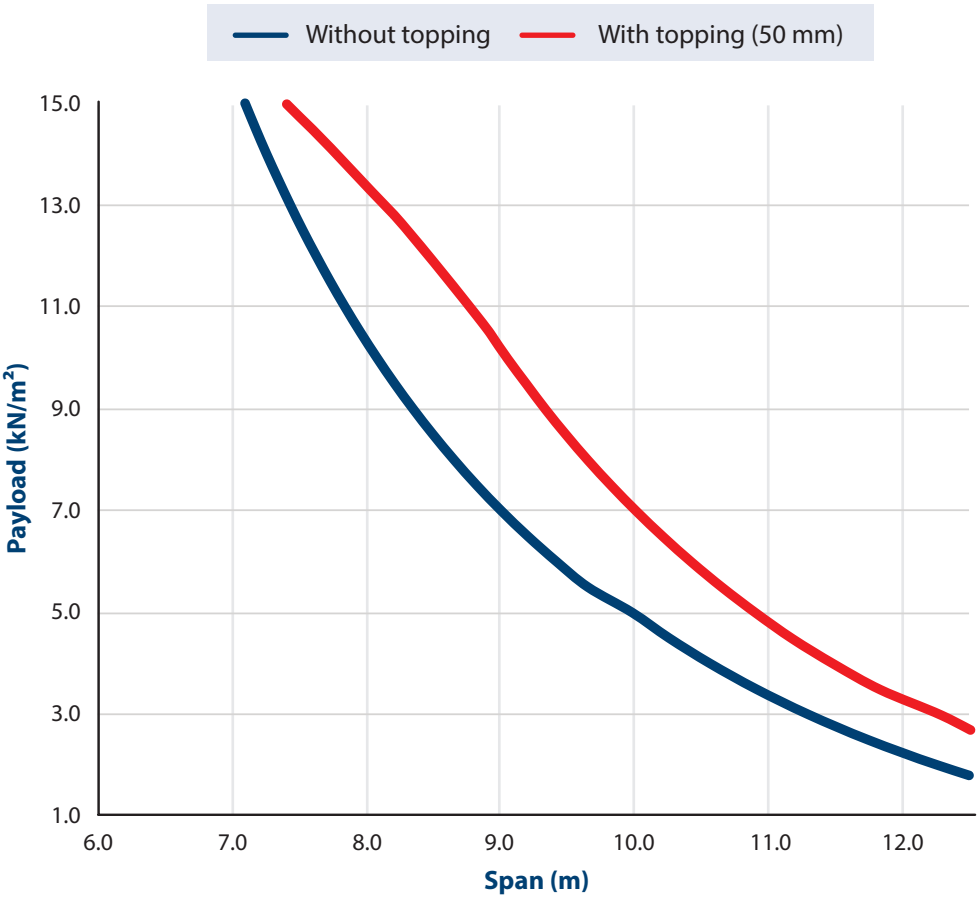


WX 265

MANIPULATION WEIGHT: 365 kg/m²
JOINT FILLING: 11.0 l/m
STANDARD FIRE RESISTANCE:: R60 minutes
STANDARD ENVIRONMENTAL CLASS: XC1

WXT265

CC2/XC1/R60



OPTIONAL: WXTD265

Fire resistance:
R90 & R120 minutes

Environmental classes:
other than XC1 possible

CROSS-SECTIONAL PROPERTIES

WXT 265/1200

A = 1703.31 x10² mm²

I = 146067.76 x10⁴ mm⁴

Centre of gravity top = 135.41 mm

Centre of gravity bottom = 129.59 mm

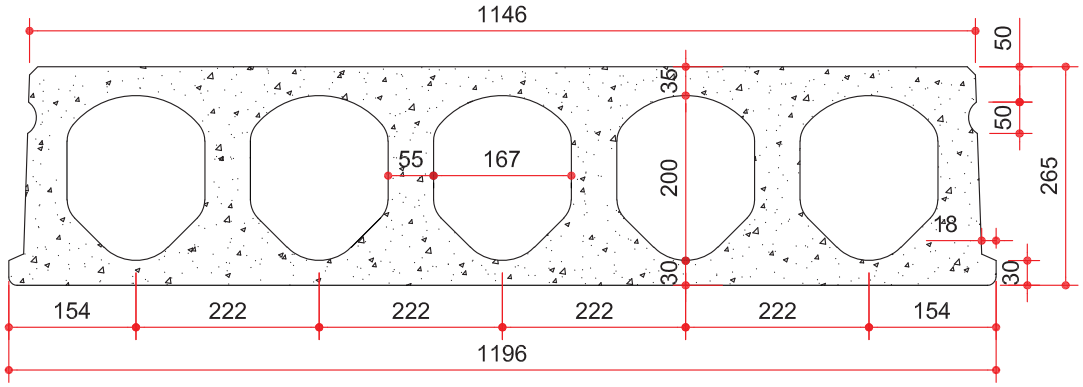
WXT 265 /1200 + 50 mm topping

A = 2303.30 x10² mm²

I = 261487.64 x10⁴ mm⁴

Centre of gravity top = 143.62 mm

Centre of gravity bottom = 171.38 mm

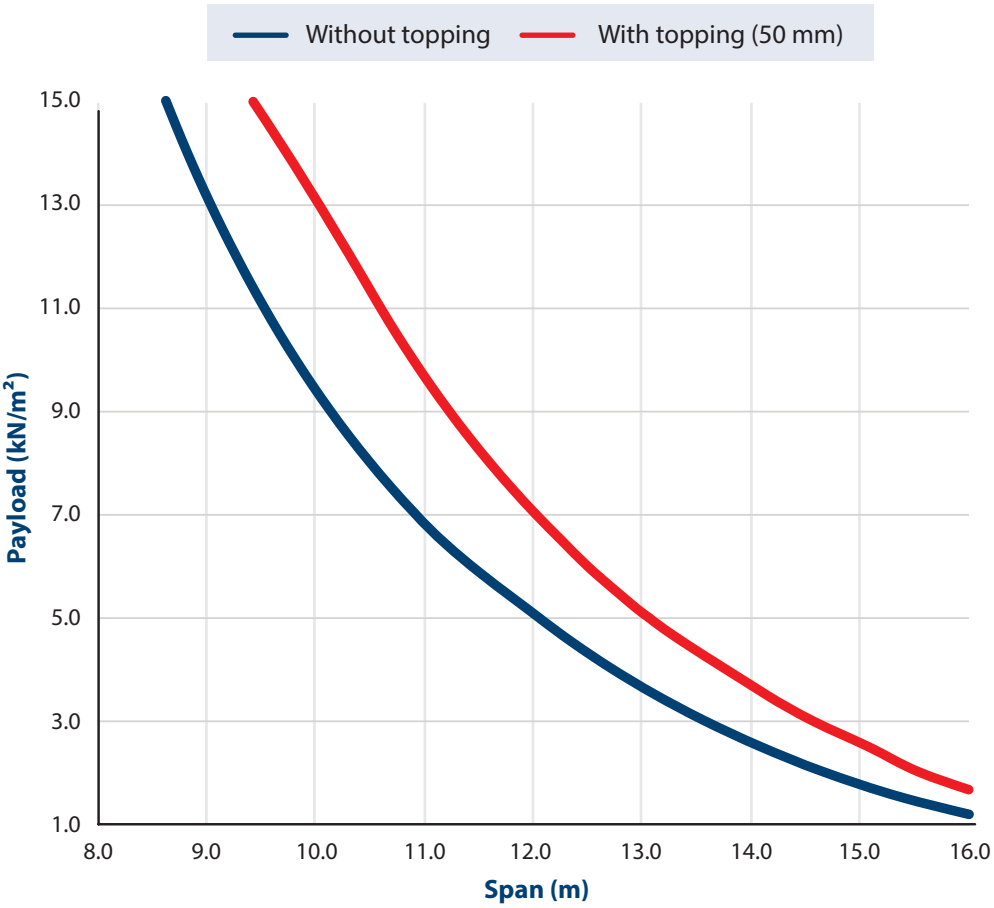


WX 320

MANIPULATION WEIGHT: 405 kg/m²
JOINT FILLING: 13.2 l/m
STANDARD FIRE RESISTANCE:: R60 minutes
STANDARD ENVIRONMENTAL CLASS: XC1

WXT320

CC2/XC1/R60



OPTIONAL: WXTD320

Fire resistance:
R90 & R120 minutes

Environmental classes:
other than XC1 possible

CROSS-SECTIONAL PROPERTIES

WXT 320/1200

A = 1978.26 x10² mm²

I = 251861.32 x10⁴ mm⁴

Centre of gravity top = 160.80 mm

Centre of gravity bottom = 159.20 mm

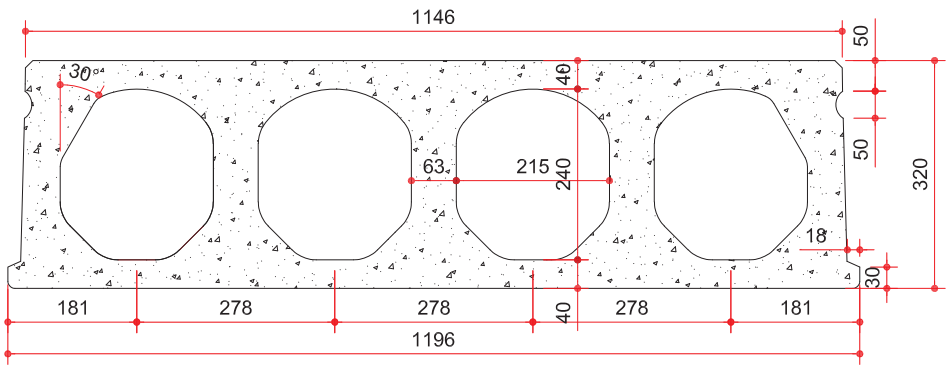
WXT 320 /1200 + 50 mm topping

A = 2578.25 x10² mm²

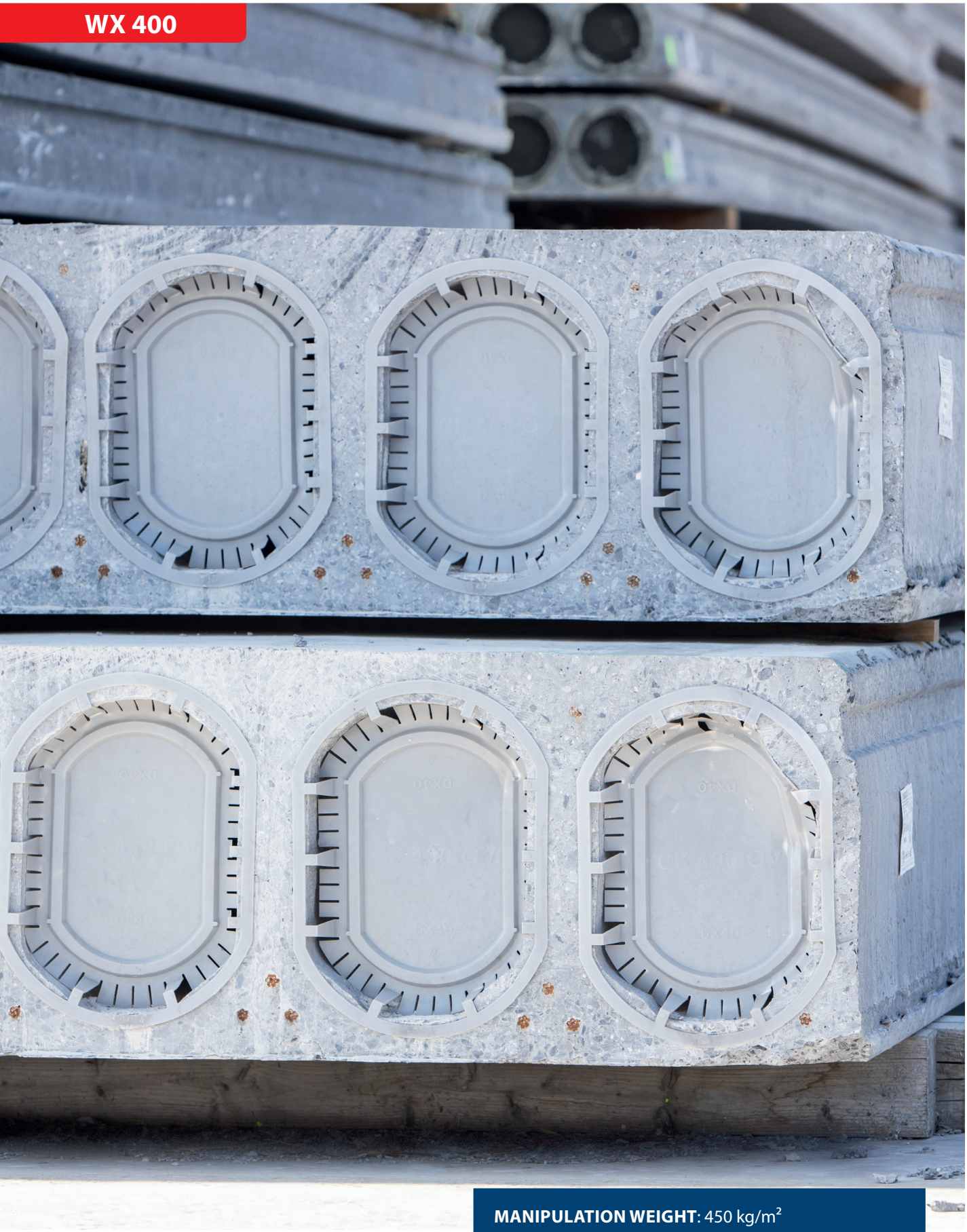
I = 412038.73 x10⁴ mm⁴

Centre of gravity top = 167.56 mm

Centre of gravity bottom = 202.44 mm



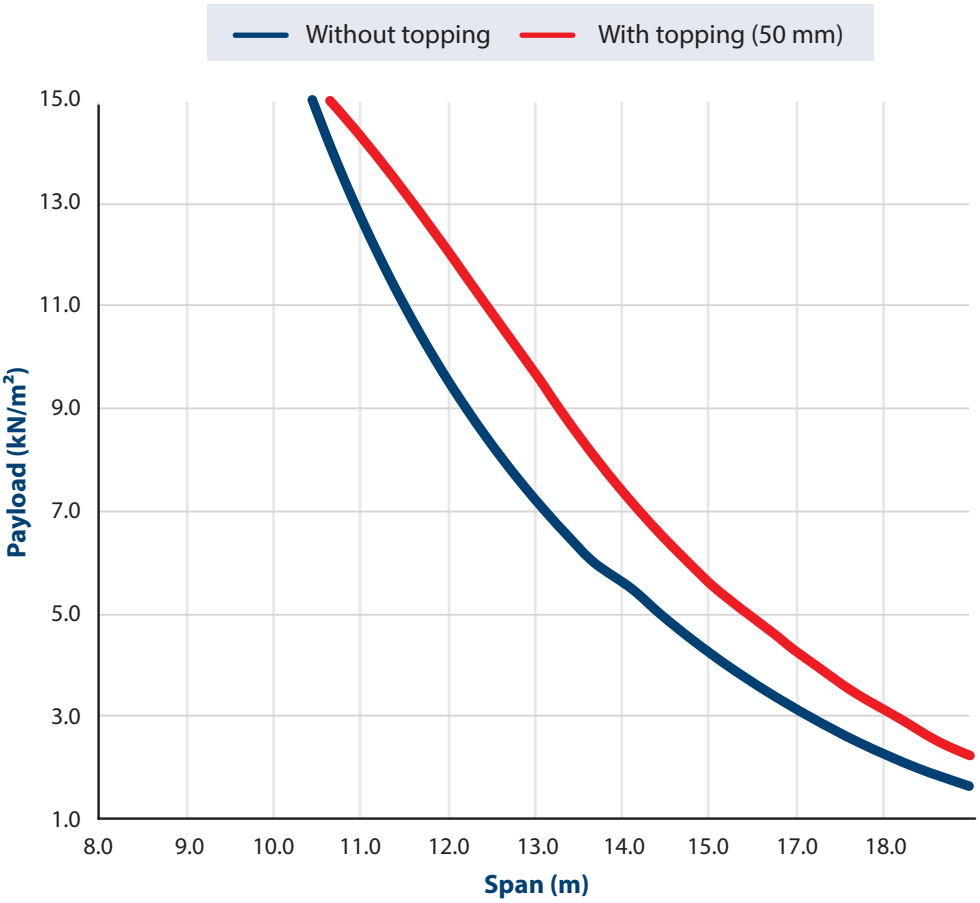
WX 400



MANIPULATION WEIGHT: 450 kg/m²
JOINT FILLING: 16.9 l/m
STANDARD FIRE RESISTANCE:: R60 minutes
STANDARD ENVIRONMENTAL CLASS: XC1

WXT400

CC2/XC1/R60



OPTIONAL: WXTD400

Fire resistance:
R90 & R120 minutes

Environmental classes:
other than XC1 possible

CROSS-SECTIONAL PROPERTIES

WXT 400/1200

A = 2208.84 x10² mm²

I = 450684.93 x10⁴ mm⁴

Centre of gravity top = 200.44 mm

Centre of gravity bottom = 199.56 mm

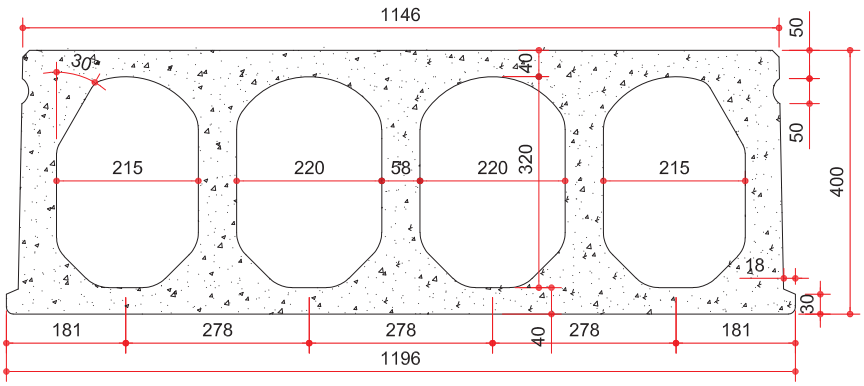
WXT 400 /1200 + 50 mm topping

A = 2808.83 x10² mm²

I = 691734.22 x10⁴ mm⁴

Centre of gravity top = 202.28 mm

Centre of gravity bottom = 247.72 mm

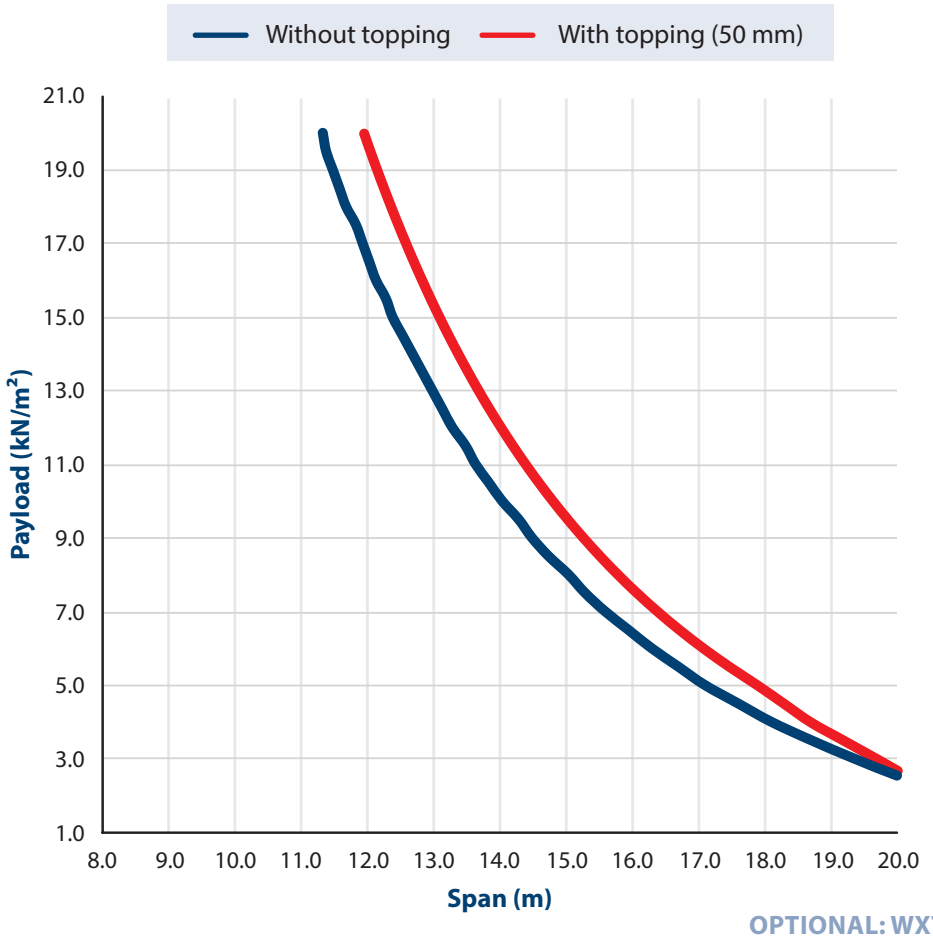


WX 500

MANIPULATION WEIGHT: 530 kg/m²
JOINT FILLING: 21.9 l/m
STANDARD FIRE RESISTANCE:: R60 minutes
STANDARD ENVIRONMENTAL CLASS: XC1

WXT500

CC2/XC1/R60



OPTIONAL: WXTD500

Fire resistance:
R90 & R120 minutes

Environmental classes:
other than XC1 possible

CROSS-SECTIONAL PROPERTIES

WXT 500/1200

A = 2585.61 x10² mm²

I = 822527.39 x10⁴ mm⁴

Centre of gravity top = 251.19 mm

Centre of gravity bottom = 248.81 mm

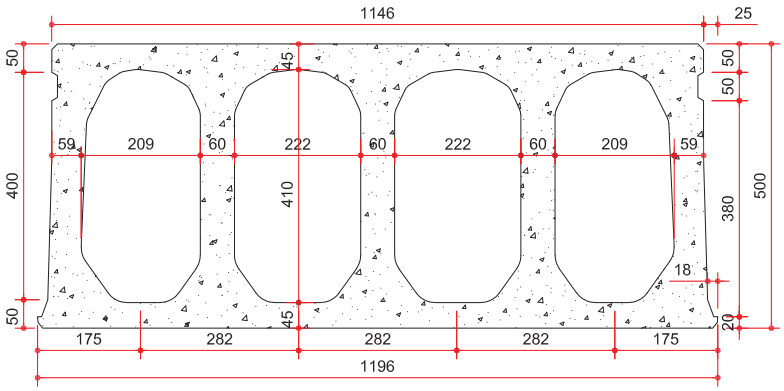
WXT 500 /1200 + 50 mm topping

A = 3185.83 x10² mm²

I = 1195251.61 x10⁴ mm⁴

Centre of gravity top = 249.17 mm

Centre of gravity bottom = 300.83 mm



SPECIFICATION TEXT FOR PRE-STRESSED VAULTS

Product description

Floors composed of type WX pre-stressed concrete prefabricated hollow floor elements.

Materials and production properties

- The following documents apply:
  - NBN EN 1168 - Pre-fabricated concrete products - Hollow floor slabs + addenda
  - NBN B 21-605 - Pre-prefabricated concrete products - Hollow floor slabs - National supplement to NBN EN 1168 + addenda
- The hollow floor elements bear the BENOR quality mark, KOMO quality mark and NF quality mark.
- The pre-stressing is achieved by means of 7 wire strands of different diameters, anchored on adhesive.
- The slabs are manufactured according to the extrusion process in a closed production room.
- Production is under the permanent control of various monitoring bodies.

Execution

- Execution ensues in accordance with the manufacturer's instructions, type **MEGATON/STRUCTO PREFAB SYSTEMS**.
- When being stacked provisionally on the construction site, the contractor shall ensure that no unacceptable stresses occur in the concrete and steel. They must be supported on stacks of timber placed one above the other at a distance according to the instructions of the manufacturer type **MEGATON/STRUCTO PREFAB SYSTEMS**.
- During installation, the floor elements are laid in a mortar bed (masonry) or rubber support (concrete/steel). When laying on masonry, the mortar bed is provided with a reinforcing bar.
- The slabs are placed consecutively, next to each other, on the pre-prepared support surfaces, according to an installation plan drawn up by the manufacturer, type **MEGATON/STRUCTO PREFAB SYSTEMS**.
- The joints between the prefab elements are filled with concrete. The use of filler mortar is not permitted. The infill concrete must be ordered separately, the use of residues from other concrete works is not permitted.
- The joints must be protected against premature drying out (in accordance with the regulations of NBN B 15-001).
- Before applying the joint filling and any topping, the surfaces must be cleaned and sufficiently moistened.
- The floor may not be loaded until the concrete of the joint filling and, where applicable, the topping has hardened completely.
- In order to avoid frost or water damage, the contractor must clear the pre-drilled drainage holes on the site.

Specifications

- **Height:** 15/20/26.5/32/40/50 cm according to indication on plan
- **Width:** 120 cm or filling slabs according to a fixed width interval
- Elements narrower than 120 cm are fitted with dovetail anchors according to slab thickness and weight
- Concrete quality of the slabs according to NBN EN 206-1 and NBN B 15-001

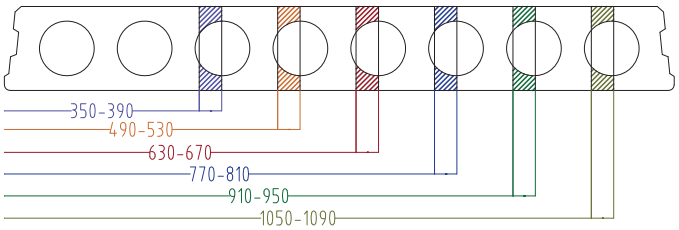
STRENGTH CLASS	DOMAIN OF USE	ENVIRONMENTAL CLASS
C50/60	Pre-stressed concrete	EI/EE1/EE2/EE3

- **Concrete quality of the infill concrete for the joints:** C25/30/C30/37/ …
- **Type of pre-stressing reinforcement:** F_{pk} = 1860 N/mm²
- **Bottom:** smooth
- **Side:** profiled
- **Top:** smooth/roughened
- **Fire resistance:** R60/R120

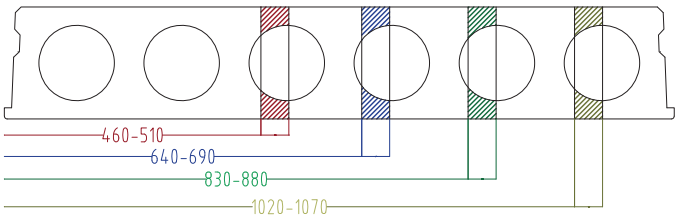
FITTING PIECES

WX elements are always produced at a fixed width of 1.2 m, but can be cut to size according to defined width intervals. Cutting with a saw in the longitudinal direction is possible only in the channels in order to avoid coming into contact with the pre-stressing strands.

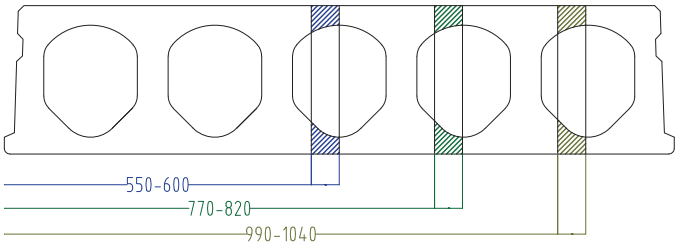
WX 150



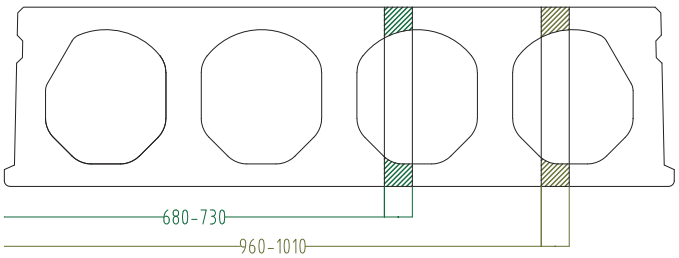
WX 200



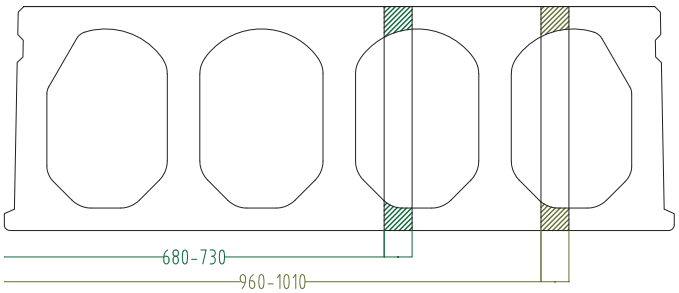
WX 265



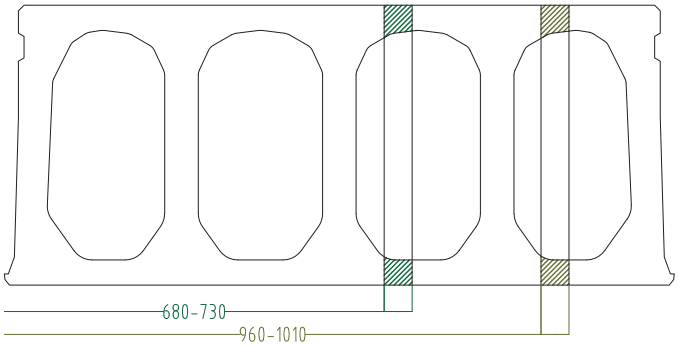
WX 320



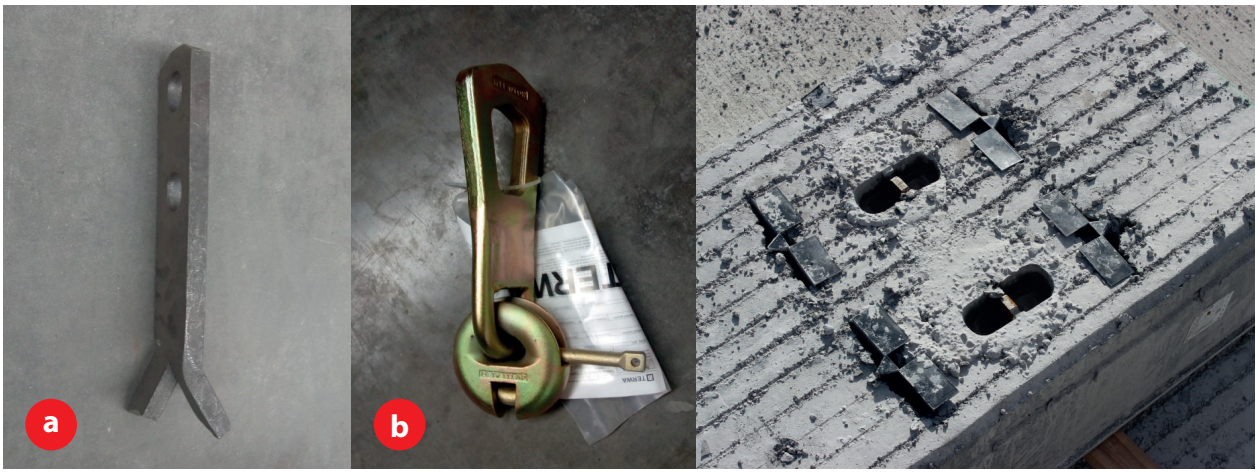
WX 400



WX 500



Fitting pieces are provided with **dovetail anchors (a)**, which must always be handled with a matching **ring transport anchor (b)**.



Slab type	Dovetail anchor (a)	Ring transport anchor (b)
WX 150	1.4-11	2.5 tonnes
WX 200	2.5-15	2.5 tonnes
WX 265	4.0-18	5.0 tonnes
WX 320	5.0-24	5.0 tonnes
WX 400	7.5-30	10.0 tonnes
WX 500	10.0-37	10.0 tonnes

Note: Dovetail anchors are also used for slabs with bevel heads and for slabs of less than 3 m (see also MANIPULATION).

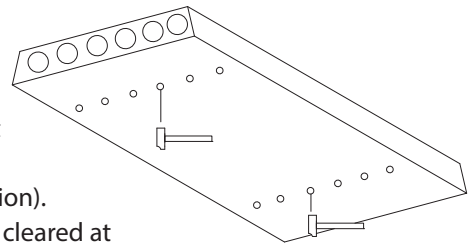
TOLERANCES

PRE-STRESSED SLABS				
		Europe/Belgium	Netherlands	France
		EN 13369/1168	NEN 2889	NF 384
Length	L< 10 m	± (10+0.0005*L) mm	± 28 mm	± 20 mm
Width		± 5 mm	± 12 mm	± 5 mm
Height	H 150	- 5 mm/+ 10 mm	± 12 mm	see EN
	H 200	- 10 mm/+ 12.5 mm		
	H 265	± 15 mm		
	H 320	± 15mm		
	H 400	± 15 mm		
	H 500	± 15 mm		
Curvature	ε	± L/700	± 1 mm	± L/700
End bend	υ	± L/467	± 2 mm	± L/467
Squareness		5 mm	20 mm	5 mm

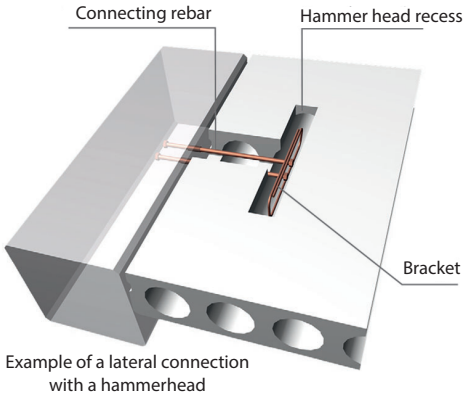
The width tolerance on a fitting piece is 3 cm.

TAILOR-MADE

Drainage holes



Drainage holes can be pre-drilled in the factory and can be important for preventing frost and water damage (drainage of construction moisture/precipitation that penetrates the channels during construction). On site, it must be ensured that the pre-drilled holes are checked and cleared at all times.



Example of a lateral connection with a hammerhead

Hammerheads

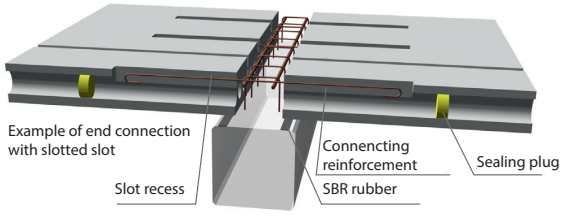
A coupling can also be provided using lateral structural elements. Depending on the type of slab, the first or the second channel is opened over a length of 600 mm for this purpose. In this way, a lateral connection can be established by means of passive reinforcement.

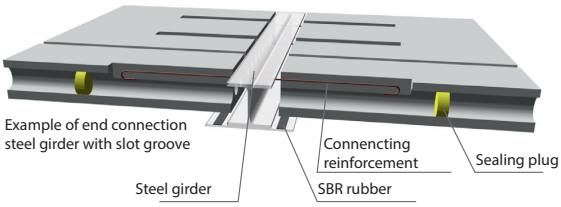
Slot openings

Channels can be opened at the top on the end faces.

This allows:

- a link to the supporting structure to be established. The open slots are poured full after the installation of passive connecting reinforcement, which in this way forms a whole with the end face of the overlying slabs and/or the supporting structural element. A maximum of two elements per side can be fitted at the factory.
- In the event of high loads, an extra concrete section can be created afterwards on site to increase the shear capacity.





Applying a (reinforcing) topping

If a topping is required, the elements are supplied with a rough top (photo below left) to ensure good adhesion. The composition of the topping differs according to its thickness and has to be reinforced in most cases. The concrete class of the topping is at least C25/30 (preferably C30/37) and its reinforcement, if provided, is determined by our engineering office. The topping thickness specified is always measured in the middle of the element. In other words, at the highest point and will therefore be a bit thicker at the ends because of the curvature.

Jointing

In order to obtain a good transverse connection, the slabs must be correctly jointed. It is therefore very important to moisten the joint walls well beforehand so that no water from the mortar is absorbed by the dry concrete and the mortar must at least comply with concrete class C25/30. After applying the topping, the joint must be protected against excessively rapid drying out by means of moistening.

Openings

		WX 150		WX 200		WX 265		WX 320		WX 400		WX 500	
		L ≤ (mm)	B ≤ (mm)	L ≤ (mm)	B ≤ (mm)	L ≤ (mm)	B ≤ (mm)	L ≤ (mm)	B ≤ (mm)	L ≤ (mm)	B ≤ (mm)	L ≤ (mm)	B ≤ (mm)
CORNER OPENING	1	600(1)	300	600(1)	300	1000(1)	300	1000(1)	300	1000(1)	300	1000(1)	300
SIDE OPENING (7)	2	1000(1)	300	1000(1)	300	1000(1)	300	1000(1)	300	1000(1)	300	1000(1)	300
HEAD OPENING	3	600(2)	300(3)	600(2)	300(3)	600(2)	300(3)	600(2)	300(3)	600(2)	300(3)	600(2)	300(3)
CENTRE OPENING	4	1000(5)	300(4)	1000(5)	300(4)	1000(5)	300(4)	1000(5)	300(4)	1000(5)	300(4)	1000(5)	300(4)
BORE IN CHANNEL	5	max Ø65		max Ø120		max Ø100		max Ø150		max Ø150		max Ø150	
HAMMER HEAD	6	in the 2nd channel		in the 2nd channel		in the 2nd channel		in the 1st channel		in the 1st channel		in the 1st channel	
OPEN SLOT	7	600	channel	600	channel	600	channel	600(6)	channel	600(6)	channel	600(6)	channel

(1) L ≤ 0.20 x slab length

(2) & L ≥ 50 mm

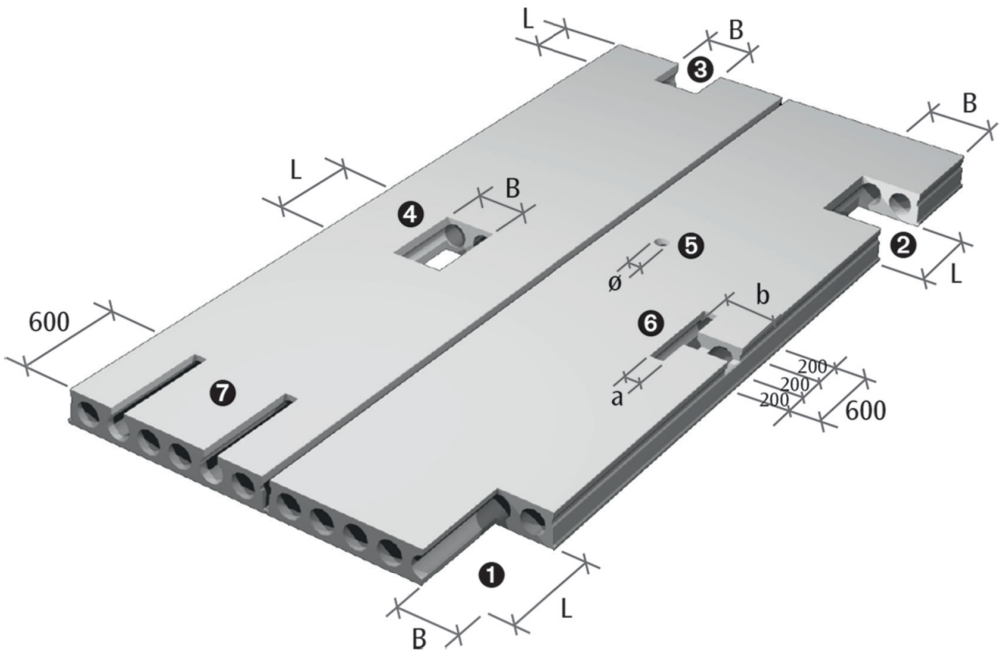
(3) at least 120 mm left per side of residual support/edge zone

(4) leave at least two strands in each edge zone

(5) start of opening at least at 3xB from support

(6) the first 150 mm is always left closed

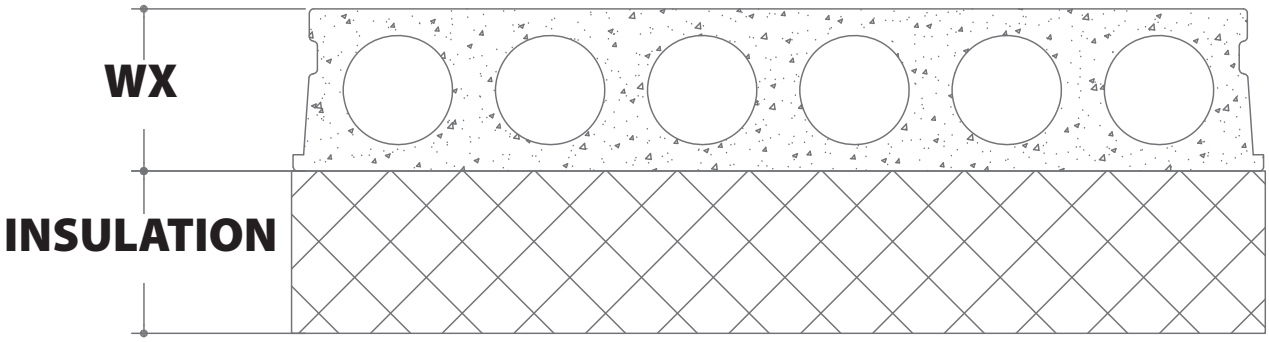
(7) A side opening can also be in the form of a semicircle with a radius of 300 mm (if calculated)



For deviations, our engineering office should be consulted.

Insulated slabs

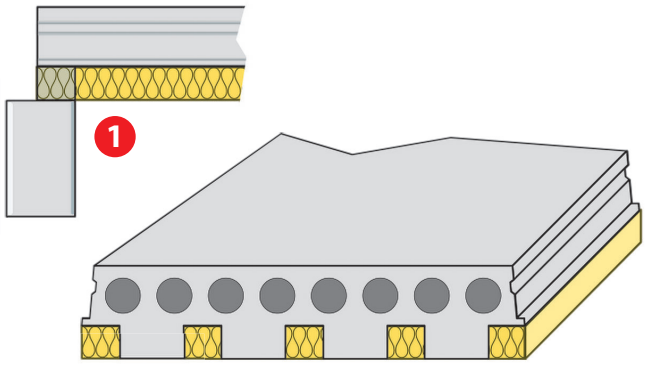
For specific applications, certain types of slabs can be provided with an insulating sheet underneath in accordance with the desired insulation requirement.

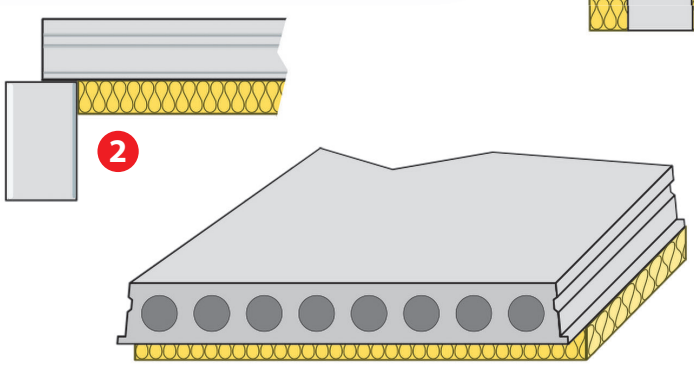


HEAT RESISTANCE RC (m^2K/W)	2.5	3.0	3.5	4.0	4.5		5.0		6.0	6.5
INSULATION THICKNESS (mm)	+ 90	+ 120	+ 130	+ 150	+ 170	+ 135	+ 190	+ 150	+ 180	+ 195
LAMBDA INSULATION VALUE (W/mK)	0.038	0.038	0.038	0.038	0.038	0.030	0.038	0.030	0.030	0.030
WX 200	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
WX 265	✓	✓	✓	✓	✓	✓		✓		
WX 320	✓	✓	✓	✓	✓	✓		✓		
WX 400	✓									

Support systems for insulated slabs:

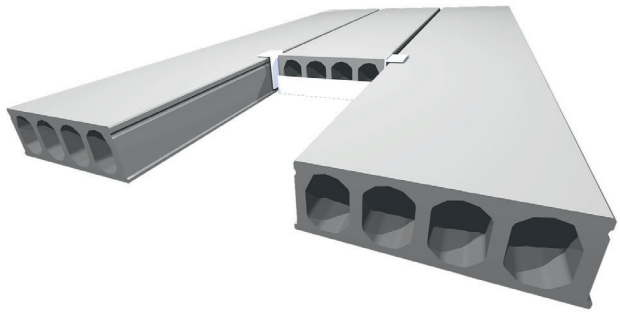
1. Support on ridges
2. Mirror support (standard version if laid on corbel)



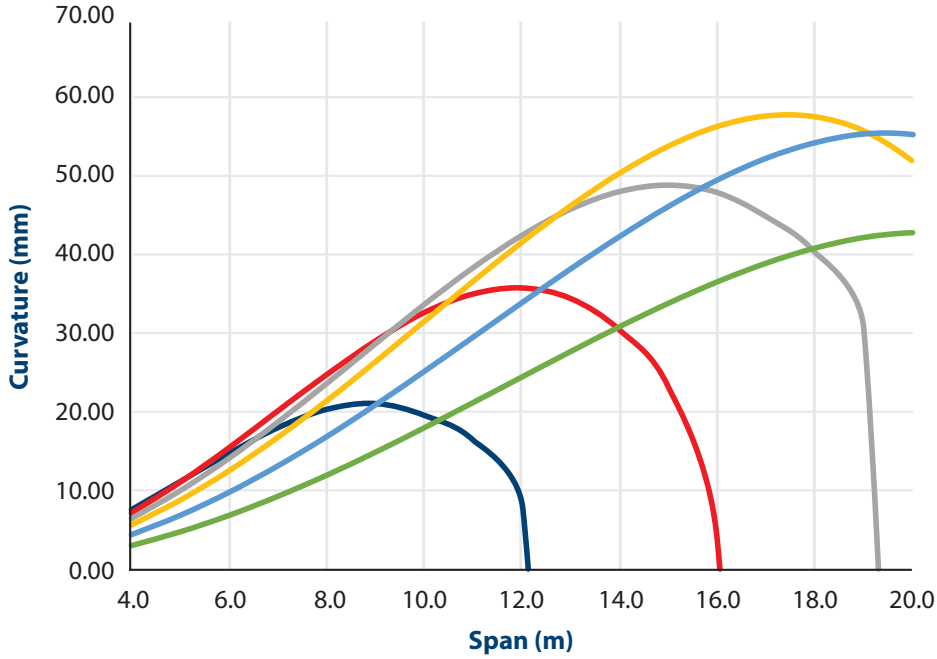


Corbel

For large openings in the floor, which cannot be made by cutting out part of the concrete, corbels can be used. A tailor-made steel profile is placed between two adjacent full-width slabs (1200 mm) on which another (tailor-made) slab can rest. When sizing, an additional load on the elements that support the corbel construction should be taken into account (our design office should be consulted for this). The corbel itself (without post-treatment on site) has no fire resistance, but can be supplied hot-dip galvanised.



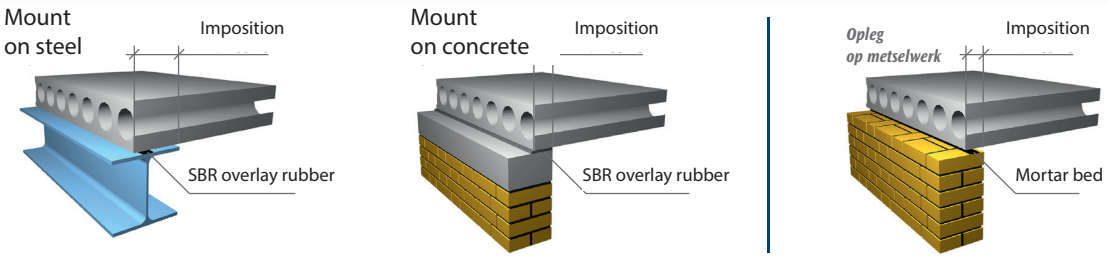
CURVATURE CHART



Note: The graph shows the theoretical curvature of the slabs, at maximum pre-stressing, after a storage period of 60 days. For accurate calculations, consult engineering office **Megaton/Structo Prefab Systems**.

SUPPORT LENGTH

MINIMUM OVERLAY ON:	CONCRETE AND STEEL (mm)		MASONRY (mm)
	MINIMUM	ADVICE	MINIMUM
WX 150	80	≥ 100	100
WX 200	80	≥ 100	100
WX 265	80	≥ 100	100
WX 320	130	≥ 150	150
WX 400	130	≥ 150	150
WX 500	130	≥ 150	150

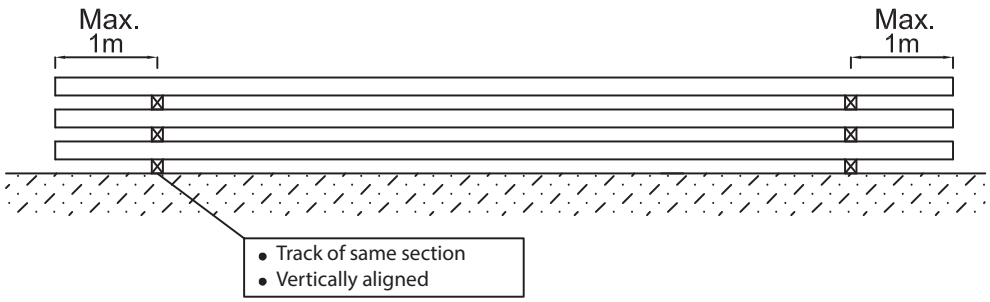


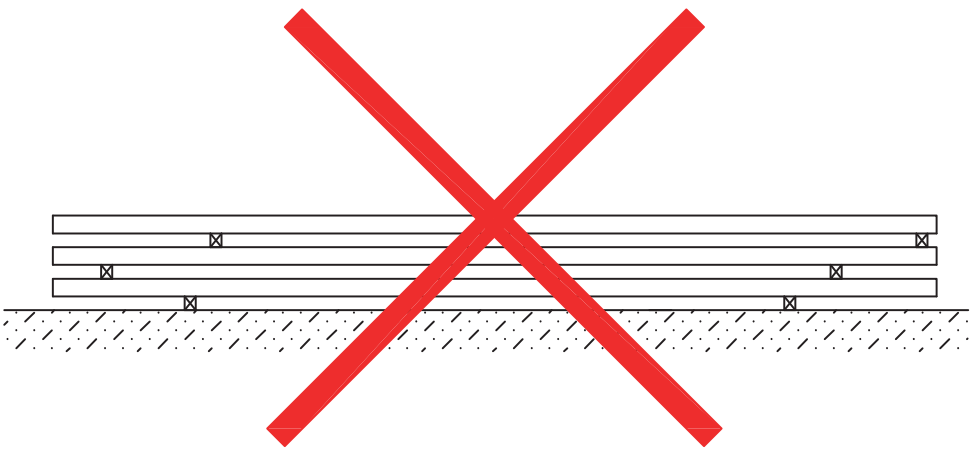
Note: concrete beams are made with a chamfer (bevel) of 15 mm. This must be taken into account when determining the overlay length.

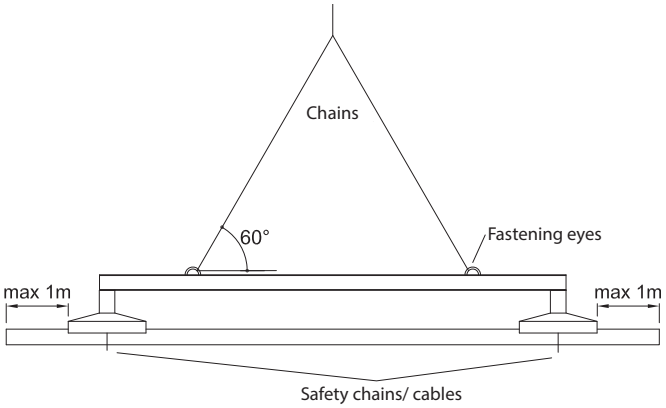
MANIPULATION

1. Storage

In the case of on-site storage, this must be done on a flat, load-bearing surface (clear of the ground) and the supports between the stacked elements must be placed in the same vertical plane, at a maximum distance of 1 m from the end of the slab.







2. Manipulation with clamp

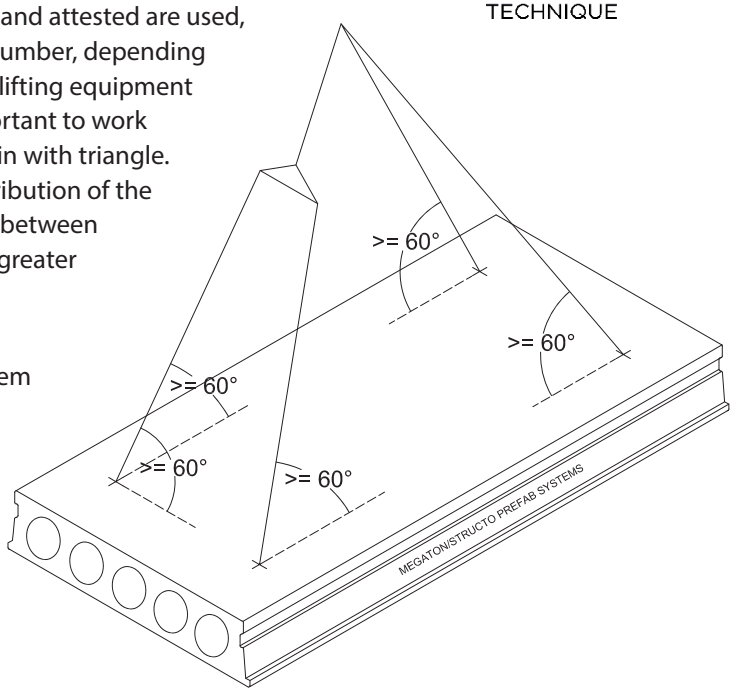
The clamp should be placed in the middle of the slab. The slab may protrude a maximum of 1 m beyond the jaws of the clamp. The safety chains must always be fitted correctly before starting any handling. The lifting chains themselves are sufficiently long to ensure that the lifting angle is always greater than 60°. The net weights of our clamps are available on request.

3. Handling with chains and ring transport anchor

Short slabs (L < 3 m), strongly bevelled slabs and filling slabs (= slabs with a width < 120 cm) cannot be handled using the classic clamp. For this, dovetail anchors that have been cast in the factory and attested are used, and are installed according to a fixed pattern and number, depending on the dimensions of the slab. When attaching the lifting equipment (= corresponding ring transport anchors), it is important to work with sufficiently long chains and with a 4-hook chain with triangle. An additional distribution point ensures equal distribution of the weight over the lifting points provided. The angle between the plane of the slab and the chain should also be greater than 60° in each direction.

For the French market, we have had this lifting system certified by the CSTB and CCFAT and we are also in possession of an ATEC certificate, which endorses and demonstrates the handling of our pre-stressed floor elements in accordance with French safety regulations.

* Technical advice available on request

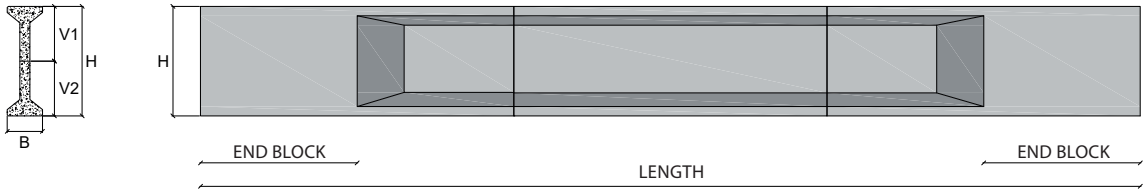


TECHNICAL BROCHUREBEAMS IN PRE-STRESSED CONCRETE

I-BEAMS
MADE OF PRE-STRESSED CONCRETE

Beams with an I-shaped section and constant height, IC beams or IK beams, are used to absorb higher line loads (IC beams) of floor elements, for example, over a longer distance. They can also be used as tie beams (IK beams) and can be made with or without brackets. Using IK beams (tie beams) can greatly reduce the number of free-standing columns.

IC BEAMS – BEAMS WITH A CONSTANT HEIGHT

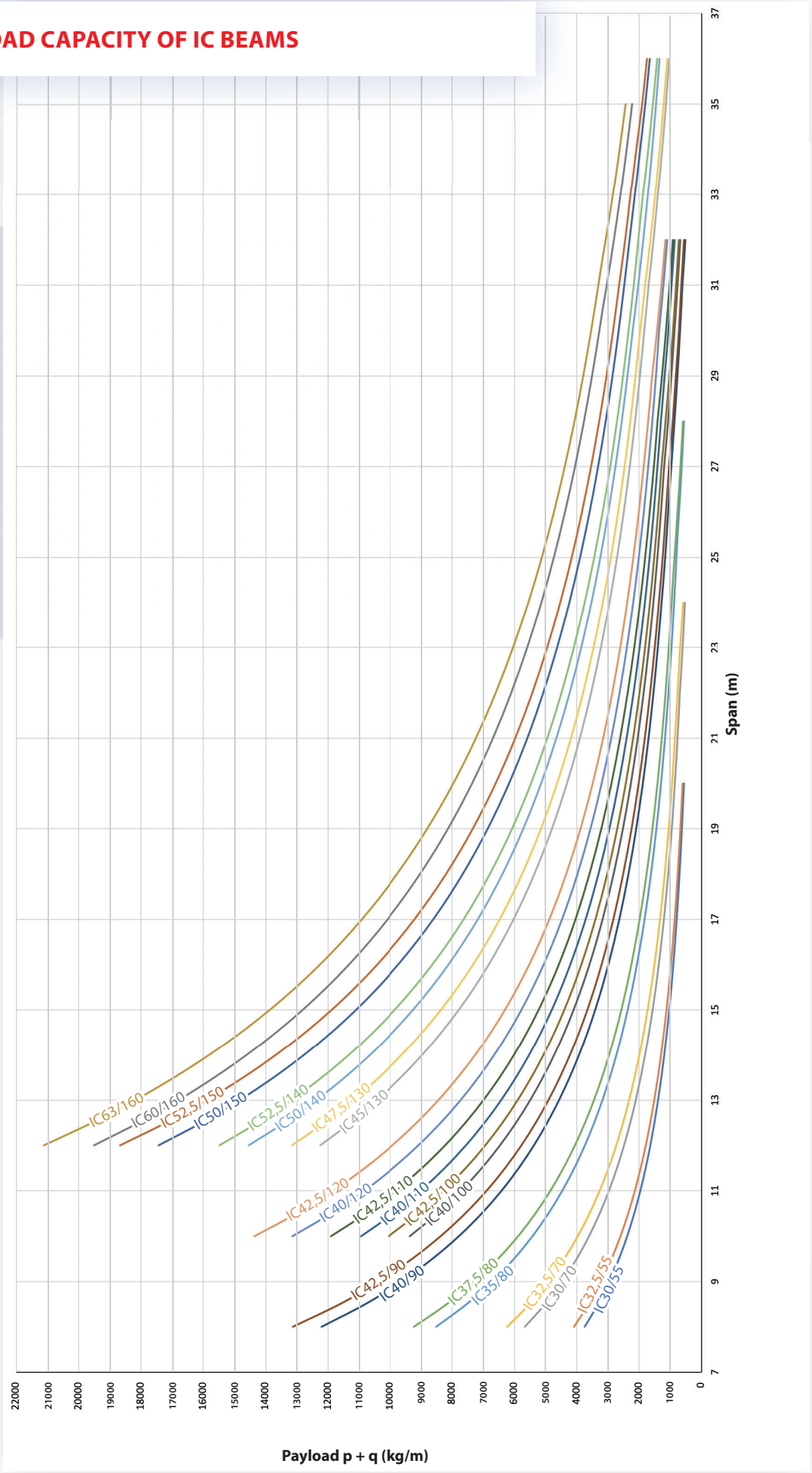


CHARACTERISTICS

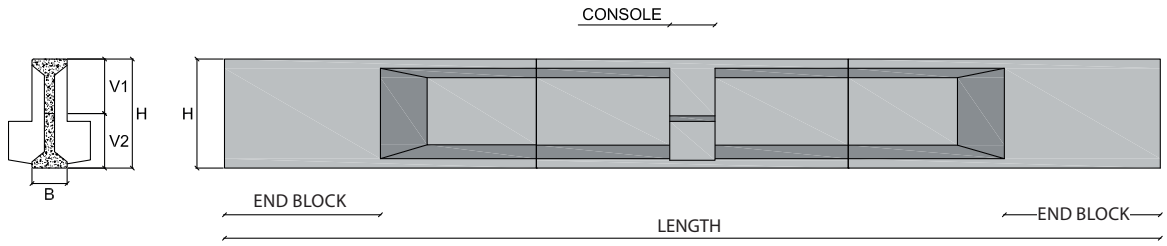
Beam IC(b)/(h)	A ($x10^2 mm^2$)	I ($x10^4 mm^4$)	v_1 (mm)	v_2 (mm)	minimum		maximum	
					L_{min} (m)*	EG_{min} (kg)	L_{max} (m)	EG_{max} (kg)
IC30/55	1050	368648	280	270	8	2371	20	5585
IC32.5/55	1187.5	403345	280	270	8	2652	20	6299
IC30/70	1240	722909	350	350	8	2856	24	7931
IC32.5/70	1415	794368	350	350	8	3213	24	9002
IC35/80	1525	1211707	408	392	8	3621	28	11399
IC37.5/80	1725	1318489	407	393	8	4029	28	12827
IC40/90	1860	1929298	459	441	8	4590	32	15020
IC42.5/90	2085	2081333	458	442	8	5049	32	16754
IC40/100	2020	2598093	500	500	12	7191	32	17493
IC42.5/100	2270	2806427	500	500	12	7956	32	19533
IC40/110	2120	3320227	550	550	12	7777	32	18590
IC42.5/110	2395	3597518	550	550	12	8619	32	20834
IC40/120	2280	4251935	611	589	12	8517	32	20145
IC42.5/120	2580	4612259	610	590	12	9435	32	22593
IC45/130	2880	6203217	660	640	12	10787	36	28407
IC47.5/130	3205	6661236	659	641	12	11781	36	31390
IC50/140	2870	7688276	719	681	12	11730	36	29300
IC52.5/140	3220	8261065	717	683	12	12801	36	32513
IC50/150	3358	9880957	768	732	12	13439	36	33992
IC52.5/150	3733	10585147	766	734	12	14586	36	37434
IC60/160	3924	13651920	829	771	12	16651	36	40647
IC63/160	4404	14679567	826	774	12	18105	36	45059

** L_{min}: Shorter lengths can also be used depending on the formwork options.*

LOAD CAPACITY OF IC BEAMS



IK BEAMS WITH A CONSTANT HEIGHT AND WITH A BRACKET ON THE CENTRE STIFFENER

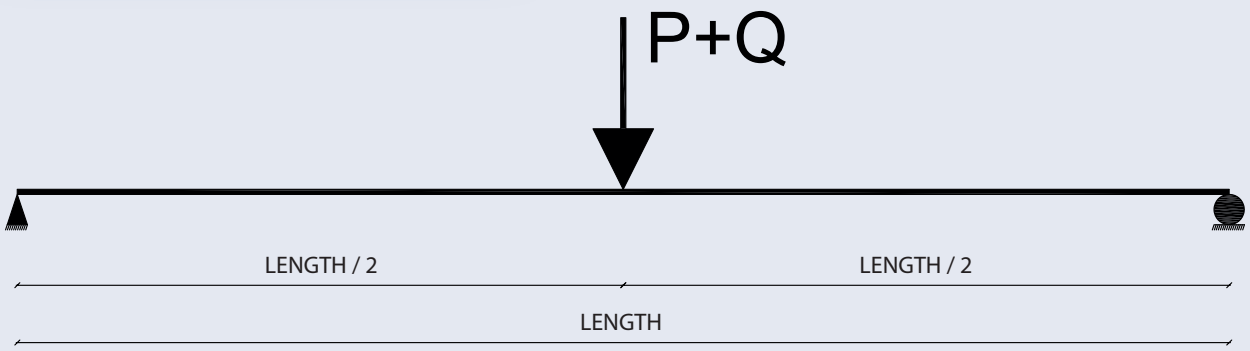


CHARACTERISTICS

Beam IK(b)/(h)	A ($x10^2mm^2$)	I ($x10^4mm^4$)	v_1 (mm)	v_2 (mm)	minimum		maximum	
					L_{min} (m)*	EG_{min} (kg)	L_{max} (m)	EG_{max} (kg)
IK35/90	1927	1772777	455	445	10.00	5964	13.00	8373
IK40/90	2377	2076623	454	446	10.00	7111	13.00	9865
IK35/95	2102	2127315	494	456	10.00	6410	13.00	8952
IK40/95	2577	2485992	491	459	10.00	7621	13.00	10528
IK35/100	2277	2501035	531	469	10.00	6856	13.00	9534
IK40/100	2777	2921695	526	474	10.00	8131	13.00	11190
IK45/130	4050	7518750	683	617	16.00	18854	18.50	22584
IK50/130	4700	8440390	679	621	16.00	21505	18.50	25649
IK45/140	4500	9700500	710	690	16.00	20690	18.50	24706
IK50/140	5200	10844439	709	691	16.00	23546	18.50	28008
IK45/150	4950	12067159	741	759	16.00	22525	18.50	26830
IK50/150	5700	13473947	742	758	16.00	25585	18.50	30367

** L_{min}: Shorter lengths can also be used depending on the formwork options.*

IF LOAD CAPACITY



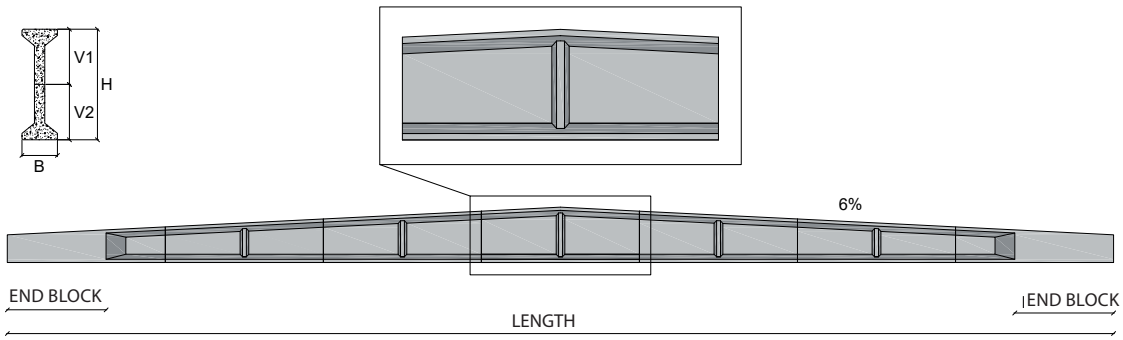
P+Q (kg) / L (m)	IK35/90-0%	IK40/90-0%	IK35/95-0%	IK40/95-0%	IK35/100-0%	IK40/100-0%
10.0	34500	40300	40200	46700	44100	51500
10.5	32900	38400	38200	44300	41900	48900
11.0	31400	36600	36300	42200	40000	46600
11.5	29800	35000	34700	40400	38200	44500
12.0	28600	33500	33100	38800	36600	42500
12.5	27500	32000	31800	37200	35100	41000
13.0	26400	30900	30600	35700	33700	39300

- assumption P+Q= 75% permanent & 25% mobile
- check of the torsion resistance of the beam and the load-bearing capacity of the brackets was not taken into consideration.

I-BEAMS
IN PRE-STRESSED CONCRETE

I-section beams with variable height, also known as IV beams, are used in roof structures with larger spans. Due to the variable height, they provide for sufficient drainage without additional intervention. An additional advantage is that the variable, increasingly smaller concrete section results in a relevant material saving and, therefore, is also a particularly interesting solution from an economic point of view.

IV BEAMS 6% - BEAMS WITH VARIABLE HEIGHT AND SLOPE OF 6%

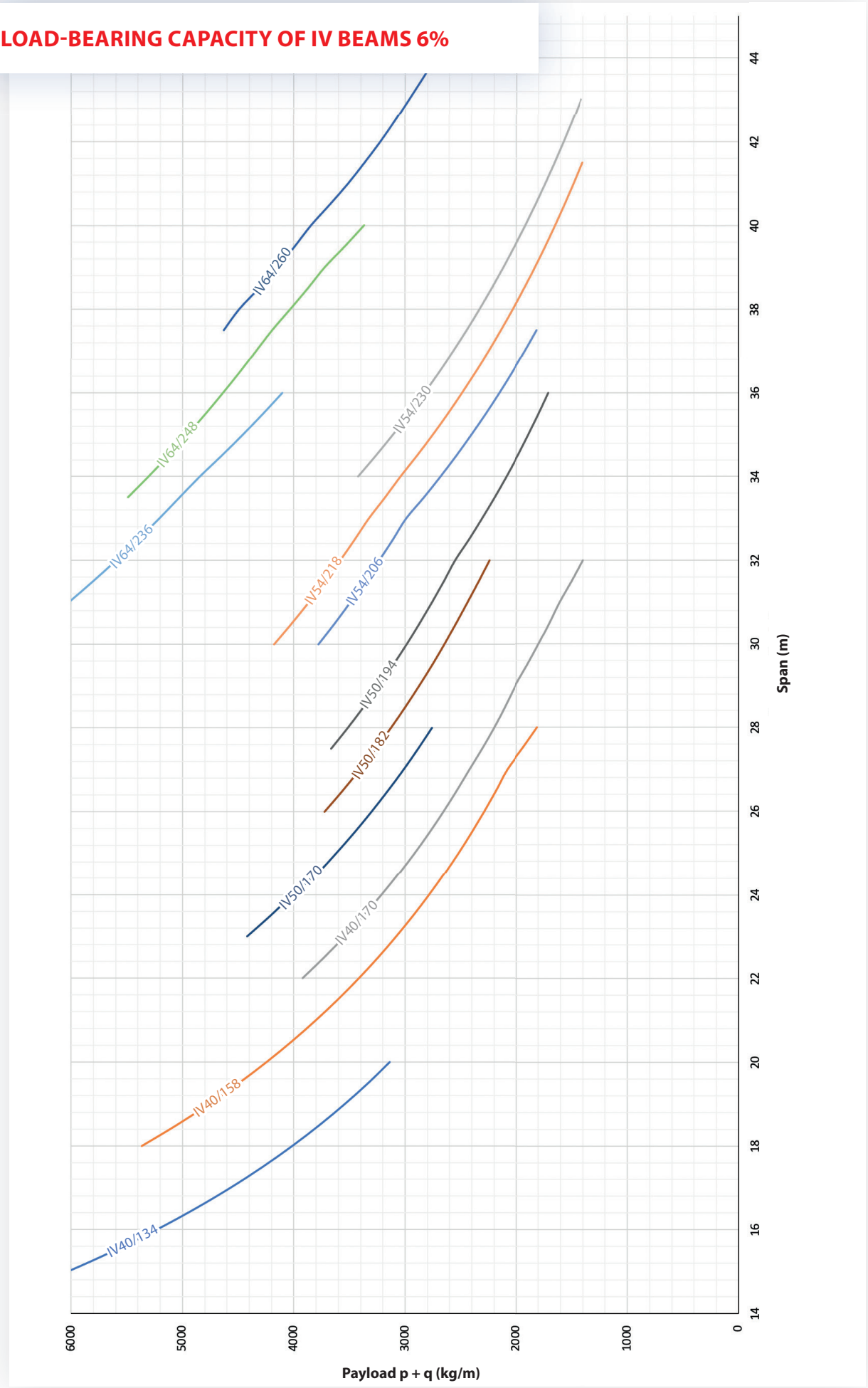


CHARACTERISTICS

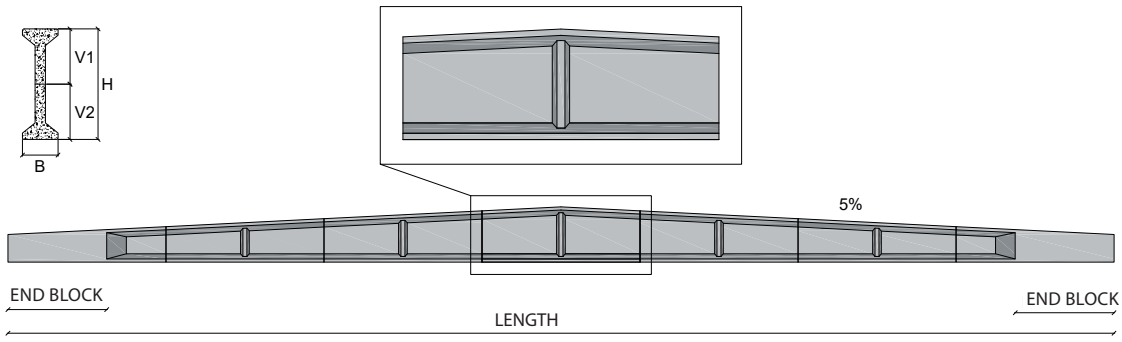
Beam IV (B/H)	A_{centre} ($x10^2 mm^2$)	$I_{x\ centre}$ ($x10^4 mm^4$)	$v_{1\ centre}$ (mm)	$v_{2\ centre}$ (mm)	minimum		maximum	
					L_{min} (m)	G_{min} (kg)	L_{max} (m)	G_{max} (kg)
IV40/134-6%	2288	5627063	690	650	10	6360	20	12687
IV40/158-6%	2480	8495301	813	767	18	11473	28	17800
IV40/170-6%	2576	10193642	874	826	22	14176	32	20504
IV50/170-6%	2956	12352790	878	822	23	19156	28	23530
IV50/182-6%	3052	14592217	939	881	26	21235	32	26916
IV50/194-6%	3148	17051239	1001	939	27.50	24154	34	28443
IV54/206-6%	3396	21059746	1064	996	30	30175	37.50	36707
IV54/218-6%	4212	26116915	1117	1063	30	30528	41.50	41071
IV54/230-6%	4356	29879534	1177	1123	34	35039	43	44409
IV64/236-6%	5432	41362479	1268	1092	29.50	40192	36	50932
IV64/248-6%	5576	46783500	1331	1149	33.50	45963	40	56703
IV64/260-6%	5720	52604820	1394	1206	37.50	51941	44	62621

With some beam profiles (40 & 50 cm wide), solutions with a higher load-bearing capacity are possible by using wider body and flange thicknesses. The profiles shown have a standard fire resistance of 60 minutes, but 120 minutes is also possible if the beams are foreseen with a wider body thickness. Please contact us for advice in this regard.

LOAD-BEARING CAPACITY OF IV BEAMS 6%



IV BEAMS 5% - BEAMS WITH VARIABLE HEIGHT AND SLOPE OF 5%

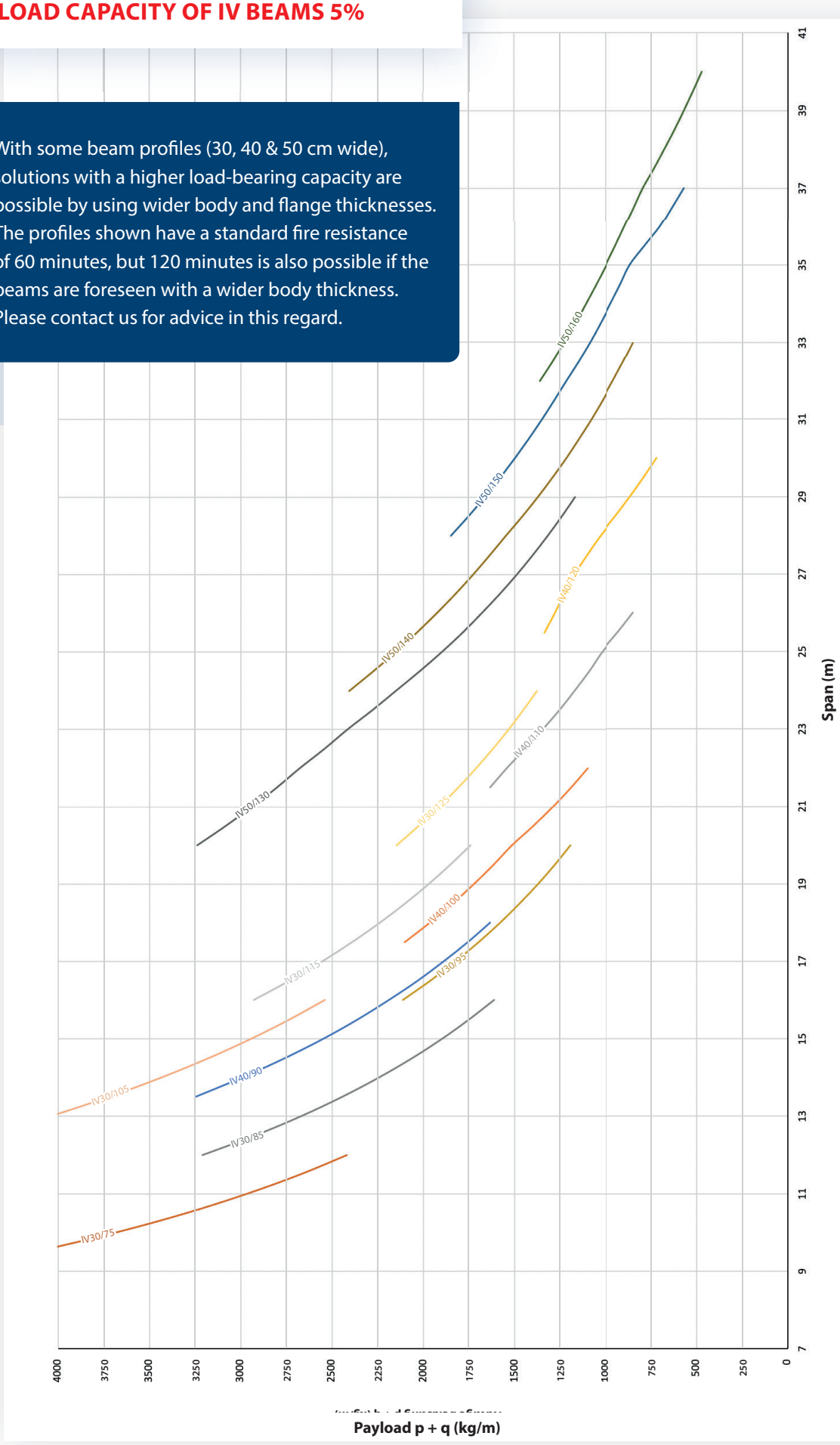


CHARACTERISTICS

Beam IV (B/H)	A_{centre} ($x10^2mm^2$)	$I_{x\ centre}$ ($x10^4mm^4$)	$v_{1\ centre}$ (mm)	$v_{2\ centre}$ (mm)	minimum		maximum	
					L_{min} (m)	G_{min} (kg)	L_{max} (m)	G_{max} (kg)
IV30/75-5%	1436	954410	383	367	8	2880	12	4410
IV30/85-5%	1516	1335206	435	415	12	4385	16	5915
IV30/95-5%	1596	1791717	486	464	16	5972	20	7502
IV30/105-5%	1676	2327955	538	512	12	4998	16	7140
IV30/115-5%	1756	2947931	589	561	16	6748	20	8890
IV30/125-5%	1836	3655653	640	610	20	8693	24	10835
IV30/135-5%	1916	4455127	691	659	24	10679	24	10679
IV40/90-5%	1648	1797227	450	450	13.50	5544	18	7768
IV40/100-5%	1728	2346907	500	500	17.50	7213	22	9537
IV40/110-5%	1808	2982987	550	550	21.50	9064	26	11388
IV40/120-5%	1888	3709467	600	600	25.50	11013	30	13336
IV50/130-5%	2338.5	5527246	650	650	20	11933	29	18011
IV50/140-5%	2428.5	6637639	700	700	24	14465	33	20544
IV50/150-5%	2518.5	7869458	750	750	28	17089	37	23168
IV50/160-5%	2608.5	9227201	800	800	32	19822	40	25151

LOAD CAPACITY OF IV BEAMS 5%

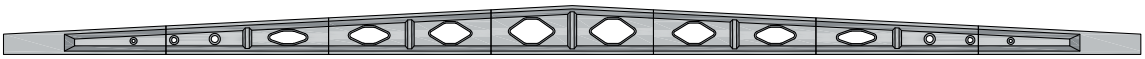
With some beam profiles (30, 40 & 50 cm wide), solutions with a higher load-bearing capacity are possible by using wider body and flange thicknesses. The profiles shown have a standard fire resistance of 60 minutes, but 120 minutes is also possible if the beams are foreseen with a wider body thickness. Please contact us for advice in this regard.



IVTEC BEAMS

IVTEC BEAMS 5% - BEAMS WITH VARIABLE HEIGHT AND SLOPE OF 5%

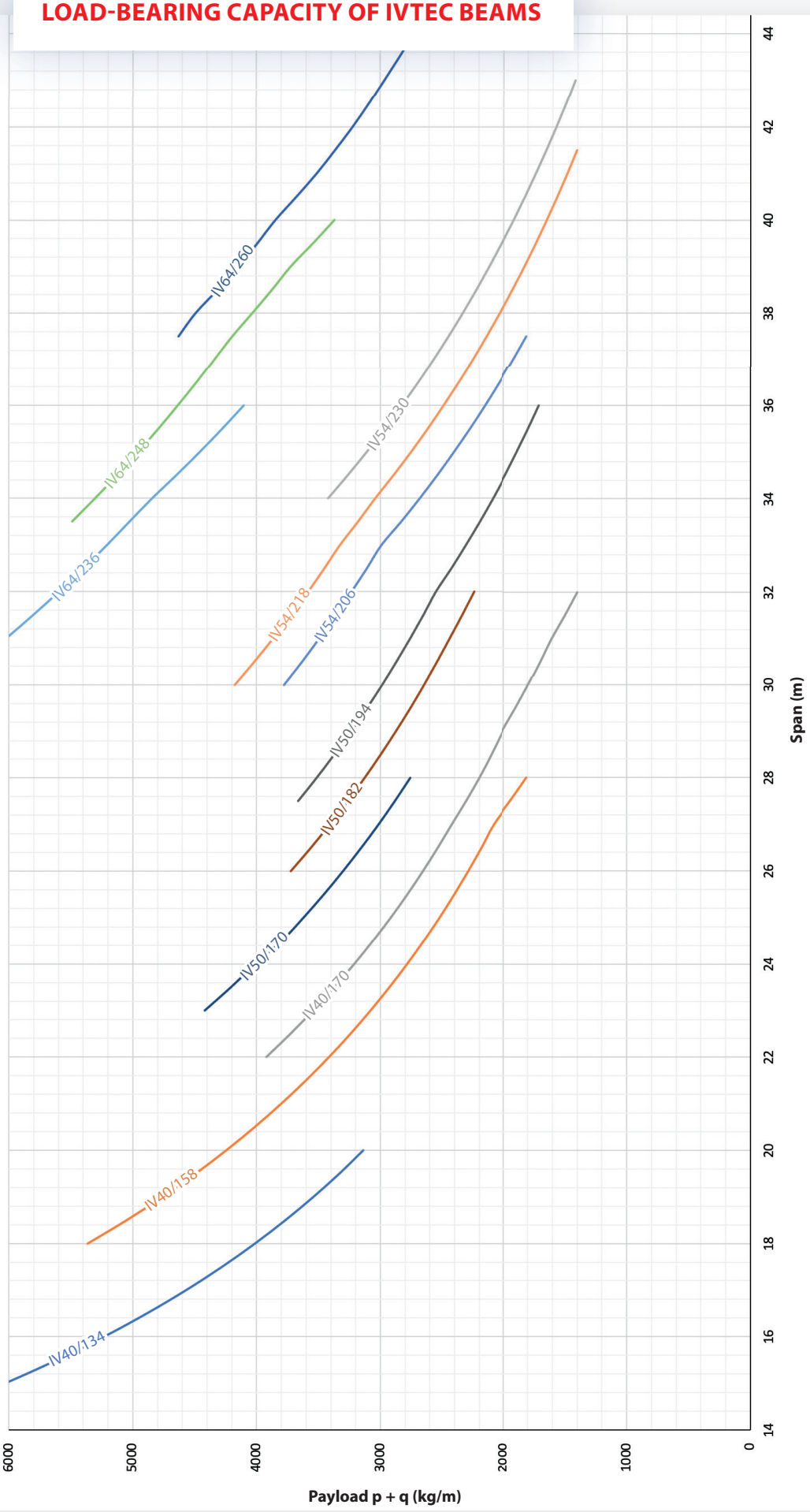
Some of our 5% IV beams are also available with hexagonal openings in the body (IVTEC beam). An IVTEC beam allows for openings of relative diameter (dimensions according to profile and available on request).
The location, shape and size of the openings are fixed and cannot be changed.



CHARACTERISTICS

Beam IVTEC (B/H)	Dimension of the largest opening		minimum		maximum	
	Diameter (cm)	Surface area (cm²)	L_{min} (m)	G_{min} (kg)	L_{max} (m)	G_{max} (kg)
IVTEC40/90	30.4	2049	14	5591	18	7631
IVTEC40/100	39.9	2691	18	7232	22	9272
IVTEC40/110	49.9	3366	22	8925	26	10965
IVTEC40/120	59.8	4343	26	10675	30	12715
IVTEC50/130	62.0	4421	23	14129	33	17978
IVTEC50/140	63.5	4454	24	13509	36	19559
IVTEC50/150	63.5	4720	28	15934	36	21227
IVTEC50/160	73.5	6170	32	18347	36	22172
IVTEC60/150	62.8	4703	27	20776	34	26881
IVTEC60/170	82.8	6555	35	27164	42	33269

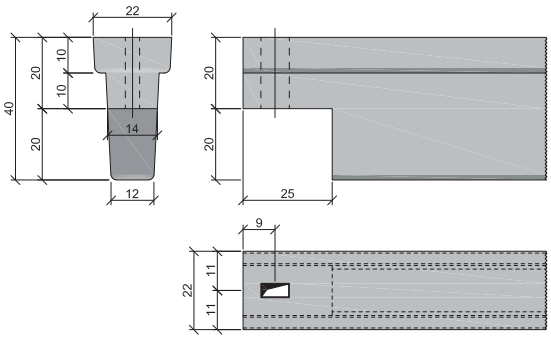
LOAD-BEARING CAPACITY OF IVTEC BEAMS



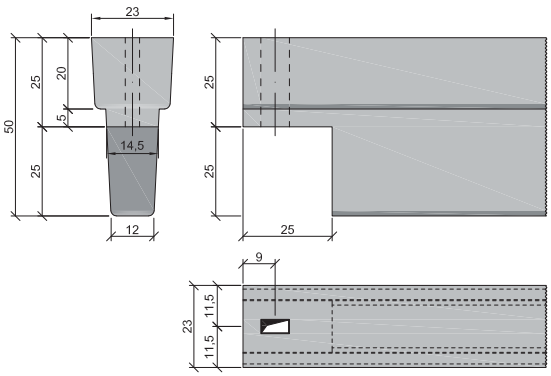
PURLINS

Purlins, GX beams, are intended for a light roof structure (steel deck) and usually span about 12 metres, supported by other IV or IC beams. Purlins have a fixed cross-section and reinforcement pattern.

GX/400/220-120



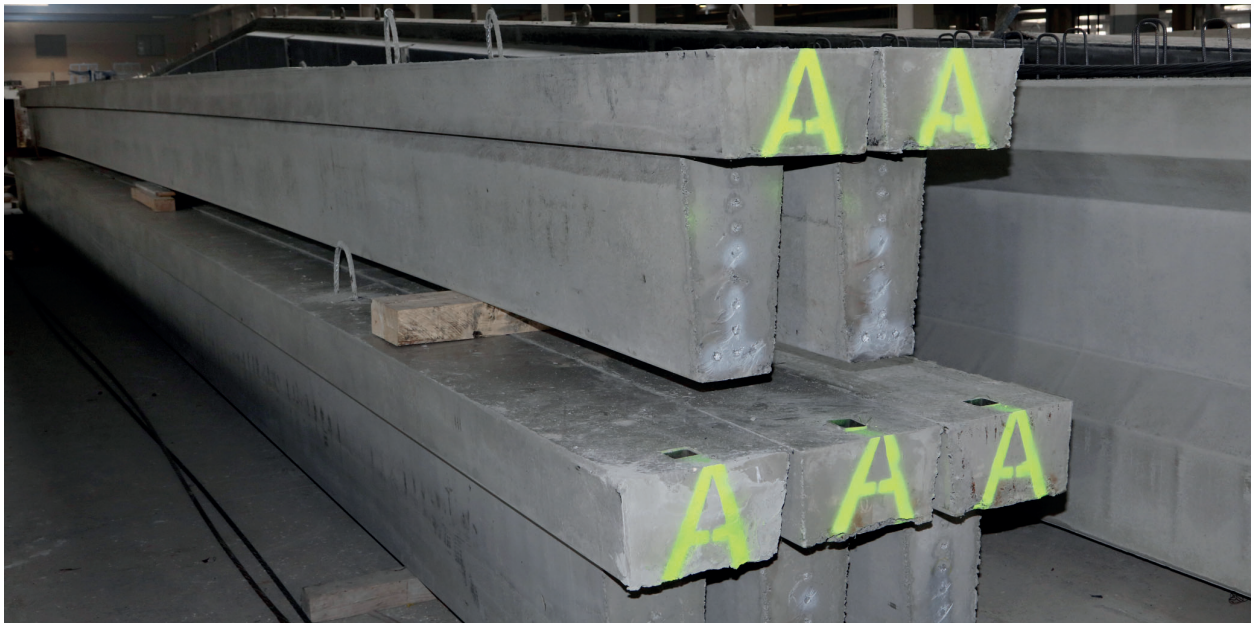
GX/500/230-120



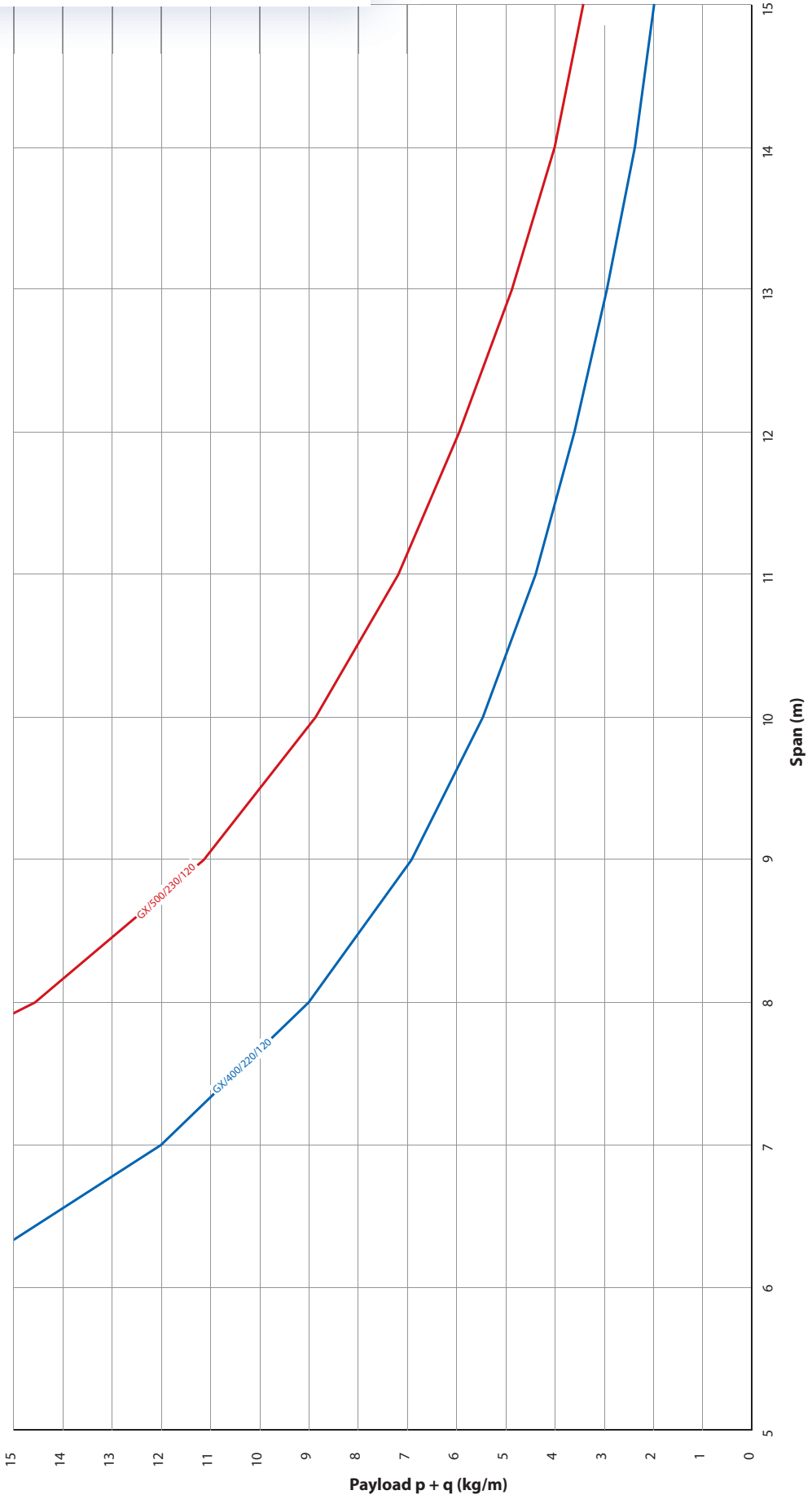
The dimensions of the cantilever support and position of the tube are fixed and are preferably made with standard dimensions

CHARACTERISTICS

Type	A_{centre} ($x10^2mm^2$)	$I_{x\ centre}$ ($x10^4mm^4$)	$v_{1\ centre}$ (mm)	$v_{2\ centre}$ (mm)	Weight kg
GX/400/220-120	618.3	85353	177	223	155
GX/500/230-120	843.6	169141	216	284	211

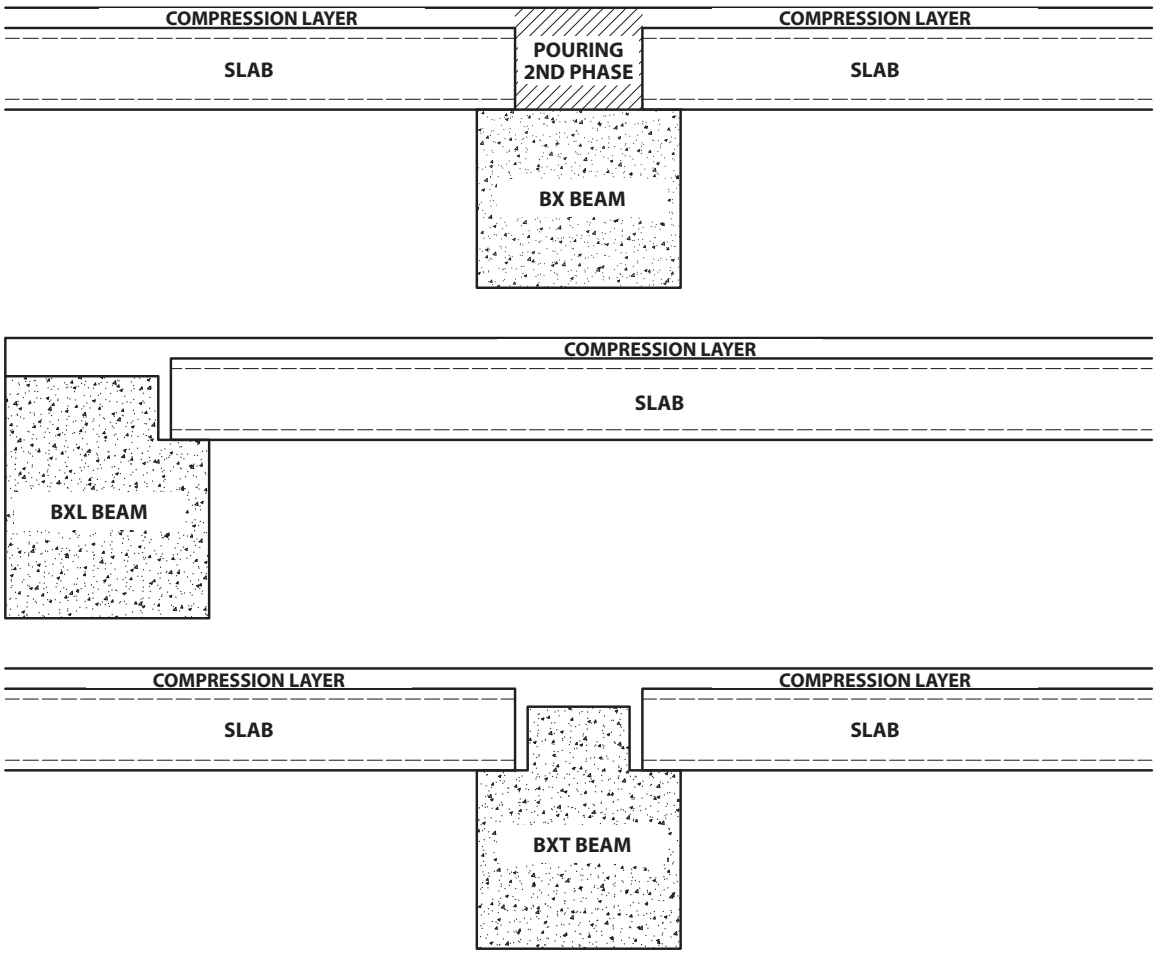


LOAD CAPACITY OF PURLINS

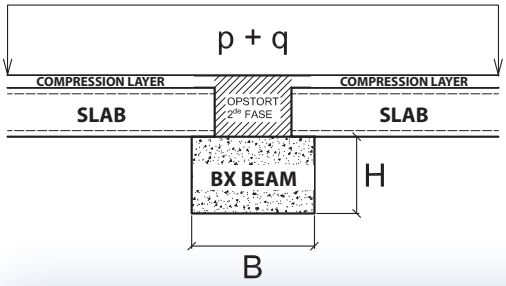


BX BEAM

Pre-stressed beams with rectangular section, BX beams, are used as storey beams when it is important to keep the height of the beam as low as possible. BX beams have a rectangular section but can also be provided with longitudinal toothing, with the possibility of producing L-shaped (BXL beam) and even inverted T-shaped (BXT beam) sections. For example, the support length of a slab or TT floor element can be recessed over the desired height in order to gain additional headroom.



DIMENSIONING TABLE FOR A PAYLOAD OF 500 kg/m²



EG SLAB & COMPRESSION LAYER

EG BEAM

p + q = **payload (excl. EC vault, compression layer & beam)**
with p = **permanent load**
with q = **Mobile load**
with p + q = 500 kg/m² **(Characteristic)**
with p ≤ 400 kg/m² (Characteristic)

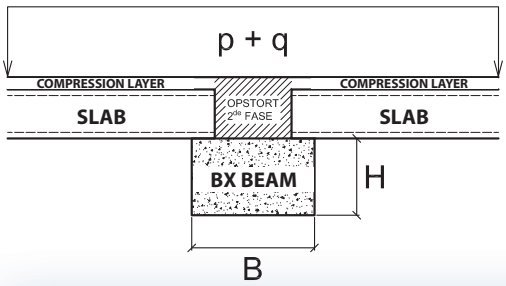
	Slab sizes (m)	6	7.2	8.4	9.6	10.8	12	13.2	14.4
Beam sizes (m)	WIDTH (B) (cm)	WX 150 + 5 cm	WX 200 + 5 cm		WX 265 + 5 cm		WX 320 + 7 cm		WX 400 + 7 cm
		HEIGHT (H) (cm)							
4.8	BX 30/	35	40	45	50	50	60		
	BX 40/	30	35	40	40	45	50	50	55
	BX 50/					40	45	45	50
	BX 60/						40	40	45
	BX 70/								40
	BX 80/								
6	BX 30/	45	50	55	60				
	BX 40/	40	45	50	50	55	60	65	70
	BX 50/		40	40	45	50	55	60	65
	BX 60/				40	45	50	50	55
	BX 70/					40	45		50
	BX 80/	0							
7.2	BX 30/	55	60						
	BX 40/	45	50	60	65	70	75	80	
	BX 50/	40	45	50	55	60	65	70	75
	BX 60/		40	45	50	55	60	65	70
	BX 70/			40	45	50	55	60	65
	BX 80/					45	50	55	60
8.4	BX 30/								
	BX 40/	55	60	70	75	80			
	BX 50/	50	55	60	65	70	80	80	90
	BX 60/	45	50	55	60	65	70	75	80
	BX 70/	40	45	50	55	60	65	70	75
	BX 80/		40	45	50	55	60	65	70
9.6	BX 30/								
	BX 40/	65	70	80					
	BX 50/	55	60	70	75	80	90	95	
	BX 60/	50	55	65	70	75	80	85	95
	BX 70/	45	50	60	65	65	75	80	90
	BX 80/			55	60		70	75	80
10.8	BX 30/								
	BX 40/	75	80						
	BX 50/	65	70	80	85	90			
	BX 60/	60	65	70	80	85	95	95	
	BX 70/	55	60	65	70	75	85	90	95
	BX 80/	50	55	60	65	70	80	85	90
12	BX 30/								
	BX 40/	80							
	BX 50/	70	80	90	95				
	BX 60/	65	70	80	90	95			
	BX 70/	60	65	75	80	85	95	100	
	BX 80/	55	60	70	75	80	90	95	100

FRAMEWORK CONDITIONS FOR USE TABLES

… Concrete strength class of pre-stressed beam C50/60
… Installation height = slab + topping (with concrete C30/37)
… Fire resistance R60
… Environmental class EI

Environmental class EI
For dimensions outside the range of the above table, please consult our engineering office.

DIMENSIONING TABLE FOR A PAYLOAD OF 1000 kg/m²



EG SLAB & COMPRESSION LAYER

EG BEAM

p + q = **payload (excl. EC vault, compression layer & beam)**
with p = **permanent load**
with q = **Mobile load**
with p + q = **1000 kg/m²** **(Characteristic)**
with **p ≤ 800 kg/m²** **(Characteristic)**

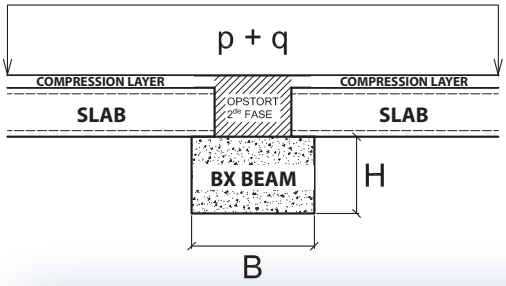
	Slab sizes (m)	6	7.2	8.4	9.6	10.8	12
Beam sizes (m)	WIDTH (B) (cm)	WX200 + 5 cm	WX 265 + 5 cm		WX 320 + 7 cm		WX 400 + 7 cm
		HEIGHT (H) (cm)					
4.8	BX 30/	50	50	55	60		
	BX 40/	35	40	45	50	50	55
	BX 50/			40	40	45	50
	BX 60/					40	45
	BX 70/						40
	BX 80/						
6	BX 30/	60					
	BX 40/	50	50	55	60	65	70
	BX 50/	40	45	50	55	60	60
	BX 60/		40	45	50	50	55
	BX 70/			40	45	45	50
	BX 80/				40		
7.2	BX 30/						
	BX 40/	60	65	70	75	80	
	BX 50/	50	55	60	65	70	75
	BX 60/	45	50	55	60	65	70
	BX 70/	40	45	50	55	60	65
	BX 80/		40	45	50	55	60
8.4	BX 30/						
	BX 40/	70	75	80			
	BX 50/	60	65	70	80	85	90
	BX 60/	50	60	65	70	75	80
	BX 70/	45	55	60	65	70	75
	BX 80/		50	55	60	65	70
9.6	BX 30/						
	BX 40/	80					
	BX 50/	70	75	80	90		
	BX 60/	60	70	75	80	90	95
	BX 70/	55	60	70	75	80	90
	BX 80/	50		65	70	75	80
10.8	BX 30/						
	BX 40/						
	BX 50/	80	85	95			
	BX 60/	70	80	85	95	100	
	BX 70/	65	70	75	85	90	100
	BX 80/	60	65	70	80	85	90
12	BX 30/						
	BX 40/						
	BX 50/	90	100				
	BX 60/	80	90	95			
	BX 70/	70	80	85	95		
	BX 80/	65	75	80	90	95	

FRAMEWORK CONDITIONS FOR USE TABLES

- Concrete strength class of pre-stressed beam C50/60
- Installation height = slab + topping (with concrete C30/37)
- Fire resistance R60
- Environmental class EI

Environmental class EI
For dimensions outside the range of the above table, please consult our engineering office.

DIMENSIONING TABLE FOR A PAYLOAD OF 1500 kg/m²



EG SLAB & COMPRESSION LAYER

EG BEAM

p + q = **payload (excl. EC vault, compression layer & beam)**
with p = **permanent load**
with q = **Mobile load**
with p + q = **1500 kg/m²** **(Characteristic)**
with **p ≤ 1200 kg/m²** **(Characteristic)**

	Slab sizes (m)	6	7.2	8.4	9.6	10.8
Beam sizes (m)	WIDTH (B) (cm)	WX 200 + 5 cm	WX 265 + 5 cm	WX 320 + 7 cm		WX 400 + 7 cm
		HEIGHT (H) (cm)				
4.8	BX 30/	60				
	BX 40/	45	45	50	50	55
	BX 50/	40	40	40	45	50
	BX 60/				40	45
	BX 70/					40
	BX 80/					
6	BX 30/					
	BX 40/	60	60	65	70	75
	BX 50/	45	50	55	60	65
	BX 60/	40	45	50	50	55
	BX 70/		40	45		50
	BX 80/			40		
7.2	BX 30/					
	BX 40/	75	75	80		
	BX 50/	60	65	65	75	80
	BX 60/	50	55	60	65	70
	BX 70/	45	50	55	60	65
	BX 80/	40	45	50	55	60
8.4	BX 30/					
	BX 40/					
	BX 50/	70	75	80	90	95
	BX 60/	65	65	70	80	85
	BX 70/	55	60	65	70	75
	BX 80/	50	55	60	65	70
9.6	BX 30/					
	BX 40/					
	BX 50/	85	90	95		
	BX 60/	75	80	85	90	100
	BX 70/	65	70	75	85	90
	BX 80/	60	65	70	75	85
10.8	BX 30/					
	BX 40/					
	BX 50/	95				
	BX 60/	85		95		
	BX 70/	75	115	90	95	
	BX 80/	70	70	80	90	95
12	BX 30/					
	BX 40/					
	BX 50/					
	BX 60/	95				
	BX 70/	85		100		
	BX 80/	75	120	90	100	

FRAMEWORK CONDITIONS FOR USE TABLES

- Concrete strength class of pre-stressed beam C50/60
- Installation height = slab + topping (with concrete C30/37)
- Fire resistance R60
- Environmental class EI

Environmental class EI
For dimensions outside the range of the above table, please consult our engineering office.

SPECIFICATION TEXT FOR PRE-STRESSED BEAMS

Product description

Pre-stressed beams produced in smooth metal formwork, tensioned with strands anchored to adhesive.

Type IC, IK, IV, BD, GX & BX

Materials and production properties

- The following documents apply:
  - EURO CODES EN 1990 – EN 1991 – EN 1992 (with their national annexes)
  - EN 13369 + national supplement
  - EN 13225 + national supplement
- The pre-stressed beams bear the following quality mark: KOMO or BENOR
- The pre-stressing is achieved by means of 7 wire strands anchored to adhesive.
- The pre-stressed beams are manufactured in a closed production area.
- This product is under the permanent control of various monitoring bodies

Execution

- Execution ensues in accordance with the manufacturer's instructions, **MEGATON/STRUCTO PREFAB SYSTEMS**.
- When being installed, the beams are laid on (reinforced) felt.
- The pre-stressed beams can be provided with protruding brackets at the top.
- Any pouring must be done in 1 phase and must comply with the strength class specified by **MEGATON/STRUCTO PREFAB SYSTEMS**.
- Depending on the type and their height, the beams can be provided with a strut-and-tie support.
- The connection to the load-bearing structure is made with a pin/hole connection.

Specifications

- Height: according to beam type
- Width: according to beam type
- All elements are equipped with lifting devices according to weight
- Concrete quality of the elements according to NBN EN 206-1 and NBN B-15-001

STRENGTH CLASS	DOMAIN OF USE	ENVIRONMENTAL CLASS
C50/60 and higher	Pre-stressed concrete	EI/EE1/EE2/EE3/EE4

- Type of pre-stressing reinforcement: F_{pk} = 1860 N/mm^2
- Bottom: smooth formwork
- Side: smooth formwork
- Top: carefully levelled
- Fire resistance: R60/R120

TECHNICAL BROCHURE TTX ELEMENTS

TTX ELEMENTS

APPLICATIONS

TTX elements are pre-stressed double-T-shaped elements that are used where pre-stressed slabs cannot provide a solution. Either in terms of span length or floor load. They are mainly used in:

- Heavily loaded and/or long mezzanines
- Car parks with spans in excess of 20 m
- Sports floors
- Shop facilities with underground parking facilities
- Public facilities
- All other applications outside the performance range of the pre-stressed slab

PRODUCTS/TYPES

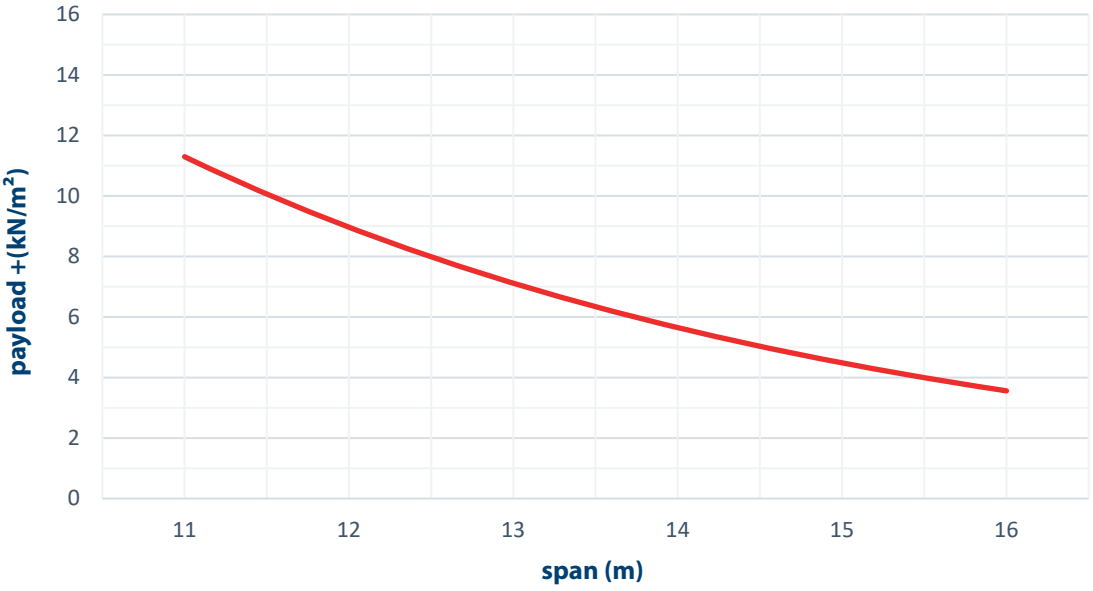
The TTX elements are produced in accordance with a linear production process in which the width can be adapted to a limited extent in line with specific standards. The concrete has a strength class of C50/60 and the pre-stressing strands used in the ribs are F_{pk} 1860 N/mm^2 quality.

The production itself is under the permanent control of various monitoring bodies and all elements bear the KOMO quality mark. Different profile heights are possible.

TTX420 **TTX520** **TTX620** **TTX720** **TTX820**

TTX420

TTX 420/2400 +70 mm



For deviations, our engineering office should be consulted

STANDARD

Fire resistance: R60

Environmental class: XC1

OPTIONAL:

Fire resistance: R90 & R120

Environmental class: other than XC1 possible

CROSS-SECTIONAL PROPERTIES

TTX420/2400

A = 3601.50 x 10^2 mm²

I = 570022.00 x 10^4 mm⁴

Centre of gravity top = 143.28 mm

Centre of gravity bottom = 276.72 mm

TTX420/2400 + 70 mm topping

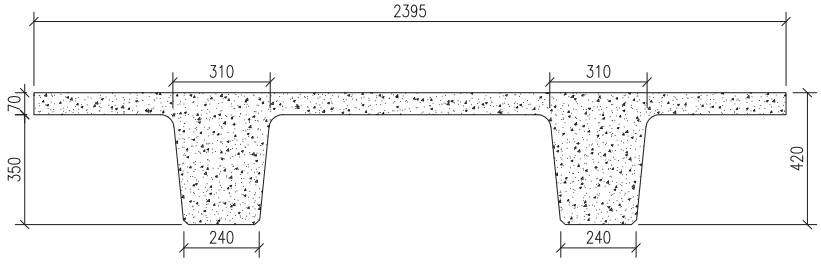
A = 5278.00 x 10^2 mm²

I = 940453.00 x 10^4 mm⁴

Centre of gravity top = 156.65 mm

Centre of gravity bottom = 333.35 mm

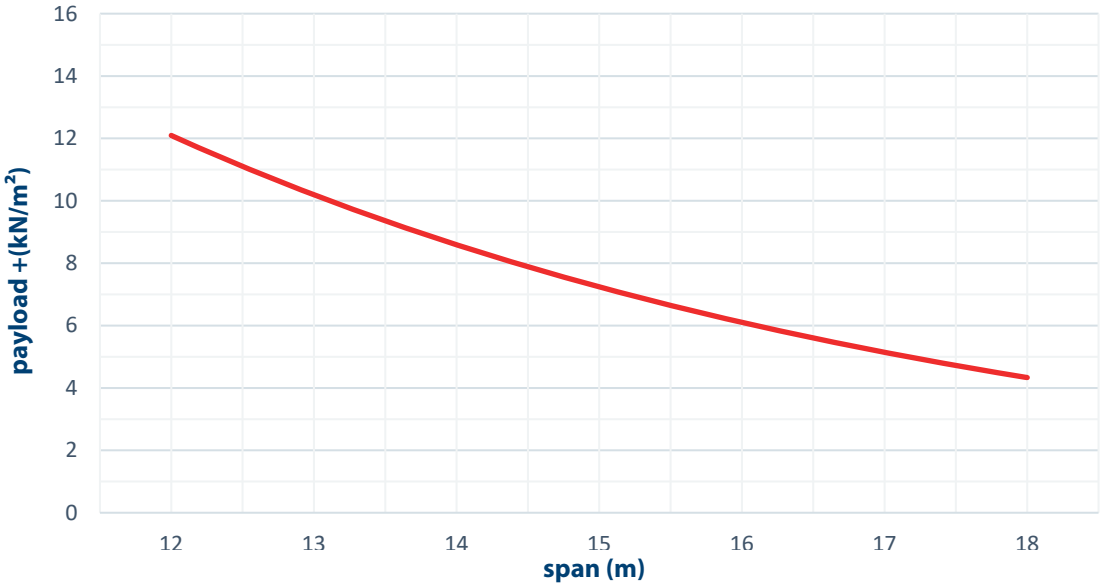
The standard has a TTX420 with a width of 2400 mm and a compression table of 70 mm. On request, the width of the compression table can be adjusted to a maximum of 2600 mm maximum and a minimum of 1700 mm. The compression table can also be made in a thickness of 90 mm on request. The specified values and diagrams apply to elements with a width of 2400 mm and a compression table of 70 mm.



HANDLING WEIGHT (with a slab width of 2400 mm and a compression table of 70 mm): 375 kg/m²

TTX520

TTX 520/2400 + 70 mm



For deviations, our engineering office should be consulted

STANDARD

Fire resistance: R60

Environmental class: XC1

OPTIONAL:

Fire resistance: R90 & R120

Environmental class: other than XC1 possible

CROSS-SECTIONAL PROPERTIES

TTX520/2400

A = 4061.50 x 10^2 mm^2

I = 1007351.00 x 10^4 mm^4

Centre of gravity top = 180.20 mm

Centre of gravity bottom = 339.80 mm

TTX520/2400 + 70 mm topping

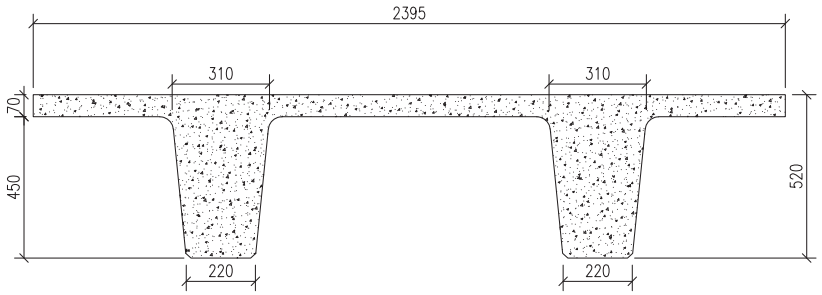
A = 5738.00 x 10^2 mm^2

I = 1563749.00 x 10^4 mm^4

Centre of gravity top = 187.32 mm

Centre of gravity bottom = 402.68 mm

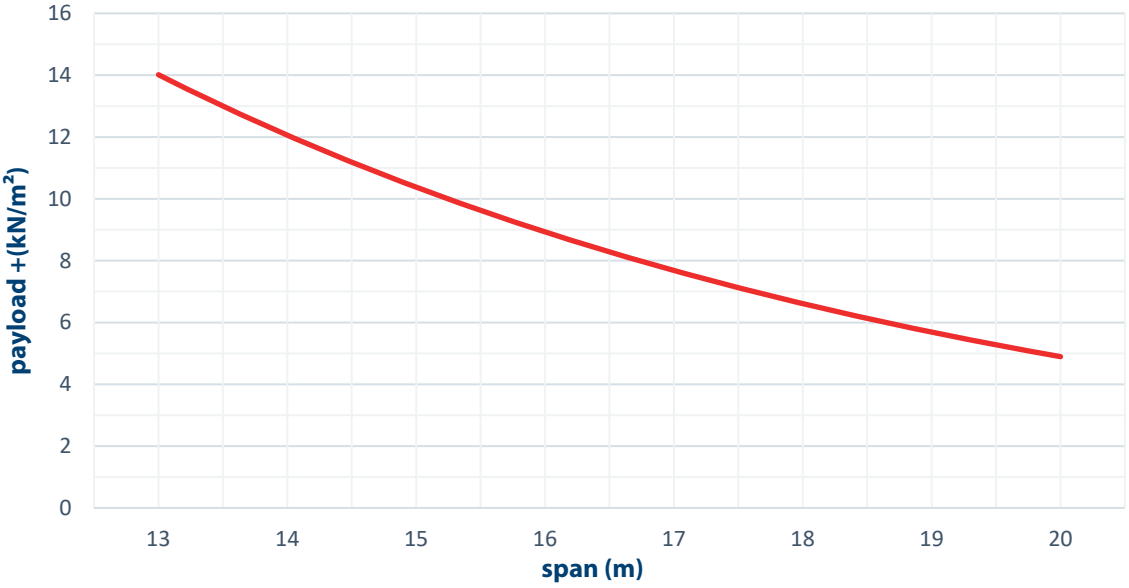
The standard has a TTX420 with a width of 2400 mm and a compression table of 70 mm. On request, the width of the compression table can be adjusted to a maximum of 2600 mm maximum and a minimum of 1700 mm. The compression table can also be made in a thickness of 90 mm on request. The specified values and diagrams apply to elements with a width of 2400 mm and a compression table of 70 mm.



HANDLING WEIGHT (with a slab width of 2400 mm and a pressure table of 70 mm): 423 kg/m^2

TTX620

TTX 620/2400 + 70 mm



For deviations, our engineering office should be consulted

STANDARD

Fire resistance: R60

Environmental class: XC1

OPTIONAL:

Fire resistance: R90 & R120

Environmental class: other than XC1 possible

CROSS-SECTIONAL PROPERTIES

TTX620/2400

A = 4481.50 x 10^2 mm^2

I = 1586856.00 x 10^4 mm^4

Centre of gravity top = 216.66 mm

Centre of gravity bottom = 403.34 mm

TTX620/2400 + 70 mm topping

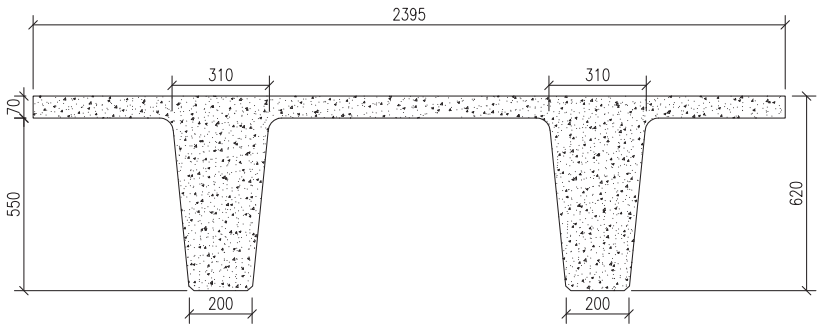
A = 6158.00 x 10^2 mm^2

I = 2366386.00 x 10^4 mm^4

Centre of gravity top = 218.14 mm

Centre of gravity bottom = 471.86 mm

The standard has a TTX420 with a width of 2400 mm and a compression table of 70 mm. On request, the width of the compression table can be adjusted to a maximum of 2600 mm maximum and a minimum of 1700 mm. The compression table can also be made in a thickness of 90 mm on request. The specified values and diagrams apply to elements with a width of 2400 mm and a compression table of 70 mm.

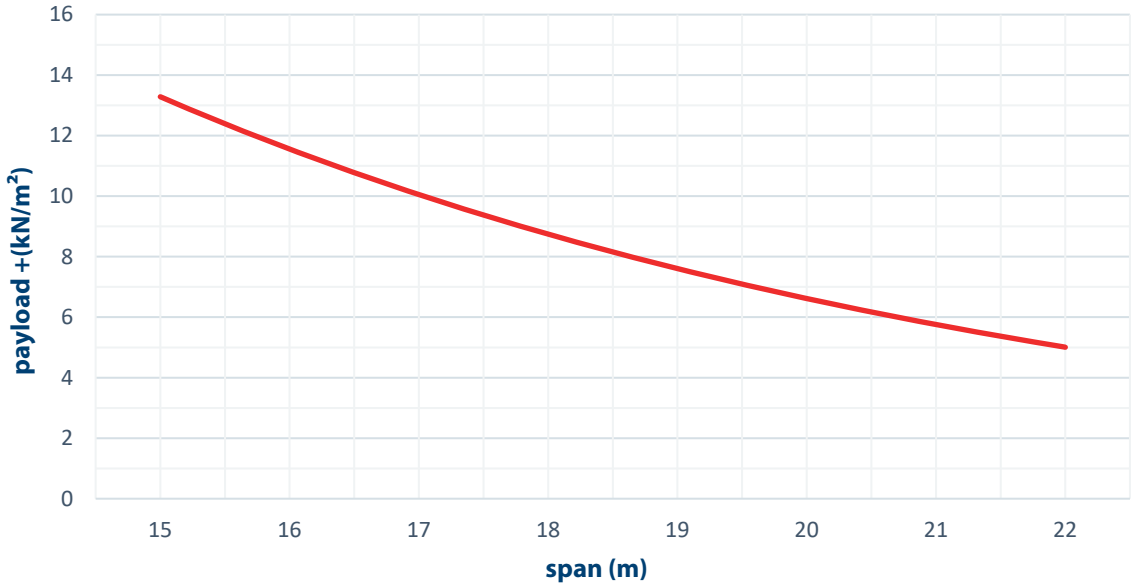


HANDLING WEIGHT (with a slab width of 2400 mm and a compression table of 70 mm): 467 kg/m^2

TTX720

Louise

TTX 720/2400 + 70 mm



For deviations, our engineering office should be consulted

STANDARD

Fire resistance: R60

Environmental class: XC1

OPTIONAL:

Fire resistance: R90 & R120

Environmental class: other than XC1 possible

CROSS-SECTIONAL PROPERTIES

TTX720/2400

A = 4861.50 x 10^2 mm^2

I = 2307170.00 x 10^4 mm^4

Centre of gravity top = 252.02 mm

Centre of gravity bottom = 467.98 mm

TTX720/2400 + 70 mm topping

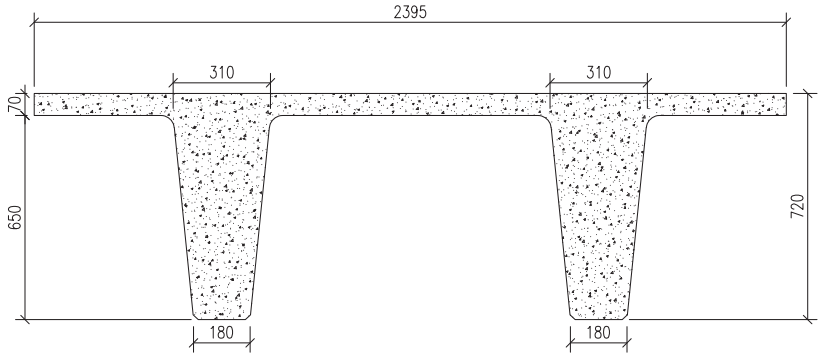
A = 6538.00 x 10^2 mm^2

I = 3340998.00 x 10^4 mm^4

Centre of gravity top = 248.42 mm

Centre of gravity bottom = 541.58 mm

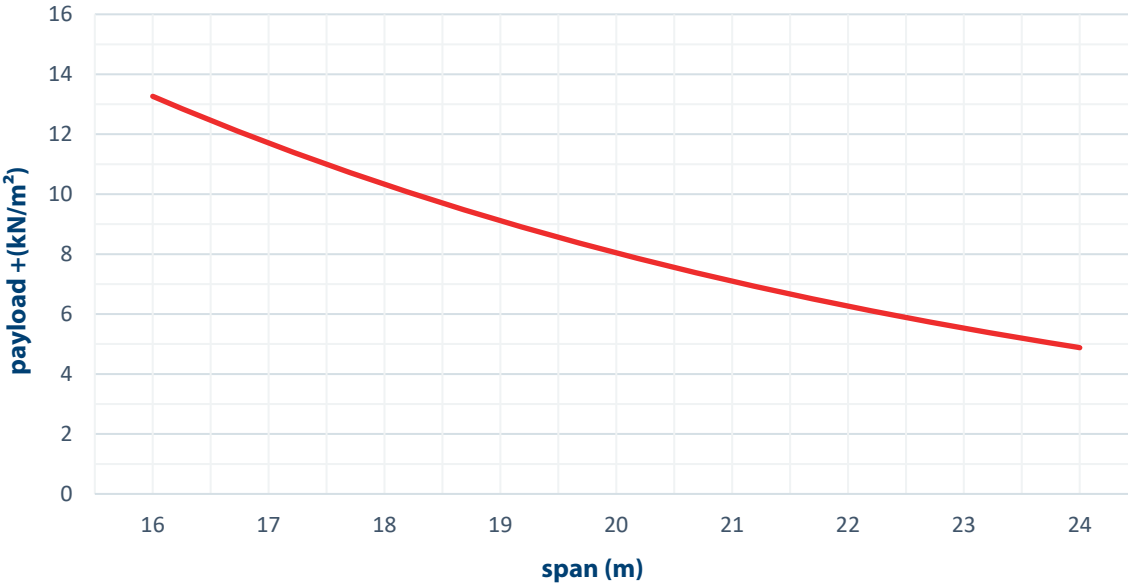
The standard has a TTX420 with a width of 2400 mm and a compression table of 70 mm. On request, the width of the compression table can be adjusted to a maximum of 2600 mm maximum and a minimum of 1700 mm. The compression table can also be made in a thickness of 90 mm on request. The specified values and diagrams apply to elements with a width of 2400 mm and a compression table of 70 mm.



HANDLING WEIGHT (with a slab width of 2400 mm and a compression table of 70 mm): 506 kg/m^2

TTX820

TTX 820/2400 + 70 mm



For deviations, our engineering office should be consulted

STANDARD

Fire resistance: R60

Environmental class: XC1

OPTIONAL:

Fire resistance: R90 & R120

Environmental class: other than XC1 possible

CROSS-SECTIONAL PROPERTIES

TTX820/2400

A = 5201.50 x 10^2 mm^2

I = 3159367.00 x 10^4 mm^4

Centre of gravity top = 285.82 mm

Centre of gravity bottom = 534.18 mm

TTX820/2400 + 70 mm topping

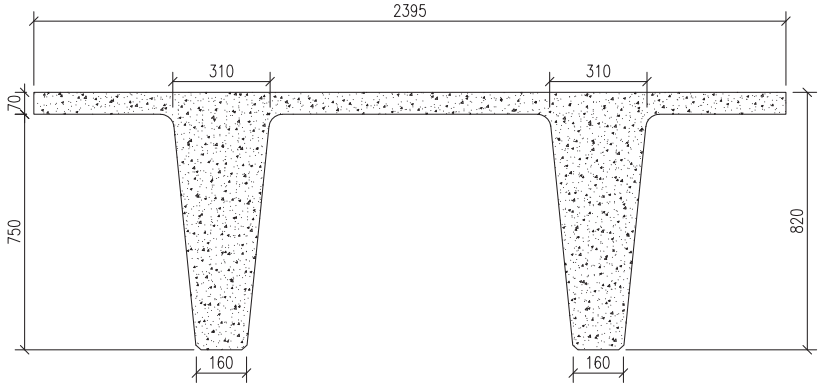
A = 6878.00 x 10^2 mm^2

I = 4471136.00 x 10^4 mm^4

Centre of gravity top = 277.62 mm

Centre of gravity bottom = 612.38 mm

The standard has a TTX420 with a width of 2400 mm and a compression table of 70 mm. On request, the width of the compression table can be adjusted to a maximum of 2600 mm maximum and a minimum of 1700 mm. The compression table can also be made in a thickness of 90 mm on request. The specified values and diagrams apply to elements with a width of 2400 mm and a compression table of 70 mm.



HANDLING WEIGHT (with a slab width of 2400 mm and a compression table of 70 mm): 542 kg/m^2

SPECIFICATION TEST FOR TT FLOORS

Product description

Floors composed of pre-fabricated TT-shaped elements in pre-stressed concrete type TTX.

Materials and production properties

- The following documents apply:
  - NBN EN 13369
  - NBN EN 13224
  - NBN B 21-603
- The TT-shaped pre-stressed floor elements bear the KOMO quality mark and NF quality mark.
- The pre-stressing is achieved by means of 7 wire strands of different strengths anchored on adhesive.
- The TT elements are manufactured in a closed production area.
- Production is under the permanent control of various monitoring bodies.

Execution

- Execution ensues in accordance with the manufacturer's instructions, type MEGATON/STRUCTO PREFAB SYSTEMS.
- When being stacked provisionally on the construction site, the contractor shall ensure that no unacceptable stresses occur in the concrete and steel. They must be supported on stacks of timber placed one above the other at a distance according to the instructions of the manufacturer type MEGATON/STRUCTO PREFAB SYSTEMS.
- When being installed, the floor elements are laid on (reinforced) neoprene.
- The floor elements are placed consecutively, next to each other, on the pre-prepared support surfaces, according to an installation plan drawn up by the manufacturer, type MEGATON/STRUCTO PREFAB SYSTEMS.
- For good connection between the elements, angle irons can be inserted at the sides and can be welded together on site
- Before applying the topping, the surfaces must be cleaned and sufficiently moistened.
- According to a standard determined by the manufacturer, the ribs can be provided with a notch, which makes a cantilever support possible.

Specifications

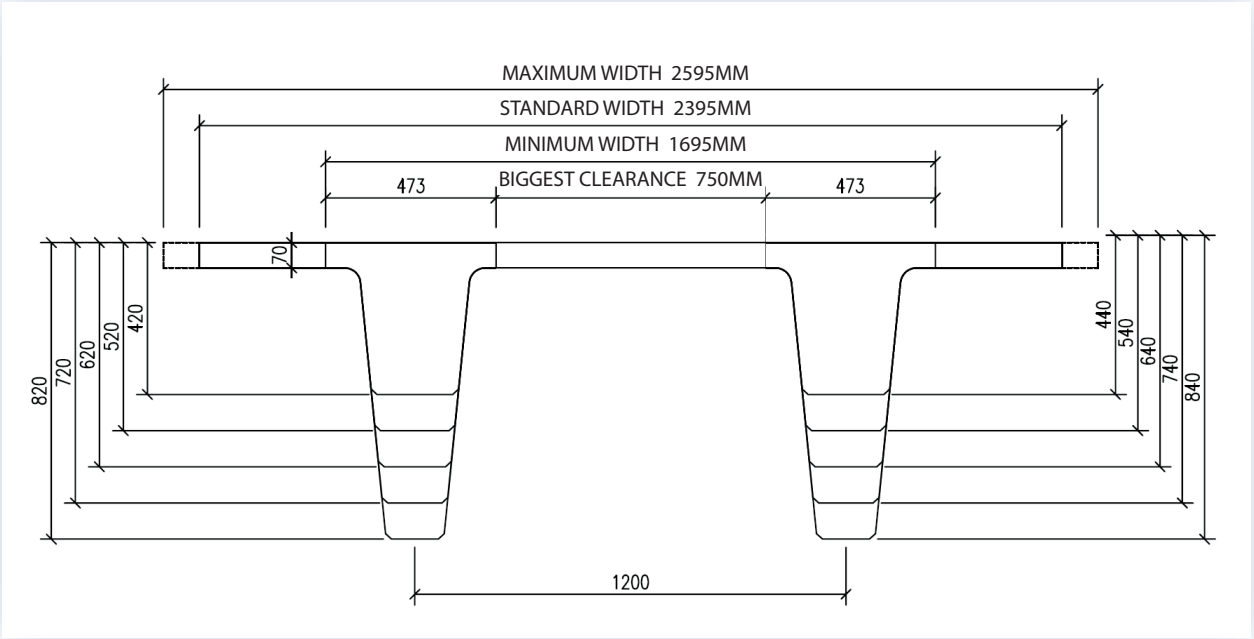
- Height: 52/62/72/40/82 cm according to indication on plan
- Width: 240 cm or according to a fixed width interval
- All elements are equipped with lifting devices according to weight
- Concrete quality of the elements according to NBN EN 206-1 and NBN B-15-001

STRENGTH CLASS	DOMAIN OF USE	ENVIRONMENTAL CLASS
C50/60	Pre-stressed concrete	EI/EE1/EE2/EE3

- Type of pre-stressing reinforcement: $F_{pk} = 1860\ N/mm^2$
- Bottom: smooth formwork
- Side: smooth formwork
- Top: carefully levelled/roughened
- Fire resistance: R60/R120

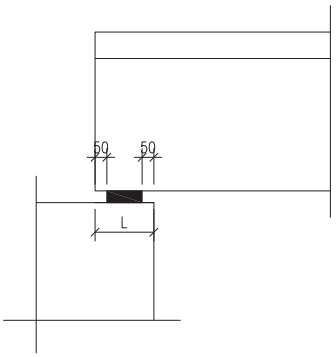
FITTING PIECES

Fitting slabs and recesses (only possible in the compression table) can be carried out according to the diagram below.



SUPPORT POSSIBILITIES

CLASSIC SUPPORT



$$L \leq \frac{R}{\sigma_n \times b} + 2 \times 50\ mm$$

Whereby:

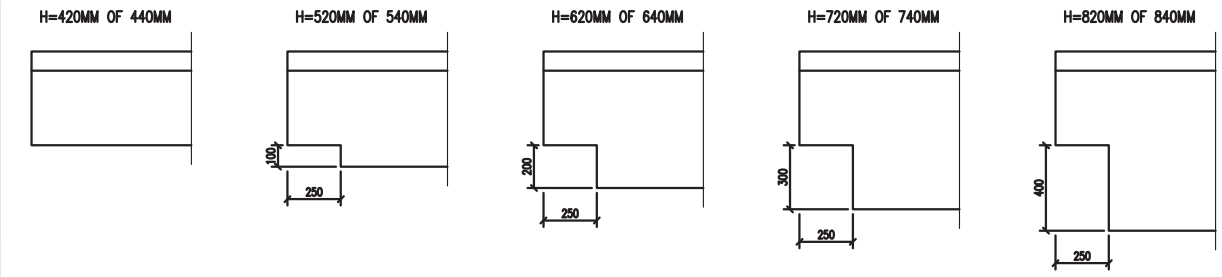
R = support reaction per rib end in Newtons

σ_n = permissible tension in the neoprene

- 6 to 10 N/mm² fretted neoprene
- 3 to 5 N/mm² fretted neoprene

b = rib width at the bottom reduced by 2 x 20 mm

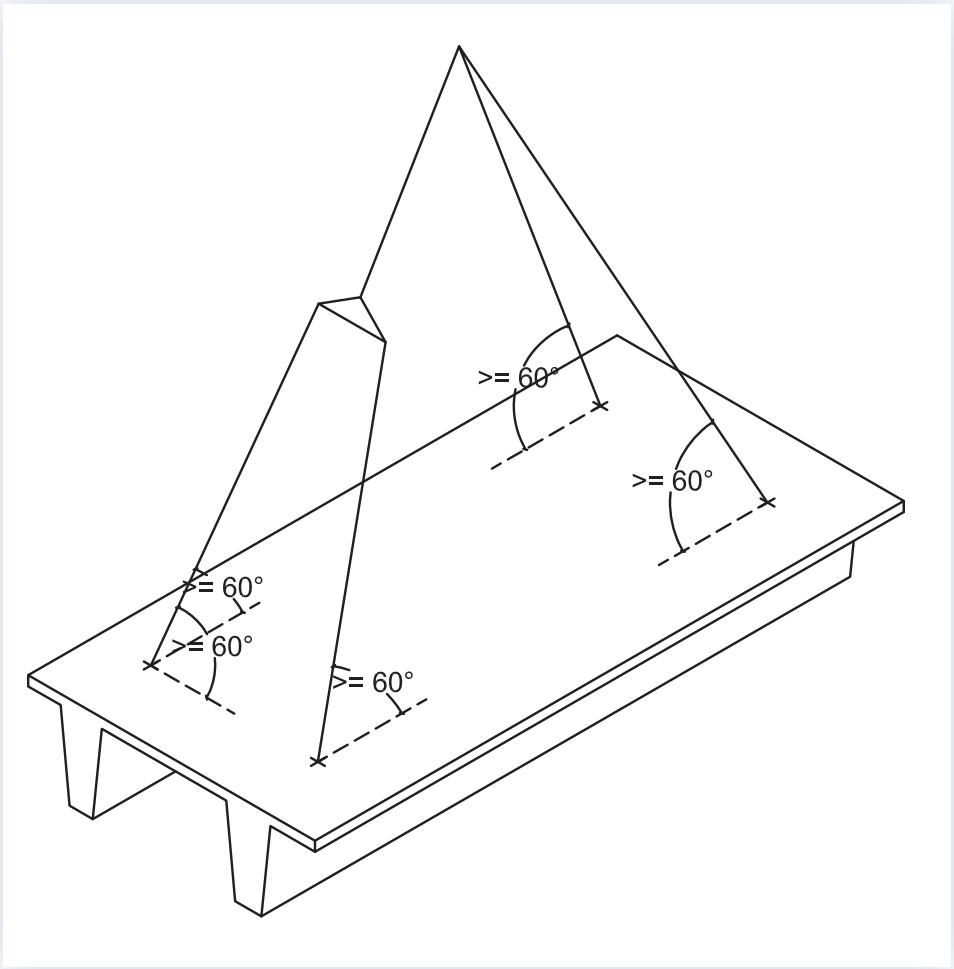
SUPPORTING CORBEL



To reduce the construction height, elements with reduced rib heights at the ends can be used. The heights of the notches are chosen in such a way that they allow connection with standard elements of a different height on the same load-bearing surface. The height to be recessed is fixed per profile so that the height not recessed is always the same.

HANDLING

The TT elements are provided with 4 lifting elements, fitted at the 2 ends of each of the ribs. The TT elements must be lifted via these lifting devices. When attaching the lifting equipment, it is important to work with sufficiently long chains and with a 4-hook chain with triangle. An additional distribution point ensures equal distribution of the weight over the lifting points provided. The angle between the plane of the slab and the chain should also be greater than 60° in each direction.



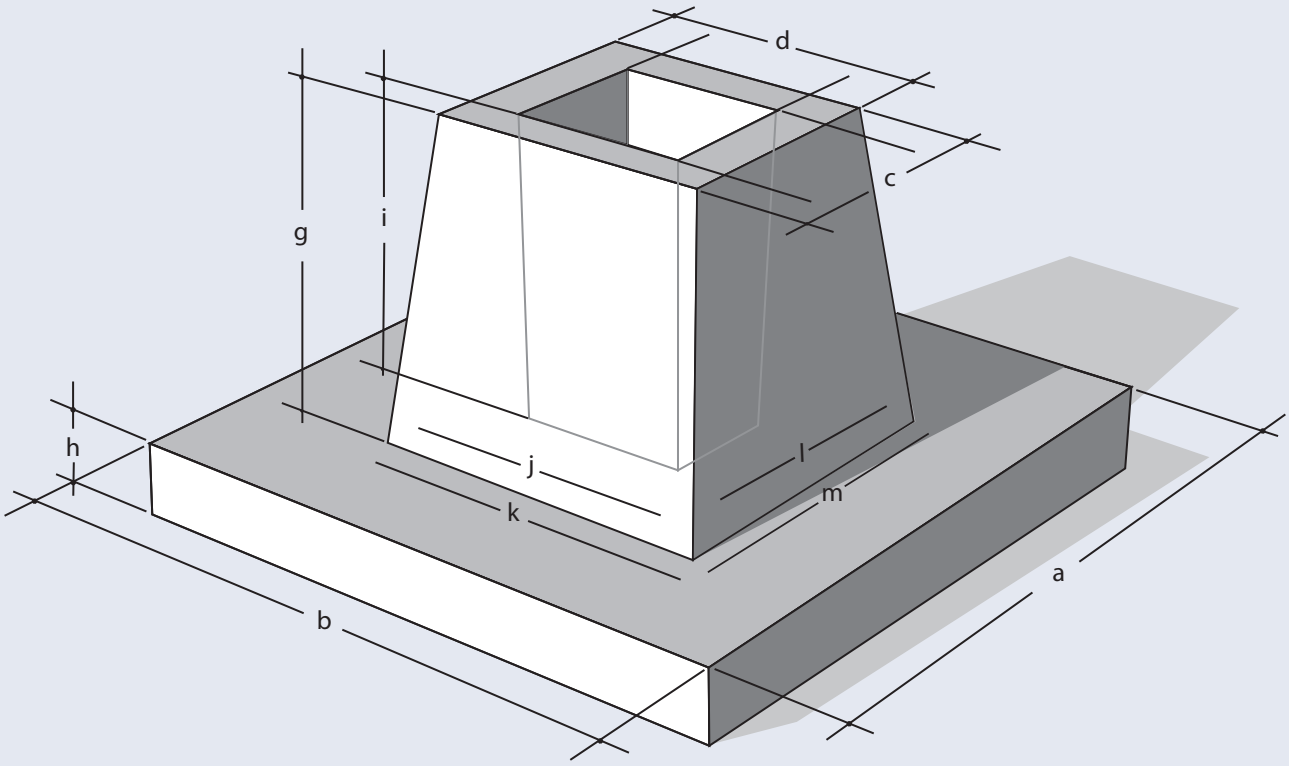
TECHNICAL BROCHURE FOUNDATIONS

FOUNDATIONS
ON STEEL OR OPEN GROUND

INTRODUCTION

Start of foundations on load-bearing soil at a shallow depth.
A distinction can be made here between pre-fabricated foundations and foundations poured on site.

The foundation pads have a rectangular base with different dimensions (see tables). They are placed on an even surface consisting of sand, stabilised sand or pure concrete.



PRE-FABRICATED FOUNDATIONS

There is either a full block or a block with a shaft on top of the foundation pad.

Standard dimensions

Hollow foundations with shaft

Type	1400/1400	1400/2000	2000/2000	2500/2000	3000/2000
a	1400	1400	2000	2000	2000
b	1400	2000	2000	2500	3000
c	900	900	900	900	900
d	1000	1000	1000	1000	1000
g	700	700	700	700	700
h	200	200	200	200	200
i	650	650	650	650	650
Weight (kg)	2010	2450	3030	3600	4150

j = 700 - k = 1060 - l = 630 - m = 980

Full foundations

Type	700/800	1200/1200	1400/1400	1400/2000	2000/2000	2500/2000	3000/2000
a		1200	1400	1400	2000	2000	2000
b		1200	1400	2000	2000	2500	3000
c	650	650	650	650	650	650	650
d	750	750	750	750	750	750	750
g	700	700	700	700	700	700	700
h		150	200	200	200	200	200
Weight	980	1570	1970	2410	3020	3540	4080

k = 830 - m = 690

Positioning

Three lifting anchors in the foundation pads ensure easy handling of the pre-fabricated foundations.
(3 x ball head anchor 5 TONNES)

Transport

The foundations can be transported to the site by trailer on account of the dimensions being determined depending on the means of transport. The number of items that can be transported depends on the maximum permissible weight of the trailer.

The pre-fabricated foundation pads are made of reinforced concrete and are manufactured in a designated production area. They are poured into solid metal formwork. The strength class of the concrete according to Eurocode 2 is C40/45. The foundation type is chosen depending on the permissible ground pressure and is calculated in line with the applicable standards.

FOUNDATIONS POURED ON SITE

In this case, concrete columns have in this case to be (reverse) injected on top of the foundation pad. (See 'Column' heading)

If foundations have to be placed against existing buildings, they are poured on site and provided with the necessary starter bar to enable the assembly of concrete columns.

This solution is also chosen if the dimensions of the prefabricated pads are too large for transport.

Concrete quality is class C25/30.

FOUNDATIONS AT GREATER DEPTH

FOUNDATIONS IN FALSE PITS

If the load-bearing soil is at a greater depth, false foundation pits can be used. A "pit" is dug down to the load-bearing soil, which is then filled with class C12/15 concrete. A 25/30 concrete foundation pad can then be poured into this false pit.
Dimensions vary from 80 cm to 240 cm in diameter. Depth according to geotechnical advice.
Applied in practice up to a maximum depth of ± 8 m.

FOUNDATIONS ON GRAVEL CORES

In light industrial construction, it is usually sufficient to provide concrete pads below the structure of the building to transfer the column load to one or more gravel cores.

The internal vibrator is inserted into the ground to the desired depth using continuous vibration and partly thanks to the weight of the internal vibrator and force directed downwards.. The natural soil is pushed to the side in a radial manner. This creates a cylindrical space which is kept open by injecting compressed air.
As soon as the load-bearing layer has been reached, the internal vibrator is raised approx. 50 cm and gravel is injected into this space using compressed air via a feed tube that extends from ground level to below the internal vibrator.
The gravel is then pressed into the wall by the internal vibrator until the absorption capacity of the soil in the zone in question has been reached. This builds up a highly compacted continuous gravel column in the soil by progressively raising the vibrator.

PILE FOUNDATIONS

When the load-bearing soil is at a greater depth, when the loads become very considerable or if subsidence needs to be strictly limited, the foundation of the structure can be on piles.

The following solutions are offered here:

PILES/PRE-FAB PILES

A pre-fabricated concrete pile or a steel guide tube is driven down as far as the load-bearing soil. In the event of a steel guide tube being used, this will be filled with concrete and raised again for a concrete pile to be formed in the ground. This technique is especially interesting where there is
a very soft top layer with a strong resistive layer underneath.

IN-GROUND SCREW PILES

With a screw pile formed in the ground, a steel guide tube is screwed into the soil down to the desired depth. When returning back towards the surface, concrete is poured in via this feed tube and a pile formed in the ground. The type of drill used by Naessens Industriebouw NV ensures that
the soil is not only compacted when piling downwards, but also when coming back up.
This provides for double displacement of the soil, thus increasing the load-bearing capacity of the pile.

Piles can be formed with either a smooth shaft or a helical shaft.

The following diameters are possible, among others:

- smooth: ø41 and ø46
- helical: ø36/56 and ø46/66

Piles constructed in this manner improve adhesion between the pile and the ground, which makes it possible to reduce the length of the pile or make piles stick when the load-bearing layer is excessively deep.

TRUNCATING PILES

After the foundation piles down to the level of the work platform have been formed, the top must always be truncated to the cut-off level in order to make the connection between pile and the mass of the pile. To do this, the piles are first dug free and then cut to the desired depth.

Pile masses

Solid masses are poured on top of the piles, with the dimensions and shape depending on the number of piles and the load per pile.

FOUNDATION BEAMS

To guarantee stability in both directions, pile masses can be connected with each other on one or two piles by foundation beams. For a pile mass on 3 or more piles, stability is guaranteed per se.

TECHNICAL BROCHURE
SPECIAL CONCRETE ELEMENTS

LIFT SHAFTS AND STAIRWELLS

Pre-fabricated composite tube-shaped reinforced concrete elements that are stacked on top of each other to create lift shafts and stairwells

Concrete quality: C50/60
Steel quality: BE 500

- External dimensions:
  - Smallest dimension: 2 m x 2 m
  - Largest dimension: 4.50 m x 9.50 m
  - Both sides adjustable per 5 cm
  - Wall thicknesses: 20 cm
  - Min. ring height: 0.70 m
  - Max. ring height: 3.50 m
  - Max. weight: 25 t per ring (if for mounting crane) (in production up to 40 t)
- Horizontal joint between pre-fab rings: 1.5 cm
- Standard 4x collapsed tube K60/100/2
- 4 x RD42 lifting hooks
- Pre-fabricated rings have NO chamfers/bevelled edges
- Possibility to provide saw-tooth beams and bracket for support
- Lift shafts and stairwells are structural elements made of grey concrete.

REINFORCED CONCRETE STAIRS AND PLATFORMS

- Straight stairs
- Winding stairs
- With loose or backfilled platforms

Finish:

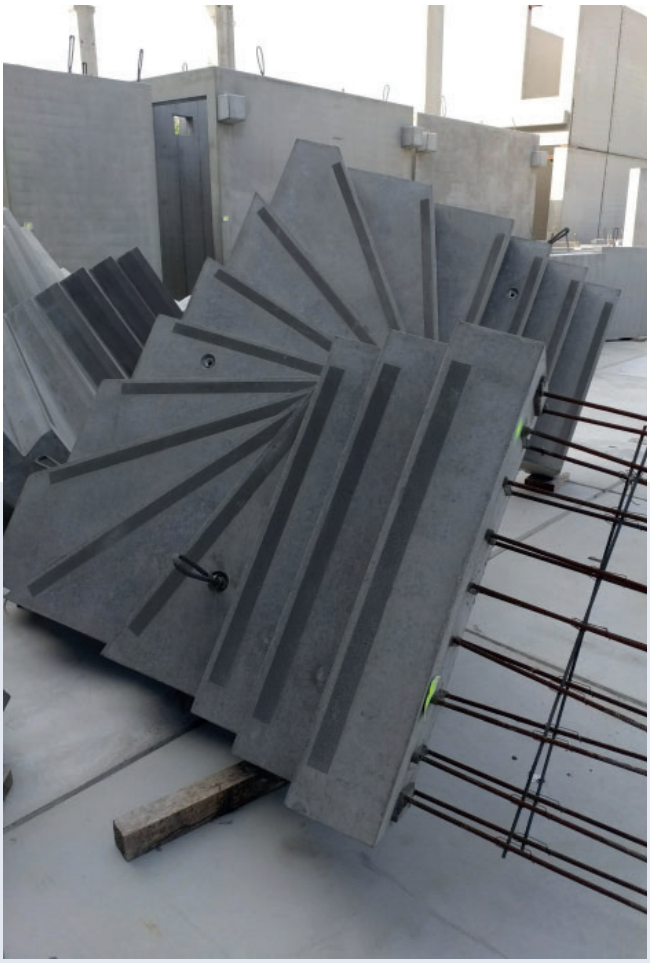
- Risers and treads with smooth formwork
- Made of reinforced concrete.
- Anti-slip: PVC or bush-hammered strip
- Concrete pellets for sealing lifting points
- Protection through spray film

Dimensions:

- Straight step or displaced step
- Max. 22 steps
- Maximum width of straight stairs = 197 cm
- Risers of straight stairs between 160 mm and 200 mm
- Maximum width of spiral stairs = 140 cm
- Risers of spiral stairs between 168 mm and 195 mm
- Treads between 200 mm and 300 mm
- Sled thickness for stability

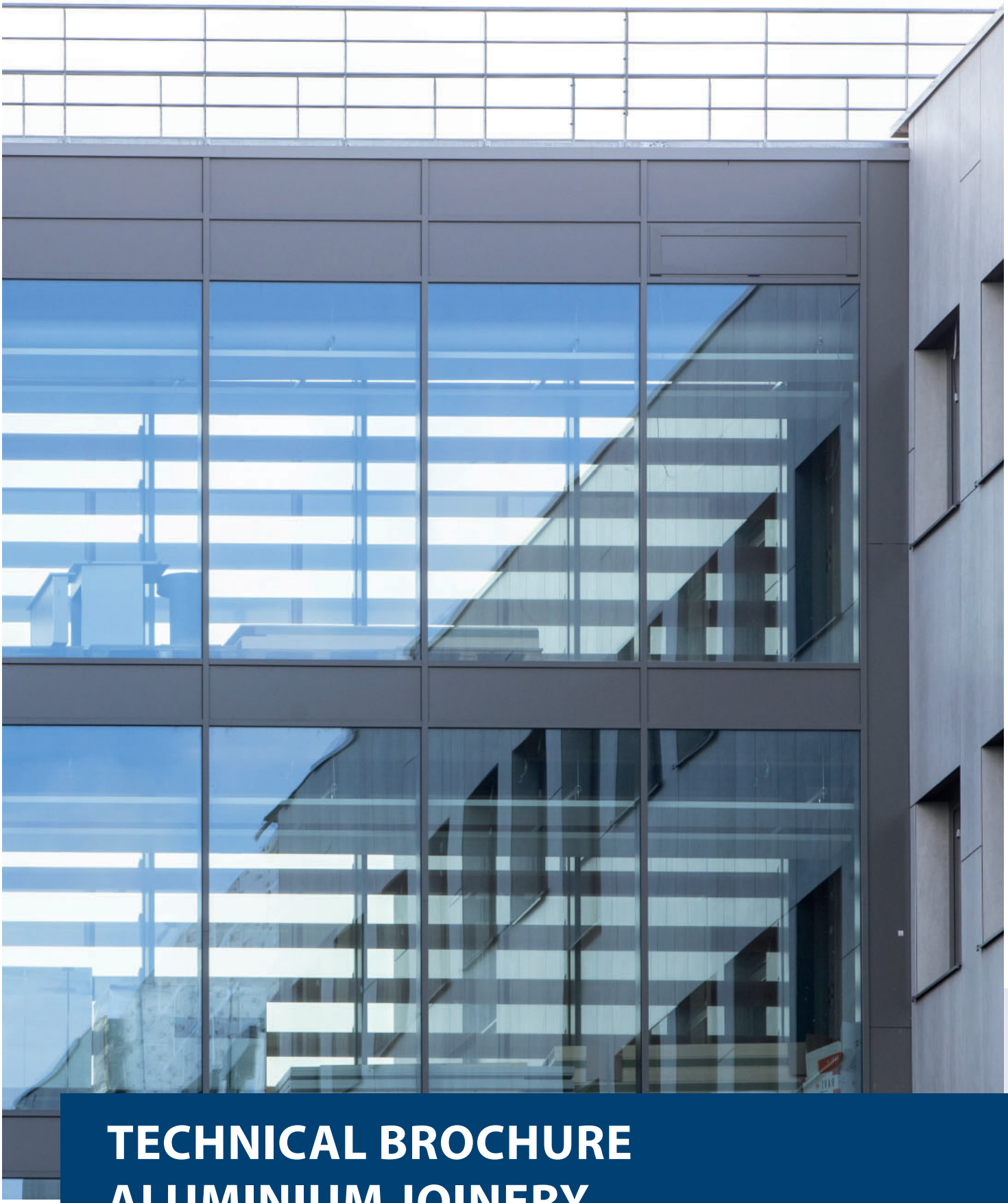
Connections:

- Stair foot (with or without injection sleeves)
- Anchoring with protruding reinforcement/stabox
- Support with supporting corbels/angle iron



SPECIAL CONCRETE ELEMENTS: UPON REQUEST

- Canopy elements
- Platform beams
- etc.



TECHNICAL BROCHURE ALUMINIUM JOINERY

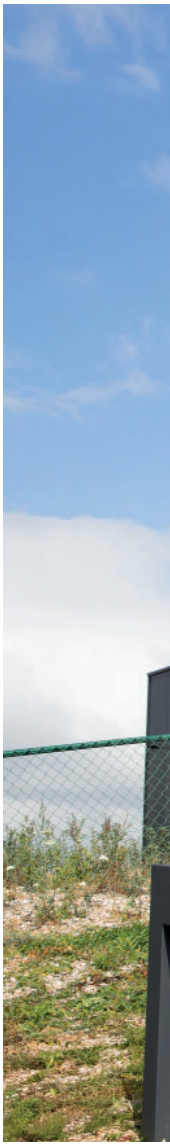
The main properties of aluminium are that it is a light but strong material and has a long service life. It lends itself perfectly to modern architecture thanks to the slim profiles and large spans.

Thermal quality is guaranteed by an insulating core (thermal break) that separates the inside and outside from each other, as a result of which this multi-chamber system ensures better insulation.

Profiles with thermal break are used to increase the thermal insulating capacity of façade elements (windows, doors, sliding windows, curtain walls, etc.) and avoid condensation as far possible.

The quality labels Qualicoat and Qualanod guarantee high-quality surface treatment.

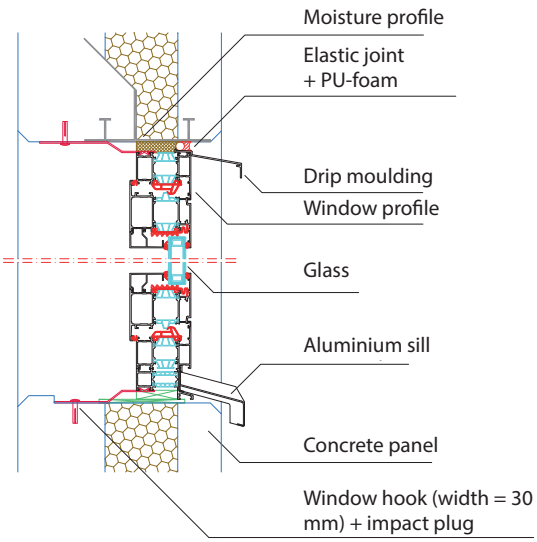
The close internal cooperation between the aluminium joinery department and the other departments within the Willy Naessens Group makes it possible to implement certain adjustments to production. One of the most important adjustments is the incorporation of a PVC moisture profile during production of the panels.



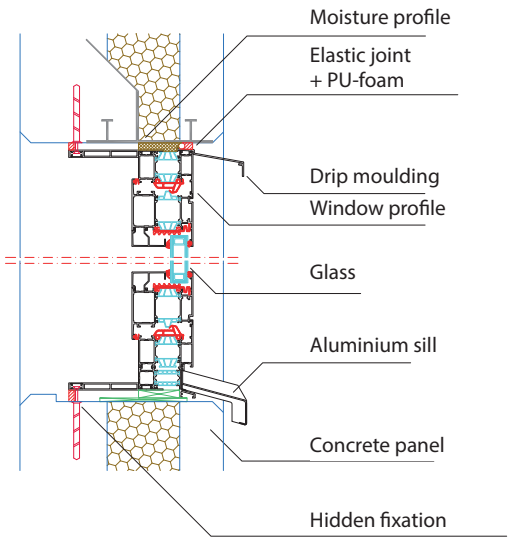
SPECIFICATION TEXT

- The thermally broken profiles have a maximum Uf value of 2.0 W/m^2 and glass a maximum Ug value of 1.0 W/m^{2}K .
- Profiles are enamelled on both sides with textured lacquer (Qualicoat).
- EPDM slab or sealant fitted to the wall connection.
- PU foam between the window frame and concrete structure and an elastic jointing material sprayed on the outside.
- All windows, doors, sliding windows and curtain walls are fitted with an aluminium drip moulding and/or aluminium sill.
- Windows have concealed drainage.
- All window hardware is concealed and modular.
- Glazing must comply with STS 38 and standard NBN S 23-002.

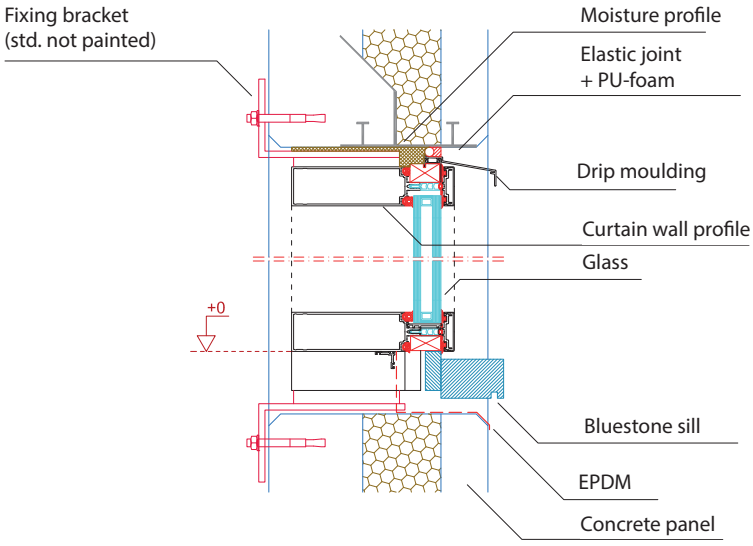
Fixation with window hooks



Fixation with hidden fixing profile



Curtain wall



TECHNICAL BROCHURE
WATERPROOF ROOFING

MUTEC bv

MUTEC has been part of the Willy Naessens Group since 2013. As a flexible part of our construction company, MUTEC extends the vertical integration principle to flat roofs. Together with its permanent partners, we offer you a completely watertight system.
In this package, you will find information about industrial flat roofs and everything that comes with them.
Do not hesitate to contact us if you would like obtain additional information about one of the following topics:

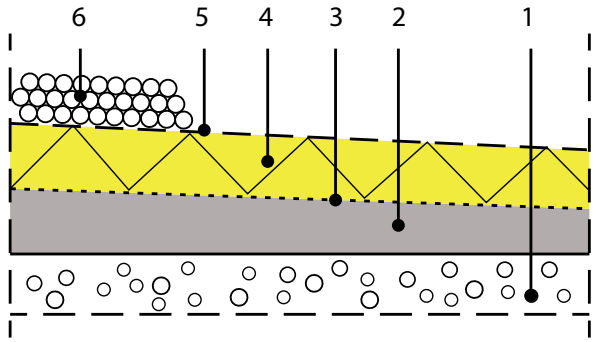
- Gilles Adams manager gilles-a@mutec.be
- Tom Peters commercial manager tom-p@mutec.be

Roof structure

The type of structure is often chosen according to the design of the building.
Knowing or recognising the different structures is important for roof renovation works, for example.
The most common of these are described below:

WARM ROOF

The warm roof is the most standard roof structure, with the vapour barrier located along the 'warm' side of the insulation. The structure comprises:

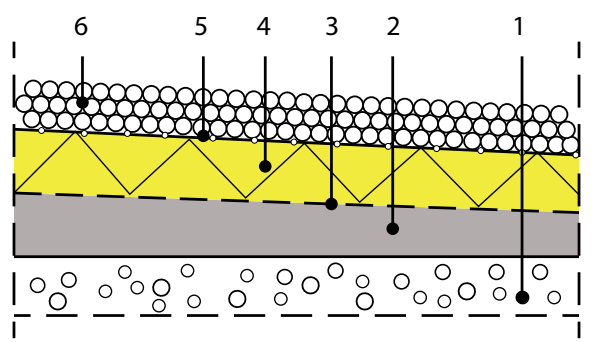


1. Load-bearing floor
2. (any) sloping layer
3. Vapour barrier
4. Insulation
5. Seal
6. (possible) ballast layer

The advantage of a warm roof is that the insulation is always dry and thus retains its optimum insulating capacity. This structure can be installed in three ways: screwed, glued or loose fitting. In the latter case, the ballast described is required to hold the roof structure in place.

INVERTED ROOF

With the inverted roof, we work in a 'reverse' way by placing the sealing layer under the insulating layer.
The structure comprises:



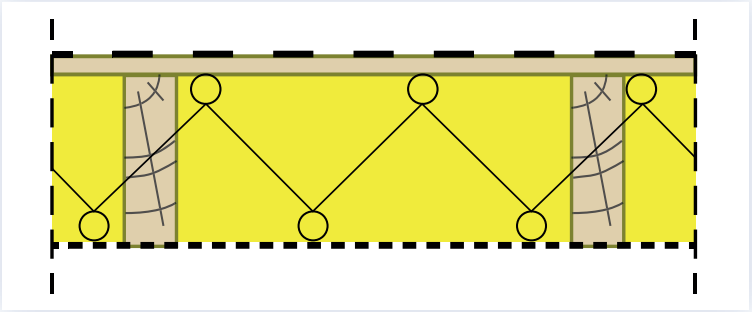
1. Load bearing floor
2. (any) sloping layer
3. Seal
4. Insulation (loose)
5. Separating fabric
6. Ballast layer

The insulation in an inverted roof is placed loosely, hence the necessary ballast layer. This ballast must be vapour-permeable to ensure that the underlying insulation provides for sufficient ventilation. The insulation layer must be resistant to moisture and vermin. XPS boards are always used for this.

The inverted roof has the advantage of the roofing being fully protected against UV light, thus providing for a longer lifespan in theory. The disadvantage, however, is that ballast is often regarded as a 'nuisance'. Ballast often collects dirt and makes it difficult to detect any leaks.

COMPACT ROOF

The compact roof is less common in industrial construction, but is common in family homes or older buildings. The timber grid frame is filled completely with insulation material, the vapour barrier is fitted along the underside and the sealing layer is placed on top of the wooden supporting floor.

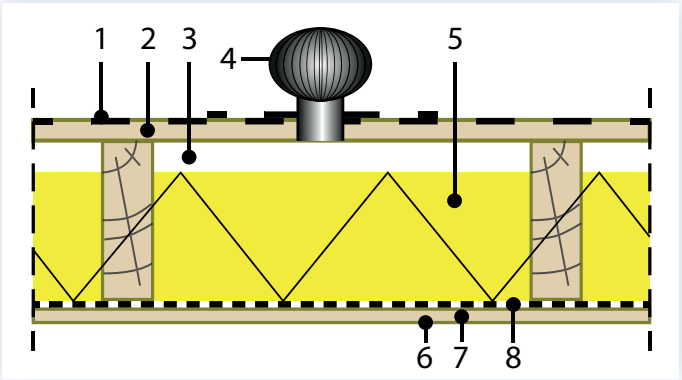


The vapour barrier is of crucial importance in this construction: it must be 'moisture-regulating'. This means self-regulating pores that can influence vapour diffusion. In winter, the pores close, preventing/limiting internal condensation. In summer, the pores open to allow any moisture in the roof structure to dry out inwards.

The term 'compact' roof reveals the advantage: space is gained with this solution on account of the supporting structure being completely filled with insulation material. The disadvantage is that, in theory, the wooden beams form cold connections from the inside to the outside. The insulation values become increasingly high, with the result that wood is seen more and more as a cold bridge.

COLD ROOF

The cold roof was used in the past, but is no longer allowed now. This structure resembles the compact roof described above, with the difference that the supporting floor was not completely filled and was ventilated additionally (often recognisable by the large number of ventilation pipes on the roof). It was assumed that any moisture in the structure would evaporate. However, most of the moisture accumulates in the winter period. The cold air during the winter cannot absorb as much moisture and, therefore, does not dry out the structure. What is more: the cold air exacerbates internal moisture problems, resulting in damage to the timber structure, sometimes endangering stability. This type of structure is now completely out of the question.



1. Roofing
2. Roof cladding
3. Ventilated air cavity
4. Ventilation pipe
5. Insulation
6. Interior finish
7. Lattice work
8. Air and vapour barrier

Substrate type

The substrate often determines which structure will be used, as well as which fixing method and what type of roof materials.

TT ROOF ELEMENTS

No additional topping is installed on concrete TT arched roofs. The mechanical fastening must therefore take place at the height of the vertical 'ribs'. Only there is the concrete suitable for fixing the screws deep enough. MUTEC has unique sealing membranes tailored to TT arched roofs for efficient installation.

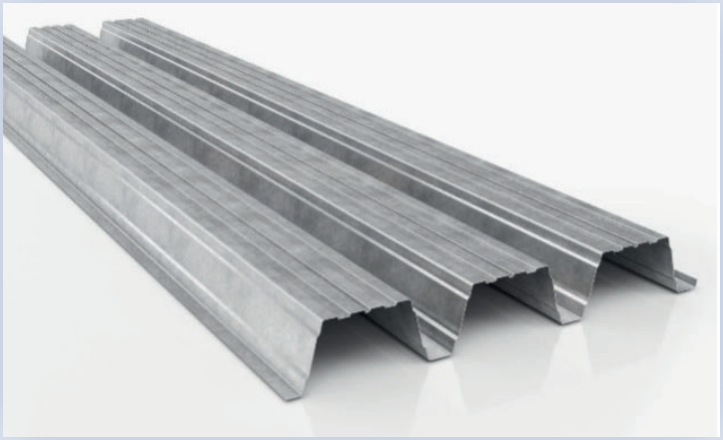
Due to the pre-tensioning in TT elements, height differences at the seams are possible. Sturdy, non-tear vapour barriers are recommended

CONCRETE ARCHED ROOFS

A loose roof structure can be screwed, glued and installed on concrete arched roofs.
There are two important conditions for the screwed structure: the topping must consist of rich concrete (a standard slope screed will not suffice in most cases) and no pipes may be present in the topping/screed.

Both the glued and loose-fitting roof structure can offer solutions as long as one of these two conditions can be met. N.B.: with a loose-fitting roof structure, a ballast layer is required, so this additional permanent load has to be taken into consideration.

PROFILED STEEL SHEETS



A steel base allows for both a screwed and bonded roof structure.
N.B.: account needs to be taken of the fact that the (bituminous) vapour barrier is 'only' **partially** bonded to the profiled sheets (upper side of groove).

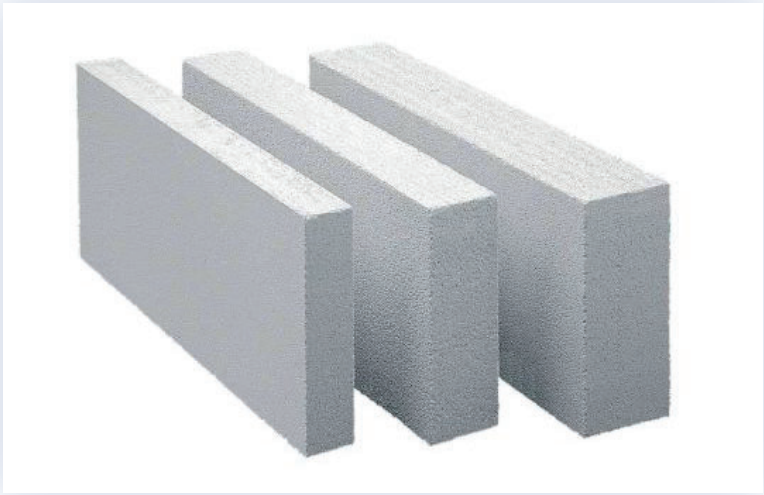
MUTEC refers to this if several partial bondings are foreseen on top of each other.
An example is given below:

Partially bonded vapour barrier — upper side of groove
Partially bonded insulation — glue 'lines'/'garlands'
Partially self-adhesive bituminous substrate — vapour pressure equalising underlay
Full-surface heat-welded bituminous top layer

The architect must take this into account, especially in locations with high wind loads.
MUTEC prefers at least one screwed roof layer (insulation and/or roof skin).

AERATED CONCRETE

Arched roofs made of aerated concrete were used more in the past. Here too, both a screwed and bonded roof structure can be applied. Two things should definitely be taken into account:



1. Bonded roof structure = bituminous vapour barrier (self-adhesive/heat-welded)

   Much **higher consumption** than usual has to be taken into account for the required bonding primer. The aerated concrete 'sucks up' a lot of primer.
2. Screwed roof construction
   It should be checked whether the aerated concrete has the required **pull-out values**. With older buildings (roof renovations), it is best to carry out a number of tensile tests beforehand.

VAPOUR BARRIER TYPE

The following should be looked at when choosing the suitable type of vapour barrier.

1. Required vapour class in relation to indoor climate class
2. Desired roof structure

The vapour class required depends on the function of the space inside the building and the associated indoor climate class. The more moisture "produced" inside, the more vapour the vapour barrier has to retain to prevent internal condensation in the roof structure.

An overview of the vapour classes is given below:

Vapour class	Vapour barrier type
E1	PE foil seams not taped
E2	PE foil seams taped
	Bituminous vapour barrier thickness 2 mm
E3	Bituminous vapour barrier thickness 3 mm
E4	Bituminous vapour barrier with aluminium insert

- Standard warehouse: indoor climate class I => vapour class E1/E2
- Offices: indoor climate class III => vapour class E3
- Swimming pools: indoor climate class IV => vapour class E4

It is not possible to bond on top of PE foil. PE foil can therefore be used only for a screwed or loose roof construction. The insulation can be screwed storm-tight, of course, and then finished with an adhesive roof foil.

It is then possible to bond on top of a bituminous vapour barrier. A bituminous vapour barrier is therefore suitable for screwed, bonded and loose-fitting roof structures.

The vapour barrier must, of course, be adhered/heat-welded onto the substrate in the event of a bonded structure. While a screwed roof construction allows the vapour barrier to be placed loosely and only the seams need to be glued/heat-welded. Correct finishing of connections and roof details is important for achieving a complete vapour-tight system.

INDOOR CLIMATE CLASSES

Indoor climate classes	Examples	annual average vapour pressures indoors p_i (Pa)	average vapour pressure differences over 4 weeks (p_i - p_e) (Pa) (*)
I Buildings with little to no permanent moisture production	• places for stacking dry goods • churches, showrooms, garages, workshops	$1100 \leq p_i < 1165$	$< 159 - 10.\ \theta_e$ (**)
II Buildings with limited moisture production per m^3 and good ventilation	• large houses • schools • shops • non-air-conditioned offices • sports halls and multi-purpose halls	$1165 \leq p_i < 1370$	$< 436 - 22\ .\ \theta_e$
III Buildings with significant moisture production and moderate to adequate ventilation	• (small) houses, flats • hospitals, nursing homes • canteens, restaurants, banquet halls, theatres • buildings with a low level or air conditioning (RH ≤ 60%)	$1370 \leq p_i < 1500$	$< 713 - 22\ .\ \theta_e$
IV Buildings with high moisture production	… buildings with a high level or air-conditioning (RH> 60%) … hydrotherapy rooms … swimming pools (indoor) … damp industrial areas, such as: laundries, printers, breweries, paper mills	$p_i \geq 1500$ for this TV limited to 3000 Pa	$> 713 - 22\ .\ \theta_e$

Note: buildings in excess pressure situations with a strongly fluctuating moisture content (e.g. dance halls) or roofs with an insulated suspended ceiling require a special engineering study.
(*) Corresponds to figure 34.
(**) θ_e = outside temperature.

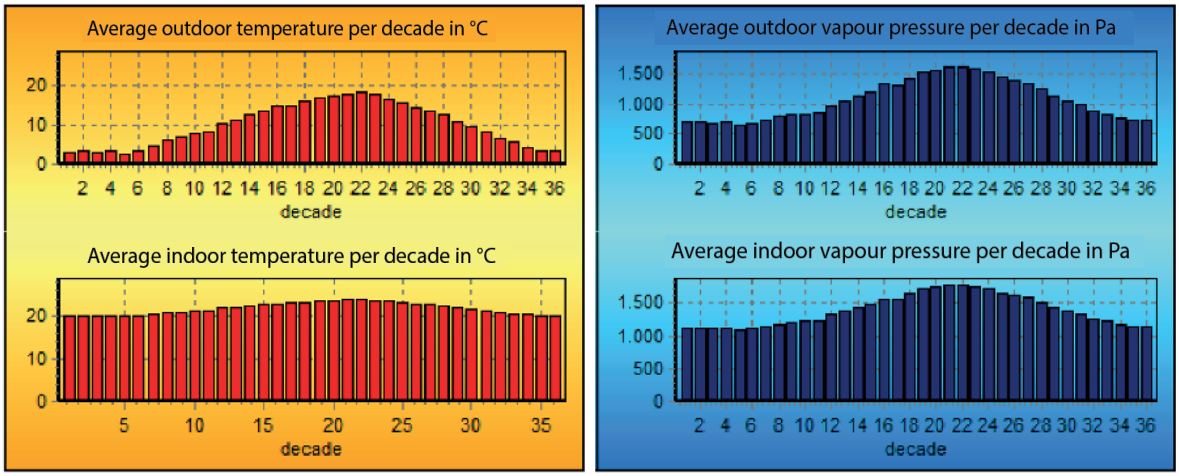
VAPOUR CLASSES

Class + $(\mu d)_{eq}$ (*)	Material	Note
E1 (≥ 2 to < 5 m)	PE film (thickness = 0.2 mm) with minimum overlap of 100 mm. Also usable: all class 2, 3 and 4 materials	An adhesive layer, even on a continuous substrate, should not be regarded as a fully-fledged vapour barrier.
E2 (≥ 5 to < 25 m)	• PE films (thickness ≥ 0.2 mm) and aluminium laminates • Bitumen glass fibre fleece V50/16 • Bitumen polyester fleece P 150/16 • Also usable: all class 3 and 4 materials	Overlapping joints must always be bonded or welded to each other and to other components.
E3 (≥ 25 to < 200 m)	• Reinforced bitumen V3, V4, P3 or P4 • Polymer bitumen APP or SBS (minimum thickness = 3 mm), glass fibre fleece or PES reinforced. • Also usable: all class 4 materials	Overlapping joints must always be bonded or welded to each other and to other components.
E4 (≥ 200 m)	• Reinforced bitumen with metal foils (ALU 3) • Multilayer polymer bitumen vapour barriers (≥ 8 mm)	Overlapping joints must always be bonded or welded to each other and to other components. Vapour barrier class E4 must be installed on on a continuous load-bearing surface. Perforations (e.g. through the screws of mechanical fastenings) are not allowed.

(*) $(\mu d)_{eq}$ is the corresponding vapour diffusion thickness and determines the vapour barrier properties of a (vapour barrier) layer.
[$(\mu d)_{eq}$ = 1 m] corresponds to a layer of still air 1 m thick.
[$(\mu d)_{eq}$ > 200 m] "absolute" vapour barrier.

GLASER SIMULATION

Average indoor temperature (°C)	22,0	**Amplitudo [°C]:**	2,0
Indoor mean vapour pressure (Pa)	1430	**Amplitudo [Pa]:**	342



TYPE OF INSULATION

When choosing the appropriate insulation type and thickness, any requirements regarding fire safety, density and insulating capacity should be taken into account. Ecology is also becoming increasingly important, with particular attention paid to the production process and recycling.

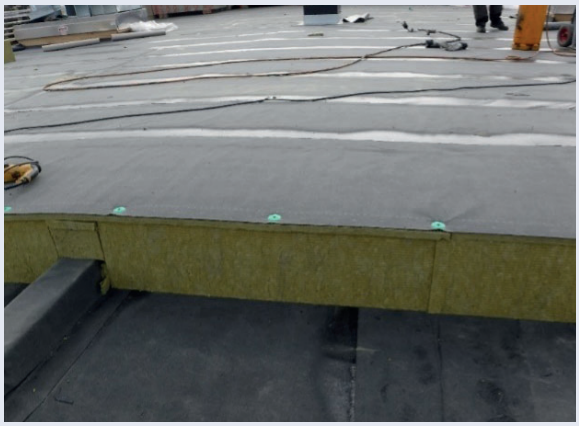
The most commonly used insulation materials on flat roofs in the industrial construction segment are PIR, XPS, EPS and rockwool.
Below is a brief summary of some of the properties of these insulation types:

Type of insulation	Lambda (W/mK)	Density (kg/m^3)	Fire class	Properties:
PIR (with aluminium backing)	0.022	30	F	• Most commonly used on industrial roofs • Good insulating value • Light and easy to work with • Sufficient fasteners are required to avoid an 'uneven surface'
EPS	0.030 – 0.040	15 to 40	E	• Thick insulation packs • Heat-welded directly on EPS with a bituminous underlay, for example, is not obvious.
Rockwool	0.038 – 0.040	15 to 40	E	• Thicker insulation packs • Heavy, slower installation • Excellent fire properties: compartmentalisation, fire zones, etc.
XPS	0.033 – 0.036	30 to 35	E	• XPS does not absorb moisture and is resistant to vermin. These properties make this type of insulation is perfectly suitable for inverted roofs • XPS is usually installed loosely (in combination with a ballast layer) • XPS may not be used in a 'warm roof'

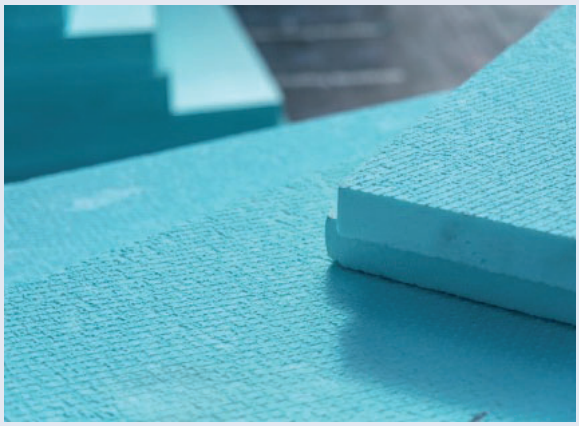
PIR (with aluminium backing)

EPS

Rockwool



XPS



TYPES OF ROOFING

We can divide the types of roofing materials into plastic foils: EPDM, TPO & PVC and the classic bituminous sealing system. The first major difference is the number of sealing layers. Plastic films are fitted in one layer, with bituminous roofing (usually) applied in two layers, consisting of a bottom and top layer.

MUTEC is convinced that each type of seal has advantages and disadvantages, each applicable in the appropriate situation. Below is a brief description of each type of seal with the most important properties.

TPO (**T**hermoplastic **PO**lyolefin)

MUTEC is a pioneer and market leader for the installation of TPO membranes in the Benelux countries. The flexible roof membrane lends itself well to commercial and industrial flat roofs with a gentle slope.

With its light colour, clear rainwater certificate and FLL (German Research Company for Landscape Development and Landscaping) approval, TPO is the perfect solution for **roof gardens** and **PV installations**. The first TPO roofs date from the early 1990s; since then, more than
100 million m^2 has been installed successfully. TPO is the most commonly used roof waterproofing on projects carried out by the Willy Naessens Group. This product is definitely our preference because of the excellent **price-quality ratio**.

Properties:

- Reinforced white plastic film = lower roof temperature
  - Up to 2 to 3°C difference inside the building
  - Up to 25 to 30°C difference on the roof surface
  - Higher efficiency of solar panels
  - Reduces the emerging 'heat Island effect'
- Single-layer application
- No plasticisers, but rubber for elasticity
  - Durability/lifespan 35 to 40 years
- Usually screwed installation/full-surface bonded installation possible
- Welded seams
  - No open flame = no fire hazard
  - FLL approval = root resistant
  - Resistance against red algae and moss formation
- Clear rainwater certificate
  - Rainwater reuse possible

PVC (**P**oly **V**inyl **C**hloride)

PVC is used worldwide as a thermoplastic roof membrane for sealing industrial flat roofs. For reasons of economy and easy installation, PVC is still one of the most common roofing films today.

Properties

- Reinforced beige plastic film
- Single-layer application
- Plasticisers for elasticity
- Lifespan 10 to 20 years
- Screwed installation
- Rapid installation
- Welded seams
  - No open flame = no fire hazard
- Relatively vapour permeable
- Sleek appearance
- Clear rainwater certificate
  - Rainwater reuse possible

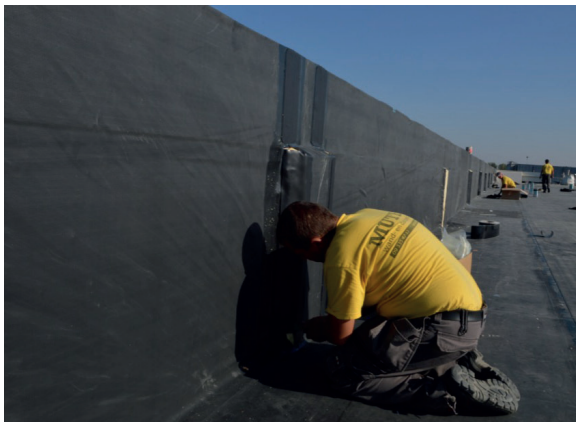
Bituminous roofing

A bituminous finish is preferred by those who wish to have a double-layer roof waterproofing system. This product also offers the ideal solution for the single-layer overlaying of your current bitumen roof. Bituminous roofing membranes have long proven their lifespan and are still regularly used, also on industrial flat roofs.

Properties:

- Double-layer bitumen-based sealing system
- Lifespan 20 to 40 years
- Screwed/bonded/heat-welded installation
- Seam heat-welded
  - Open flame (mandatory fire watch)
  - Less weather dependent
- Huge range of products according to:
  - Sustainability/quality
  - Vapour class
  - Securing method/substrate
  - Green roof/solar panels

EPDM (**E**thyleen **P**ropylene **D**iene **M**onomer)



Single-layer EPDM membranes have proven their durability on industrial flat roofs for over fifty years. Thanks to the collaboration with the manufacturer that sets the standard, MUTEC offers you the most durable and innovative EPDM membrane on the market.

Properties:

- (Non-)reinforced black rubber film
- Single-layer application
- UV-resistant
  - Lasting flexibility (>500%)
  - Durability/lifespan 50 to 60 years
- Full-surface bonded installation
  - Good weather conditions required (dry and +10°C)
- Bonded seams
  - No open flame = no fire hazard
- Clear rainwater certificate
  - Rainwater reuse possible

Combination options for roof structure

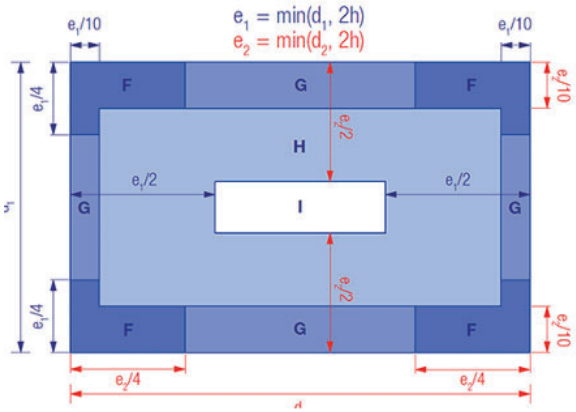
SUBSTRATE	SECURING METHOD	VAPOUR BARRIER	INSULATION	ROOF SKIN
Concrete	Screws	PE foil Bituminous	PIR Rockwool	PVC TPO Bitumen
	Bonding	Bituminous	PIR Rockwool	EPDM TPO Bitumen with self-adhesive backing
Steel deck	Screws	PE foil Bituminous with aluminium insert (sturdy, non-tear)	PIR Rockwool	PVC TPO Bitumen
	Bonding	Bituminous with aluminium insert (sturdy, non-tear)	PIR Rockwool	EPDM TPO Bitumen with self-adhesive backing

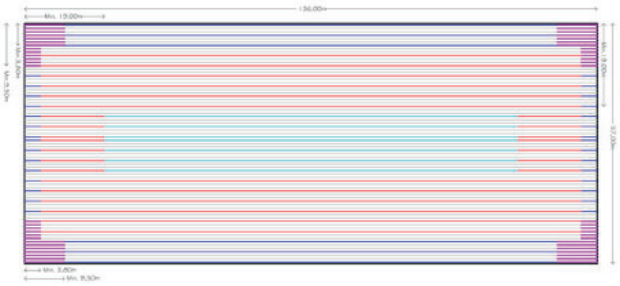
WIND LOAD CALCULATION

The wind forces a roof structure is exposed to are influenced by various factors, such as:

- height of the building
- adjacent buildings
- surroundings
- height of roof curbs

The interaction of forces between the different elements in a roof is very important in order to create wind resistance on the roof. The fastening technique also plays an important role.
MUTEC assists the architect in drawing up a wind load calculation.





In principle, the most airtight layer (usually the roof skin) will absorb the wind load. For example, if a roof structure is fully bonded, each layer will in turn transfer these forces to the underlying layer.
Good adhesion between these layers is therefore essential.

The zones that are highly exposed to wind forces are the corner and edge areas. As can be seen from the installation plan above, narrower strips and consequently more fixings are placed in these zones to withstand such forces.

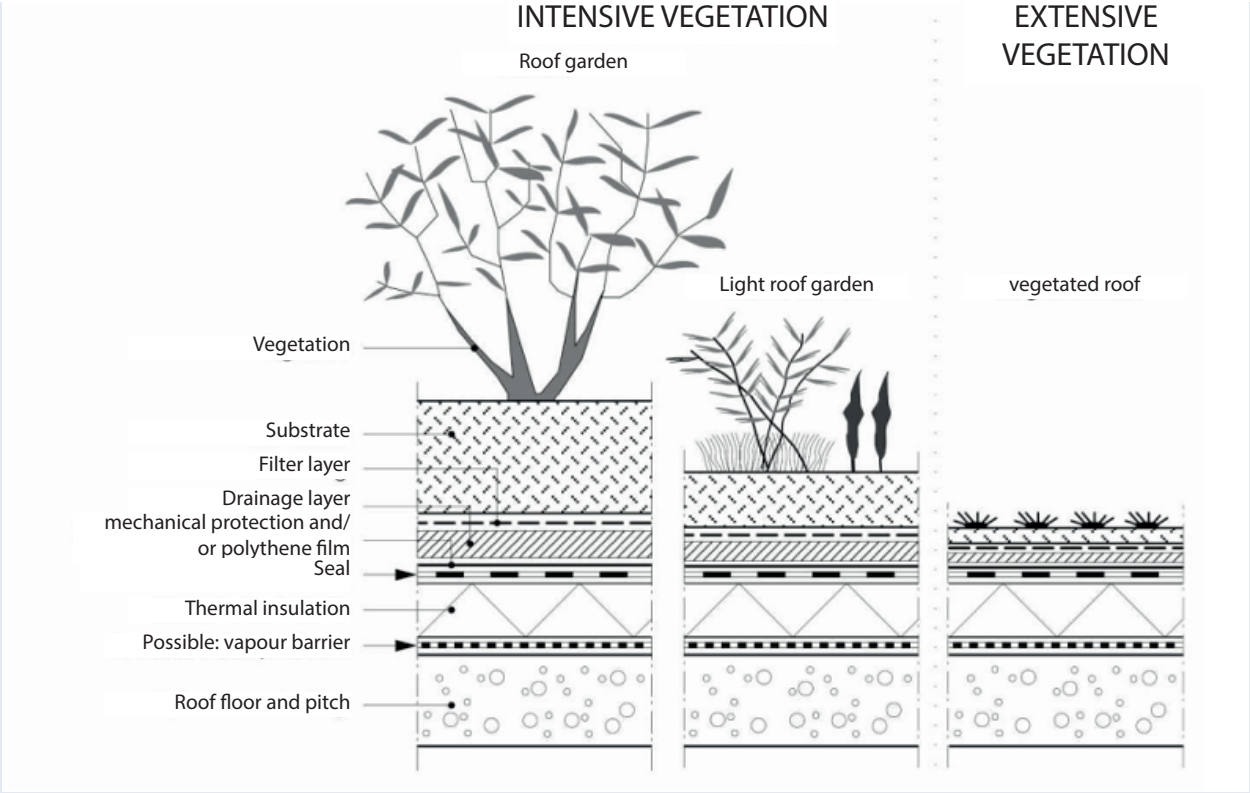
SOLAR PANELS & GREEN ROOFS

Both green roofs and solar panels create a permanent load on the roof surface and, therefore, require extra attention when carrying out the roof construction.

A fully bonded roof structure is often requested under green roofs in order to be able to detect any perforations resulting in leaks more quickly. With a screwed roof structure, the water can seep through in all directions and it is often a difficult task to locate the leak on the roof.

Screwed roof foils, such as PVC and TPO, tend to bulge during high winds. This results in an upward force, which the installer of the solar panels must take into account with extra ballast to counteract this force. Although a bonded roof film also avoids this upward force, it is hardly ever chosen because of the higher cost price.

Green roofs may not just be placed on just any roof skin. With most types of roofing, additional measures need to be taken. A schematic representation is provided below:



TPO	√	√	√v
EPDM	x	x	√
PVC	√*	√*	√*
Bitumen	√*	√*	√*

√* For this type of roofing materials, the standard product composition should be changed.

RENOVATION

With roof renovation works, it is not only necessary to think about the new roof materials to be used but, rather, also the existing roof structure. What is the condition of the old roofing? Can it be retained or should it be completely dismantled? How do we keep the inside of the building dry in the meantime? Will the additional roof insulation not create internal condensation over the long term? Etc.

A site visit by the roofer and/or architect is crucial. As much information as possible needs to be collected, because the more you know about the current roof structure, the better you can put together a suitable working method.

MUTEC regularly performs roof inspections (and entirely without any obligation). During these inspections, we make (several) incisions in the roof in order to find out about the old roof structure. We use this information and the new roof structure desired to create a Glaser simulation. This simulates, as it were, the build-up and drying out of the entire roof structure after the planned roof renovation. The results of such a simulation show how much moisture accumulates in the winter and whether there is sufficient drying capacity in the summer period. This way, we know for sure before the start of the work that we shall not be creating any condensation problems.

Tensile tests are often required to determine the securing method. Certainly with old concrete load-bearing floors or arched roofs made of aerated concrete. Based on these results, we can determine whether a screwed roof construction is possible and carry out an accurate wind load calculation.

These inspections are best combined with the maintenance of your flat roof. During this annual maintenance, we remove bulky waste, the drains are checked and we draw up a clear photographic report of all this. This ensures that you remain informed of the condition of your roof, without having to set foot on it. Short and long-term measures can be planned in order to free up the necessary budgets in time and avoid consequential damage.

Projects accomplished


GOSSELIN


vandendorpe

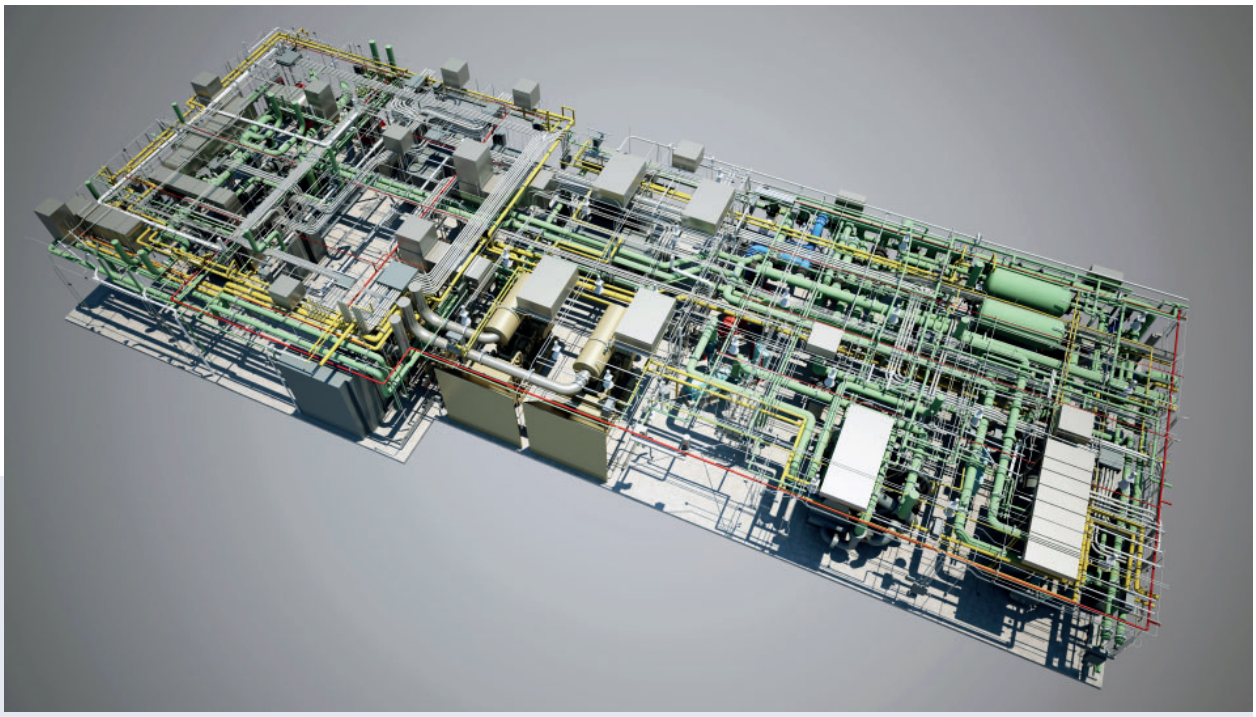
TECHNICAL BROCHURE
TECHNICS

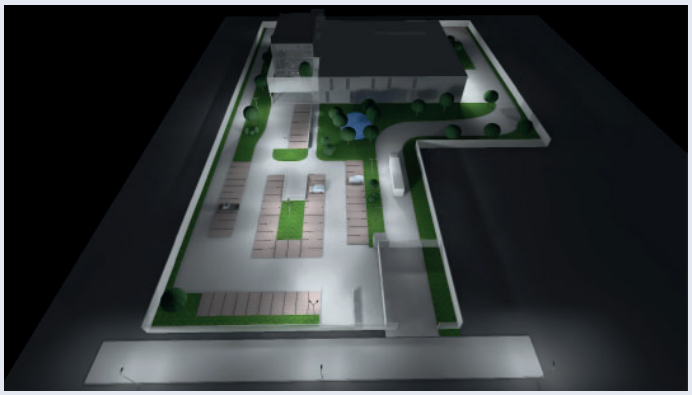
WILLY NAESSENS TECHNICS

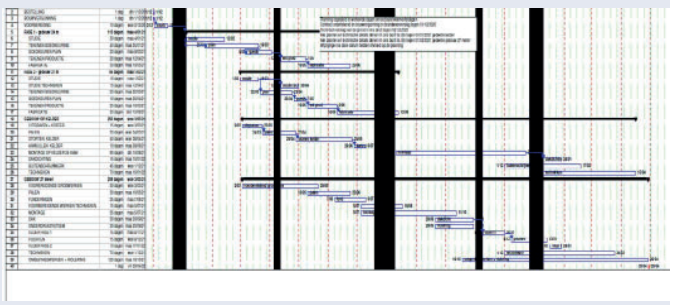
Willy Naessens Technics is the department within the Willy Naessens Group that can design and build all your technical installations. With our own engineering office, design and build is one of our major assets to ensure you get the comfort you wish.

All of our installations are built in accordance with the current legislation and regulations in force.

Willy Naessens Technics has its own engineering office where each installation (electrical installation, HVAC installation, sanitary installation) can be calculated, designed and drawn up in detail.
Our professional team has the most recent software, such as dialux,
CFD (dynamic calculation of heat and cooling load calculations), Autocad, 3D BIM, etc.







ELECTRICAL INSTALLATIONS

The electrical power required is matched to the demand and need of your complete building installation.

Low-voltage connection

When you need limited power to provide all the installations in your building with the electrical power required, you can request a low-voltage connection from the grid operator.

The maximum power that can be requested for a low-voltage connection varies from region to region. With a 3-phase low-voltage connection, this is usually limited to a maximum power of ± 200 A or 140 KVA.

Medium voltage connection

… If you need a power supply **in excess of 200 A**, you need to contact the network operator You have two options in this regard, either **a distribution cabinet** (usually limited to 630 KVA or 900 A) or a **customer cabin**et. If you connect to a distribution cabinet, you connect to a cabinet owned by the grid operator. The use of and connection to a distribution cabinet is calculated by the network operator.

… You can also choose to invest in a medium voltage cabinet yourself. The energy cost at medium voltage is lower than for low voltage. As a result, this investment will pay for itself in the long run. The power of a medium voltage cabinet starts from 100 KVA and can reach up to 2000 KVA and above.

This power is supplied by a transformer. There are different types for this:

- **Oil-filled transformers**
  In this type, oil is used in the transformer as an insulating medium.
  This is to prevent electrical breakdown and dissipate the heat that is generated.
- **Cast resin filled transformers**
  This type of transformer uses cast resin as an insulating medium to protect against electrical breakdown. A cast resin transformer is often used for higher fire safety or in water catchment areas to rule out soil contamination. The cast resin transformer is air-cooled and is also called a 'dry transformer' because it does not contain any oil as a cooling medium.

Requesting a connection from the network operator

You have to submit a request to the grid operator for each connection, both for low voltage and medium voltage. The grid operator will then carry out a study to determine whether the electricity grid installed in the region of the construction site can supply the power required.
The study costs, as well as the connection costs, are passed on to the end customer by the network operator.

Concluding a contract with an energy supplier

Once the above points have been completed, all you need to do is choose an energy supplier.
As soon a contract has been entered into with an energy supplier, your building can be connected to the grid.

The electrical power supplied must now be distributed in your building. That is why we start from the general low-voltage board. The total power is distributed from this board, via a structure of cable ducts, to all distribution boards, machines, terminals, etc. This network becomes the backbone of your building.

Important electrical sub-installations

- Lighting
  - The lighting and emergency lighting in and around your building must comply with the Belgian standards. Each room must be provided with the correct lighting level (lux) in line with the function of the space concerned. Our engineering office can simulate every room in your building via a dialux calculation
    and, in this way, select of lighting devices that are sufficient to guarantee this lux value.
- Sockets and power supplies
  - All necessary power supplies are included in the power list. Power and length determine the section of the cable provided for each power point.
  - Good distribution and the right number of sockets are also necessary.
    That is why we provide both work sockets and maintenance sockets in our installations.
- Fire detection installation
  - A fully automatic fire alarm system notifies you and your employees if an emergency occurs. This installation is equipped with an automatic reporting system
    so that emergency services get to the scene quickly.

    An emergency is detected by means of detectors and/or infra-red beams, depending on the location in which they are placed. The new Belgian standard NBN S21-100-1&2 "Fire detection and fire alarm systems" is applicable from 19/11/2015 (A.R. 9.11. 2015). This standard is required by the fire service regulations and the requirements for certain buildings the study and design of which had not yet started before 19/11/2015.
- Various installations
  - as part of our "turnkey" buildings, we also offer all other installations such as:
    - data installation
    - wi-fi installation
    - intrusion detection
    - camera surveillance
    - access control
    - solar installation
    - building management installation
    - …



HVAC: HEATING AND/OR AIR-CONDITIONING OF YOUR BUILDING

The choice solely to heat your building or also provide air-conditioning (heating and cooling) will ultimately determine the amount of your construction cost.

If you opt only to heat your building, you can, for example, opt for a traditional system based on a gas-fired heating installation (boiler). In most cases, this solution is the cheapest in terms of price. However, for this your building must be equipped for connection to a gas network.

The type of heating elements will then ultimately depend on several factors such as:

- function of the space
- volume of the room
- aesthetic requirements

Large volumes

For halls, warehouses, etc.that need to be heated, aerotherms (air heating) can be provided. We explain the different types below:

- **Indirect fired air heating**
  With indirect fired air heating, your central heating boiler pumps hot water to the air heating appliance in order to bring heating elements up to temperature. The air is then sucked into your room, passed along the elements and then, heated, blown back into your room.
- **Direct fired air heating**
  With direct fired air heating, the heating device is fitted to your gas connection. These appliances have their own gas combustion elements that ensure that the air drawn out from the room is heated. Direct-fired air heaters are often quite large (size of a refrigerator). These units are available as a condensing (to provide an additional sanitary drain for condensation) or non-condensing version. The condensing version is generally more efficient than the non-condensing version.

What are the advantages of air heating?

There are a number of reasons that make (in)direct fired air heating attractive;

- The air heating systems ensure that your room is comfortably heated in a relatively short time (faster than heating your room by means with radiators, for example).
- With (in)direct fired air heating, you can heat your room without having radiators hanging everywhere. This saves quite a bit of space, making it a real advantage in logistics warehouses, for instance.
- It is often also possible to connect an air-conditioning unit to your air heating system. This allows you to quickly switch between warm and cold air.
- The latest models are quite energy efficient and quiet.
- With good filtering, a lot of dust is filtered out of the air, which can contribute to a better indoor climate.

Smaller volumes

For heating office spaces, workshops, etc., for example, you can choose to install underfloor heating.

Principle of underfloor heating

In the classic heating system, the central heating heats the water and feeds it into the available heating elements – the radiators – that give off the heat to the room.
With underfloor heating, your floor takes over the function of a radiator: the heat is released into the room through pipes that are distributed over the entire surface of your floor. This provides you with a pleasant temperature due to the evenly spread radiant heat.

Benefits of underfloor heating

There are a number of reasons why you should opt for underfloor heating instead of classic radiators and convectors:

- **Energy saving**
  Underfloor heating can seriously reduce your energy bill. To obtain a pleasant temperature, the heating water for radiators must be at least 60°C, while 35°C is more than sufficient for underfloor heating. The central heating boiler, therefore, does not have to deliver such high temperatures, resulting in higher efficiency. The perceived temperature of a room is determined by the heat of the walls and the temperature of the room. Because the floor has a higher temperature with an underfloor heating installation, the surface temperature present rises,
  meaning that the room does not have to heat up to such a high temperature.
- **Comfort and health**
  An additional advantage of underfloor heating is that heat is spread upwards evenly from below, resulting in the occupants feeling comfortable more quickly. The heat from radiators and convectors will, after all, spread less evenly, so that it can sometimes be warmer at the top of the room than at floor level, making you tend to set the thermostat a few degrees higher.

  It is a myth that underfloor heating is bad for your health. The radiant heat provides for better humidity and minimal air circulation, with the result that you are not bothered by flying dust particles that can sometimes occur with radiators. In addition, underfloor heating is also safe for children because the floor surface never gets too hot. Burns from contact with radiator pipes are then a thing of the past.
- **Space-saving and innovative**
  Radiators simply need space, which means you lose a lot of useful space.
  With underfloor heating, there are no disturbing heating elements, meaning you can use your space to the maximum.

  Underfloor heating is also extremely suitable for combining with the latest techniques, such as a heat pump or solar panels, thereby increasing the efficiency of your installation.

- **Disadvantages of underfloor heating**

  Of course, there are also some disadvantages associated with underfloor heating. For example, it can be considered a slow heating system as it takes more time than radiators to raise the temperature in a room and, therefore, to actually experience the heat in the room. Underfloor heating is not recommended for rooms where constant heating is not required. Opting for a combined system of underfloor heating and radiators may be an option.

  In addition, it is not always possible to install underfloor heating because of the higher floor structure. Damage such as leaks is rare, but does imply major repairs since the entire floor has to be broken open. The installation of underfloor heating is more expensive than radiators. You will, of course, make this additional cost back quickly thanks to the higher efficiency and the savings on your energy bill.

Building

If you opt for air-conditioning (heating and cooling) your building, it is better to choose a heat pump system.

There are four types of heat pump: water-water, ground-water, air-water and air-air heat pumps. The operation of all these heat pumps is based on the same physical principles, it is only the way in which the heat is extracted and released that differs for each type of pump.

- **Air-to-air heat pump**
  An air-to-air heat pump extracts heat from the outside air. The warm air is blown into the rooms to be heated. In summer, the process of the air-to-air heat pump is reversed and the installation functions as an air-conditioning system.
- **Air-to-water heat pump**
  The air-to-water heat pump extracts heat from the air and feeds that air inside via a water circuit. You can use this heat for domestic hot water or for central heating.
  You can also combine this system with underfloor heating.
- **Ground-to-water heat pump**
  A ground-to-water heat pump uses the heat present in the subsoil.
  When installing a ground-to-water heat pump, you can choose from two systems: a horizontal or vertical pipe network. If there is little space available, it is best to use a vertical system. You have to take a fairly high investment cost into account (due to the bore depths). A horizontal pipe network is installed at a depth of approximately

  one and a half metres. The bores are less expensive than for a vertical network.
  But you must have sufficient ground surface available.
- **Water/water heat pump**
  A water-to-water heat pump extracts heat from the groundwater, which even in winter still reaches a temperature between 7 and 12°C. In addition, the temperature of the groundwater remains constant nearly all the time. For this, you need a deep-well pump in order to pump the water out of the ground and a discharge well for the used groundwater.

A water-to-water heat pump has the highest level of efficiency of all heat pump systems. In addition, water is a medium with a very high storage capacity and good regeneration. With a water-to-water heat pump system, two deep wells have to be bored, which obviously requires an additional investment cost.

Some heat pump systems:

- **VRF system**
  VRF systems are used in large buildings, such as offices, retail chains and even hospitals. VRF stands for Variable Refrigerant Flow and is a way of carrying out the function of both cooling and heating at the same time. The principle involves the installation of an outdoor unit, which is linked to multiple indoor units. Due to the variable refrigerant content, the installation is able to heat or cool the buildings (offices, hospital rooms, hotel rooms, etc.), according to need.

  How does a VRF system work?
  Not every office, hotel or hospital room needs the same temperature. The refrigeration technology entails a quantity of refrigerant being sent to each separate place. The volume of refrigerant is determined by the individual indoor unit. In short, the variable flow. This is something that suits everyone. Whether you fit a VRF system or a VRV installation, they are based on two different applications. Cooling or heating with the heat pump variant, or cooling or heating with so-called heat recovery. The heat recovery system involves using the heat from the part to be cooled to heat other rooms.

  Benefits of a VRF system
  The advantages of a VRF installation have already been mentioned above. It is an energy-saving method in order to provide any place with a desired temperature. It is not equally cold or warm in the various rooms. And that saves energy. You get perfect climate control. A wonderful example is the invention of the defrost cycle. It was found that ice formed on the outdoor units during the heating process. It was found that, with a built-in defrost cycle installed, the heating cycle in the installation was reversed. As a result, the indoor temperature dropped.

  Heating and air-conditioning in one
  And there are other advantages of a VRF system. It is primarily a heating and air-conditioning system in one. In addition, a VRF installation is energy efficient. After all, 75% of the energy is extracted from the air and only 25% from electricity. Gases or other sources are not used.

Ventilation

In addition to providing heating and/or cooling, ventilation is also an important factor for the comfort of the staff. During a project study, we therefore also adjust the ventilation to the correct amount determined beforehand on the basis of the regulations chosen.

The following regulations affect the ventilation:

- EPB
- Well-being at work codex
- Ventilation standard EN 13779

The minimum requirements of EPB must be met; in addition, it is often chosen to follow the regulations of the well-being at work codex. This is slightly stricter than the EPB, but at the same time also provides more comfort. Finally, there is also the ventilation standard EN 13779. This is divided into 4 different categories, namely the IDA categories. These IDA categories range from 4 to 1, labelled as low to high air quality respectively.

Benefits of ventilation

Ventilation ensures good comfort and the well-being of the staff. Because the staff feel well, their performance will be better. This has only advantages for the company. In addition, it also ensures the prevention of formation of mould.

Disadvantages of ventilation

The use of ventilation will increase the building's energy consumption. Rotating fans consumes more electrical energy; in addition, the fresh outside air (especially in winter) also has to be reheated. Heating consumption will therefore also increase.

System types

There are currently four different ventilation systems, namely type A, B, C and D. This first two systems are rare because of their uncontrolled operation. In addition, these systems are not promoted by the authorities, which is a second explanation for their rare presence in practice. Since ventilation systems types C and D do have a controlled operation, they are used quite often.

- **Ventilation system type C**
  With ventilation system type C, the fresh air is brought in naturally through grilles that are incorporated above the windows or in the wall. The air is discharged in the wet rooms. The polluted air is then expelled mechanically by electric fans.
  - **Advantages of type C**
    - The cost price of this system is relatively low on account of no mechanical supply being required.
    - The maintenance of a type C system is more limited compared to a type D.
    - It takes up less space than a type D system.
    - It is less complex than a type D ventilation system.
  - **Disadvantages of type C**
    - With this type of ventilation system, there will be more energy loss than with a type D.
    - The supplied air is not filtered.

- **Ventilation system type D**
  With ventilation system type D, the fresh air is supplied to the dry rooms mechanically. After which the polluted air is in turn discharged mechanically in the wet rooms.
  Today, heat recovery is often used in this type of ventilation system.
  Hence the increasing popularity of this system.

  ¨ Heat recovery
  Heat recovery is integrated in most type D ventilation systems. This means that with the help of a heat exchanger or rotary heat exchanger, the polluted air releases its heat to the fresh air from the outside. Maximum direct energy recovery is and remains the basic priority, of course. For example, the dry efficiency of a rotary heat exchanger is between 80 and 90%, with perceptible efficiency therefore between 75 and 80%.

  ¨ **Advantages of type D**

  - By using a ventilation system type D, heating costs can be saved with the aid of a heat exchanger. Part of the heat from the warm exhaust air is recovered.
  - It is the better installation for those who are allergic to pollen.
  - Less noise pollution

  ¨ **Disadvantages of type D**

  - It is a more complex system than type C.
  - The maintenance of the installation is slightly more intensive than that for a type C.
  - The cost price of a similar installation is more expensive than the type C variant.

TECHNICAL BROCHURE
INDUSTRIAL WALL ELEMENTS

In the pre-fab construction sector, pre-fabricated concrete walls offer an efficient solution for all façades and interior walls. The wall elements are placed against the structures. The great diversity of colours and dimensions means that these walls can be incorporated to suit any project. Our solid and insulated wall elements allow for contemporary architecture to be combined with a high level of functionality and technical efficiency.

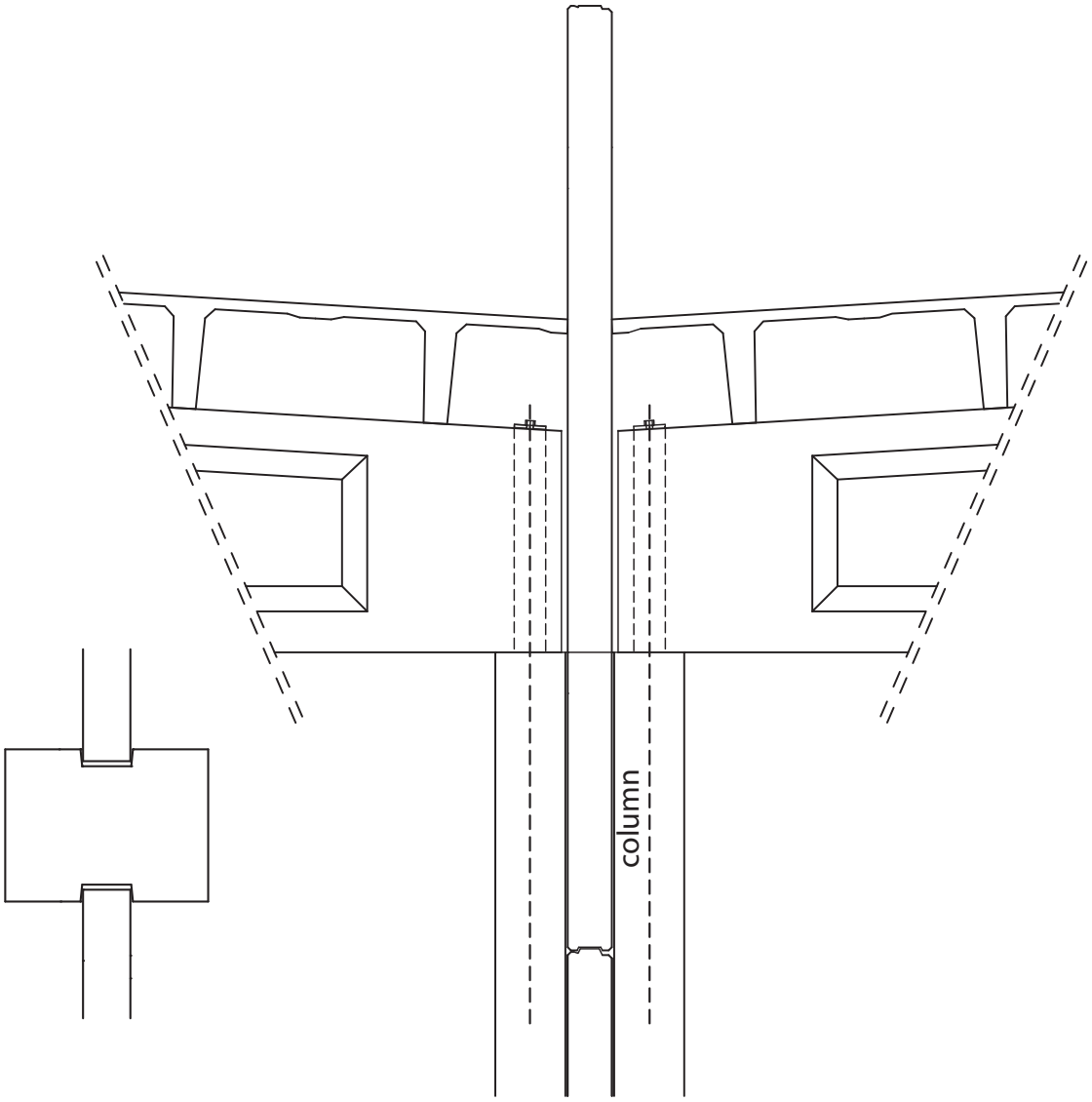
1. SOLID SMOOTH CONCRETE WALL ELEMENTS

These elements are used, among other things, as plinths, retaining walls, interior walls, firewalls, etc. Particular attention should be paid to elements that also have aesthetic functions, requiring post-treatment or adapted production methods and resources.

Specific applications

- **Interior walls**
  These solid smooth concrete panels are the ideal elements for interior walls in buildings.
- **Firewalls**
  Firewalls are a special application for the solid smooth concrete walls. Due to their large size, these elements enable very rapid assembly, with a minimum of joints. Lengths up to 16 metres are possible. Fire resistances are standard up to 60 minutes, but can easily be extended up to 240 minutes.

  The fire resistance of the wall elements is calculated according to Eurocode 2 and P92-701.



- **“Permanent fair-faced concrete” façades**
  When using smooth concrete panels as "permanent fair-faced concrete” façade elements, the significant cloud-like appearance of the elements and efflorescence have to be taken into account.

  These effects can be reduced by using special concrete compositions and/or formwork. The elements can also be treated afterwards to enhance uniformity.

  In any case, the possibilities and limitations of smooth concrete panels regarding the aesthetic character should be part of the design.

- **Plinths**
  These solid wall elements are partly placed below the finished floor level and are bearing components from foundation to foundation. They act as a frost border and in some cases as a supporting beam for the façade cladding.

- **Retaining walls**
  Pre-fabricated concrete retaining walls can be used as earth retaining elements and can also be used for the storage of goods.
  Thickness (max. 30 cm), reinforcement and fixings are determined according to the loads occurring.

- **Loading bays**
  Here we distinguish between the individual pits for quay levellers with or without recesses for the tail gates, concrete shelters, loading bay walls, etc.

SPECIFICATION TEXT - SMOOTH CONCRETE PANELS

Pre-fabricated smooth concrete industrial wall elements are poured flat on metal formwork.
The elements are self-supporting and intended for horizontal installation and are fixed to the structure.
The elements are poured mechanically. They have one smooth and one levelled side. Due to the use of metal formwork, removal oil and cement of the CEM I class, significant cloud formation can occur on the smooth side.

CONCRETE COMPOSITION:

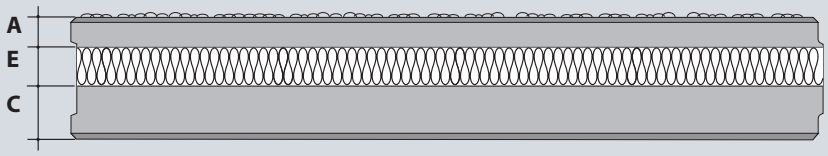
Washed limestone 2/6 and 7/14, sea sand, Rhine sand, limestone powder, blast furnace slag and grey cement CEM I 52.5 N or R. Superplasticisers ensure an optimal W/C factor (<0.5) and a high flow rate. The standard concrete quality is C30/37.

These elements can display a curvature as a result of, among other things, thermal differences and uneven shrinkage.

2. INSULATED SMOOTH CONCRETE WALL ELEMENTS

Remarks:

- Insulated elements are made up as follows:
  - reinforced concrete outer layer poured on metal formwork.
  - insulating core (see below).
  - reinforced concrete inner layer. This layer is levelled off manually.
  - inner and outer layers are connected by an anchoring system, with the insulation extending over the entire surface.
- In the case of sandwich elements, a substantial curvature can occur as a result of the thermal effect and unequal shrinkage of the elements. This should be taken into account when further finishing off the building.
- The formation of cracks in the outer layer as a result of shrinkage cannot be ruled out. This remains limited to the values stated in Eurocode 2.



SPECIFICATION TEXT - INSULATED SMOOTH CONCRETE PANELS

Industrial smooth concrete insulated wall elements are poured flat on metal formwork. The elements are self-supporting and intended for horizontal installation. The elements are poured mechanically and have one smooth and one levelled side.

Applying the insulation core over the entire surface. A layer of grey concrete is poured on top of this insulation core. This layer is levelled off mechanically.

CONCRETE COMPOSITION OF GREY CONCRETE:

Washed limestone 2/6 and 7/14, sea sand, Rhine sand, limestone powder, blast furnace slag and grey cement CEM I 52.5 N or R. Superplasticisers ensure an optimal W/C factor (<0.5) and a high flow rate. The standard concrete quality is C30/37.

These elements can display a curvature as a result of, among other things, thermal differences and uneven shrinkage.

The outer layer of pre-fabricated industrial walls can be produced in different concrete compositions:

- no. 980: grey concrete without colour requirement
- no. 983: grey concrete based on white cement
- no. 986: super white concrete with white cement and white colouring agent

You can also opt for a finish in washed concrete or with relief (see table with colour codes).
This is possible for both solid and insulated wall elements.

SPECIFICATION TEXT - SOLID SILEX PANELS

Industrial washed concrete wall elements are poured flat on metal formwork. The elements are self-supporting and intended for horizontal installation. The elements are poured mechanically and have
one smooth and one levelled side. After pouring, the decorative layer is vibrated and washed with high-pressure after the formwork is removed, so that the aggregates are visible in relief. Surface retarders are applied to the metal formwork prior to pouring in order to facilitate this washing out. This layer consists of concrete
made with coloured aggregates. A layer of grey concrete is poured on top of this layer.
This layer is levelled off mechanically.

CONCRETE COMPOSITION OF THE DECORATIVE LAYER:

Decorative aggregate according to colour choice, sand and cement CEM I 52.5 N (white/grey). Superplasticisers ensure an optimal W/C factor. Colour pigments are used in certain cases to colour the concrete depending on the decorative aggregates. The standard concrete quality is C30/37.

CONCRETE COMPOSITION OF GREY CONCRETE:

Washed limestone 2/6 and 7/14, sea sand, Rhine sand, limestone powder, blast furnace slag and grey cement CEM I 52.5 N or R. Superplasticisers ensure an optimal W/C factor (<0.5) and a high flow rate. The standard concrete quality is C30/37.

These elements can display a curvature as a result of, among other things, thermal differences and uneven shrinkage.

SPECIFICATION TEXT - INSULATED SILEX PANELS

Industrial washed concrete insulated wall elements are poured flat on metal formwork.
The elements are self-supporting and intended for horizontal installation. The elements are poured mechanically and have
one smooth and one levelled side. After pouring, the decorative layer is vibrated and washed with high-pressure after the formwork is removed, so that the aggregates are visible in relief. Surface retarders are applied to the metal formwork prior to pouring in order to facilitate this washing out. This layer consists of concrete
made with coloured aggregates. Applying the insulation core over the entire surface. A layer of grey concrete is poured on top of this insulation core. This layer is levelled off mechanically.

CONCRETE COMPOSITION OF THE DECORATIVE LAYER:

Decorative aggregate according to colour choice, sand and cement CEM I 52.5 N (white/grey). Superplasticisers ensure an optimal W/C factor. Colour pigments are used in certain cases to colour the concrete depending on the decorative aggregates. The standard concrete quality is C30/37.

CONCRETE COMPOSITION OF GREY CONCRETE:
Washed limestone 2/6 and 7/14, sea sand, Rhine sand, limestone powder, blast furnace slag and grey cement CEM I 52.5 N or R. Superplasticisers ensure an optimal W/C factor (<0.5) and a high flow rate. The standard concrete quality is C30/37.

These elements can display a curvature as a result of, among other things, thermal differences and uneven shrinkage.

DIMENSIONS

Product technical

- Maximum panel height = 4 m
- Maximum panel length = 16 m
- Maximum panel thickness = 45 cm
- Maximum insulation thickness = 30 cm
- Maximum weight = 32 TONNES/element

Transport technical

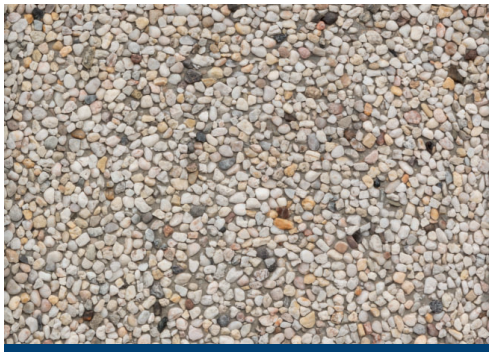
- Standard: height limited to 3.4 m with transport via panel carrier. Height between 3.4 m and 4 m transported by inloader.
- standard: from a length of 14 m, the height is limited to 2.6 m, transport carried out using a panel carrier.
- Insulated panels of a length greater than 7 m are provided with an expansion joint in the outer layer to compensate for curvature of the panels.
- Dimensions that deviate from this require a special study, in consultation with the production and transport companies.

	THICKNESS (CM):			U-VALUE (W/M²K)	
Wall thickness	outer layer	insulation	inner layer	PS	PIR
20	6	4	10	0.796	0.502
21	6	5	10	0.663	0.412
22	6	6	10	0.568	0.349
23	6	7	10	0.496	0.303
24	6	8	10	0.441	0.268
25	6	9	10	0.397	0.240
26	6	10	10	0.361	0.217
27	6	11	10	0.331	0.198
28	6	12	10	0.305	0.182
29	6	13	10	0.283	0.169
30	6	14	10	0.264	0.157
31	6	15	10	0.248	0.147

Insulation values are custom calculated per project

Chestnut • 101

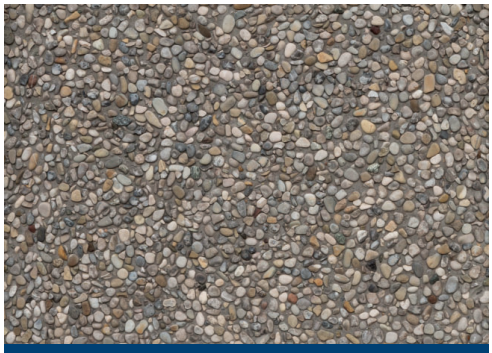
Wina • 104



Grianca • 116

Vm pink • 122

Niagara blue • 125



Negro • 208

Black and white • 209

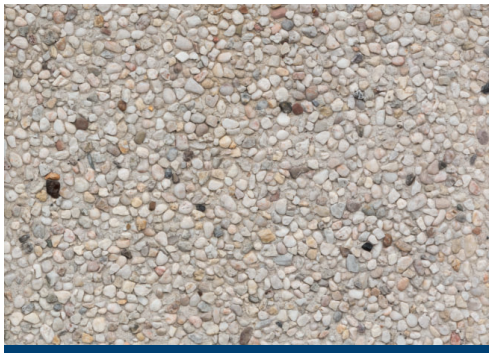
Verdi alpi • 210

Labrador Blue • 250

Norway black • 291

Luna • 304

Lahn yellow • 306



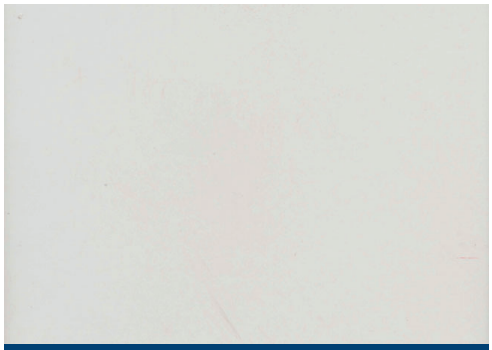
Bianca • 316

Niagara blue • 325

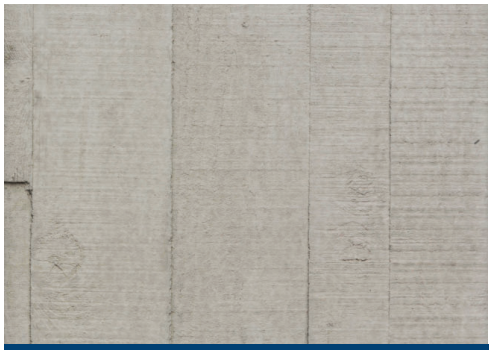
Madagascar • 840

Grey exposed concrete • 980

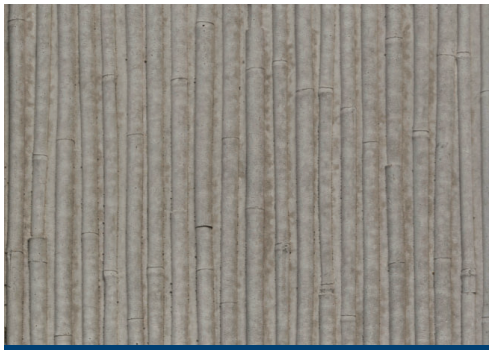
Grey concrete • 983



Super white concrete • 986



Patterned panels • 989

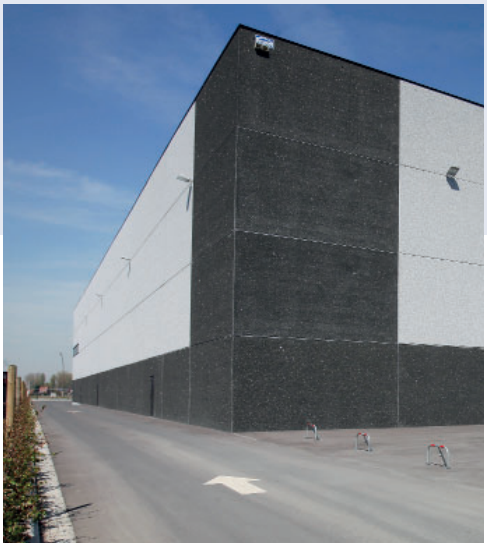


Patterned panels

Patterned panels


BEDRIJVENPARK
DE KROMMEWEGE

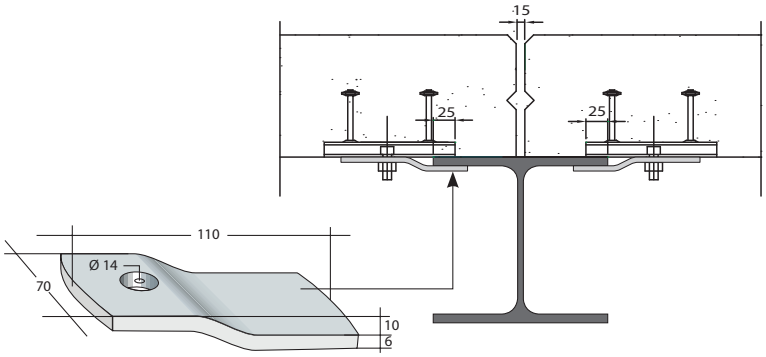

alsico



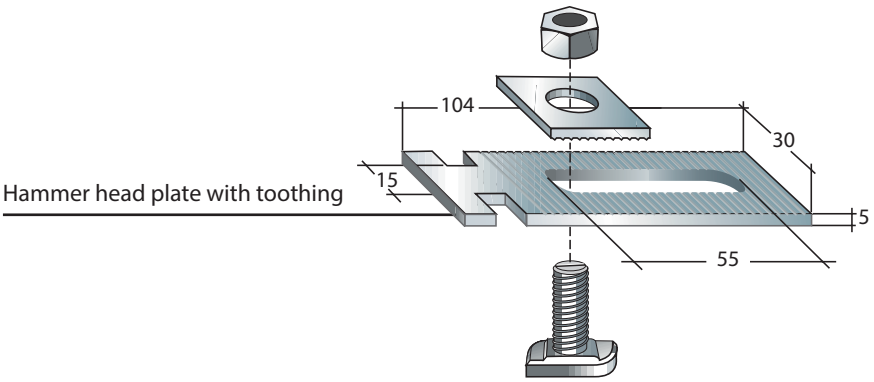
FASTENING METHODS

Fastening wall elements for tall buildings are part of a separate study.

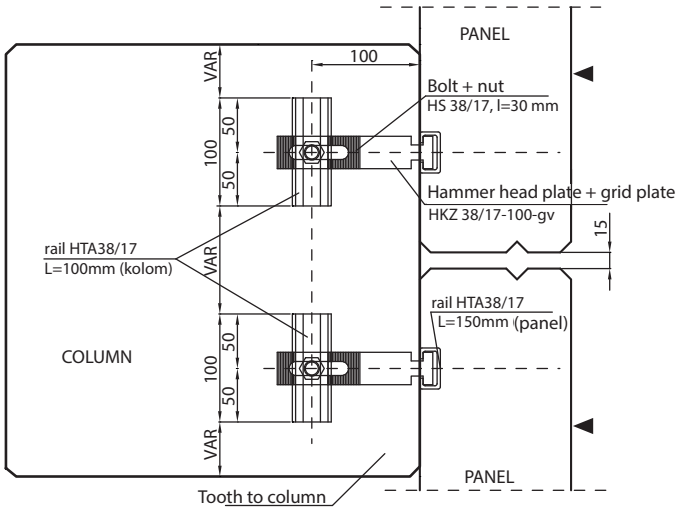
- **Metal structures**
  The panels are anchored to the metal columns with metal Z-shaped clamping plates.
  Anchor profiles are poured into the façade elements for this purpose.



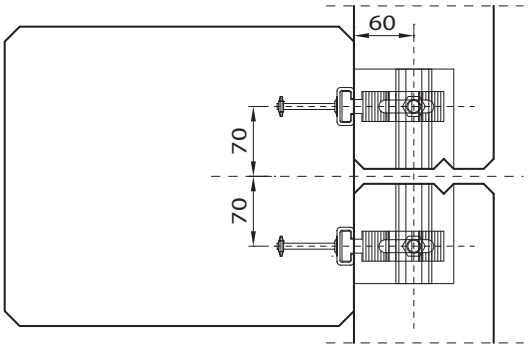
- **Concrete structures**
  The panels are anchored to the concrete columns by means of anchors, concealed fixings and/or visible metal corner profiles. Anchor profiles are poured into both the façade elements and the concrete columns for this purpose.



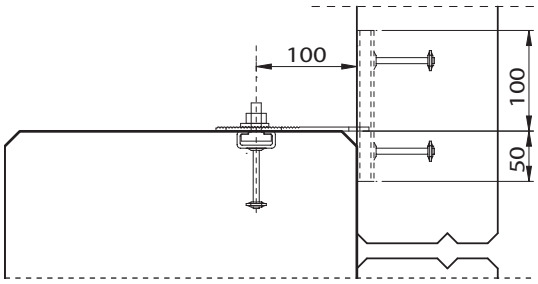
Detail 3 - Top view of column

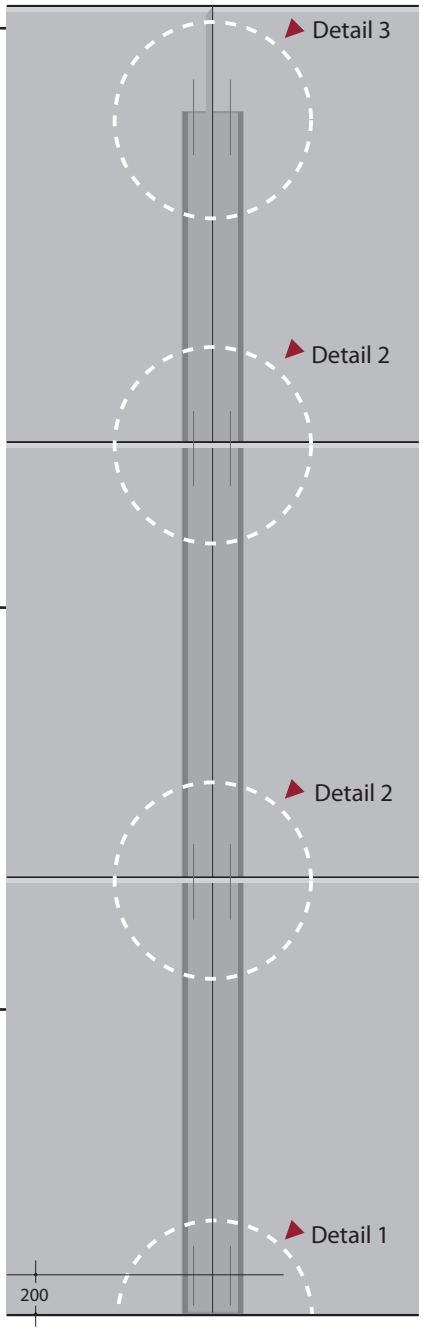


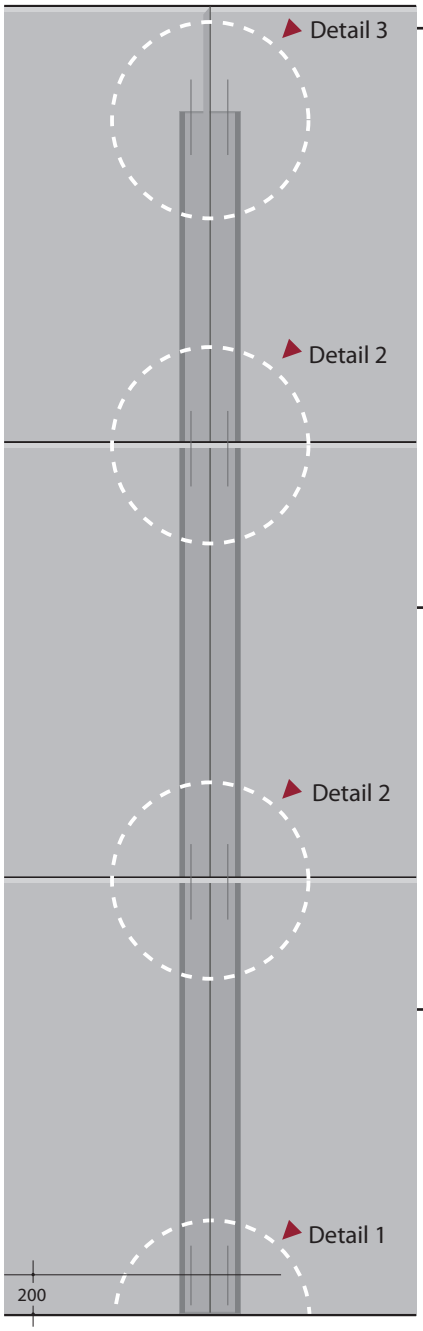
Detail 2 - Top view



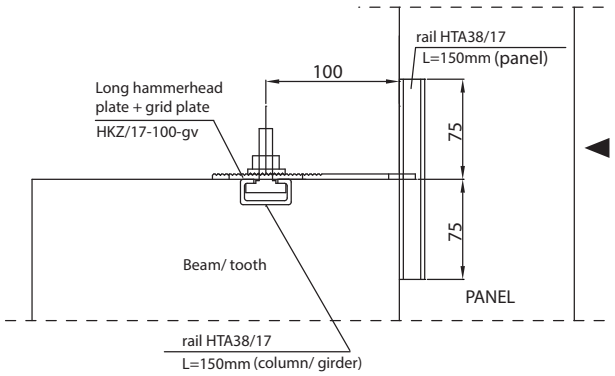
Detail 1 - Top view



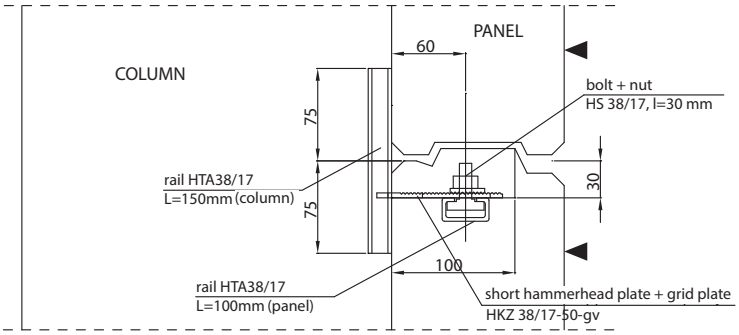




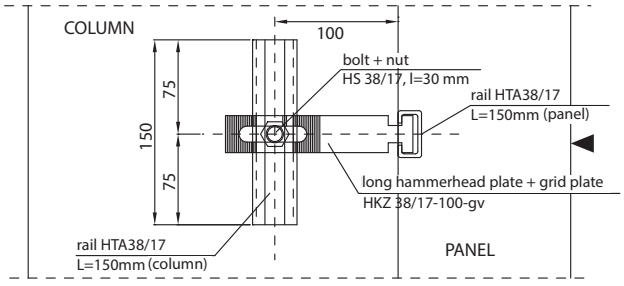
Detail 3 - Side view of column



Detail 2 - Side view

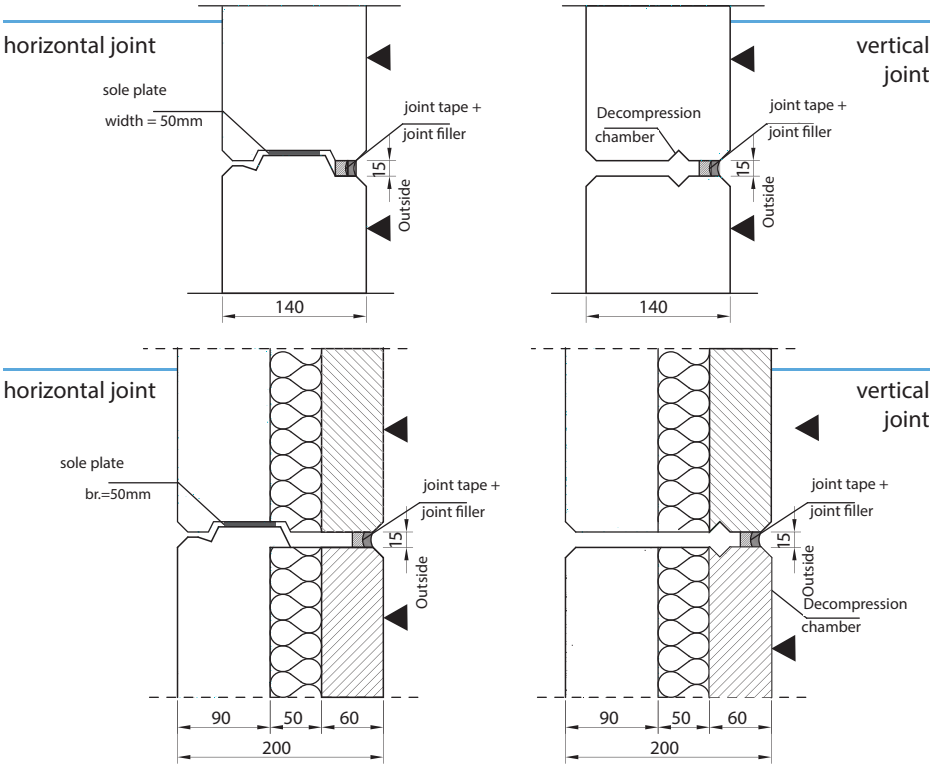


Detail 1 - Side view

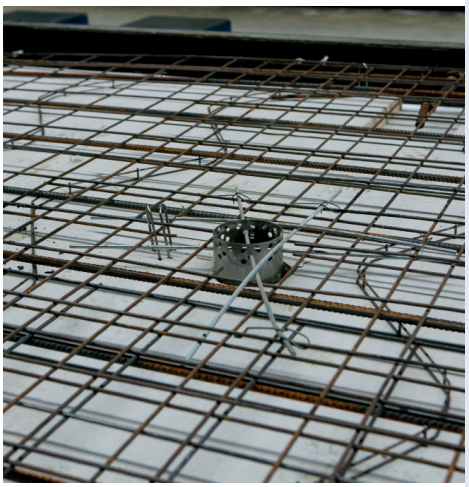


DETAILS

- **Tongue and groove**
  All panels are provided with a tongue and groove connection in the horizontal joint as standard.
  This tongue and groove connection provides a water barrier for the façades and can be omitted in certain applications and elements
- **Decompression**
  Decompression spaces can be provided in the vertical joints. These avoid the build-up of negative pressure in the vertical joints, which increases the watertightness of the façades and reduces the risk of infiltrations. This decompression space also ensures a controlled evacuation of water infiltrating into the joints accidentally.



- **Stainless steel anchorage**
  The inner and outer layers are connected by means of a stainless steel anchoring system. This consists of:
  - one or more load-bearing anchors that bear the dead weight of the outer layer
  - torsion anchors that prevent the torsion of the outer layer relative to the inner layer
  - pins distributed over the surface of the element according to a certain grid to effect the transfer of the wind load from the outer layer to the load-bearing inner layer



ASSEMBLY INSTRUCTIONS

Joints

It is essential for the elements to be supported at both ends. For this purpose, each element is placed on sole plates at both ends. In this way, a joint is actually created and any irregularities are bridged.

The joints are sealed after assembly. The choice of joint sealant is made in consultation with the designer, client and contractor. Special attention should be paid to the elasticity of the joint sealant.
PU foam is often chosen to seal the joints so as to allow the insulation shell to continue.

TOLERANCES

Production tolerances (according to PTV200)

- Length: ± 11 mm
- Deviation on h: ± 8 mm
- Deviation on thickness: ± 7 mm
- Horizontal curvature: f ≤ 0,005 L
- Deviation on diagonals: ± 11 mm
- Squareness 10 mm
- Flatness 8 mm

Tolerances on the location of encased elements (according to PTV200)

- Deviation from the size of the position of single elements:
  - Stability element ± 10 mm
  - Other element inner wall ± 20 mm
outer wall: ± 11 mm
- Deviation from the measure of relative positions of multiple elements: ± 5 mm

Placement tolerances

The following permissible placement deviations apply:

- Insertion: ± 5 mm
- Verticality: ± 1 mm/m with a maximum of 5 mm per element
- Horizontality: ± 5 mm
- Joint width: ± 5 mm

In addition, the specified width and length dimensions of the completed building must be respected to within 1‰.

When assembling the various wall elements, the lifting anchors cast in the panels must be used in such a way that each lifting point is loaded evenly.

An apex angle of 60° is therefore the maximum allowed.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