OK
STATIKA

STATICKÝ VÝPOČET

Investor	Silnice LK a.s.
Objednatel	O+R Montáže, s.r.o.
Název zakázky	Konstrukce přístřešku Ocelová konstrukce
Zhotovitel	**OCELOVÉ KONSTRUKCE - STATIKA s.r.o.** Pohraniční 504/27 703 00 Ostrava Vítkovice
Vypracoval	Ing. Ernest Ježowicz
Kontroloval	Ing. Petr Kubánek
Číslo zakázky	OKST - 21099
Stupeň	TP
Datum	25.01.22

OBSAH

01/2022

Vypracoval :

Ing. Ježowicz

1. ÚVOD

Účelem statického výpočtu je posoudit ocelovou konstrukci samostatně stojícího přístřešku nad nádržemi s PHM, který bude umístěn na území města Liberec a Jablonec nad Nisou.

2. PODKLADY

Podkladem pro zpracování statického výpočtu jsou :

[1] Schéma geometrie přístřešku (**O+R Montaže, s.r.o.,** , *J. Rozsypal, 11/2021).*

Projekt je zpracován v souladu s *ČSN EN 1991 – ČSN EN 1991 – Zatížení konstrukcí, část 1-1: obecná zatížení, část 1-3: zatížení sněhem, část 1-4" zatížení větrem, ČSN EN 1993 – Navrhování ocelových konstrukcí, část 1-1: obecná pravidla.*

3. VÝPOČET

Výpočet prvků jednotlivých částí nosné ocelové konstrukce je proveden programem *SCIA ENGINEER 2021* jako prostorový model. Pro posuzování jednotlivých prutových prvků OK byl použit modul „Posouzení ocel (EC3)". Návrh hlavních, montážních přípojů je proveden programem IDEA Statika 21. Návrh přístřešku je proveden pro zatížení sněhem, které odpovídá sněhové oblasti VII (Jablonec n. Nisou) s charakteristickou hodnotou zatížení s_k=4.0 kN/m^2. **V případě umístění přístřešku ve sněhové oblasti VIII (s_k>4.0 kN/m^2) je nutno uvědomit o této skutečnosti zpracovatele statického výpočtu.**

4. KONSTRUKČNÍ ŘEŠENÍ

Konstrukce přístřešku má půdorysnou osnovu sloupů 3.5 x 4 m. Jedná se o otevřenou konstrukci s pultovou střechou ve sklonu 9°. Průjezdná výška v příčném směru je 4.06 m a v podélném směru 4.98 m. Nosný systém přístřešku je navržen jako rámová konstrukce s vetknutými sloupy a skládá se z jednoho podélného rámu (rám A) a dvou příčných rámů (rámy B). Příčné rámy jsou propojené příčli, rámem A a vaznicemi v rovině střechy.

Prostorovou tuhost konstrukce jako celku zajišťuje střešní ztužidlo. Ocelová konstrukce je navržena z oceli řady S235.

Střecha přístřešku je z trapézového plechu výšky 40 mm, který je ukotven k vaznicím v každé vlně.

Montážní přípoje

Konstrukce přístřešku je navržena jako šroubovaná. Přípoje mezi sloupy a příčlemi rámů jsou navržené jako rámové, šroubované přípoje Svařované montážní přípoje je možno použít pouze po konzultaci s projektantem OK.

Šroubované přípoje:

- minimální vzdálenosti a rozteče šroubů jsou provedeny dle *ČSN EN 1993-1-8 - Navrhování ocelových konstrukcí - navrhování styčníků*
- Šrouby pro momentové přípoje jsou navrženy z materiálu 10.9, pro ostatní přípoje z materiálu 8.8. Všechny spojovací prostředky jsou navrženy jako pozinkované.

Čelní desky rámových a momentových spojů musí být kontrolovány proti zdvojení materiálu ultrazvukem.

Svařované přípoje:

- Všechny dílenské svary jsou provedeny na plnou únosnost
- Svarové úkosy jsou provedeny dle *ČSN EN 29692 – Příprava svarových ploch pro svařování oceli.*
- V případě použití tupých svarů čelních desek momentových přípojů nutno prokázat klasifikační stupeň UT SP2 dle ČSN EN ISO 11666. U koutových svarů čelních desek momentových přípojů nutno prokázat klasifikační stupeň PT SP2 dle ČSN EN ISO 23 277.

Kotvení

Sloupy přístřešku jsou ukotveny do betonové desky pomoci chemických šroubů.

Ochrana proti korozi

Pro OK je stanoven stupeň korozní agresivity C4. V souladu s normou ISO 12944 je navržena protikorozní ochrana žárovým pozinkováním.

Uzemnění OK

Vodivé propojení sloupů od úrovně podlahy až po střechu objektu. Propojení musí být provedeno Fe materiálem sloupů průřezu minimálně 150 mm2 v každém ze sloupů. Uzemnění se bude napojovat v místě nad patou sloupu.

ZATÍŽENÍ

1. STÁLÉ

1.1 Vlastní hmotnost konstrukce ..... generována z průřezových ploch prvků

1.2 Střecha

Trapézový plech h=40 mm, (10kg/m²)..... 0.10

$q_{3NP,k}$= 0.10 kN/m²

Součinitel zatížení γ_f=1.35

2. PROMĚNLIVÉ

2.1 Sníh

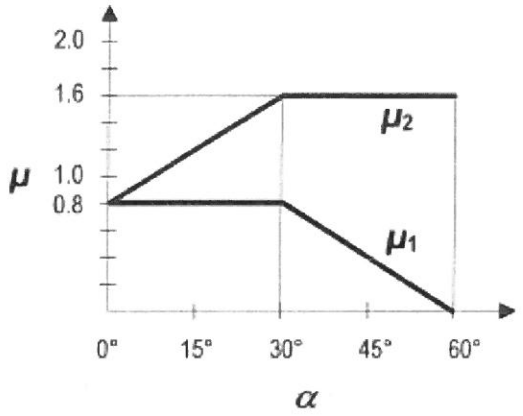
sněhová oblast VII (Jablonec n. Nisou) ..... s_k=4.0 kN/m^2

tepelný součinitel ..... C_t=1.0

součinitel expozice ..... C_e=1.0

tvarový součinitel μ

ČSN EN 1991-1-3



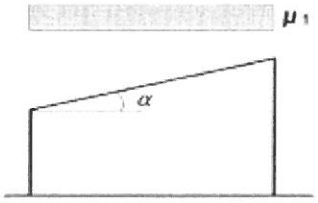
Obrázek 5.1 – Tvarové součinitele zatížení sněhem

(2) Hodnoty uvedené v tabulce 5.2 platí, pokud není zabráněno sklouzávání sněhu ze střechy. Pokud jsou na střeše sněžníky nebo jiné překážky nebo je dolní okraj střechy ukončen atikou (nadezdívkou), potom hodnota tvarového součinitele zatížení sněhem nemá klesnout pod 0,8.

Tabulka 5.2 – Tvarové součinitele zatížení sněhem

úhel sklonu střechy α	$0° \le \alpha \le 30°$	$30° < \alpha < 60°$	$\alpha \ge 60°$
μ_1	0,8	0,8(60 - α)/30	0,0
μ_2	0,8 + 0,8α/30	1,6	–

(3) Uspořádání zatížení podle obrázku 5.2 se má použít pro zatížení nenavátým i navátým sněhem.



Obrázek 5.2 – Tvarový součinitel zatížení sněhem – pultová střecha

α=3° - > μ_1=0.8,

$s_{1,k} = s_k \cdot C_t \cdot C_e \cdot \mu_1 = 4 \cdot 1 \cdot 1 \cdot 0.8 = 3.2$ kN/m^2

VÝPOČET ZATÍŽENÍ VĚTREM PODLE ČTN EN 1991-1-4

Větrová oblast

II	místo:	Ostrava	odečteno z mapy větrových oblastí ČR	
$v_{b,0}$ = **25**	m/s		výchozí základní rychlost větru	

Základní rychlost větru

$v_b = v_{b,0}.c_{dir}.c_{season}$ =	**25**	m/s	základní rychlost větru	4.2 (4.1)
c_{dir} = 1			součinitel směru větru	NA.2.6.
c_{season} = 1			součinitel ročního období	NA.2.7.

Kategorie terénu

III				Příloha A.1
z_0 =	0,3	m		tab.4.1
z_{min} =	5,00	m		tab.4.1
z_{max} =	200	m		
z_{e1} =	5,50	m	referenční výška	7.2.2 (1)
z_{e2} =	4	m		

Součinitel terénu

$k_r = 0,19.(z_0/z_{0,II})^{0,07}$ =	0,215	součinitel terénu	4.3.2 (4.5)
$z_{0,II}$ =	0,05	kat. terénu II	tab.4.1

Součinitel drsnosti terénu

$c_r(z_{e1}) = k_r.\ln(z/z_0)$ =	0,627	4.3.2 (4.4)
$c_r(z_{e2}) = k_r.\ln(z/z_0)$ =	0,558	

Součinitel orografie

$c_0(z)$ = 1	4.3.1.

Střední rychlost větru

$v_m(z_{e1}) = c_r(z).c_0(z).v_b$ =	15,66 ms^{-1}	4.3.1 (4.3)
$v_m(z_{e2}) = c_r(z).c_0(z).v_b$ =	13,95 ms^{-1}	

Intenzita turbulence

$I_v(z_{e1}) = k_I/c_0(z).\ln(z/z_0)$ =	0,344	k_I = 1	součinitel turbulence	4.4 (4.7)
$I_v(z_{e2}) = k_I/c_0(z).\ln(z/z_0)$ =	0,386			

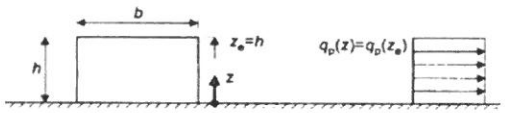
Maximální dynamický tlak větru

$q_p(z_{e1}) = [1+7I_v(z)].0.5\rho.v_m(z)^2$ =	**522** Nm^{-2}	=	**0,522** kNm^{-2}	4.4 (4.8)
$q_p(z_{e2}) = [1+7I_v(z)].0.5\rho.v_m(z)^2$ =	**450** Nm^{-2}	=	**0,45** kNm^{-2}	

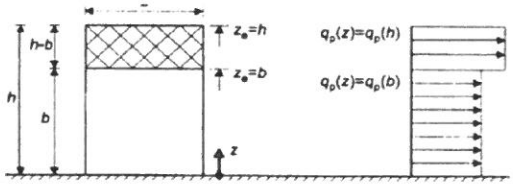
Rozměry objektu

h =	5,50 m	výška stavby
b =	4,00 m	rozměr kolmo na hřeben - délka štítu
l =	6,00 m	rozměr rovnoběžně s hřebenem
l_1=	3,50 m	vzdálenost rámů
l_2=	4,00 m	vzdálenost štítových sloupů
l_3=	1,50 m	vzdálenost vaznic

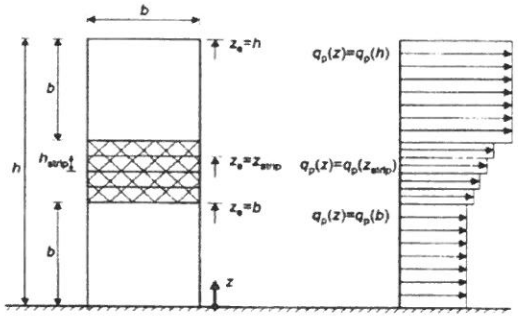
(1)		výška	průběh	
z_{e1} =	5,5 m	0 až h	konst.	h < b



(2)				
z_{e1} = h	5,5 m	b až h	konst.	b < h <2 b
z_{e2} = b	4 m	0 až b	konst.	



(3)				
z_{e1} = h	5,5 m	(h - b) a	konst.	
z_{es} = h	m	b až (h ·	lin.	h > 2b
z_{e2} = b	4 m	0 až b	konst.	



PLATÍ 2.PŘÍPAD

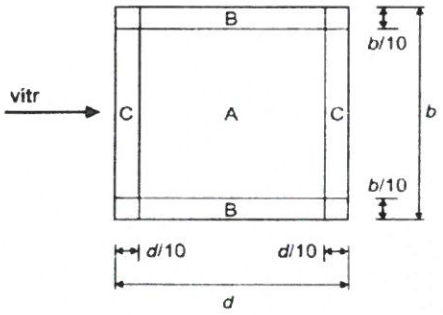
$q_p(h)$ = **0,52 kNm^{-2}**

Typ přístřešku: uzavřený na 1 straně

Půdorysné rozměry
d = 4 m
b = 6 m hřeben

tab.7.6
Součinitele výsledného tlaku - pro návrh střešních prvků - lokální

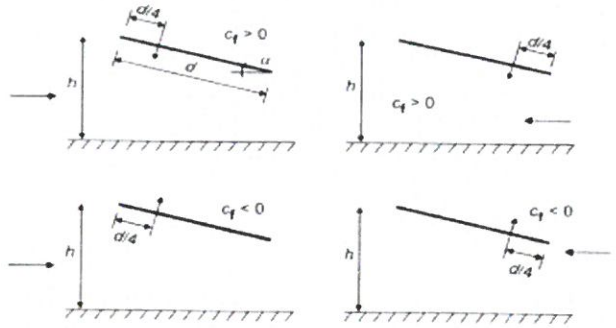
Sklon [°]	Oblast	A		B		C	
9	$c_{p,net}$	1,12	-1,98	2,34	-2,52	1,54	-2,66
	$w_e(z_e)$	**0,58**	**-1,03**	**1,22**	**-1,32**	**0,80**	**-1,39**



Celková výslednice - pro návrh nosných prvků (sloupy)

C_f ... součinitel celk. síly	0,48	-1,40
$w=C_f q_p(h)$... na celé ploše	0,25	-0,73
$w=2C_f q_p(h)$... na polovině	**0,50**	**-1,46**

...na polovině plochy přístřešku u návětrné strany



Obdélníkové průřezy 7.VI

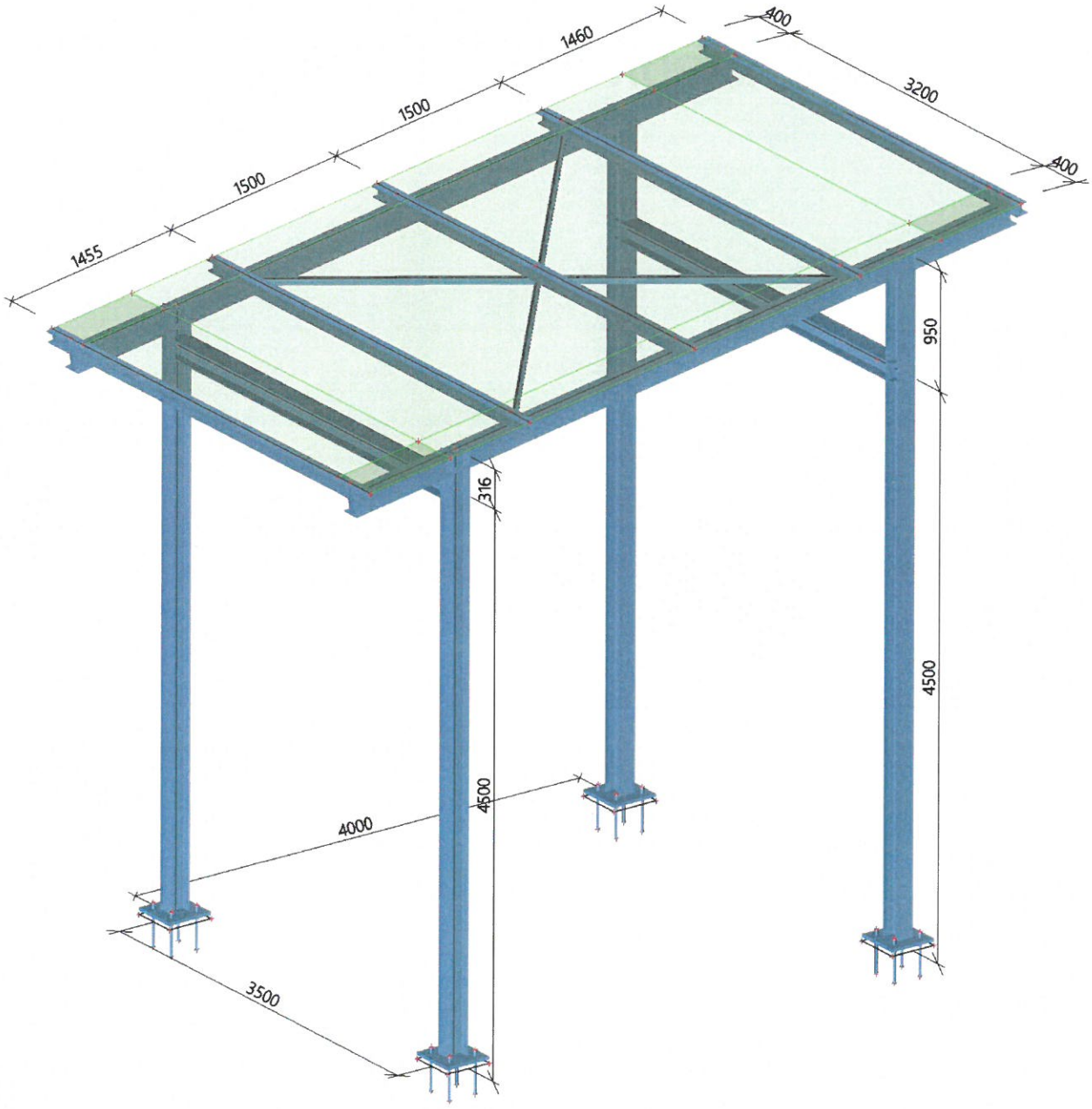
$q_p(h)$ =	0,52 kNm^{-2}			
b =	100 mm	Šířka profilu vystavená větru	d/b =	1,70
d =	170 mm			
c_f =	2	Součinitel síly		
w =	0,10 kNm^{-1}	Liniové zatížení na profil		

Otevřené průřezy 7.VII

$q_p(h)$ =	0,52 kNm^{-2}	
b =	170 mm	Šířka profilu vystavená větru
c_f =	2	Součinitel síly
w =	0,18 kNm^{-1}	Liniové zatížení na profil

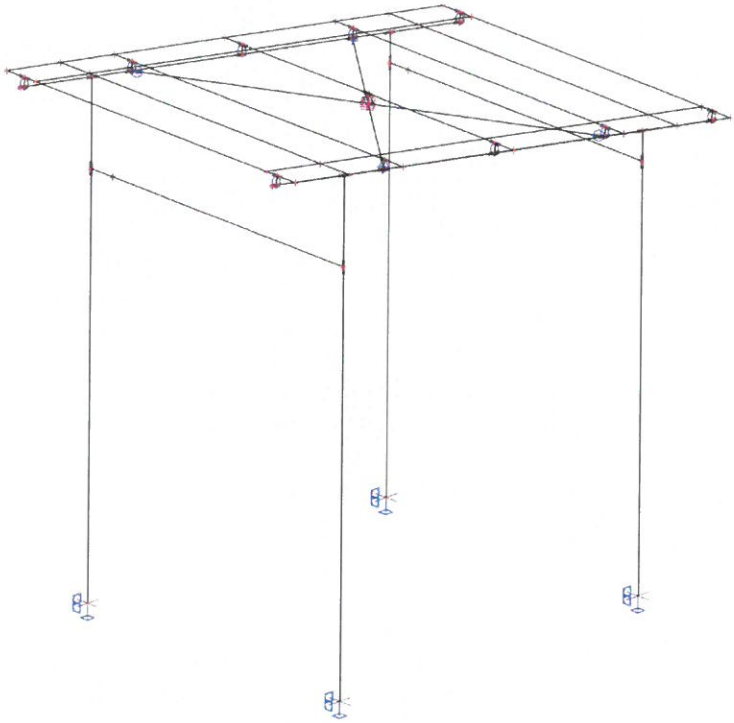
KONSTRUKCE PŘÍSTŘEŠKU

3D MODEL OF STRUCTURE

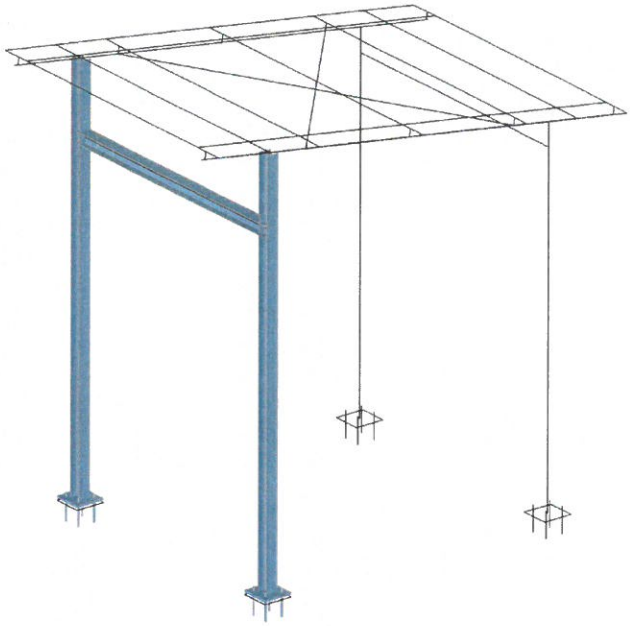


3D MODEL OF STRUCTURE

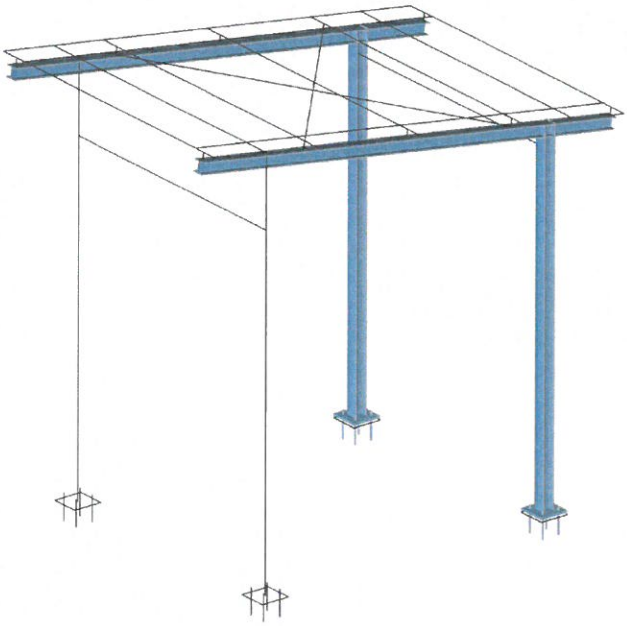
Structural model



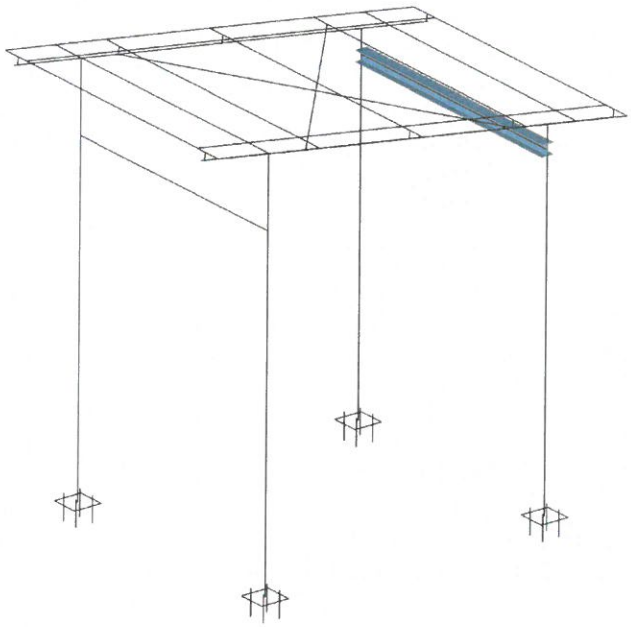
FRAME A



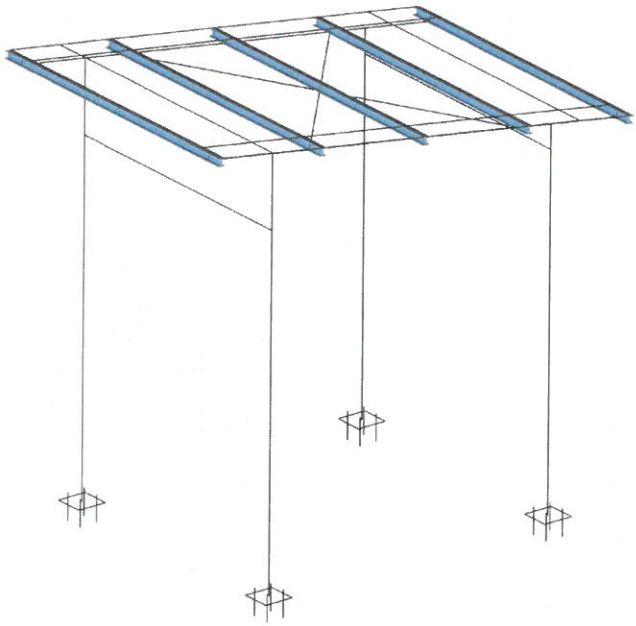
FRAMES B



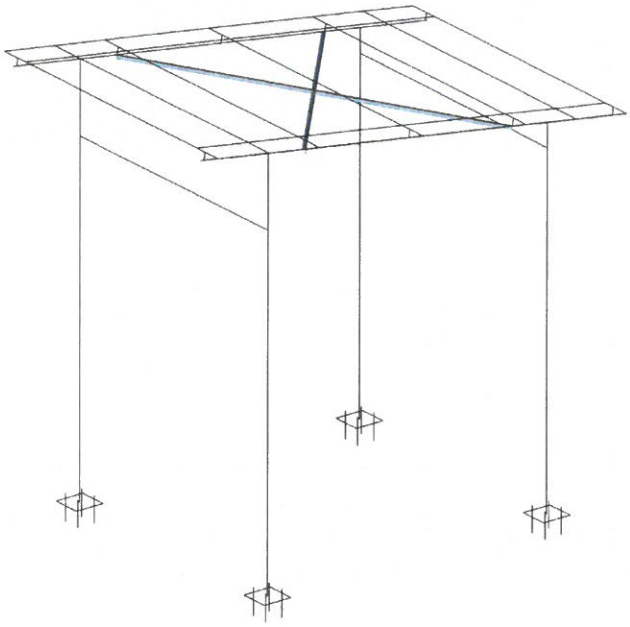
GIRDER



PURLINS



BRACING



Project

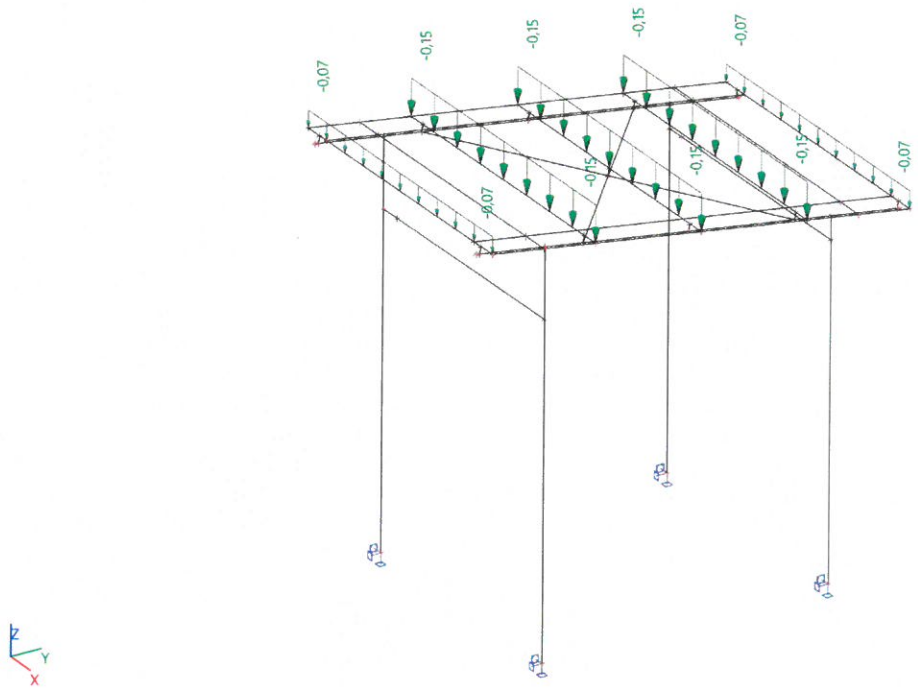
Version	SCIA Engineer 21.1.0023
Licence number	671245
Project	O+R Montáže
Part	Přístřešek
Description	Ocelová konstrukce (TP)
Author	Ing. Ernest Ježowicz
Date	21. 10. 2021
Structure	General XYZ
No. of nodes :	126
No. of beams :	43
No. of slabs :	4
No. of solids :	0
No. of used profiles :	5
No. of load cases :	9
No. of used materials :	1
Acceleration of gravity [m/s^2]	9,810
National code	EC - EN

Load cases

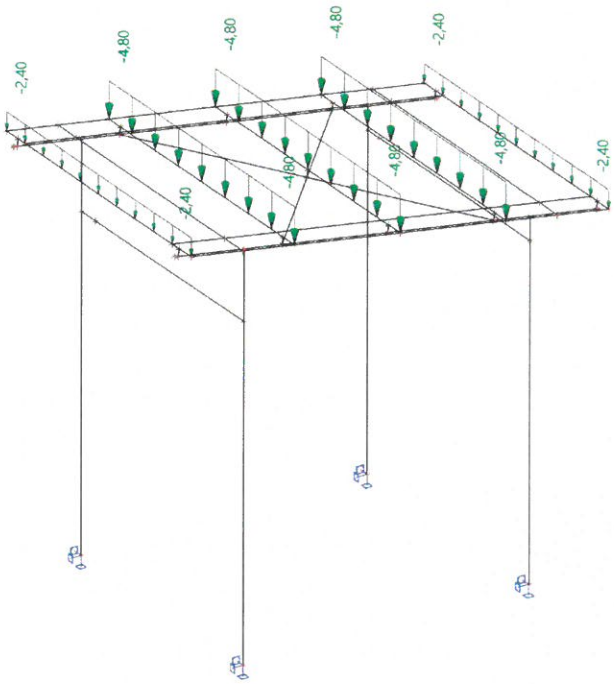
Name	Description Spec	Action type Load type	Load group	Direction	Duration	Master load case
LC1	Self weight	Permanent Self weight	LG1	-Z		
LC2	dead load	Permanent Standard	LG1			
LC3	snow (i) Standard	Variable Static	snow		Medium	None
LC4	wind +X Standard	Variable Static	wind		Short	None

Name	Description Spec	Action type Load type	Load group	Direction	Duration	Master load case
LC5	wind -X Standard	Variable Static	wind		Short	None
LC6	wind +Y up Standard	Variable Static	wind		Short	None
LC7	wind +Y down Standard	Variable Static	wind		Short	None
LC8	wind -Y up Standard	Variable Static	wind		Short	None
LC9	wind -Y down Standard	Variable Static	wind		Short	None

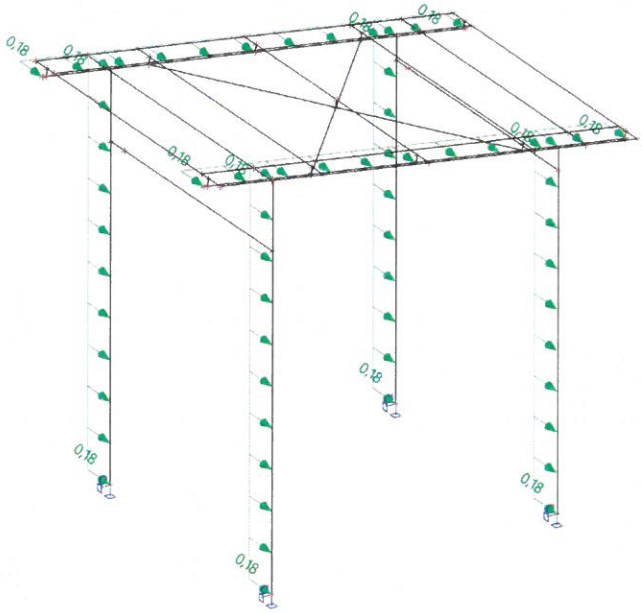
LC2 / Tot. value



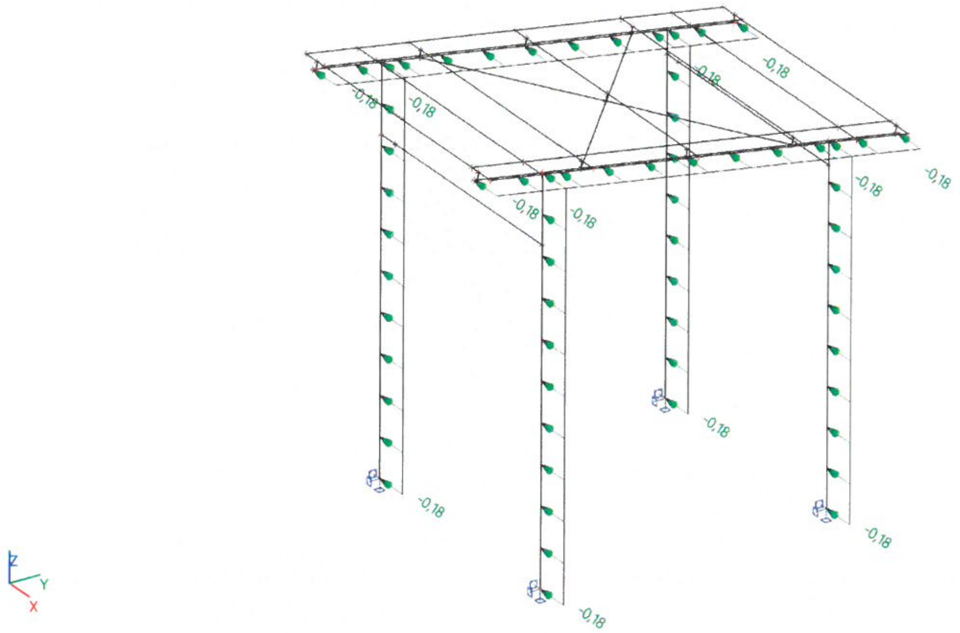
LC3 / Tot. value



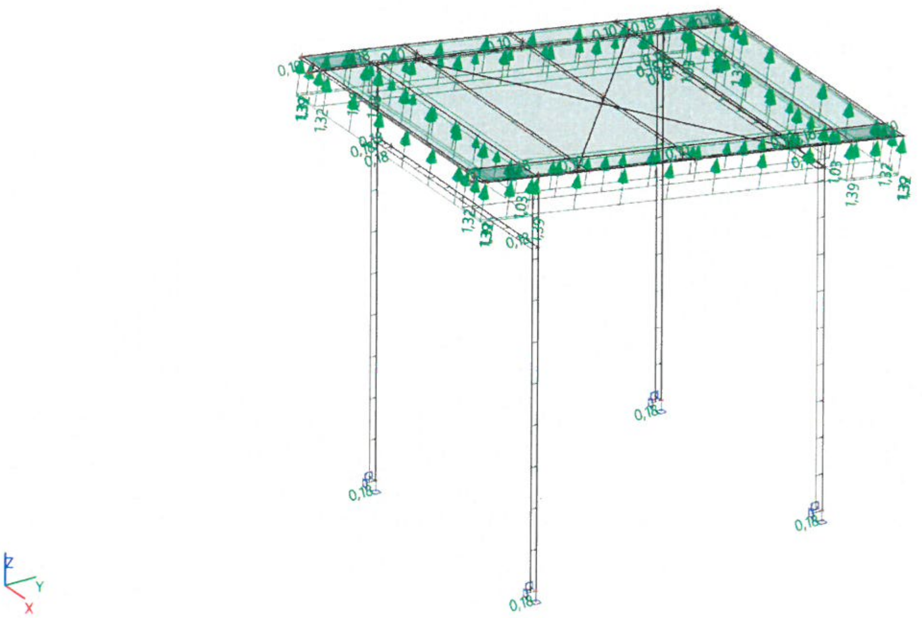
LC4 / Tot. value



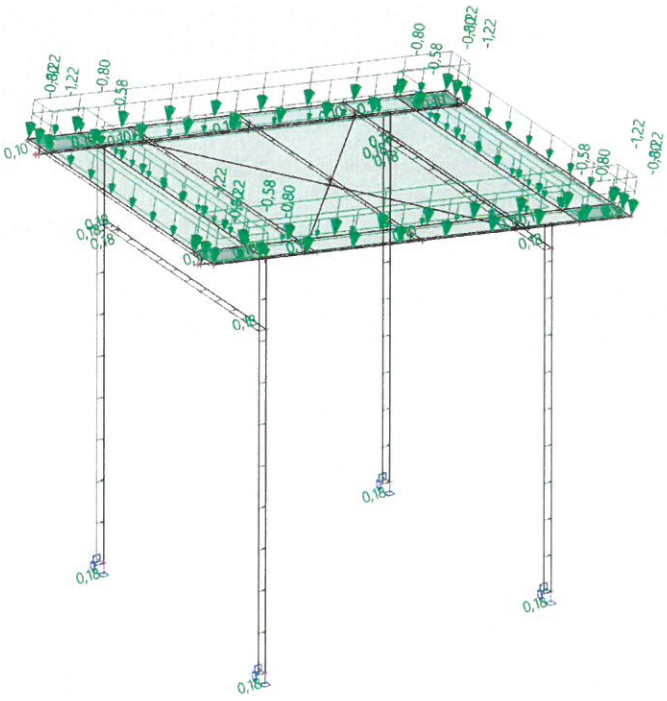
LC5 / Tot. value



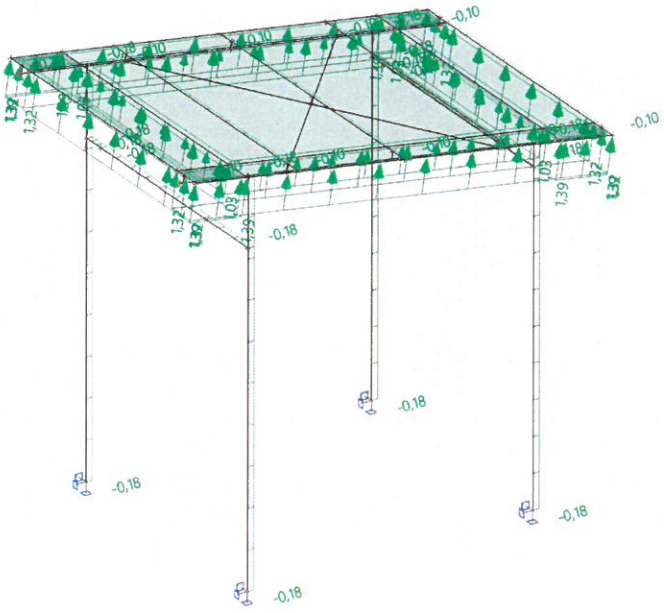
LC6 / Tot. value



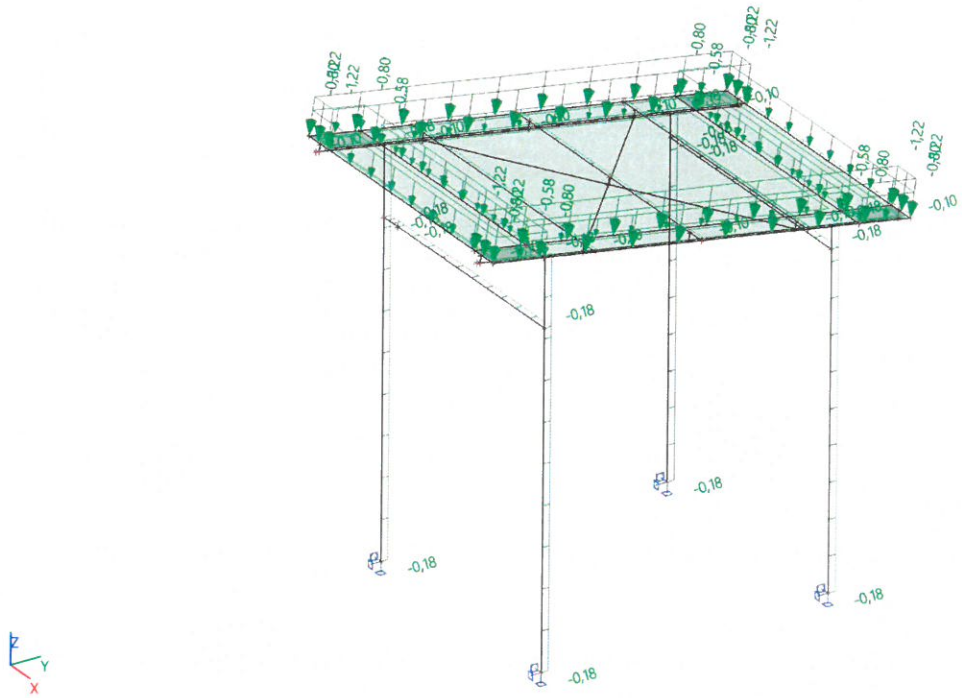
LC7 / Tot. value



LC8 / Tot. value



LC9 / Tot. value



Load groups

Name	Load	Relation	Type
LG1	Permanent		
snow	Variable	Exclusive	Snow
wind	Variable	Exclusive	Wind

Combinations

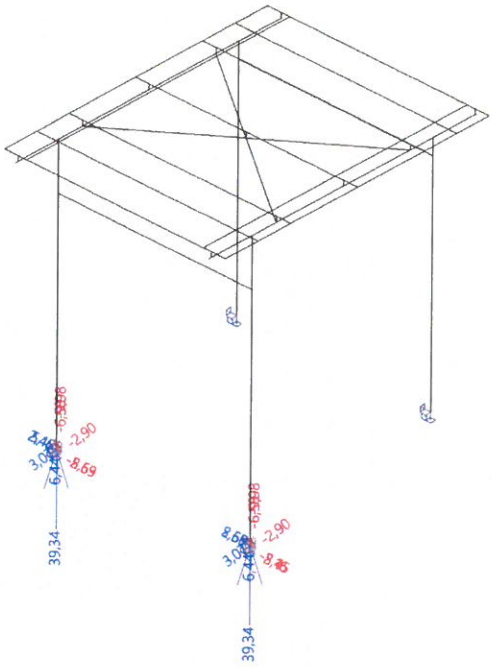
Name	Description	Type	Load cases	Coeff. [-]
ULS-Set B (auto)		EN-ULS (STR/GEO) Set B	LC1 - Self weight	1,000
			LC2 - dead load	1,000
			LC3 - snow (i)	1,000
			LC4 - wind +X	1,000
			LC5 - wind -X	1,000
			LC6 - wind +Y up	1,000
			LC7 - wind +Y down	1,000
			LC8 - wind -Y up	1,000
			LC9 - wind -Y down	1,000
SLS-Char (auto)		EN-SLS Characteristic	LC1 - Self weight	1,000
			LC2 - dead load	1,000
			LC3 - snow (i)	1,000
			LC4 - wind +X	1,000
			LC5 - wind -X	1,000
			LC6 - wind +Y up	1,000
			LC7 - wind +Y down	1,000
			LC8 - wind -Y up	1,000
			LC9 - wind -Y down	1,000

REAKCE

REACTIONS

R1 - Reactions; R_x; R_y; R_z; M_x; M_y

Values: R_x, R_y, R_z, M_x, M_y
Linear calculation
Combination: ULS-Set B (auto)
System: Global
Extreme: Member
Selection: Named selection - R1



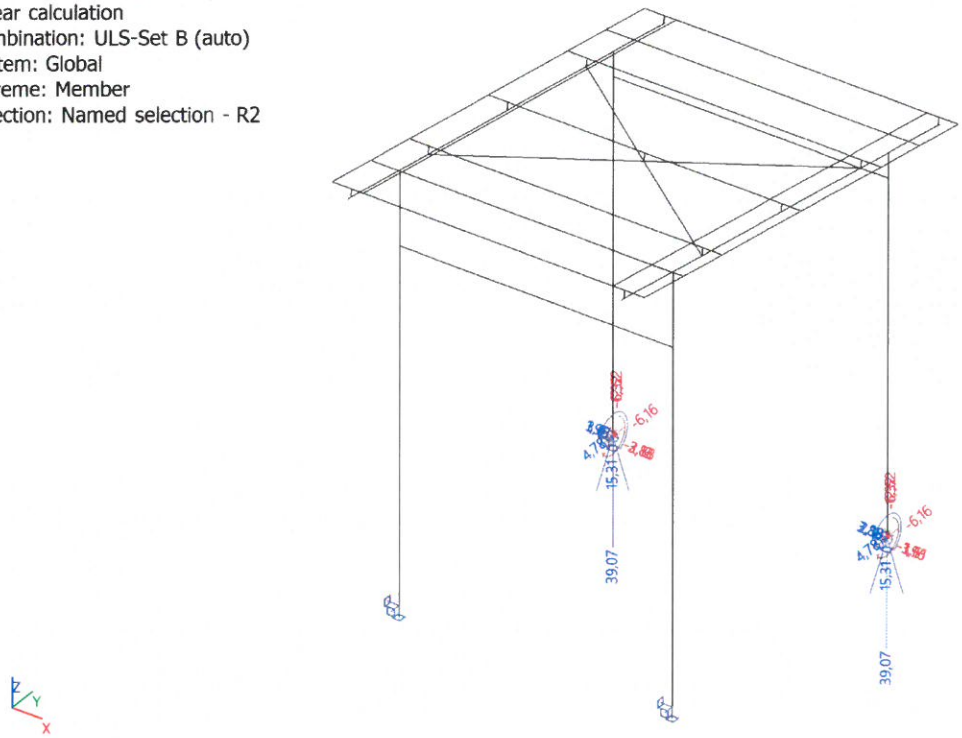
Reactions

Linear calculation
Combination: ULS-Set B (auto)
System: Global
Extreme: Global
Selection: Named selection - R1
Nodal reactions

Name	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
Sn1/N1	ULS-Set B (auto)/1	0,18	**-2,90**	**-9,98**	**6,44**	0,27	0,00
Sn1/N1	ULS-Set B (auto)/2	-0,56	2,46	**39,34**	-5,24	-0,83	0,00
Sn1/N1	ULS-Set B (auto)/3	-0,35	**3,07**	29,27	**-6,58**	-0,52	0,00
Sn1/N1	ULS-Set B (auto)/4	**-2,69**	0,38	16,03	-0,73	**-5,53**	0,00
Sn3/N3	ULS-Set B (auto)/5	**2,69**	0,38	16,03	-0,73	**5,53**	0,00
Sn1/N1	ULS-Set B (auto)/6	2,19	0,60	21,82	-1,31	4,79	**0,00**
Sn3/N3	ULS-Set B (auto)/7	-2,19	0,60	21,82	-1,31	-4,79	**0,00**

R2 - Reactions; R_x; R_y; R_z; M_x; M_y

Values: R_x, R_y, R_z, M_x, M_y
Linear calculation
Combination: ULS-Set B (auto)
System: Global
Extreme: Member
Selection: Named selection - R2



Reactions

Linear calculation
Combination: ULS-Set B (auto)
System: Global
Extreme: Global
Selection: Named selection - R2
Nodal reactions

Name	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
Sn2/N7	ULS-Set B (auto)/1	-0,05	**-6,16**	12,79	**15,31**	-0,08	0,00
Sn2/N7	ULS-Set B (auto)/2	0,13	1,00	**-6,32**	-1,24	0,19	0,00
Sn2/N7	ULS-Set B (auto)/3	-0,41	-2,05	**39,07**	2,81	-0,61	0,00
Sn2/N7	ULS-Set B (auto)/4	-0,07	**4,78**	8,27	**-12,52**	-0,10	0,00
Sn2/N7	ULS-Set B (auto)/5	**-2,13**	-0,75	17,88	1,06	**-3,88**	0,00
Sn4/N5	ULS-Set B (auto)/6	**2,13**	-0,75	17,88	1,06	**3,88**	0,00
Sn4/N5	ULS-Set B (auto)/7	2,13	-0,76	18,53	1,07	3,87	**0,00**
Sn2/N7	ULS-Set B (auto)/8	-2,13	-0,76	18,53	1,07	-3,87	**0,00**

Project:	**Přístřešek**
Project no:	**K1**
Author:	**Ing. Ježowicz**

Project data

Project name	Přístřešek
Project number	K1
Author	Ing. Ježowicz
Description	kotvení K1
Date	1/25/2022
Design code	EN

Material

Steel	S 235
Concrete	C25/30

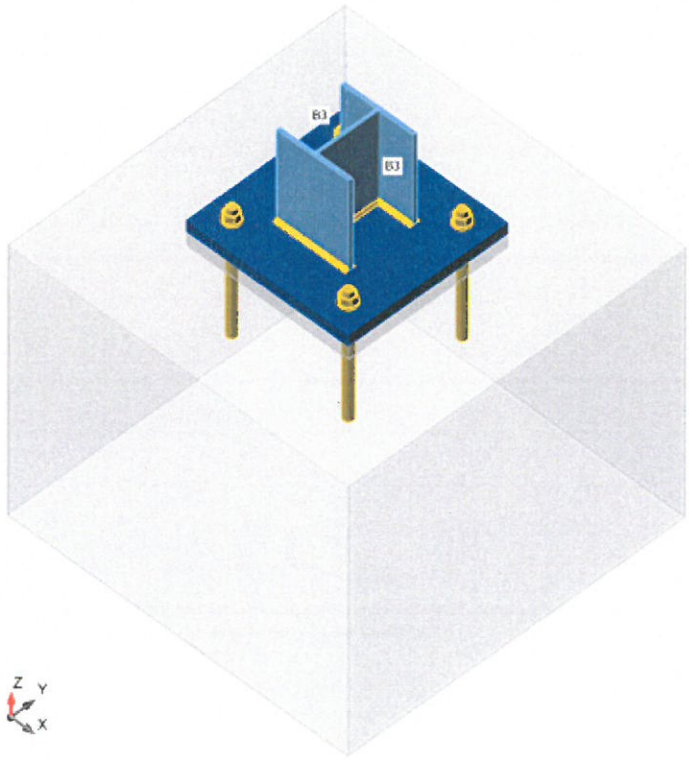
Project item Con N5

Design

Name	Con N5
Description	
Analysis	Stress, strain/ loads in equilibrium

Beams and columns

Name	Cross-section	β – Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]	Forces in
B3	1 - HEA160	0.0	0.0	0.0	0	0	0	Position



Cross-sections

Name	Material
1 - HEA160	S 235

Anchors

Name	Bolt assembly	Diameter [mm]	fu [MPa]	Gross area [mm^2]
M20 8.8	M20 8.8	20	800.0	314

Load effects (forces in equilibrium)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
ULS-Set(2)(1)	B3	-39.1	0.4	-2.1	0.0	2.8	0.6
ULS-Set(1)(2)	B3	6.3	-0.1	1.0	0.0	-1.2	-0.2
ULS-Set(5)(12)	B3	-17.9	2.1	-0.8	0.0	1.1	3.9
ULS-Set(3)(13)	B3	-6.3	-2.0	0.2	0.0	-0.7	-3.6
ULS-Set(8)(3)	B3	-8.3	0.1	4.8	0.0	-12.5	0.1
ULS-Set(7)(4)	B3	-12.8	0.1	-6.2	0.0	15.3	0.1
ULS-Set(9)(9)	B3	-5.7	-2.0	0.2	0.0	-0.7	-3.6
ULS-Set(10)(10)	B3	-18.5	2.1	-0.8	0.0	1.1	3.9
ULS-Set(6)(5)	B3	2.6	-0.1	-5.7	0.0	15.0	-0.2
ULS-Set(12)(6)	B3	-23.6	0.3	4.3	0.0	-12.2	0.4
ULS-Set(17)(14)	B3	-20.4	-1.8	-0.2	0.0	-0.5	-3.3
ULS-Set(14)(15)	B3	-3.8	1.9	-0.3	0.0	0.8	3.6
ULS-Set(18)(16)	B3	-34.6	-0.8	-0.7	0.0	0.1	-1.6
ULS-Set(19)(17)	B3	-33.1	1.5	-1.1	0.0	1.0	2.7
ULS-Set(15)(18)	B3	1.9	-0.1	-5.7	0.0	15.0	-0.2
ULS-Set(4)(7)	B3	-36.8	0.4	2.0	0.0	-7.0	0.6
ULS-Set(13)(8)	B3	-30.3	0.3	-4.3	0.0	9.6	0.4
ULS-Set(11)(11)	B3	-27.4	0.3	-2.4	0.0	4.0	0.4
ULS-Set(16)(19)	B3	-23.0	0.3	4.4	0.0	-12.2	0.4

Foundation block

Item	Value	Unit
CB 1		
Dimensions	760 x 752	mm
Depth	600	mm
Anchor	M20 8.8	
Anchoring length	200	mm
Shear force transfer	Anchors	
Mortar joint	30	mm

Check

Summary

Name	Value	Status
Analysis	100.0%	OK
Plates	0.0 < 5.0%	OK
Anchors	59.8 < 100%	OK
Welds	88.6 < 100%	OK
Concrete block	14.3 < 100%	OK
Buckling	Not calculated	

Project:	**Přístřešek**
Project no:	**K1**
Author:	**Ing. Ježowicz**

Plates

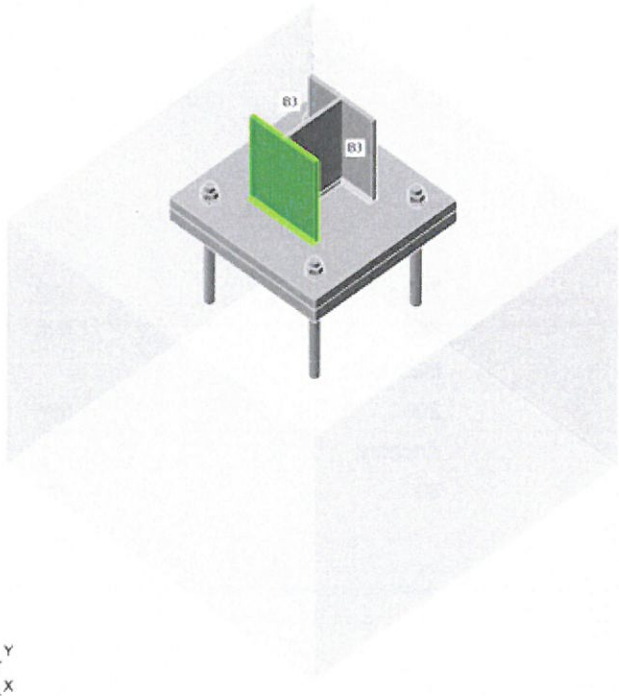
Name	Thickness [mm]	Loads	σ_{Ed} [MPa]	ε_{Pl} [%]	σc_{Ed} [MPa]	Status
B3-bfl 1	9.0	ULS-Set(8)(3)	148.5	0.0	0.0	OK
B3-tfl 1	9.0	ULS-Set(6)(5)	184.9	0.0	0.0	OK
B3-w 1	6.0	ULS-Set(7)(4)	91.4	0.0	0.0	OK
BP1	25.0	ULS-Set(6)(5)	109.6	0.0	0.0	OK

Design data

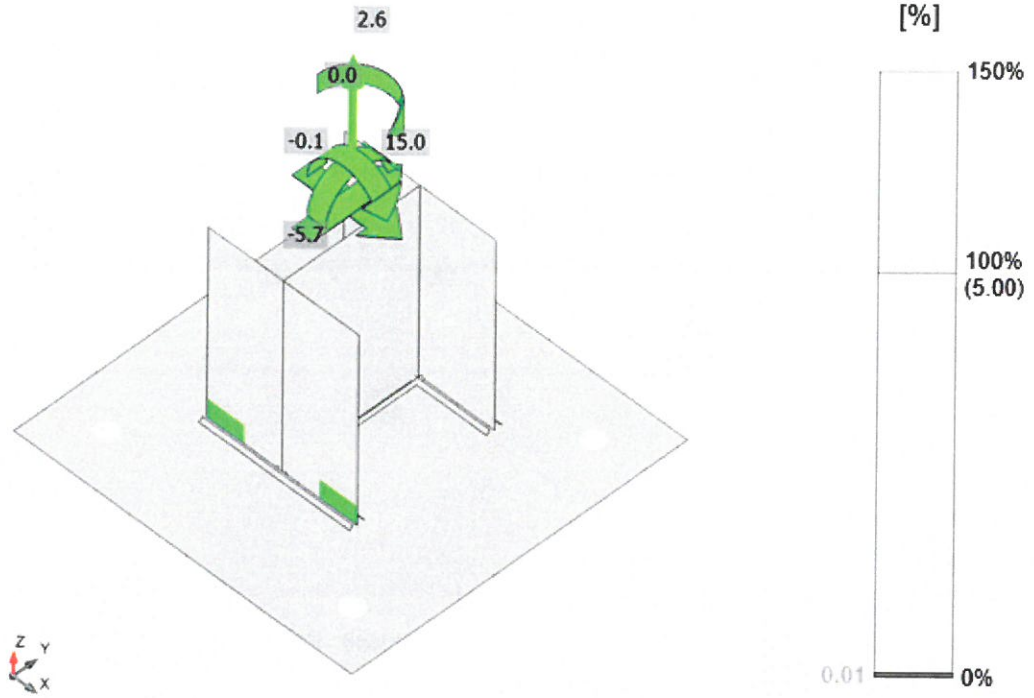
Material	f_y [MPa]	ε_{lim} [%]
S 235	235.0	5.0

Symbol explanation

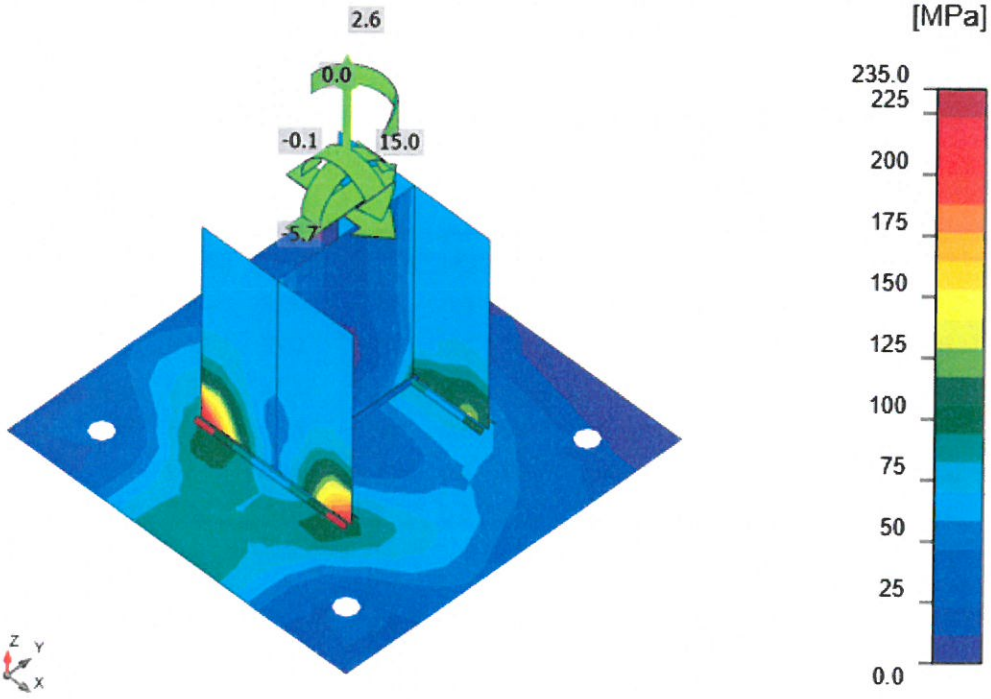
ε_{Pl}	Strain
σ_{Ed}	Eq. stress
σc_{Ed}	Contact stress
f_y	Yield strength
ε_{lim}	Limit of plastic strain



Overall check, ULS-Set(6)(5)



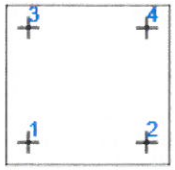
Strain check, ULS-Set(6)(5)



Equivalent stress, ULS-Set(6)(5)

Project:	**Přístřešek**
Project no:	**K1**
Author:	**Ing. Ježowicz**

Anchors

Shape	Item	Loads	N_{Ed} [kN]	V_{Ed} [kN]	$N_{Rd,c}$ [kN]	$V_{Rd,s}$ [kN]	$V_{Rd,c}$ [kN]	$V_{Rd,cp}$ [kN]	Ut_t [%]	Ut_s [%]	Ut_{ts} [%]	Status
	A1	ULS-Set(6)(5)	31.8	1.5	105.3	11.3	-	360.7	59.8	13.0	46.4	OK
	A2	ULS-Set(6)(5)	31.2	1.5	105.3	11.4	101.6	360.7	59.8	12.8	46.7	OK
	A3	ULS-Set(8)(3)	24.0	1.2	106.2	12.4	101.0	360.7	45.5	9.8	31.1	OK
	A4	ULS-Set(8)(3)	24.3	1.2	106.2	12.4	-	360.7	45.5	9.8	30.9	OK

Design data

Grade	$N_{Rd,s}$ [kN]
M20 8.8 - 1	111.1

Symbol explanation

N_{Ed}	Tension force
V_{Ed}	Resultant of shear forces Vy, Vz in bolt
$N_{Rd,c}$	Design resistance in case of concrete cone failure under tension load - EN1992-4 - Cl. 7.2.1.4
$V_{Rd,s}$	Design shear resistance in case of steel failure - EN1992-4 - Cl.7.2.2.3.2
$V_{Rd,c}$	Design resistance in case of concrete cone failure under shear load - EN1992-4 - Cl. 7.2.2.5
$V_{Rd,cp}$	Design resistance in case of concrete pryout failure - EN1992-4 - Cl. 7.2.2.4
Ut_t	Utilization in tension
Ut_s	Utilization in shear
Ut_{ts}	Utilization in tension and shear
$N_{Rd,s}$	Design tensile resistance of a fastener in case of steel failure - EN1992-4 - Cl. 7.2.1.3

Welds (Plastic redistribution)

Item	Edge	Throat th. [mm]	Length [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	ε_{Pl} [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	$\tau_{\perp}$ [MPa]	Ut [%]	Ut_c [%]	Status
BP1	B3-bfl 1	◢5.0◣	160	ULS-Set(8)(3)	227.1	0.0	79.8	-78.9	94.1	63.1	22.9	OK
		◢5.0◣	160	ULS-Set(8)(3)	250.6	0.0	101.3	99.7	-87.0	69.6	30.7	OK
BP1	B3-tfl 1	◢5.0◣	160	ULS-Set(6)(5)	318.8	0.0	128.1	127.8	110.0	88.6	39.6	OK
		◢5.0◣	160	ULS-Set(6)(5)	293.2	0.0	102.9	-102.0	-121.3	81.4	29.5	OK
BP1	B3-w 1	◢4.0◣	143	ULS-Set(6)(5)	40.7	0.0	8.6	21.3	8.6	11.3	9.7	OK
		◢4.0◣	143	ULS-Set(6)(5)	40.4	0.0	8.7	-21.1	-8.7	11.2	9.6	OK

Design data

	β_w [-]	$\sigma_{w,Rd}$ [MPa]	0.9 σ [MPa]
S 235	0.80	360.0	259.2

Symbol explanation

ε_{Pl}	Strain
$\sigma_{w,Ed}$	Equivalent stress
$\sigma_{w,Rd}$	Equivalent stress resistance
$\sigma_{\perp}$	Perpendicular stress
$\tau_{\parallel}$	Shear stress parallel to weld axis
$\tau_{\perp}$	Shear stress perpendicular to weld axis
0.9 σ	Perpendicular stress resistance - 0.9*fu/γM2
β_w	Corelation factor EN 1993-1-8 tab. 4.1
Ut	Utilization
Utc	Weld capacity utilization

Concrete block

Item	Loads	c [mm]	A_{eff} [mm^2]	σ [MPa]	k_j [-]	F_{jd} [MPa]	Ut [%]	Status
CB 1	ULS-Set(7)(4)	38	15218	4.8	3.00	33.5	14.3	OK

Symbol explanation

c	Bearing width
A_{eff}	Effective area
σ	Average stress in concrete
k_j	Concentration factor
F_{jd}	The ultimate bearing strength of the concrete block
Ut	Utilization

Buckling

Buckling analysis was not calculated.

Project:	**Přístřešek**
Project no:	**K1**
Author:	**Ing. Ježowicz**

Project item Con N5

Design

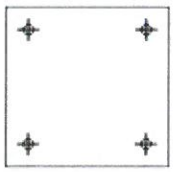
Name	Con N5
Description	
Analysis	Stress, strain/ loads in equilibrium

Foundation block

Item	Value	Unit
CB 1		
Dimensions	760 x 752	mm
Depth	600	mm
Anchor	M20 8.8	
Anchoring length	200	mm
Shear force transfer	Anchors	
Mortar joint	30	mm

Bill of material

Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds [mm]	Length [mm]	Bolts	Nr.
BP1	P25.0x360.0-352.0 (S 235)		1	Double fillet: a = 5.0 Double fillet: a = 4.0	320.0 143.0	M20 8.8	4

Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Double fillet	S 235	5.0	7.1	320.0
Double fillet	S 235	4.0	5.7	143.0

Anchors

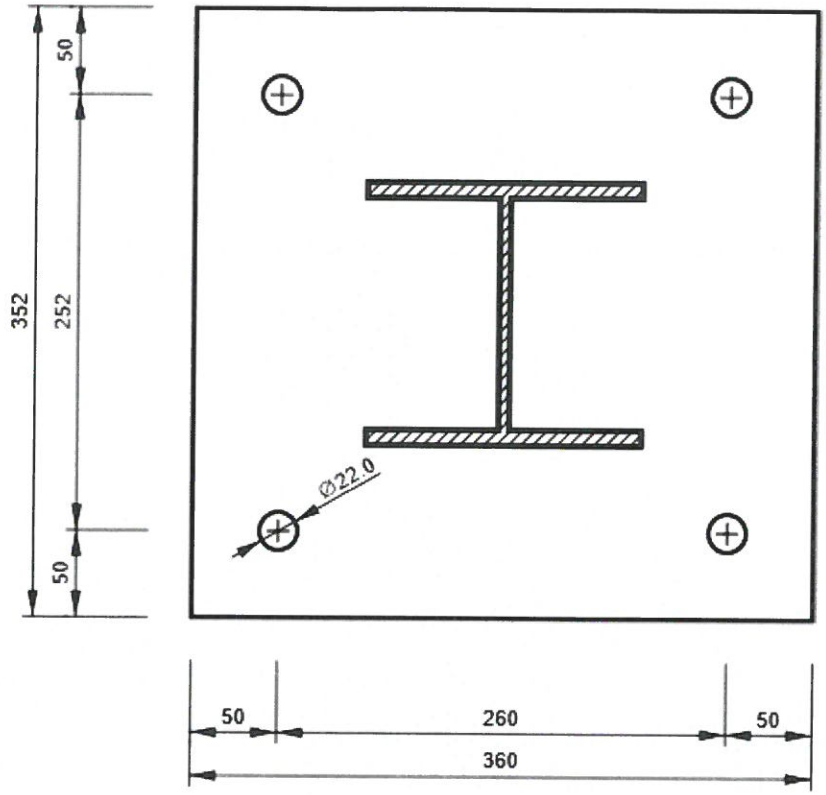
Name	Length [mm]	Drill length [mm]	Count
M20 8.8	255	200	4

Drawing

BP1

Project:	**Přístřešek**
Project no:	**K1**
Author:	**Ing. Ježowicz**

P25.0x352-360 (S 235)

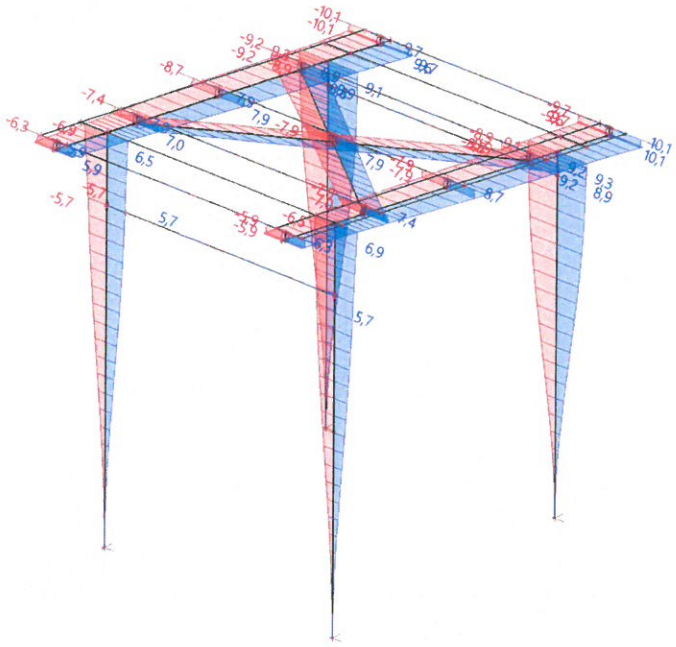


DEFORMACE

DEFORMATIONS

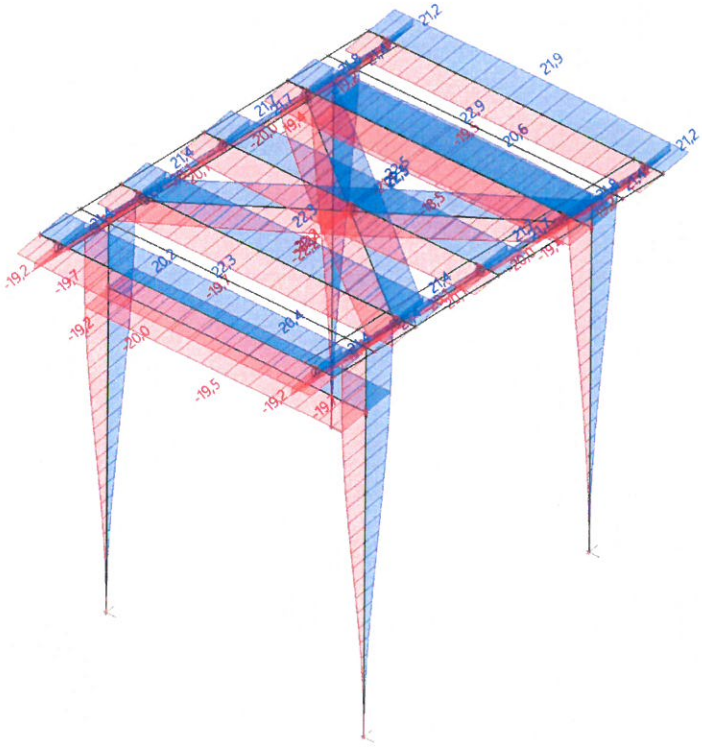
1D deformations; u_x

Values: u_x
Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Global
Extreme 1D: Member
Selection: All



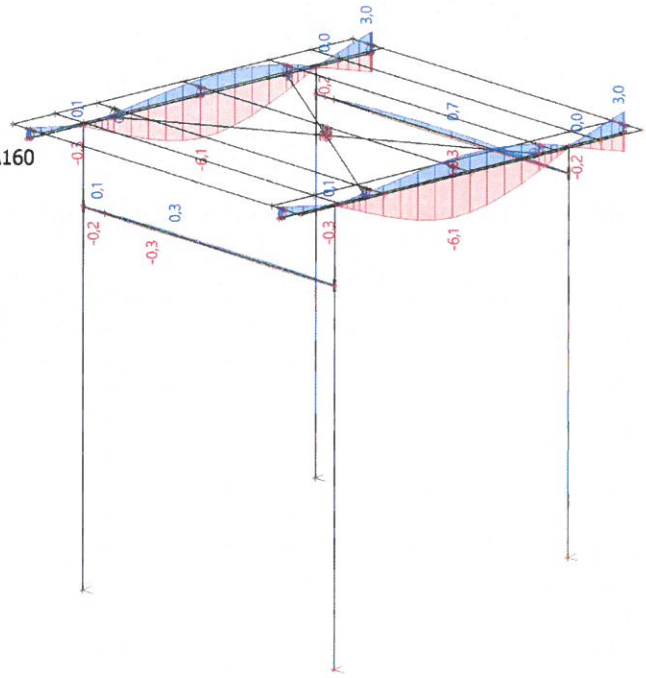
1D deformations; u_y

Values: u_y
Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Global
Extreme 1D: Member
Selection: All



1D deformations; u_z

Values: u_z
Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Global
Extreme 1D: Member
Selection: All
Filter: Cross-section = CS11 - HEA160



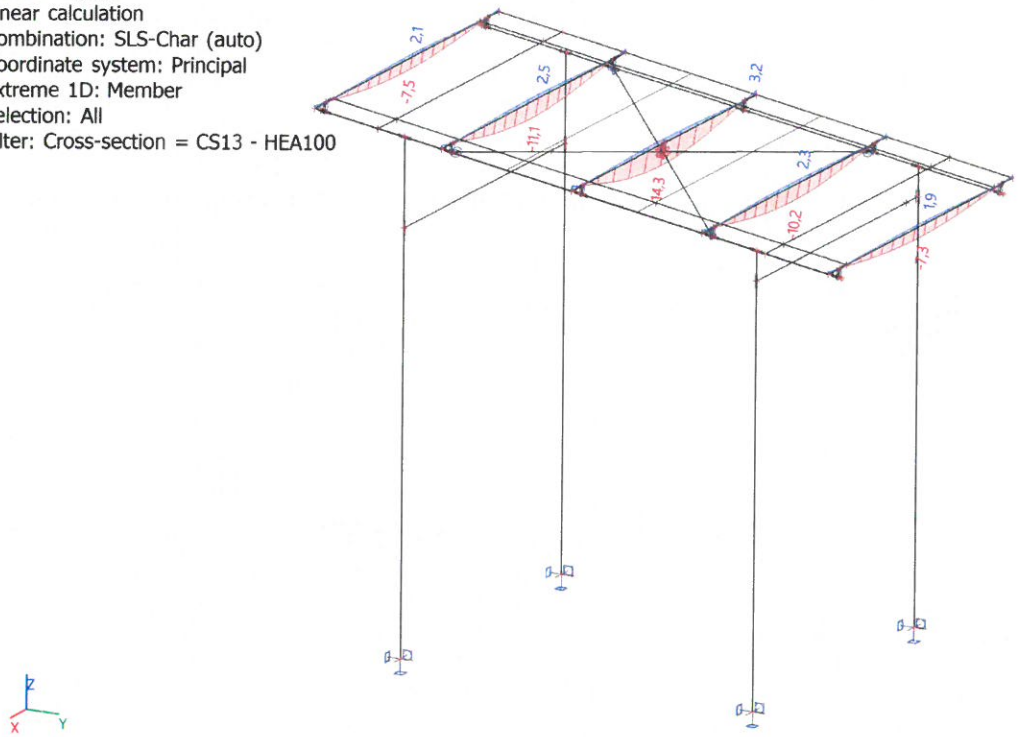
1D deformations

Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Global
Extreme 1D: Global
Selection: All
Deformations

Name	dx [mm]	Case	u_x [mm]	u_y [mm]	u_z [mm]	φ_x [mrad]	φ_y [mrad]	φ_z [mrad]	U_{total} [mm]
B9	6000,000	ULS-Set B (auto)/1	**-10,1**	-2,5	0,8	0,8	-1,1	1,3	10,5
B8	6000,000	ULS-Set B (auto)/2	**10,1**	-2,5	0,8	0,8	1,1	-1,3	10,5
B12	2304,886-	ULS-Set B (auto)/3	0,0	**-22,2**	-17,9	-1,5	0,0	0,0	28,5
B74	1883,333	ULS-Set B (auto)/4	0,0	**22,9**	4,9	-2,1	-0,3	0,1	23,4
B12	2074,398	ULS-Set B (auto)/5	-0,1	-17,9	**-26,9**	-0,4	2,1	-0,1	**32,3**
B12	2304,886-	ULS-Set B (auto)/4	0,0	22,5	**7,1**	-0,2	0,0	0,0	23,6
B12	4609,772	ULS-Set B (auto)/5	1,1	-13,8	-2,2	**-13,0**	-9,5	2,4	14,1
B14	4609,772	ULS-Set B (auto)/5	0,9	-14,0	-2,5	**14,6**	-10,7	1,7	14,2
B71	3750,000-	ULS-Set B (auto)/5	0,0	-14,5	-6,1	-0,2	**-18,6**	2,8	15,7
B70	96,000	ULS-Set B (auto)/5	0,0	-14,5	-6,1	-0,2	**18,6**	-2,8	15,7
B70	0,000	ULS-Set B (auto)/6	3,1	-2,9	-4,8	0,1	16,8	**-3,0**	6,4
B72	0,000	ULS-Set B (auto)/7	-3,1	-2,9	-4,8	0,1	-16,8	**3,0**	6,4

EC-EN 1993 Steel Check SLS; $u^{z,max}$

Values: $u_{z,max}$
Linear calculation
Combination: SLS-Char (auto)
Coordinate system: Principal
Extreme 1D: Member
Selection: All
Filter: Cross-section = CS13 - HEA100



EC-EN 1993 Steel Check SLS

Linear calculation
Combination: SLS-Char (auto)
Coordinate system: Principal
Extreme 1D: Global
Selection: All
Filter: Cross-section = CS13 - HEA100
Deformation u_z

Name	dx [mm]	Case	Cross-section	$u_{z,max}$ [mm]	$u_{z,var}$ [mm]	Lim. $u_{z,max}$ [mm]	Lim. $u_{z,var}$ [mm]	Check $u_{z,max}$ [-]	Check $u_{z,var}$ [-]	Camber dx u_z [mm]	Camber [mm]	Check u_z [-]
B71	2000,000-	SLS-Char (auto)/1	CS13 - HEA100	**-14,3**	-13,2	17,5	9,7	0,82	1,36	-	-	1,36
B71	0,000	SLS-Char (auto)/1	CS13 - HEA100	**3,2**	3,0	2,5	1,4	1,27	2,12	-	-	**2,12**

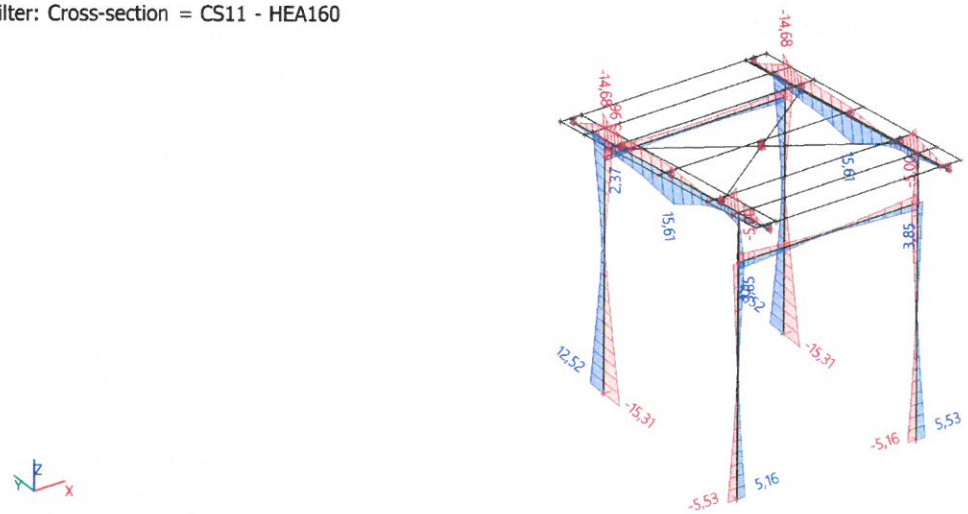
Name	Combination key
SLS-Char (auto)/1	LC1 + LC2 + LC3 + 0.60*LC9

POSOUZENÍ PRŮŘEZŮ

CHECK OF CROSS SECTIONS

CS11 - 1D internal forces; M_y

Values: M_y
Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Principal
Extreme 1D: Member
Selection: All
Filter: Cross-section = CS11 - HEA160



Cross-sections

Cross-sections - CS11

Name	Type	Item material	Fabrication	Shape type	Flex. buckling y-y	Flex. buckling z-z	Picture
	Detailed						
CS11	HEA160	S 235	rolled	Thin-walled	b	c	

1D internal forces

Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Principal
Extreme 1D: Global
Selection: All
Filter: Cross-section = CS11 - HEA160

Name	dx [mm]	Case	Cross-section	N [kN]	V_y [kN]	V_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
B1	0,000	ULS-Set B (auto)/1	CS11 - HEA160	**-39,34**	2,46	0,56	0,00	-0,83	-5,24
B62	0,000	ULS-Set B (auto)/1	CS11 - HEA160	**12,42**	0,28	0,60	0,00	-2,55	0,00
B4	4500,000+	ULS-Set B (auto)/1	CS11 - HEA160	-34,69	**-12,00**	-0,97	0,00	-0,33	3,80
B3	4500,000+	ULS-Set B (auto)/1	CS11 - HEA160	-34,69	**12,00**	-0,97	0,00	-0,33	-3,80
B9	5024,930-	ULS-Set B (auto)/2	CS11 - HEA160	-5,29	8,93	**-26,89**	0,00	-13,85	3,33
B9	975,070+	ULS-Set B	CS11 - HEA160	3,40	-1,24	**27,24**	0,00	-13,94	1,47

Name	dx [mm]	Case	Cross-section	N [kN]	V_y [kN]	V_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
		(auto)/1							
B3	4500,000+	ULS-Set B (auto)/3	CS11 - HEA160	-25,23	7,70	0,70	**-0,01**	3,96	-2,44
B4	4500,000+	ULS-Set B (auto)/3	CS11 - HEA160	-25,23	-7,70	0,70	**0,01**	3,96	2,44
B3	0,000	ULS-Set B (auto)/4	CS11 - HEA160	-12,79	-0,05	6,16	0,00	**-15,31**	0,08
B8	3010,000+	ULS-Set B (auto)/1	CS11 - HEA160	-21,92	-0,90	-7,19	0,00	**15,61**	1,41
B1	0,000	ULS-Set B (auto)/5	CS11 - HEA160	-29,27	3,07	0,35	0,00	-0,52	**-6,58**
B1	0,000	ULS-Set B (auto)/6	CS11 - HEA160	9,98	-2,90	-0,18	0,00	0,27	**6,44**

Name	Combination key
ULS-Set B (auto)/1	1.15*LC1 + 1.15*LC2 + 1.50*LC3 + 0.90*LC9
ULS-Set B (auto)/2	1.15*LC1 + 1.15*LC2 + 1.50*LC3 + 0.90*LC7
ULS-Set B (auto)/3	1.15*LC1 + 1.15*LC2 + 0.75*LC3 + 1.50*LC7
ULS-Set B (auto)/4	1.15*LC1 + 1.15*LC2 + 0.75*LC3 + 1.50*LC6
ULS-Set B (auto)/5	1.15*LC1 + 1.15*LC2 + 0.75*LC3 + 1.50*LC9
ULS-Set B (auto)/6	LC1 + LC2 + 1.50*LC6

EC-EN 1993 Steel check ULS

Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Principal
Extreme 1D: Global
Selection: All
Filter: Cross-section = CS11 - HEA160

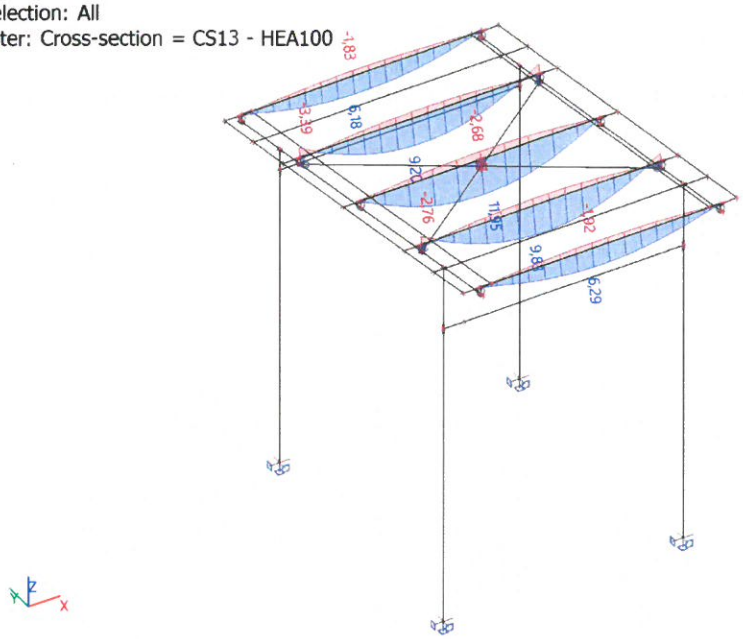
Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	$UC_{Overall}$ [-]	UC_{Sec} [-]	UC_{Stab} [-]
B9	4510,000-	ULS-Set B (auto)/1	CS11 - HEA160	S 235	**0,30**	0,08	0,30

Name	Combination key
ULS-Set B (auto)/1	1.15*LC1 + 1.15*LC2 + 1.50*LC3 + 0.90*LC9

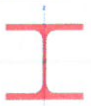
CS13 - 1D internal forces; M_y

Values: M_y
Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Principal
Extreme 1D: Member
Selection: All
Filter: Cross-section = CS13 - HEA100



Cross-sections

Cross-sections - CS13

Name	Type	Item material	Fabrication	Shape type	Flex. buckling y-y	Flex. buckling z-z	Picture
	Detailed						
CS13	HEA100	S 235	rolled	Thin-walled	b	c	

1D internal forces

Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Principal
Extreme 1D: Global
Selection: All
Filter: Cross-section = CS13 - HEA100

Name	dx [mm]	Case	Cross-section	N [kN]	V_y [kN]	V_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
B74	250,000+	ULS-Set B (auto)/1	CS13 - HEA100	**7,64**	-0,35	-3,59	0,00	0,82	0,15
B68	3750,000-	ULS-Set B (auto)/2	CS13 - HEA100	-19,07	**2,23**	-10,58	0,00	-2,01	1,09
B68	3750,000-	ULS-Set B (auto)/3	CS13 - HEA100	-25,78	1,91	**-14,57**	0,00	-2,76	0,91
B68	250,000+	ULS-Set B (auto)/3	CS13 - HEA100	-25,78	-1,91	**14,57**	0,00	-2,76	0,91
B71	3050,000-	ULS-Set B	CS13 - HEA100	-1,11	0,29	-6,29	**-0,01**	5,60	-0,16

Name	dx [mm]	Case	Cross-section	N [kN]	V_y [kN]	V_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
		(auto)/2							
B71	250,000+	ULS-Set B (auto)/2	CS13 - HEA100	-1,11	-1,18	10,48	**0,01**	-0,28	0,36
B74	250,000+	ULS-Set B (auto)/3	CS13 - HEA100	**-32,31**	-1,91	14,57	0,00	**-3,39**	1,14
B71	2000,000+	ULS-Set B (auto)/3	CS13 - HEA100	-1,64	-0,93	0,15	-0,01	**11,95**	0,23
B68	1883,333	ULS-Set B (auto)/4	CS13 - HEA100	-25,63	-0,15	0,96	0,00	9,80	**-0,86**
B74	250,000+	ULS-Set B (auto)/4	CS13 - HEA100	-32,21	**-2,23**	14,52	0,00	-3,38	**1,30**

Name	Combination key
ULS-Set B (auto)/1	LC1 + LC2 + 1.50*LC6
ULS-Set B (auto)/2	1.15*LC1 + 1.15*LC2 + 1.50*LC3 + 0.90*LC6
ULS-Set B (auto)/3	1.15*LC1 + 1.15*LC2 + 1.50*LC3 + 0.90*LC9
ULS-Set B (auto)/4	1.15*LC1 + 1.15*LC2 + 1.50*LC3 + 0.90*LC7

EC-EN 1993 Steel check ULS

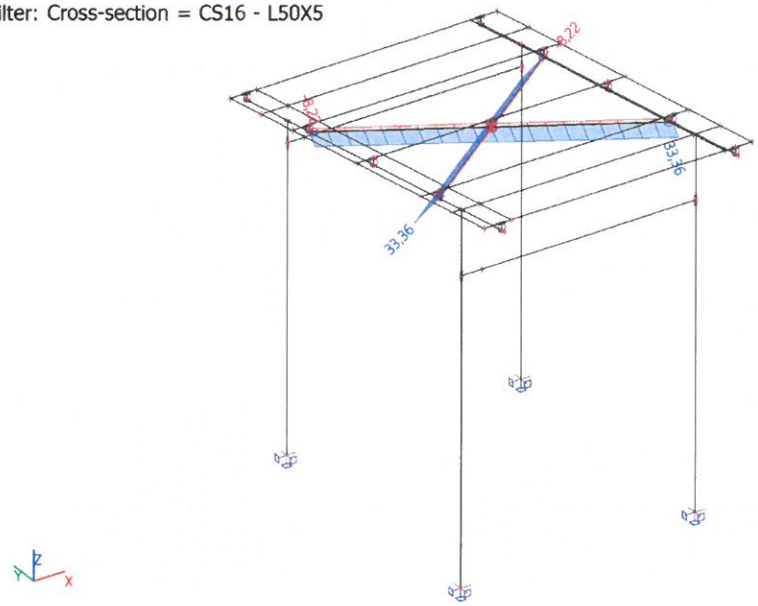
Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Principal
Extreme 1D: Global
Selection: All
Filter: Cross-section = CS13 - HEA100
Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	$UC_{Overall}$ [-]	UC_{Sec} [-]	UC_{Stab} [-]
B71	2000,000-	ULS-Set B (auto)/1	CS13 - HEA100	S 235	**0,80**	0,61	0,80

Name	Combination key
ULS-Set B (auto)/1	1.15*LC1 + 1.15*LC2 + 1.50*LC3 + 0.90*LC9

CS16 - 1D internal forces; N

Values: **N**
Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Principal
Extreme 1D: Member
Selection: All
Filter: Cross-section = CS16 - L50X5



Cross-sections

Cross-sections - CS16

Name	Type	Item material	Fabrication	Shape type	Flex. buckling y-y	Flex. buckling z-z	Picture
	Detailed						
CS16	L50X5	S 235	rolled	Thin-walled	b	b	

1D internal forces

Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Principal
Extreme 1D: Global
Selection: All
Filter: Cross-section = CS16 - L50X5

Name	dx [mm]	Case	Cross-section	N [kN]	V_y [kN]	V_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
B14	4609,772	ULS-Set B (auto)/1	CS16 - L50X5	**-8,22**	0,01	-0,01	0,00	0,00	0,00
B14	0,000	ULS-Set B (auto)/2	CS16 - L50X5	**33,36**	-0,06	-0,15	0,00	0,00	0,00
B12	0,000	ULS-Set B (auto)/3	CS16 - L50X5	31,82	**-0,07**	**-0,22**	0,00	0,00	0,00
B14	4609,772	ULS-Set B (auto)/3	CS16 - L50X5	31,82	**0,07**	**0,22**	0,00	0,00	0,00
B14	2304,886+	ULS-Set B	CS16 - L50X5	32,09	0,01	0,14	**0,00**	-0,41	-0,09

Name	dx [mm]	Case	Cross-section	N [kN]	V_y [kN]	V_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
		(auto)/2							
B12	0,000	ULS-Set B (auto)/2	CS16 - L50X5	32,08	-0,07	-0,22	**0,00**	0,00	0,00
B14	2304,886+	ULS-Set B (auto)/3	CS16 - L50X5	31,83	0,01	0,14	0,00	**-0,41**	-0,09
B12	2304,886-	ULS-Set B (auto)/4	CS16 - L50X5	31,67	-0,01	-0,15	0,00	-0,41	**-0,09**
B14	2304,886-	ULS-Set B (auto)/5	CS16 - L50X5	-7,77	0,05	0,09	0,00	**0,12**	**0,04**

Name	Combination key
ULS-Set B (auto)/1	LC1 + LC2 + 1.50*LC6
ULS-Set B (auto)/2	1.15*LC1 + 1.15*LC2 + 1.50*LC3 + 0.90*LC9
ULS-Set B (auto)/3	1.15*LC1 + 1.15*LC2 + 1.50*LC3 + 0.90*LC7
ULS-Set B (auto)/4	LC1 + LC2 + 1.50*LC3 + 0.90*LC7
ULS-Set B (auto)/5	1.15*LC1 + 1.15*LC2 + 1.50*LC6

EC-EN 1993 Steel check ULS

Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Principal
Extreme 1D: Global
Selection: All
Filter: Cross-section = CS16 - L50X5
Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	$UC_{Overall}$ [-]	UC_{Sec} [-]	UC_{Stab} [-]
B12	2304,886-	ULS-Set B (auto)/1	CS16 - L50X5	S 235	**0,61**	0,61	0,34

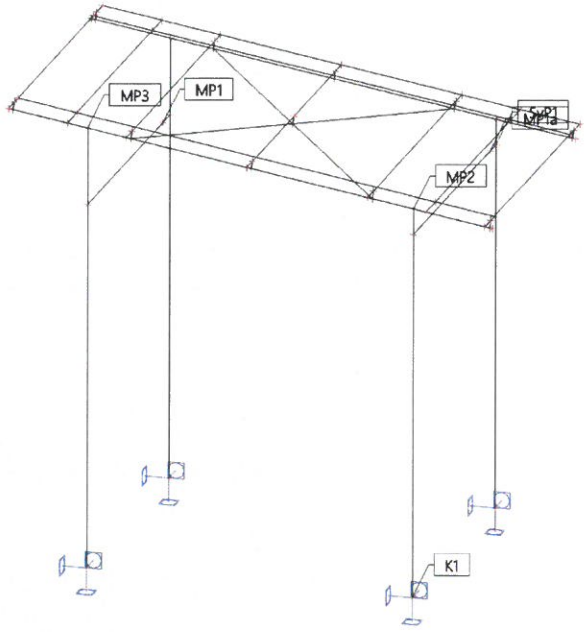
Name	Combination key
ULS-Set B (auto)/1	1.15*LC1 + 1.15*LC2 + 1.50*LC3 + 0.90*LC9

MONTÁŽNÍ PŘÍPOJE

CONNECTIONS

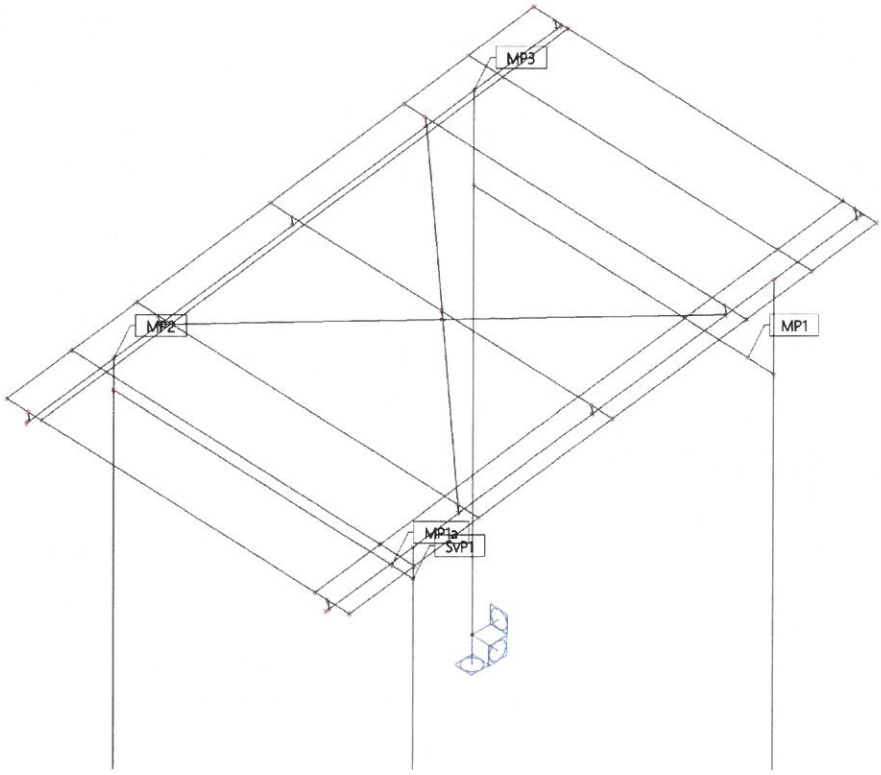
IDEA StatiCa Connection; UC

Values: **UC**
Linear calculation
Combination: ULS-Set B (auto)
Extreme: Global
Selection: All



IDEA StatiCa Connection; UC

Values: **UC**
Linear calculation
Combination: ULS-Set B (auto)
Extreme: Global
Selection: All



Project:	**Přístřešek**
Project no:	**MP1 girder+col**
Author:	**Ing. Ježowicz**

Project data

Project name	Přístřešek
Project number	MP1 girder+col
Author	Ing. Ježowicz
Description	MP1 girder+col
Date	1/25/2022
Design code	EN

Material

Steel	S 235

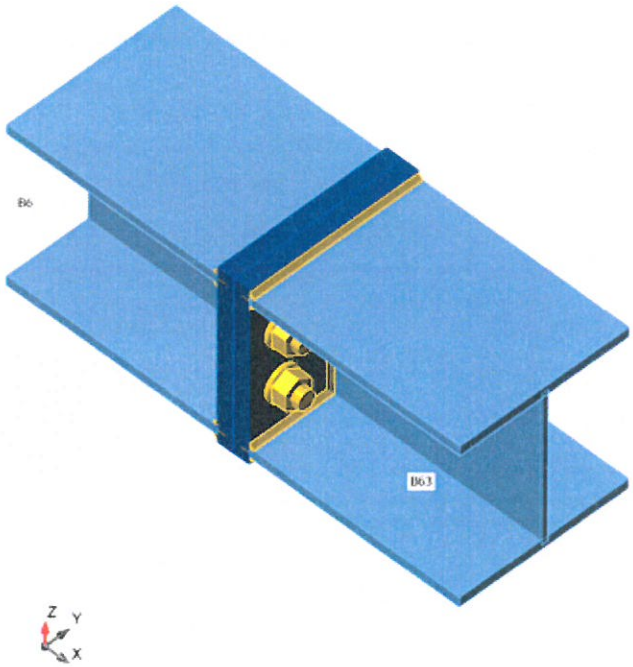
Project item Con N163

Design

Name	Con N163
Description	
Analysis	Stress, strain/ loads in equilibrium

Beams and columns

Name	Cross-section	β – Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]	Forces in
B6	1 - HEA160	0.0	0.0	0.0	0	0	0	Position
B63	1 - HEA160	0.0	0.0	0.0	0	0	0	Position



Cross-sections

Name	Material
1 - HEA160	S 235

Bolts

Name	Bolt assembly	Diameter [mm]	fu [MPa]	Gross area [mm^2]
M16 10.9	M16 10.9	16	1000.0	201

Load effects (forces in equilibrium)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
ULS-Set(2)(1)	B6	0.8	-0.4	0.4	0.0	0.2	0.1
	B63	-0.8	0.4	-0.4	0.0	-0.2	-0.1
ULS-Set(1)(2)	B6	-3.9	0.2	0.5	0.0	-1.3	-0.1
	B63	3.9	-0.2	-0.5	0.0	1.3	0.1
ULS-Set(3)(3)	B6	0.8	0.4	0.5	0.0	0.2	-0.1
	B63	-0.8	-0.4	-0.5	0.0	-0.2	0.1
ULS-Set(6)(7)	B6	-0.3	0.0	-1.9	0.0	3.3	0.0
	B63	0.3	0.0	1.9	0.0	-3.3	0.0
ULS-Set(5)(8)	B6	-0.4	0.0	2.9	0.0	-3.6	0.0
	B63	0.4	0.0	-2.9	0.0	3.6	0.0
ULS-Set(8)(9)	B6	-1.9	0.0	2.9	0.0	-4.1	0.0
	B63	1.9	0.0	-2.9	0.0	4.1	0.0
ULS-Set(10)(4)	B6	-2.6	0.4	0.5	0.0	-0.9	-0.1
	B63	2.6	-0.4	-0.5	0.0	0.9	0.1
ULS-Set(11)(5)	B6	-2.6	-0.4	0.5	0.0	-0.9	0.1
	B63	2.6	0.4	-0.5	0.0	0.9	-0.1
ULS-Set(9)(6)	B6	0.8	0.4	0.4	0.0	0.2	-0.1
	B63	-0.8	-0.4	-0.4	0.0	-0.2	0.1
ULS-Set(13)(12)	B6	-1.9	0.0	2.8	0.0	-4.1	0.0
	B63	1.9	0.0	-2.8	0.0	4.1	0.0
ULS-Set(7)(10)	B6	-0.4	0.0	-1.9	0.0	3.3	0.0
	B63	0.4	0.0	1.9	0.0	-3.3	0.0
ULS-Set(14)(13)	B6	-3.5	0.0	1.9	0.0	-3.2	0.0
	B63	3.5	0.0	-1.9	0.0	3.2	0.0
ULS-Set(12)(11)	B6	-0.3	0.0	2.8	0.0	-3.6	0.0
	B63	0.3	0.0	-2.8	0.0	3.6	0.0
ULS-Set(15)(14)	B6	-3.5	0.0	-1.0	0.0	0.9	0.0
	B63	3.5	0.0	1.0	0.0	-0.9	0.0
ULS-Set(4)(15)	B6	0.8	-0.4	0.5	0.0	0.2	0.1
	B63	-0.8	0.4	-0.5	0.0	-0.2	-0.1
ULS-Set(16)(16)	B6	-1.9	0.0	-1.9	0.0	2.8	0.0
	B63	1.9	0.0	1.9	0.0	-2.8	0.0
ULS-Set(17)(17)	B6	-1.9	0.0	-1.9	0.0	2.8	0.0
	B63	1.9	0.0	1.9	0.0	-2.8	0.0

Check

Summary

Name	Value	Status
Analysis	100.0%	OK
Plates	0.0 < 5.0%	OK
Bolts	22.2 < 100%	OK
Welds	30.9 < 100%	OK
Buckling	Not calculated	

Plates

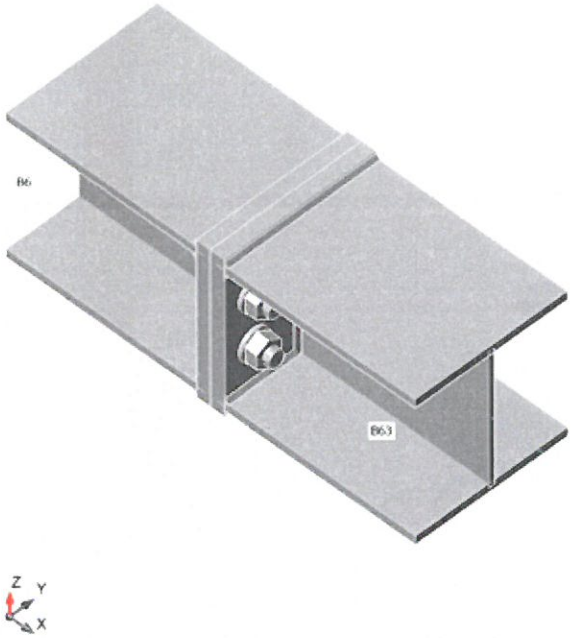
Name	Thickness [mm]	Loads	σ_{Ed} [MPa]	ε_{Pl} [%]	σc_{Ed} [MPa]	Status
B6-bfl 1	9.0	ULS-Set(6)(7)	53.5	0.0	0.0	OK
B6-tfl 1	9.0	ULS-Set(8)(9)	69.3	0.0	0.0	OK
B6-w 1	6.0	ULS-Set(8)(9)	59.8	0.0	0.0	OK
B63-bfl 1	9.0	ULS-Set(8)(9)	52.0	0.0	0.0	OK
B63-tfl 1	9.0	ULS-Set(8)(9)	66.1	0.0	0.0	OK
B63-w 1	6.0	ULS-Set(8)(9)	55.9	0.0	0.0	OK
PP1a	15.0	ULS-Set(8)(9)	145.3	0.0	22.0	OK
PP1b	15.0	ULS-Set(8)(9)	144.6	0.0	22.0	OK

Design data

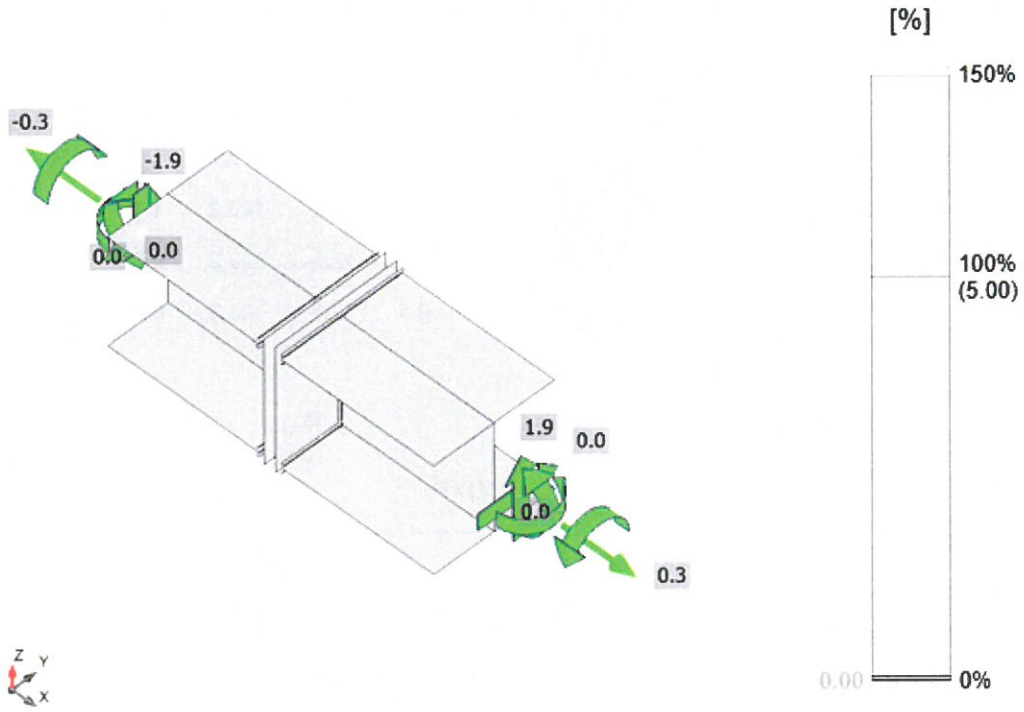
Material	f_y [MPa]	ε_{lim} [%]
S 235	235.0	5.0

Symbol explanation

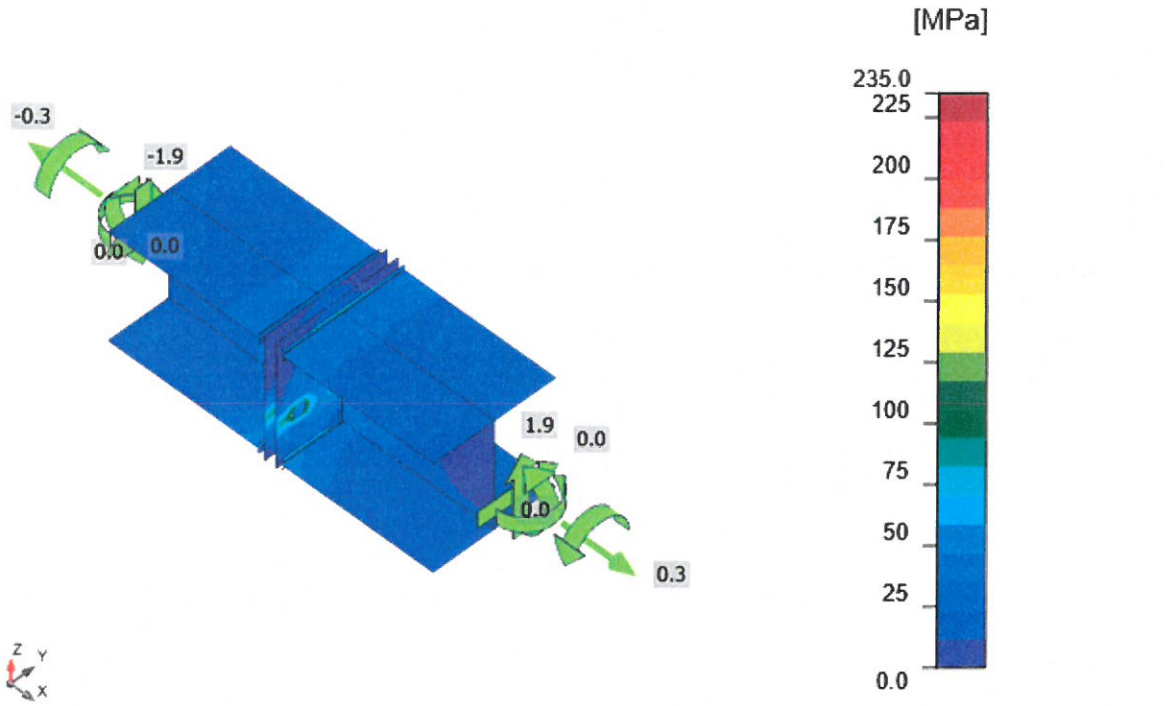
ε_{Pl}	Strain
σ_{Ed}	Eq. stress
σc_{Ed}	Contact stress
f_y	Yield strength
ε_{lim}	Limit of plastic strain



Overall check, ULS-Set(6)(7)

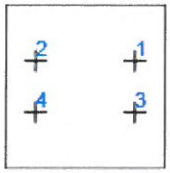


Strain check, ULS-Set(6)(7)



Equivalent stress, ULS-Set(6)(7)

Bolts



Name	Loads	$F_{t,Ed}$ [kN]	V [kN]	Ut_t [%]	$F_{b,Rd}$ [kN]	Ut_s [%]	Ut_{ts} [%]	Status
B1	ULS-Set(8)(9)	25.1	0.7	22.2	123.2	1.1	17.0	OK
B2	ULS-Set(8)(9)	25.1	0.7	22.2	123.2	1.1	17.0	OK
B3	ULS-Set(6)(7)	19.5	0.5	17.3	123.2	0.8	13.1	OK
B4	ULS-Set(6)(7)	19.5	0.5	17.3	123.2	0.8	13.1	OK

Design data

Name	$F_{t,Rd}$ [kN]	$B_{p,Rd}$ [kN]	$F_{v,Rd}$ [kN]
M16 10.9 - 1	113.0	230.3	62.8

Symbol explanation

$F_{t,Rd}$	Bolt tension resistance EN 1993-1-8 tab. 3.4
$F_{t,Ed}$	Tension force
$B_{p,Rd}$	Punching shear resistance
V	Resultant of shear forces Vy, Vz in bolt
$F_{v,Rd}$	Bolt shear resistance EN_1993-1-8 table 3.4
$F_{b,Rd}$	Plate bearing resistance EN 1993-1-8 tab. 3.4
Ut_t	Utilization in tension
Ut_s	Utilization in shear

Welds (Plastic redistribution)

Item	Edge	Throat th. [mm]	Length [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	ε_{Pl} [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	$\tau_{\perp}$ [MPa]	Ut [%]	Ut_c [%]	Status
PP1a	B6-bfl 1	◢3.0◣	160	ULS-Set(6)(7)	71.4	0.0	25.6	-33.5	18.9	19.8	16.1	OK
		◢3.0◣	160	ULS-Set(8)(9)	88.3	0.0	-41.8	6.5	44.4	24.5	20.0	OK
PP1a	B6-tfl 1	◢3.0◣	160	ULS-Set(8)(9)	78.7	0.0	-27.9	-23.3	-35.5	21.9	15.4	OK
		◢3.0◣	160	ULS-Set(8)(9)	92.2	0.0	33.0	43.4	-24.2	25.6	20.8	OK
PP1a	B6-w 1	◢3.0◣	143	ULS-Set(8)(9)	102.9	0.0	-25.3	51.8	-25.2	28.6	15.9	OK
		◢3.0◣	143	ULS-Set(8)(9)	103.0	0.0	-25.1	-51.9	25.2	28.6	15.9	OK
PP1b	B63-bfl 1	◢3.0◣	160	ULS-Set(6)(7)	69.1	0.0	23.9	-33.1	17.6	19.2	15.6	OK
		◢3.0◣	160	ULS-Set(8)(9)	90.5	0.0	-43.9	8.6	44.9	25.1	20.3	OK
PP1b	B63-tfl 1	◢3.0◣	160	ULS-Set(8)(9)	75.6	0.0	-25.9	21.4	-35.0	21.0	15.0	OK
		◢3.0◣	160	ULS-Set(8)(9)	88.5	0.0	30.4	-42.5	-22.2	24.6	20.1	OK
PP1b	B63-w 1	◢3.0◣	143	ULS-Set(8)(9)	111.1	0.0	-27.3	-55.8	-27.4	30.9	16.4	OK
		◢3.0◣	143	ULS-Set(8)(9)	110.9	0.0	-27.3	55.8	27.2	30.8	16.4	OK

Design data

	β_w [-]	$\sigma_{w,Rd}$ [MPa]	0.9 σ [MPa]
S 235	0.80	360.0	259.2

Symbol explanation

ε_{Pl}	Strain
$\sigma_{w,Ed}$	Equivalent stress
$\sigma_{w,Rd}$	Equivalent stress resistance
$\sigma_{\perp}$	Perpendicular stress
$\tau_{\parallel}$	Shear stress parallel to weld axis
$\tau_{\perp}$	Shear stress perpendicular to weld axis
0.9 σ	Perpendicular stress resistance - 0.9*fu/γM2
β_w	Corelation factor EN 1993-1-8 tab. 4.1
Ut	Utilization
Utc	Weld capacity utilization

Buckling

Buckling analysis was not calculated.

Project:	**Přístřešek**
Project no:	**MP1 girder+col**
Author:	**Ing. Ježowicz**

Project item Con N163

Design

Name	Con N163
Description	
Analysis	Stress, strain/ loads in equilibrium

Bill of material

Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds [mm]	Length [mm]	Bolts	Nr.
PP1	P15.0x160.0-165.0 (S 235)		1	Double fillet: a = 3.0	926.0	M16 10.9	4
	P15.0x160.0-165.0 (S 235)		1				

Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Double fillet	S 235	3.0	4.2	926.0

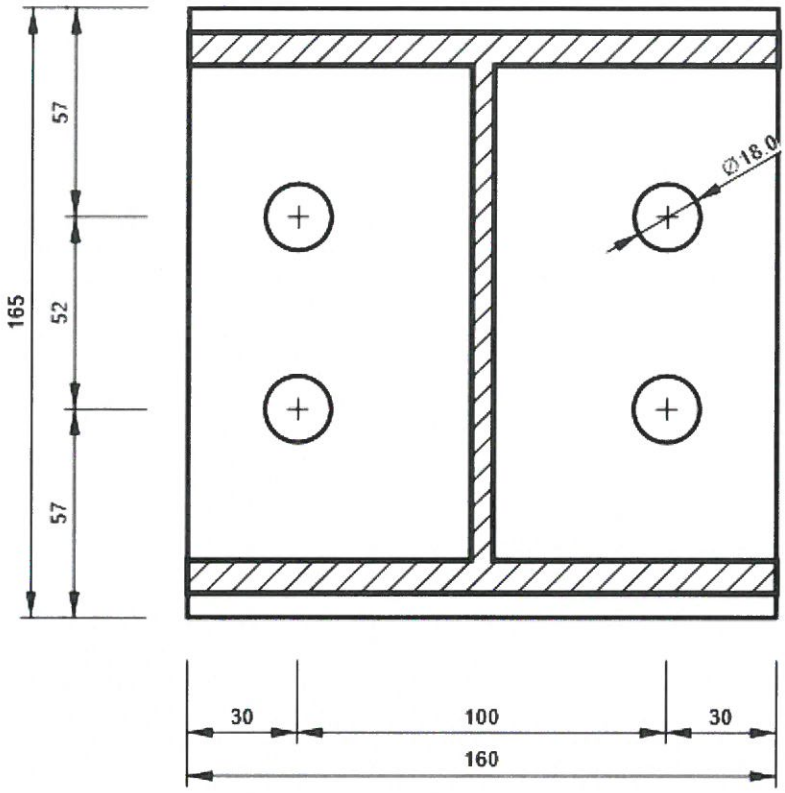
Bolts

Name	Grip length [mm]	Count
M16 10.9	30	4

Drawing

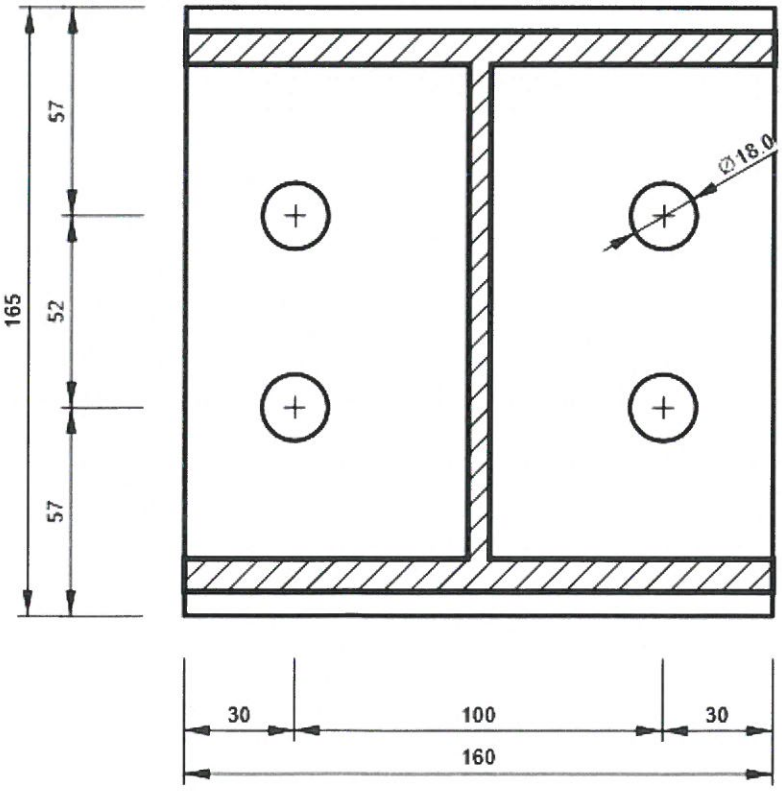
PP1 - PP1a

P15.0x165-160 (S 235)



PP1 - PP1b

P15.0x165-160 (S 235)



Project:	**Přístřešek**
Project no:	**MP2**
Author:	**Ing. Ježowicz**

OK STATIKA

Project data

Project name	Přístřešek
Project number	MP2
Author	Ing. Ježowicz
Description	MP2 -polorámy
Date	1/25/2022
Design code	EN

Material

Steel	S 235

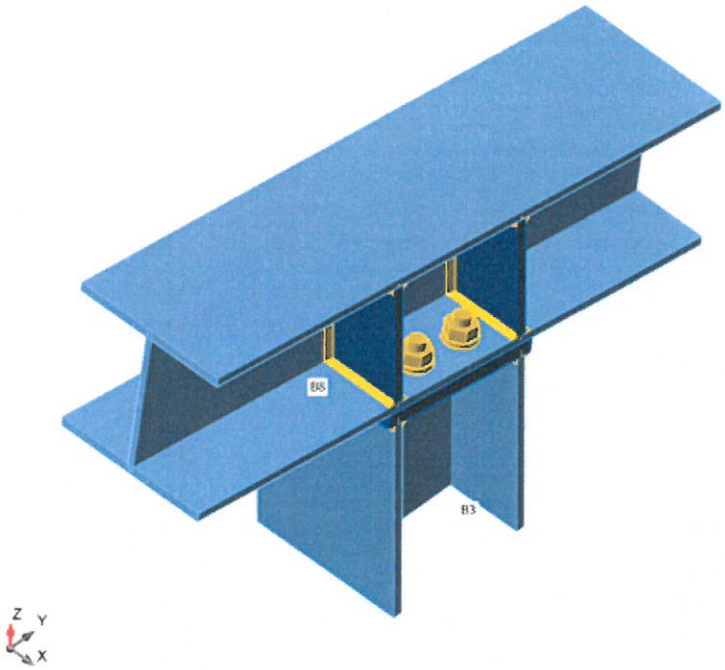
Project item Con N160

Design

Name	Con N160
Description	
Analysis	Stress, strain/ loads in equilibrium

Beams and columns

Name	Cross-section	β – Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]	Forces in
B3	1 - HEA160	0.0	0.0	0.0	0	0	0	Position
B8	1 - HEA160	0.0	0.0	0.0	0	0	0	Position



Cross-sections

Name	Material
1 - HEA160	S 235

Bolts

Name	Bolt assembly	Diameter [mm]	fu [MPa]	Gross area [mm^2]
M16 10.9	M16 10.9	16	1000.0	201

Load effects (forces in equilibrium)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
ULS-Set(2)(1)	B3	36.8	11.9	1.0	0.0	5.1	0.0
	B8	5.3	-8.9	-26.9	0.0	-13.8	3.3
	B8	1.4	-3.0	-9.3	0.0	8.7	-3.3
ULS-Set(1)(2)	B3	-8.3	-2.5	0.8	0.0	-0.3	0.0
	B8	-0.4	1.7	5.5	0.0	3.1	-0.8
	B8	-0.2	0.7	2.8	0.0	-2.8	0.7
ULS-Set(5)(12)	B3	17.4	5.1	0.8	0.0	2.6	0.0
	B8	2.8	-3.9	-12.8	0.0	-6.5	1.5
	B8	0.7	-1.2	-4.3	0.0	4.0	-1.5
ULS-Set(3)(13)	B3	2.6	1.6	-0.2	0.0	-0.2	0.0
	B8	0.1	-1.0	-1.7	0.0	-0.4	0.4
	B8	0.1	-0.5	-0.9	0.0	0.7	-0.4
ULS-Set(8)(3)	B3	6.3	2.7	-3.0	0.0	-7.2	0.0
	B8	-1.8	-1.7	-3.6	0.0	4.5	0.8
	B8	-0.2	-1.0	-3.1	0.0	2.7	-0.8
ULS-Set(7)(4)	B3	10.5	2.5	4.4	0.0	11.1	0.0
	B8	5.0	-2.3	-9.0	0.0	-11.7	0.6
	B8	1.0	-0.2	-0.8	0.0	0.7	-0.6
ULS-Set(9)(9)	B3	2.2	1.5	-0.2	0.0	-0.3	0.0
	B8	0.0	-1.0	-1.5	0.0	-0.3	0.4
	B8	0.1	-0.5	-0.8	0.0	0.6	-0.4
ULS-Set(10)(10)	B3	17.8	5.3	0.8	0.0	2.6	0.0
	B8	2.8	-4.0	-13.0	0.0	-6.7	1.5
	B8	0.7	-1.2	-4.4	0.0	4.1	-1.5
ULS-Set(6)(5)	B3	-4.6	-2.5	4.0	0.0	9.3	0.0
	B8	2.8	1.5	2.2	0.0	-6.4	-0.8
	B8	0.4	1.1	2.9	0.0	-2.8	0.8
ULS-Set(12)(6)	B3	21.4	7.8	-2.6	0.0	-5.4	0.0
	B8	0.4	-5.5	-14.8	0.0	-0.8	2.2
	B8	0.4	-2.3	-6.7	0.0	6.2	-2.2
ULS-Set(17)(14)	B3	16.9	6.4	0.2	0.0	1.5	0.0
	B8	2.2	-4.7	-12.4	0.0	-5.5	1.7
	B8	0.7	-1.7	-4.3	0.0	4.0	-1.7
ULS-Set(14)(15)	B3	3.1	0.3	0.3	0.0	0.8	0.0
	B8	0.7	-0.3	-2.1	0.0	-1.5	0.2
	B8	0.1	0.0	-0.9	0.0	0.7	-0.1
ULS-Set(18)(16)	B3	31.8	11.1	0.7	0.0	3.5	0.0
	B8	4.5	-8.3	-23.4	0.0	-10.9	3.0
	B8	1.2	-2.9	-7.9	0.0	7.4	-3.0
ULS-Set(19)(17)	B3	32.1	10.4	1.1	0.0	4.1	0.0
	B8	4.8	-7.8	-23.6	0.0	-11.5	2.9

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
	B8	1.2	-2.5	-7.9	0.0	7.4	-2.9
ULS-Set(15)(18)	B3	-4.2	-2.4	4.0	0.0	9.3	0.0
	B8	2.8	1.4	2.0	0.0	-6.6	-0.8
	B8	0.4	1.0	2.8	0.0	-2.7	0.8
ULS-Set(4)(7)	B3	34.6	12.0	-0.9	0.0	-0.6	0.0
	B8	3.4	-8.8	-24.9	0.0	-8.1	3.4
	B8	1.1	-3.2	-9.4	0.0	8.8	-3.4
ULS-Set(13)(8)	B3	28.1	8.9	3.3	0.0	9.3	0.0
	B8	6.2	-6.9	-21.4	0.0	-14.7	2.4
	B8	1.4	-2.0	-5.8	0.0	5.4	-2.4
ULS-Set(11)(11)	B3	25.1	7.7	0.6	0.0	4.2	0.0
	B8	3.5	-5.7	-18.1	0.0	-10.4	2.2
	B8	1.0	-2.0	-6.7	0.0	6.2	-2.2
ULS-Set(16)(19)	B3	21.0	7.7	-2.6	0.0	-5.4	0.0
	B8	0.4	-5.4	-14.5	0.0	-0.7	2.2
	B8	0.4	-2.3	-6.6	0.0	6.1	-2.2
ULS-Set(26)(20)	B3	3.3	1.1	0.1	0.0	0.3	0.0
	B8	0.4	-0.8	-2.2	0.0	-1.1	0.3
	B8	0.2	-0.3	-1.0	0.0	0.8	-0.3
ULS-Set(23)(21)	B3	2.7	0.2	0.3	0.0	0.8	0.0
	B8	0.6	-0.2	-1.9	0.0	-1.4	0.1
	B8	0.1	0.0	-0.8	0.0	0.6	-0.1
ULS-Set(24)(22)	B3	32.1	11.3	0.8	0.0	3.5	0.0
	B8	4.5	-8.4	-23.6	0.0	-11.0	3.1
	B8	1.3	-2.9	-8.0	0.0	7.5	-3.1
ULS-Set(20)(23)	B3	32.4	10.5	1.1	0.0	4.2	0.0
	B8	4.9	-7.9	-23.9	0.0	-11.6	2.9
	B8	1.3	-2.6	-8.0	0.0	7.5	-2.9
ULS-Set(21)(24)	B3	10.2	2.4	4.4	0.0	11.1	0.0
	B8	4.9	-2.2	-8.7	0.0	-11.6	0.6
	B8	1.0	-0.2	-0.7	0.0	0.6	-0.6
ULS-Set(22)(25)	B3	6.7	2.8	-3.0	0.0	-7.2	0.0
	B8	-1.8	-1.8	-3.9	0.0	4.3	0.9
	B8	-0.2	-1.1	-3.2	0.0	2.8	-0.9
ULS-Set(28)(26)	B3	27.7	8.7	3.2	0.0	9.2	0.0
	B8	6.1	-6.8	-21.2	0.0	-14.6	2.3
	B8	1.4	-1.9	-5.7	0.0	5.3	-2.3

Check

Summary

Name	Value	Status
Analysis	100.0%	OK
Plates	0.6 < 5.0%	OK
Bolts	59.4 < 100%	OK
Welds	98.0 < 100%	OK
Buckling	Not calculated	

Plates

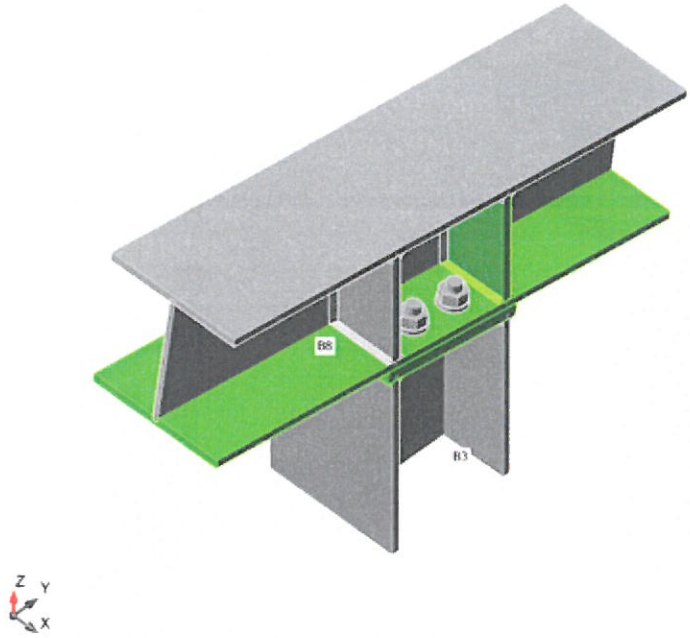
Name	Thickness [mm]	Loads	σ_{Ed} [MPa]	ε_{Pl} [%]	σc_{Ed} [MPa]	Status
B3-bfl 1	9.0	ULS-Set(7)(4)	155.1	0.0	0.0	OK
B3-tfl 1	9.0	ULS-Set(7)(4)	163.4	0.0	0.0	OK
B3-w 1	6.0	ULS-Set(7)(4)	125.6	0.0	0.0	OK
B8-bfl 1	9.0	ULS-Set(7)(4)	236.2	0.6	98.5	OK
B8-tfl 1	9.0	ULS-Set(13)(8)	100.5	0.0	0.0	OK
B8-w 1	6.0	ULS-Set(7)(4)	217.1	0.0	0.0	OK
EP1	15.0	ULS-Set(7)(4)	235.1	0.0	100.9	OK
STIFF1a	10.0	ULS-Set(7)(4)	235.1	0.0	0.0	OK
STIFF1b	10.0	ULS-Set(7)(4)	235.0	0.0	0.0	OK
STIFF1c	10.0	ULS-Set(8)(3)	147.0	0.0	0.0	OK
STIFF1d	10.0	ULS-Set(7)(4)	140.0	0.0	0.0	OK

Design data

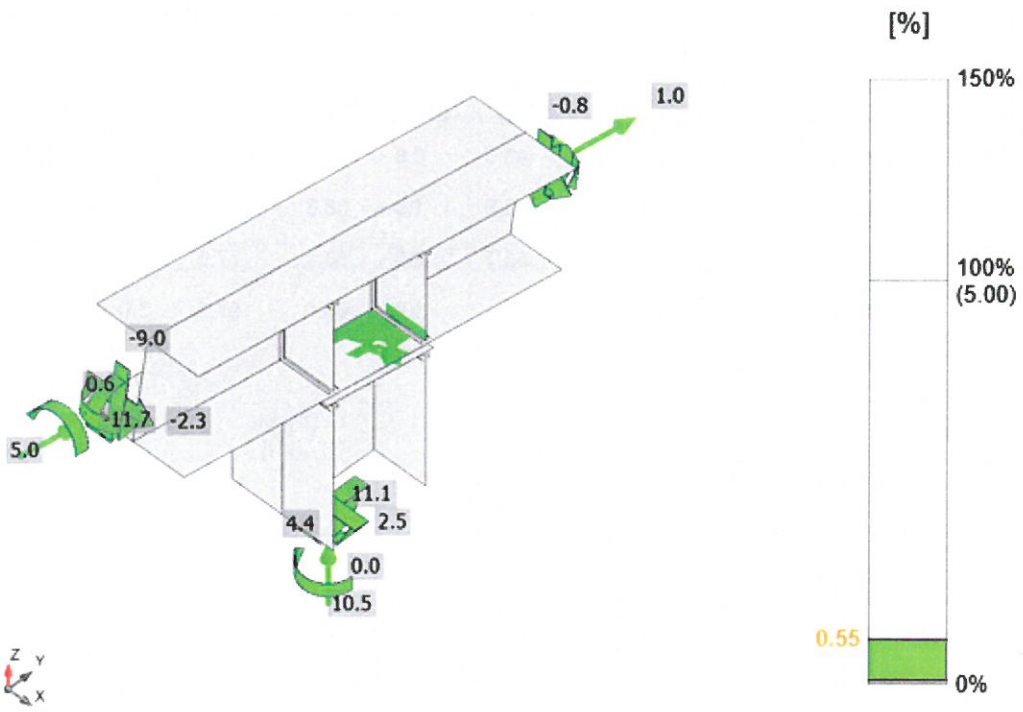
Material	f_y [MPa]	ε_{lim} [%]
S 235	235.0	5.0

Symbol explanation

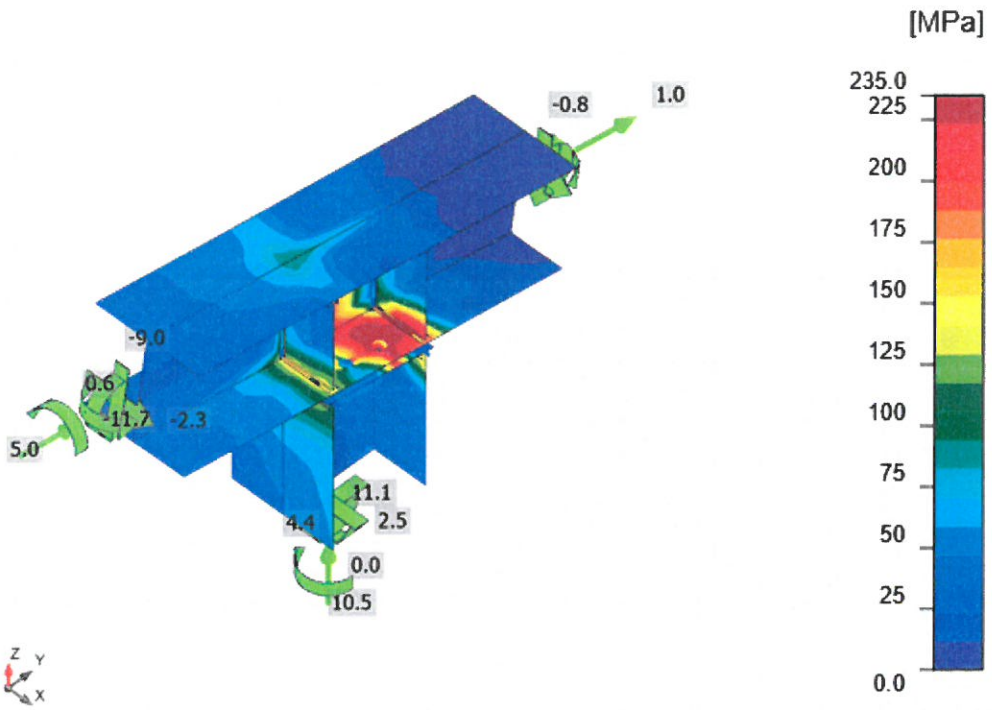
ε_{Pl}	Strain
σ_{Ed}	Eq. stress
σc_{Ed}	Contact stress
f_y	Yield strength
ε_{lim}	Limit of plastic strain



Overall check, ULS-Set(7)(4)

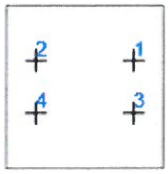


Strain check, ULS-Set(7)(4)



Equivalent stress, ULS-Set(7)(4)

Bolts



Name	Loads	$F_{t,Ed}$ [kN]	V [kN]	Ut_t [%]	$F_{b,Rd}$ [kN]	Ut_s [%]	Ut_{ts} [%]	Status
B1	ULS-Set(8)(3)	43.0	0.8	38.0	103.7	1.2	28.4	OK
B2	ULS-Set(8)(3)	43.9	1.5	38.8	58.4	2.5	30.1	OK
B3	ULS-Set(7)(4)	65.7	2.0	58.1	77.6	3.1	44.7	OK
B4	ULS-Set(7)(4)	67.1	1.9	59.4	67.5	3.0	45.4	OK

Design data

Name	$F_{t,Rd}$ [kN]	$B_{p,Rd}$ [kN]	$F_{v,Rd}$ [kN]
M16 10.9 - 1	113.0	138.2	62.8

Symbol explanation

$F_{t,Rd}$	Bolt tension resistance EN 1993-1-8 tab. 3.4
$F_{t,Ed}$	Tension force
$B_{p,Rd}$	Punching shear resistance
V	Resultant of shear forces Vy, Vz in bolt
$F_{v,Rd}$	Bolt shear resistance EN_1993-1-8 table 3.4
$F_{b,Rd}$	Plate bearing resistance EN 1993-1-8 tab. 3.4
Ut_t	Utilization in tension
Ut_s	Utilization in shear

Welds (Plastic redistribution)

Item	Edge	Throat th. [mm]	Length [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	ε_{Pl} [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	$\tau_{\perp}$ [MPa]	Ut [%]	Ut_c [%]	Status
EP1	B3-bfl 1	◢4.0◣	160	ULS-Set(7)(4)	156.6	0.0	48.0	-76.5	39.3	43.5	33.9	OK
		◢4.0◣	160	ULS-Set(8)(3)	181.1	0.0	-97.3	0.1	88.2	50.3	30.2	OK
EP1	B3-tfl 1	◢4.0◣	160	ULS-Set(7)(4)	237.0	0.0	-117.5	-0.9	-118.8	65.8	43.8	OK
		◢4.0◣	160	ULS-Set(7)(4)	136.3	0.0	-68.9	9.9	67.2	37.9	26.9	OK
EP1	B3-w 1	◢3.0◣	145	ULS-Set(7)(4)	352.8	0.0	-71.4	-192.3	-52.9	98.0	39.9	OK
		◢3.0◣	145	ULS-Set(7)(4)	352.8	0.0	-51.3	189.6	68.3	98.0	40.0	OK
B8-bfl 1	STIFF1a	◢4.0◣	77	ULS-Set(7)(4)	152.6	0.0	-22.2	83.6	-24.5	42.4	35.3	OK
		◢4.0◣	77	ULS-Set(7)(4)	337.5	0.0	149.2	147.5	-93.8	93.8	69.9	OK
B8-w 1	STIFF1a	◢4.0◣	134	ULS-Set(7)(4)	82.9	0.0	59.1	20.3	26.8	23.0	16.0	OK
		◢4.0◣	134	ULS-Set(7)(4)	62.5	0.0	-45.8	-20.5	13.4	17.7	14.0	OK
B8-tfl 1	STIFF1a	◢4.0◣	77	ULS-Set(7)(4)	52.5	0.0	-11.5	-26.4	13.5	14.6	10.5	OK
		◢4.0◣	77	ULS-Set(8)(3)	34.5	0.0	-13.5	-13.6	12.3	9.6	7.0	OK
B8-bfl 1	STIFF1b	◢4.0◣	77	ULS-Set(7)(4)	329.9	0.0	145.0	-145.2	90.4	91.6	67.0	OK
		◢4.0◣	77	ULS-Set(7)(4)	145.8	0.0	-19.4	-80.3	22.6	40.5	33.6	OK
B8-w 1	STIFF1b	◢4.0◣	134	ULS-Set(7)(4)	59.5	0.0	-44.4	19.3	-12.2	17.1	13.7	OK
		◢4.0◣	134	ULS-Set(7)(4)	81.8	0.0	58.6	-19.6	-26.5	22.7	15.4	OK
B8-tfl 1	STIFF1b	◢4.0◣	77	ULS-Set(8)(3)	36.7	0.0	-13.6	15.2	-12.5	10.2	7.6	OK
		◢4.0◣	77	ULS-Set(7)(4)	52.4	0.0	-11.7	26.2	-13.6	14.6	10.1	OK
B8-bfl 1	STIFF1c	◢4.0◣	77	ULS-Set(8)(3)	156.6	0.0	65.0	-66.8	47.9	43.5	35.6	OK
		◢4.0◣	77	ULS-Set(7)(4)	168.4	0.0	-61.1	-80.3	42.0	46.8	40.1	OK
B8-w 1	STIFF1c	◢4.0◣	134	ULS-Set(7)(4)	76.7	0.0	-30.5	-39.5	9.4	21.3	15.4	OK
		◢4.0◣	134	ULS-Set(7)(4)	67.8	0.0	32.2	32.6	-11.2	18.8	14.0	OK
B8-tfl 1	STIFF1c	◢4.0◣	77	ULS-Set(13)(8)	38.4	0.0	-15.5	17.6	-10.1	10.7	6.3	OK
		◢4.0◣	77	ULS-Set(13)(8)	30.6	0.0	-4.6	-15.3	8.4	8.5	4.4	OK
B8-bfl 1	STIFF1d	◢4.0◣	77	ULS-Set(7)(4)	167.5	0.0	-77.3	48.5	-70.7	46.5	41.6	OK
		◢4.0◣	77	ULS-Set(8)(3)	145.2	0.0	61.1	61.2	-45.2	40.3	33.8	OK
B8-w 1	STIFF1d	◢4.0◣	134	ULS-Set(7)(4)	68.4	0.0	31.5	-33.4	10.7	19.0	14.6	OK
		◢4.0◣	134	ULS-Set(7)(4)	78.5	0.0	-29.0	41.0	-9.7	21.8	16.4	OK
B8-tfl 1	STIFF1d	◢4.0◣	77	ULS-Set(13)(8)	36.4	0.0	-3.9	19.4	-7.7	10.1	5.1	OK
		◢4.0◣	77	ULS-Set(13)(8)	42.5	0.0	-15.4	-20.6	9.9	11.8	7.3	OK

Design data

	β_w [-]	$\sigma_{w,Rd}$ [MPa]	0.9 σ [MPa]
S 235	0.80	360.0	259.2

Symbol explanation

ε_{Pl}	Strain
$\sigma_{w,Ed}$	Equivalent stress
$\sigma_{w,Rd}$	Equivalent stress resistance
$\sigma_{\perp}$	Perpendicular stress
$\tau_{\parallel}$	Shear stress parallel to weld axis
$\tau_{\perp}$	Shear stress perpendicular to weld axis
0.9 σ	Perpendicular stress resistance - 0.9*fu/γM2
β_w	Corelation factor EN 1993-1-8 tab. 4.1
Ut	Utilization
Utc	Weld capacity utilization

Buckling

Buckling analysis was not calculated.

Project:	**Přístřešek**
Project no:	**MP2**
Author:	**Ing. Ježowicz**

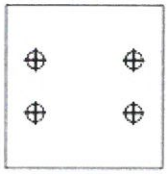
Project item Con N160

Design

Name	Con N160
Description	
Analysis	Stress, strain/ loads in equilibrium

Bill of material

Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds [mm]	Length [mm]	Bolts	Nr.
EP1	P15.0x160.0-166.9 (S 235)		1	Double fillet: a = 4.0 Double fillet: a = 3.0	320.0 144.8	M16 10.9	4
STIFF1	P10.0x77.0-134.1 (S 235)		4	Double fillet: a = 4.0	1152.3		

Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Double fillet	S 235	4.0	5.7	1472.3
Double fillet	S 235	3.0	4.2	144.8

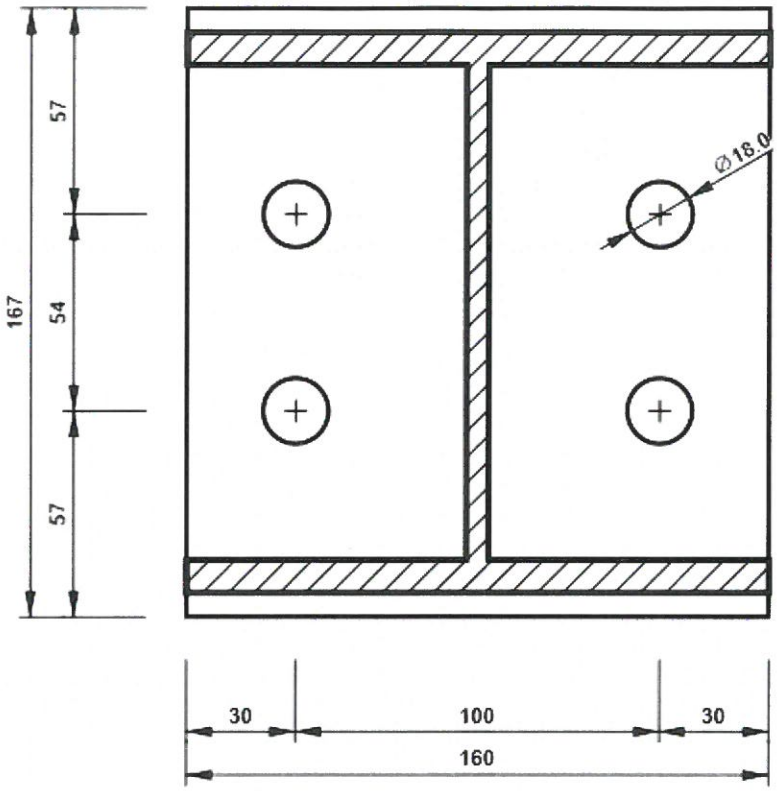
Bolts

Name	Grip length [mm]	Count
M16 10.9	24	4

Drawing

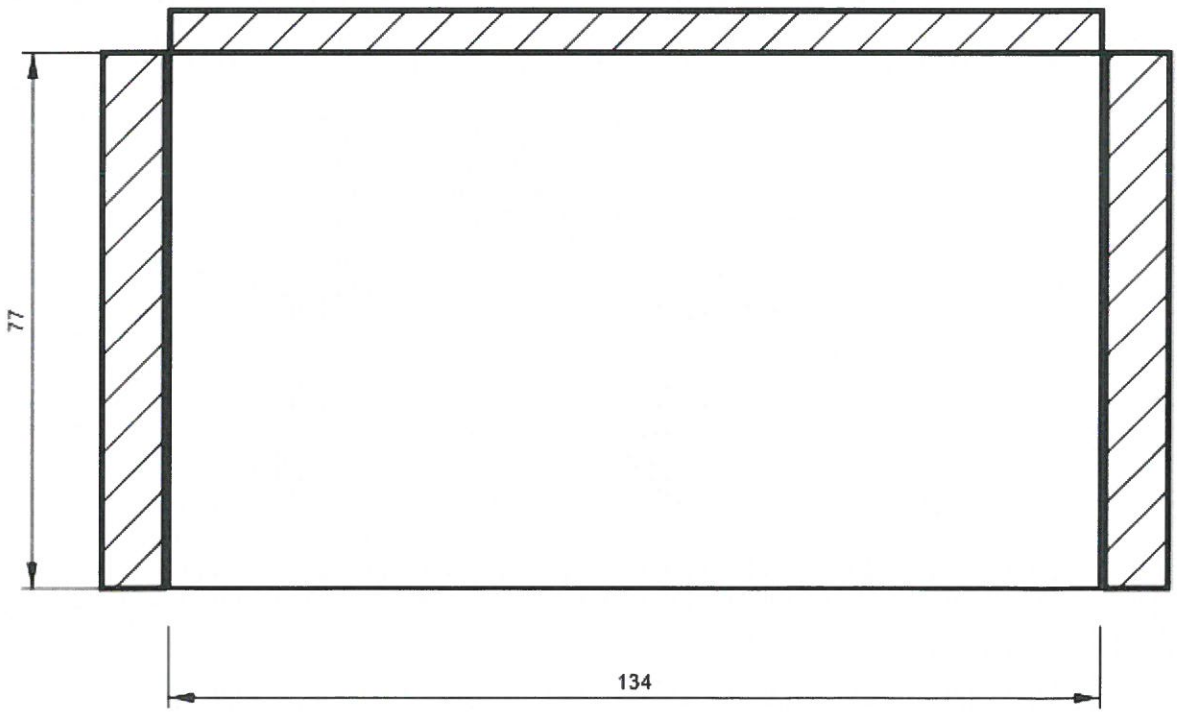
EP1

P15.0x167-160 (S 235)

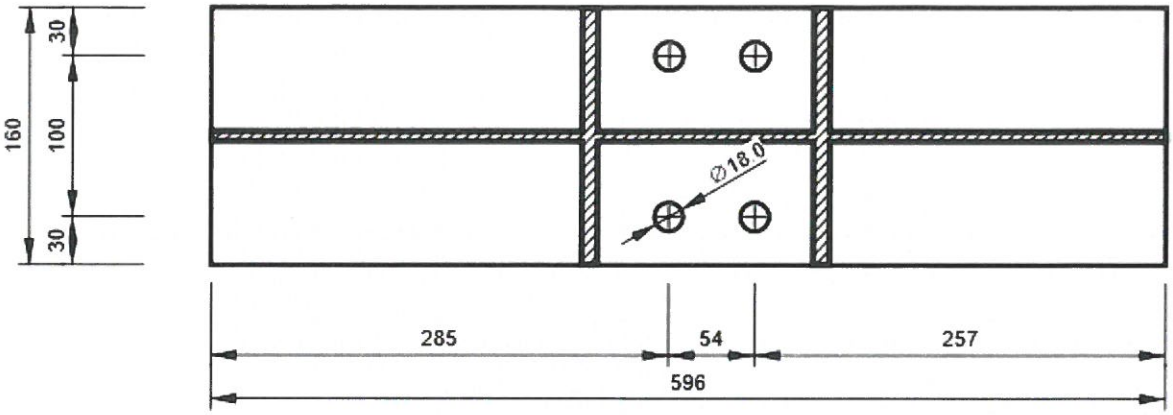


STIFF1

P10.0x134-77 (S 235)



B8, HEA160 - Bottom flange 1:



Project:	**Přístřešek**
Project no:	**MP3**
Author:	**Ing. Ježowicz**

OK STATIKA

Project data

Project name	Přístřešek
Project number	MP3
Author	Ing. Ježowicz
Description	rám - polorám
Date	1/25/2022
Design code	EN

Material

Steel	S 235

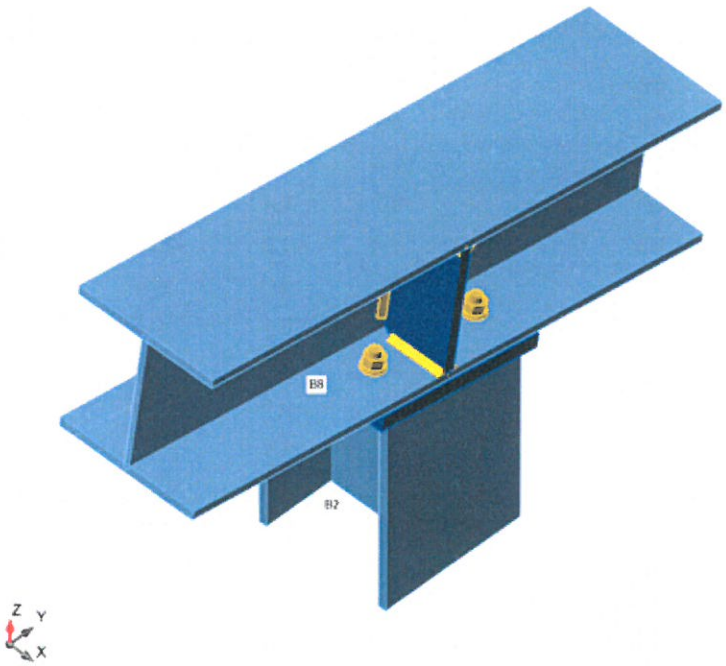
Project item Con N159

Design

Name	Con N159
Description	
Analysis	Stress, strain/ loads in equilibrium

Beams and columns

Name	Cross-section	β – Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]	Forces in
B2	1 - HEA160	0.0	0.0	0.0	0	0	0	Position
B8	1 - HEA160	0.0	0.0	0.0	0	0	0	Position



Cross-sections

Name	Material
1 - HEA160	S 235

Bolts

Name	Bolt assembly	Diameter [mm]	fu [MPa]	Gross area [mm^2]
M12 4.6	M12 4.6	12	400.0	113

Load effects (forces in equilibrium)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
ULS-Set(2)(1)	B2	36.9	1.3	3.3	0.0	0.0	-5.5
	B8	1.1	-2.1	-9.4	0.0	-8.4	1.5
	B8	3.4	-1.2	-27.2	0.0	13.9	-1.5
ULS-Set(1)(2)	B2	-12.1	-1.0	-0.6	0.0	0.0	4.9
	B8	0.4	0.1	2.9	0.0	2.9	-0.3
	B8	-1.4	0.5	9.2	0.0	-7.7	0.3
ULS-Set(3)(3)	B2	26.8	1.1	2.2	0.0	0.0	-5.7
	B8	0.4	-1.2	-6.8	0.0	-6.1	1.0
	B8	2.7	-1.0	-19.9	0.0	11.8	-1.0
ULS-Set(8)(12)	B2	16.3	0.4	0.7	0.0	0.0	-1.4
	B8	0.7	-0.8	-4.3	0.0	-3.8	0.6
	B8	1.5	0.2	-11.8	0.0	5.2	-0.6
ULS-Set(6)(13)	B2	2.9	0.2	1.3	0.0	0.0	-0.5
	B8	0.1	-0.5	-0.9	0.0	-0.7	0.3
	B8	0.2	-0.9	-2.0	0.0	1.2	-0.3
ULS-Set(10)(10)	B2	17.0	0.6	2.7	0.0	0.0	-1.9
	B8	0.7	-1.4	-4.4	0.0	-3.9	0.9
	B8	1.4	-1.3	-12.4	0.0	5.8	-0.9
ULS-Set(9)(11)	B2	2.2	0.0	-0.7	0.0	0.0	0.1
	B8	0.1	0.1	-0.8	0.0	-0.6	0.0
	B8	0.3	0.6	-1.4	0.0	0.5	0.0
ULS-Set(13)(15)	B2	16.6	0.6	2.6	0.0	0.0	-1.9
	B8	0.7	-1.4	-4.3	0.0	-3.8	0.9
	B8	1.4	-1.3	-12.2	0.0	5.7	-0.9
ULS-Set(11)(16)	B2	2.5	0.0	-0.6	0.0	0.0	0.0
	B8	0.2	0.1	-0.9	0.0	-0.6	0.0
	B8	0.3	0.6	-1.6	0.0	0.6	0.0
ULS-Set(14)(17)	B2	30.6	1.0	3.6	0.0	0.0	-3.2
	B8	1.2	-2.2	-7.9	0.0	-7.0	1.4
	B8	2.6	-1.4	-22.5	0.0	10.3	-1.4
ULS-Set(19)(4)	B2	12.4	0.7	0.8	0.0	0.0	-4.2
	B8	-0.2	-0.3	-3.1	0.0	-2.8	0.3
	B8	1.4	-0.6	-9.2	0.0	7.0	-0.3
ULS-Set(17)(5)	B2	2.3	-0.5	0.7	0.0	0.0	3.4
	B8	1.0	-0.8	-0.8	0.0	-0.5	0.3
	B8	-0.1	0.1	-1.4	0.0	-3.0	-0.3
ULS-Set(15)(18)	B2	36.5	1.3	3.3	0.0	0.0	-5.5
	B8	1.1	-2.1	-9.3	0.0	-8.3	1.5
	B8	3.4	-1.2	-27.0	0.0	13.8	-1.5
ULS-Set(12)(19)	B2	-11.8	-0.9	-0.6	0.0	0.0	4.9
	B8	0.4	0.1	2.8	0.0	2.8	-0.3

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
	B8	-1.3	0.5	9.0	0.0	-7.6	0.3
ULS-Set(20)(6)	B2	8.7	0.9	0.8	0.0	0.0	-0.2
	B8	0.4	-0.6	-3.0	0.0	-2.6	0.4
	B8	0.1	-0.3	-5.7	0.0	2.8	-0.3
ULS-Set(18)(7)	B2	24.4	0.2	2.5	0.0	0.0	-2.4
	B8	1.1	-1.7	-5.8	0.0	-5.2	1.1
	B8	2.5	-0.8	-18.3	0.0	7.6	-1.1
ULS-Set(16)(20)	B2	30.4	0.8	2.4	0.0	0.0	-2.9
	B8	1.3	-1.9	-7.9	0.0	-7.0	1.2
	B8	2.7	-0.5	-22.3	0.0	9.9	-1.2
ULS-Set(7)(14)	B2	31.0	1.0	3.6	0.0	0.0	-3.3
	B8	1.3	-2.2	-8.0	0.0	-7.1	1.4
	B8	2.6	-1.4	-22.8	0.0	10.4	-1.4
ULS-Set(5)(8)	B2	-8.4	-1.1	-0.6	0.0	0.0	0.9
	B8	-0.2	0.4	2.8	0.0	2.7	-0.3
	B8	0.0	0.2	5.7	0.0	-3.6	0.3
ULS-Set(4)(9)	B2	34.6	1.4	3.3	0.0	0.0	-3.1
	B8	1.4	-2.3	-9.3	0.0	-8.3	1.5
	B8	2.6	-1.1	-25.1	0.0	11.5	-1.5
ULS-Set(26)(21)	B2	3.2	0.1	0.4	0.0	0.0	-0.3
	B8	0.2	-0.2	-1.0	0.0	-0.8	0.2
	B8	0.3	-0.2	-2.2	0.0	1.0	-0.2
ULS-Set(25)(22)	B2	22.2	0.3	2.4	0.0	0.0	0.0
	B8	1.4	-1.9	-5.8	0.0	-5.1	1.1
	B8	1.7	-0.6	-16.2	0.0	5.1	-1.1
ULS-Set(28)(23)	B2	30.8	0.9	2.4	0.0	0.0	-2.9
	B8	1.3	-1.9	-8.0	0.0	-7.1	1.2
	B8	2.7	-0.6	-22.5	0.0	10.0	-1.2
ULS-Set(30)(26)	B2	1.9	-0.5	0.7	0.0	0.0	3.4
	B8	1.0	-0.8	-0.6	0.0	-0.4	0.3
	B8	-0.2	0.1	-1.2	0.0	-3.1	-0.3
ULS-Set(29)(24)	B2	2.6	0.2	1.3	0.0	0.0	-0.5
	B8	0.1	-0.4	-0.8	0.0	-0.6	0.3
	B8	0.1	-0.8	-1.8	0.0	1.0	-0.3
ULS-Set(21)(25)	B2	26.4	1.1	2.2	0.0	0.0	-5.6
	B8	0.4	-1.2	-6.6	0.0	-6.0	0.9
	B8	2.7	-1.0	-19.7	0.0	11.6	-0.9
ULS-Set(32)(27)	B2	12.7	0.7	0.9	0.0	0.0	-4.2
	B8	-0.2	-0.3	-3.2	0.0	-2.8	0.4
	B8	1.5	-0.6	-9.5	0.0	7.1	-0.4
ULS-Set(31)(28)	B2	21.8	0.3	2.4	0.0	0.0	0.0
	B8	1.4	-1.8	-5.7	0.0	-5.0	1.1
	B8	1.7	-0.6	-15.9	0.0	5.0	-1.1

Check

Summary

Name	Value	Status
Analysis	100.0%	OK
Plates	0.0 < 5.0%	OK
Bolts	72.7 < 100%	OK
Welds	98.0 < 100%	OK
Buckling	Not calculated	

Plates

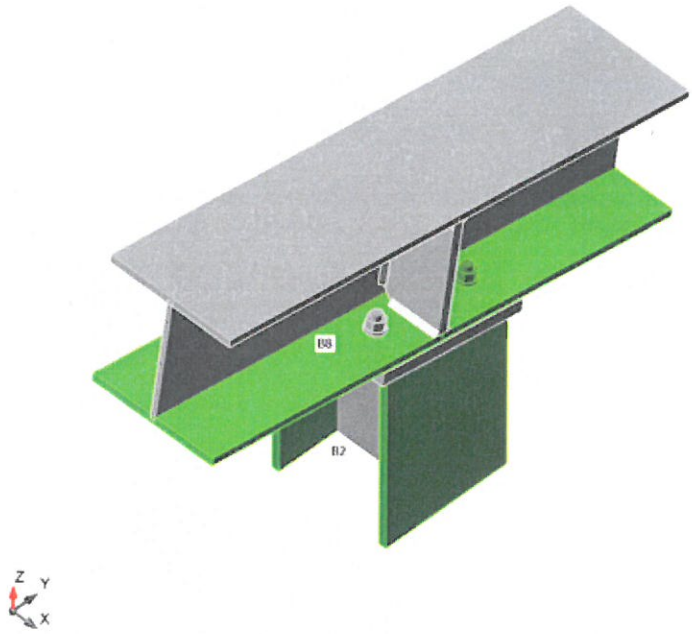
Name	Thickness [mm]	Loads	σ_{Ed} [MPa]	ε_{Pl} [%]	σc_{Ed} [MPa]	Status
B2-bfl 1	9.0	ULS-Set(2)(1)	198.5	0.0	0.0	OK
B2-tfl 1	9.0	ULS-Set(3)(3)	196.0	0.0	0.0	OK
B2-w 1	6.0	ULS-Set(2)(1)	129.9	0.0	0.0	OK
B8-bfl 1	9.0	ULS-Set(1)(2)	227.4	0.0	21.3	OK
B8-tfl 1	9.0	ULS-Set(2)(1)	71.1	0.0	0.0	OK
B8-w 1	6.0	ULS-Set(3)(3)	96.8	0.0	0.0	OK
EP1	15.0	ULS-Set(3)(3)	235.0	0.0	37.7	OK
STIFF1a	12.0	ULS-Set(1)(2)	109.2	0.0	0.0	OK
STIFF1b	12.0	ULS-Set(3)(3)	119.5	0.0	0.0	OK

Design data

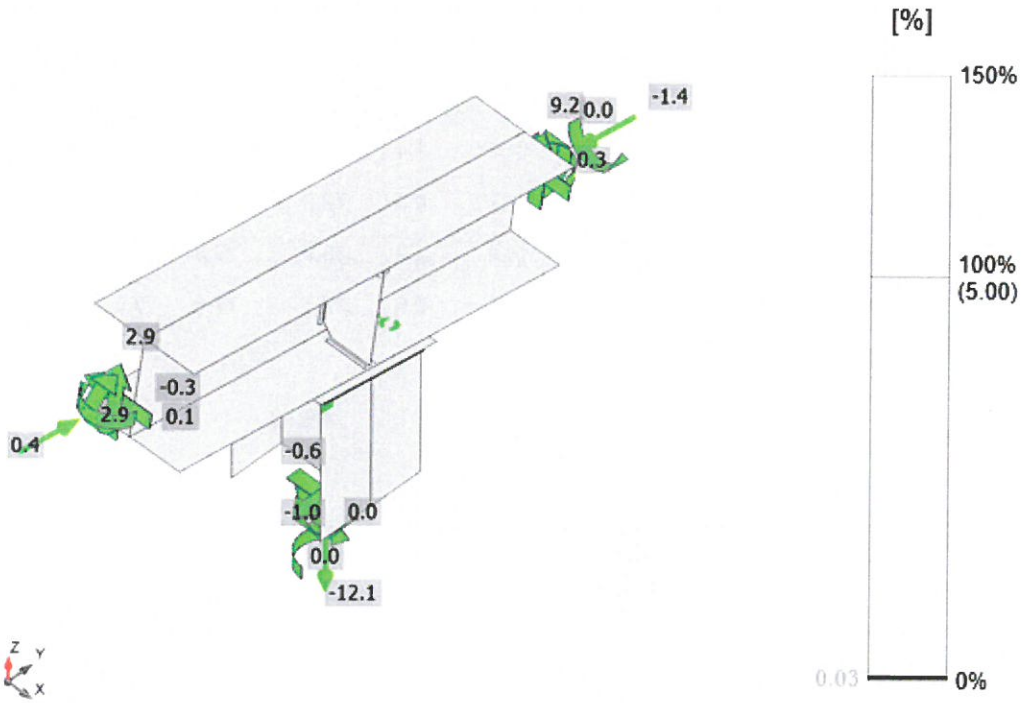
Material	f_y [MPa]	ε_{lim} [%]
S 235	235.0	5.0

Symbol explanation

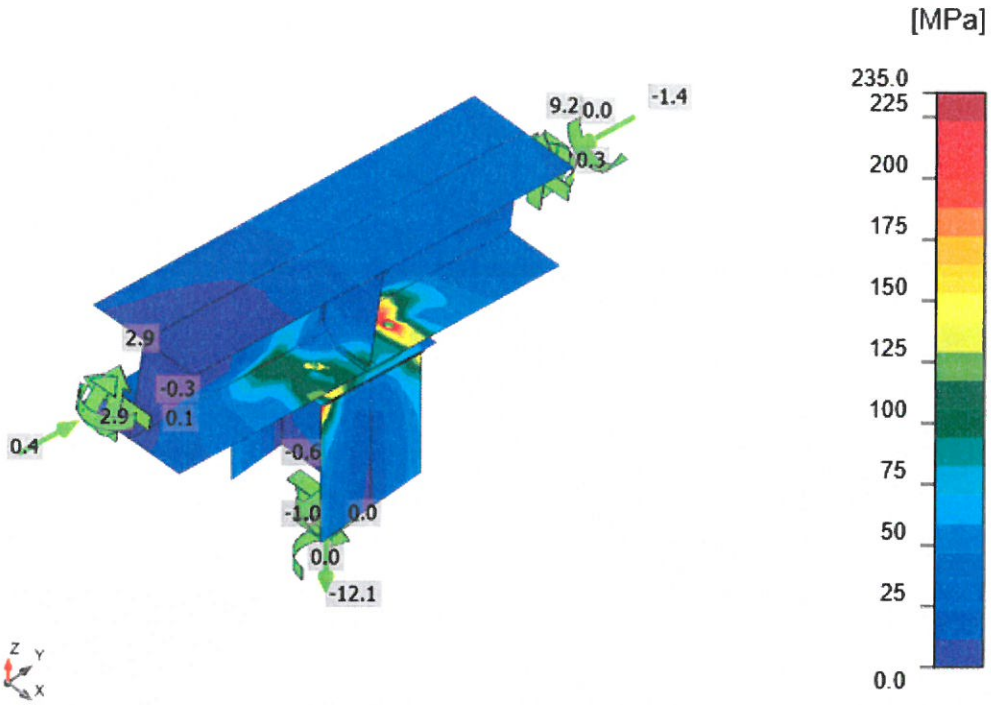
ε_{Pl}	Strain
σ_{Ed}	Eq. stress
σc_{Ed}	Contact stress
f_y	Yield strength
ε_{lim}	Limit of plastic strain



Overall check, ULS-Set(1)(2)

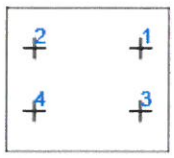


Strain check, ULS-Set(1)(2)



Equivalent stress, ULS-Set(1)(2)

Bolts



Name	Loads	$F_{t,Ed}$ [kN]	V [kN]	Ut_t [%]	$F_{b,Rd}$ [kN]	Ut_s [%]	Ut_{ts} [%]	Status
B1	ULS-Set(3)(3)	14.9	1.4	60.9	77.8	8.3	51.8	OK
B2	ULS-Set(1)(2)	17.7	0.3	72.2	77.8	1.9	53.5	OK
B3	ULS-Set(3)(3)	14.4	1.2	58.9	77.8	7.1	49.2	OK
B4	ULS-Set(1)(2)	17.8	0.6	72.7	77.8	3.5	55.5	OK

Design data

Name	$F_{t,Rd}$ [kN]	$B_{p,Rd}$ [kN]	$F_{v,Rd}$ [kN]
M12 4.6 - 1	24.5	95.3	16.3

Symbol explanation

$F_{t,Rd}$	Bolt tension resistance EN 1993-1-8 tab. 3.4
$F_{t,Ed}$	Tension force
$B_{p,Rd}$	Punching shear resistance
V	Resultant of shear forces Vy, Vz in bolt
$F_{v,Rd}$	Bolt shear resistance EN_1993-1-8 table 3.4
$F_{b,Rd}$	Plate bearing resistance EN 1993-1-8 tab. 3.4
Ut_t	Utilization in tension
Ut_s	Utilization in shear

Welds (Plastic redistribution)

Item	Edge	Throat th. [mm]	Length [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	ε_{Pl} [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	$\tau_{\perp}$ [MPa]	Ut [%]	Ut_c [%]	Status
EP1	B2-bfl 1	◢4.0◣	162	ULS-Set(3)(3)	352.9	0.1	-181.8	123.3	-123.7	98.0	43.3	OK
		◢4.0◣	162	ULS-Set(3)(3)	259.1	0.0	-50.0	-34.8	142.6	72.0	44.8	OK
EP1	B2-tfl 1	◢4.0◣	162	ULS-Set(3)(3)	258.4	0.0	-49.1	34.1	-142.5	71.8	44.7	OK
		◢4.0◣	162	ULS-Set(3)(3)	352.9	0.1	-181.9	-124.1	122.8	98.0	43.1	OK
EP1	B2-w 1	◢3.0◣	143	ULS-Set(2)(1)	172.3	0.0	-44.2	-94.3	-18.6	47.9	35.8	OK
		◢3.0◣	143	ULS-Set(3)(3)	125.2	0.0	20.3	71.3	-2.7	34.8	21.9	OK
B8-bfl 1	STIFF1a	◢4.0◣	62	ULS-Set(1)(2)	95.7	0.0	26.9	-45.3	27.5	26.6	22.8	OK
		◢4.0◣	62	ULS-Set(30)(26)	99.6	0.0	-61.3	-34.2	29.8	27.7	20.3	OK
B8-w 1	STIFF1a	◢4.0◣	104	ULS-Set(2)(1)	41.6	0.0	34.7	6.5	11.6	13.4	5.9	OK
		◢4.0◣	104	ULS-Set(3)(3)	28.6	0.0	-24.5	-8.3	1.6	9.5	5.5	OK
B8-tfl 1	STIFF1a	◢4.0◣	62	ULS-Set(2)(1)	29.0	0.0	9.7	-12.3	9.8	8.0	5.3	OK
		◢4.0◣	62	ULS-Set(1)(2)	25.9	0.0	15.3	8.9	-8.2	7.2	4.5	OK
B8-bfl 1	STIFF1b	◢4.0◣	62	ULS-Set(30)(26)	107.3	0.0	-65.6	36.5	-32.7	29.8	21.4	OK
		◢4.0◣	62	ULS-Set(3)(3)	96.7	0.0	-60.5	-27.2	34.0	26.9	22.6	OK
B8-w 1	STIFF1b	◢4.0◣	104	ULS-Set(3)(3)	29.1	0.0	-27.8	4.8	-1.4	10.7	5.2	OK
		◢4.0◣	104	ULS-Set(3)(3)	41.8	0.0	37.2	0.9	-10.9	14.4	5.6	OK
B8-tfl 1	STIFF1b	◢4.0◣	62	ULS-Set(2)(1)	28.6	0.0	-15.6	10.8	-8.7	8.0	4.7	OK
		◢4.0◣	62	ULS-Set(3)(3)	22.8	0.0	9.2	7.6	-9.3	6.3	5.3	OK

Design data

	β_w [-]	$\sigma_{w,Rd}$ [MPa]	0.9 σ [MPa]
S 235	0.80	360.0	259.2

Symbol explanation

ε_{Pl}	Strain
$\sigma_{w,Ed}$	Equivalent stress
$\sigma_{w,Rd}$	Equivalent stress resistance
$\sigma_{\perp}$	Perpendicular stress
$\tau_{\parallel}$	Shear stress parallel to weld axis
$\tau_{\perp}$	Shear stress perpendicular to weld axis
0.9 σ	Perpendicular stress resistance - 0.9*fu/γM2
β_w	Corelation factor EN 1993-1-8 tab. 4.1
Ut	Utilization
Utc	Weld capacity utilization

Buckling

Buckling analysis was not calculated.

Code settings

Item	Value	Unit	Reference

Item	Value	Unit	Reference
γ_{M0}	1.00	-	EN 1993-1-1: 6.1
γ_{M1}	1.00	-	EN 1993-1-1: 6.1
γ_{M2}	1.25	-	EN 1993-1-1: 6.1
γ_{M3}	1.25	-	EN 1993-1-8: 2.2
γ_{C}	1.50	-	EN 1992-1-1: 2.4.2.4
γ_{Inst}	1.20	-	EN 1992-4: Table 4.1
Joint coefficient βj	0.67	-	EN 1993-1-8: 6.2.5
Effective area - influence of mesh size	0.10	-	
Friction coefficient - concrete	0.25	-	EN 1993-1-8
Friction coefficient in slip-resistance	0.30	-	EN 1993-1-8 tab 3.7
Limit plastic strain	0.05	-	EN 1993-1-5
Weld stress evaluation	Plastic redistribution		
Detailing	No		
Distance between bolts [d]	2.20	-	EN 1993-1-8: tab 3.3
Distance between bolts and edge [d]	1.20	-	EN 1993-1-8: tab 3.3
Concrete breakout resistance check	Both		EN 1992-4: 7.2.1.4 and 7.2.2.5
Use calculated αb in bearing check.	Yes		EN 1993-1-8: tab 3.4
Cracked concrete	Yes		EN 1992-4
Local deformation check	No		CIDECT DG 1, 3 - 1.1
Local deformation limit	0.03	-	CIDECT DG 1, 3 - 1.1
Geometrical nonlinearity (GMNA)	Yes		Analysis with large deformations for hollow section joints
Braced system	No		EN 1993-1-8: 5.2.2.5

Project:	**Přístřešek**
Project no:	**MP3**
Author:	**Ing. Ježowicz**

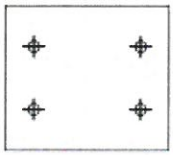
Project item Con N159

Design

Name	Con N159
Description	
Analysis	Stress, strain/ loads in equilibrium

Bill of material

Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds [mm]	Length [mm]	Bolts	Nr.
EP1	P15.0x187.0-165.0 (S 235)		1	Double fillet: a = 4.0 Double fillet: a = 3.0	324.0 143.0	M12 4.6	4
STIFF1	P12.0x77.0-134.0 (S 235)		2	Double fillet: a = 4.0	456.0		

Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Double fillet	S 235	4.0	5.7	780.0
Double fillet	S 235	3.0	4.2	143.0

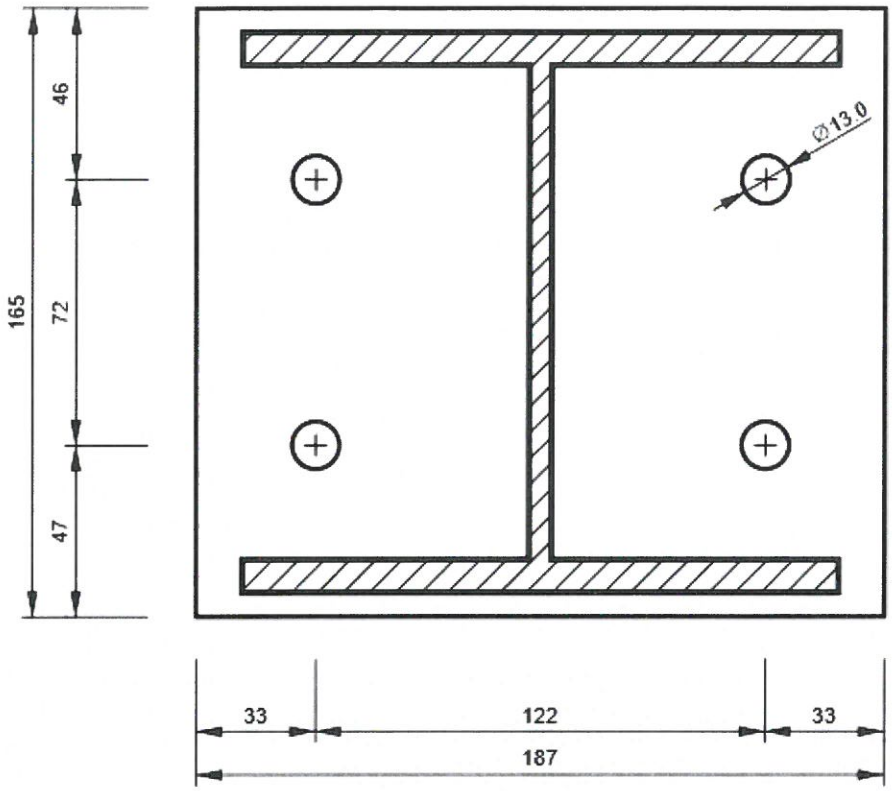
Bolts

Name	Grip length [mm]	Count
M12 4.6	24	4

Drawing

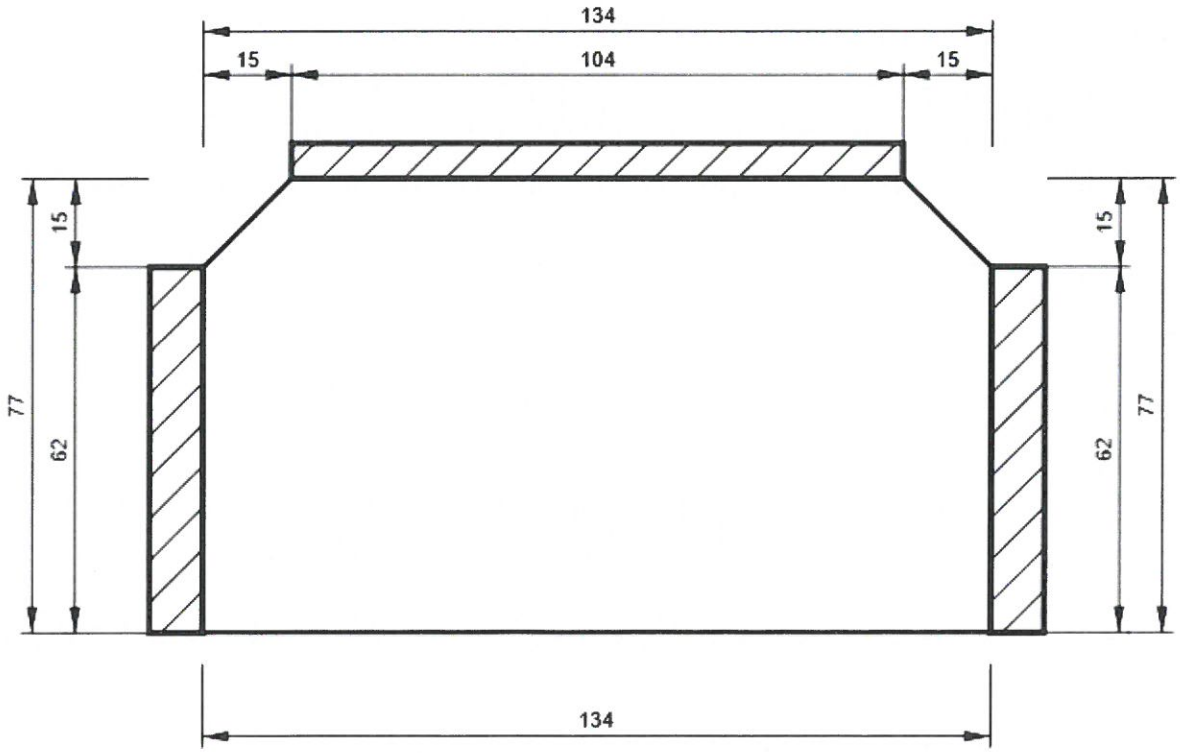
EP1

P15.0x165-187 (S 235)

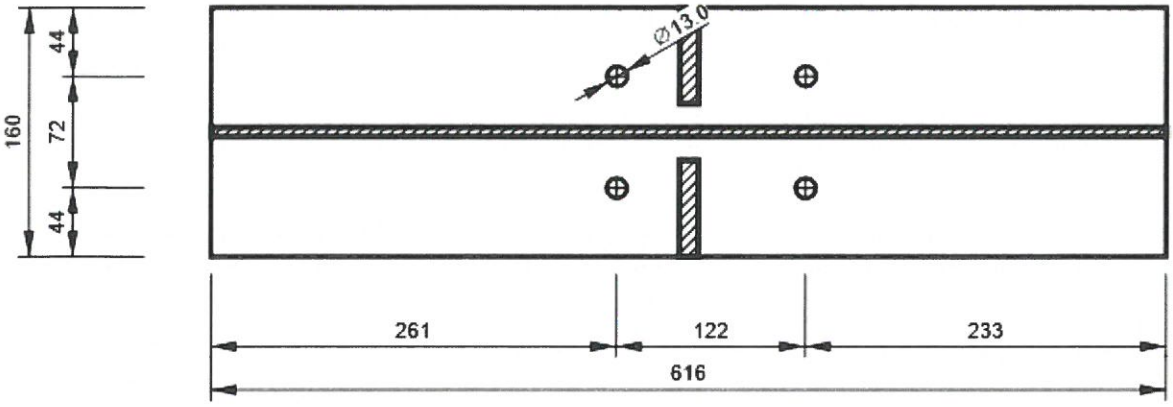


STIFF1

P12.0x134-77 (S 235)



B8, HEA160 - Bottom flange 1:



Project:	**Přístřešek**
Project no:	**SvP1**
Author:	**Ing. Ježowicz**

Project data

Project name	Přístřešek
Project number	SvP1
Author	Ing. Ježowicz
Description	SvP1 - příčel - polorámy
Date	1/25/2022
Design code	EN

Material

Steel	S 235

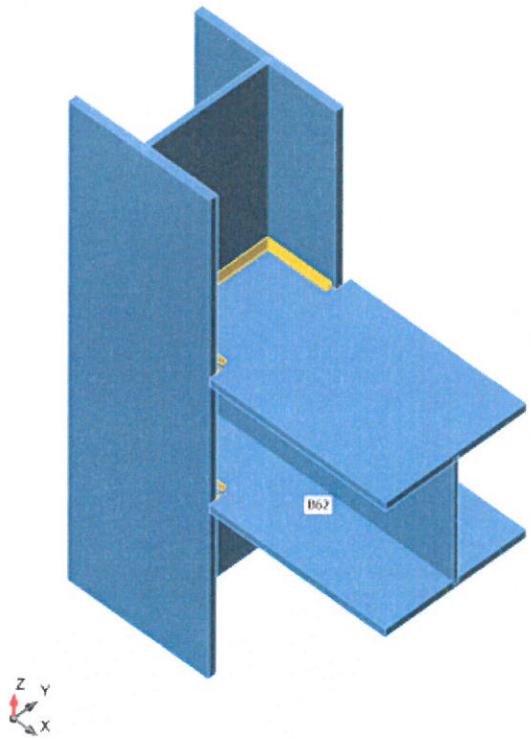
Project item Con N161

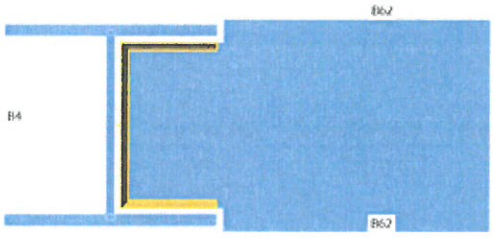
Design

Name	Con N161
Description	
Analysis	Stress, strain/ loads in equilibrium

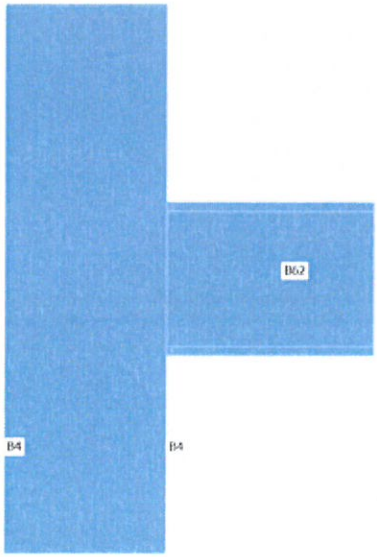
Beams and columns

Name	Cross-section	β – Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]	Forces in
B4	1 - HEA160	0.0	0.0	0.0	0	0	0	Position
B62	1 - HEA160	0.0	0.0	0.0	0	0	0	Position

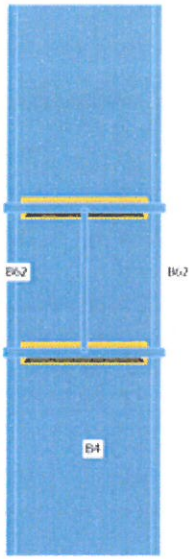



B62
B4
B62


Y
Z
X


B62
B4
B4


Z
Y
X



Cross-sections

Name	Material
1 - HEA160	S 235

Load effects (forces in equilibrium)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
ULS-Set(2)(1)	B4	37.5	0.4	1.3	0.0	4.8	-1.2
	B4	-36.9	11.9	-1.0	0.0	-4.8	3.8
	B62	12.4	0.3	-0.6	0.0	2.5	0.0
ULS-Set(1)(2)	B4	-7.7	-0.1	0.2	0.0	-0.5	0.4
	B4	8.2	-2.5	-0.7	0.0	0.5	-0.8
	B62	-2.6	-0.5	-0.5	0.0	-0.4	0.0
ULS-Set(5)(12)	B4	4.8	-0.7	-0.2	0.0	-0.2	2.4
	B4	-2.7	1.7	0.2	0.0	0.2	0.5
	B62	0.9	0.0	-2.1	0.0	3.0	0.0
ULS-Set(3)(13)	B4	16.5	0.9	0.8	0.0	2.3	-3.0
	B4	-17.5	5.0	-0.8	0.0	-2.3	1.6
	B62	6.0	0.0	1.0	0.0	-1.4	0.0
ULS-Set(8)(3)	B4	6.9	0.1	-3.6	0.0	-6.3	-0.2
	B4	-6.4	2.7	3.1	0.0	6.3	0.9
	B62	2.8	-0.5	-0.5	0.0	0.7	0.0
ULS-Set(7)(4)	B4	11.2	0.1	4.9	0.0	9.7	-0.2
	B4	-10.6	2.5	-4.5	0.0	-9.7	0.8
	B62	2.6	0.5	-0.6	0.0	0.6	0.0
ULS-Set(9)(9)	B4	17.0	0.9	0.8	0.0	2.4	-3.0
	B4	-17.9	5.2	-0.8	0.0	-2.4	1.6
	B62	6.1	0.0	0.9	0.0	-1.3	0.0
ULS-Set(11)(10)	B4	4.3	-0.7	-0.2	0.0	-0.2	2.4
	B4	-2.3	1.5	0.2	0.0	0.2	0.5
	B62	0.8	0.0	-2.0	0.0	2.9	0.0
ULS-Set(4)(5)	B4	-3.9	-0.1	4.5	0.0	8.0	0.4
	B4	4.5	-2.5	-4.0	0.0	-8.0	-0.8
	B62	-2.7	0.5	-0.5	0.0	-0.4	0.0
ULS-Set(12)(6)	B4	22.1	0.3	-3.1	0.0	-4.6	-0.8
	B4	-21.5	7.8	2.7	0.0	4.6	2.5
	B62	8.0	-0.5	-0.6	0.0	1.7	0.0
ULS-Set(18)(14)	B4	2.3	0.7	0.3	0.0	0.7	-2.4
	B4	-3.2	0.2	-0.3	0.0	-0.7	0.1
	B62	0.9	0.0	0.9	0.0	-2.3	0.0
ULS-Set(14)(15)	B4	19.1	-0.5	0.2	0.0	1.4	1.9
	B4	-17.0	6.5	-0.2	0.0	-1.4	2.0
	B62	6.0	0.0	-2.0	0.0	3.9	0.0
ULS-Set(15)(16)	B4	33.3	-0.1	0.7	0.0	3.3	0.3
	B4	-31.9	11.2	-0.7	0.0	-3.3	3.5
	B62	11.1	0.0	-1.4	0.0	3.9	0.0
ULS-Set(17)(17)	B4	-3.5	-0.1	4.5	0.0	8.0	0.4
	B4	4.1	-2.4	-4.0	0.0	-8.0	-0.8

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
	B62	-2.6	0.5	-0.6	0.0	-0.4	0.0
ULS-Set(16)(18)	B4	31.8	0.8	1.1	0.0	3.8	-2.6
	B4	-32.2	10.3	-1.1	0.0	-3.8	3.3
	B62	11.1	0.0	0.4	0.0	0.7	0.0
ULS-Set(6)(7)	B4	35.3	0.4	-1.3	0.0	-0.3	-1.2
	B4	-34.7	12.0	1.0	0.0	0.3	3.8
	B62	12.4	-0.3	-0.6	0.0	2.5	0.0
ULS-Set(13)(8)	B4	28.8	0.3	3.6	0.0	8.2	-0.9
	B4	-28.2	8.9	-3.3	0.0	-8.2	2.8
	B62	9.1	0.3	-0.6	0.0	1.9	0.0
ULS-Set(10)(11)	B4	25.8	0.3	1.2	0.0	4.0	-0.8
	B4	-25.2	7.7	-0.7	0.0	-4.0	2.4
	B62	7.9	0.5	-0.6	0.0	1.7	0.0
ULS-Set(19)(19)	B4	21.7	0.3	-3.1	0.0	-4.6	-0.8
	B4	-21.1	7.7	2.7	0.0	4.6	2.4
	B62	7.9	-0.5	-0.5	0.0	1.7	0.0
ULS-Set(22)(20)	B4	19.5	-0.6	0.2	0.0	1.5	1.9
	B4	-17.4	6.6	-0.2	0.0	-1.5	2.1
	B62	6.1	0.0	-2.1	0.0	4.0	0.0
ULS-Set(20)(21)	B4	1.8	0.7	0.3	0.0	0.7	-2.4
	B4	-2.8	0.1	-0.3	0.0	-0.7	0.0
	B62	0.8	0.0	1.0	0.0	-2.4	0.0
ULS-Set(21)(22)	B4	33.7	-0.1	0.8	0.0	3.3	0.3
	B4	-32.2	11.3	-0.8	0.0	-3.3	3.6
	B62	11.2	0.0	-1.5	0.0	3.9	0.0
ULS-Set(28)(23)	B4	34.8	0.4	-1.3	0.0	-0.4	-1.3
	B4	-34.3	11.9	1.0	0.0	0.4	3.8
	B62	12.3	-0.3	-0.5	0.0	2.5	0.0
ULS-Set(23)(24)	B4	32.2	0.8	1.1	0.0	3.8	-2.6
	B4	-32.5	10.4	-1.1	0.0	-3.8	3.3
	B62	11.2	0.0	0.3	0.0	0.7	0.0

Check

Summary

Name	Value	Status
Analysis	100.0%	OK
Plates	0.0 < 5.0%	OK
Welds	25.0 < 100%	OK
Buckling	Not calculated	

Plates

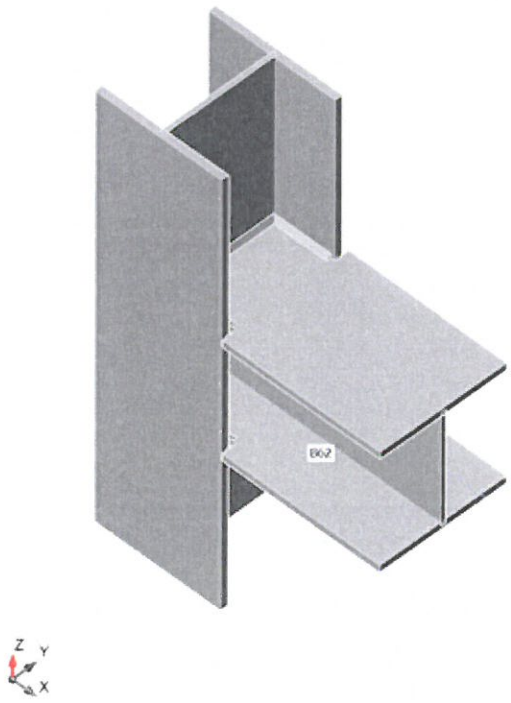
Name	Thickness [mm]	Loads	σ_{Ed} [MPa]	ε_{Pl} [%]	σc_{Ed} [MPa]	Status
B4-bfl 1	9.0	ULS-Set(13)(8)	60.1	0.0	0.0	OK
B4-tfl 1	9.0	ULS-Set(13)(8)	71.1	0.0	0.0	OK
B4-w 1	6.0	ULS-Set(7)(4)	44.9	0.0	0.0	OK
B62-bfl 1	9.0	ULS-Set(22)(20)	44.8	0.0	0.0	OK
B62-tfl 1	9.0	ULS-Set(21)(22)	55.8	0.0	0.0	OK
B62-w 1	6.0	ULS-Set(21)(22)	17.6	0.0	0.0	OK

Design data

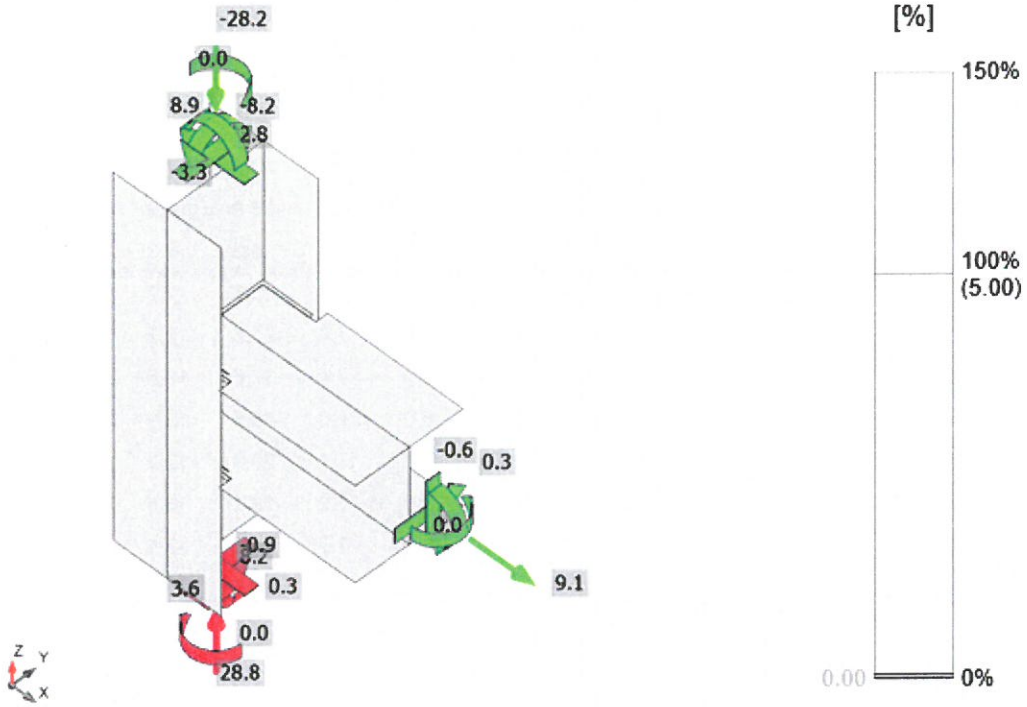
Material	f_y [MPa]	ε_{lim} [%]
S 235	235.0	5.0

Symbol explanation

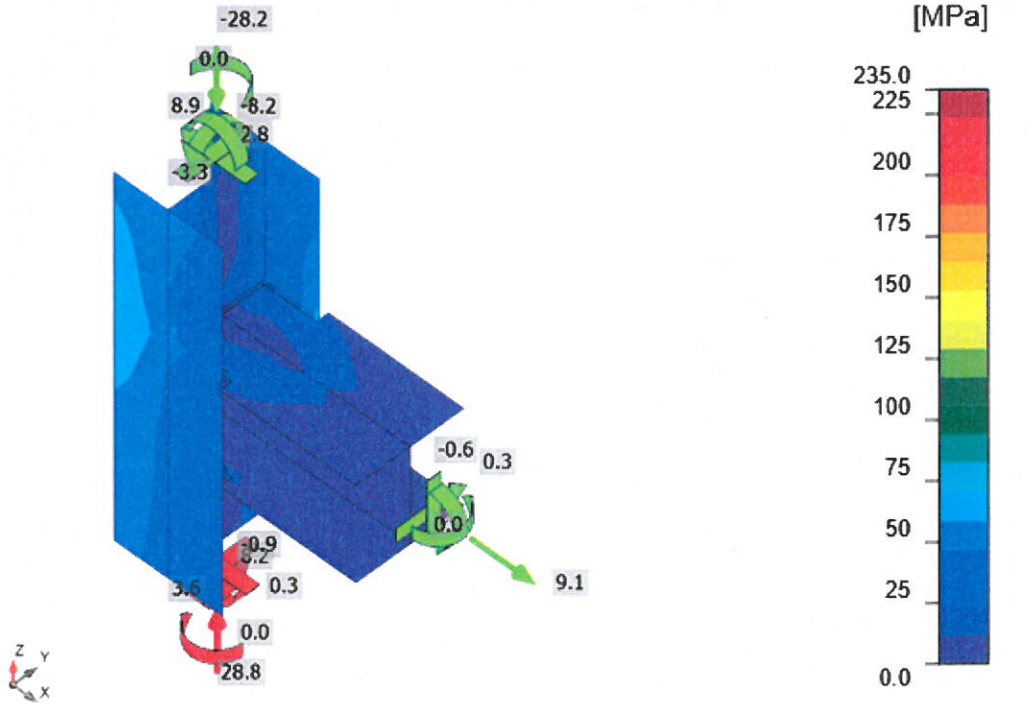
ε_{Pl}	Strain
σ_{Ed}	Eq. stress
σc_{Ed}	Contact stress
f_y	Yield strength
ε_{lim}	Limit of plastic strain



Overall check, ULS-Set(13)(8)



Strain check, ULS-Set(13)(8)



Equivalent stress, ULS-Set(13)(8)

Welds (Plastic redistribution)

Item	Edge	Throat th. [mm]	Length [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	ε_{Pl} [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	$\tau_{\perp}$ [MPa]	Ut [%]	Ut_c [%]	Status
B4-w 1	B62-w 1	4.0	143	ULS-Set(2)(1)								OK
B4-bfl 1	B62-bfl 1	◢4.0◣	72	ULS-Set(22)(20)	37.6	0.0	-6.5	20.1	-7.3	10.4	7.1	OK
		◢4.0◣	72	ULS-Set(22)(20)	70.0	0.0	-16.7	-35.8	15.9	19.4	12.2	OK
B4-w 1	B62-bfl 1	◢4.0◣	124	ULS-Set(22)(20)	11.7	0.0	-0.8	-6.3	-2.3	3.3	1.8	OK
		◢4.0◣	124	ULS-Set(22)(20)	23.7	0.0	0.1	13.6	-1.7	6.6	4.7	OK
B4-tfl 1	B62-bfl 1	◢4.0◣	72	ULS-Set(22)(20)	41.0	0.0	-7.4	-21.8	-8.2	11.4	7.3	OK
		◢4.0◣	72	ULS-Set(22)(20)	73.3	0.0	-17.4	37.6	16.6	20.4	12.4	OK
B4-bfl 1	B62-tfl 1	◢4.0◣	72	ULS-Set(21)(22)	90.1	0.0	21.0	-46.5	19.9	25.0	15.5	OK
		◢4.0◣	72	ULS-Set(21)(22)	57.0	0.0	11.1	29.9	-12.2	15.8	10.6	OK
B4-w 1	B62-tfl 1	◢4.0◣	124	ULS-Set(21)(22)	33.0	0.0	1.2	-19.1	-0.6	9.2	5.7	OK
		◢4.0◣	124	ULS-Set(21)(22)	24.9	0.0	1.2	14.0	-3.1	6.9	3.6	OK
B4-tfl 1	B62-tfl 1	◢4.0◣	72	ULS-Set(21)(22)	82.6	0.0	19.5	42.6	18.2	23.0	15.1	OK
		◢4.0◣	72	ULS-Set(21)(22)	50.5	0.0	9.5	-26.6	-10.7	14.0	10.4	OK

Design data

	β_w [-]	$\sigma_{w,Rd}$ [MPa]	0.9 σ [MPa]
S 235	0.80	360.0	259.2

Symbol explanation

ε_{Pl}	Strain
$\sigma_{w,Ed}$	Equivalent stress
$\sigma_{w,Rd}$	Equivalent stress resistance
$\sigma_{\perp}$	Perpendicular stress
$\tau_{\parallel}$	Shear stress parallel to weld axis
$\tau_{\perp}$	Shear stress perpendicular to weld axis
0.9 σ	Perpendicular stress resistance - 0.9*fu/γM2
β_w	Corelation factor EN 1993-1-8 tab. 4.1
Ut	Utilization
Utc	Weld capacity utilization

Buckling

Buckling analysis was not calculated.

Project:	**Přístřešek**
Project no:	**SvP1**
Author:	**Ing. Ježowicz**

Project item Con N161

Design

Name	Con N161
Description	
Analysis	Stress, strain/ loads in equilibrium

Bill of material

Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds [mm]	Length [mm]	Bolts	Nr.
CUT1				Double fillet: a = 4.0	679.0		

Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Double fillet	S 235	4.0	5.7	679.0

TRAPÉZOVÉ PLECHY

NÁVRH A POSOUZENÍ TRAPÉZOVÝCH PLECHŮ

1) Přístřešek

Zatížení

Střecha	$q_{roof,k}$	=	0.10	γ_f=1.35
Sníh	$s_{1,k}$	=	3.20	γ_f=1.5
Vítr	$w_{e,max}$	=	0.58 (tlak)	γ_f=1.5

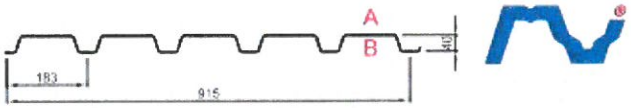
Charakteristické celkem: q_k =4.68 kN/m^2
Výpočtové q_d =5.08 kN/m^2

spojitý nosník 4x 1.5m

deformace: q_{k1}= 9.30 kN/m^2 > q_k = 4.68 kN/m^2 (pro L/200)

únosnost : q_{d1}= 7.17 kN/m^2 > q_d = 5.08 kN/m^2

TR 40/183 pozitivní



dle ČSN EN 1993-1-3: 2010 γ_{M0} = 1,00 Deformace = L/200

Přípustné rovnoměrné zatížení [kN/m²]

t_N [mm]	g [kg/m²]		Rozpětí [m] 1,00	1,25	1,50	1,75	2,00	2,25	2,50	2,75	3,00	3,25	3,50	3,75	4,00	4,25	4,50	4,75	5,00	5,25	5,50	5,75	6,00
0,63	6,89	q_{d1}	11,99	8,27	6,06	4,63	3,65	2,91	2,36	1,95	1,64	1,40	1,21	1,05	0,93	0,82	0,73	0,66	0,59	0,54	0,49	0,45	0,41
		q_{d2}	10,25	7,21	5,36	4,15	3,31	2,70	2,25	1,90	1,63	1,40	1,21	1,05	0,93	0,82	0,73	0,66	0,59	0,54	0,49	0,45	0,41
		q_k	*24,28*	*12,43*	*7,19*	*4,53*	*3,04*	*2,13*	*1,55*	*1,17*	*0,90*	*0,71*	*0,57*	*0,46*	*0,38*	*0,32*	*0,27*	*0,23*	*0,19*	*0,17*	*0,15*	*0,13*	*0,11*
0,75	8,20	q_{d1}	16,11	11,05	8,06	6,14	4,77	3,77	3,06	2,53	2,13	1,81	1,56	1,36	1,20	1,06	0,95	0,85	0,77	0,70	0,63	0,58	0,53
		q_{d2}	13,82	9,68	7,17	5,53	4,40	3,58	2,97	2,51	2,13	1,81	1,56	1,36	1,20	1,06	0,95	0,85	0,77	0,70	0,63	0,58	0,53
		q_k	*31,40*	*16,08*	*9,30*	*5,86*	*3,92*	*2,76*	*2,01*	*1,51*	*1,16*	*0,91*	*0,73*	*0,60*	*0,49*	*0,41*	*0,34*	*0,29*	*0,25*	*0,22*	*0,19*	*0,17*	*0,15*
0,88	9,62	q_{d1}	21,01	14,35	10,43	7,84	6,02	4,76	3,86	3,20	2,69	2,29	1,97	1,72	1,51	1,34	1,20	1,07	0,97	0,88	0,80	0,73	0,67
		q_{d2}	18,09	12,61	9,30	7,16	5,68	4,62	3,83	3,20	2,69	2,29	1,97	1,72	1,51	1,34	1,20	1,07	0,97	0,88	0,80	0,73	0,67
		q_k	*40,33*	*20,65*	*11,95*	*7,53*	*5,04*	*3,54*	*2,58*	*1,94*	*1,49*	*1,17*	*0,94*	*0,76*	*0,63*	*0,53*	*0,44*	*0,38*	*0,32*	*0,28*	*0,24*	*0,21*	*0,19*
1,00	10,93	q_{d1}	25,88	17,61	12,76	9,41	7,22	5,72	4,64	3,84	3,23	2,75	2,37	2,07	1,82	1,61	1,44	1,29	1,16	1,06	0,96	0,88	0,81
		q_{d2}	22,34	15,51	11,42	8,76	6,94	5,64	4,64	3,84	3,23	2,75	2,37	2,07	1,82	1,61	1,44	1,29	1,16	1,06	0,96	0,88	0,81
		q_k	*49,12*	*25,15*	*14,55*	*9,17*	*6,14*	*4,31*	*3,14*	*2,36*	*1,82*	*1,43*	*1,15*	*0,93*	*0,77*	*0,64*	*0,54*	*0,46*	*0,39*	*0,34*	*0,30*	*0,26*	*0,23*
1,13	12,35	q_{d1}	31,47	21,34	15,13	11,16	8,57	6,79	5,51	4,55	3,83	3,26	2,82	2,45	2,16	1,91	1,70	1,53	1,38	1,25	1,14	1,04	0,96
		q_{d2}	27,22	18,84	13,83	10,59	8,37	6,79	5,51	4,55	3,83	3,26	2,82	2,45	2,16	1,91	1,70	1,53	1,38	1,25	1,14	1,04	0,96
		q_k	*59,12*	*30,27*	*17,52*	*11,03*	*7,39*	*5,19*	*3,78*	*2,84*	*2,19*	*1,72*	*1,38*	*1,12*	*0,92*	*0,77*	*0,65*	*0,55*	*0,47*	*0,41*	*0,36*	*0,31*	*0,27*
1,25	13,66	q_{d1}	36,64	24,54	17,17	12,67	9,73	7,71	6,25	5,17	4,35	3,71	3,20	2,79	2,45	2,17	1,94	1,74	1,57	1,42	1,30	1,19	1,09
		q_{d2}	31,77	21,90	16,03	12,25	9,67	7,71	6,25	5,17	4,35	3,71	3,20	2,79	2,45	2,17	1,94	1,74	1,57	1,42	1,30	1,19	1,09
		q_k	*68,68*	*35,17*	*20,35*	*12,82*	*8,59*	*6,03*	*4,40*	*3,30*	*2,54*	*2,00*	*1,60*	*1,30*	*1,07*	*0,89*	*0,75*	*0,64*	*0,55*	*0,47*	*0,41*	*0,36*	*0,32*

navržen trapézový plech
TR40/183, t=0,75mm

ZÁVĚR

Ocelová konstrukce **vyhovuje na mezní stav pevnosti a mezní stav použitelnosti dle ČSN EN 1993 pro sněhovou oblast VII (s_k>4.0 kN/m^2).**

V případě umístění přístřešku do sněhové oblasti VIII (s_k>4.0 kN/m^2), je nutno provést posouzení konstrukce na vyšší zatížení od sněhu.

V případě nejasností nebo změny montážních přípojů, navržených ve statickém výpočtu, je nutno o této skutečnosti uvědomit zpracovatele statického výpočtu.