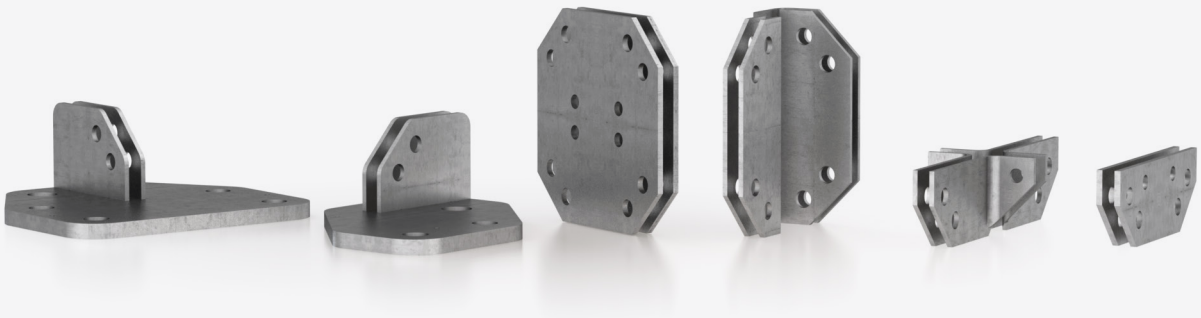
X-PLATE

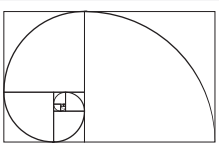
CE
EN1090

Complete range of connection plates



SIMPLE

The panels are mounted at the site through the simple tightening of steel bolts



COMPLETE

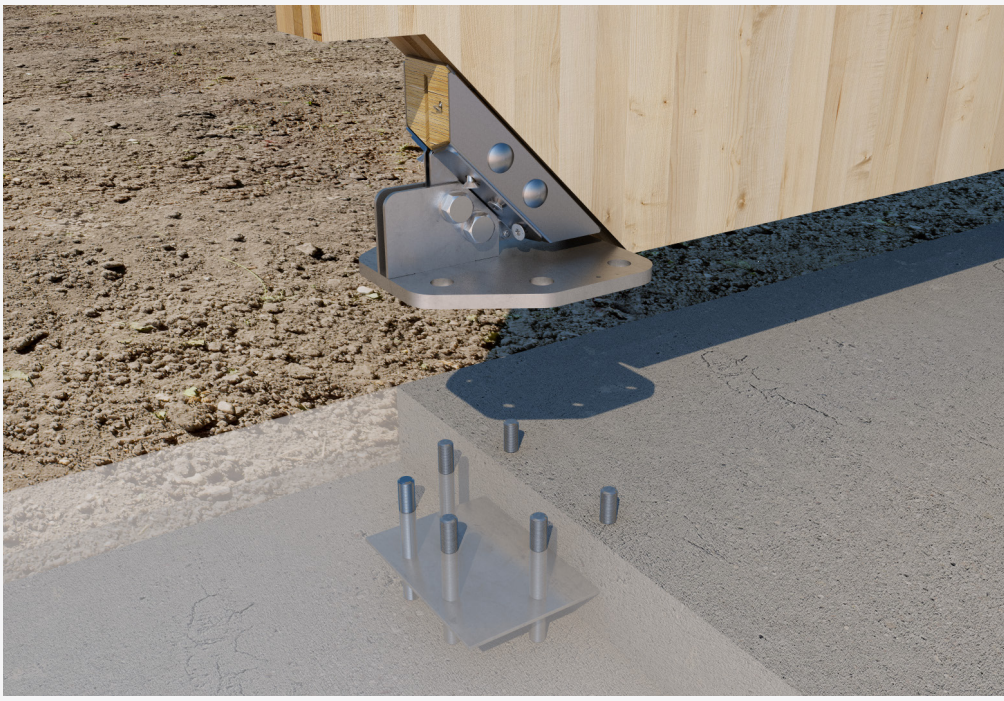
The range meets every on-site need, from attachment to the ground, to connection between walls at different levels and with different thicknesses, to fastening the walls at top level

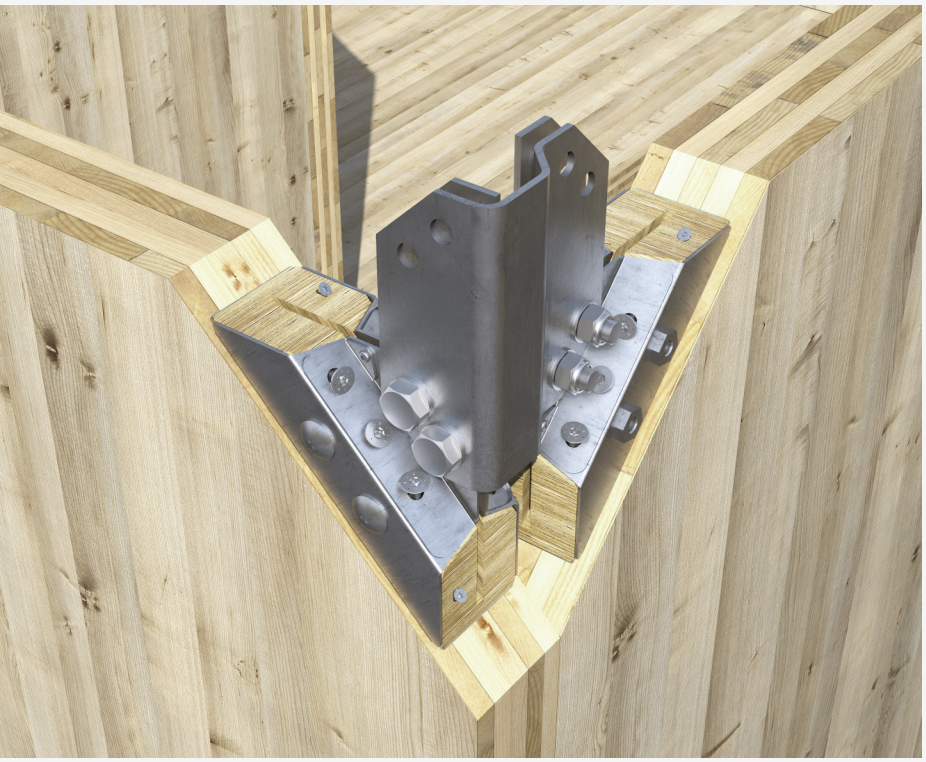
CERTIFIED

High quality guaranteed by the CE marking according to EN1090 of the X-PLATE components

DID YOU KNOW THAT...?

X-PLATE is the range of certified steel plates for mounting the CLT panels on the building site, made up of X-BASE, X-MID and X-TOP.
The connectable panel thicknesses vary from 100 mm to 200 mm.
X-BASE plates introduce a new concept of ground alignment and creating the attachment to the ground, making the mounting of the walls extremely precise and quick, with a saving in building times of between 50% and 70%.





INTUITIVE

The reference holes on the base of the plate make it possible to avoid any installation mistakes, for precise attachment of the system to the ground

ADVANCED

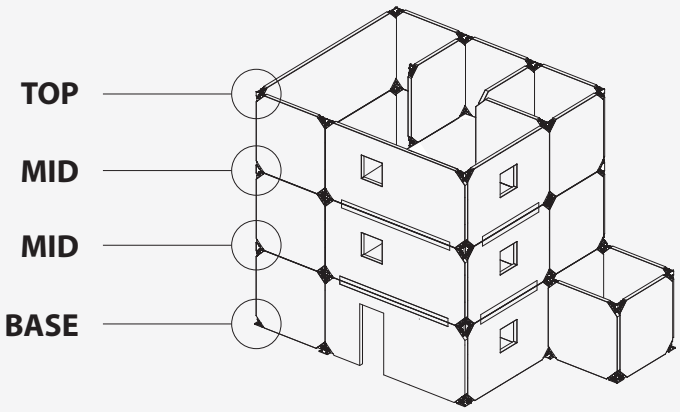
The system guarantees a high degree of prefabrication; it also solves problems relating to positioning, levelling and anchoring in the foundation of the CLT panels

PRACTICAL

The panels are quickly connected to each other using X-PLATE plates.
A practical solution suitable for every building site

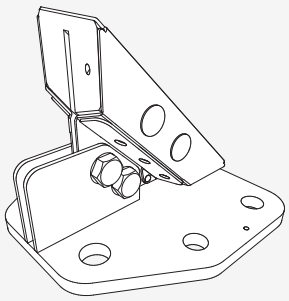
X-PLATE CONNECTION PLATES SYSTEM

X-ONE makes the CLT panel a module provided with specific connections for fastening. X-PLATE enables the modules to become buildings. Panels with a thickness between 100 and 200 mm can be connected.
X-PLATE plates are the ideal solution for every building site situation, developed for all geometric configurations.
The X-PLATE plates are identified according to their placing at the level of the building (X-BASE, X-MID, X-TOP) and according to the geometric configuration of the node and to the thickness of the panels connected.



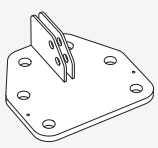
X-PLATE BASE CODE COMPOSITION

CODES =
level + thickness + orientation

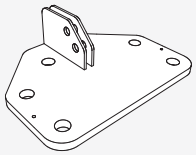


- LEVEL: B indicates that these are base plates
- THICKNESS: indicates the interval of thickness of the panel that can be used with that plate. There are two families of plates, the first designed for thicknesses between 100 and 130 mm (code BMINI), the second for thicknesses between 130 and 200 mm (code BMAXI)
- ORIENTATION: indicates the orientation of the plate with respect to the wall, right/left (R/L), indication only for asymmetric plates

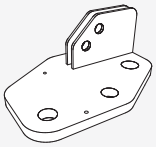
BMINI



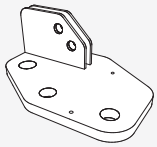
BMAXI



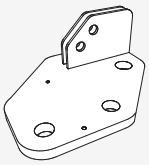
BMINIL



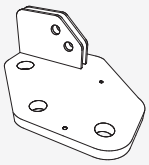
BMINIR



BMAXIL

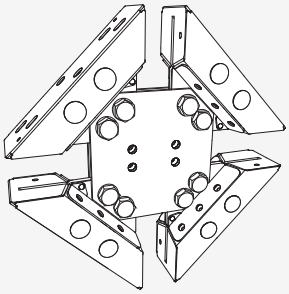


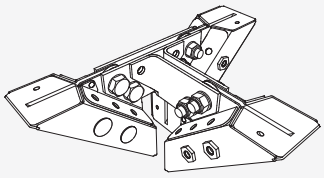
BMAXIR



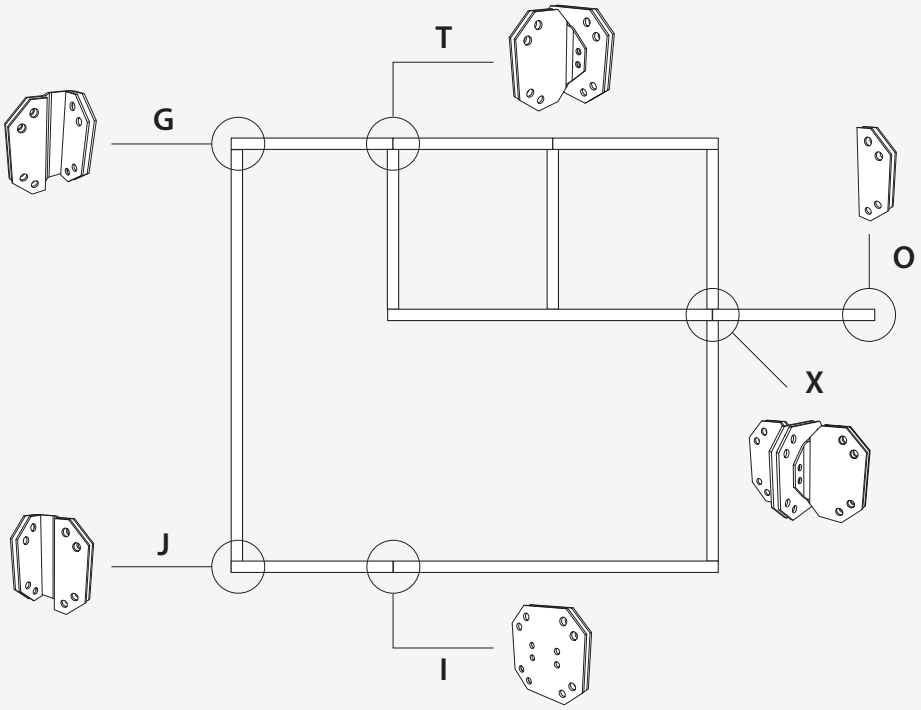
CODES =

level + node + thickness



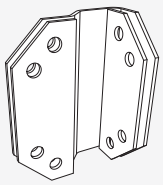


- LEVEL: indicates that these are mid-floor MID (M) and TOP (T) plates
- NODE: indicates the type of node (X, T, G, J, I, O)
- THICKNESS: indicates the thickness of the panel that can be used with that plate. There are three families of standard thickness, 100 mm - 120 mm - 140 mm. IT is possible to use all thicknesses of panels between 100 mm and 200 mm, with universal plates for the G, J, T and X nodes, in conjunction with SPACER plates, developed ad hoc. Universal plates are available in MID-S and TOP-S versions for panels with a thickness between 100 and 140 mm and in MID-SS and TOP-SS versions for panels with a thickness between 140 and 200 mm.

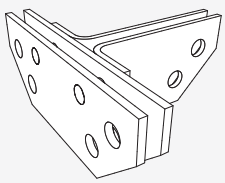


Examples:

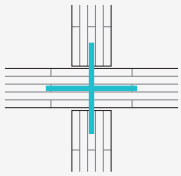
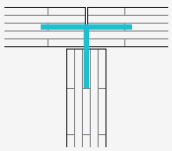
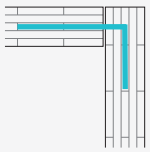
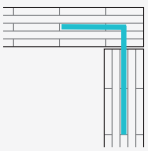
MG140 = **M + G + 140**



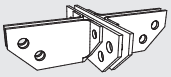
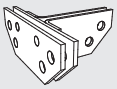
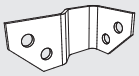
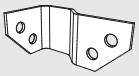
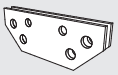
TT120 = **T + T + 120**



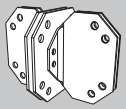
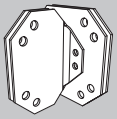
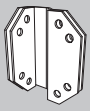
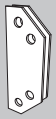
X-PLATE CODES

SHAPE X	SHAPE T	SHAPE G	SHAPE J	SHAPE I	SHAPE O
					

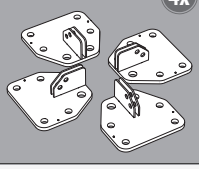
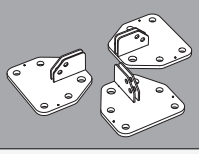
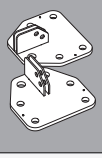
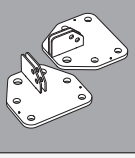
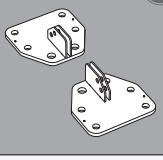
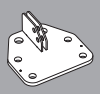
X-PLATE TOP

					
code **TX100 / TX120 / TX140**	code **TT100 / TT120 / TT140**	code **TG100 / TG120 / TG140**	code **TJ100 / TJ120 / TJ140**	code **TI100 / TI120 / TI140**	
no. 4 XONE no. 24 XVGS11350 no. 8 XBOLT1660 no. 2 XBOLT1260	no. 3 XONE no. 18 XVGS11350 no. 6 XBOLT1660 no. 2 XBOLT1260	no. 2 XONE no. 12 XVGS11350 no. 4 XBOLT1660 -	no. 2 XONE no. 12 XVGS11350 no. 4 XBOLT1660 -	no. 2 XONE no. 12 XVGS11350 no. 4 XBOLT1660 -	

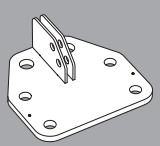
X-PLATE MID

					
code **MX100 / MX120 / MX140**	code **MT100 / MT120 / MT140**	code **MG100 / MG120 / MG140**	code **MJ100 / MJ120 / MJ140**	code **MI100 / MI120 / MI140**	code **MO100 / MO120 / MO140**
no. 8 XONE no. 48 XVGS11350 no. 8 XBOLT1665 no. 8 XBOLT1660 no. 4 XBOLT1260	no. 6 XONE no. 36 XVGS11350 no. 8 XBOLT1665 no. 4 XBOLT1660 no. 4 XBOLT1260	no. 4 XONE no. 24 XVGS11350 no. 8 XBOLT1660 - -	no. 4 XONE no. 24 XVGS11350 no. 8 XBOLT1660 - -	no. 4 XONE no. 24 XVGS11350 no. 8 XBOLT1665 - -	no. 2 XONE no. 12 XVGS11350 no. 4 XBOLT1660 - -

X-PLATE BASE

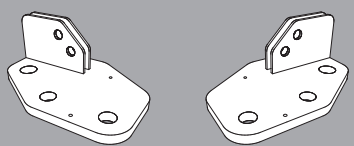
4x 	3x 	2x 	2x 	2x 	1x 

code **BMINI / BMAXI**



no. 1 XONE
no. 6 XVGS11350
no. 2 XBOLT1660
chemical anchor FIS-V410C
no. 6 threaded rods 8.8 - M20 x 250
(obtained from MGS12088 M20 x 1000)

code **BMINIL / BMINIR / BMAXIL / BMAXIR**

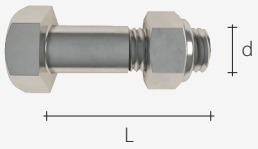


no. 1 XONE
no. 6 XVGS11350
no. 2 XBOLT1660
chemical anchor FIS-V410C
no. 3 threaded rods 8.8 - M20 x 250 / 400
(obtained from MGS12088 M20 x 1000)

NOTE: X-BOLT bolts must always be installed with the corresponding X-ULS washers. MGS rods must always be installed with nut and washer.
XBOLT1665 bolts must always be installed together with 6 mm thick X-PLATE plates.

ADDITIONAL PRODUCTS FOR FASTENING X-PLATE PLATES

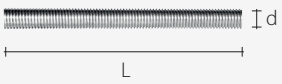
PRODUCTS FOR ASSEMBLING X-PLATE / X-ONE



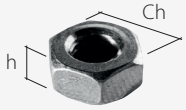
code	description	d [mm]	L [mm]	pcs/box
XBOLT1260	hexagonal head bolt with nut (steel strength grade 8.8 bright zinc-plated) EN 15048	M12	60	50
XBOLT1265		M12	65	50
XBOLT1270		M12	70	50
XBOLT1275		M12	75	50
XBOLT1280		M12	80	50
XBOLT1285		M12	85	50
XBOLT1290		M12	90	50
XBOLT1295		M12	95	50
XBOLT12100		M12	100	50
XBOLT12105		M12	105	50
XBOLT12110		M12	110	50
XBOLT12115		M12	115	50
XBOLT12120		M12	120	50
XBOLT1660		M16	60	25
XBOLT1665		M16	65	25
XBOLT1670		M16	70	25
XBOLT1675		M16	75	25
XBOLT1680		M16	80	25
XBOLT1685		M16	85	25
XBOLT1690		M16	90	25

code	description	rod	d_{INT} [mm]	d_{EXT} [mm]	s [mm]	pcs/box
XULS1324	washer UNI 5714	M12	13	24	3	50
XULS1730	washer UNI 5714	M16	17	30	4	50

PRODUCTS FOR ANCHORING IN FOUNDATION OF X-PLATE BASE



code	description	rod	L [mm]	pcs/box
MGS12088	threaded rod (steel strength grade 8.8 - bright zinc-plated)	M20	1000	1



code	description	rod	h [mm]	Ch [mm]	pcs/box
MUT93420	hexagonal nut (steel strength grade 8 - bright zinc-plated)	M20	16	30	100

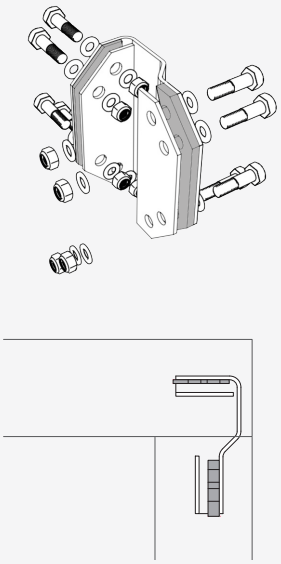
code	description	rod	d_{INT} [mm]	d_{EXT} [mm]	s [mm]	pcs/box
ULS21373	washer ISO 7089 (S235 steel - bright zinc-plated)	M20	21	37	3	250

code	description	format [ml]	pcs/box
521431	vinyl ester chemical anchor FIS V 410 C	410	1

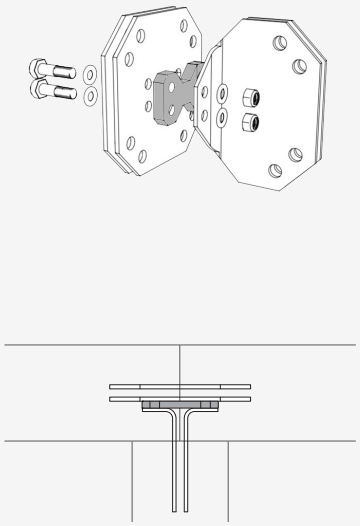
NOTE: The wide range of X-BOLT provided is required for fastening X-PLATE plates; for panels with thicknesses other than standard (100 - 120 - 140 mm), in combination with SPACER plates.

ACCESSORIES: EXAMPLE OF A SOLUTION WITH X-PLATE PLATES FOR NON-STANDARD WALL THICKNESSES

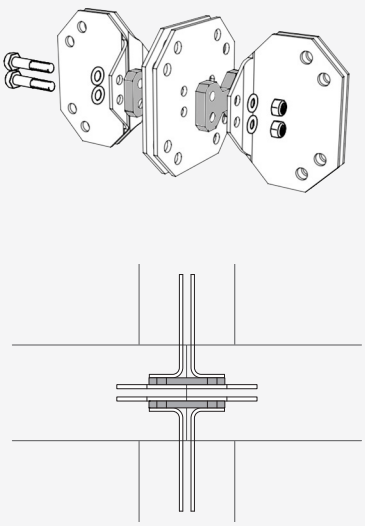
Below are the J (or G), T and X geometric configurations for MID and TOP levels, where the wall thickness affects the geometry of the X-PLATE plate. As an example, we have analysed panels with a thickness of 130 mm (so different to standard thicknesses of 100 - 120 - 140 mm), solved with MID-S and TOP-S universal plates, in combination with SPACER plates.



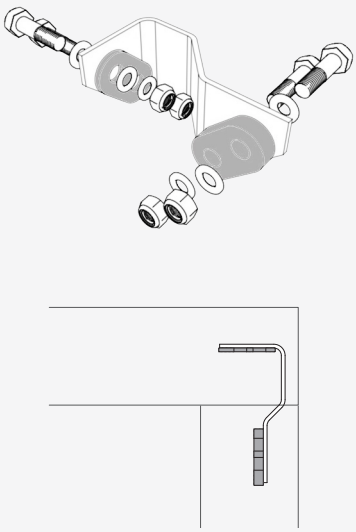
XPLATE MJS
no. 2 MJSPACER (1 MJ50S + 1 MJ150S)
no. 4 XBOLT1675
no. 4 XBOLT1665



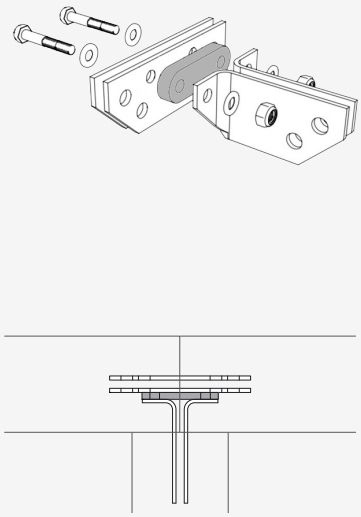
XPLATE MTS
no. 1 MTSPACER (1 MT150S)
no. 12 XBOLT1665
no. 4 XBOLT1275



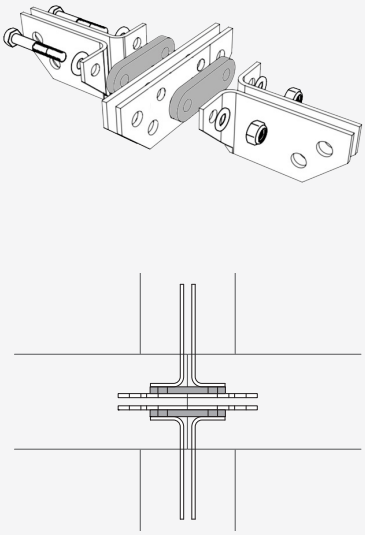
XPLATE MXS
no. 2 MTSPACER (2 MT150S)
no. 16 XBOLT1665
no. 4 XBOLT1290



XPLATE TJS
no. 2 TJSPACER (1 TJ50S + 1 TJ150S)
no. 2 XBOLT1675
no. 2 XBOLT1665



XPLATE TTS
no. 1 TTSPACER (1 TT150S)
no. 6 XBOLT1660
no. 2 XBOLT1275

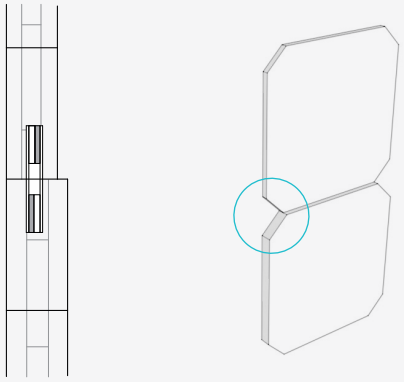


XPLATE TXS
no. 2 TTSPACER (2 TT150S)
no. 8 XBOLT1660
no. 2 XBOLT1290

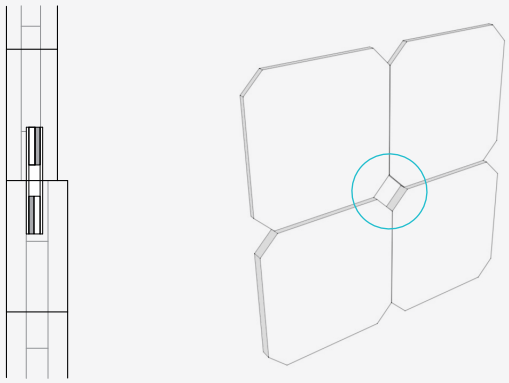
ACCESSORIES: EXAMPLE OF A SOLUTION WITH X-PLATE PLATES FOR CHANGES OF WALL THICKNESS AT MID-FLOOR LEVEL

All of the mid-floor geometric configurations are shown below, where the change of wall thickness from the floor below to the floor above affects the geometry of the X-PLATE plate. On a schematic level, you can understand how every variation in thickness can be solved using MID-S (or MID-SS) universal plates, in combination with the appropriate SPACER plates.

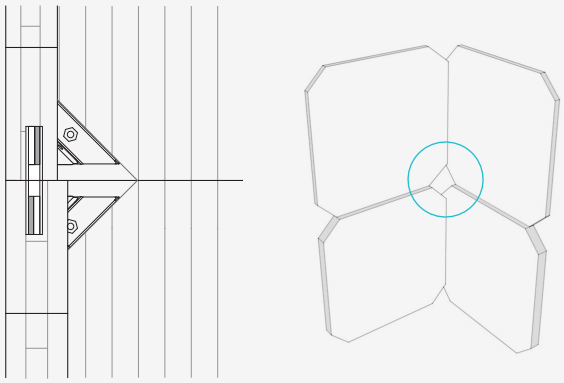
MO (2 TJSPACER)



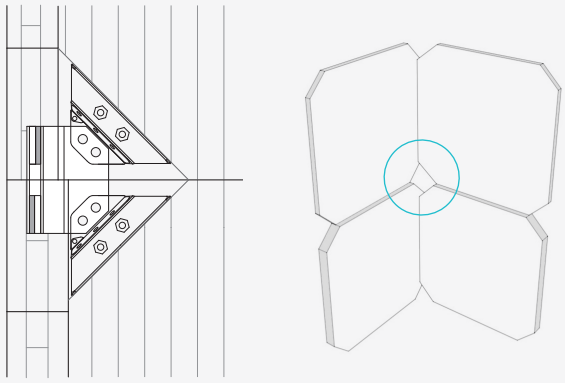
MI (4 TJSPACER)



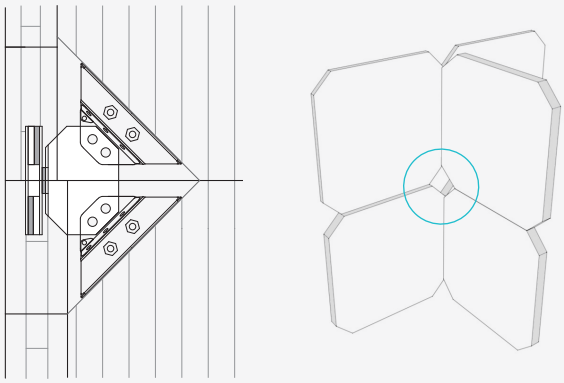
MG (4 TJSPACER)



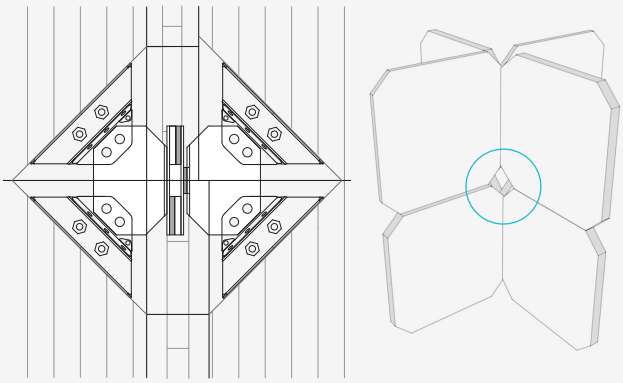
MJ (4 TJSPACER)



MT (4 TJSPACER + 1 MTSPACER)



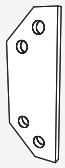
MX (4 TJSPACER + 1 MTSPACER)



NOTE: For any doubts or assistance on X-PLATE plates and SPACER plates to be used in specific cases, contact Rothoblaas Technical Office.

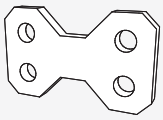
ACCESSORIES: SPACER PLATES AND UNIVERSAL PLATES CODES

MJSPACER



code	s [mm]
MJ25S	2
MJ50S	5
MJ75S	8
MJ100S	10
MJ125S	12
MJ150S	15
MJ175S	18
MJ200S	20
MJ225S *	22
MJ250S *	25
MJ275S *	28
MJ300S *	30

MTSPACER

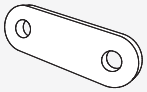


code	s [mm]
MT25S	2
MT50S	5
MT75S	8
MT100S	10
MT125S	12
MT150S	15
MT175S	18
MT200S	20
MT225S *	22
MT250S *	25
MT275S *	28
MT300S *	30

TJSPACER

code	s [mm]
TJ25S	2
TJ50S	5
TJ75S	8
TJ100S	10
TJ125S	12
TJ150S	15
TJ175S	18
TJ200S	20
TJ225S *	22
TJ250S *	25
TJ275S *	28
TJ300S *	30

TTSPACER



code	s [mm]
TT25S	2
TT50S	5
TT75S	8
TT100S	10
TT125S	12
TT150S	15
TT175S	18
TT200S	20
TT225S *	22
TT250S *	25
TT275S *	28
TT300S *	30

* supplied upon request

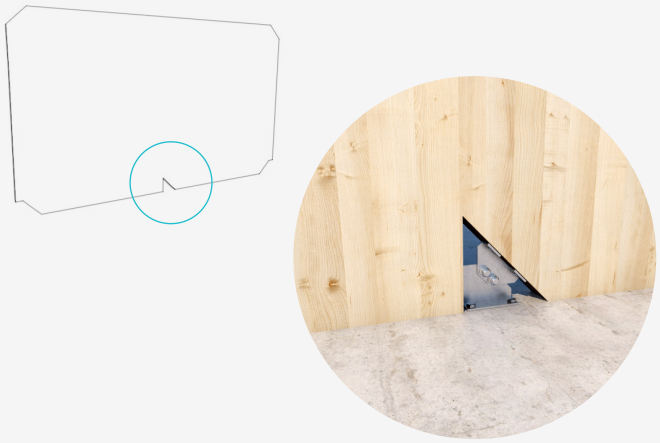
UNIVERSAL PLATES

code	**panel thickness** [mm]
MJS - MGS - MTS - MXS - TJS - TGS - TTS - TXS	100 - 140
MJSS - MGSS - MTSS - MXSS - TJSS - TGSS - TTSS - TXSS	140 - 200

PRODUCTS RELATED TO ASSEMBLY OF CLT WALLS AND X-PLATE PLATES

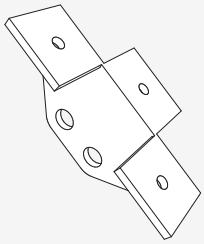
code	description	pcs/box
GEKO	slab puller	1
GIR4000	assembly support 4000 mm	1
ANT	handling lever	1
CRICKET	torque wrench	1
PANIMP18	18 V pulse screw gun	1
ATRE6040	bushing M16 - 24 mm - 1/2"	1
ATRE6050	bushing M20 - 30 mm - 1/2"	1

ACCESSORIES: X-PLATE BASE EASY PLATES FOR NON-STRUCTURAL FASTENING

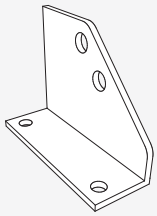


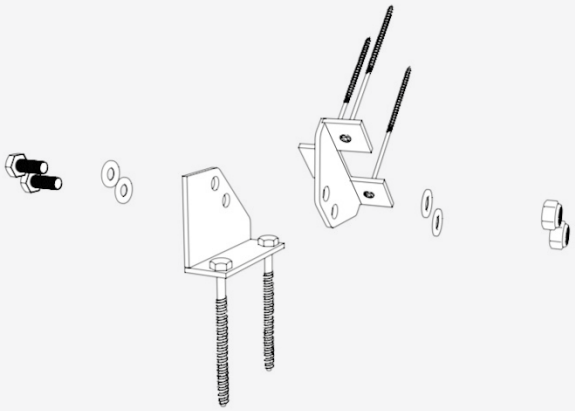
Where foundation fastening for non-structural walls or temporary fastening for correct wall alignment (e.g. walls of considerable length) is required, a BEASYT plate (as an alternative to X-ONE) can be installed on the bottom corner of the CLT panel (with simple 45° cut without horizontal cut) and a BEASYC plate (as an alternative to X-PLATE BASE plates) can be installed on the mat foundation [1].

BEASYT



BEASYC





The CLT panels are fastened with 3 HBS+ evo screws 8 x 200 mm and the reinforced concrete base is fastened with 2 SKR 12 x min 100 mm or alternatively 2 AB1 M12 x 103 mm.

CODES AND DIMENSIONS

code	s [mm]	Ø$_{SUP}$ [mm]	n. Ø$_{SUP}$	Ø$_{INT}$ [mm]	n. Ø$_{INT}$	pcs/box
BEASYT	5	9	3	17	2	1
BEASYC	5	17	2	13	2	1

RELATED PRODUCTS

code	description	pcs/box
HBSP8200C	HBS+ evo: flat screw with cone-shaped under-head	100
SKR12100	SKR: screw anchor	25
FE210440	AB1: mechanical anchor	25

NOTE: [1] The BEASYT plate is always assembled on the inclined surface in a central position, the same as X-ONE, both with respect to the length of the cut and in the direction of the panel thickness.

STRUCTURAL ENGINEERING

The aim of this section is to provide the resistance specifications for X-PLATE connection plates.
The plates, of varying thickness according to the type, are all made of S355JR steel, CE marked according to EN1090 in EXC2 execution class. Each plate has been designed and verified by applying the maximum stresses transmitted by the X-ONE connector, according to three classes of strengths [1]:

1. OVERALL STRENGTHS OF THE PLATE (with FEM analysis):
- shear;
- pure traction;
- pure compression;
- buckling stress or flexural stress.

2. LOCAL STRENGTHS:
- shear strength of the bolt (EN 1993-1-8 §3.6.1);
- bearing strength of the plate (EN 1993-1-8 §3.6.1);
- block tearing strength of the plate (EN 1993-1-8 §8.10.2);
- strength of the welds.

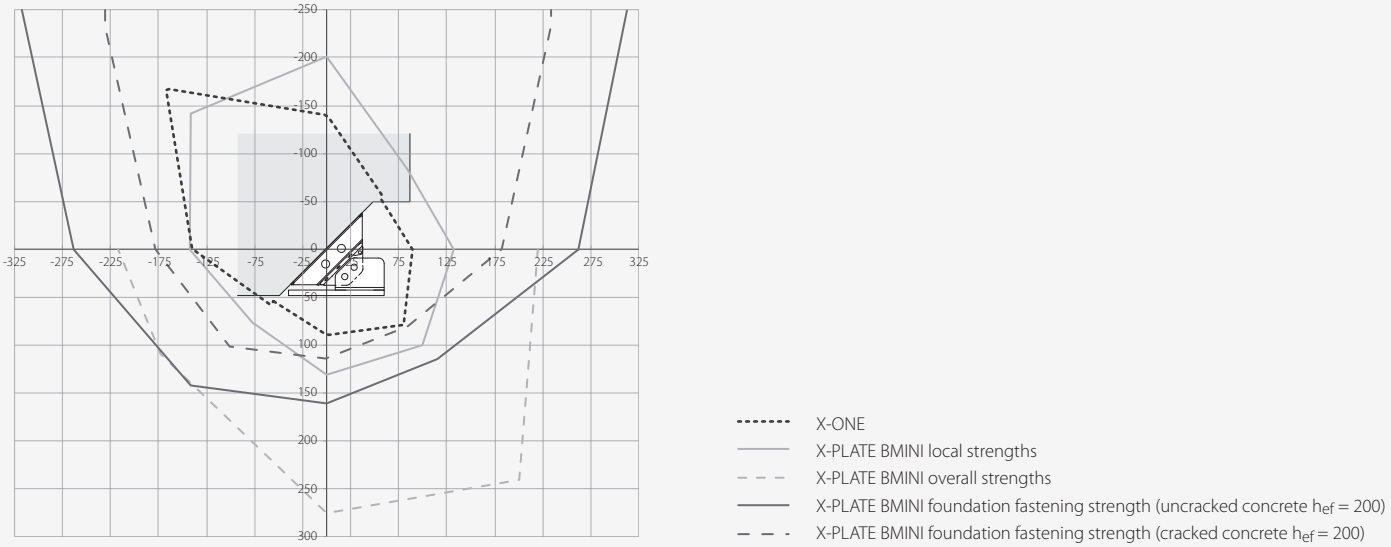
3. FASTENING STRENGTH ON THE FOUNDATION SUPPORT

X-PLATE BASE PLATES

The X-PLATE BASE plates can be used under the following conditions:
- use of vinyl ester chemical anchor and 20 mm diameter threaded rod - steel strength grade 8.8
- minimum strength class for C25/30 concrete

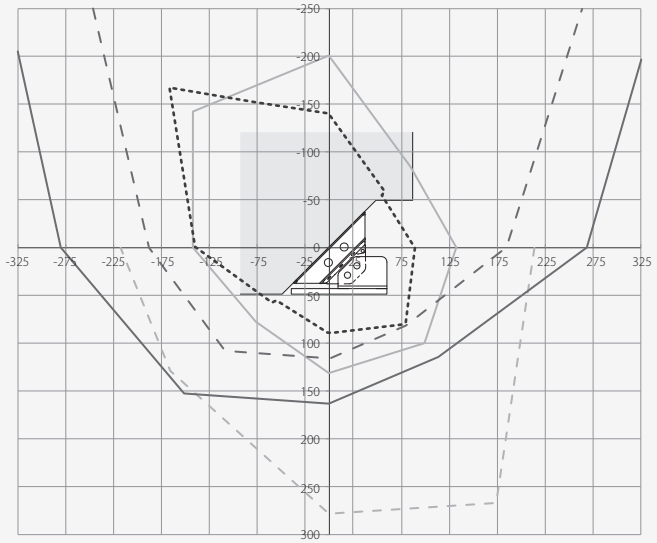
X-PLATE BMINI and BMAXI plates **fully restore** the resistance of the X-ONE connector.
X-PLATE BMINIL/R and BMAXIL/R plates **partially restore** the resistance of the X-ONE connector.
This aspect is illustrated by the resistance domains shown below [2].

RESISTANCE DOMAINS OF X-PLATE PLATES COMPARED TO THE RESISTANCE DOMAIN OF THE X-ONE CONNECTOR



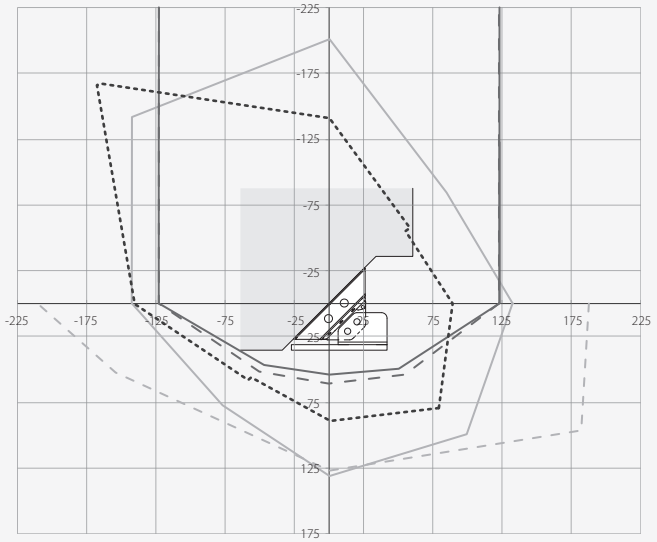
X-PLATE BMINI - Design resistance domain

NOTE: [1] The full report on structural design of the X-PLATE plates can be downloaded from www.rothoblaas.com or from the MyProject software.
[2] The domains are shown according to the reference system for the X-ONE connector. To refer to the reference system for the X-PLATE plates, by applying forces on the X-PLATE plates that are equal and opposite to those applied on the X-ONE connector, these domains must be mirrored with respect to the bisector of the first quadrant.



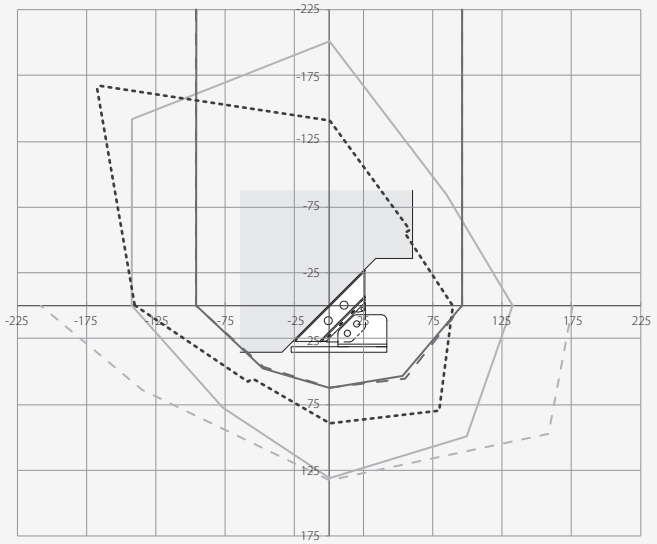
- X-ONE
- X-PLATE BMAXI local strengths
- X-PLATE BMAXI overall strengths
- X-PLATE BMAXI foundation fastening strength (uncracked concrete h_{ef} = 200)
- X-PLATE BMAXI foundation fastening strength (cracked concrete h_{ef} = 200)

X-PLATE BMAXI - Design resistance domain



- X-ONE
- X-PLATE BMINILR local strengths
- X-PLATE BMINILR overall strengths
- X-PLATE BMINILR foundation fastening strength (uncracked concrete h_{ef} = 200)
- X-PLATE BMINILR foundation fastening strength (cracked concrete h_{ef} = 350)

X-PLATE BMINIL/R - Design resistance domain



- X-ONE
- X-PLATE BMAXILR local strengths
- X-PLATE BMAXILR overall strengths
- X-PLATE BMAXILR foundation fastening strength (uncracked concrete h_{ef} = 200)
- X-PLATE BMAXILR foundation fastening strength (cracked concrete h_{ef} = 350)

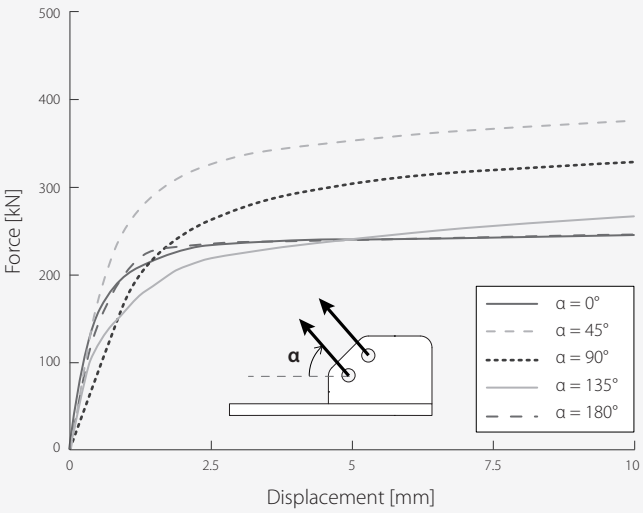
X-PLATE BMAXIL/R - Design resistance domain

FEM ANALYSES ON X-PLATE BASE PLATES

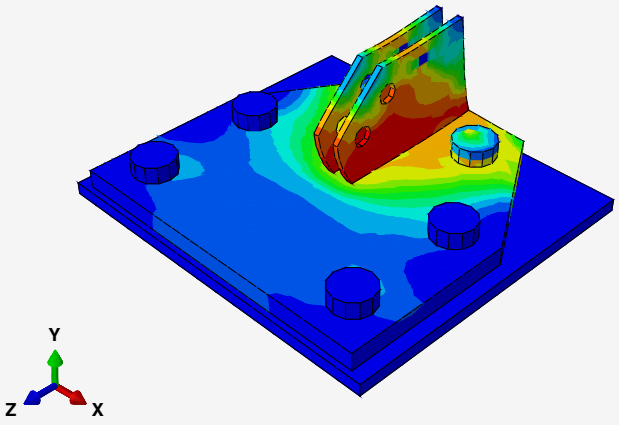
The following FEM analyses, performed controlling displacement and assuming a final displacement of 15 mm, were conducted by analysing the 5 main load directions (positive/negative pure shear, positive/negative shear-traction and pure traction). The results of these simulations are as follows:

- diagram showing force-displacement for every load direction (0° ≤ α ≤ 180°)
- 3D deformation of the system in stress contours (von Mises) for α = + 90°

X-PLATE BMINI PLATE

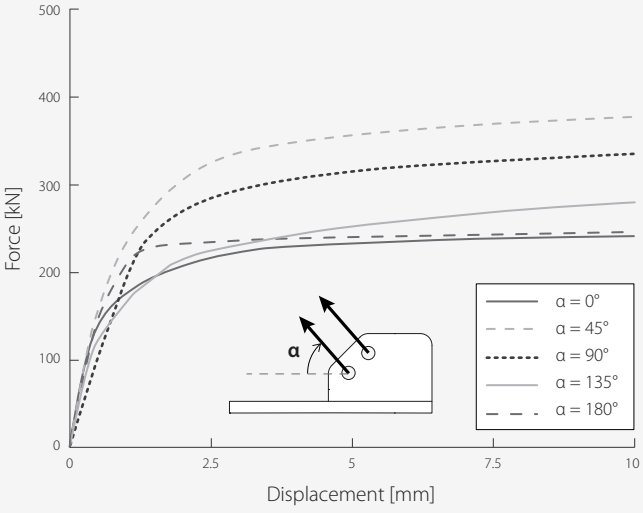


Force-displacement diagram

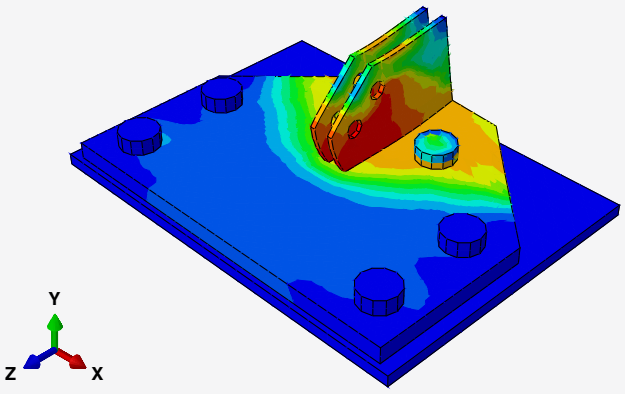


3D deformation in stress contours (von Mises) - α = + 90°

X-PLATE BMAXI PLATE

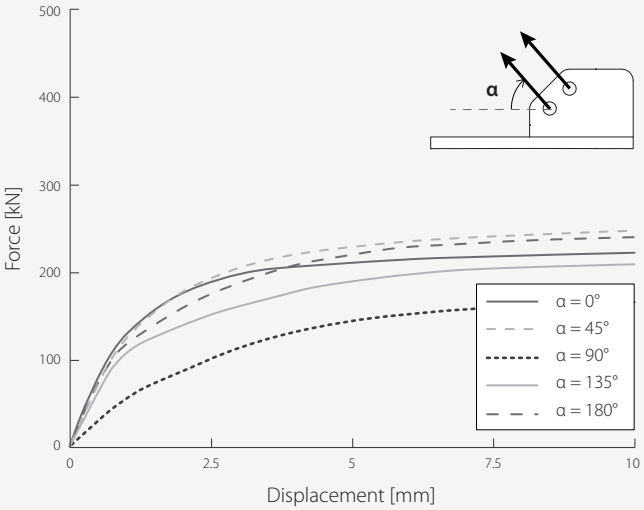


Force-displacement diagram

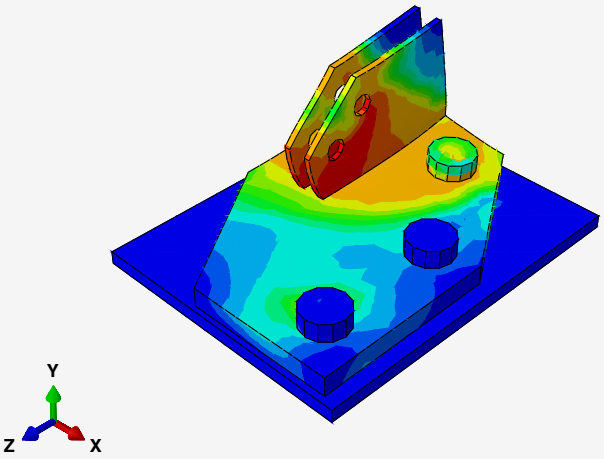


3D deformation in stress contours (von Mises) - α = + 90°

X-PLATE BMINIR PLATE

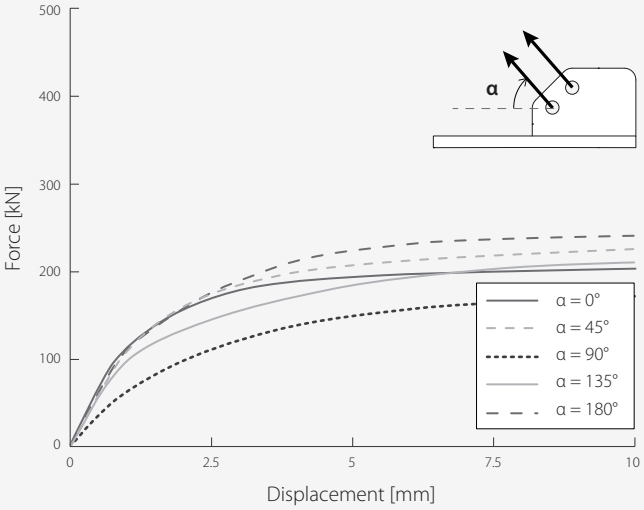


Force-displacement diagram

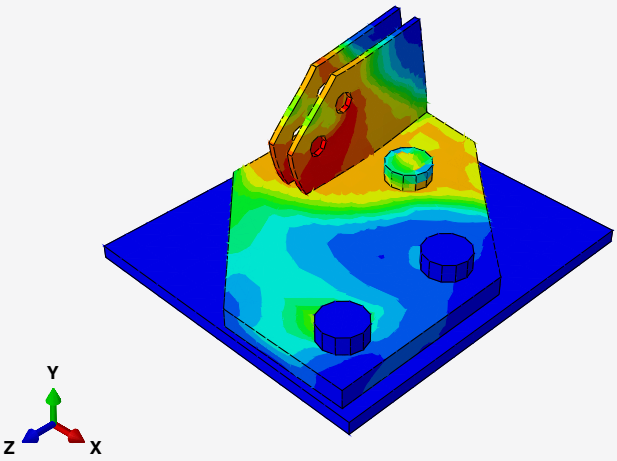


3D deformation in stress contours (von Mises) - α = + 90°

X-PLATE BMAXIR PLATE

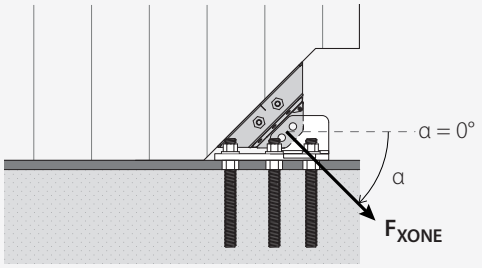


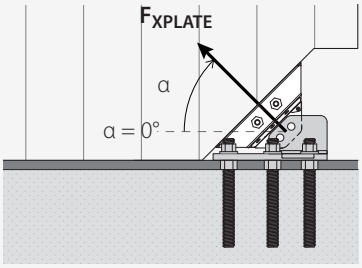
Force-displacement diagram



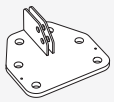
3D deformation in stress contours (von Mises) - α = + 90°

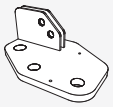
DESIGN RESISTANCES - X-ONE / X-PLATE GROUND ATTACHMENT





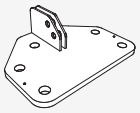
X-PLATE BMINI / BMINIL / BMINIR

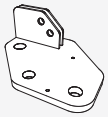




STRESS F	R_d XONE	R_d X-PLATE BMINI				R_d X-PLATE BMINIL / BMINIR			
		UNCRACKED CONCRETE		CRACKED CONCRETE		UNCRACKED CONCRETE		CRACKED CONCRETE	
α [°]	$R_{d,XONE}$ [kN]	chemical anchor No. - Ø x L [mm]	$R_{d,XPLATE}$ [kN]	chemical anchor No. - Ø x L [mm]	$R_{d,XPLATE}$ [kN]	chemical anchor No. - Ø x L [mm]	$R_{d,XPLATE}$ [kN]	chemical anchor No. - Ø x L [mm]	$R_{d,XPLATE}$ [kN]
0°	89.3	6 - M20 x 250 cl. 8.8 h_{ef} = 200 mm	132.4	6 - M20 x 250 cl. 8.8 h_{ef} = 200 mm	132.4	3 - M20 x 250 cl. 8.8 h_{ef} = 200 mm	123.0	3 - M20 x 400 cl. 8.8 h_{ef} = 350 mm	123.0
45°	112.8		140.8		116.0		65.8		73.5
90°	89.3		131.1		114.0		51.5		60.0
135°	77.6		109.1		109.1		62.9		71.4
180°	140.4		142.5		142.5		116.0		122,0

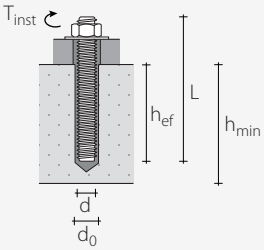
X-PLATE BMAXI / BMAXIL / BMAXIR





STRESS F	R_d XONE	R_d X-PLATE BMAXI				R_d X-PLATE BMAXIL / BMAXIR			
		UNCRACKED CONCRETE		CRACKED CONCRETE		UNCRACKED CONCRETE		CRACKED CONCRETE	
α [°]	$R_{d,XONE}$ [kN]	chemical anchor No. - Ø x L [mm]	$R_{d,XPLATE}$ [kN]	chemical anchor No. - Ø x L [mm]	$R_{d,XPLATE}$ [kN]	chemical anchor No. - Ø x L [mm]	$R_{d,XPLATE}$ [kN]	chemical anchor No. - Ø x L [mm]	$R_{d,XPLATE}$ [kN]
0°	89.3	6 - M20 x 250 cl. 8.8 h_{ef} = 200 mm	132.4	6 - M20 x 250 cl. 8.8 h_{ef} = 200 mm	132.4	3 - M20 x 250 cl. 8.8 h_{ef} = 200 mm	96.0	3 - M20 x 400 cl. 8.8 h_{ef} = 350 mm	96.0
45°	112.8		140.8		114.6		67.9		75.2
90°	89.3		131.1		116.0		54.0		59.0
135°	77.6		109.1		109.1		60.8		65.1
180°	140.4		142.5		142.5		94.0		96.0

ANCHOR INSTALLATION PARAMETERS



ANCHOR TYPE type	d x L [mm]	rod code	steel strength grade	d_0 [mm]	h_{ef} [mm]	h_{min} [mm]	T_{inst} [Nm]	resin quantity [ml/rod]
vinyl ester chemical code 521431	M20 x 250	MGS12088 (1)	8.8	24	200	250	120	60
	M20 x 400			24	350	400	120	100

(1) Rods 1000 mm long to be cut to size and used with a MUT nut and ULS washer (page 43).

GENERAL PRINCIPLES:

- The design values are in compliance with EN 1995:2014 in compliance with ETA-15/0632, in compliance with EN1993-1-8 and in compliance with the product certificates.
- The total resistance of the connection is obtained as follows:

$$R_d = \min \begin{cases} R_{d,XONE} \\ R_{d,XPLATE} \end{cases}$$

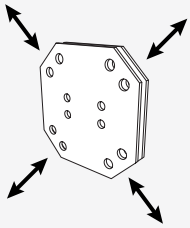
- During calculation a C24 strength class for the CLT panel plates and a C25/30 strength class for the concrete were considered. There must be no annular space between the holes in the plate and the anchor (holes filled).
- Dimensioning and verification of the wooden and concrete elements must be done separately.
- Concrete strength values are valid for the calculation assumptions defined in the table; conditions with different contour conditions (e.g. minimum distances from the edges) must be checked.

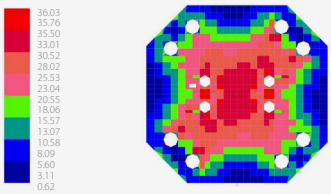
RESISTANCE OF CONNECTIONS IN ELEVATION: X-PLATE MID AND TOP PLATES

The mid-floor nodes are made with X-PLATE MID plates, starting from the MI and MO element plates and ending with the most complex MT and MX plates, natural evolution and combination of the MI and MO plates.
At a structural level:

MI PLATE: shear and traction strength

- the MI plate fully restores the shear and traction strength of the 4 X-ONE connectors converging in the node and is verified for every possible stress combination transmitted by the connectors



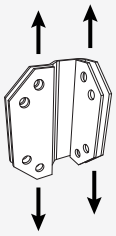


Von Mises stresses - traction and compression at 45°

$R_{MI} > R_{XONE}$

MO, MG, MJ PLATES: traction strength

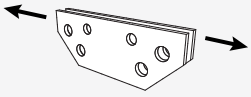
- the MO and MG/MJ plates restore the traction strength (vertical stress at 90°) of each X-ONE connector connected to it



$R_{MO,\ \alpha = 90°} > R_{XONE,\ \alpha = 90°}$

TI PLATES: shear strength

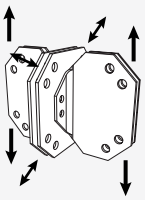
- the TI plate restores the shear strength (horizontal stress at 0°) of each X-ONE connector connected to it

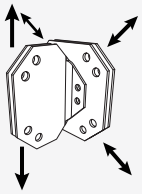


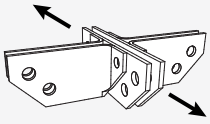
$R_{TI,\ \alpha = 0°} > R_{XONE,\ \alpha = 0°}$

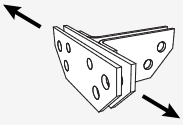
MX, MT, TX, TT PLATES

- the MX, MT, TX and TT plates are the simple composition of the single MI, MO and TI plates, where each plate maintains its original structural performance





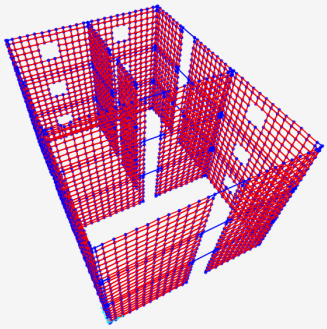




FROM MODELLING TO THE BUILDING SITE

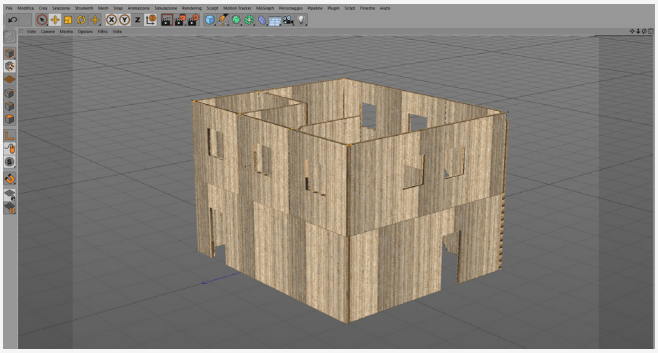
STEP 1

Structural design and verification of the X-ONE connectors and X-PLATE plates (page 32).



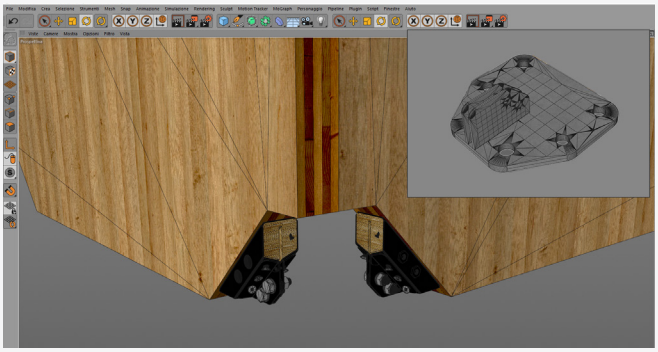
STEP 2

Realisation of the final drawing of the CLT panels forming the structure with 3D CAD/CAM software.



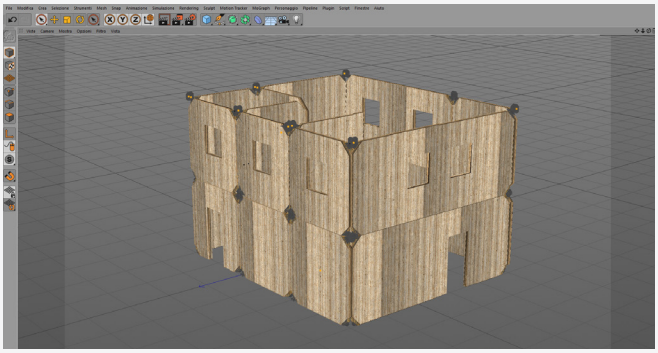
STEP 3

Automatic import of the shear/machining geometry for the X-ONE model and the X-PLATE from the design software database.



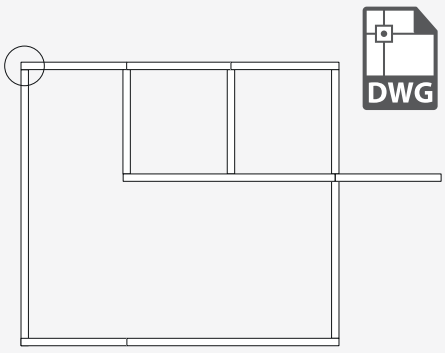
STEP 4

Export of the full list of connections (X-ONE, X-PLATE) from the design software.



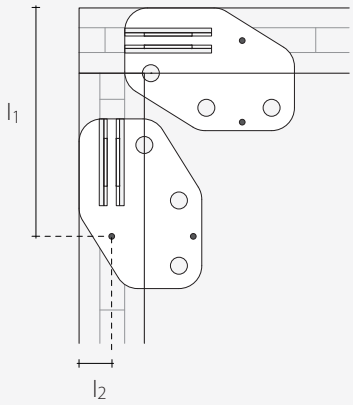
STEP 5

Positioning the X-PLATE BASE plates on the ground floor wall plan using import CAD file on rothoblaas website or using CAD-CAM software database.



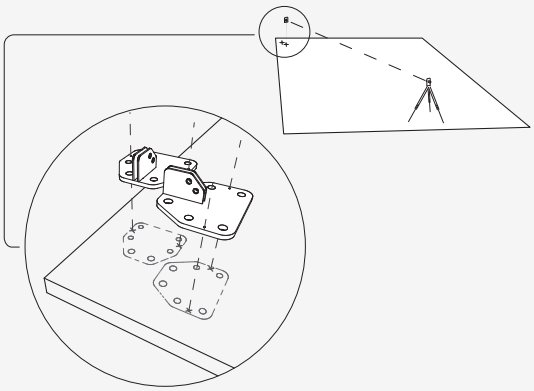
STEP 6

Identification of the X-PLATE plates tracing holes (l_1, l_2) to position the reference points to be traced on site.



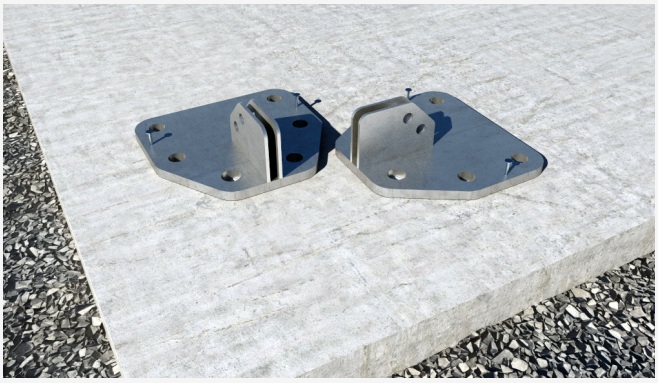
STEP 7

Tracing the positioning holes for the X-PLATE plates on site.



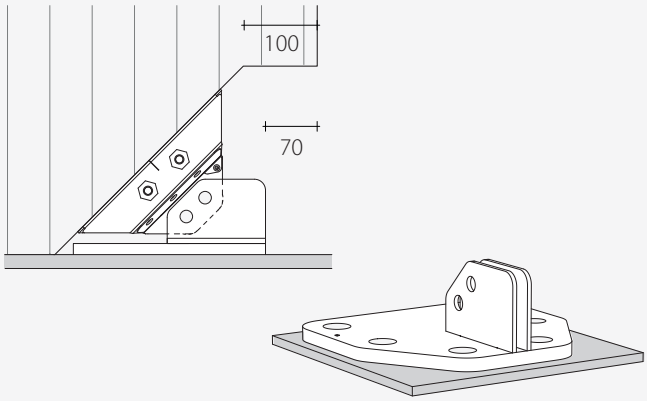
STEP 8

Positioning the X-PLATE plates on the foundation base in reinforced concrete.



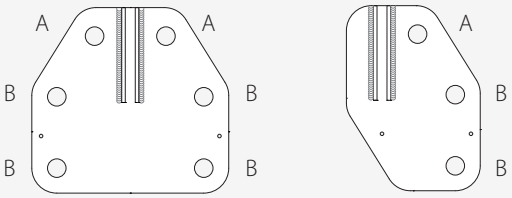
STEP 9

The X-PLATE plates are positioned and levelled to the required height. The CLT panel, with the bottom edge aligned with the intrados of the plate, will continue to support the foundation.



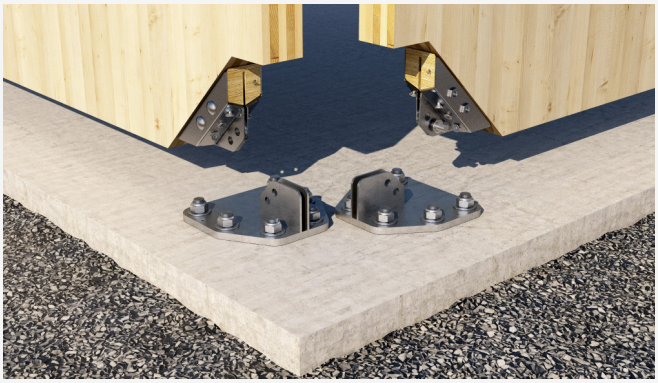
STEP 10

Once the plates have been positioned, the operator will drill a Ø24 mm hole in the reinforced concrete support for the subsequent insertion of the Ø20 mm chemical anchors. The fasteners adjacent to the vertical wings of the plate (A) must be installed before assembling the CLT walls, those furthest away (B) can be installed later. The tolerance between the diameter of the anchor and the hole in the plate, to be filled with structural resin, allows the position of the plate to still be adjusted.



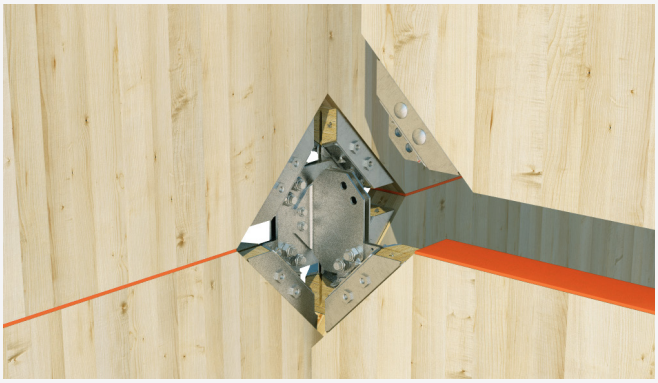
STEP 11

Positioning the base walls: X-ONE housing in the X-PLATE plates and connection with bolts, nuts and washers.



STEP 12

Positioning the mid-floor walls and roof: X-ONE housing in the X-PLATE plates and connection with bolts, nuts and washers.

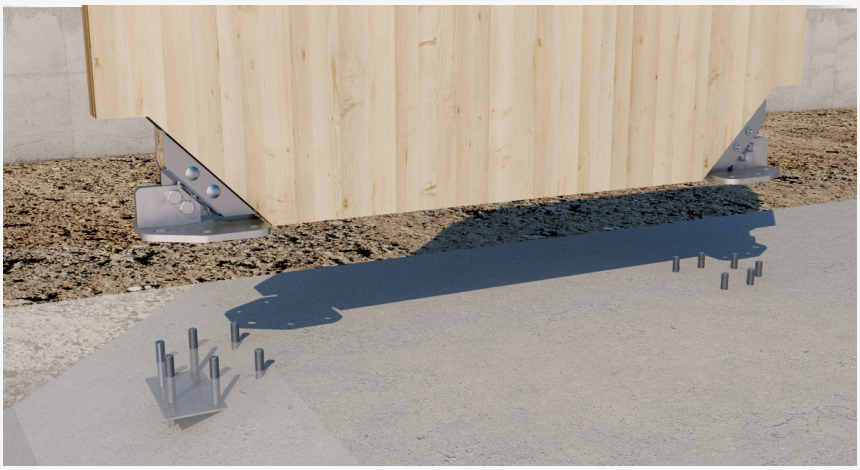


NOTE: Video showing assemble of the system is available on www.rothoblaas.com.

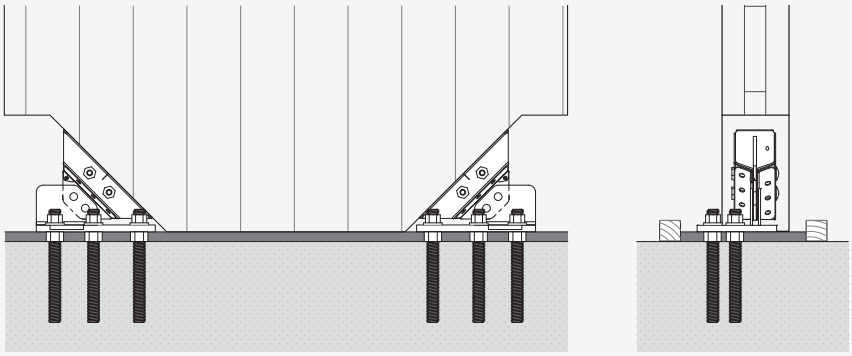
ALTERNATIVE GROUND ATTACHMENT SOLUTIONS

PRE-INSTALLED X-PLATE PLATES AND PRE-CAST ANCHORS

Maximum assembling and prefabrication speed using tracing and installation of pre-cast anchors in the foundation slab casting and subsequent assembly of the CLT walls with the X-PLATE plates already fitted to the X-ONE connectors. In this case, it is recommended to use counter-plates or templates embedded in the cast in order to correctly position the anchor bars.

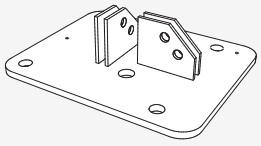


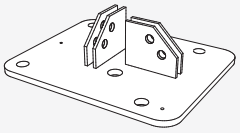
To ensure perfect levelling, correct transmission of the vertical loads and protection from moisture rising from the foundation plane, it is advisable to space the CLT walls and the X-PLATE plates by a few centimetres and then to cast by filling with expansive structural cement mortar with a high degree of impermeability.

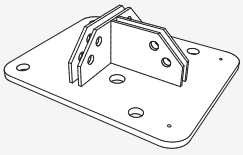


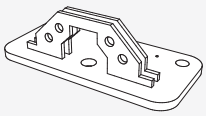
NON-STANDARD X-PLATE PLATES

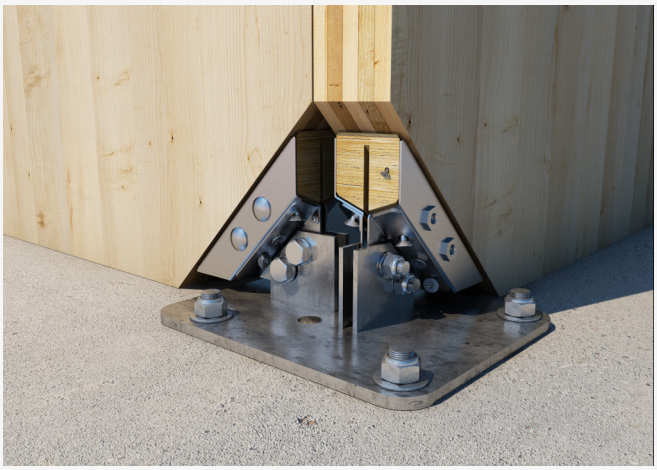
If X-PLATE plates are required with geometries (see examples below) and capacities that are not standard, contact the Rothoblaas Technical Office.





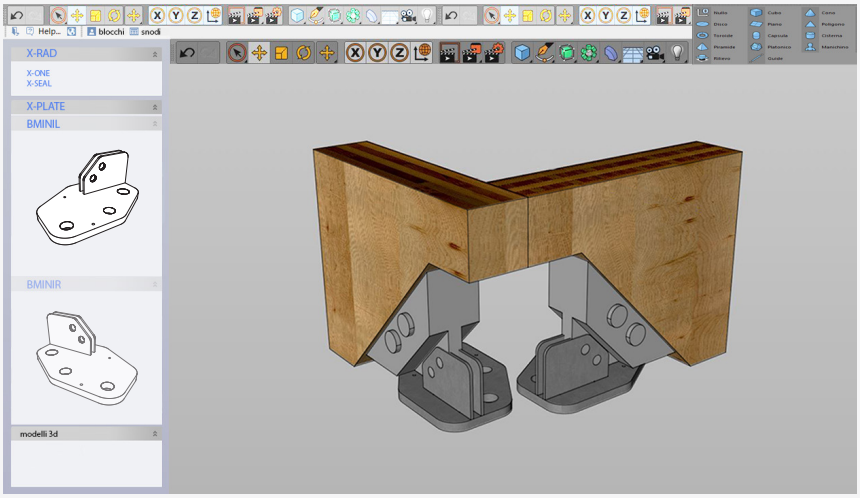






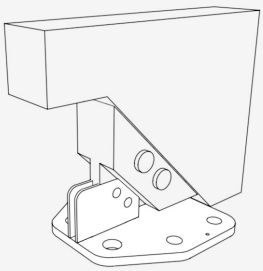
CAD/CAM CONSTRUCTION DESIGN

Using the most common CAD/CAM 3D software, it is possible to automatically define the machining geometry required on the CLT panels and to automatically insert the X-RAD system into the structure model. It is therefore immediately possible to preview the overall dimension of X-ONE and X-PLATE, the correct positioning and the components' list and calculation.

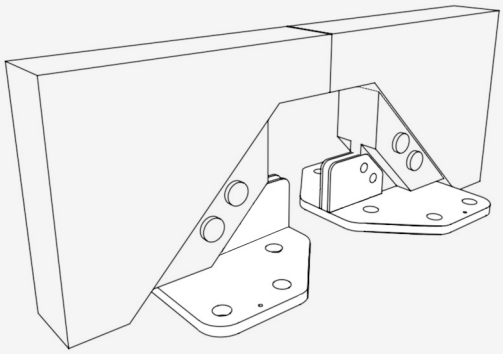


BASE NODES

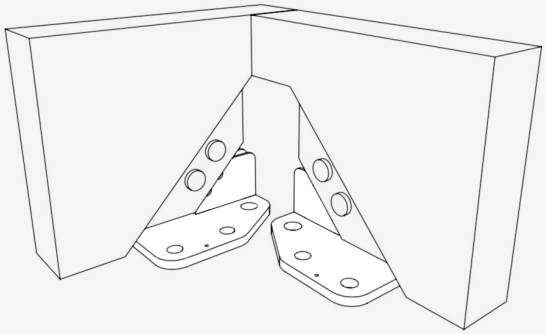
BMINI („O" NODE)



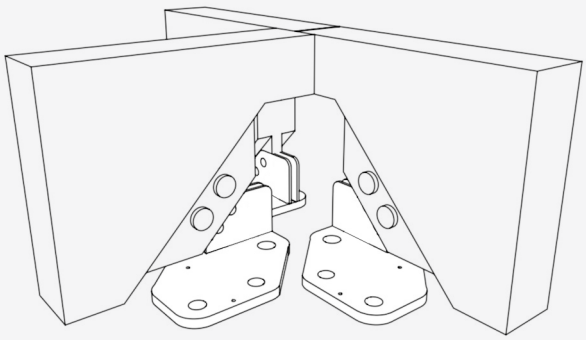
BMAXI („I" NODE)



BMINIL/R („J" NODE)

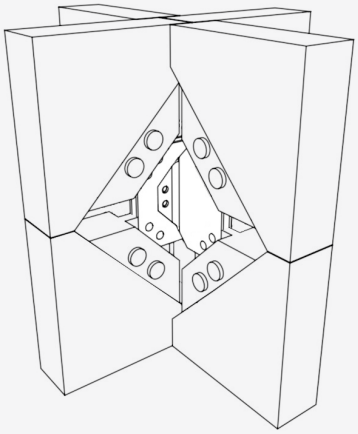


BMAXIL/R („T" NODE)

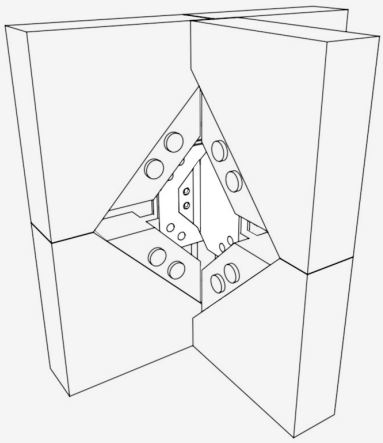


MID NODES

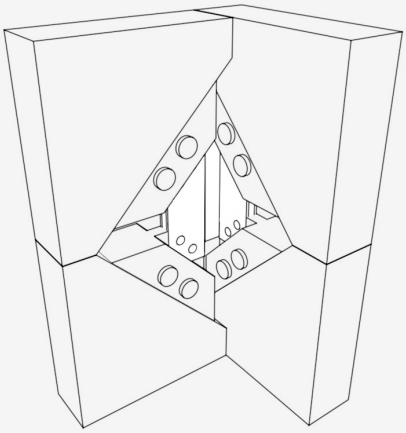
MX100



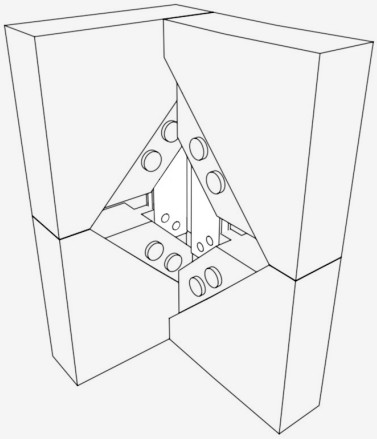
MT100



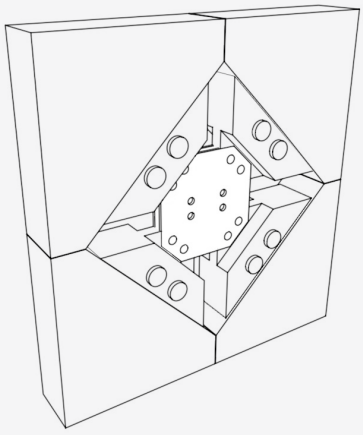
MG100



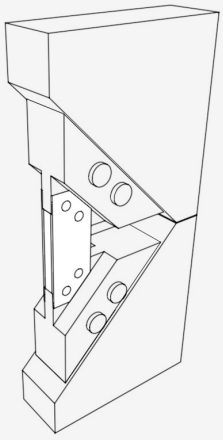
MJ100



MI100

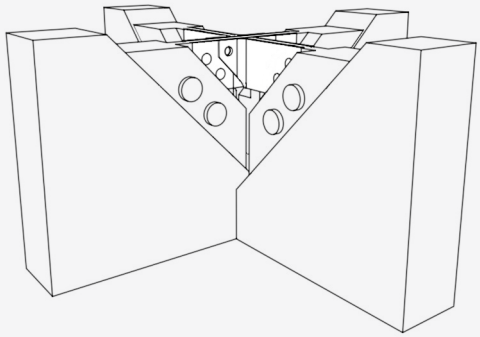


MO100

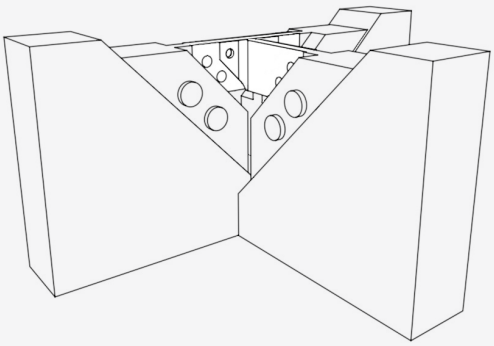


TOP NODES

TX100



TT100



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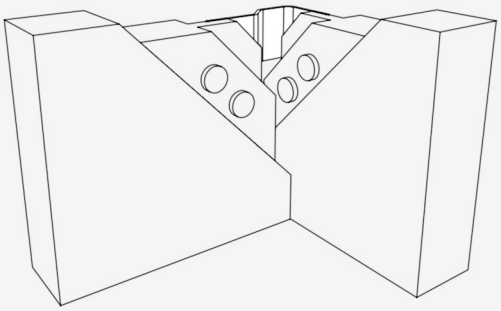

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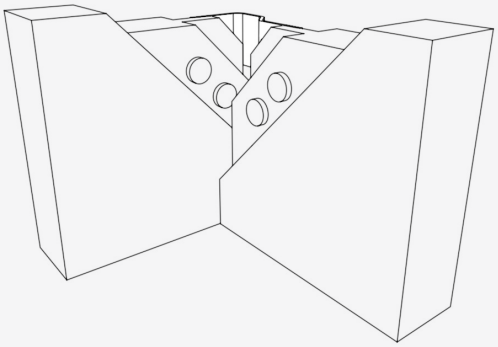

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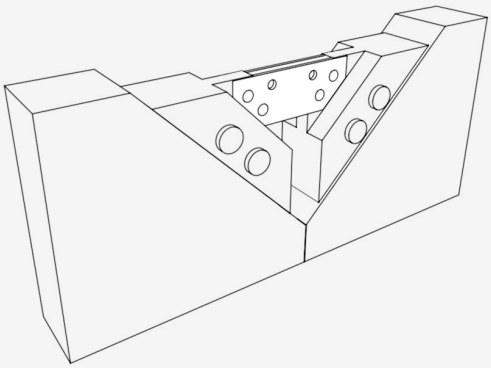
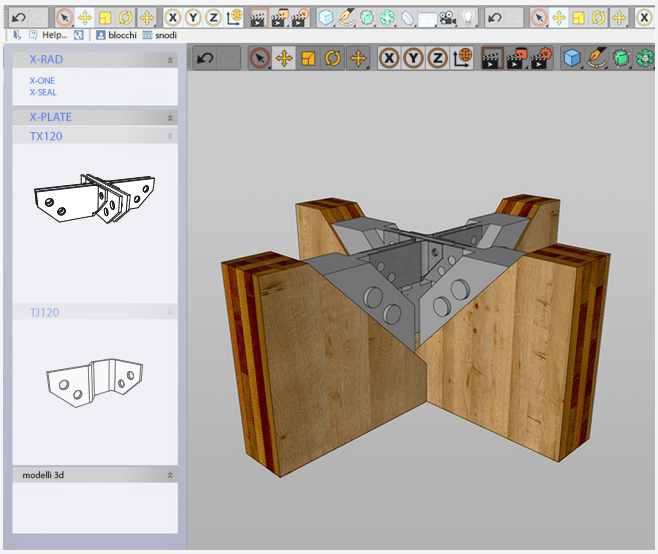
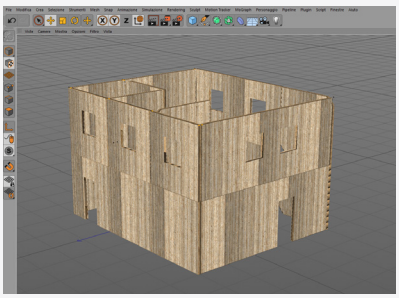


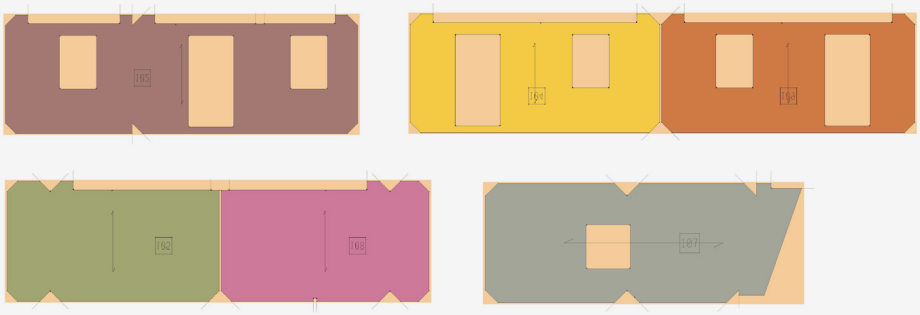


FROM THE PRODUCTION DRAWING TO PROCESSING CLT PANELS

STEP 1: SOFTWARE MODEL



STEP 2: NESTING PHASE



Optimisation of the raw panel, on which all of the machining processes required for openings, slab housing and insertion of X-ONE connectors have been identified.

STEP 3: MACHINING WITH CNC MACHINES

Cutting operations with circular saw and candle cutter to create the geometry required for positioning the X-ONE.

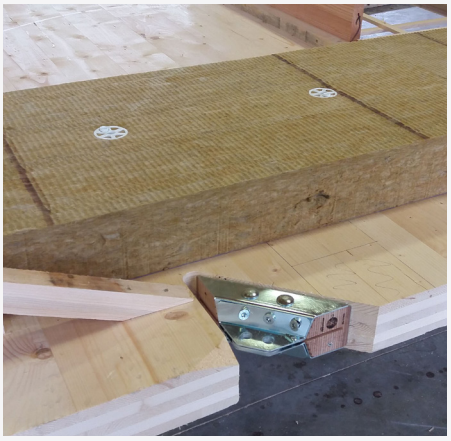
STEP 4: CLT PANEL AFTER THE CUTTING AND MACHINING OPERATIONS

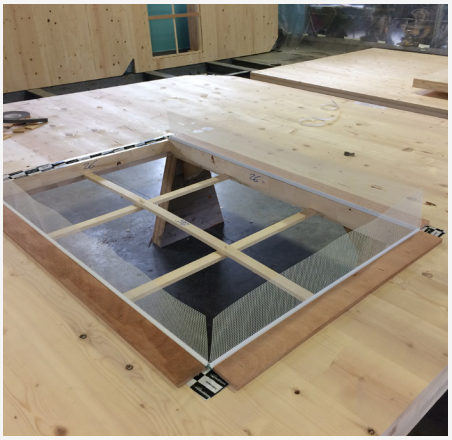
fig. 1

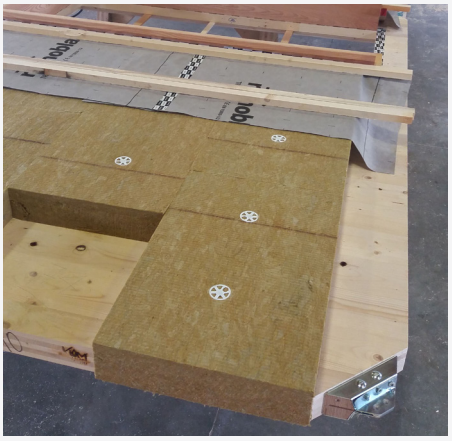
fig. 2

Examples of finished machining with detail on the inclined cut for assembling 1 X-ONE connector (fig. 1) and on the whole panel with cuts on the corners and housing for insertion of the slab (fig. 2).

POSSIBILITY OF ADVANCED PREFABRICATION IN THE FACTORY




EXAMPLES OF CONSTRUCTION DETAILS CREATED

The X-RAD system is extremely flexible, providing a wide range of design solutions and adapting to complex and articulate structural configurations.

Connection of slab panels for the creation of rigid planes

Single machining for insertion of single X-ONE connector

Difference in height overcome with disjointed panels and double X-ONE connector

Vertical rigid connection between the front walls for the creation of a single monolithic wall

Continuous support of roof panels without specific machining on the vertical walls

Examples of machining and arrangement of the X-ONE connector at ground, slab and roof nodes