



<b><u>PROJEKTO PAVADINIMAS:</u></b>	Specialios paskirties pastato Lauko g. 19, Jurbarkas, statybos projektas
<b><u>ADRESAS:</u></b>	Lauko g. 19, Jurbarkas
<b><u>SKLYPO KADASTRINIS NR.:</u></b>	9420/0006:49
<b><u>UŽSAKOVAS:</u></b>	Priešgaisrinės apsaugos ir gelbėjimo departamentas prie Vidaus reikalų ministerijos
<b><u>STATYTOJAS:</u></b>	Priešgaisrinės apsaugos ir gelbėjimo departamentas prie Vidaus reikalų ministerijos
<b><u>STATINIO KATEGORIJA:</u></b>	Ypatingasis statinys
<b><u>STATYBOS RŪŠIS:</u></b>	Nauja statyba
<b><u>STATINIO NAUDOJIMO PASKIRTIS:</u></b>	Specialios paskirties pastatas
<b><u>PROJEKTO RENGIMO ETAPAS:</u></b>	Techninis projektas
<b><u>PROJEKTO DALIS</u></b>	Konstrukcijų. Sprendinių detalieji skaičiavimai
<b><u>LAIDA</u></b>	0
<b><u>PROJEKTO NUMERIS:</u></b>	IN2410-01-TP-SK-S

Direktorius

AV.

Parašas

Marius Matuliukštis

PV

Parašas

Marius Matuliukštis KA Nr. 33679

PDV.

Parašas

Margarita Čekalina KA Nr. 40628

Eil. Nr.	Bylos (segtuvo) žymuo	Pavadinimas	Pastabos
1.	BD	Bendroji dalis	
2.	SP	Sklypo sutvarkymo (sklypo planas)	
3.	SA	Architektūros (statinio architektūra)	
4.	SK	Konstrukcijų (statinio konstrukcijos)	
	SK-S	Konstruktinė. Sprendinių detalieji skaičiavimai	
5.	VN	Vandentiekio ir nuotekų šalinimo (vidaus)	
	LVN	Vandentiekio ir nuotekų šalinimo (lauko)	
6.	ŠVOK	Šildymo, vėdinimo ir oro kondicionavimo	
7.	E	Elektrotechnikos (vidaus)	
	LE	Elektrotechnikos (lauko)	
8.	ER	Elektroninių ryšių (telekomunikacijų) (vidaus)	
	LER	Elektroninių ryšių (telekomunikacijų) (lauko)	
9.	AS	Apsauginės signalizacijos	
10.	GSS	Gaisro aptikimo ir signalizacijos	
11.	PVA	Procesų valdymo ir automatizacijos	
12.	GS	Gaisrinės saugos	
13.	ŠT	Šilumos gamybos ir tiekimo	
14.	SO	Pasirengimo statybai ir statybos darbų organizavimo	
15.	KS	Statybos skaičiuojamosios kainos nustatymo	

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	2	251	0

**PROJEKTO DALIES BYLŲ (SEGTUVŲ) SUDĖTIES ŽINIARAŠTIS**

Eil. Nr.	Bylos (segtuvo) žymuo	Laida	Pavadinimas	Pastabos
1.	IN2410-01-TP-SK	0	Konstrukcijų (statinio konstrukcijos)	
<b>3.</b>	<b>IN2410-01-TP-SK-S</b>	<b>0</b>	<b>Konstrukcijų. Sprendinių detalieji skaičiavimai</b>	

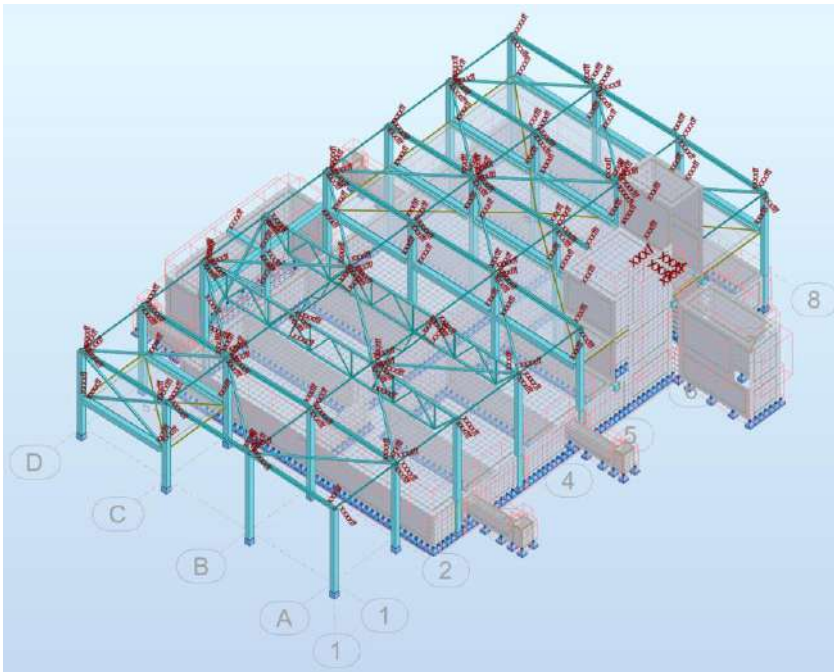
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	3	251	0

# 1. KONSTRUKCIJŲ SKAIČIAVIMAS

Laikančių konstrukcijų skaičiavimai atlikti baigtinių elementų skaičiavimo programa Autodesk Robot Structural Analysis Professional 2023.

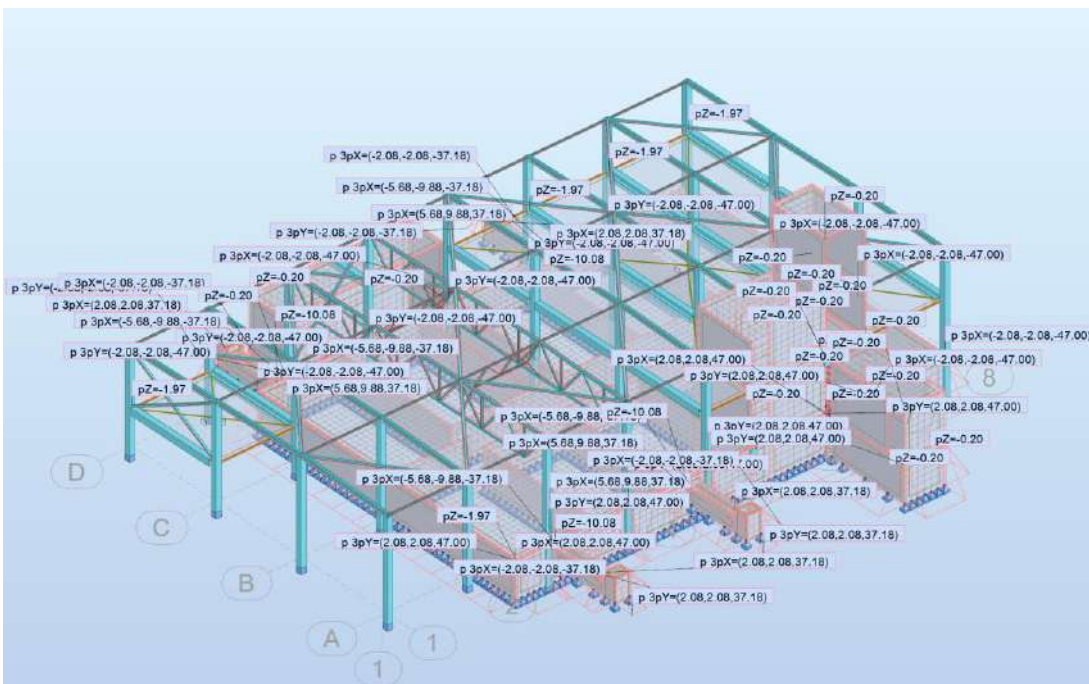
## 1.1. Pastato diskretinis modelis ir veikiančios apkrovos

Diskretinis modelis:



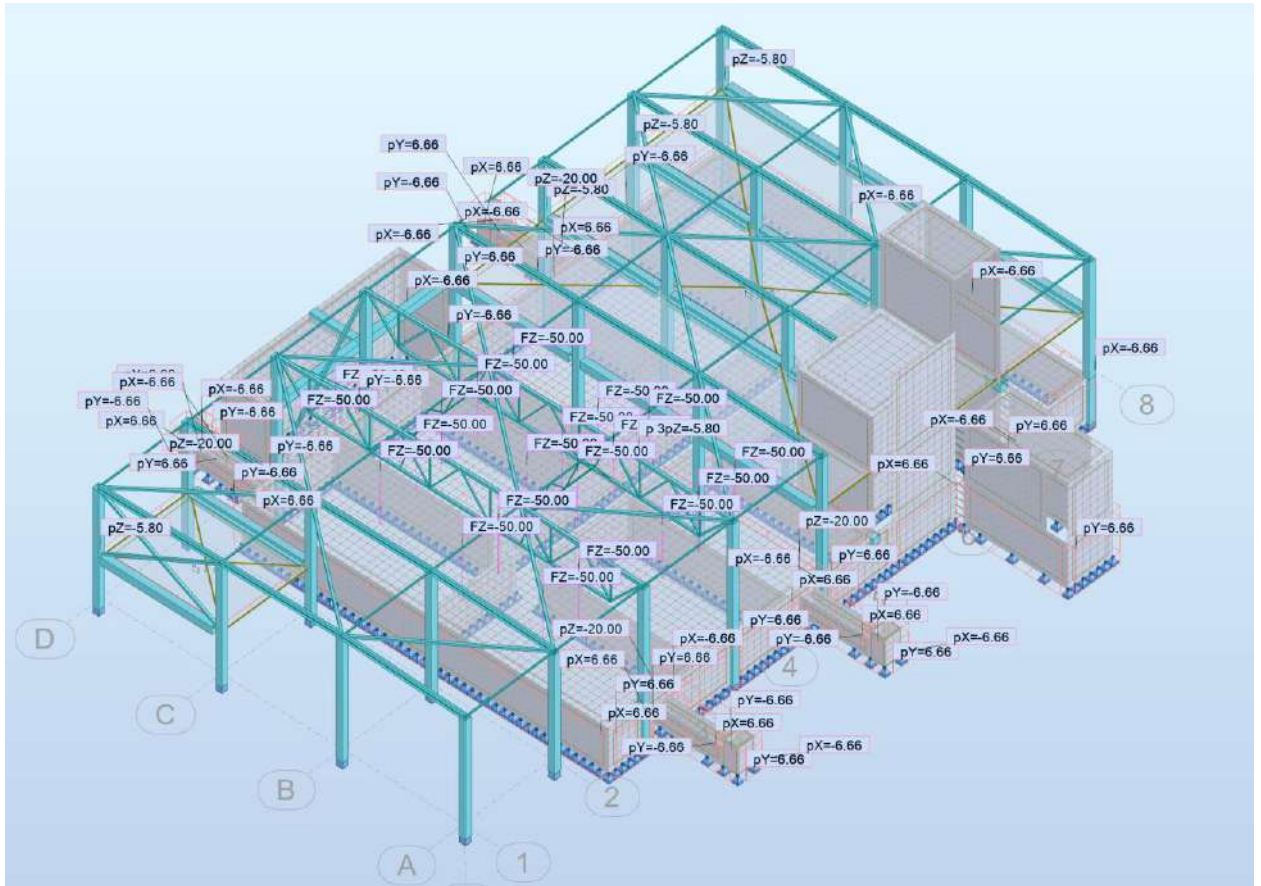
Veikiančios apkrovos.

Nuolatinės apkrovos:

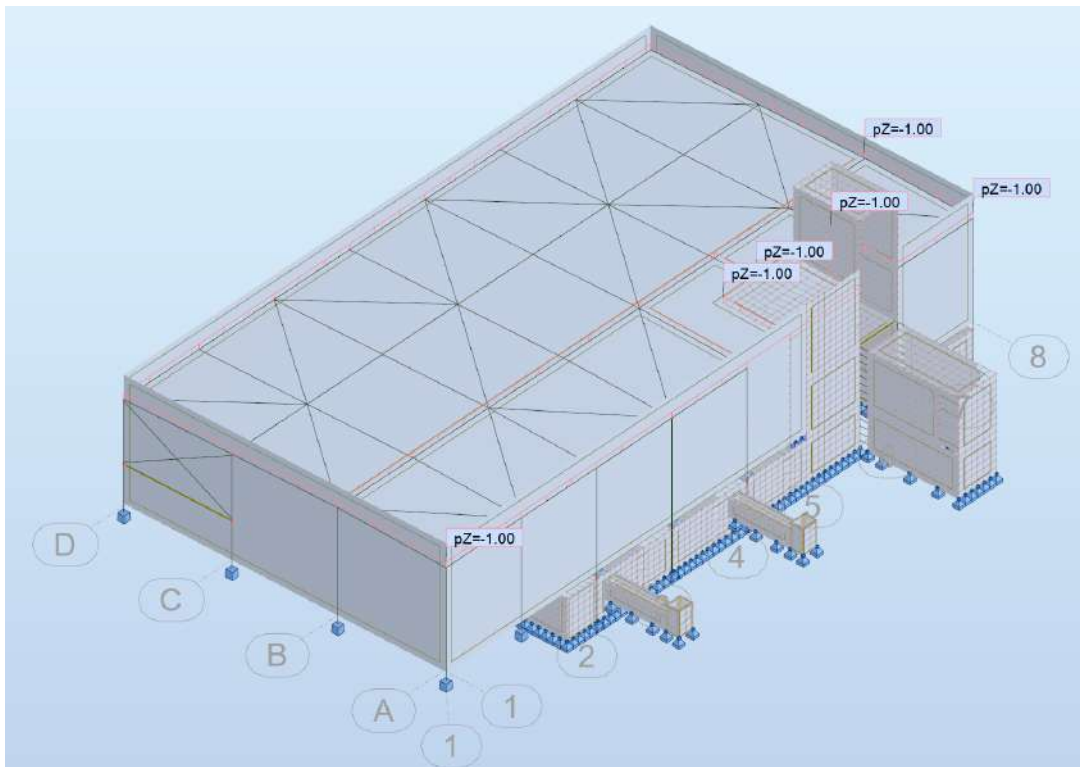


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	4	251	0

Naudojimo apkrovos:

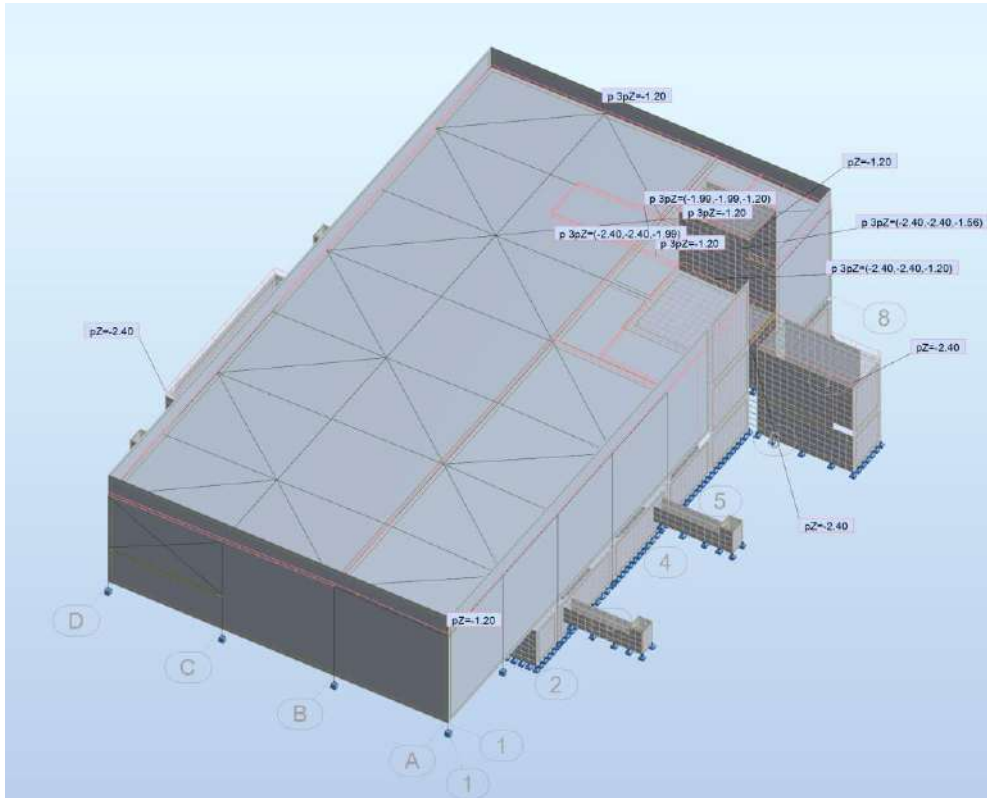


Stogo naudojimo apkrovos:

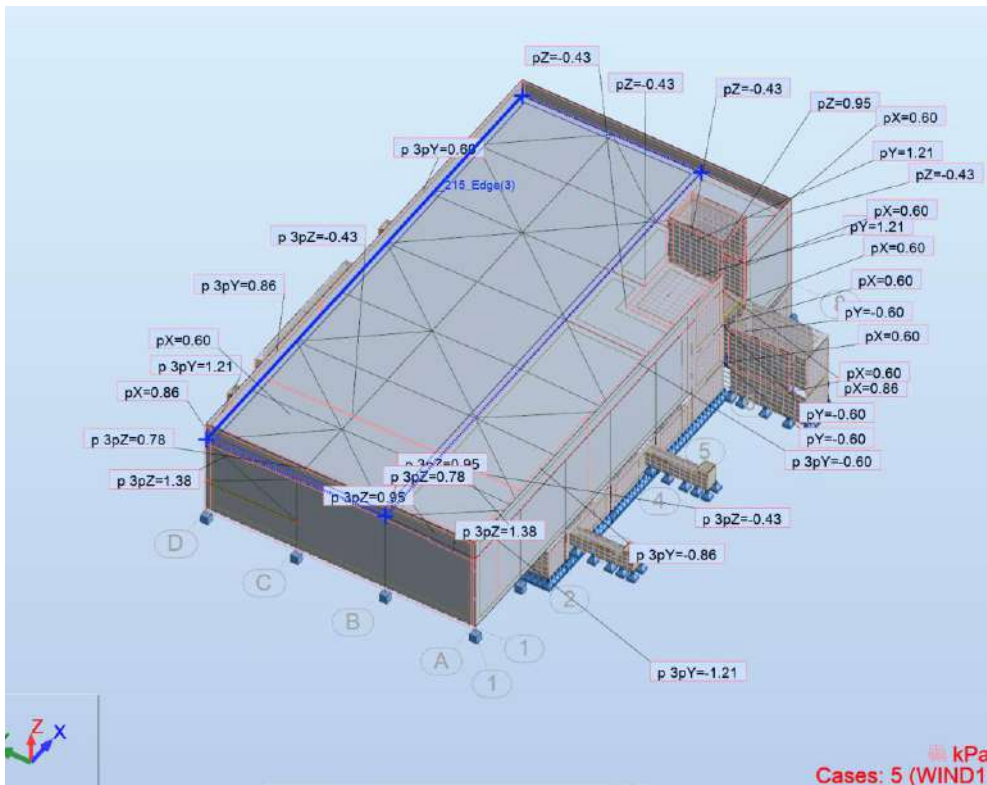


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	5	251	0

Sniego apkrovos:

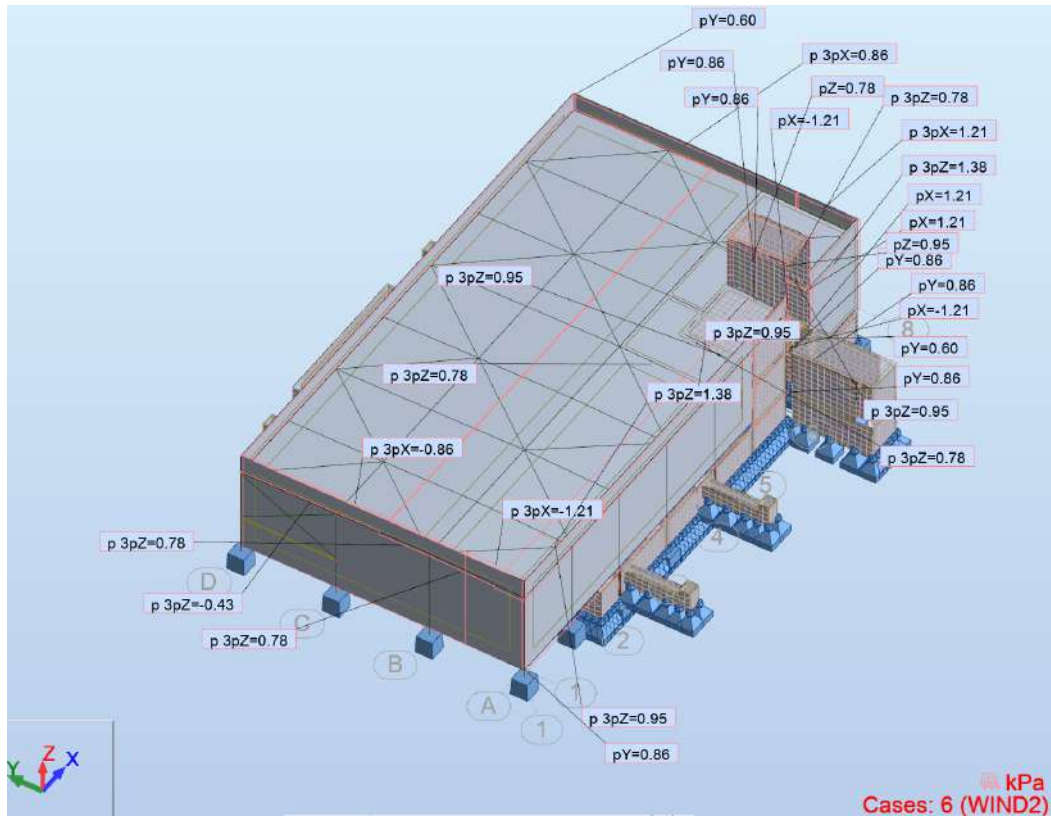


Vėjo apkrova 1:

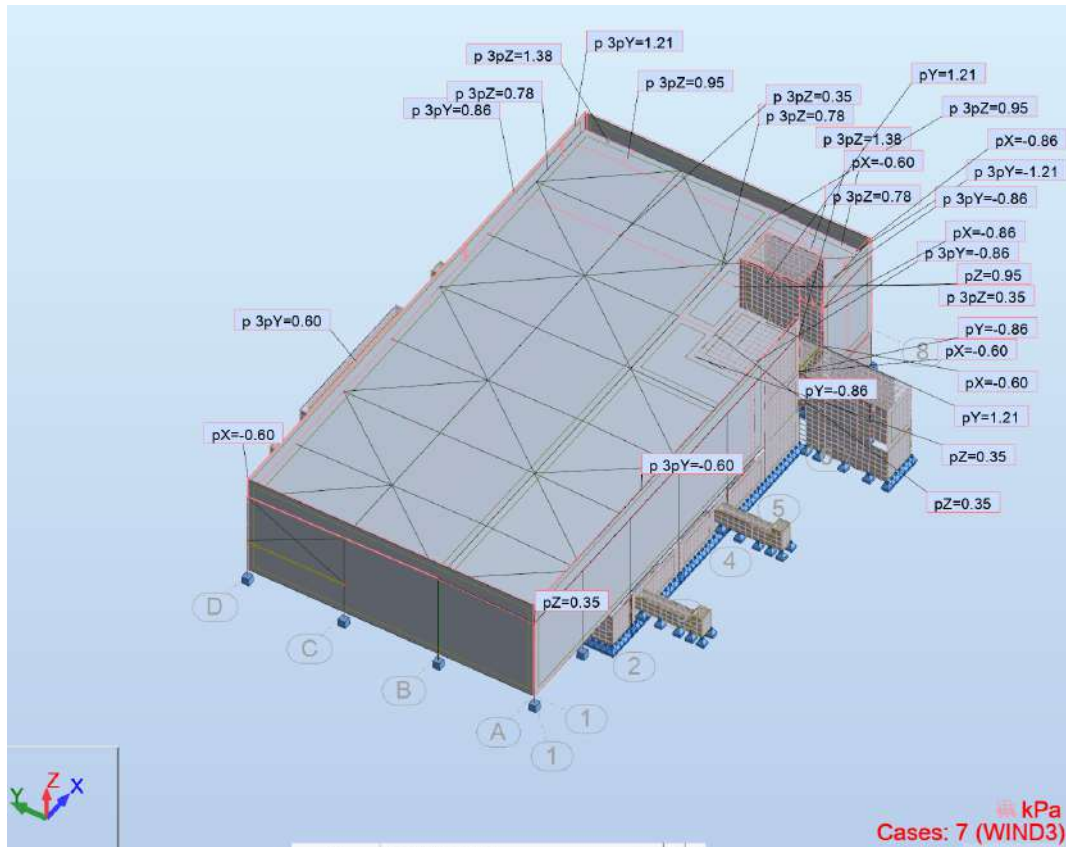


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	6	251	0

Vėjo apkrova 2:

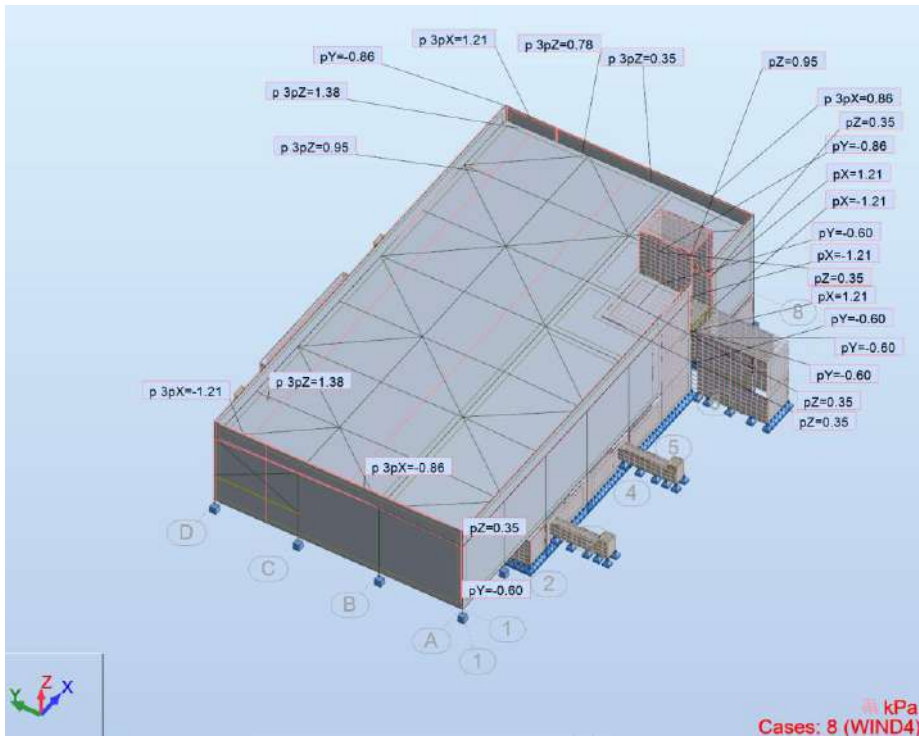


Vėjo apkrova 3:

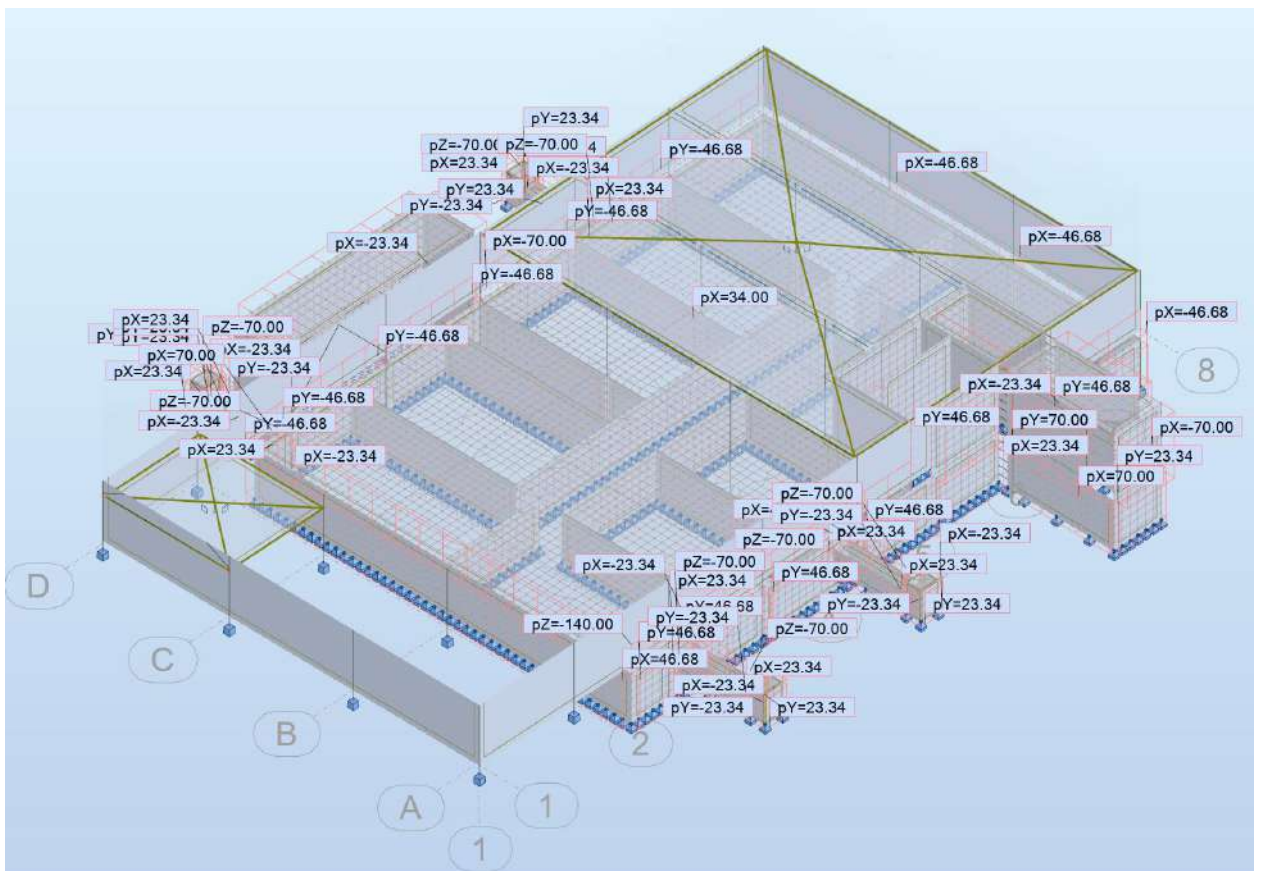


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	7	251	0

Vėjo apkrova 4:

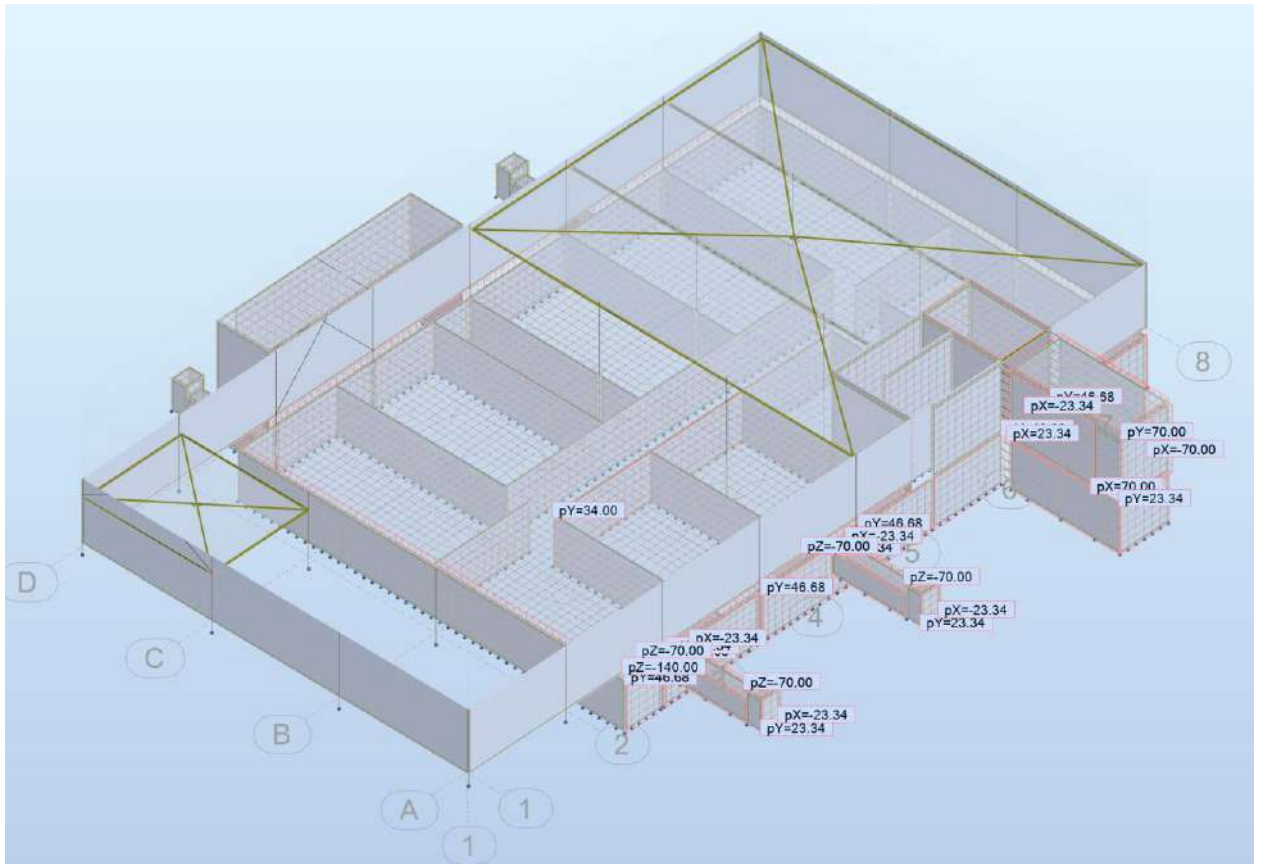


Ypatingasis sprogimo poveikis 1:



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	8	251	0

Ypatingasis sprogo poveikis 2:



### 1.2. Pakloto projektavimas

Paklotui naudojami apkrovas laikantys profiliuotos skardos lakštai. Lakštai projektuojami kaip nekarpyta sija ir standus diskas, suvaržantis santvaros viršutinę juostą. Paklotas turi atitikti ugniaatsparumo reikalavimą R20.

Pakloto skaičiavimus tikslina pakloto gamintojai Darbo projekte.

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	9	251	0

## Structural part: Part

Updated: 2025-04-02 07:36 (GMT) Version: 1.1.119 (2025-03-11)

Created: 2024-10-16 06:14 (GMT)

Reliability class: RC2

Reliability class for stressed skin design: RC2

Structure type: Load bearing roof deck

Profile: Ruukki T153-40L-840

Design situation: Normal

Deflection limit: L/200 (custom)

SLS combination: Frequent

Roof slope: 0°

Usage as lateral bracing for rafters: Yes

Usage of stressed skin effect: Yes

Supporting framework: Sheet on main supports

Building length: 42000 mm

Building width: 6000 mm

Ridge height: 8000 mm

Parapet height: 600 mm

Side wall column height: 7400 mm

Gable wall column distance: 7500 mm

Friction: No friction

Transversal crane load: 0 kN

Top flange displacement prevented on end support: No

Wind bracings: Every wall

### Custom wind loads for skin effect

Wind direction	Pressure [kN/m]	Suction [kN/m]
left gable	2.25	0.97
lower side	2.34	1.0
upper side	2.34	1.0
right gable	2.25	0.97

Internal pressure coefficient,  $C_{pi}$ : 0.3

External pressure coefficient,  $C_{pe,pg}$ : 0.7

Gable beam: Steel HEA260

Edge beam: KB2-T130-510/2.5

Chosen sheets fulfill design criteria. Maximum utilization rate: 47.0 %

Chosen fasteners fulfill design criteria. Maximum utilization rate: 90.8 %

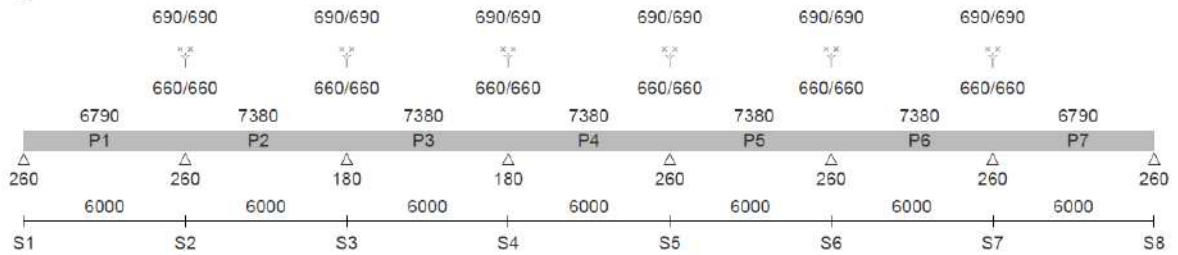
Stressed skin fulfills design criteria. Maximum utilization rate: 35.8 %

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	10	251	0

## Structural model

**Left end:** Distance to end of sheet: 100 mm

**Right end:** Distance to end of sheet: 100 mm



## Selected profile: Ruukki T153-40L-840

**Total weight of the sheeting:** 28.7 kg/m<sup>2</sup>

**Global warming potential, GWP (A1...A3):** 74.7 kg CO<sub>2</sub> eq. / m<sup>2</sup> Zinc-coated

**Global warming potential, GWP (A1...A3):** 78.7 kg CO<sub>2</sub> eq. / m<sup>2</sup> Colour-coated

Sheet	Thickness / strength [mm] / [MPa]	Side overlap	Length [mm]
P1	1.5 / 350	Double	6790
P2	1.5 / 350	0	7380
P3	1.2 / 350	0	7380
P4	0.8 / 350	0	7380
P5	1.2 / 350	0	7380
P6	1.5 / 350	0	7380
P7	1.5 / 350	Double	6790

## Supports and joints

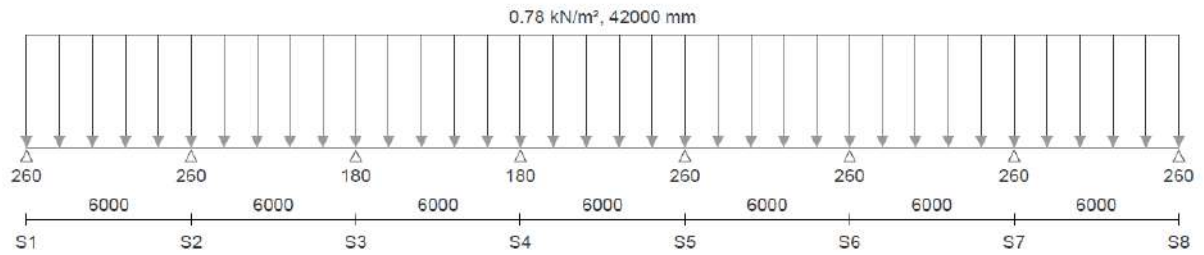
Support	Support width [mm]	Joint type	Overlap [mm]
S1	260	End support (vertical)	-
S2	260	Overlap	660 / 660
S3	180	Overlap	660 / 660
S4	180	Overlap	660 / 660
S5	260	Overlap	660 / 660
S6	260	Overlap	660 / 660
S7	260	Overlap	660 / 660
S8	260	End support (vertical)	-

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Lapas	Lapų	Laida
11	251	0

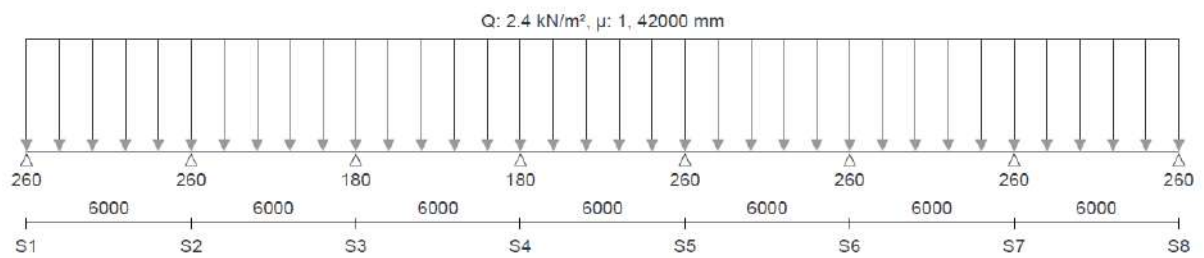
### Dead load

Structure weight without sheet:  $0.78 \text{ kN/m}^2$



### Snow load

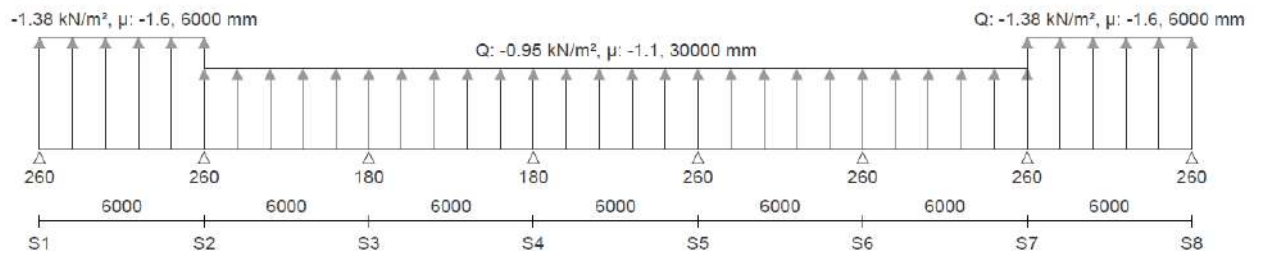
Basic snow load:  $2.4 \text{ kN/m}^2$



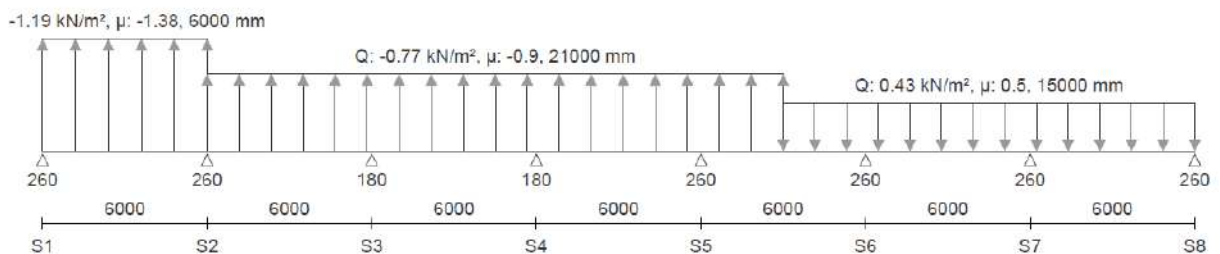
### Wind load

Basic wind load:  $0.86 \text{ kN/m}^2$

#### Case 1



#### Case 2



### Lateral bracing for rafters

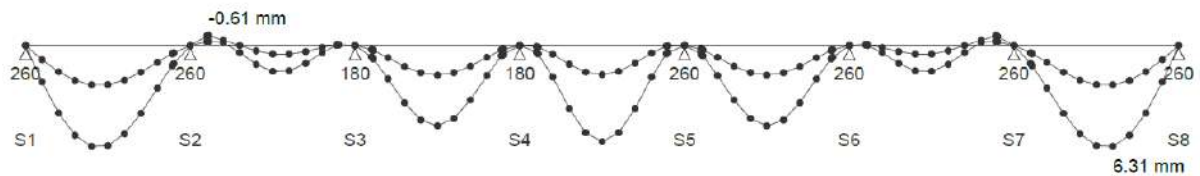
Percentage of lateral force: 2.0 %

Support	Area of top flange [mm <sup>2</sup> ]	Compression force in top flange [kN]
S1	260.0	48.0
S2	260.0	48.0
S3	180.0	481.0
S4	180.0	481.0
S5	260.0	48.0
S6	260.0	48.0
S7	260.0	48.0
S8	260.0	48.0

### Utilization rates

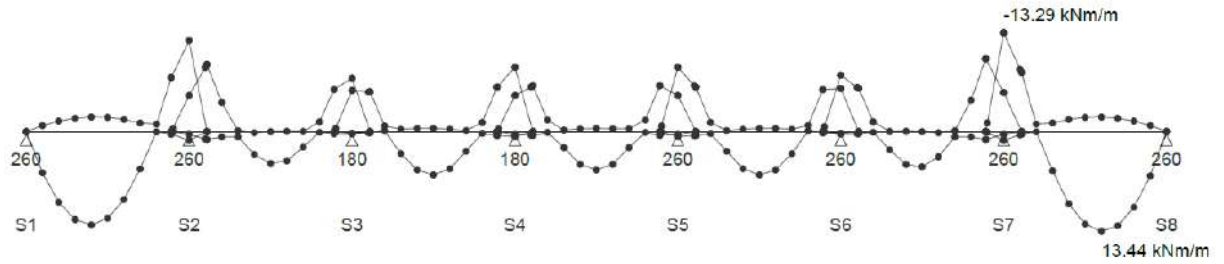
Sheet	Weight [kg/m <sup>2</sup> ]	M [kNm/m]	R [kN/m]	M/R	V [kN/m]	N/V/M	D [mm]
P1	42.1	12.6 / 59.0 21.3 %	10.6 / 115.6 9.2 %	20.1 %	19.4 / 414.0 4.7 %	21.3 %	6.3 / 30.0 21.0 %
P2	21.0	9.0 / 30.3 29.9 %	14.9 / 137.5 10.9 %	25.9 %	11.6 / 207.0 5.6 %	29.9 %	1.6 / 30.0 5.4 %
P3	16.8	8.7 / 25.0 34.7 %	17.4 / 90.8 19.2 %	41.8 %	13.8 / 117.0 11.8 %	34.7 %	5.0 / 30.0 16.7 %
P4	11.2	6.2 / 13.2 47.0 %	8.0 / 41.4 19.2 %	42.7 %	9.7 / 35.8 27.1 %	47.0 %	6.0 / 30.0 20.0 %
P5	16.8	8.7 / 25.5 34.0 %	17.4 / 94.6 18.4 %	40.0 %	13.8 / 117.0 11.8 %	34.0 %	5.0 / 30.0 16.7 %
P6	21.0	9.8 / 30.3 32.4 %	15.9 / 143.2 11.1 %	26.2 %	12.3 / 207.0 5.9 %	32.4 %	1.6 / 30.0 5.4 %
P7	42.1	13.4 / 59.0 22.8 %	11.4 / 115.6 9.8 %	21.8 %	21.0 / 414.0 5.1 %	22.8 %	6.3 / 30.0 21.0 %

### Deflection

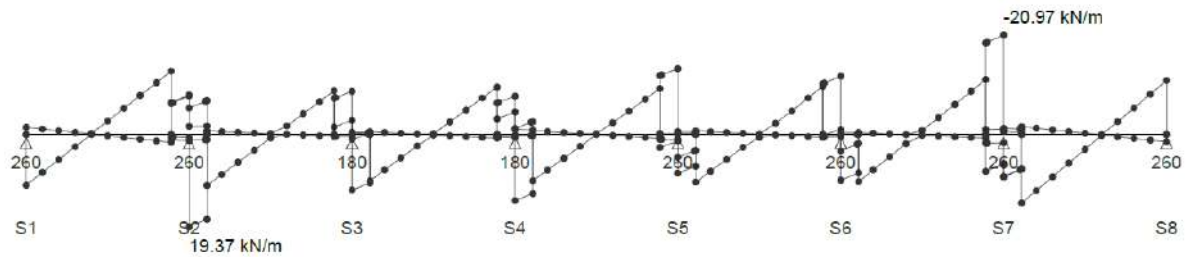


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	13	251	0

### Bending moment



### Shear force



### Support reactions

ULS

Support	Min [kN/m]	Max [kN/m]
S1	-1.53	10.62
S2	-2.54	30.26
S3	-1.09	24.79
S4	-1.77	25.38
S5	-1.77	25.38
S6	-1.09	26.36
S7	-2.54	32.63
S8	-1.53	11.39

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**Support wall thickness:** 6 mm

**Support fastener type:** SD6-T16-6.3\*19

**Support fastener length:** 19.0 mm

**End overlap fastener type:** SL2-T-A14-4.8x20

**Sidelap fastener type:** SL2-T-A14-4.8x20

Support	Support fasteners		End overlap fasteners		Sidelap fasteners		Utilization rate [%]
	Pcs / trough	Utilization rate [%]	Pcs / web	Utilization rate [%]	Span	c/c [mm]	
S1	2	70.3 *	-	-	1	350	93.9 *
S1 (at column)	2	89.7 *	-	-	2	400	95.4
S2	1	51.8 *	2 + 1	12.4	3	350	95.0
S3	1	59.2 **	2 + 1	18.1	4	500	27.7
S4	1	25.8	2 + 1	42.5	5	400	96.0
S5	1	28.4	2 + 1	79.3	6	400	89.6
S6	1	56.6 **	2 + 1	25.4	7	350	93.9 *
S7	1	90.8 *	2 + 1	36.4			
S8	2	70.3 *	-	-			
S8 (at column)	2	89.7 *	-	-			

\* Warning: fragile fastener

#### Total amounts

**Support fasteners:** 214 pcs (36 pcs / m)

**End overlap fasteners:** 771 pcs (129 pcs / m)

**Sidelap fasteners:** 774 pcs (129 pcs / m)

#### Sheeting to edge beam fastening

Self drilling screw 6.3 \*

c/c: 500 mm

Number of fasteners: 168 pcs

#### Edge beam splice fasteners

Self drilling screw 6.3 \*

Number of fasteners: 17 + 17 mm

Total number of fasteners: 408 pcs

#### Edge beam to frame fastening

Self drilling screw 6.3 \*

Number of fasteners: 4

Total number of fasteners: 64 pcs

\* Warning: fragile fastener

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## Stressed skin design

### Edge beam

Maximum normal force: 163.48 kN

Normal force resistance: 204.14 kN

Utility rate normal force: 80 %

Diaphragm deflection: 70 mm

### Supports

Support	$V_r$ [%]	$R_v V$ [%]	$R/R_v V$ [%]	$M/V_w$ [%]	$R/V_w$ [%]	$S_{act} > S_y$	$R_{rafter} \geq R_{seam}$	$V_r \geq R_{seam}$	$R_{buckling} \geq R_{seam}$
S1	17	18	26	-	-	OK	OK	OK	OK
S2	-	-	-	16	7	OK	OK	-	OK
S3	-	-	-	19	11	OK	OK	-	OK
S4	-	-	-	28	17	OK	OK	-	OK
S5	-	-	-	28	16	OK	OK	-	OK
S6	-	-	-	19	11	OK	OK	-	OK
S7	-	-	-	13	8	OK	OK	-	OK
S8	17	18	26	-	-	OK	OK	OK	OK

Design checks ( $S_{act} > S_y$ ,  $R_{rafter} \geq R_{seam}$ ,  $V_r \geq R_{seam}$  and  $R_{buckling} \geq R_{seam}$ ) are related to using diaphragm as lateral bracing for rafters. The diaphragm must have sufficient stiffness ( $S_{act} > S_y$ ) in addition to adequate strength to be able to support rafter against buckling. Also, undesired failure modes should be prevented by assuring that side overlap fastening is the governing failure mode, if the structure fails for any reason ( $R_{rafter} \geq R_{seam}$ ,  $V_r \geq R_{seam}$ ,  $R_{buckling} \geq R_{seam}$ ). Design is conducted according to ECCS (1995), pub. No. 88, annexes B.1 - 11.

$S_{act}$  = shear stiffness of the diaphragm [kN] (Annex B.10, section III.2.1)

$S_y$  = required stiffness of the diaphragm [kN] (Annex B.2, section II)

$R_{seam} = P_{max}$  = strength of the sheet side overlap fastening [kN] (Annex B.10, section III.2.2)

$R_{rafter}$  = strength of the sheet to rafter fastening [kN] (Annex B.11, section III.2.2.a)

$V_r$  = distortional/end collapse resistance of the sheet profile [kN] (Annex B.11, section III.2.2.b)

$R_{buckling}$  = shear buckling resistance of the sheeting [kN] (Annex B.11, section III.2.2.c)

### Spans

Span	$\tau$ [%]	$V_w$ [%]	$V_f$ [%]	$V_g$ [%]	$V_f/V_g$ [%]	$N_c$ [%]	$N_c/M$ [%]	$N_c/M/V_w$ [%]
1	5	4	3	4	6	2	34	27
2	7	5	4	5	9	-	-	-
3	5	5	3	4	7	-	-	-
4	1	2	1	1	2	-	-	-
5	4	4	3	4	6	-	-	-
6	7	5	4	5	9	-	-	-
7	5	4	3	4	6	2	36	29

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**Diaphragm load and forces**

	Wind towards long wall	Wind towards gable wall
<b>Diaphragm loads</b>		
Wind [kN/m]	4.34	2.93
Sway imperfection [kN/m]	0.11	0.0
Friction [kN/m]	0.0	0.0
Lateral bracing [kN/m]	0.0	1.31
Total forces [kN/m]	4.45	4.23
<b>Diaphragm forces</b>		
Normal force [kN]	163.48	2.33
Reaction force [kN]	93.42	8.44
Max shear force [kN/m]	13.48	1.67
<b>Shear forces</b>		
Field 1 [kN/m]	13.48	1.67
Field 2 [kN/m]	9.55	0.65
Field 3 [kN/m]	5.1	0.65
Field 4 [kN/m]	0.65	0.65
Field 5 [kN/m]	4.51	0.07
Field 6 [kN/m]	8.96	0.07
Field 7 [kN/m]	13.48	1.67

**Sheet list:** Ruukki T153-40L-840

	Thickness / strength [mm] / [MPa]	Total length [mm]	Total weight [kg]
1	0.8 / 350	7380	69.5
2	1.2 / 350	14760	208.5
3	1.5 / 350	28340	1220.3

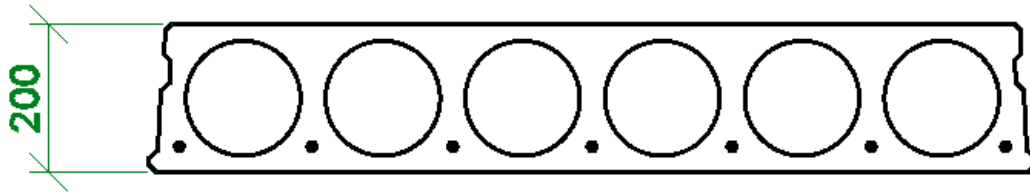
**Išvada: laikomoji galia užtikrinta. Pakloto gamintojas tikslina skaičiavimus Darbo projekte.**

### 1.3.Surenkamų perdangos plokščių projektavimas

Projektuojamos standartinės įtempto gelžbetonio kiaurymėtos perdangos plokštės.

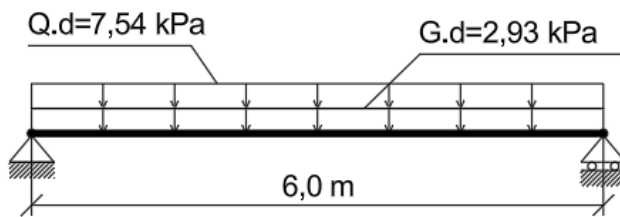
Perdangų armavimą pagal Projekto brėžiniuose pateiktas atrėmimo ir apkrovų schemas konstruoja gamintojas. Perdangų minimalus atsparumas ugniai R20.

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	17	251	0



Skaičiuojamoji schema:

Skaičiuojamoji schema



Perdangos plokščių aukštis nustatomas pagal gamintojų apkrovų lenteles.

Pagal pateiktą apkrovimo schemą perdangos armavimo skaičiavimus atlieka gamintojas.

#### 1.4. Rygelių projektavimas

*Rygelių armavimą pagal pareiktas apkrovas ir atrėmimo schemas parenka gamintojas.*

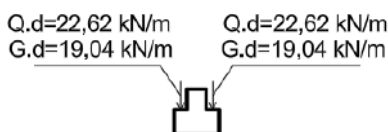
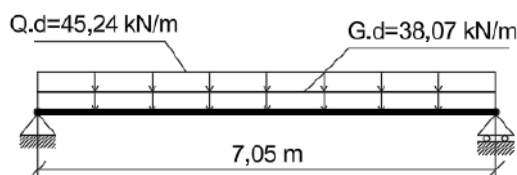
#### T Rygeliai

Projektuojami surenkami g/b rygeliai. Rygelių geometrija parenkama pagal gamintojų katalogus.

Rygelių tikslus skaičiavimus pateikia gamintojas Darbo projekto metu. Rygelių minimalus atsparumas ugniai R45. Maksimalus plyšių atsivėrimo plotis 0,3mm.

Tarpaukštinių rygelių skaičiuojamoji schema:

Skaičiuojamoji schema



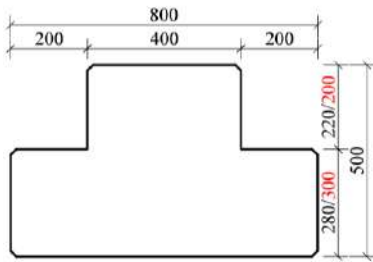
IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	18	251	0

Pagal gkg3 RT rygelių laikomosios galios lentelę veikiant skaičiuojamosioms apkrovoms 800x500mm rygelio skerspjūvis gali būti iki 7,10m ilgio.

Sija	$b_{pl} \times h(h_{pl})$	Skaičiuotinė $\lambda$								
		30	40	50	60	70	80	90	100	11
Didžiausias										
GRT1	700x400(220)	7.70	6.80	6.30	5.90	5.50	4.88	-	-	-
GRT2	700x500(220)	9.20	8.30	7.80	7.25	6.65	6.30	6.05	5.70	5.3
GRT3	700x500(265)	9.40	8.40	7.80	7.20	6.70	6.40	6.10	5.80	5.3
GRT4	700x500(320)	9.35	8.40	7.80	7.20	6.75	6.45	6.10	5.80	5.3
GRT5	700x600(220)	10.90	9.90	9.20	8.70	8.19	7.73	7.30	6.90	6.4
GRT6	700x600(265)	11.36	10.17	9.30	8.70	8.20	7.70	7.30	7.00	6.7
GRT7	700x600(320)	11.15	10.00	9.34	8.61	8.27	7.80	7.40	7.00	6.4
GRT8	700x700(220)	13.46	12.10	11.10	10.30	9.70	9.30	8.90	8.40	7.9
GRT9	700x700(265)	13.47	12.10	11.10	10.30	9.70	9.30	8.90	8.45	7.9
GRT10	700x700(320)	13.36	12.00	10.80	10.20	9.64	9.20	8.85	8.35	7.8
GRT11	700x800(220)	14.56	13.17	12.16	11.49	10.97	10.50	10.06	9.60	9.2
GRT12	700x800(265)	14.56	13.17	12.16	11.50	10.97	10.50	10.06	9.60	9.2
GRT13	700x800(320)	14.60	13.20	12.20	11.56	11.00	10.56	10.14	9.70	9.3
GRT14	800x400(220)	9.00	8.00	7.30	6.70	6.30	6.10	5.80	5.50	-
GRT15	800x500(220)	10.90	9.70	8.90	8.20	7.80	7.40	7.10	6.80	6.5
GRT16	800x500(265)	11.30	10.24	9.34	8.65	8.09	7.62	7.30	7.00	6.8
GRT17	800x500(320)	11.30	10.30	9.40	8.70	8.10	7.70	7.30	7.00	6.8
GRT18	800x600(220)	13.00	11.70	10.80	10.00	9.40	8.90	8.50	8.20	7.9
GRT19	800x600(265)	13.40	12.32	11.29	10.48	9.80	9.28	8.80	8.50	8.2
GRT20	800x600(320)	13.40	12.40	11.30	10.50	9.80	9.30	8.80	8.50	8.2
GRT21	800x700(220)	15.20	13.85	12.76	11.88	11.10	10.50	10.00	9.70	9.4
GRT22	800x700(265)	15.20	13.85	12.76	11.88	11.10	10.50	10.00	9.70	9.4
GRT23	800x700(320)	15.20	13.90	12.80	11.90	11.10	10.50	10.00	9.70	9.4
GRT24	800x800(220)	16.90	15.40	14.24	13.30	12.50	11.87	11.30	10.88	10.3
GRT25	800x800(265)	16.90	15.40	14.24	13.30	12.50	11.87	11.30	10.90	10.3
GRT26	800x800(320)	16.90	15.45	14.26	13.30	12.50	11.87	11.30	10.90	10.3
GRT27	900x400(220)	9.80	8.90	8.20	7.50	7.00	6.60	6.30	6.00	5.8
GRT28	900x500(220)	12.00	11.00	10.10	9.40	8.80	8.30	7.90	7.55	7.3

Pasirinkto rygelio geometrija:

*GRT15*



**Išvada: rygelio laikomoji galia pakankama**

## L Rygeliai

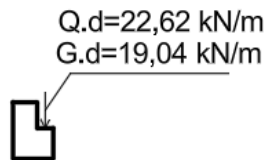
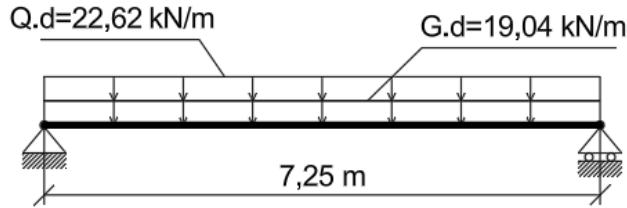
Projektuojami surenkami g/b rygeliai. Rygelių geometrija parenkama pagal gamintojų katalogus.

Rygelių tikslus skaičiavimus pateikia gamintojas Darbo projekto metu. Rygelių minimalus atsparumas ugniai R45. Maksimalus plyšių atsivėrimo plotis 0,3mm.

Tarpaukštinių rygelių skaičiuojamoji schema:

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	19	251	0

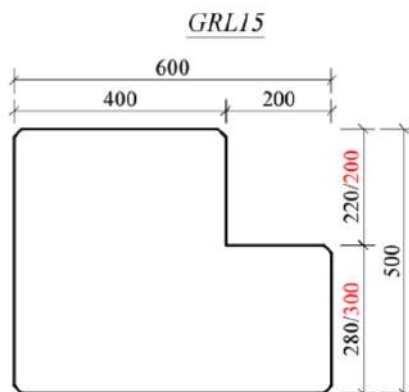
### Skaičiuojamoji schema



Pagal gkg3 RL rygelių laikomosios galios lentelę veikiant skaičiuojamosioms apkrovoms 600x500mm rygelio skerspjūvis gali būti iki 8,79m ilgio.

Sija	$b_{fl} \times h(h_{pl})$	Skaičiu						
		30	40	50	60	70	80	90
		Didži						
GRL01	500x400(220)	7.80	6.97	6.34	5.95	5.64	5.37	-
GRL02	500x500(220)	9.32	8.38	7.80	7.34	6.96	6.64	6.26
GRL03	500x500(265)	9.40	8.40	7.81	7.35	6.97	6.64	6.29
GRL04	500x500(320)	9.54	8.44	7.84	7.37	6.98	6.65	6.30
GRL05	500x600(220)	11.07	9.93	9.27	8.73	8.28	7.91	7.50
GRL06	500x600(265)	11.11	9.96	9.28	8.74	8.29	7.92	7.50
GRL07	500x600(320)	11.22	9.98	9.30	8.76	8.31	7.93	7.55
GRL08	500x700(220)	13.37	11.96	10.92	10.12	9.57	9.15	8.78
GRL09	500x700(265)	13.38	11.97	10.92	10.11	9.58	9.15	8.79
GRL10	500x700(320)	13.46	12.02	10.97	10.15	9.59	9.17	8.80
GRL11	500x800(220)	14.61	13.12	12.02	11.32	10.79	10.33	9.94
GRL12	500x800(265)	14.60	13.11	12.00	11.34	10.80	10.34	9.94
GRL13	500x800(320)	14.64	13.13	12.01	11.35	10.82	10.36	9.96
GRL14	600x400(220)	9.00	7.97	7.23	6.67	6.24	5.97	5.72
GRL15	600x500(220)	10.84	9.66	8.79	8.13	7.67	7.32	7.02
GRL16	600x500(265)	10.84	9.66	8.79	8.13	7.67	7.32	7.02
GRL17	600x500(320)	10.92	9.72	8.85	8.17	7.67	7.33	7.03
GRL18	600x600(220)	13.08	11.71	10.70	9.92	9.28	8.79	8.47
GRL19	600x600(265)	13.13	11.75	10.73	9.94	9.30	8.79	8.48
GRL20	600x600(320)	13.16	11.84	10.81	10.00	9.36	8.84	8.49
GRL21	600x700(220)	14.98	13.48	12.35	11.47	10.75	10.16	9.73

Pasirinkto rygelio geometrija:



IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	20	251	0

## Išvada: rygelio laikomoji galia pakankama

### 1.5.Kolonų projektavimas

Betonas: C30/37;

Aplinkos klasė XC2;

Rūsio monolitinės kolonos su pamatu ir su monolitine rūsio perdanga jungiamos standžiai.

Antžeminės kolonos surenkamos jungiamos su rūsio monolitinėmis kolonomis per monolitinę rūsio perdangą inkariniais varžtais standžiai.

Apsauginis betono sluoksnis: ne mažiau kaip armatūros skersmuo ir ne mažiau nei 30 mm iki pagrindinės armatūros krašto. Ugniaatsparumas R45.

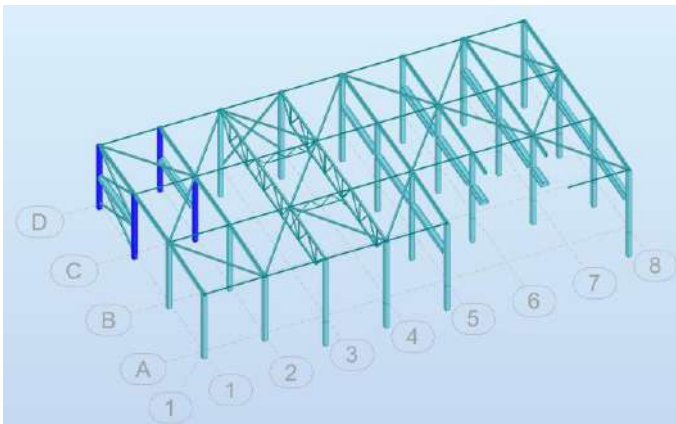
Projektuojamos dviejų skerspjūvio tipų kolonos: 400x400mm.

Surenkamos kolonos projektuojamos montavimo ir eksploataavimo stadijoje. Kolonų atsparumą transportavimo ir kėlimo metu turi įvertinti Gamintojas.

Surenkamų ir monolitinių kolonų išilginės armatūros kiekis negali būti mažesnis nei nurodyta skaičiavimuose.



#### K1 surenkamos kolonos

Kolonų išdėstymas:



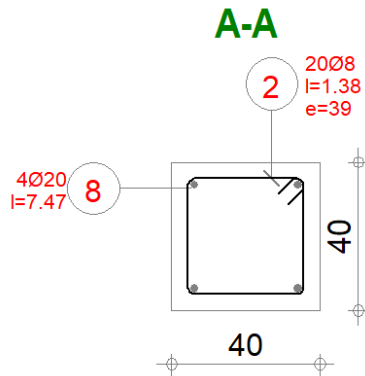
Kolonos geometrinis ilgis: 7.51 m ir 7.40 m.

Skaičiuojamieji ilgiai:

Buckling with respect to Y axis Member length $l_y$ <input type="radio"/> at support faces <input type="radio"/> in axes <input checked="" type="radio"/> real <input type="text" value="3.880"/> m <input type="radio"/> coeff. <input type="text"/> * $L_0$ Buckling length coefficient $K_y$ : <input type="text" value="1.25"/> 	Buckling with respect to Z axis Member length $l_z$ <input type="radio"/> at support faces <input type="radio"/> in axes <input checked="" type="radio"/> real <input type="text" value="3.880"/> m <input type="radio"/> coeff. <input type="text"/> * $L_0$ Buckling length coefficient $K_z$ : <input type="text" value="1.25"/> 
--	--

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	21	251	0

Reikalingas armavimas:



## 1 Level:

- Name :
- Reference level : -0.600 (m)
- Concrete creep coefficient :  $\varphi_p = 2.47$
- Cement class : N
- Environment class : XC2
- Structure class : S4

## 2 Column: Column17..18

Number of identical elements: 2

### 2.1 Material properties:

- Concrete : C30/37  $f_{ck} = 30.00$  (MPa)
- Unit weight : 2501.36 (kG/m<sup>3</sup>)
- Aggregate size : 20.0 (mm)
- Longitudinal reinforcement: : B500B  $f_{yk} = 500.00$  (MPa)
- Ductility class : B
- Transversal reinforcement: : B500B  $f_{yk} = 500.00$  (MPa)
- Modified partial coefficients:  
 $\alpha_{cc} = 0.9$  1992-1-1 3.1.6 (1)P

### 2.2 Geometry:

- 2.2.1 Rectangular 40.0 x 40.0 (cm)
- 2.2.2 Height: L = 7.513 (m)
- 2.2.3 Slab thickness = 0.000 (m)
- 2.2.4 Beam height = 0.000 (m)
- 2.2.5 Cover = 4.0 (cm)

### 2.3 Calculation options:

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Seismic dispositions : No requirements
- Precast column : yes
- Pre-design : no

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	22	251	0

- Slenderness taken into account : yes
- Compression : with bending
- Ties : to slab
- Fire resistance class : No requirements

## 2.4 Calculation results:

Safety factors  $Rd/Ed = 2.42 > 1.0$

### 2.4.1 ULS/ALS Analysis

Design combination:  $ULS/54 = 1 \cdot 1.00 + 8 \cdot 1.30$  (B)

Combination type: ULS

Internal forces:

$Nsd = 174.63$  (kN)     $Msd_y = -44.83$  (kN\*m)     $Msd_z = -37.63$  (kN\*m)

Design forces:

Lower node

$N = 174.63$  (kN)     $N^*etot_z = -46.95$  (kN\*m)     $N^*etoty = -37.63$  (kN\*m)

Eccentricity:

		ez (My/N) (cm)	ey (Mz/N) (cm)
Initial	e0:	-25.7	-21.5
Imperfection	ei:	1.2	0.0
1 order (e0 + ei)	e0Ed:	-24.5	-21.5
Minimal	eEdmin:	2.0	2.0
Total	eEd:	-26.9	-21.5

#### 2.4.1.1. Detailed analysis-Direction Y:

##### 2.4.1.1.1 Slenderness analysis

Non-sway structure

L (m)	Lo (m)	$\lambda$	$\lambda_{lim}$	
3.880	4.850	42.00	44.68	Short column

##### 2.4.1.1.2 Buckling analysis

$MA = 0.00$  (kN\*m)     $MB = -44.83$  (kN\*m)

Case: Cross-section at the column end (Lower node), Slenderness not taken into account

$M0 = -44.83$  (kN\*m)

$ei = \theta_1 \cdot lo / 2 = 1.2$  (cm)

$\theta_1 = \theta_0 \cdot \alpha_\eta \cdot \alpha_m = 0.01$

$\theta_0 = 0.01$

$\alpha_h = 1.00$

$\alpha_m = (0.5(1+1/m))^{0.5} = 1.00$

$m = 1.00$

$Ma = N \cdot ei = 2.12$  (kN\*m)

$MEdmin = 3.49$  (kN\*m)

$M0Ed = \max(MEdmin, M0 + Ma) = -46.95$  (kN\*m)

#### 2.4.1.2. Detailed analysis-Direction Z:

##### 2.4.1.2.1 Slenderness analysis

Non-sway structure

L (m)	Lo (m)	$\lambda$	$\lambda_{lim}$	
3.880	4.850	42.00	44.68	Short column

##### 2.4.1.2.2 Buckling analysis

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	23	251	0

$MA = 0.00 \text{ (kN*m)}$        $MB = -37.63 \text{ (kN*m)}$   
 Case: Cross-section at the column end (Lower node), Slenderness not taken into account  
 $M0 = -37.63 \text{ (kN*m)}$   
 $ei = 0.0 \text{ (cm)}$   
 $Ma = N*ei = 0.00 \text{ (kN*m)}$   
 $ME_{min} = 3.49 \text{ (kN*m)}$   
 $M0Ed = \max(ME_{min}, M0 + Ma) = -37.63 \text{ (kN*m)}$

#### 2.4.2 Reinforcement:

Real (provided) area       $Asr = 12.57 \text{ (cm}^2\text{)}$   
 Ratio:       $\rho = 0.79 \%$

#### 2.5 Reinforcement:

##### Main bars (B500B):

- 4  $\phi 20$   $l = 7.473 \text{ (m)}$

##### Transversal reinforcement: (B500B):

stirrups:      20  $\phi 8$        $l = 1.376 \text{ (m)}$

### 3 Material survey:

- Concrete volume      = 2.404 (m<sup>3</sup>)
- Formwork      = 24.040 (m<sup>2</sup>)
- Steel B500B
  - Total weight      = 169.21 (kG)
  - Density      = 70.39 (kG/m<sup>3</sup>)
  - Average diameter      = 14.2 (mm)
  - Reinforcement survey:

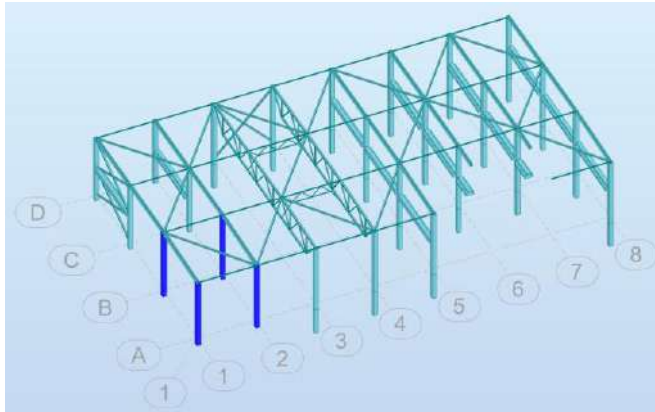
Diameter	Length (m)	Weight (kG)	Number (No.)	Total weight (kG)
8	1.376	0.54	40	21.73
20	7.473	18.43	8	147.48

**IŠVADA:** kolonų laikomoji galia užtikrinta.

#### K1a surenkamos kolonos

Kolonų išdėstymas:

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	24	251	0



Kolonos geometrinis ilgis: 7.63 m ir 7.40 m.

Skaičiuojamieji ilgiai:

Member:

**Buckling with respect to Y axis**

Member length  $l_y$

at support faces

in axes

real  m

coeff.  \*  $L_0$

Buckling length coefficient

Ky:

**Buckling with respect to Z axis**

Member length  $l_z$

at support faces

in axes

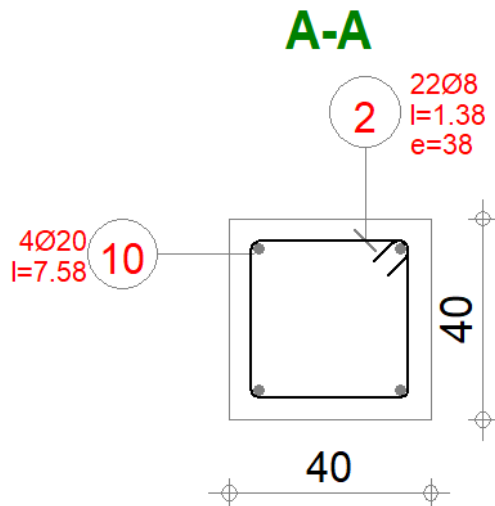
real  m

coeff.  \*  $L_0$

Buckling length coefficient

Kz:

Reikalingas armavimas:



**1 Level:**

- Name : \_\_\_\_\_
- Reference level : -0.600 (m)
- Concrete creep coefficient :  $\varphi_p = 2.47$
- Cement class : N
- Environment class : XC2

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	25	251	0

- Structure class : S4

## 2 Column: Column19..22

Number of identical elements: 2

### 2.1 Material properties:

- Concrete : C30/37  $f_{ck} = 30.00$  (MPa)
- Unit weight : 2501.36 (kG/m<sup>3</sup>)
- Aggregate size : 20.0 (mm)
- Longitudinal reinforcement: : B500B  $f_{yk} = 500.00$  (MPa)
- Ductility class : B
- Transversal reinforcement: : B500B  $f_{yk} = 500.00$  (MPa)
- Modified partial coefficients:  
 $\alpha_{cc} = 0.9$  1992-1-1 3.1.6 (1)P

### 2.2 Geometry:

- 2.2.1 Rectangular 40.0 x 40.0 (cm)
- 2.2.2 Height: L = 7.625 (m)
- 2.2.3 Slab thickness = 0.000 (m)
- 2.2.4 Beam height = 0.000 (m)
- 2.2.5 Cover = 4.0 (cm)

### 2.3 Calculation options:

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Seismic dispositions : No requirements
- Precast column : yes
- Pre-design : no
- Slenderness taken into account : yes
- Compression : with bending
- Ties : to slab
- Fire resistance class : No requirements

### 2.4 Calculation results:

Safety factors  $R_d/E_d = 1.26 > 1.0$

#### 2.4.1 ULS/ALS Analysis

Design combination:  $ULS/42 = 1 \cdot 1.00 + 2 \cdot 0.91 + 6 \cdot 1.30$  (B)

Combination type: ULS

Internal forces:

$N_{sd} = 38.69$  (kN)  $M_{sdy} = -75.01$  (kN\*m)  $M_{sdz} = 7.91$  (kN\*m)

Design forces:

Lower node

$N = 38.69$  (kN)  $N^*etotz = -75.68$  (kN\*m)  $N^*etoty = 7.91$  (kN\*m)

Eccentricity:

		$e_z$ (My/N) (cm)	$e_y$ (Mz/N) (cm)
Initial	e0:	-193.9	20.4
Imperfection	ei:	1.7	0.0

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	26	251	0

I order (e0 + ei)	e0Ed:	-192.2		20.4
Minimal	eEdmin:	2.0	2.0	
Total	eEd:	-195.6		20.4

### 2.4.1.1. Detailed analysis-Direction Y:

#### 2.4.1.1.1 Slenderness analysis

Non-sway structure

L (m)	Lo (m)	$\lambda$	$\lambda_{lim}$	
7.625	9.531	82.54	94.93	Short column

#### 2.4.1.1.2 Buckling analysis

MA = 0.00 (kN\*m) MB = -75.01 (kN\*m)

Case: Cross-section at the column end (Lower node), Slenderness not taken into account

M0 = -75.01 (kN\*m)

ei =  $\theta_1 \cdot l_0 / 2 = 1.7$  (cm)

$\theta_1 = \theta_0 \cdot \alpha \eta \cdot \alpha m = 0.00$

$\theta_0 = 0.01$

$\alpha h = 0.72$

$\alpha m = (0.5(1+1/m))^{0.5} = 1.00$

m = 1.00

Ma = N\*ei = 0.67 (kN\*m)

MEdmin = 0.77 (kN\*m)

M0Ed = max(MEdmin, M0 + Ma) = -75.68 (kN\*m)

### 2.4.1.2. Detailed analysis-Direction Z:

#### 2.4.1.2.1 Slenderness analysis

Non-sway structure

L (m)	Lo (m)	$\lambda$	$\lambda_{lim}$	
7.625	9.531	82.54	94.93	Short column

#### 2.4.1.2.2 Buckling analysis

MA = 0.00 (kN\*m) MB = 7.91 (kN\*m)

Case: Cross-section at the column end (Lower node), Slenderness not taken into account

M0 = 7.91 (kN\*m)

ei = 0.0 (cm)

Ma = N\*ei = 0.00 (kN\*m)

MEdmin = 0.77 (kN\*m)

M0Ed = max(MEdmin, M0 + Ma) = 7.91 (kN\*m)

### 2.4.2 Reinforcement:

Real (provided) area

Asr = 12.57 (cm<sup>2</sup>)

Ratio:

$\rho = 0.79$  %

### 2.5 Reinforcement:

Main bars (B500B):

- 4  $\phi$ 20 l = 7.585 (m)

Transversal reinforcement: (B500B):

stirrups: 22  $\phi$ 8 l = 1.376 (m)

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	27	251	0

### 3 Material survey:

- Concrete volume = 2.440 (m<sup>3</sup>)
- Formwork = 24.400 (m<sup>2</sup>)
- Steel B500B
  - Total weight = 173.60 (kG)
  - Density = 71.15 (kG/m<sup>3</sup>)
  - Average diameter = 14.0 (mm)
  - Reinforcement survey:

Diameter	Length (m)	Weight (kG)	Number (No.)	Total weight (kG)
8	1.376	0.54	44	23.91
20	7.585	18.71	8	149.70

#### Kolonų bazių skaičiavimas

Kolonos K1 ir K1a bazės inkariniai varžtai pagal atramines reakcijas pamate parenkami „Peikko Designer“ programa.

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	28	251	0

## Summary

Name	Stage	#	Load Case	Page No.	Max Utilization	Status
Column 1	Final	1	N max	5	39%	OK
	Final	2	M max	5	39%	OK

## Column 1

Note:

Number of Columns: 1

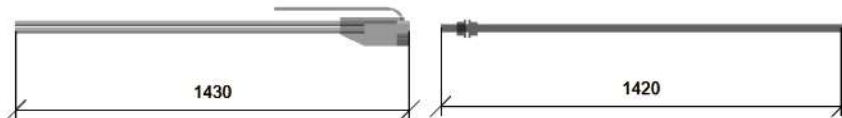
### Peikko Products

Column Shoes: 4 x HPKM30

Bolts: 4 x HPM30P

Totals

Product	Amount
HPKM30	4
HPM30P	4



Minimum required torque value of nuts :  $T_{min} = 250 \text{ Nm}$

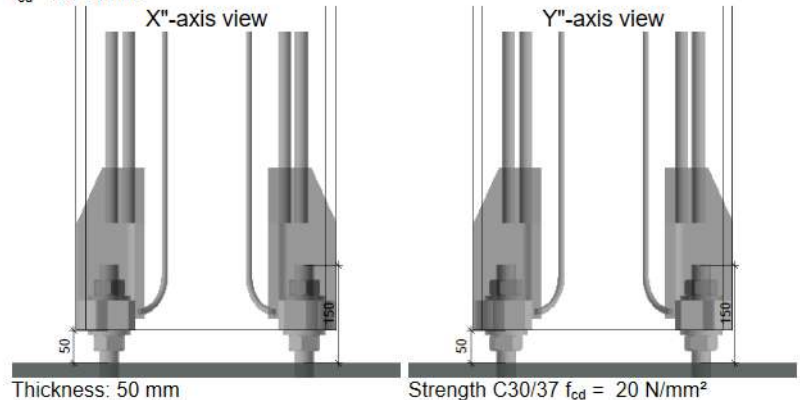
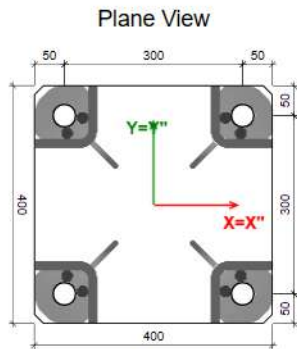
Maximum allowed torque value of nuts :  $T_{max} = 450 \text{ Nm}$

Bolt installation template: PPL30-4 300x300

### Materials and Geometry

Column: 400x400

Concrete: C30/37  
 $f_{cd} = 20 \text{ N/mm}^2$



Grouting:

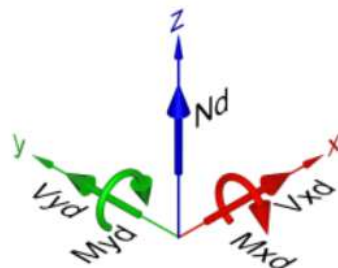
X; Y = local coordinate system of profile

X''; Y'' = local coordinate system of anchors

### Load Cases

NOTE: Loads are defined in the local coordinate system of the profile.

(Design loads)



#### Final Stage

#	Name	$N_d$ [kN]	$M_{xd}$ [kNm]	$M_{yd}$ [kNm]	$V_{xd}$ [kN]	$V_{yd}$ [kN]
1	N max	-356.0	-12.0	18.0	7.0	13.0
2	M max	-310.0	58.0	34.0	16.0	-68.0

#### Erection stage

No load case for this stage defined

#### Fire Situation Loads

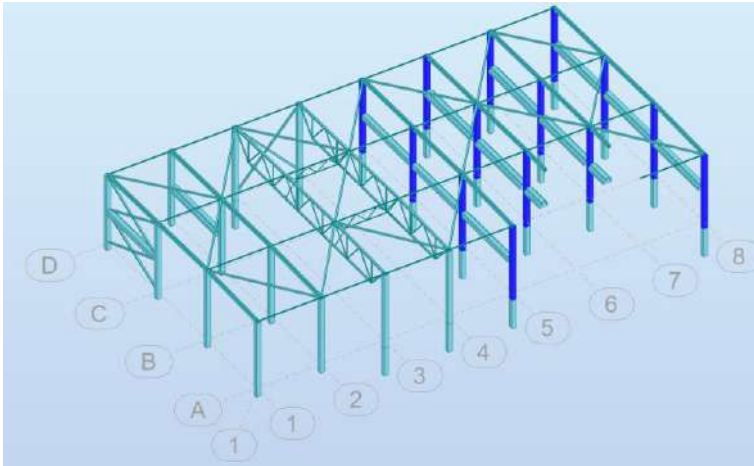
No load case for this stage defined

**IŠVADA:** kolonų laikomoji galia užtikrinta.

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	29	251	0

## K2 surenkamos kolonos

Kolonų išdėstymas:

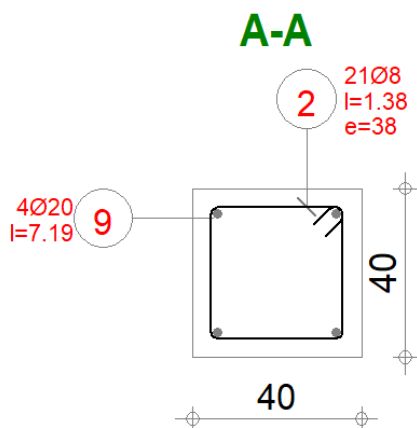


Kolonos geometrinis ilgis: 7,38 m, 7.50 m ir 7.27 m.

Skaičiuojamieji ilgiai:

Member: Kolona 2	
<p>Buckling with respect to Y axis</p> <p>Member length <math>l_y</math></p> <p><input type="radio"/> at support faces</p> <p><input type="radio"/> in axes</p> <p><input checked="" type="radio"/> real 3.750 m</p> <p><input type="radio"/> coeff. * <math>L_0</math></p>	<p>Buckling with respect to Z axis</p> <p>Member length <math>l_z</math></p> <p><input type="radio"/> at support faces</p> <p><input type="radio"/> in axes</p> <p><input checked="" type="radio"/> real 3.750 m</p> <p><input type="radio"/> coeff. * <math>L_0</math></p>
<p>Buckling length coefficient</p> <p>Ky: 1.25</p>	<p>Buckling length coefficient</p> <p>Kz: 1.25</p>

Reikalingas armavimas:



### 1 Level:

- Name :
- Reference level : -0.470 (m)
- Concrete creep coefficient :  $\varphi_p = 2.47$

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	30	251	0

- Cement class : N
- Environment class : XC2
- Structure class : S4

## 2 Column: Column34..41

Number of identical elements: 4

### 2.1 Material properties:

- Concrete : C30/37  $f_{ck} = 30.00$  (MPa)
- Unit weight : 2501.36 (kG/m<sup>3</sup>)
- Aggregate size : 20.0 (mm)
- Longitudinal reinforcement: : B500B  $f_{yk} = 500.00$  (MPa)
- Ductility class : B
- Transversal reinforcement: : B500B  $f_{yk} = 500.00$  (MPa)
- Modified partial coefficients:  
 $\alpha_{cc} = 0.9$  1992-1-1 3.1.6 (1)P

### 2.2 Geometry:

- 2.2.1 Rectangular 40.0 x 40.0 (cm)
- 2.2.2 Height: L = 7.233 (m)
- 2.2.3 Slab thickness = 0.000 (m)
- 2.2.4 Beam height = 0.000 (m)
- 2.2.5 Cover = 4.0 (cm)

### 2.3 Calculation options:

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Seismic dispositions : No requirements
- Precast column : yes
- Pre-design : no
- Slenderness taken into account : yes
- Compression : with bending
- Ties : to slab
- Fire resistance class : No requirements

### 2.4 Calculation results:

Safety factors  $R_d/E_d = 1.94 > 1.0$

#### 2.4.1 ULS/ALS Analysis

Design combination: ACC:ACC/23=1\*1.00 + 8\*0.20 + 9\*1.00 (B)

Combination type: ALS

Internal forces:

$N_{sd} = 200.17$  (kN)  $M_{sdy} = 78.78$  (kN\*m)  $M_{sdz} = -10.91$  (kN\*m)

Design forces:

Lower node

$N = 200.17$  (kN)  $N^*etotz = 81.12$  (kN\*m)  $N^*etoty = -10.91$  (kN\*m)

Eccentricity:

$e_z$  (My/N)

$e_y$  (Mz/N)

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	31	251	0

Initial	e0:	(cm)	(cm)
Imperfection	ei:	39.4	-5.4
I order (e0 + ei)	e0Ed:	1.2	0.0
Minimal	eEdmin:	40.5	-5.4
Total	eEd:	2.0	2.0
		40.5	-5.4

#### 2.4.1.1. Detailed analysis-Direction Y:

##### 2.4.1.1.1 Slenderness analysis

Non-sway structure

L (m)	Lo (m)	$\lambda$	$\lambda_{lim}$	
3.750	4.688	40.59	46.14	Short column

##### 2.4.1.1.2 Buckling analysis

MA = 0.00 (kN\*m)      MB = 78.78 (kN\*m)  
Case: Cross-section at the column end (Lower node), Slenderness not taken into account  
M0 = 78.78 (kN\*m)  
ei =  $\theta_1 \cdot l_0 / 2 = 1.2$  (cm)  
 $\theta_1 = \theta_0 \cdot \alpha_1 \cdot \alpha_m = 0.01$   
 $\theta_0 = 0.01$   
 $\alpha_h = 1.00$   
 $\alpha_m = (0,5(1+1/m))^{0.5} = 1.00$   
m = 1.00  
Ma = N \* ei = 2.35 (kN\*m)  
MEdmin = 4.00 (kN\*m)  
M0Ed = max(MEdmin, M0 + Ma) = 81.12 (kN\*m)

#### 2.4.1.2. Detailed analysis-Direction Z:

##### 2.4.1.2.1 Slenderness analysis

Non-sway structure

L (m)	Lo (m)	$\lambda$	$\lambda_{lim}$	
3.750	4.688	40.59	46.14	Short column

##### 2.4.1.2.2 Buckling analysis

MA = 0.00 (kN\*m)      MB = -10.91 (kN\*m)  
Case: Cross-section at the column end (Lower node), Slenderness not taken into account  
M0 = -10.91 (kN\*m)  
ei = 0.0 (cm)  
Ma = N \* ei = 0.00 (kN\*m)  
MEdmin = 4.00 (kN\*m)  
M0Ed = max(MEdmin, M0 + Ma) = -10.91 (kN\*m)

#### 2.4.2 Reinforcement:

Real (provided) area      Asr = 12.57 (cm<sup>2</sup>)  
Ratio:       $\rho = 0.79 \%$

#### 2.5 Reinforcement:

##### Main bars (B500B):

- 4  $\phi 20$  l = 7.193 (m)

##### Transversal reinforcement: (B500B):

stirrups:      21  $\phi 8$       l = 1.376 (m)

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	32	251	0

### 3 Material survey:

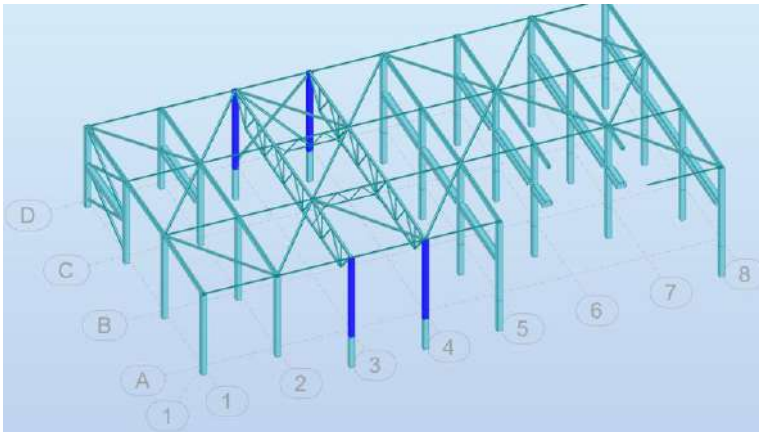
- Concrete volume = 4.629 (m<sup>3</sup>)
- Formwork = 46.288 (m<sup>2</sup>)
- Steel B500B
  - Total weight = 329.54 (kG)
  - Density = 71.19 (kG/m<sup>3</sup>)
  - Average diameter = 14.0 (mm)
  - Reinforcement survey:

Diameter	Length (m)	Weight (kG)	Number (No.)	Total weight (kG)
8	1.376	0.54	84	45.64
20	7.193	17.74	16	283.90

**IŠVADA:** kolonų laikomoji galia užtikrinta.



#### K2a surenkamos kolonos

Kolonų išdėstymas:



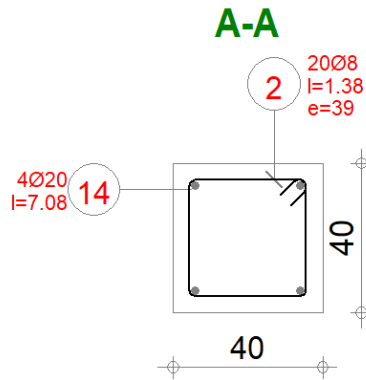
Kolonos geometrinis ilgis: 7.27 m.

Skaičiuojamieji ilgiai:

Member: Kolona 2a	
Buckling with respect to Y axis Member length $l_y$ <input type="radio"/> at support faces <input type="radio"/> in axes <input type="radio"/> real <input type="text"/> m <input checked="" type="radio"/> coeff. <input type="text" value="1.00"/> * $L_0$	Buckling with respect to Z axis Member length $l_z$ <input type="radio"/> at support faces <input type="radio"/> in axes <input type="radio"/> real <input type="text"/> m <input checked="" type="radio"/> coeff. <input type="text" value="1.00"/> * $L_0$
Buckling length coefficient Ky: <input type="text" value="1.25"/> 	Buckling length coefficient Kz: <input type="text" value="1.25"/> 

Reikalingas armavimas:

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	33	251	0



## 1 Level:

- Name :
- Reference level : -0.470 (m)
- Concrete creep coefficient :  $\varphi_p = 2.47$
- Cement class : N
- Environment class : XC2
- Structure class : S4

## 2 Column: Column46..121

Number of identical elements: 2

### 2.1 Material properties:

- Concrete : C30/37  $f_{ck} = 30.00$  (MPa)
- Unit weight : 2501.36 (kg/m<sup>3</sup>)
- Aggregate size : 20.0 (mm)
- Longitudinal reinforcement: : B500B  $f_{yk} = 500.00$  (MPa)
- Ductility class : B
- Transversal reinforcement: : B500B  $f_{yk} = 500.00$  (MPa)
- Modified partial coefficients:  
 $\alpha_{cc} = 0.9$  1992-1-1 3.1.6 (1)P

### 2.2 Geometry:

- 2.2.1 Rectangular 40.0 x 40.0 (cm)
- 2.2.2 Height: L = 7.118 (m)
- 2.2.3 Slab thickness = 0.000 (m)
- 2.2.4 Beam height = 0.000 (m)
- 2.2.5 Cover = 4.0 (cm)

### 2.3 Calculation options:

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Seismic dispositions : No requirements
- Precast column : yes
- Pre-design : no
- Slenderness taken into account : yes
- Compression : with bending

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	34	251	0

- Ties : to slab
- Fire resistance class : No requirements

## 2.4 Calculation results:

Safety factors  $Rd/Ed = 1.62 > 1.0$

### 2.4.1 ULS/ALS Analysis

Design combination:  $ULS/56=1*1.35 + 2*0.91 + 5*0.78 + 4*1.30$  (C)

Combination type: ULS

Internal forces:

$Nsd = 340.94$  (kN)     $Msd_y = -1.17$  (kN\*m)     $Msd_z = -43.69$  (kN\*m)

Design forces:

Cross-section in the middle of the column

$N = 340.94$  (kN)     $N^*etotz = -6.82$  (kN\*m)     $N^*etoty = -49.43$  (kN\*m)

Eccentricity:

		ez (My/N) (cm)	ey (Mz/N) (cm)
Initial	e0:	-0.3	-12.8
Imperfection	ei:	0.0	1.7
1 order (e0 + ei)	e0Ed:	-0.3	-11.1
Minimal	eEdmin:	2.0	2.0
Total	eEd:	-2.0	-14.5

#### 2.4.1.1. Detailed analysis-Direction Y:

##### 2.4.1.1.1 Slenderness analysis

Non-sway structure

L (m)	Lo (m)	$\lambda$	$\lambda_{lim}$	
7.268	9.085	78.68	31.98	Slender column

##### 2.4.1.1.2 Buckling analysis

$MA = -0.00$  (kN\*m)     $MB = 20.51$  (kN\*m)     $MC = -1.17$  (kN\*m)

Case: Cross-section in the middle of the column, Slenderness taken into account

$M0 = -1.17$  (kN\*m)

$ei = 0.0$  (cm)

Method based on nominal stiffness

$$\left[ 1 + \frac{\beta}{(N_B / N) - 1} \right] = 1.90$$

$\beta = 1.00$

$Nb = (\pi^2 * EJ) / lo^2 = 720.55$  (kN)

$EJ = Kc * Ecd * Jc + Ks * Es * Js = 6025.420$  (kN\*m<sup>2</sup>)

$\phi_{ef} = 2.47$

$Jc = 213333.3$  (cm<sup>4</sup>)

$Js = 2463.0$  (cm<sup>4</sup>)

$Kc = 0.02$  ()

$Ks = 1.00$  ()

$MEdmin = 6.82$  (kN\*m)

$$M_{Ed} = \max \left\{ M_{Edmin}; \left[ 1 + \frac{\beta}{(N_B / N) - 1} \right] M_{0Ed} \right\} = -6.82 \text{ (kN*m)}$$

#### 2.4.1.2. Detailed analysis-Direction Z:

##### 2.4.1.2.1 Slenderness analysis

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	35	251	0

Non-sway structure

L (m)	Lo (m)	$\lambda$	$\lambda_{lim}$	
7.268	9.085	78.68	100.24	Short column

#### 2.4.1.2.2 Buckling analysis

$MA = -54.41 \text{ (kN*m)}$        $MB = 26.88 \text{ (kN*m)}$        $MC = -43.69 \text{ (kN*m)}$   
 Case: Cross-section in the middle of the column, Slenderness not taken into account  
 $M_0 = -43.69 \text{ (kN*m)}$   
 $ei = \theta_1 * lo/2 = 1.7 \text{ (cm)}$   
 $\theta_1 = \theta_0 * \alpha h * \alpha m = 0.00$   
 $\theta_0 = 0.01$   
 $\alpha h = 0.74$   
 $\alpha m = (0.5(1+1/m))^{0.5} = 1.00$   
 $m = 1.00$   
 $Ma = N * ei = 5.74 \text{ (kN*m)}$   
 $ME_{dmin} = 6.82 \text{ (kN*m)}$   
 $M_{0Ed} = \max(ME_{dmin}, M_0 + Ma) = -49.43 \text{ (kN*m)}$

#### 2.4.2 Reinforcement:

Real (provided) area       $Asr = 12.57 \text{ (cm}^2\text{)}$   
 Ratio:       $\rho = 0.79 \%$

#### 2.5 Reinforcement:

##### Main bars (B500B):

- 4  $\phi 20$  l = 7.078 (m)

##### Transversal reinforcement: (B500B):

stirrups: 20  $\phi 8$  l = 1.376 (m)

### 3 Material survey:

- Concrete volume = 2.278 (m<sup>3</sup>)
- Formwork = 22.777 (m<sup>2</sup>)
- Steel B500B
  - Total weight = 161.42 (kG)
  - Density = 70.87 (kG/m<sup>3</sup>)
  - Average diameter = 14.1 (mm)
  - Reinforcement survey:

Diameter	Length (m)	Weight (kG)	Number (No.)	Total weight (kG)
8	1.376	0.54	40	21.73
20	7.078	17.46	8	139.69

#### Kolonų bazių skaičiavimas

Kolonos K2 ir K2a bazės inkariniai varžtai pagal atramines reakcijas pamate parenkami „Peikko Designer“ programa.

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	36	251	0

## Summary

Name	Stage	#	Load Case	Page No.	Max Utilization	Status
Column 1	Final	1	N max	5	39%	OK
	Final	2	M max	5	39%	OK

## Column 1

Note:

Number of Columns: 1

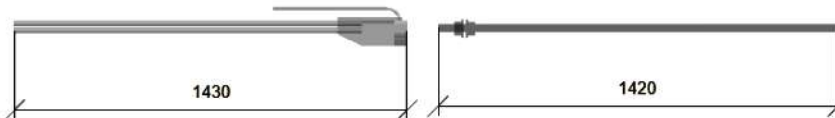
### Peikko Products

Column Shoes: 4 x HPKM30

Bolts: 4 x HPM30P

Totals

Product	Amount
HPKM30	4
HPM30P	4



Minimum required torque value of nuts :  $T_{min} = 250 \text{ Nm}$

Maximum allowed torque value of nuts :  $T_{max} = 450 \text{ Nm}$

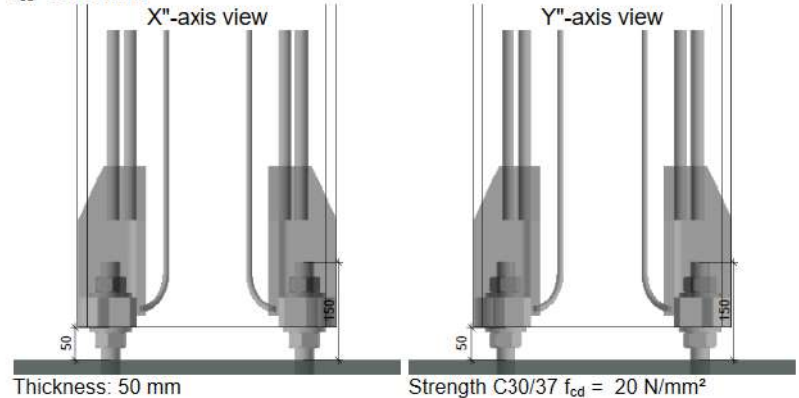
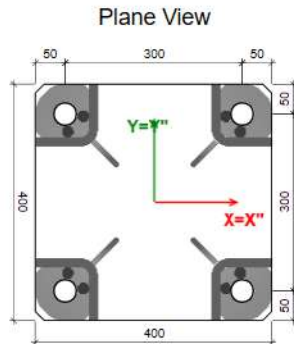
Bolt installation template: PPL30-4 300x300

### Materials and Geometry

Column: 400x400

Concrete: C30/37

$f_{cd} = 20 \text{ N/mm}^2$



Grouting:

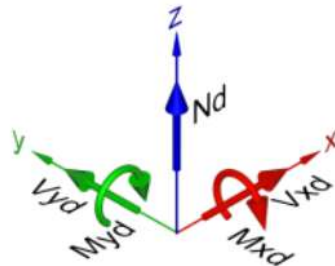
X; Y = local coordinate system of profile

X''; Y'' = local coordinate system of anchors

### Load Cases

NOTE: Loads are defined in the local coordinate system of the profile.

(Design loads)



#### Final Stage

#	Name	$N_d$ [kN]	$M_{xd}$ [kNm]	$M_{yd}$ [kNm]	$V_{xd}$ [kN]	$V_{yd}$ [kN]
1	N max	-866.0	2.0	1.0	1.0	-3.0
2	M max	-169.0	-17.0	-54.0	36.0	30.0

#### Erection stage

No load case for this stage defined

#### Fire Situation Loads

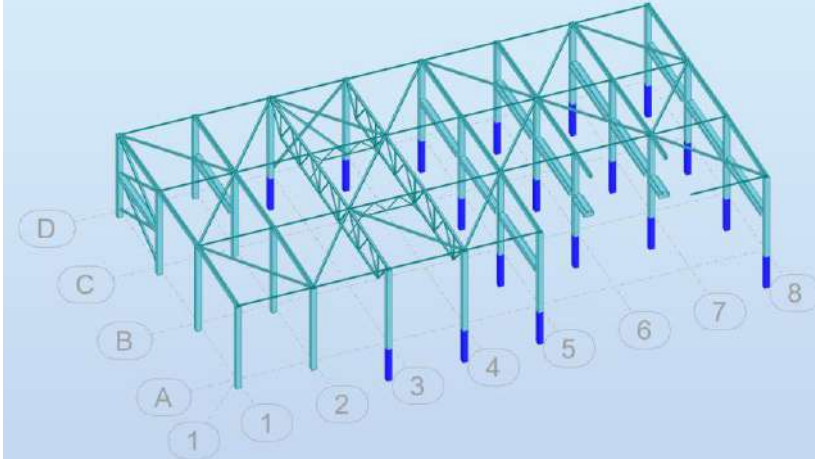
No load case for this stage defined

IŠVADA: kolonų laikomoji galia užtikrinta.

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	37	251	0

### K3 monolitinės kolonos

Kolonų išdėstymas:



Kolonos geometrinis ilgis: 2,82 m.

Skaičiuojamieji ilgiai:

Member:

**Buckling with respect to Y axis**

Member length  $l_y$

at support faces

in axes

real  m

coeff.  \*  $L_0$

Buckling length coefficient

Ky:

**Buckling with respect to Z axis**

Member length  $l_z$

at support faces

in axes

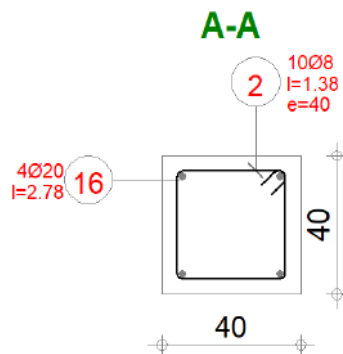
real  m

coeff.  \*  $L_0$

Buckling length coefficient

Kz:

Reikalingas armavimas:



### 1 Level:

- Name : \_\_\_\_\_
- Reference level : -3.290 (m)
- Concrete creep coefficient :  $\varphi_p = 2.47$
- Cement class : N

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	38	251	0

- Environment class : XC2
- Structure class : S4

## 2 Column: Column1..27

Number of identical elements: 18

### 2.1 Material properties:

- Concrete : C30/37  $f_{ck} = 30.00$  (MPa)
- Unit weight : 2501.36 (kG/m<sup>3</sup>)
- Aggregate size : 20.0 (mm)
- Longitudinal reinforcement: : B500B  $f_{yk} = 500.00$  (MPa)
- Ductility class : B
- Transversal reinforcement: : B500B  $f_{yk} = 500.00$  (MPa)
- Modified partial coefficients:  
 $\alpha_{cc} = 0.9$  1992-1-1 3.1.6 (1)P

### 2.2 Geometry:

- 2.2.1 Rectangular 40.0 x 40.0 (cm)
- 2.2.2 Height: L = 2.820 (m)
- 2.2.3 Slab thickness = 0.000 (m)
- 2.2.4 Beam height = 0.000 (m)
- 2.2.5 Cover = 4.0 (cm)

### 2.3 Calculation options:

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Seismic dispositions : No requirements
- Precast column : yes
- Pre-design : no
- Slenderness taken into account : yes
- Compression : with bending
- Ties : to slab
- Fire resistance class : No requirements

### 2.4 Calculation results:

Safety factors  $R_d/E_d = 1.59 > 1.0$

#### 2.4.1 ULS/ALS Analysis

Design combination: ACC:ACC/37=1\*1.00 + 7\*0.20 + 10\*1.00 (A)

Combination type: ALS

Internal forces:

$N_{sd} = 310.53$  (kN)  $M_{sdy} = -105.04$  (kN\*m)  $M_{sdz} = -15.06$  (kN\*m)

Design forces:

Upper node

$N = 310.53$  (kN)  $N^*etotz = -107.78$  (kN\*m)  $N^*etoty = -15.06$  (kN\*m)

Eccentricity:

$e_z$  (My/N)  
(cm)

$e_y$  (Mz/N)  
(cm)

Initial

$e_0$ :

-33.8

-4.8

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	39	251	0

Imperfection	ei:	0.9	0.0
I order (e0 + ei)	e0Ed:	-32.9	-4.8
Minimal	eEdmin:	2.0	2.0
Total	eEd:	-34.7	-4.8

#### 2.4.1.1. Detailed analysis-Direction Y:

##### 2.4.1.1.1 Slenderness analysis

Non-sway structure

L (m)	Lo (m)	$\lambda$	$\lambda_{lim}$	
2.820	3.525	30.53	115.68	Short column

##### 2.4.1.1.2 Buckling analysis

$$MA = -105.04 \text{ (kN*m)} \quad MB = 51.02 \text{ (kN*m)}$$

Case: Cross-section at the column end (Upper node), Slenderness not taken into account

$$M0 = -105.04 \text{ (kN*m)}$$

$$ei = \theta1 * lo / 2 = 0.9 \text{ (cm)}$$

$$\theta1 = \theta0 * \alpha\eta * \alpha m = 0.01$$

$$\theta0 = 0.01$$

$$\alpha h = 1.00$$

$$\alpha m = (0.5(1+1/m))^{0.5} = 1.00$$

$$m = 1.00$$

$$Ma = N * ei = 2.74 \text{ (kN*m)}$$

$$MEdmin = 6.21 \text{ (kN*m)}$$

$$M0Ed = \max(MEdmin, M0 + Ma) = -107.78 \text{ (kN*m)}$$

#### 2.4.1.2. Detailed analysis-Direction Z:

##### 2.4.1.2.1 Slenderness analysis

Non-sway structure

L (m)	Lo (m)	$\lambda$	$\lambda_{lim}$	
2.820	3.525	30.53	117.84	Short column

##### 2.4.1.2.2 Buckling analysis

$$MA = -15.06 \text{ (kN*m)} \quad MB = 7.93 \text{ (kN*m)}$$

Case: Cross-section at the column end (Upper node), Slenderness not taken into account

$$M0 = -15.06 \text{ (kN*m)}$$

$$ei = 0.0 \text{ (cm)}$$

$$Ma = N * ei = 0.00 \text{ (kN*m)}$$

$$MEdmin = 6.21 \text{ (kN*m)}$$

$$M0Ed = \max(MEdmin, M0 + Ma) = -15.06 \text{ (kN*m)}$$

#### 2.4.2 Reinforcement:

Real (provided) area

$$Asr = 12.57 \text{ (cm}^2\text{)}$$

Ratio:

$$\rho = 0.79 \%$$

#### 2.5 Reinforcement:

Main bars (B500B):

- 4  $\phi$ 20 l = 2.780 (m)

Transversal reinforcement: (B500B):

stirrups: 10  $\phi$ 8 l = 1.376 (m)

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	40	251	0

### 3 Material survey:

- Concrete volume = 8.122 (m<sup>3</sup>)
- Formwork = 81.216 (m<sup>2</sup>)
- Steel B500B
  - Total weight = 591.59 (kG)
  - Density = 72.84 (kG/m<sup>3</sup>)
  - Average diameter = 13.4 (mm)
  - Reinforcement survey:

Diameter	Length (m)	Weight (kG)	Number (No.)	Total weight (kG)
8	1.376	0.54	180	97.80
20	2.780	6.86	72	493.79

**IŠVADA:** kolonų laikomoji galia užtikrinta.

Kolonų gėmių skaičiavimas:

Betonas C30/37

$$f_{cd} := \frac{30000}{1.5} \cdot 0.9 = 1.8 \times 10^4 \text{ kPa}$$

$$f_{ctm} := \frac{2900}{1.5} = 1.933 \times 10^3 \text{ kPa}$$

$$f_{ctd} := \frac{2000}{1.5} = 1.333 \times 10^3 \text{ kPa}$$

$$E_{cm} := 33000000 \text{ kPa}$$

Armatūra S500

$$f_{yd} := \frac{500000}{1.15} = 4.348 \times 10^5 \text{ kPa}$$

$$E_s := 205000000 \text{ kPa}$$

$$V_{Ed} := 347 \text{ kN}$$

$$b := 0.4 \text{ m}$$

$$h := 0.6 \text{ m}$$

$$l_w := 0.3 \text{ m}$$

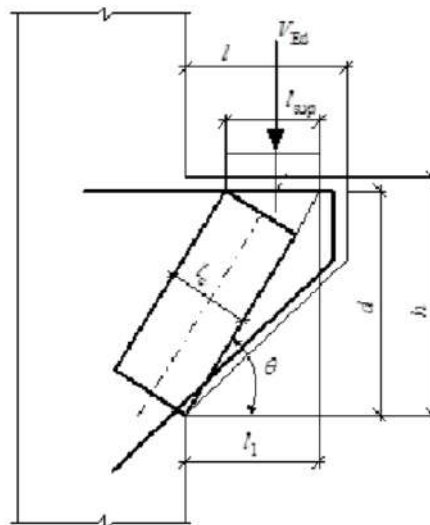
$$l_1 := 0.28 \text{ m}$$

$$d := 0.56 \text{ m}$$

$$l_{sup} := 0.26 \text{ m}$$

$$\theta := 65$$

$$l_c := l_{sup} \cdot \sin(\text{deg} \cdot \theta) = 0.236$$



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	41	251	0

$$\alpha_1 := \frac{E_s}{E_{cm}} = 6.212$$

$$A_{sw} := 101 \text{ mm}^2 \quad 2d8S500$$

$$s_w := 150 \text{ mm}$$

$$\rho_{w1} := \frac{A_{sw}}{s_w \cdot b \cdot 10^3} = 1.683 \times 10^{-3}$$

$$\varphi_{w2} := 1 + 5 \cdot \alpha_1 \cdot \rho_{w1} = 1.052$$

$$\varphi_n := 0$$

$$\varphi_{c3} := 0.6 \quad \text{Normaliam betonui}$$

$$V_{Rd} := 0.8 \cdot \varphi_{w2} \cdot f_{cd} \cdot b \cdot l_c \cdot \sin(\text{deg} \cdot \theta) = 1.294 \times 10^3 \text{ kN}$$

$$\varphi_{c3} \cdot (1 + \varphi_n) \cdot f_{ctd} \cdot b \cdot d = 179.2 \quad \bullet < \bullet \quad \text{OK}$$

$$V_{Ed} = 347 \text{ kN} \quad \bullet < \bullet \quad \text{OK}$$

$$3.5 \cdot f_{ctd} \cdot b \cdot d = 1.045 \times 10^3 \text{ kN}$$

$$A_{s1} := \frac{V_{Ed} \cdot l_1}{d \cdot f_{yd}} = 3.99 \times 10^{-4} \text{ m}^2$$

Armatūra 4d16S500 As=8.04cm<sup>2</sup>

Betono glemžimas:

$$l_{sup} := 0.26$$

$$b := 0.4$$

$$\alpha := 0.82$$

$$A_{c1} := l_{sup} \cdot b = 0.104$$

$$A_{c0} := l_{sup} \cdot b = 0.104$$

$$k_f := 0.8$$

$$k_u := 0.8 \cdot \frac{f_{cd}}{f_{ctd}} = 10.8$$

$$w_u := 1 + k_u \cdot k_f \cdot \frac{f_{ctd}}{f_{cd}} \cdot \left( \sqrt{\frac{A_{c1}}{A_{c0}}} - 1 \right) = 1 \quad \bullet < \bullet \quad \text{OK}$$

$$w_{u,max} := 1$$

$$f_{cud} := \alpha \cdot w_u \cdot f_{cd} = 1.476 \times 10^4$$

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	42	251	0

Įtempių pasiskirstymas per neopreno plokštelę:

$$\sigma_{u,\min} := 1$$

$$\sigma_{u,\max} := 1$$

$$\alpha_u := \frac{1}{4} \cdot \left( 3 + \frac{\sigma_{u,\min}}{\sigma_{u,\max}} \right) = 1$$

$$V_{Ed} = 347$$

$$N_{Rd} := \alpha_u \cdot f_{twd} \cdot A_{c0} = 1.535 \times 10^3 \quad \text{kN}$$

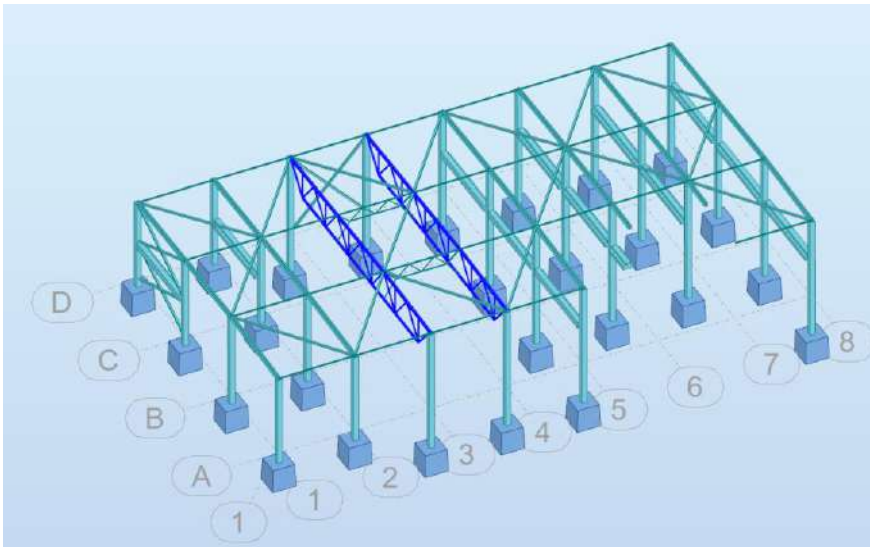
Išvada: laikomoji galia pakankama.

## 1.6. Plieninių konstrukcijų projektavimas

### Santvarų projektavimas

Santvarų elementai projektuojami iš dėžinių ir stačiakampių tuščiavidurių profiliuotųjų, plieno klasė S355J2H. Santvarų atsparumas ugniai R20.

Santvarų išdėstymas:



S-1 santvara:

### Viršutinės juostos projektavimas

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 144

POINT: 3

COORDINATE:  $x = 0.50 L = 7.501$   
m

LOADS:

Governing Load Case:  $71 \text{ ULS}/61 = 1 \cdot 1.35 + 5 \cdot 0.78 + 4 \cdot 1.30 \quad 1 \cdot 1.35 + 5 \cdot 0.78 + 4 \cdot 1.30$

MATERIAL:

S 355 ( S 355 )  $f_y = 355.00 \text{ MPa}$

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	43	251	0



### SECTION PARAMETERS: SQUA 180x180x6

h=18.0 cm	gM0=1.10	gM1=1.10	
b=18.0 cm	Ay=20.42 cm <sup>2</sup>	Az=20.42 cm <sup>2</sup>	Ax=40.83 cm <sup>2</sup>
tw=0.6 cm	Iy=2036.52 cm <sup>4</sup>	Iz=2036.52 cm <sup>4</sup>	Ix=3165.83 cm <sup>4</sup>
tf=0.6 cm	Wply=264.35 cm <sup>3</sup>	Wplz=264.35 cm <sup>3</sup>	

### INTERNAL FORCES AND CAPACITIES:

N,Ed = 480.56 kN	My,Ed = 0.84 kN*m	Mz,Ed = -2.63 kN*m	Vy,Ed = 19.34 kN
Nc,Rd = 1317.79 kN	My,Ed,max = 0.84 kN*m	Mz,Ed,max = -54.42 kN*m	Vy,T,Rd = 380.35 kN
Nb,Rd = 1272.85 kN	My,c,Rd = 85.31 kN*m	Mz,c,Rd = 85.31 kN*m	Vz,Ed = 0.21 kN
	MN,y,Rd = 70.90 kN*m	MN,z,Rd = 70.90 kN*m	Vz,T,Rd = 380.35 kN
	Mb,Rd = 85.31 kN*m		Tt,Ed = 0.01 kN*m
			Class of section = 1



### LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 22600.31 kN*m	Curve,LT - d	XLT = 1.00
Lcr,upp=0.310 m	Lam_LT = 0.06	fi,LT = 0.37	XLT,mod = 1.00

### BUCKLING PARAMETERS:



About y axis:

Ly = 1.880 m	Lam_y = 0.35
Lcr,y = 1.880 m	Xy = 0.97
Lamy = 26.62	kzy = 0.58

About z axis:



Lz = 0.310 m	Lam_z = 0.06
Lcr,z = 0.310 m	Xz = 1.00
Lamz = 4.39	kzz = 0.92

### VERIFICATION FORMULAS:

#### Section strength check:

$$N,Ed/Nc,Rd = 0.36 < 1.00 \quad (6.2.4.(1))$$

$$My,Ed/MN,y,Rd = 0.01 < 1.00 \quad (6.2.9.1.(2))$$

$$Mz,Ed/MN,z,Rd = 0.04 < 1.00 \quad (6.2.9.1.(2))$$

$$(My,Ed/MN,y,Rd)^{1.95} + (Mz,Ed/MN,z,Rd)^{1.95} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

$$Vy,Ed/Vy,T,Rd = 0.05 < 1.00 \quad (6.2.6-7)$$

$$Vz,Ed/Vz,T,Rd = 0.00 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(\tau_{xy,Rd}/\sqrt{3}) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(\tau_{xz,Rd}/\sqrt{3}) = 0.00 < 1.00 \quad (6.2.6)$$

#### Global stability check of member:

$$\lambda_{y,Ed} = 26.62 < \lambda_{y,max} = 120.00 \quad \lambda_{z,Ed} = 4.39 < \lambda_{z,max} = 120.00 \quad \text{STABLE}$$

$$My,Ed,max/Mb,Rd = 0.01 < 1.00 \quad (6.3.2.1.(1))$$

$$N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) + kyz*Mz,Ed,max/(Mz,Rk/gM1) = 0.74 < 1.00 \quad (6.3.3.(4))$$

$$N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) + kzz*Mz,Ed,max/(Mz,Rk/gM1) = 0.96 < 1.00 \quad (6.3.3.(4))$$

### LIMIT DISPLACEMENTS



#### Deflections (LOCAL SYSTEM):

$$u_y = 1.69 \text{ cm} < u_{y,max} = L/250.00 = 6.06 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 121 \text{ SLS: CHR/29} = 1*1.00 + 2*0.70 + 5*0.60 + 4*1.00 \quad (1+4)*1.00 + 2*0.70 + 5*0.60$$

$$u_z = 0.18 \text{ cm} < u_{z,max} = L/250.00 = 6.06 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 121 \text{ SLS: CHR/29} = 1*1.00 + 2*0.70 + 5*0.60 + 4*1.00 \quad (1+4)*1.00 + 2*0.70 + 5*0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

**Section OK !!!**

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	44	251	0

Išvada: sąlyga tenkinama

## Apatinės juostos projektavimas

**CODE:** EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

**CODE GROUP:**

**MEMBER:** 123  
m

**POINT:** 2

**COORDINATE:** x = 0.29 L = 3.750

**LOADS:**

Governing Load Case: 71 ULS/61=1\*1.35 + 5\*0.78 + 4\*1.30 1\*1.35+5\*0.78+4\*1.30

**MATERIAL:**

S 355 ( S 355 ) fy = 355.00 MPa



**SECTION PARAMETERS: SQUA 140x140x5**

h=14.0 cm  
b=14.0 cm  
tw=0.5 cm  
tf=0.5 cm

gM0=1.10

Ay=13.18 cm<sup>2</sup>

Iy=790.56 cm<sup>4</sup>

Wply=132.30 cm<sup>3</sup>

gM1=1.10

Az=13.18 cm<sup>2</sup>

Iz=790.56 cm<sup>4</sup>

Wplz=132.30 cm<sup>3</sup>

Ax=26.36 cm<sup>2</sup>

Ix=1232.44 cm<sup>4</sup>

**INTERNAL FORCES AND CAPACITIES:**

N<sub>Ed</sub> = -551.32 kN

N<sub>t,Rd</sub> = 850.59 kN

M<sub>y,Ed</sub> = 0.03 kN\*m

M<sub>y,pl,Rd</sub> = 42.70 kN\*m

M<sub>y,c,Rd</sub> = 42.70 kN\*m

MN<sub>y,Rd</sub> = 19.62 kN\*m

M<sub>z,Ed</sub> = 1.59 kN\*m

M<sub>z,pl,Rd</sub> = 42.70 kN\*m

M<sub>z,c,Rd</sub> = 42.70 kN\*m

MN<sub>z,Rd</sub> = 19.62 kN\*m

V<sub>y,Ed</sub> = -0.02 kN

V<sub>y,T,Rd</sub> = 245.50 kN

V<sub>z,Ed</sub> = 0.07 kN

V<sub>z,T,Rd</sub> = 245.50 kN

T<sub>t,Ed</sub> = 0.01 kN\*m

Class of section = 1



**LATERAL BUCKLING PARAMETERS:**



About y axis:



About z axis:

**VERIFICATION FORMULAS:**

*Section strength check:*

$N_{Ed}/N_{t,Rd} = 0.65 < 1.00$  (6.2.3.(1))

$M_{y,Ed}/M_{N,y,Rd} = 0.00 < 1.00$  (6.2.9.1.(2))

$M_{z,Ed}/M_{N,z,Rd} = 0.08 < 1.00$  (6.2.9.1.(2))

$(M_{y,Ed}/M_{N,y,Rd})^{3.16} + (M_{z,Ed}/M_{N,z,Rd})^{3.16} = 0.00 < 1.00$  (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$  (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$  (6.2.6-7)

$\tau_{ty,Ed}/(\tau_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$  (6.2.6)

$\tau_{tz,Ed}/(\tau_z/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$  (6.2.6)

**LIMIT DISPLACEMENTS**



*Deflections (LOCAL SYSTEM):*

u<sub>y</sub> = 1.39 cm < u<sub>y</sub> max = L/250.00 = 5.25 cm

Verified

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	45	251	0

**Governing Load Case:** 121 SLS:CHR/29=1\*1.00 + 2\*0.70 + 5\*0.60 + 4\*1.00 (1+4)\*1.00+2\*0.70+5\*0.60  
uz = 0.14 cm < uz max = L/250.00 = 5.25 cm Verified

**Governing Load Case:** 104 SLS:CHR/12=1\*1.00 + 2\*0.70 + 5\*1.00 + 4\*0.70 (1+5)\*1.00+(2+4)\*0.70



**Displacements (GLOBAL SYSTEM):** Not analyzed

**Section OK !!!**

**Išvada: sąlyga tenkinama**

## Kraštinio tinklelio projektavimas

**CODE:** EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

**CODE GROUP:**

**MEMBER:** 125

**POINT:** 1

**COORDINATE:** x = 0.00 L = 0.000

m

**LOADS:**

**Governing Load Case:** 66 ULS/56=1\*1.35 + 2\*0.91 + 5\*0.78 + 4\*1.30 1\*1.35+2\*0.91+5\*0.78+4\*1.30

**MATERIAL:**

S 355 ( S 355 )  $f_y = 355.00$  MPa



**SECTION PARAMETERS: SQUA 100x100x5**

h=10.0 cm

gM0=1.10

gM1=1.10

b=10.0 cm

Ay=9.18 cm<sup>2</sup>

Az=9.18 cm<sup>2</sup>

Ax=18.36 cm<sup>2</sup>

tw=0.5 cm

Iy=271.10 cm<sup>4</sup>

Iz=271.10 cm<sup>4</sup>

Ix=430.27 cm<sup>4</sup>

tf=0.5 cm

Wply=64.59 cm<sup>3</sup>

Wplz=64.59 cm<sup>3</sup>

**INTERNAL FORCES AND CAPACITIES:**

N,Ed = -262.17 kN

My,Ed = -0.06 kN\*m

Mz,Ed = 1.45 kN\*m

Vy,Ed = 0.73 kN

Nt,Rd = 592.40 kN

My,pl,Rd = 20.84 kN\*m

Mz,pl,Rd = 20.84 kN\*m

Vy,T,Rd = 170.88 kN

My,c,Rd = 20.84 kN\*m

Mz,c,Rd = 20.84 kN\*m

Vz,Ed = 0.03 kN

MN,y,Rd = 15.04 kN\*m

MN,z,Rd = 15.04 kN\*m

Vz,T,Rd = 170.88 kN

Tt,Ed = 0.01 kN\*m

Class of section = 1



**LATERAL BUCKLING PARAMETERS:**

**BUCKLING PARAMETERS:**



About y axis:



About z axis:

**VERIFICATION FORMULAS:**

**Section strength check:**

$N_{Ed}/N_{t,Rd} = 0.44 < 1.00$  (6.2.3.(1))

$M_{y,Ed}/M_{N,y,Rd} = 0.00 < 1.00$  (6.2.9.1.(2))

$M_{z,Ed}/M_{N,z,Rd} = 0.10 < 1.00$  (6.2.9.1.(2))

$(M_{y,Ed}/M_{N,y,Rd})^{2.13} + (M_{z,Ed}/M_{N,z,Rd})^{2.13} = 0.01 < 1.00$  (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$  (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$  (6.2.6-7)

$\tau_{Ed}/(\tau_{y}/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$  (6.2.6)

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	46	251	0

$$\tau_{Ed} / (f_y / (\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

**LIMIT DISPLACEMENTS**

**Deflections (LOCAL SYSTEM):**

$$u_y = 0.08 \text{ cm} < u_{y \text{ max}} = L/150.00 = 1.95 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 126 \text{ SLS:CHR/34} = 1 \cdot 1.00 + 5 \cdot 0.60 + 4 \cdot 1.00 \quad (1+4) \cdot 1.00 + 5 \cdot 0.60$$

$$u_z = 0.01 \text{ cm} < u_{z \text{ max}} = L/150.00 = 1.95 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 118 \text{ SLS:CHR/26} = 1 \cdot 1.00 + 8 \cdot 1.00 + 4 \cdot 0.70 \quad (1+8) \cdot 1.00 + 4 \cdot 0.70$$


**Displacements (GLOBAL SYSTEM):** Not analyzed

**Section OK !!!**
**Išvada: sąlyga tenkinama**

## Tinklelio 1 projektavimas

**CODE:** EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

**CODE GROUP:**
**MEMBER:** 126  
m

**POINT:** 2

**COORDINATE:** x = 0.50 L = 1.467

**LOADS:**

$$\text{Governing Load Case: } 71 \text{ ULS/61} = 1 \cdot 1.35 + 5 \cdot 0.78 + 4 \cdot 1.30 \quad 1 \cdot 1.35 + 5 \cdot 0.78 + 4 \cdot 1.30$$

**MATERIAL:**

 S 355 ( S 355 )  $f_y = 355.00 \text{ MPa}$ 

**SECTION PARAMETERS: SQUA 100x100x4**

$$h = 10.0 \text{ cm}$$

$$g_{M0} = 1.10$$

$$g_{M1} = 1.10$$

$$b = 10.0 \text{ cm}$$

$$A_y = 7.47 \text{ cm}^2$$

$$A_z = 7.47 \text{ cm}^2$$

$$A_x = 14.95 \text{ cm}^2$$

$$t_w = 0.4 \text{ cm}$$

$$I_y = 226.35 \text{ cm}^4$$

$$I_z = 226.35 \text{ cm}^4$$

$$I_x = 354.71 \text{ cm}^4$$

$$t_f = 0.4 \text{ cm}$$

$$W_{ply} = 53.30 \text{ cm}^3$$

$$W_{plz} = 53.30 \text{ cm}^3$$

**INTERNAL FORCES AND CAPACITIES:**

$$N_{Ed} = 230.21 \text{ kN}$$

$$M_{y,Ed} = -0.01 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed} = -0.12 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = -0.34 \text{ kN}$$

$$N_{c,Rd} = 482.41 \text{ kN}$$

$$M_{y,Ed,max} = -0.03 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = -0.51 \text{ kN} \cdot \text{m}$$

$$V_{y,T,Rd} = 139.25 \text{ kN}$$

$$N_{b,Rd} = 322.67 \text{ kN}$$

$$M_{y,c,Rd} = 17.20 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 17.20 \text{ kN} \cdot \text{m}$$

$$V_{z,Ed} = -0.01 \text{ kN}$$

$$M_{N,y,Rd} = 11.72 \text{ kN} \cdot \text{m}$$

$$M_{N,z,Rd} = 11.72 \text{ kN} \cdot \text{m}$$

$$V_{z,T,Rd} = 139.25 \text{ kN}$$

$$M_{b,Rd} = 17.20 \text{ kN} \cdot \text{m}$$

$$T_{t,Ed} = 0.00 \text{ kN} \cdot \text{m}$$

Class of section = 1


**LATERAL BUCKLING PARAMETERS:**

$$z = 1.00$$

$$M_{cr} = 433.42 \text{ kN} \cdot \text{m}$$

Curve,LT - d

$$X_{LT} = 1.00$$

$$L_{cr,low} = 2.934 \text{ m}$$

$$\lambda_{m,LT} = 0.21$$

$$f_{i,LT} = 0.44$$

$$X_{LT,mod} = 1.00$$

**BUCKLING PARAMETERS:**


About y axis:

$$L_y = 2.934 \text{ m}$$

$$\lambda_{m,y} = 0.79$$

$$L_{cr,y} = 2.347 \text{ m}$$

$$X_y = 0.67$$

$$L_{m,y} = 60.31$$

$$k_{zy} = 0.88$$



About z axis:

$$L_z = 2.934 \text{ m}$$

$$\lambda_{m,z} = 0.79$$

$$L_{cr,z} = 2.347 \text{ m}$$

$$X_z = 0.67$$

$$L_{m,z} = 60.31$$

$$k_{zz} = 1.23$$

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	47	251	0

### VERIFICATION FORMULAS:

#### Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.48 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{N,y,Rd} = 0.00 < 1.00 \quad (6.2.9.1.(2))$$

$$M_{z,Ed}/M_{N,z,Rd} = 0.01 < 1.00 \quad (6.2.9.1.(2))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{2.24} + (M_{z,Ed}/M_{N,z,Rd})^{2.24} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

#### Global stability check of member:

$$\lambda_{b,y} = 60.31 < \lambda_{b,max} = 150.00 \quad \lambda_{b,z} = 60.31 < \lambda_{b,max} = 150.00 \quad \text{STABLE}$$

$$M_{y,Ed,max}/M_{b,Rd} = 0.00 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.74 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.75 < 1.00 \quad (6.3.3.(4))$$

### LIMIT DISPLACEMENTS



#### Deflections (LOCAL SYSTEM):

$$u_y = 0.02 \text{ cm} < u_{y,max} = L/150.00 = 1.96 \text{ cm} \quad \text{Verified}$$

**Governing Load Case:** 126 SLS:CHR/34=1\*1.00 + 5\*0.60 + 4\*1.00 (1+4)\*1.00+5\*0.60

$$u_z = 0.00 \text{ cm} < u_{z,max} = L/150.00 = 1.96 \text{ cm} \quad \text{Verified}$$

**Governing Load Case:** 129 SLS:CHR/37=1\*1.00 + 8\*0.60 + 4\*1.00 (1+4)\*1.00+8\*0.60



#### Displacements (GLOBAL SYSTEM): Not analyzed

### Section OK !!!

Išvada: sąlyga tenkinama

## Tinklelio 2 projektavimas

**CODE:** EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

### CODE GROUP:

**MEMBER:** 128

**POINT:** 2

**COORDINATE:** x = 0.50 L = 1.489

m

### LOADS:

**Governing Load Case:** 71 ULS/61=1\*1.35 + 5\*0.78 + 4\*1.30 1\*1.35+5\*0.78+4\*1.30

### MATERIAL:

S 355 ( S 355 )  $f_y = 355.00 \text{ MPa}$



### SECTION PARAMETERS: SQUA 80x80x4

h=8.0 cm	$g_{M0}=1.10$	$g_{M1}=1.10$	
b=8.0 cm	$A_y=5.87 \text{ cm}^2$	$A_z=5.87 \text{ cm}^2$	$A_x=11.75 \text{ cm}^2$
tw=0.4 cm	$I_y=111.04 \text{ cm}^4$	$I_z=111.04 \text{ cm}^4$	$I_x=176.24 \text{ cm}^4$
tf=0.4 cm	$W_{ply}=33.07 \text{ cm}^3$	$W_{plz}=33.07 \text{ cm}^3$	

### INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 121.12 \text{ kN}$	$M_{y,Ed} = 0.01 \text{ kN}\cdot\text{m}$	$M_{z,Ed} = -0.14 \text{ kN}\cdot\text{m}$	$V_{y,Ed} = -0.11 \text{ kN}$
$N_{c,Rd} = 379.14 \text{ kN}$	$M_{y,Ed,max} = 0.02 \text{ kN}\cdot\text{m}$	$M_{z,Ed,max} = -0.22 \text{ kN}\cdot\text{m}$	$V_{y,T,Rd} = 109.34 \text{ kN}$

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	48	251	0

Nb,Rd = 201.68 kN      My,c,Rd = 10.67 kN\*m      Mz,c,Rd = 10.67 kN\*m      Vz,Ed = 0.01 kN  
 MN,y,Rd = 9.40 kN\*m      MN,z,Rd = 9.40 kN\*m      Vz,T,Rd = 109.34 kN  
 Mb,Rd = 10.67 kN\*m      Tt,Ed = 0.01 kN\*m  
 Class of section = 1



**LATERAL BUCKLING PARAMETERS:**

z = 1.00      Mcr = 212.31 kN\*m      Curve,LT - d      XLT = 1.00  
 Lcr,upp=2.977 m      Lam\_LT = 0.24      fi,LT = 0.46      XLT,mod = 1.00

**BUCKLING PARAMETERS:**



About y axis:

Ly = 2.977 m      Lam\_y = 1.01  
 Lcr,y = 2.382 m      Xy = 0.53  
 Lam\_y = 77.47      kzy = 0.96



About z axis:

Lz = 2.977 m      Lam\_z = 1.01  
 Lcr,z = 2.382 m      Xz = 0.53  
 Lam\_z = 77.47      kzz = 1.26

**VERIFICATION FORMULAS:**

**Section strength check:**

N,Ed/Nc,Rd = 0.32 < 1.00 (6.2.4.(1))  
 My,Ed/MN,y,Rd = 0.00 < 1.00 (6.2.9.1.(2))  
 Mz,Ed/MN,z,Rd = 0.01 < 1.00 (6.2.9.1.(2))  
 (My,Ed/MN,y,Rd)^1.88 + (Mz,Ed/MN,z,Rd)^1.88 = 0.00 < 1.00 (6.2.9.1.(6))  
 Vy,Ed/Vy,T,Rd = 0.00 < 1.00 (6.2.6-7)  
 Vz,Ed/Vz,T,Rd = 0.00 < 1.00 (6.2.6-7)  
 Tau,ty,Ed/(fy/(sqrt(3)\*gM0)) = 0.00 < 1.00 (6.2.6)  
 Tau,tz,Ed/(fy/(sqrt(3)\*gM0)) = 0.00 < 1.00 (6.2.6)

**Global stability check of member:**

Lambda,y = 77.47 < Lambda,max = 150.00      Lambda,z = 77.47 < Lambda,max = 150.00      STABLE  
 My,Ed,max/Mb,Rd = 0.00 < 1.00 (6.3.2.1.(1))  
 N,Ed/(Xy\*N,Rk/gM1) + kyy\*My,Ed,max/(XLT\*My,Rk/gM1) + kyz\*Mz,Ed,max/(Mz,Rk/gM1) = 0.62 < 1.00  
 (6.3.3.(4))  
 N,Ed/(Xz\*N,Rk/gM1) + kzy\*My,Ed,max/(XLT\*My,Rk/gM1) + kzz\*Mz,Ed,max/(Mz,Rk/gM1) = 0.63 < 1.00  
 (6.3.3.(4))

**LIMIT DISPLACEMENTS**



**Deflections (LOCAL SYSTEM):**

uy = 0.05 cm < uy max = L/150.00 = 1.98 cm      Verified

**Governing Load Case:** 121 SLS:CHR/29=1\*1.00 + 2\*0.70 + 5\*0.60 + 4\*1.00 (1+4)\*1.00+2\*0.70+5\*0.60

uz = 0.00 cm < uz max = L/150.00 = 1.98 cm      Verified

**Governing Load Case:** 126 SLS:CHR/34=1\*1.00 + 5\*0.60 + 4\*1.00 (1+4)\*1.00+5\*0.60



**Displacements (GLOBAL SYSTEM):** Not analyzed

**Section OK !!!**

**Išvada: sąlyga tenkinama**

**Statramsčio projektavimas**

**CODE:** EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

**CODE GROUP:**

**MEMBER:** 137

**POINT:** 1

**COORDINATE:** x = 0.00 L = 0.000

m

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	49	251	0

### LOADS:

Governing Load Case:  $66 \text{ ULS}/56 = 1 \cdot 1.35 + 2 \cdot 0.91 + 5 \cdot 0.78 + 4 \cdot 1.30 \quad 1 \cdot 1.35 + 2 \cdot 0.91 + 5 \cdot 0.78 + 4 \cdot 1.30$

### MATERIAL:

S 355 ( S 355 )  $f_y = 355.00 \text{ MPa}$



### SECTION PARAMETERS: RECT 80x60x4

h=8.0 cm	gM0=1.10	gM1=1.10	
b=6.0 cm	Ay=4.35 cm <sup>2</sup>	Az=5.80 cm <sup>2</sup>	Ax=10.15 cm <sup>2</sup>
tw=0.4 cm	Iy=87.92 cm <sup>4</sup>	Iz=56.12 cm <sup>4</sup>	Ix=110.34 cm <sup>4</sup>
tf=0.4 cm	Wply=26.99 cm <sup>3</sup>	Wplz=22.12 cm <sup>3</sup>	

### INTERNAL FORCES AND CAPACITIES:

N,Ed = 34.70 kN	My,Ed = -0.01 kN*m	Mz,Ed = -0.42 kN*m	Vy,Ed = -0.38 kN
Nc,Rd = 327.57 kN	My,Ed,max = -0.01 kN*m	Mz,Ed,max = 0.44 kN*m	Vy,T,Rd = 81.00 kN
Nb,Rd = 214.10 kN	My,c,Rd = 8.71 kN*m	Mz,c,Rd = 7.14 kN*m	Vz,Ed = 0.01 kN
	MN,y,Rd = 8.71 kN*m	MN,z,Rd = 7.14 kN*m	Vz,T,Rd = 108.00 kN
	Mb,Rd = 8.71 kN*m		Tt,Ed = -0.00 kN*m
			Class of section = 1



### LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 154.99 kN*m	Curve,LT - d	XLT = 1.00
Lcr,low=2.284 m	Lam_LT = 0.25	fi,LT = 0.47	XLT,mod = 1.00

### BUCKLING PARAMETERS:



About y axis:

Ly = 2.284 m	Lam_y = 0.81
Lcr,y = 1.827 m	Xy = 0.79
Lamy = 62.09	kzy = 0.68



About z axis:

Lz = 2.284 m	Lam_z = 1.02
Lcr,z = 1.827 m	Xz = 0.65
Lamz = 77.72	kzz = 1.09

### VERIFICATION FORMULAS:

#### Section strength check:

$N,Ed/Nc,Rd = 0.11 < 1.00 \quad (6.2.4.(1))$   
 $My,Ed/MN,y,Rd = 0.00 < 1.00 \quad (6.2.9.1.(2))$   
 $Mz,Ed/MN,z,Rd = 0.06 < 1.00 \quad (6.2.9.1.(2))$   
 $(My,Ed/MN,y,Rd)^{1.68} + (Mz,Ed/MN,z,Rd)^{1.68} = 0.01 < 1.00 \quad (6.2.9.1.(6))$   
 $Vy,Ed/Vy,T,Rd = 0.00 < 1.00 \quad (6.2.6-7)$   
 $Vz,Ed/Vz,T,Rd = 0.00 < 1.00 \quad (6.2.6-7)$   
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$   
 $\tau_{tz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$

#### Global stability check of member:

$\lambda_{y} = 62.09 < \lambda_{y,max} = 150.00 \quad \lambda_{z} = 77.72 < \lambda_{z,max} = 150.00 \quad \text{STABLE}$   
 $My,Ed,max/Mb,Rd = 0.00 < 1.00 \quad (6.3.2.1.(1))$   
 $N,Ed/(Xy \cdot N,Rk/gM1) + kyy \cdot My,Ed,max/(XLT \cdot My,Rk/gM1) + kyz \cdot Mz,Ed,max/(Mz,Rk/gM1) = 0.18 < 1.00 \quad (6.3.3.(4))$   
 $N,Ed/(Xz \cdot N,Rk/gM1) + kzy \cdot My,Ed,max/(XLT \cdot My,Rk/gM1) + kzz \cdot Mz,Ed,max/(Mz,Rk/gM1) = 0.23 < 1.00 \quad (6.3.3.(4))$

### LIMIT DISPLACEMENTS



#### Deflections (LOCAL SYSTEM):

$u_y = 0.02 \text{ cm} < u_y \text{ max} = L/150.00 = 1.52 \text{ cm} \quad \text{Verified}$   
 Governing Load Case:  $126 \text{ SLS}:CHR/34 = 1 \cdot 1.00 + 5 \cdot 0.60 + 4 \cdot 1.00 \quad (1+4) \cdot 1.00 + 5 \cdot 0.60$   
 $u_z = 0.00 \text{ cm} < u_z \text{ max} = L/150.00 = 1.52 \text{ cm} \quad \text{Verified}$

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	50	251	0

**Governing Load Case:** 118 SLS:CHR/26=1\*1.00 + 8\*1.00 + 4\*0.70 (1+8)\*1.00+4\*0.70



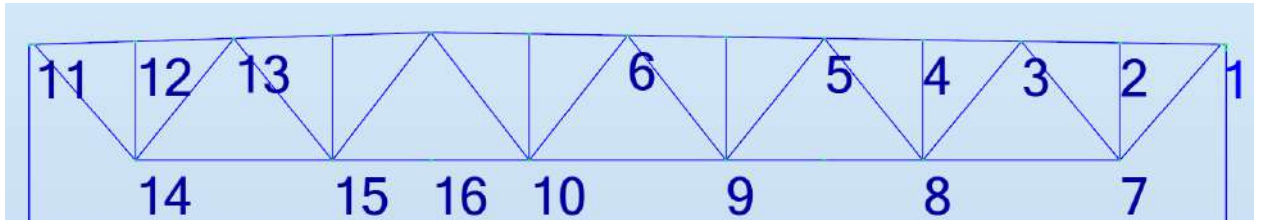
**Displacements (GLOBAL SYSTEM):** Not analyzed

**Section OK !!!**

**Išvada: sąlyga tenkinama**

### S1 santvaros mazgų projektavimas

Mazgų numerių vietos:



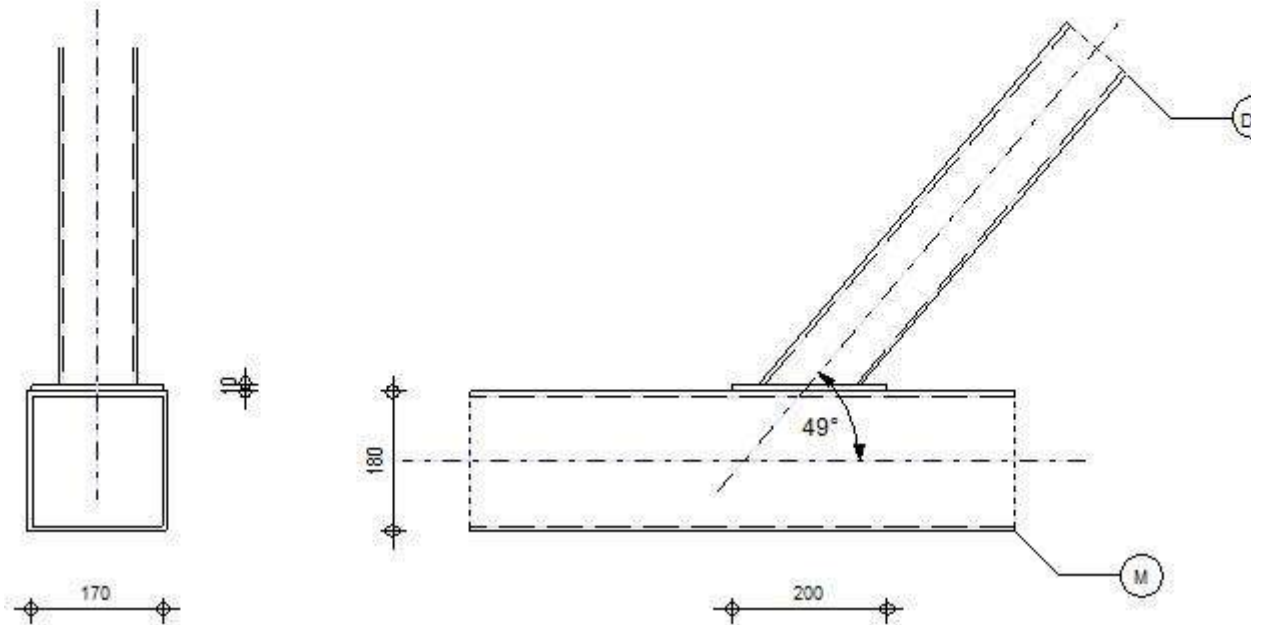
### Mazgas NR. 1

	<p>Robot Structural Analysis Professional 2023</p> <p><b>Design of truss node connection</b></p> <p>EN 1993-1-8:2005/AC:2009</p>	<div style="border: 1px solid black; border-radius: 50%; width: 40px; height: 40px; background-color: #90EE90; display: flex; align-items: center; justify-content: center; margin: 0 auto;"> <span style="font-size: 24px; font-weight: bold; color: black;">OK</span> </div> <p>Ratio <b>0.86</b></p>
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	51	251	0

D2 - SQUA 100x100x5

M - SQUA 180x180x8



## GENERAL

Connection no.: 1  
Connection name: Tube  
Structure node: 63  
Structure members: 144, 125

## GEOMETRY

## MEMBERS

	Chord	Diagonal 1	Diagonal 2	Post	
<b>Member no.:</b>	144		125		
<b>Section:</b>	SQUA 180x180x6		SQUA 100x100x5		
	h		100		mm
	b <sub>f</sub>		100		mm
	t <sub>w</sub>		5		mm
	t <sub>f</sub>		5		mm
	r		5		mm
<b>Material:</b>	S 355		S 355		
	f <sub>y</sub>	355.00	355.00		MPa
	f <sub>u</sub>	470.00	470.00		MPa
<b>Angle</b>	θ	0.0	49.4		Deg
<b>Length</b>	l	15152	2828		mm

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52	251	0

## HORIZONTAL BRACKET

$b_{ph} = 170$  [mm] Width  
 $l_{ph} = 200$  [mm] Length  
 $t_{ph} = 10$  [mm] Thickness  
 Material: S 355  
 $f_{yp} = 355.00$  [MPa] Resistance

## WELDS

$a_d = 4$  [mm] Thickness of welds of diagonals and posts  
 $a_{st} = 4$  [mm] Thickness of stiffener welds

## LOADS

Case: 66: ULS/56=1\*1.35 + 2\*0.91 + 5\*0.78 + 4\*1.30 1\*1.35+2\*0.91+5\*0.78+4\*1.30

## CHORD

$N_{01,Ed} = -0.05$  [kN] Axial force  
 $M_{01,Ed} = 0.68$  [kN\*m] Bending moment  
 $N_{02,Ed} = -169.19$  [kN] Axial force  
 $M_{02,Ed} = 0.63$  [kN\*m] Bending moment

## DIAGONAL 2

$N_2 = 262.17$  [kN] Axial force  
 $M_2 = 0.06$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

## RESULTS

### CAPACITY VERIFICATION EUROCODE 3: EN 1993-1-8:2005

$\gamma_{M5} = 1.00$  Partial safety factor [Table 2.1]

**FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS)** [Table 7.10] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

### GEOMETRICAL PARAMETERS

$\beta = 0.59$  Coefficient taking account of geometry of connection members  $\beta = b_2/b_{ph}$  [1.5 (6)]  
 $\gamma = 9.00$  Coefficient taking account of geometry of the chord  $\gamma = b_0/(2*t_{ph})$  [1.5 (6)]  
 $n = 0.12$  Coefficient taking account of stresses in the chord  $n_0 = \sigma_{0,Ed}/f_{y0}$   
 $k_n = 1.00$  Coefficient taking account of stresses in the chord  $k_n = 1.0$

### TUBE CHORD FACE FAILURE

#### DIAGONAL 2

$N_{2,Rd} = 467.27$  [kN] Tension capacity  $N_{2,Rd} = [(k_n * f_{yp} * t_{ph}^2)/(1-\beta) * \sin(\theta_2)] * [2 * \beta / \sin(\theta_2) + 4 * \sqrt{1-\beta}] / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|262.17| < 467.27$  **verified** (0.56)  
 $M_{2,Rd} = 6.86$  [kN\*m] Bending resistance  $M_{2,Rd} = k_n * f_{y0} * t_0^2 * h_2 * [1/(2 * \eta) + 2/\sqrt{1-\beta} + \eta/(1-\beta)] / \gamma_{M5}$   
 $|M_2| \leq M_{2,Rd}$   $|0.06| < 6.86$  **verified** (0.01)  
 $N_2/N_{2,Rd} + M_2/M_{2,Rd} \leq 1$   $0.57 < 1.00$  **verified** (0.57)

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	53	251	0

## CHORD SHEAR

### DIAGONAL 2

$A_v =$	21.60	[cm <sup>2</sup> ]	Shear area of the chord	$A_v = 2 \cdot h_0 \cdot t_0$
$N_{2,Rd} =$	582.96	[kN]	Tension capacity	$N_{2,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_2)] / \gamma_{M5}$
$ N_2  \leq N_{2,Rd}$	262.17	<	582.96	verified (0.45)

### CHORD RESISTANCE

$N_{0,Rd} =$	1449.57	[kN]	Compression capacity	$N_{0,Rd} = (A_0 \cdot f_{y0}) / \gamma_{M5}$
$ N_{02}  \leq N_{0,Rd}$	-169.19	<	1449.57	verified (0.12)

## VERIFICATION OF WELDS

### DIAGONAL 2

$\beta_w =$	0.88		Correlation coefficient	[Table 4.1]
$\gamma_{M2} =$	1.25		Partial safety factor	[Table 2.1]
Longitudinal weld				
$\sigma_{\perp} =$	129.10	[MPa]	Normal stress in a weld	
$\tau_{\perp} =$	129.10	[MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	154.21	[MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	129.10	<	338.40	verified (0.38)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	371.50	<	429.71	verified (0.86)

**Connection conforms to the code** Ratio 0.86

Išvada: sąlyga tenkinama

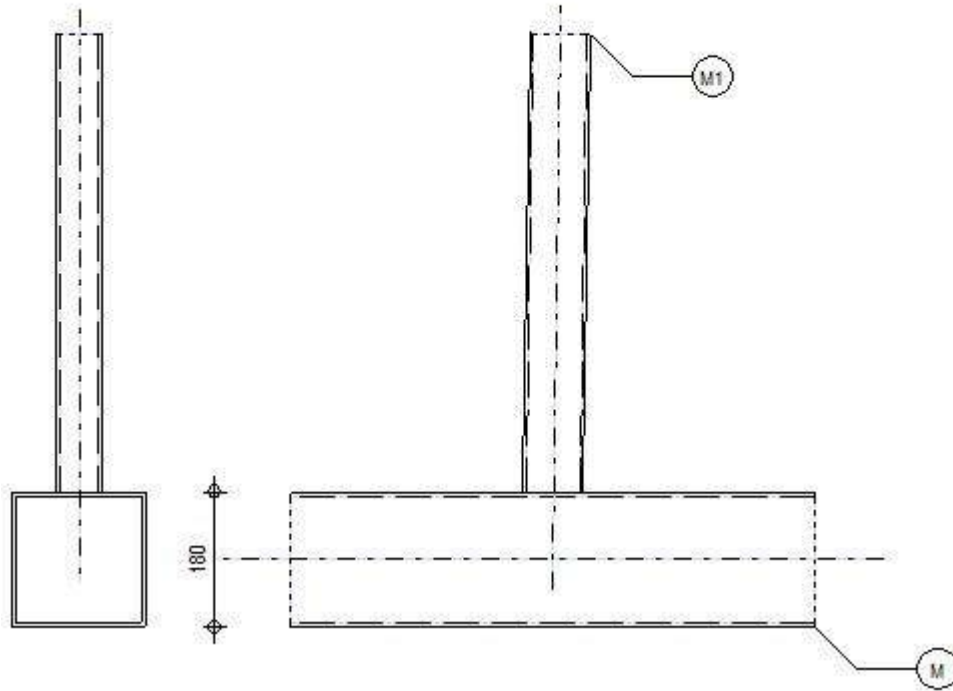
Mazgas NR. 2

	Robot Structural Analysis Professional 2023 <b>Design of truss node connection</b> EN 1993-1-8:2005/AC:2009	
		Ratio <b>0.26</b>

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	54	251	0

M1 - RECT 80x80x4

M - SQUA 180x180x6



## GENERAL

Connection no.:	2
Connection name:	Tube
Structure node:	111
Structure members:	144, 138

## GEOMETRY

### MEMBERS

	Chord	Diagonal 1	Diagonal 2	Post	
<b>Member no.:</b>	144			138	
<b>Section:</b>	SQUA 180x180x6			RECT 80x60x4	
	h			80	mm
	b <sub>f</sub>			60	mm
	t <sub>w</sub>			4	mm
	t <sub>f</sub>			4	mm
	r			4	mm
<b>Material:</b>	S 355			S 355	
	f <sub>y</sub>	355.00		355.00	MPa
	f <sub>u</sub>	470.00		470.00	MPa
<b>Angle</b>	θ	0.0		89.1	Deg
<b>Length</b>	l	15152		2228	mm

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	55	251	0

## WELDS

$a_d = 3$  [mm] Thickness of welds of diagonals and posts

## LOADS

Case: 67: ULS/57=1\*1.35 + 2\*0.91 + 6\*0.78 + 4\*1.30 1\*1.35+2\*0.91+6\*0.78+4\*1.30

## CHORD

$N_{01,Ed} = -154.68$  [kN] Axial force  
 $M_{01,Ed} = 0.05$  [kN\*m] Bending moment  
 $N_{02,Ed} = -155.52$  [kN] Axial force  
 $M_{02,Ed} = 0.05$  [kN\*m] Bending moment

## POST

$N_3 = -21.09$  [kN] Axial force  
 $M_3 = -0.00$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

## RESULTS

### CAPACITY VERIFICATION EUROCODE 3: EN 1993-1-8:2005

$\gamma_{M5} = 1.00$  Partial safety factor [Table 2.1]

**FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS)** [Table 7.11] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

#### GEOMETRICAL PARAMETERS

$\beta = 0.33$  Coefficient taking account of geometry of connection members  $\beta = b_3/b_0$  [1.5 (6)]  
 $\gamma = 15.00$  Coefficient taking account of geometry of the chord  $\gamma = b_0/(2*t_0)$  [1.5 (6)]  
 $n = 0.11$  Coefficient taking account of stresses in the chord  $n_0 = \sigma_{0,Ed}/f_{y0}$   
 $k_n = 1.00$  Coefficient taking account of stresses in the chord  $k_n = 1.0$

#### TUBE CHORD FACE FAILURE

##### POST

$\eta = 0.44$  Coefficient taking account of geometry of connection members  $\eta = h_3/b_0$   
 $N_{3,Rd} = 79.66$  [kN] Compression capacity  $N_{3,Rd} = [(k_n*f_{y0}*t_0^2)/(1-\beta)*\sin(\theta_3)]*[2*\eta/\sin(\theta_3) + 4*\sqrt{1-\beta}]/\gamma_{M5}$   
 $|N_3| \leq N_{3,Rd}$   $|-21.09| < 79.66$  **verified** (0.26)  
 $M_{3,Rd} = 4.34$  [kN\*m] Bending resistance  $M_{3,Rd} = k_n*f_{y0}*t_0^2*h_3*[1/(2*\eta) + 2/\sqrt{1-\beta} + \eta/(1-\beta)]/\gamma_{M5}$   
 $|M_3| \leq M_{3,Rd}$   $|-0.00| < 4.34$  **verified** (0.00)  
 $N_3/N_{3,Rd} + M_3/M_{3,Rd} \leq 1$   $0.26 < 1.00$  **verified** (0.26)

#### CHORD SHEAR

##### POST

$A_v = 21.60$  [cm<sup>2</sup>] Shear area of the chord  $A_v = 2*h_0*t_0$   
 $N_{3,Rd} = 442.76$  [kN] Compression capacity  $N_{3,Rd} = f_{y0}*A_w/[\sqrt{3}*\sin(\theta_3)]/\gamma_{M5}$   
 $|N_3| \leq N_{3,Rd}$   $|-21.09| < 442.76$  **verified** (0.05)

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	56	251	0

### CHORD RESISTANCE

$N_{0,Rd} = 1449.57$  [kN] Compression capacity  $N_{0,Rd} = (A_0 \cdot f_{y0}) / \gamma_{M5}$   
 $|N_{02}| \leq N_{0,Rd}$   $|-155.52| < 1449.57$  **verified** (0.11)

### VERIFICATION OF WELDS

#### POST

$\beta_w = 0.88$  Correlation coefficient [Table 4.1]  
 $\gamma_{M2} = 1.25$  Partial safety factor [Table 2.1]

#### Longitudinal weld

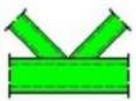
$\sigma_{\perp} = -30.93$  [MPa] Normal stress in a weld  
 $\tau_{\perp} = -30.93$  [MPa] Perpendicular tangent stress  
 $\tau_{\parallel} = -0.66$  [MPa] Tangent stress

$|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2}$   $|-30.93| < 338.40$  **verified** (0.09)  
 $\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$   $61.87 < 429.71$  **verified** (0.14)

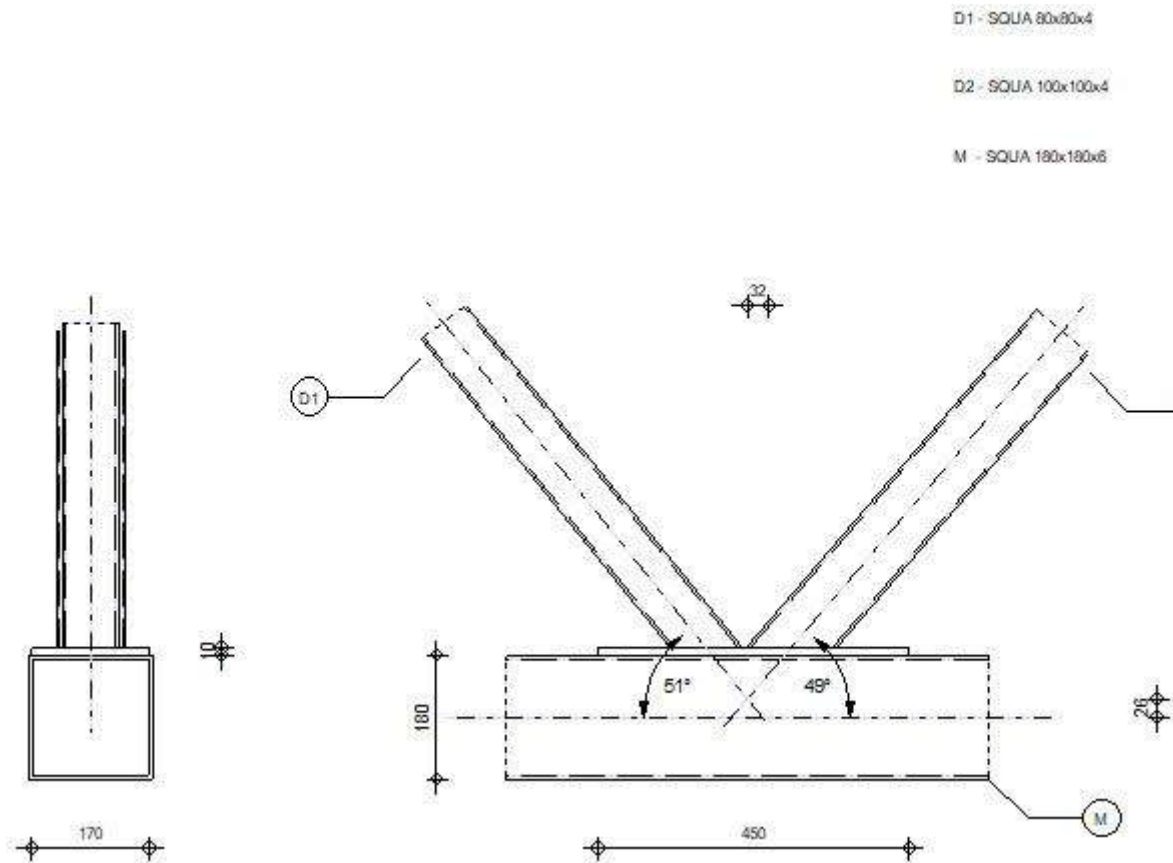
**Connection conforms to the code** Ratio 0.26

**Išvada: sąlyga tenkinama**

#### Mazgas NR. 3

	<p style="font-size: small;">Robot Structural Analysis Professional 2023</p> <p style="font-weight: bold; font-size: large;">Design of truss node connection</p> <p>EN 1993-1-8:2005/AC:2009</p>	<div style="background-color: #90EE90; border-radius: 50%; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center; margin: 0 auto;">OK</div> <p style="font-weight: bold; font-size: small;">Ratio 0.63</p>
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IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	57	251	0



D1 - SQUA 80x80x4

D2 - SQUA 100x100x4

M - SQUA 180x180x6

## GENERAL

Connection no.: 3  
 Connection name: Tube  
 Structure node: 100  
 Structure members: 144, 126, 127

## GEOMETRY

### MEMBERS

	Chord	Diagonal 1	Diagonal 2	Post	
<b>Member no.:</b>	144	127	126		
<b>Section:</b>	SQUA 180x180x6	SQUA 80x80x4	SQUA 100x100x4		
h	180	80	100		mm
b <sub>f</sub>	180	80	100		mm
t <sub>w</sub>	6	4	4		mm
t <sub>f</sub>	6	4	4		mm
r	6	4	4		mm
<b>Material:</b>	S 355	S 355	S 355		
f <sub>y</sub>	355.00	355.00	355.00		MPa
f <sub>u</sub>	470.00	470.00	470.00		MPa
<b>Angle</b>	θ	51.1	49.4		Deg
<b>Length</b>	l	15152	2934	2934	mm

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Lapas	Lapų	Laida
58	251	0

### OFFSET

$e_0 = -26$  [mm] Offset

### SPACINGS

$g_2 = 32$  [mm] Spacing of 2nd diagonal

### HORIZONTAL BRACKET

$b_{ph} = 170$  [mm] Width  
 $l_{ph} = 450$  [mm] Length  
 $t_{ph} = 10$  [mm] Thickness  
 Material: S 355  
 $f_{yph} = 355.00$  [MPa] Resistance

### WELDS

$a_d = 3$  [mm] Thickness of welds of diagonals and posts  
 $a_{st} = 5$  [mm] Thickness of stiffener welds

### LOADS

Case: 71: ULS/61=1\*1.35 + 5\*0.78 + 4\*1.30 1\*1.35+5\*0.78+4\*1.30

### CHORD

$N_{01,Ed} = -168.09$  [kN] Axial force  
 $M_{01,Ed} = -0.16$  [kN\*m] Bending moment  
 $N_{02,Ed} = -423.50$  [kN] Axial force  
 $M_{02,Ed} = -0.13$  [kN\*m] Bending moment

### DIAGONAL 1

$N_1 = 167.80$  [kN] Axial force  
 $M_1 = -0.01$  [kN\*m] Bending moment

### DIAGONAL 2

$N_2 = -230.03$  [kN] Axial force  
 $M_2 = 0.03$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

### RESULTS

#### CONSIDER NON-AXIAL CONNECTION OF MEMBERS IN THE NODE

$M_0 = -6.67$  [kN\*m] Additional moment from eccentric connection of members  $M_0 = (N_{02}-N_{01}) * e_0$   
 $\Sigma E_i J_i / L_i = 1370551.81$  [kN\*m] Overall connection stiffness  
 $\Delta M_{01} = -2.75$  [kN\*m] Additional moment in the chord  
 $\Delta M_{02} = -2.75$  [kN\*m] Additional moment in the chord  
 $\Delta M_2 = -0.79$  [kN\*m] Additional moment in the diagonal  
 $\Delta M_1 = -0.39$  [kN\*m] Additional moment in the diagonal

### CAPACITY VERIFICATION EUROCODE 3: EN 1993-1-8:2005

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	59	251	0

$\gamma_{M5} = 1.00$  Partial safety factor [Table 2.1]

**FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS)** [Table 7.10] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

### GEOMETRICAL PARAMETERS

$\beta = 0.50$  Coefficient taking account of geometry of connection members  $\beta = (b_2 + b_1) / (2 \cdot b_0)$  [1.5 (6)]  
 $\gamma = 9.00$  Coefficient taking account of geometry of the chord  $\gamma = b_0 / (2 \cdot t_{ph})$  [1.5 (6)]  
 $n = 0.29$  Coefficient taking account of stresses in the chord  $n_0 = \sigma_{0,Ed} / f_{y0}$   
 $k_n = 1.00$  Coefficient taking account of stresses in the chord  $k_n = 1.0$

### TUBE CHORD FACE FAILURE

#### DIAGONAL 2

$N_{2,Rd} = 624.06$  [kN] Compression capacity  $N_{2,Rd} = 8.9 \cdot k_n \cdot f_{y0} \cdot t_{ph}^2 \cdot \sqrt{\gamma} / \sin(\theta_2) \cdot \beta$   
 $|N_2| \leq N_{2,Rd}$   $|-230.03| < 624.06$  **verified** (0.37)  
 $M_{2,Rd} = 6.18$  [kN\*m] Bending resistance  $M_{2,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_2 \cdot [1 / (2 \cdot \eta) + 2 \cdot \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_2 + \Delta M_2| \leq M_{2,Rd}$   $|-0.76| < 6.18$  **verified** (0.12)  
 $N_2 / N_{2,Rd} + (M_2 + \Delta M_2) / M_{2,Rd} \leq 1$   $0.49 < 1.00$  **verified** (0.49)

#### DIAGONAL 1

$N_{1,Rd} = 608.69$  [kN] Tension capacity  $N_{1,Rd} = 8.9 \cdot k_n \cdot f_{y0} \cdot t_{ph}^2 \cdot \sqrt{\gamma} / \sin(\theta_1) \cdot \beta$   
 $|N_1| \leq N_{1,Rd}$   $|167.80| < 608.69$  **verified** (0.28)  
 $M_{1,Rd} = 4.95$  [kN\*m] Bending resistance  $M_{1,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_1 \cdot [1 / (2 \cdot \eta) + 2 \cdot \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_1 + \Delta M_1| \leq M_{1,Rd}$   $|-0.40| < 4.95$  **verified** (0.08)  
 $N_1 / N_{1,Rd} + (M_1 + \Delta M_1) / M_{1,Rd} \leq 1$   $0.36 < 1.00$  **verified** (0.36)

### CHORD PUNCHING

#### DIAGONAL 2

$b_{e,p} = 56$  [mm] Effective width for punching shear  $b_{e,p} = (10 \cdot b_2) / (b_0 / t_0)$   
 $N_{2,Rd} = 1130.60$  [kN] Compression capacity  $N_{2,Rd} = f_{y0} \cdot t_{ph} / (\sqrt{3} \cdot \sin(\theta_2)) \cdot [2 \cdot h_2 / \sin(\theta_2) + b_2 + b_{e,p}] / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|-230.03| < 1130.60$  **verified** (0.20)

#### DIAGONAL 1

$b_{e,p} = 44$  [mm] Effective width for punching shear  $b_{e,p} = (10 \cdot b_1) / (b_0 / t_0)$   
 $N_{1,Rd} = 868.55$  [kN] Tension capacity  $N_{1,Rd} = f_{y0} \cdot t_{ph} / (\sqrt{3} \cdot \sin(\theta_1)) \cdot [2 \cdot h_1 / \sin(\theta_1) + b_1 + b_{e,p}] / \gamma_{M5}$   
 $|N_1| \leq N_{1,Rd}$   $|167.80| < 868.55$  **verified** (0.19)

### CHORD SHEAR

#### DIAGONAL 2

$A_v = 23.35$  [cm<sup>2</sup>] Shear area of the chord  $A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$   
 $N_{2,Rd} = 630.22$  [kN] Compression capacity  $N_{2,Rd} = f_{y0} \cdot A_v / (\sqrt{3} \cdot \sin(\theta_2)) / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|-230.03| < 630.22$  **verified** (0.37)

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	60	251	0

## DIAGONAL 1

$A_v =$	23.35	[cm <sup>2</sup> ]	Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{1,Rd} =$	614.70	[kN]	Tension capacity	$N_{1,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_1)] / \gamma_{M5}$
$ N_1  \leq N_{1,Rd}$	167.80	<	614.70	verified (0.27)

## CHORD RESISTANCE

$V_{pl,Rd} =$	478.60	[kN]	Plastic resistance for shear	$V_{pl,Rd} = (A_v \cdot f_{y0}) / (\sqrt{3} \cdot \gamma_{M0})$
$ V_{Ed}  \leq V_{pl,Rd}$	174.69	<	478.60	verified (0.37)
$N_{0,Rd} =$	1392.38	[kN]	Compression capacity	$N_{0,Rd} = [(A_0 - A_v) \cdot f_{y0} + A_v \cdot f_{y0} \cdot \sqrt{1 - (V_{Ed}/V_{pl,Rd})^2}] / \gamma_{M5}$
$ N_{02}  \leq N_{0,Rd}$	-423.50	<	1392.38	verified (0.30)

## VERIFICATION OF WELDS

### DIAGONAL 2

$\beta_w =$	0.88		Correlation coefficient	[Table 4.1]
$\gamma_{M2} =$	1.25		Partial safety factor	[Table 2.1]
Longitudinal weld				
$\sigma_{\perp} =$	-88.86	[MPa]	Normal stress in a weld	
$\tau_{\perp} =$	-88.86	[MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	-107.66	[MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	-88.86	<	338.40	verified (0.26)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	257.60	<	429.71	verified (0.60)
Transverse inner weld				
$\sigma_{\perp} =$	-150.14	[MPa]	Normal stress in a weld	
$\tau_{\perp} =$	-68.74	[MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	-150.14	<	338.40	verified (0.44)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	191.62	<	429.71	verified (0.45)
Transverse outer weld				
$\sigma_{\perp} =$	-69.59	[MPa]	Normal stress in a weld	
$\tau_{\perp} =$	-150.53	[MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	-69.59	<	338.40	verified (0.21)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	269.85	<	429.71	verified (0.63)

### DIAGONAL 1

$\beta_w =$	0.88		Correlation coefficient	[Table 4.1]
$\gamma_{M2} =$	1.25		Partial safety factor	[Table 2.1]
Longitudinal weld				
$\sigma_{\perp} =$	84.54	[MPa]	Normal stress in a weld	
$\tau_{\perp} =$	84.54	[MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	98.47	[MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	84.54	<	338.40	verified (0.25)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	240.16	<	429.71	verified (0.56)
Transverse inner weld				
$\sigma_{\perp} =$	145.14	[MPa]	Normal stress in a weld	
$\tau_{\perp} =$	75.22	[MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	145.14	<	338.40	verified (0.43)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	195.04	<	429.71	verified (0.45)

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	61	251	0

Transverse outer weld

$\sigma_{\perp} = 66.43$  [MPa] Normal stress in a weld  
 $\tau_{\perp} = 140.94$  [MPa] Perpendicular tangent stress  
 $\tau_{\parallel} = 0.00$  [MPa] Tangent stress

$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ 66.43  < 338.40$	verified	(0.20)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$252.99 < 429.71$	verified	(0.59)

**REMARKS**

Ratio of the distance of members to the chord width is too small  $0.18 < 0.25$

<b>Connection conforms to the code</b>	Ratio	0.63
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**Išvada: sąlyga tenkinama**

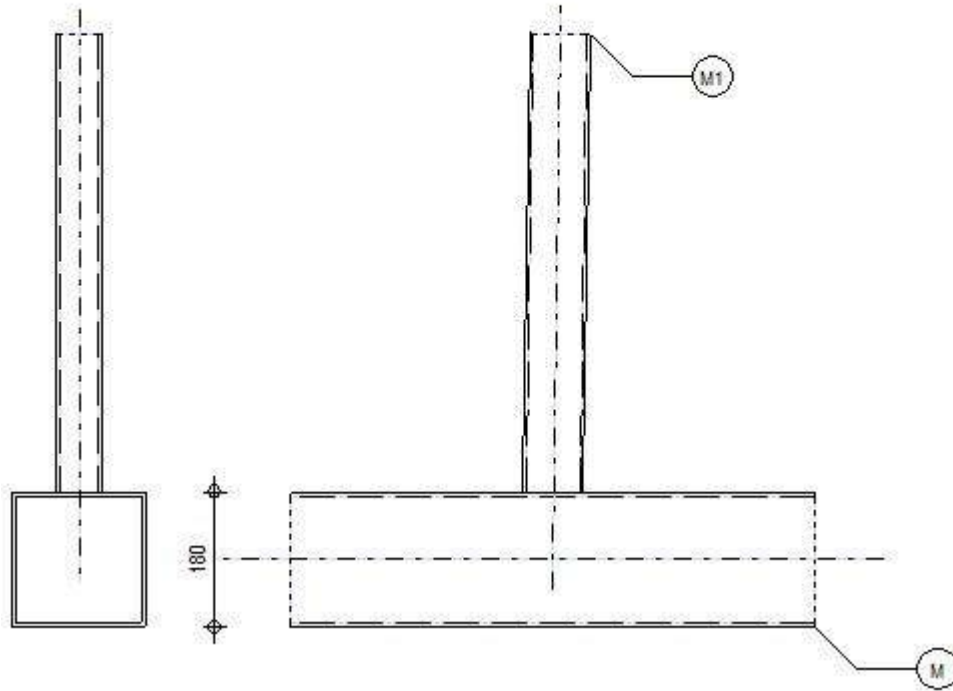
**Mazgas NR. 4**

	Robot Structural Analysis Professional 2023 <b>Design of truss node connection</b> EN 1993-1-8:2005/AC:2009	
		Ratio <b>0.46</b>

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	62	251	0

M1 - RECT 80x80x4

M - SQUA 180x180x6



## GENERAL

Connection no.: 4  
Connection name: Tube  
Structure node: 110  
Structure members: 144, 137

## GEOMETRY

## MEMBERS

	Chord	Diagonal 1	Diagonal 2	Post	
<b>Member no.:</b>	144			137	
<b>Section:</b>	SQUA 180x180x6			RECT 80x60x4	
h	180			80	mm
b <sub>f</sub>	180			60	mm
t <sub>w</sub>	6			4	mm
t <sub>f</sub>	6			4	mm
r	6			4	mm
<b>Material:</b>	S 355			S 355	
f <sub>y</sub>	355.00			355.00	MPa
f <sub>u</sub>	470.00			470.00	MPa
<b>Angle</b>	0			89.1	Deg
<b>Length</b>	1	15152		2284	mm

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	63	251	0

## WELDS

$a_d = 3$  [mm] Thickness of welds of diagonals and posts

## LOADS

Case: 71: ULS/61=1\*1.35 + 5\*0.78 + 4\*1.30 1\*1.35+5\*0.78+4\*1.30

## CHORD

$N_{01,Ed} = -422.69$  [kN] Axial force  
 $M_{01,Ed} = -0.48$  [kN\*m] Bending moment  
 $N_{02,Ed} = -423.58$  [kN] Axial force  
 $M_{02,Ed} = -0.48$  [kN\*m] Bending moment

## POST

$N_3 = -34.46$  [kN] Axial force  
 $M_3 = -0.00$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

## RESULTS

### CAPACITY VERIFICATION EUROCODE 3: EN 1993-1-8:2005

$\gamma_{M5} = 1.00$  Partial safety factor [Table 2.1]

**FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS)** [Table 7.11] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

#### GEOMETRICAL PARAMETERS

$\beta = 0.33$  Coefficient taking account of geometry of connection members  $\beta = b_3/b_0$  [1.5 (6)]  
 $\gamma = 15.00$  Coefficient taking account of geometry of the chord  $\gamma = b_0/(2*t_0)$  [1.5 (6)]  
 $n = 0.30$  Coefficient taking account of stresses in the chord  $n_0 = \sigma_{0,Ed}/f_{y0}$   
 $k_n = 0.94$  Coefficient taking account of stresses in the chord  $k_n = 1.3 - 0.4*n_0/\beta$

#### TUBE CHORD FACE FAILURE

##### POST

$\eta = 0.44$  Coefficient taking account of geometry of connection members  $\eta = h_3/b_0$   
 $N_{3,Rd} = 75.05$  [kN] Compression capacity  $N_{3,Rd} = [(k_n*f_{y0}*t_0^2)/(1-\beta)*\sin(\theta_3)]*[2*\eta/\sin(\theta_3) + 4*\sqrt{1-\beta}] / \gamma_{M5}$   
 $|N_3| \leq N_{3,Rd}$   $|-34.46| < 75.05$  **verified** (0.46)  
 $M_{3,Rd} = 4.09$  [kN\*m] Bending resistance  $M_{3,Rd} = k_n*f_{y0}*t_0^2*h_3*[1/(2*\eta) + 2/\sqrt{1-\beta} + \eta/(1-\beta)] / \gamma_{M5}$   
 $|M_3| \leq M_{3,Rd}$   $|-0.00| < 4.09$  **verified** (0.00)  
 $N_3/N_{3,Rd} + M_3/M_{3,Rd} \leq 1$   $0.46 < 1.00$  **verified** (0.46)

#### CHORD SHEAR

##### POST

$A_v = 21.60$  [cm<sup>2</sup>] Shear area of the chord  $A_v = 2*h_0*t_0$   
 $N_{3,Rd} = 442.76$  [kN] Compression capacity  $N_{3,Rd} = f_{y0}*A_v/[\sqrt{3}*\sin(\theta_3)] / \gamma_{M5}$   
 $|N_3| \leq N_{3,Rd}$   $|-34.46| < 442.76$  **verified** (0.08)

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	64	251	0

### CHORD RESISTANCE

$N_{0,Rd} = 1449.57$  [kN] Compression capacity  $N_{0,Rd} = (A_0 \cdot f_{y0}) / \gamma_{M5}$   
(0.29)  
 $|N_{02}| \leq N_{0,Rd}$   $|-423.58| < 1449.57$  **verified**

### VERIFICATION OF WELDS

#### POST

$\beta_w = 0.88$  Correlation coefficient [Table 4.1]  
 $\gamma_{M2} = 1.25$  Partial safety factor [Table 2.1]

#### Longitudinal weld

$\sigma_{\perp} = -50.22$  [MPa] Normal stress in a weld  
 $\tau_{\perp} = -50.22$  [MPa] Perpendicular tangent stress  
 $\tau_{\parallel} = -1.08$  [MPa] Tangent stress

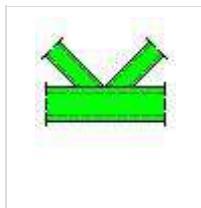
$|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2}$   $|-50.22| < 338.40$  **verified** (0.15)  
 $\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$   $100.45 < 429.71$  **verified** (0.23)

**Connection conforms to the code**

Ratio 0.46

### Išvada: sąlyga tenkinama

#### Mazgas NR. 5



Robot Structural Analysis Professional 2023

### Design of truss node connection

EN 1993-1-8:2005/AC:2009



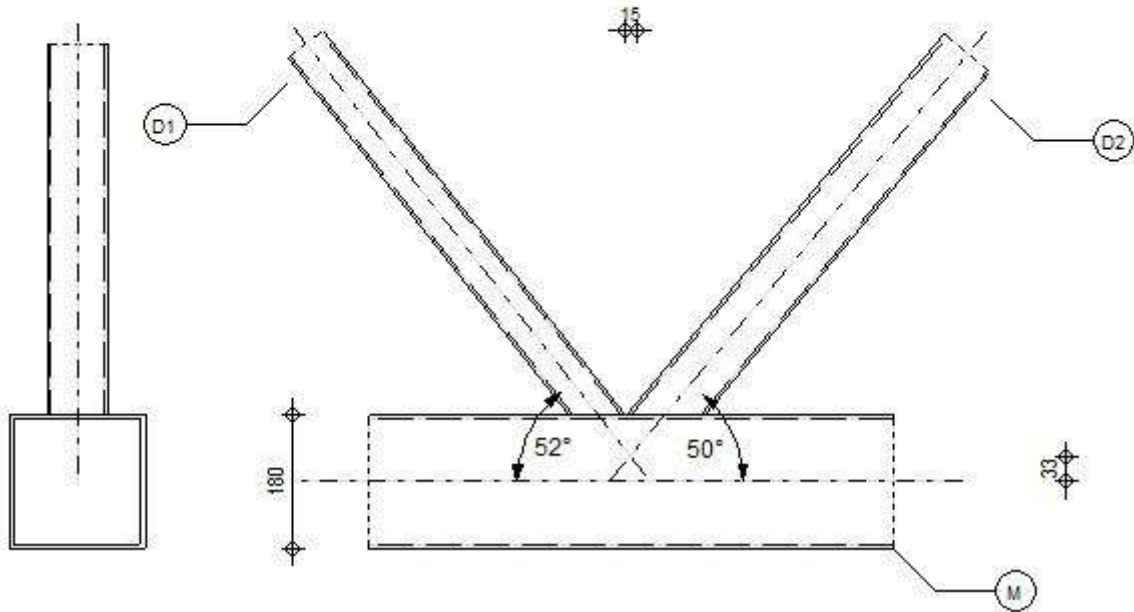
Ratio  
**0.55**

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	65	251	0

D1 - RECT 80x60x4

D2 - SQUA 80x80x4

M - SQUA 180x180x6



## GENERAL

Connection no.: 5  
Connection name: Tube  
Structure node: 102  
Structure members: 144, 128, 129

## GEOMETRY

## MEMBERS

	Chord	Diagonal 1	Diagonal 2	Post	
<b>Member no.:</b>	144	129	128		
<b>Section:</b>	SQUA 180x180x6	RECT 80x60x4	SQUA 80x80x4		
	h	60	80		mm
	b <sub>f</sub>	80	80		mm
	t <sub>w</sub>	4	4		mm
	t <sub>f</sub>	4	4		mm
	r	4	4		mm
<b>Material:</b>	S 355	S 355	S 355		
	f <sub>y</sub>	355.00	355.00		MPa
	f <sub>u</sub>	470.00	470.00		MPa
<b>Angle</b>	θ	0.0	51.8	50.1	Deg
<b>Length</b>	l	15152	2977	2977	mm

IN2410-01-TP-SK-S

Lapas	Lapų	Laida
66	251	0

### OFFSET

$e_0 = -33$  [mm] Offset

### SPACINGS

$g_2 = 15$  [mm] Spacing of 2nd diagonal

### WELDS

$a_d = 3$  [mm] Thickness of welds of diagonals and posts

### LOADS

Case: 66: ULS/56=1\*1.35 + 2\*0.91 + 5\*0.78 + 4\*1.30 1\*1.35+2\*0.91+5\*0.78+4\*1.30

### CHORD

$N_{01,Ed} = -423.19$  [kN] Axial force  
 $M_{01,Ed} = -0.84$  [kN\*m] Bending moment  
 $N_{02,Ed} = -480.47$  [kN] Axial force  
 $M_{02,Ed} = -0.84$  [kN\*m] Bending moment

### DIAGONAL 1

$N_1 = 62.43$  [kN] Axial force  
 $M_1 = -0.03$  [kN\*m] Bending moment

### DIAGONAL 2

$N_2 = -120.98$  [kN] Axial force  
 $M_2 = -0.02$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

### RESULTS

#### CONSIDER NON-AXIAL CONNECTION OF MEMBERS IN THE NODE

$M_0 = -1.90$  [kN\*m] Additional moment from eccentric connection of members  $M_0 = (N_{02}-N_{01}) * e_0$   
 $\Sigma E_i J_i / L_i = 1246946.90$  [kN\*m] Overall connection stiffness  
 $\Delta M_{01} = -0.86$  [kN\*m] Additional moment in the chord  
 $\Delta M_{02} = -0.86$  [kN\*m] Additional moment in the chord  
 $\Delta M_2 = -0.12$  [kN\*m] Additional moment in the diagonal  
 $\Delta M_1 = -0.06$  [kN\*m] Additional moment in the diagonal

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$\gamma_{M5} = 1.00$  Partial safety factor [Table 2.1]

#### FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS)

[Table 7.12] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

#### GEOMETRICAL PARAMETERS

$\beta = 0.42$  Coefficient taking account of geometry of connection members  $\beta = (b_2+h_2+b_1+h_1)/(4*b_0)$  [1.5 (6)]  
 $\gamma = 15.00$  Coefficient taking account of geometry of the chord  $\gamma = b_0/(2*t_0)$  [1.5 (6)]

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	67	251	0

$n = 0.34$  Coefficient taking account of stresses in the chord  $n_0 = \sigma_{0,Ed}/f_{y0}$   
 $k_n = 0.97$  Coefficient taking account of stresses in the chord  $k_n = 1.3 - 0.4 \cdot n_0/\beta$

## TUBE CHORD FACE FAILURE

### DIAGONAL 2

$N_{2,Rd} = 232.48$  [kN] Compression capacity  $N_{2,Rd} = 8.9 \cdot k_n \cdot f_{y0} \cdot t_0^{2 \cdot \sqrt{\gamma}} / \sin(\theta_2) \cdot \beta / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|-120.98| < 232.48$  **verified** (0.52)

$M_{2,Rd} = 4.48$  [kN\*m] Bending resistance  $M_{2,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_2 \cdot [1/(2 \cdot \eta) + 2/\sqrt{1-\beta} + \eta/(1-\beta)] / \gamma_{M5}$   
 $|M_2 + \Delta M_2| \leq M_{2,Rd}$   $|-0.14| < 4.48$  **verified** (0.03)

$N_2/N_{2,Rd} + (M_2 + \Delta M_2)/M_{2,Rd} \leq 1$   $0.55 < 1.00$  **verified** (0.55)

### DIAGONAL 1

$N_{1,Rd} = 226.89$  [kN] Tension capacity  $N_{1,Rd} = 8.9 \cdot k_n \cdot f_{y0} \cdot t_0^{2 \cdot \sqrt{\gamma}} / \sin(\theta_1) \cdot \beta / \gamma_{M5}$   
 $|N_1| \leq N_{1,Rd}$   $|62.43| < 226.89$  **verified** (0.28)

$M_{1,Rd} = 3.49$  [kN\*m] Bending resistance  $M_{1,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_1 \cdot [1/(2 \cdot \eta) + 2/\sqrt{1-\beta} + \eta/(1-\beta)] / \gamma_{M5}$   
 $|M_1 + \Delta M_1| \leq M_{1,Rd}$   $|-0.09| < 3.49$  **verified** (0.02)

$N_1/N_{1,Rd} + (M_1 + \Delta M_1)/M_{1,Rd} \leq 1$   $0.30 < 1.00$  **verified** (0.30)

## CHORD PUNCHING

### DIAGONAL 2

$b_{e,p} = 27$  [mm] Effective width for punching shear  $b_{e,p} = (10 \cdot b_2)/(b_0/t_0)$

$N_{2,Rd} = 505.24$  [kN] Compression capacity  $N_{2,Rd} = f_{y0} \cdot t_0 / (\sqrt{3} \cdot \sin(\theta_2)) \cdot [2 \cdot h_2 / \sin(\theta_2) + b_2 + b_{e,p}] / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|-120.98| < 505.24$  **verified** (0.24)

### DIAGONAL 1

$b_{e,p} = 27$  [mm] Effective width for punching shear  $b_{e,p} = (10 \cdot b_1)/(b_0/t_0)$

$N_{1,Rd} = 405.66$  [kN] Tension capacity  $N_{1,Rd} = f_{y0} \cdot t_0 / (\sqrt{3} \cdot \sin(\theta_1)) \cdot [2 \cdot h_1 / \sin(\theta_1) + b_1 + b_{e,p}] / \gamma_{M5}$   
 $|N_1| \leq N_{1,Rd}$   $|62.43| < 405.66$  **verified** (0.15)

## TUBE BRACE FAILURE

### DIAGONAL 2

$b_{eff} = 40$  [mm] Effective width in the connection of the diagonal to the chord  $b_{eff} = [10/(b_0/t_0)] \cdot [(f_{y0} \cdot t_0)/(f_{y1} \cdot t_2)] \cdot b_2$

$N_{2,Rd} = 374.88$  [kN] Compression capacity  $N_{2,Rd} = f_{y2} \cdot t_2 \cdot (2 \cdot h_2 - 4 \cdot t_2 + b_2 + b_{eff}) / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|-120.98| < 374.88$  **verified** (0.32)

### DIAGONAL 1

$b_{eff} = 40$  [mm] Effective width in the connection of the diagonal to the chord  $b_{eff} = [10/(b_0/t_0)] \cdot [(f_{y0} \cdot t_0)/(f_{y1} \cdot t_1)] \cdot b_1$

$N_{1,Rd} = 318.08$  [kN] Tension capacity  $N_{1,Rd} = f_{y1} \cdot t_1 \cdot (2 \cdot h_1 - 4 \cdot t_1 + b_1 + b_{eff}) / \gamma_{M5}$   
 $|N_1| \leq N_{1,Rd}$   $|62.43| < 318.08$  **verified** (0.20)

## CHORD SHEAR

### DIAGONAL 2

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$$A_v = 25.14 \text{ [cm}^2\text{]} \quad \text{Shear area of the chord} \quad A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$$

$$N_{2,Rd} = 671.47 \text{ [kN]} \quad \text{Compression capacity} \quad N_{2,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_2)] / \gamma_{M5}$$

$$|N_2| \leq N_{2,Rd} \quad |-120.98| < 671.47 \text{ verified} \quad (0.18)$$

### DIAGONAL 1

$$A_v = 25.14 \text{ [cm}^2\text{]} \quad \text{Shear area of the chord} \quad A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$$

$$N_{1,Rd} = 655.33 \text{ [kN]} \quad \text{Tension capacity} \quad N_{1,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_1)] / \gamma_{M5}$$

$$|N_1| \leq N_{1,Rd} \quad |62.43| < 655.33 \text{ verified} \quad (0.10)$$

### CHORD RESISTANCE

$$V_{pl,Rd} = 515.17 \text{ [kN]} \quad \text{Plastic resistance for shear} \quad V_{pl,Rd} = (A_v \cdot f_{y0}) / (\sqrt{3} \cdot \gamma_{M0})$$

$$|V_{Ed}| \leq V_{pl,Rd} \quad |92.82| < 515.17 \text{ verified} \quad (0.18)$$

$$N_{0,Rd} = 1434.97 \text{ [kN]} \quad \text{Compression capacity} \quad N_{0,Rd} = [(A_0 - A_v) \cdot f_{y0} + A_v \cdot f_{y0} \cdot \sqrt{1 - (V_{Ed} / V_{pl,Rd})^2}] / \gamma_{M5}$$

$$|N_{02}| \leq N_{0,Rd} \quad |-480.47| < 1434.97 \text{ verified} \quad (0.33)$$

### VERIFICATION OF WELDS

#### DIAGONAL 2

$$\beta_w = 0.88 \quad \text{Correlation coefficient} \quad [\text{Table 4.1}]$$

$$\gamma_{M2} = 1.25 \quad \text{Partial safety factor} \quad [\text{Table 2.1}]$$

#### Longitudinal weld

$$\sigma_{\perp} = -58.19 \text{ [MPa]} \quad \text{Normal stress in a weld}$$

$$\tau_{\perp} = -58.19 \text{ [MPa]} \quad \text{Perpendicular tangent stress}$$

$$\tau_{\parallel} = -70.34 \text{ [MPa]} \quad \text{Tangent stress}$$

$$|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2} \quad |-58.19| < 338.40 \text{ verified} \quad (0.17)$$

$$\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2}) \quad 168.49 < 429.71 \text{ verified} \quad (0.39)$$

#### Transverse inner weld

$$\sigma_{\perp} = -100.79 \text{ [MPa]} \quad \text{Normal stress in a weld}$$

$$\tau_{\perp} = -49.50 \text{ [MPa]} \quad \text{Perpendicular tangent stress}$$

$$\tau_{\parallel} = 0.00 \text{ [MPa]} \quad \text{Tangent stress}$$

$$|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2} \quad |-100.79| < 338.40 \text{ verified} \quad (0.30)$$

$$\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2}) \quad 132.32 < 429.71 \text{ verified} \quad (0.31)$$

#### Transverse outer weld

$$\sigma_{\perp} = -47.76 \text{ [MPa]} \quad \text{Normal stress in a weld}$$

$$\tau_{\perp} = -99.97 \text{ [MPa]} \quad \text{Perpendicular tangent stress}$$

$$\tau_{\parallel} = 0.00 \text{ [MPa]} \quad \text{Tangent stress}$$

$$|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2} \quad |-47.76| < 338.40 \text{ verified} \quad (0.14)$$

$$\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2}) \quad 179.62 < 429.71 \text{ verified} \quad (0.42)$$

#### DIAGONAL 1

$$\beta_w = 0.88 \quad \text{Correlation coefficient} \quad [\text{Table 4.1}]$$

$$\gamma_{M2} = 1.25 \quad \text{Partial safety factor} \quad [\text{Table 2.1}]$$

#### Longitudinal weld

$$\sigma_{\perp} = 37.36 \text{ [MPa]} \quad \text{Normal stress in a weld}$$

$$\tau_{\perp} = 37.36 \text{ [MPa]} \quad \text{Perpendicular tangent stress}$$

$$\tau_{\parallel} = 43.15 \text{ [MPa]} \quad \text{Tangent stress}$$

$$|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2} \quad |37.36| < 338.40 \text{ verified} \quad (0.11)$$

$$\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2}) \quad 105.68 < 429.71 \text{ verified} \quad (0.25)$$

#### Transverse inner weld

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$\sigma_{\perp} =$	64.99	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	35.02	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	64.99	<	338.40	verified	(0.19)
$\sqrt{[\sigma_{\perp}^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)]} \leq f_u / (\beta_w \cdot \gamma_{M2})$	88.89	<	429.71	verified	(0.21)
Transverse outer weld					
$\sigma_{\perp} =$	29.62	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	62.37	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	29.62	<	338.40	verified	(0.09)
$\sqrt{[\sigma_{\perp}^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)]} \leq f_u / (\beta_w \cdot \gamma_{M2})$	112.01	<	429.71	verified	(0.26)

## REMARKS

Ratio of the distance of members to the chord width is too small 0.08 < 0.28

Connection conforms to the code	Ratio	0.55
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**Išvada: sąlyga tenkinama**

**Mazgas NR. 6**

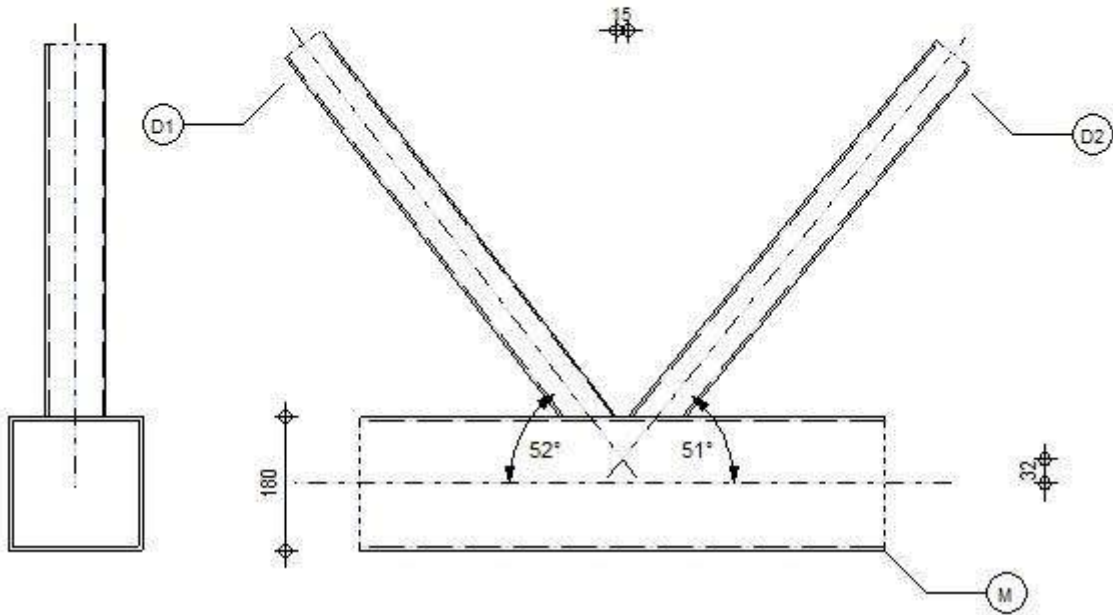
	Robot Structural Analysis Professional 2023 <b>Design of truss node connection</b> EN 1993-1-8:2005/AC:2009	
		Ratio <b>0.33</b>

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	70	251	0

D1 - RECT 80x80x4

D2 - RECT 80x80x4

M - SQUA 180x180x6



## GENERAL

Connection no.:	6
Connection name:	Tube
Structure node:	104
Structure members:	144, 130, 131

## GEOMETRY

### MEMBERS

	Chord	Diagonal 1	Diagonal 2	Post	
<b>Member no.:</b>	144	131	130		
<b>Section:</b>	SQUA 180x180x6	RECT 80x60x4	RECT 80x60x4		
h	180	60	60		mm
b <sub>f</sub>	180	80	80		mm
t <sub>w</sub>	6	4	4		mm
t <sub>f</sub>	6	4	4		mm
r	6	4	4		mm
<b>Material:</b>	S 355	S 355	S 355		
f <sub>y</sub>	355.00	355.00	355.00		MPa
f <sub>u</sub>	470.00	470.00	470.00		MPa
<b>Angle</b>	θ	52.5	50.8		Deg

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Lapas	Lapų	Laida
71	251	0

## MEMBERS

		Chord	Diagonal 1	Diagonal 2	Post	
Length	1	15152	3021	3021		mm

## OFFSET

$e_0 = -32$  [mm] Offset

## SPACINGS

$g_2 = 15$  [mm] Spacing of 2nd diagonal

## WELDS

$a_d = 3$  [mm] Thickness of welds of diagonals and posts

## LOADS

Case: 66: ULS/56=1\*1.35 + 2\*0.91 + 5\*0.78 + 4\*1.30 1\*1.35+2\*0.91+5\*0.78+4\*1.30

## CHORD

$N_{01,Ed} = -480.17$  [kN] Axial force  
 $M_{01,Ed} = -0.08$  [kN\*m] Bending moment  
 $N_{02,Ed} = -467.84$  [kN] Axial force  
 $M_{02,Ed} = -0.09$  [kN\*m] Bending moment

## DIAGONAL 1

$N_1 = -34.91$  [kN] Axial force  
 $M_1 = -0.01$  [kN\*m] Bending moment

## DIAGONAL 2

$N_2 = -14.14$  [kN] Axial force  
 $M_2 = -0.01$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

## RESULTS

### CONSIDER NON-AXIAL CONNECTION OF MEMBERS IN THE NODE

$M_0 = 0.40$  [kN\*m] Additional moment from eccentric connection of members  $M_0 = (N_{02}-N_{01}) * e_0$   
 $\Sigma E_i J_i / L_i = 1251264.78$  [kN\*m] Overall connection stiffness  
 $\Delta M_{01} = 0.18$  [kN\*m] Additional moment in the chord  
 $\Delta M_{02} = 0.18$  [kN\*m] Additional moment in the chord  
 $\Delta M_2 = 0.02$  [kN\*m] Additional moment in the diagonal  
 $\Delta M_1 = 0.02$  [kN\*m] Additional moment in the diagonal

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$\gamma_{M5} = 1.00$  Partial safety factor [Table 2.1]

FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS) [Table 7.12] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

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	72	251	0

## GEOMETRICAL PARAMETERS

$\beta = 0.39$	Coefficient taking account of geometry of connection members	$\beta = (b_2 + h_2 + b_1 + h_1) / (4 * b_0)$ [1.5 (6)]
$\gamma = 15.00$	Coefficient taking account of geometry of the chord	$\gamma = b_0 / (2 * t_0)$ [1.5 (6)]
$n = 0.33$	Coefficient taking account of stresses in the chord	$n_0 = \sigma_{0,Ed} / f_{y0}$
$k_n = 0.96$	Coefficient taking account of stresses in the chord	$k_n = 1.3 - 0.4 * n_0 / \beta$

## TUBE CHORD FACE FAILURE

### DIAGONAL 2

$N_{2,Rd} = 211.90$ [kN]	Compression capacity	$N_{2,Rd} = 8.9 * k_n * f_{y0} * t_0^{2 * \sqrt{\gamma} / \sin(\theta_2)} * \beta / \gamma M_5$
$ N_2  \leq N_{2,Rd}$	$ -14.14  < 211.90$	verified (0.07)
$M_{2,Rd} = 3.38$ [kN*m]	Bending resistance	$M_{2,Rd} = k_n * f_{y0} * t_0^{2 * h_2} * [1 / (2 * \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma M_5$
$ M_2 + \Delta M_2  \leq M_{2,Rd}$	$ 0.01  < 3.38$	verified (0.00)
$N_2 / N_{2,Rd} + (M_2 + \Delta M_2) / M_{2,Rd} \leq 1$	$0.07 < 1.00$	verified (0.07)

### DIAGONAL 1

$N_{1,Rd} = 206.93$ [kN]	Compression capacity	$N_{1,Rd} = 8.9 * k_n * f_{y0} * t_0^{2 * \sqrt{\gamma} / \sin(\theta_1)} * \beta / \gamma M_5$
$ N_1  \leq N_{1,Rd}$	$ -34.91  < 206.93$	verified (0.17)
$M_{1,Rd} = 3.38$ [kN*m]	Bending resistance	$M_{1,Rd} = k_n * f_{y0} * t_0^{2 * h_1} * [1 / (2 * \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma M_5$
$ M_1 + \Delta M_1  \leq M_{1,Rd}$	$ 0.01  < 3.38$	verified (0.00)
$N_1 / N_{1,Rd} + (M_1 + \Delta M_1) / M_{1,Rd} \leq 1$	$0.17 < 1.00$	verified (0.17)

## CHORD PUNCHING

### DIAGONAL 2

$b_{e,p} = 27$ [mm]	Effective width for punching shear	$b_{e,p} = (10 * b_2) / (b_0 / t_0)$
$N_{2,Rd} = 415.22$ [kN]	Compression capacity	$N_{2,Rd} = f_{y0} * t_0 / (\sqrt{3} * \sin(\theta_2)) * [2 * h_2 / \sin(\theta_2) + b_2 + b_{e,p}] / \gamma M_5$
$ N_2  \leq N_{2,Rd}$	$ -14.14  < 415.22$	verified (0.03)

### DIAGONAL 1

$b_{e,p} = 27$ [mm]	Effective width for punching shear	$b_{e,p} = (10 * b_1) / (b_0 / t_0)$
$N_{1,Rd} = 399.84$ [kN]	Compression capacity	$N_{1,Rd} = f_{y0} * t_0 / (\sqrt{3} * \sin(\theta_1)) * [2 * h_1 / \sin(\theta_1) + b_1 + b_{e,p}] / \gamma M_5$
$ N_1  \leq N_{1,Rd}$	$ -34.91  < 399.84$	verified (0.09)

## TUBE BRACE FAILURE

### DIAGONAL 2

$b_{eff} = 40$ [mm]	Effective width in the connection of the diagonal to the chord	$b_{eff} = [10 / (b_0 / t_0)] * [(f_{y0} * t_0) / (f_{y2} * t_2)] * b_2$
$N_{2,Rd} = 318.08$ [kN]	Compression capacity	$N_{2,Rd} = f_{y2} * t_2 * (2 * h_2 - 4 * t_2 + b_2 + b_{eff}) / \gamma M_5$
$ N_2  \leq N_{2,Rd}$	$ -14.14  < 318.08$	verified (0.04)

### DIAGONAL 1

$b_{eff} = 40$ [mm]	Effective width in the connection of the diagonal to the chord	$b_{eff} = [10 / (b_0 / t_0)] * [(f_{y0} * t_0) / (f_{y1} * t_1)] * b_1$
$N_{1,Rd} = 318.08$ [kN]	Compression capacity	$N_{1,Rd} = f_{y1} * t_1 * (2 * h_1 - 4 * t_1 + b_1 + b_{eff}) / \gamma M_5$
$ N_1  \leq N_{1,Rd}$	$ -34.91  < 318.08$	verified (0.11)

## CHORD SHEAR

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	73	251	0

## DIAGONAL 2

$A_v =$	25.14	[cm <sup>2</sup> ]	Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{2,Rd} =$	665.00	[kN]	Compression capacity	$N_{2,Rd} = f_{y0} \cdot A_w / [\sqrt{3} \cdot \sin(\theta_2)] / \gamma_{M5}$
$ N_2  \leq N_{2,Rd}$			$ -14.14  < 665.00$	verified (0.02)

## DIAGONAL 1

$A_v =$	25.14	[cm <sup>2</sup> ]	Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{1,Rd} =$	649.39	[kN]	Compression capacity	$N_{1,Rd} = f_{y0} \cdot A_w / [\sqrt{3} \cdot \sin(\theta_1)] / \gamma_{M5}$
$ N_1  \leq N_{1,Rd}$			$ -34.91  < 649.39$	verified (0.05)

## CHORD RESISTANCE

$V_{pl,Rd} =$	515.17	[kN]	Plastic resistance for shear	$V_{pl,Rd} = (A_v \cdot f_{y0}) / (\sqrt{3} \cdot \gamma_{M0})$
$ V_{Ed}  \leq V_{pl,Rd}$			$ 27.69  < 515.17$	verified (0.05)
$N_{0,Rd} =$	1448.28	[kN]	Compression capacity	$N_{0,Rd} = [(A_0 - A_v) \cdot f_{y0} + A_v \cdot f_{y0} \cdot \sqrt{1 - (V_{Ed}/V_{pl,Rd})^2}] / \gamma_{M5}$
$ N_{01}  \leq N_{0,Rd}$			$ -480.17  < 1448.28$	verified (0.33)

## VERIFICATION OF WELDS

### DIAGONAL 2

$\beta_w =$	0.88		Correlation coefficient	[Table 4.1]
$\gamma_{M2} =$	1.25		Partial safety factor	[Table 2.1]
Longitudinal weld				
$\sigma_{\perp} =$	-8.04	[MPa]	Normal stress in a weld	
$\tau_{\perp} =$	-8.04	[MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	-9.65	[MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$			$ -8.04  < 338.40$	verified (0.02)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$			$23.20 < 429.71$	verified (0.05)
Transverse inner weld				
$\sigma_{\perp} =$	-14.38	[MPa]	Normal stress in a weld	
$\tau_{\perp} =$	-7.78	[MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$			$ -14.38  < 338.40$	verified (0.04)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$			$19.70 < 429.71$	verified (0.05)
Transverse outer weld				
$\sigma_{\perp} =$	-6.10	[MPa]	Normal stress in a weld	
$\tau_{\perp} =$	-13.58	[MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$			$ -6.10  < 338.40$	verified (0.02)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$			$24.30 < 429.71$	verified (0.06)

### DIAGONAL 1

$\beta_w =$	0.88		Correlation coefficient	[Table 4.1]
$\gamma_{M2} =$	1.25		Partial safety factor	[Table 2.1]
Longitudinal weld				
$\sigma_{\perp} =$	-21.59	[MPa]	Normal stress in a weld	
$\tau_{\perp} =$	-21.59	[MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	-24.32	[MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$			$ -21.59  < 338.40$	verified (0.06)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$			$60.32 < 429.71$	verified (0.14)

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	74	251	0

Transverse inner weld

$\sigma_{\perp} =$	-38.00	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-22.08	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -38.00  < 338.40$	verified (0.11)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$53.91 < 429.71$	verified (0.13)

Transverse outer weld

$\sigma_{\perp} =$	-15.03	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-34.53	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -15.03  < 338.40$	verified (0.04)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$61.66 < 429.71$	verified (0.14)

**REMARKS**



Ratio of the distance of members to the chord width is too small  $0.08 < 0.28$

**Connection conforms to the code**

Ratio 0.33

**Išvada: sąlyga tenkinama**

**Mazgas NR. 7**

	Robot Structural Analysis Professional 2023 <b>Design of truss node connection</b> EN 1993-1-8:2005/AC:2009	
		Ratio <b>0.86</b>

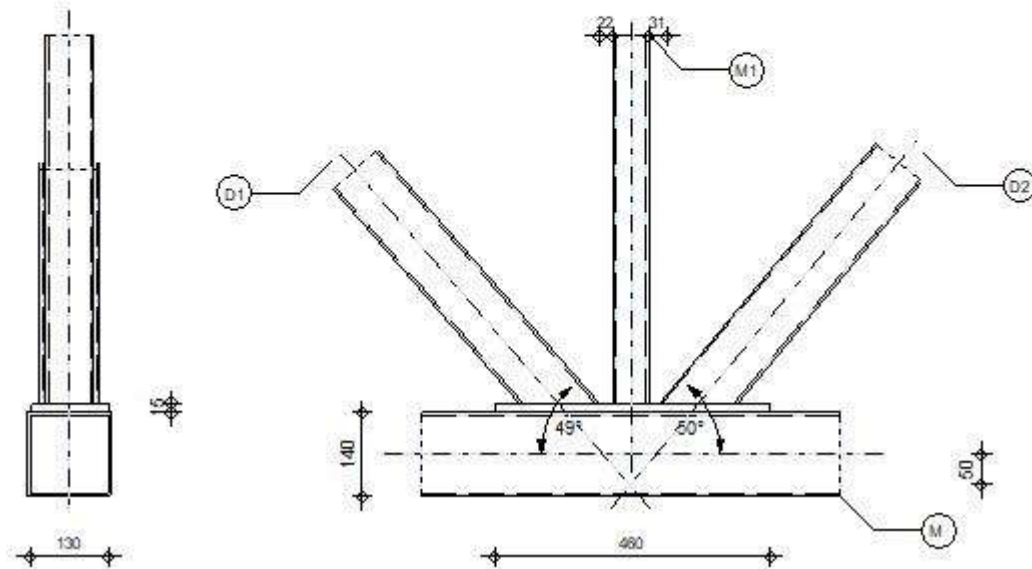
IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	75	251	0

M1 - RECT 80x80x4

D1 - SQUA 100x100x5

D2 - SQUA 100x100x4

M - SQUA 140x140x5



## GENERAL

Connection no.: 7  
Connection name: Tube  
Structure node: 58  
Structure members: 123, 126, 125, 138

## GEOMETRY

### MEMBERS

	Chord	Diagonal 1	Diagonal 2	Post		
<b>Member no.:</b>	123	125	126	138		
<b>Section:</b>	SQUA 140x140x5	SQUA 100x100x5	SQUA 100x100x4	RECT 80x60x4		
<b>h</b>	140	100	100	60	mm	
<b>b<sub>f</sub></b>	140	100	100	80	mm	
<b>t<sub>w</sub></b>	5	5	4	4	mm	
<b>t<sub>f</sub></b>	5	5	4	4	mm	
<b>r</b>	5	5	4	4	mm	
<b>Material:</b>	S 355	S 355	S 355	S 355		
<b>f<sub>y</sub></b>	355.00	355.00	355.00	355.00	MPa	
<b>f<sub>u</sub></b>	470.00	470.00	470.00	470.00	MPa	
<b>Angle</b>	θ	0.0	48.8	50.3	90.0	Deg
<b>Length</b>	l	13132	2828	2934	2228	mm

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Lapas	Lapų	Laida
76	251	0

### OFFSET

$e_0 = 50$  [mm] Offset

### SPACINGS

$g_1 = 22$  [mm] Spacing of 1st diagonal  
 $g_2 = 31$  [mm] Spacing of 2nd diagonal

### HORIZONTAL BRACKET

$b_{ph} = 130$  [mm] Width  
 $l_{ph} = 460$  [mm] Length  
 $t_{ph} = 15$  [mm] Thickness  
Material: S 355  
 $f_{yph} = 355.00$  [MPa] Resistance

### WELDS

$a_d = 3$  [mm] Thickness of welds of diagonals and posts  
 $a_{st} = 5$  [mm] Thickness of stiffener welds

### LOADS

Case: 66: ULS/56=1\*1.35 + 2\*0.91 + 5\*0.78 + 4\*1.30 1\*1.35+2\*0.91+5\*0.78+4\*1.30

### CHORD

$N_{01,Ed} = 0.00$  [kN] Axial force  
 $M_{01,Ed} = 0.00$  [kN\*m] Bending moment  
 $N_{02,Ed} = 319.16$  [kN] Axial force  
 $M_{02,Ed} = 0.00$  [kN\*m] Bending moment

### DIAGONAL 1

$N_1 = 260.57$  [kN] Axial force  
 $M_1 = -0.01$  [kN\*m] Bending moment

### DIAGONAL 2

$N_2 = -230.38$  [kN] Axial force  
 $M_2 = -0.00$  [kN\*m] Bending moment

### POST

$N_3 = -18.24$  [kN] Axial force  
 $M_3 = -0.01$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

### RESULTS

#### CONSIDER NON-AXIAL CONNECTION OF MEMBERS IN THE NODE

$M_0 = -16.11$  [kN\*m] Additional moment from eccentric connection of members  $M_0 = (N_{02}-N_{01}) * e_0$   
 $\Sigma E_i J_i / L_i = 921938.33$  [kN\*m] Overall connection stiffness  
 $\Delta M_{01} = -4.42$  [kN\*m] Additional moment in the chord

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	77	251	0

$\Delta M_{02} =$	-4.42 [kN*m]	Additional moment in the chord
$\Delta M_2 =$	-2.83 [kN*m]	Additional moment in the diagonal
$\Delta M_1 =$	-3.52 [kN*m]	Additional moment in the diagonal
$\Delta M_3 =$	-0.92 [kN*m]	Additional moment in the diagonal

## CAPACITY VERIFICATION EUROCODE 3: EN 1993-1-8:2005

$\gamma_{M5} = 1.00$  Partial safety factor [Table 2.1]

**FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS)** [Table 7.12] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

### GEOMETRICAL PARAMETERS

$\beta = 0.64$	Coefficient taking account of geometry of connection members $\beta = (b_2 + h_2 + b_1 + h_1 + b_3 + h_3) / (6 \cdot b_0)$ [1.5 (6)]
$\gamma = 4.67$	Coefficient taking account of geometry of the chord $\gamma = b_0 / (2 \cdot t_{ph})$ [1.5 (6)]
$n = 0.34$	Coefficient taking account of stresses in the chord $n_0 = \sigma_{0,Ed} / f_{y0}$
$k_n = 1.00$	Coefficient taking account of stresses in the chord $k_n = 1.0$

### TUBE CHORD FACE FAILURE

#### DIAGONAL 2

$N_{2,Rd} = 1283.63$ [kN]	Compression capacity	$N_{2,Rd} = [8.9 \cdot k_n \cdot f_{y0} \cdot t_{ph}^2 \cdot \sqrt{\gamma} / \sin(\theta_2)] \cdot \beta / \gamma_{M5}$
$ N_2  \leq N_{2,Rd}$	$ -230.38  < 1283.63$	verified (0.18)
$M_{2,Rd} = 5.37$ [kN*m]	Bending resistance	$M_{2,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_2 \cdot [1 / (2 \cdot \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$
$ M_2 + \Delta M_2  \leq M_{2,Rd}$	$ -2.83  < 5.37$	verified (0.53)
$N_2 / N_{2,Rd} + (M_2 + \Delta M_2) / M_{2,Rd} \leq 1$	$0.71 < 1.00$	verified (0.71)

#### DIAGONAL 1

$N_{1,Rd} = 1312.00$ [kN]	Tension capacity	$N_{1,Rd} = [8.9 \cdot k_n \cdot f_{y0} \cdot t_{ph}^2 \cdot \sqrt{\gamma} / \sin(\theta_1)] \cdot \beta / \gamma_{M5}$
$ N_1  \leq N_{1,Rd}$	$ 260.57  < 1312.00$	verified (0.20)
$M_{1,Rd} = 5.37$ [kN*m]	Bending resistance	$M_{1,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_1 \cdot [1 / (2 \cdot \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$
$ M_1 + \Delta M_1  \leq M_{1,Rd}$	$ -3.53  < 5.37$	verified (0.66)
$N_1 / N_{1,Rd} + (M_1 + \Delta M_1) / M_{1,Rd} \leq 1$	$0.86 < 1.00$	verified (0.86)

#### POST

$N_{3,Rd} = 987.23$ [kN]	Compression capacity	$N_{3,Rd} = [8.9 \cdot k_n \cdot f_{y0} \cdot t_{ph}^2 \cdot \sqrt{\gamma} / \sin(\theta_3)] \cdot \beta / \gamma_{M5}$
$ N_3  \leq N_{3,Rd}$	$ -18.24  < 987.23$	verified (0.02)
$M_{3,Rd} = 3.04$ [kN*m]	Bending resistance	$M_{3,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_3 \cdot [1 / (2 \cdot \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$
$ M_3 + \Delta M_3  \leq M_{3,Rd}$	$ -0.93  < 3.04$	verified (0.31)
$N_3 / N_{3,Rd} + (M_3 + \Delta M_3) / M_{3,Rd} \leq 1$	$0.33 < 1.00$	verified (0.33)

### TUBE BRACE FAILURE

#### DIAGONAL 2

$b_{eff} = 100$ [mm]	Effective width in the connection of the diagonal to the chord	$b_{eff} = b_2$
$N_{2,Rd} = 545.28$ [kN]	Compression capacity	$N_{2,Rd} = f_{y2} \cdot t_2 \cdot (2 \cdot h_2 - 4 \cdot t_2 + b_2 + b_{eff}) / \gamma_{M5}$
$ N_2  \leq N_{2,Rd}$	$ -230.38  < 545.28$	verified (0.42)

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	78	251	0

## DIAGONAL 1

$b_{eff} = 100$  [mm] Effective width in the connection of the diagonal to the chord  $b_{eff} = b_1$   
 $N_{1,Rd} = 674.50$  [kN] Tension capacity  $N_{1,Rd} = f_{y1} \cdot t_1 \cdot (2 \cdot h_1 - 4 \cdot t_1 + b_1 + b_{eff}) / \gamma_{M5}$   
 $|N_1| \leq N_{1,Rd}$   $|260.57| < 674.50$  **verified** (0.39)

## POST

$b_{eff} = 80$  [mm] Effective width in the connection of the post to the chord  $b_{eff} = b_3$   
 $N_{3,Rd} = 374.88$  [kN] Compression capacity  $N_{3,Rd} = f_{y3} \cdot t_3 \cdot (2 \cdot h_3 - 4 \cdot t_3 + b_3 + b_{eff}) / \gamma_{M5}$   
 $|N_3| \leq N_{3,Rd}$   $|-18.24| < 374.88$  **verified** (0.05)

## CHORD SHEAR

### DIAGONAL 2

$A_v = 14.27$  [cm<sup>2</sup>] Shear area of the chord  $A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$   
 $N_{2,Rd} = 380.25$  [kN] Compression capacity  $N_{2,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_2)] / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|-230.38| < 380.25$  **verified** (0.61)

### DIAGONAL 1

$A_v = 14.27$  [cm<sup>2</sup>] Shear area of the chord  $A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$   
 $N_{1,Rd} = 388.66$  [kN] Tension capacity  $N_{1,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_1)] / \gamma_{M5}$   
 $|N_1| \leq N_{1,Rd}$   $|260.57| < 388.66$  **verified** (0.67)

## POST

$A_v = 14.27$  [cm<sup>2</sup>] Shear area of the chord  $A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$   
 $N_{3,Rd} = 292.45$  [kN] Compression capacity  $N_{3,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_3)] / \gamma_{M5}$   
 $|N_3| \leq N_{3,Rd}$   $|-18.24| < 292.45$  **verified** (0.06)

## CHORD RESISTANCE

$V_{pl,Rd} = 292.45$  [kN] Plastic resistance for shear  $V_{pl,Rd} = (A_v \cdot f_{y0}) / (\sqrt{3} \cdot \gamma_{M0})$   
 $|V_{Ed}| \leq V_{pl,Rd}$   $|196.07| < 292.45$  **verified** (0.67)  
 $N_{0,Rd} = 804.94$  [kN] Tension capacity  $N_{0,Rd} = [(A_0 - A_v) \cdot f_{y0} + A_v \cdot f_{y0} \cdot \sqrt{1 - (V_{Ed} / V_{pl,Rd})^2}] / \gamma_{M5}$   
 $|N_{02}| \leq N_{0,Rd}$   $|319.16| < 804.94$  **verified** (0.40)

## VERIFICATION OF WELDS

### DIAGONAL 2

$\beta_w = 0.88$  Correlation coefficient [Table 4.1]  
 $\gamma_{M2} = 1.25$  Partial safety factor [Table 2.1]

#### Longitudinal weld

$\sigma_{\perp} = -89.72$  [MPa] Normal stress in a weld  
 $\tau_{\perp} = -89.72$  [MPa] Perpendicular tangent stress  
 $\tau_{\parallel} = -107.32$  [MPa] Tangent stress  
 $|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2}$   $|-89.72| < 338.40$  **verified** (0.27)  
 $\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$   $258.37 < 429.71$  **verified** (0.60)

#### Transverse inner weld

$\sigma_{\perp} = -153.82$  [MPa] Normal stress in a weld  
 $\tau_{\perp} = -75.18$  [MPa] Perpendicular tangent stress

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	79	251	0

$\tau_{II} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -153.82  < 338.40$	verified (0.45)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{II}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$201.53 < 429.71$	verified (0.47)
<b>Transverse outer weld</b>					
$\sigma_{\perp} =$	-72.86	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-152.73	[MPa]	Perpendicular tangent stress		
$\tau_{II} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -72.86  < 338.40$	verified (0.22)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{II}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$274.39 < 429.71$	verified (0.64)

## DIAGONAL 1

$\beta_w =$	0.88		Correlation coefficient		[Table 4.1]
$\gamma_{M2} =$	1.25		Partial safety factor		[Table 2.1]
<b>Longitudinal weld</b>					
$\sigma_{\perp} =$	99.22	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	99.22	[MPa]	Perpendicular tangent stress		
$\tau_{II} =$	122.82	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ 99.22  < 338.40$	verified (0.29)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{II}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$290.91 < 429.71$	verified (0.68)
<b>Transverse inner weld</b>					
$\sigma_{\perp} =$	169.72	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	76.83	[MPa]	Perpendicular tangent stress		
$\tau_{II} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ 169.72  < 338.40$	verified (0.50)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{II}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$215.67 < 429.71$	verified (0.50)
<b>Transverse outer weld</b>					
$\sigma_{\perp} =$	77.24	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	169.91	[MPa]	Perpendicular tangent stress		
$\tau_{II} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ 77.24  < 338.40$	verified (0.23)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{II}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$304.25 < 429.71$	verified (0.71)

## POST

$\beta_w =$	0.88		Correlation coefficient		[Table 4.1]
$\gamma_{M2} =$	1.25		Partial safety factor		[Table 2.1]
<b>Longitudinal weld</b>					
$\sigma_{\perp} =$	-20.78	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-20.78	[MPa]	Perpendicular tangent stress		
$\tau_{II} =$	-0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -20.78  < 338.40$	verified (0.06)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{II}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$41.55 < 429.71$	verified (0.10)
<b>Transverse inner weld</b>					
$\sigma_{\perp} =$	-35.35	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-35.35	[MPa]	Perpendicular tangent stress		
$\tau_{II} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -35.35  < 338.40$	verified (0.10)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{II}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$70.69 < 429.71$	verified (0.16)

## REMARKS

Eccentricity is too large.



50 [mm] > 35 [mm]

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	80	251	0

**Connection conforms to the code** Ratio 0.86

**Išvada: sąlyga tenkinama**

**Mazgas NR. 8**

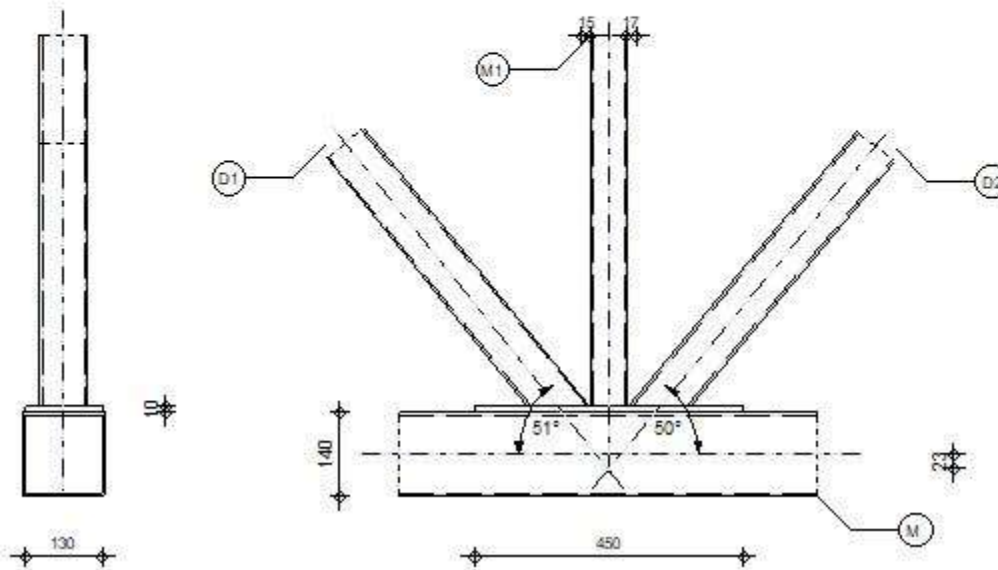
	Robot Structural Analysis Professional 2023 <b>Design of truss node connection</b> EN 1993-1-8:2005/AC:2009	
		Ratio <b>0.58</b>

M1 - RECT 80x80x4

D1 - SQUA 80x80x4

D2 - SQUA 80x80x4

M - SQUA 140x140x5



## GENERAL

Connection no.: 8  
 Connection name: Tube  
 Structure node: 101  
 Structure members: 123, 127, 128, 137

## GEOMETRY

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	81	251	0

## MEMBERS

		Chord	Diagonal 1	Diagonal 2	Post	
<b>Member no.:</b>		123	128	127	137	
<b>Section:</b>		SQUA 140x140x5	SQUA 80x80x4	SQUA 80x80x4	RECT 80x60x4	
	h	140	80	80	60	mm
	b <sub>f</sub>	140	80	80	80	mm
	t <sub>w</sub>	5	4	4	4	mm
	t <sub>f</sub>	5	4	4	4	mm
	r	5	4	4	4	mm
<b>Material:</b>		S 355	S 355	S 355	S 355	
	f <sub>y</sub>	355.00	355.00	355.00	355.00	MPa
	f <sub>u</sub>	470.00	470.00	470.00	470.00	MPa
<b>Angle</b>	θ	0.0	51.0	50.3	90.0	Deg
<b>Length</b>	l	13132	2977	2934	2284	mm

## OFFSET

e<sub>0</sub> = 23 [mm] Offset

## SPACINGS

g<sub>1</sub> = 15 [mm] Spacing of 1st diagonal  
g<sub>2</sub> = 17 [mm] Spacing of 2nd diagonal

## HORIZONTAL BRACKET

b<sub>ph</sub> = 130 [mm] Width  
l<sub>ph</sub> = 450 [mm] Length  
t<sub>ph</sub> = 10 [mm] Thickness  
Material: S 355  
f<sub>yph</sub> = 355.00 [MPa] Resistance

## WELDS

a<sub>d</sub> = 3 [mm] Thickness of welds of diagonals and posts  
a<sub>st</sub> = 5 [mm] Thickness of stiffener welds

## LOADS

Case: 71: ULS/61=1\*1.35 + 5\*0.78 + 4\*1.30 1\*1.35+5\*0.78+4\*1.30

## CHORD

N<sub>01,Ed</sub> = 503.18 [kN] Axial force  
M<sub>01,Ed</sub> = -0.19 [kN\*m] Bending moment  
N<sub>02,Ed</sub> = 319.16 [kN] Axial force  
M<sub>02,Ed</sub> = -0.17 [kN\*m] Bending moment

## DIAGONAL 1

N<sub>1</sub> = -121.27 [kN] Axial force  
M<sub>1</sub> = 0.01 [kN\*m] Bending moment

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	82	251	0

## DIAGONAL 2

$N_2 = 167.52$  [kN] Axial force  
 $M_2 = -0.02$  [kN\*m] Bending moment

## POST

$N_3 = -33.70$  [kN] Axial force  
 $M_3 = 0.01$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

## RESULTS

### CONSIDER NON-AXIAL CONNECTION OF MEMBERS IN THE NODE

$M_0 = 4.32$  [kN\*m] Additional moment from eccentric connection of members  $M_0 = (N_{02} - N_{01}) * e_0$   
 $\Sigma E_i J_i / L_i = 715104.64$  [kN\*m] Overall connection stiffness  
 $\Delta M_{01} = 1.53$  [kN\*m] Additional moment in the chord  
 $\Delta M_{02} = 1.53$  [kN\*m] Additional moment in the chord  
 $\Delta M_2 = 0.48$  [kN\*m] Additional moment in the diagonal  
 $\Delta M_1 = 0.47$  [kN\*m] Additional moment in the diagonal  
 $\Delta M_3 = 0.31$  [kN\*m] Additional moment in the diagonal

### CAPACITY VERIFICATION EUROCODE 3: EN 1993-1-8:2005

$\gamma_{M5} = 1.00$  Partial safety factor [Table 2.1]

### FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS)

[Table 7.12] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

### GEOMETRICAL PARAMETERS

$\beta = 0.5$  Coefficient taking account of geometry of connection  $\beta = (b_2 + h_2 + b_1 + h_1 + b_3 + h_3) / (6 * b_0)$  [1.5 (6)]  
 $\gamma = 7.0$  Coefficient taking account of geometry of the chord  $\gamma = b_0 / (2 * t_{ph})$  [1.5 (6)]  
 $k_n = 1.0$  Coefficient taking account of stresses in the chord  $k_n = 1.0$

### TUBE CHORD FACE FAILURE

#### DIAGONAL 2

$N_{2,Rd} = 595.21$  [kN] Tension capacity  $N_{2,Rd} = [8.9 * k_n * f_{y0} * t_{ph}^2 * \sqrt{\gamma} / \sin(\theta_2)] * \beta / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|167.52| < 595.21$  **verified** (0.28)

$M_{2,Rd} = 3.63$  [kN\*m] Bending resistance  $M_{2,Rd} = k_n * f_{y0} * t_0^2 * h_2 * [1 / (2 * \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_2 + \Delta M_2| \leq M_{2,Rd}$   $|0.46| < 3.63$  **verified** (0.13)

$N_2 / N_{2,Rd} + (M_2 + \Delta M_2) / M_{2,Rd} \leq 1$   $0.41 < 1.00$  **verified** (0.41)

#### DIAGONAL 1

$N_{1,Rd} = 589.33$  [kN] Compression capacity  $N_{1,Rd} = [8.9 * k_n * f_{y0} * t_{ph}^2 * \sqrt{\gamma} / \sin(\theta_1)] * \beta / \gamma_{M5}$   
 $|N_1| \leq N_{1,Rd}$   $|-121.27| < 589.33$  **verified** (0.21)

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$M_{1,Rd} = 3.63$ [kN*m] Bending resistance	$M_{1,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_1 \cdot [1/(2 \cdot \eta) + 2/\sqrt{1-\beta}] + \eta/(1-\beta)] / \gamma_{M5}$
$ M_1 + \Delta M_1  \leq M_{1,Rd}$	$ 0.48  < 3.63$ <b>verified</b> (0.13)
$N_1/N_{1,Rd} + (M_1 + \Delta M_1)/M_{1,Rd} \leq 1$	$0.34 < 1.00$ <b>verified</b> (0.34)

## POST

$N_{3,Rd} = 457.77$ [kN] Compression capacity	$N_{3,Rd} = [8.9 \cdot k_n \cdot f_{y0} \cdot t_{ph}^2 \cdot \sqrt{\gamma} / \sin(\theta_3)] \cdot \beta / \gamma_{M5}$
$ N_3  \leq N_{3,Rd}$	$ -33.70  < 457.77$ <b>verified</b> (0.07)
$M_{3,Rd} = 2.71$ [kN*m] Bending resistance	$M_{3,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_3 \cdot [1/(2 \cdot \eta) + 2/\sqrt{1-\beta}] + \eta/(1-\beta)] / \gamma_{M5}$
$ M_3 + \Delta M_3  \leq M_{3,Rd}$	$ 0.32  < 2.71$ <b>verified</b> (0.12)
$N_3/N_{3,Rd} + (M_3 + \Delta M_3)/M_{3,Rd} \leq 1$	$0.19 < 1.00$ <b>verified</b> (0.19)

## TUBE BRACE FAILURE

### DIAGONAL 2

$b_{eff} = 80$ [mm] Effective width in the connection of the diagonal to the chord	$b_{eff} = b_2$
$N_{2,Rd} = 431.68$ [kN] Tension capacity	$N_{2,Rd} = f_{y2} \cdot t_2 \cdot (2 \cdot h_2 - 4 \cdot t_2 + b_2 + b_{eff}) / \gamma_{M5}$
$ N_2  \leq N_{2,Rd}$	$ 167.52  < 431.68$ <b>verified</b> (0.39)

### DIAGONAL 1

$b_{eff} = 80$ [mm] Effective width in the connection of the diagonal to the chord	$b_{eff} = b_1$
$N_{1,Rd} = 431.68$ [kN] Compression capacity	$N_{1,Rd} = f_{y1} \cdot t_1 \cdot (2 \cdot h_1 - 4 \cdot t_1 + b_1 + b_{eff}) / \gamma_{M5}$
$ N_1  \leq N_{1,Rd}$	$ -121.27  < 431.68$ <b>verified</b> (0.28)

## POST

$b_{eff} = 80$ [mm] Effective width in the connection of the post to the chord	$b_{eff} = b_3$
$N_{3,Rd} = 374.88$ [kN] Compression capacity	$N_{3,Rd} = f_{y3} \cdot t_3 \cdot (2 \cdot h_3 - 4 \cdot t_3 + b_3 + b_{eff}) / \gamma_{M5}$
$ N_3  \leq N_{3,Rd}$	$ -33.70  < 374.88$ <b>verified</b> (0.09)

## CHORD SHEAR

### DIAGONAL 2

$A_v = 14.33$ [cm <sup>2</sup> ] Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{2,Rd} = 381.84$ [kN] Tension capacity	$N_{2,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_2)] / \gamma_{M5}$
$ N_2  \leq N_{2,Rd}$	$ 167.52  < 381.84$ <b>verified</b> (0.44)

### DIAGONAL 1

$A_v = 14.33$ [cm <sup>2</sup> ] Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{1,Rd} = 378.07$ [kN] Compression capacity	$N_{1,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_1)] / \gamma_{M5}$
$ N_1  \leq N_{1,Rd}$	$ -121.27  < 378.07$ <b>verified</b> (0.32)

## POST

$A_v = 14.33$ [cm <sup>2</sup> ] Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{3,Rd} = 293.67$ [kN] Compression capacity	$N_{3,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_3)] / \gamma_{M5}$
$ N_3  \leq N_{3,Rd}$	$ -33.70  < 293.67$ <b>verified</b> (0.11)

## CHORD RESISTANCE

$V_{pl,Rd} = 293.67$ [kN] Plastic resistance for shear	$V_{pl,Rd} = (A_v \cdot f_{y0}) / (\sqrt{3} \cdot \gamma_{M0})$
--	---

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$ V_{Ed}  \leq V_{pl,Rd}$	$ 128.84  < 293.67$	<b>verified</b>	(0.44)
$N_{0,Rd} = 884.08$ [kN] Tension capacity	$N_{0,Rd} = [(A_0 - A_v) \cdot f_{y0} + A_v \cdot f_{y0} \cdot \sqrt{1 - (V_{Ed}/V_{pl,Rd})^2}] / \gamma_{M5}$		
$ N_{01}  \leq N_{0,Rd}$	$ 503.18  < 884.08$	<b>verified</b>	(0.57)

## VERIFICATION OF WELDS

### DIAGONAL 2

$\beta_w = 0.88$	Correlation coefficient	[Table 4.1]
$\gamma_{M2} = 1.25$	Partial safety factor	[Table 2.1]

#### Longitudinal weld

$\sigma_{\perp} = 81.19$ [MPa]	Normal stress in a weld
$\tau_{\perp} = 81.19$ [MPa]	Perpendicular tangent stress
$\tau_{\parallel} = 97.55$ [MPa]	Tangent stress
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ 81.19  < 338.40$ <b>verified</b> (0.24)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$234.34 < 429.71$ <b>verified</b> (0.55)

#### Transverse inner weld

$\sigma_{\perp} = 139.86$ [MPa]	Normal stress in a weld
$\tau_{\perp} = 68.43$ [MPa]	Perpendicular tangent stress
$\tau_{\parallel} = 0.00$ [MPa]	Tangent stress
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ 139.86  < 338.40$ <b>verified</b> (0.41)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$183.33 < 429.71$ <b>verified</b> (0.43)

#### Transverse outer weld

$\sigma_{\perp} = 67.36$ [MPa]	Normal stress in a weld
$\tau_{\perp} = 139.36$ [MPa]	Perpendicular tangent stress
$\tau_{\parallel} = 0.00$ [MPa]	Tangent stress
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ 67.36  < 338.40$ <b>verified</b> (0.20)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$250.60 < 429.71$ <b>verified</b> (0.58)

### DIAGONAL 1

$\beta_w = 0.88$	Correlation coefficient	[Table 4.1]
$\gamma_{M2} = 1.25$	Partial safety factor	[Table 2.1]

#### Longitudinal weld

$\sigma_{\perp} = -60.63$ [MPa]	Normal stress in a weld
$\tau_{\perp} = -60.63$ [MPa]	Perpendicular tangent stress
$\tau_{\parallel} = -71.06$ [MPa]	Tangent stress
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ -60.63  < 338.40$ <b>verified</b> (0.18)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$172.78 < 429.71$ <b>verified</b> (0.40)

#### Transverse inner weld

$\sigma_{\perp} = -104.16$ [MPa]	Normal stress in a weld
$\tau_{\perp} = -53.38$ [MPa]	Perpendicular tangent stress
$\tau_{\parallel} = 0.00$ [MPa]	Tangent stress
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ -104.16  < 338.40$ <b>verified</b> (0.31)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$139.27 < 429.71$ <b>verified</b> (0.32)

#### Transverse outer weld

$\sigma_{\perp} = -48.20$ [MPa]	Normal stress in a weld
$\tau_{\perp} = -101.69$ [MPa]	Perpendicular tangent stress
$\tau_{\parallel} = 0.00$ [MPa]	Tangent stress
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ -48.20  < 338.40$ <b>verified</b> (0.14)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$182.60 < 429.71$ <b>verified</b> (0.42)

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## POST

$\beta_w =$	0.88	Correlation coefficient		[Table 4.1]
$\gamma_{M2} =$	1.25	Partial safety factor		[Table 2.1]
<b>Longitudinal weld</b>				
$\sigma_{\perp} =$	-38.39 [MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-38.39 [MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00 [MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$		$ -38.39  < 338.40$	verified	(0.11)
$\sqrt{[\sigma_{\perp}^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)]} \leq f_u / (\beta_w \cdot \gamma_{M2})$		$76.78 < 429.71$	verified	(0.18)
<b>Transverse inner weld</b>				
$\sigma_{\perp} =$	-63.97 [MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-63.97 [MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00 [MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$		$ -63.97  < 338.40$	verified	(0.19)
$\sqrt{[\sigma_{\perp}^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)]} \leq f_u / (\beta_w \cdot \gamma_{M2})$		$127.94 < 429.71$	verified	(0.30)

**Connection conforms to the code**

Ratio 0.58

**Išvada: sąlyga tenkinama**

**Mazgas NR. 9**

	Robot Structural Analysis Professional 2023 <b>Design of truss node connection</b> EN 1993-1-8:2005/AC:2009	
		Ratio <b>0.59</b>

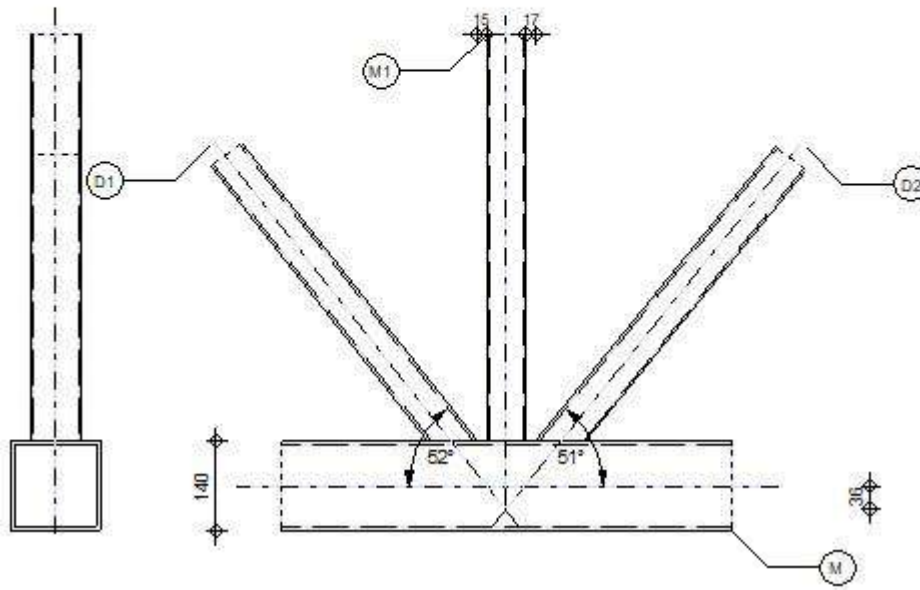
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	86	251	0

M1 - RECT 80x60x4

D1 - RECT 80x60x4

D2 - RECT 80x60x4

M - SQUA 140x140x5



## GENERAL

Connection no.: 9  
 Connection name: Tube  
 Structure node: 103  
 Structure members: 123, 129, 130, 139

## GEOMETRY

## MEMBERS

		Chord	Diagonal 1	Diagonal 2	Post	
<b>Member no.:</b>		123	130	129	139	
<b>Section:</b>		SQUA 140x140x5	RECT 80x60x4	RECT 80x60x4	RECT 80x60x4	
	h	140	60	60	60	mm
	b <sub>f</sub>	140	80	80	80	mm
	t <sub>w</sub>	5	4	4	4	mm
	t <sub>f</sub>	5	4	4	4	mm
	r	5	4	4	4	mm
<b>Material:</b>		S 355	S 355	S 355	S 355	
	f <sub>y</sub>	355.00	355.00	355.00	355.00	MPa
	f <sub>u</sub>	470.00	470.00	470.00	470.00	MPa
<b>Angle</b>	θ	0.0	51.6	51.0	90.0	Deg
<b>Length</b>	l	13132	3021	2977	2341	mm

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	87	251	0

### OFFSET

$e_0 = 36$  [mm] Offset

### SPACINGS

$g_1 = 15$  [mm] Spacing of 1st diagonal

$g_2 = 17$  [mm] Spacing of 2nd diagonal

### WELDS

$a_d = 3$  [mm] Thickness of welds of diagonals and posts

### LOADS

Case: 71: ULS/61=1\*1.35 + 5\*0.78 + 4\*1.30 1\*1.35+5\*0.78+4\*1.30

### CHORD

$N_{01,Ed} = 551.32$  [kN] Axial force

$M_{01,Ed} = -0.17$  [kN\*m] Bending moment

$N_{02,Ed} = 502.76$  [kN] Axial force

$M_{02,Ed} = -0.16$  [kN\*m] Bending moment

### DIAGONAL 1

$N_1 = -14.39$  [kN] Axial force

$M_1 = 0.00$  [kN\*m] Bending moment

### DIAGONAL 2

$N_2 = 62.72$  [kN] Axial force

$M_2 = -0.00$  [kN\*m] Bending moment

### POST

$N_3 = -36.29$  [kN] Axial force

$M_3 = 0.01$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

### RESULTS

#### CONSIDER NON-AXIAL CONNECTION OF MEMBERS IN THE NODE

$M_0 = 1.73$  [kN\*m] Additional moment from eccentric connection of members

$M_0 = (N_{02} - N_{01}) * e_0$

$\sum E_i J_i / L_i = 634645.17$  [kN\*m] Overall connection stiffness

$\Delta M_{01} = 0.69$  [kN\*m] Additional moment in the chord

$\Delta M_{02} = 0.69$  [kN\*m] Additional moment in the chord

$\Delta M_2 = 0.11$  [kN\*m] Additional moment in the diagonal

$\Delta M_1 = 0.11$  [kN\*m] Additional moment in the diagonal

$\Delta M_3 = 0.14$  [kN\*m] Additional moment in the diagonal

### CAPACITY VERIFICATION EUROCODE 3: EN 1993-1-8:2005

$\gamma_{M5} = 1.00$  Partial safety factor

[Table 2.1]

FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS) [Table 7.12] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

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	88	251	0

## GEOMETRICAL PARAMETERS

$\beta = 0.50$  Coefficient taking account of geometry of connection members  $\beta = (b_2 + h_2 + b_1 + h_1 + b_3 + h_3) / (6 \cdot b_0)$  [1.5 (6)]  
 $\gamma = 14.00$  Coefficient taking account of geometry of the chord  $\gamma = b_0 / (2 \cdot t_0)$  [1.5 (6)]  
 $k_n = 1.00$  Coefficient taking account of stresses in the chord  $k_n = 1.0$

## TUBE CHORD FACE FAILURE

### DIAGONAL 2

$N_{2,Rd} = 190.24$  [kN] Tension capacity  $N_{2,Rd} = [8.9 \cdot k_n \cdot f_{y0} \cdot t_0^2 \cdot \sqrt{\gamma} / \sin(\theta_2)] \cdot \beta / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|62.72| < 190.24$  **verified** (0.33)  
 $M_{2,Rd} = 2.58$  [kN\*m] Bending resistance  $M_{2,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_2 \cdot [1 / (2 \cdot \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_2 + \Delta M_2| \leq M_{2,Rd}$   $|0.11| < 2.58$  **verified** (0.04)  
 $N_2 / N_{2,Rd} + (M_2 + \Delta M_2) / M_{2,Rd} \leq 1$   $0.37 < 1.00$  **verified** (0.37)

### DIAGONAL 1

$N_{1,Rd} = 188.46$  [kN] Compression capacity  $N_{1,Rd} = [8.9 \cdot k_n \cdot f_{y0} \cdot t_0^2 \cdot \sqrt{\gamma} / \sin(\theta_1)] \cdot \beta / \gamma_{M5}$   
 $|N_1| \leq N_{1,Rd}$   $|-14.39| < 188.46$  **verified** (0.08)  
 $M_{1,Rd} = 2.58$  [kN\*m] Bending resistance  $M_{1,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_1 \cdot [1 / (2 \cdot \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_1 + \Delta M_1| \leq M_{1,Rd}$   $|0.11| < 2.58$  **verified** (0.04)  
 $N_1 / N_{1,Rd} + (M_1 + \Delta M_1) / M_{1,Rd} \leq 1$   $0.12 < 1.00$  **verified** (0.12)

### POST

$N_{3,Rd} = 147.77$  [kN] Compression capacity  $N_{3,Rd} = [8.9 \cdot k_n \cdot f_{y0} \cdot t_0^2 \cdot \sqrt{\gamma} / \sin(\theta_3)] \cdot \beta / \gamma_{M5}$   
 $|N_3| \leq N_{3,Rd}$   $|-36.29| < 147.77$  **verified** (0.25)  
 $M_{3,Rd} = 2.58$  [kN\*m] Bending resistance  $M_{3,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_3 \cdot [1 / (2 \cdot \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_3 + \Delta M_3| \leq M_{3,Rd}$   $|0.15| < 2.58$  **verified** (0.06)  
 $N_3 / N_{3,Rd} + (M_3 + \Delta M_3) / M_{3,Rd} \leq 1$   $0.30 < 1.00$  **verified** (0.30)

## TUBE BRACE FAILURE

### DIAGONAL 2

$b_{eff} = 36$  [mm] Effective width in the connection of the diagonal to the chord  $b_{eff} = [10 / (b_0 / t_0)] \cdot [(f_{y0} \cdot t_0) / (f_{y2} \cdot t_2)] \cdot b_2$   
 $N_{2,Rd} = 311.99$  [kN] Tension capacity  $N_{2,Rd} = f_{y2} \cdot t_2 \cdot (2 \cdot h_2 - 4 \cdot t_2 + b_2 + b_{eff}) / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|62.72| < 311.99$  **verified** (0.20)

### DIAGONAL 1

$b_{eff} = 36$  [mm] Effective width in the connection of the diagonal to the chord  $b_{eff} = [10 / (b_0 / t_0)] \cdot [(f_{y0} \cdot t_0) / (f_{y1} \cdot t_1)] \cdot b_1$   
 $N_{1,Rd} = 311.99$  [kN] Compression capacity  $N_{1,Rd} = f_{y1} \cdot t_1 \cdot (2 \cdot h_1 - 4 \cdot t_1 + b_1 + b_{eff}) / \gamma_{M5}$   
 $|N_1| \leq N_{1,Rd}$   $|-14.39| < 311.99$  **verified** (0.05)

### POST

$b_{eff} = 36$  [mm] Effective width in the connection of the post to the chord  $b_{eff} = [10 / (b_0 / t_0)] \cdot [(f_{y0} \cdot t_0) / (f_{y3} \cdot t_3)] \cdot b_3$   
 $N_{3,Rd} = 311.99$  [kN] Compression capacity  $N_{3,Rd} = f_{y3} \cdot t_3 \cdot (2 \cdot h_3 - 4 \cdot t_3 + b_3 + b_{eff}) / \gamma_{M5}$   
 $|N_3| \leq N_{3,Rd}$   $|-36.29| < 311.99$  **verified** (0.12)

## CHORD SHEAR

### DIAGONAL 2

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$A_v = 14.33$ [cm <sup>2</sup> ]	Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{2,Rd} = 378.07$ [kN]	Tension capacity	$N_{2,Rd} = f_{y0} \cdot A_w / [\sqrt{3} \cdot \sin(\theta_2)] / \gamma_{M5}$
$ N_2  \leq N_{2,Rd}$	$ 62.72  < 378.07$	<b>verified</b> (0.17)

### DIAGONAL 1

$A_v = 14.33$ [cm <sup>2</sup> ]	Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{1,Rd} = 374.53$ [kN]	Compression capacity	$N_{1,Rd} = f_{y0} \cdot A_w / [\sqrt{3} \cdot \sin(\theta_1)] / \gamma_{M5}$
$ N_1  \leq N_{1,Rd}$	$ -14.39  < 374.53$	<b>verified</b> (0.04)

### POST

$A_v = 14.33$ [cm <sup>2</sup> ]	Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{3,Rd} = 293.66$ [kN]	Compression capacity	$N_{3,Rd} = f_{y0} \cdot A_w / [\sqrt{3} \cdot \sin(\theta_3)] / \gamma_{M5}$
$ N_3  \leq N_{3,Rd}$	$ -36.29  < 293.66$	<b>verified</b> (0.12)

### CHORD RESISTANCE

$V_{pl,Rd} = 293.66$ [kN]	Plastic resistance for shear	$V_{pl,Rd} = (A_v \cdot f_{y0}) / (\sqrt{3} \cdot \gamma_{M0})$
$ V_{Ed}  \leq V_{pl,Rd}$	$ 48.72  < 293.66$	<b>verified</b> (0.17)
$N_{0,Rd} = 928.60$ [kN]	Tension capacity	$N_{0,Rd} = [(A_0 - A_v) \cdot f_{y0} + A_v \cdot f_{y0} \cdot \sqrt{1 - (V_{Ed} / V_{pl,Rd})^2}] / \gamma_{M5}$
$ N_{01}  \leq N_{0,Rd}$	$ 551.32  < 928.60$	<b>verified</b> (0.59)

## VERIFICATION OF WELDS

### DIAGONAL 2

$\beta_w = 0.88$	Correlation coefficient	[Table 4.1]
$\gamma_{M2} = 1.25$	Partial safety factor	[Table 2.1]

#### Longitudinal weld

$\sigma_{\perp} = 36.00$ [MPa]	Normal stress in a weld	
$\tau_{\perp} = 36.00$ [MPa]	Perpendicular tangent stress	
$\tau_{\parallel} = 42.92$ [MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ 36.00  < 338.40$	<b>verified</b> (0.11)
$\sqrt{[\sigma_{\perp}^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)]} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$103.49 < 429.71$	<b>verified</b> (0.24)

#### Transverse inner weld

$\sigma_{\perp} = 63.25$ [MPa]	Normal stress in a weld	
$\tau_{\perp} = 32.96$ [MPa]	Perpendicular tangent stress	
$\tau_{\parallel} = 0.00$ [MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ 63.25  < 338.40$	<b>verified</b> (0.19)
$\sqrt{[\sigma_{\perp}^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)]} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$85.20 < 429.71$	<b>verified</b> (0.20)

#### Transverse outer weld

$\sigma_{\perp} = 29.30$ [MPa]	Normal stress in a weld	
$\tau_{\perp} = 61.51$ [MPa]	Perpendicular tangent stress	
$\tau_{\parallel} = 0.00$ [MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ 29.30  < 338.40$	<b>verified</b> (0.09)
$\sqrt{[\sigma_{\perp}^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)]} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$110.50 < 429.71$	<b>verified</b> (0.26)

### DIAGONAL 1

$\beta_w = 0.88$	Correlation coefficient	[Table 4.1]
$\gamma_{M2} = 1.25$	Partial safety factor	[Table 2.1]

#### Longitudinal weld

$\sigma_{\perp} = -8.53$ [MPa]	Normal stress in a weld	
$\tau_{\perp} = -8.53$ [MPa]	Perpendicular tangent stress	
$\tau_{\parallel} = -9.92$ [MPa]	Tangent stress	

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	90	251	0

$\sigma_{\perp} =$	-8.53	[MPa]	Normal stress in a weld		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -8.53  < 338.40$	verified (0.03)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$24.22 < 429.71$	verified (0.06)
<b>Transverse inner weld</b>					
$\sigma_{\perp} =$	-14.95	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-8.11	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -14.95  < 338.40$	verified (0.04)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$20.51 < 429.71$	verified (0.05)
<b>Transverse outer weld</b>					
$\sigma_{\perp} =$	-6.64	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-14.24	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -6.64  < 338.40$	verified (0.02)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$25.54 < 429.71$	verified (0.06)

### POST

$\beta_w =$	0.88	Correlation coefficient	[Table 4.1]
$\gamma_{M2} =$	1.25	Partial safety factor	[Table 2.1]

### Longitudinal weld

$\sigma_{\perp} =$	-41.34	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-41.34	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -41.34  < 338.40$	verified (0.12)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$82.69 < 429.71$	verified (0.19)
<b>Transverse inner weld</b>					
$\sigma_{\perp} =$	-68.61	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-68.61	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -68.61  < 338.40$	verified (0.20)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$137.23 < 429.71$	verified (0.32)

### REMARKS

Eccentricity is too large. 36 [mm] > 35 [mm]

**Connection conforms to the code**

Ratio 0.59

**Išvada: sąlyga tenkinama**

**Mazgas NR. 10**

	Robot Structural Analysis Professional 2023 <b>Design of truss node connection</b> EN 1993-1-8:2005/AC:2009	
		Ratio <b>0.60</b>

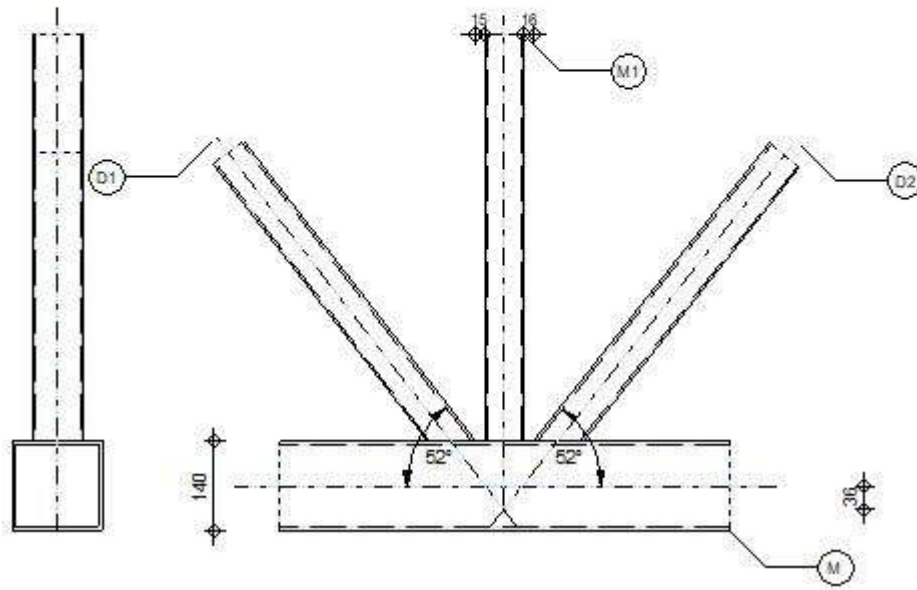
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	91	251	0

M1 - RECT 80x60x4

D1 - RECT 80x60x4

D2 - RECT 80x60x4

M - SQUA 140x140x5



## GENERAL

Connection no.: 10  
Connection name: Tube  
Structure node: 105  
Structure members: 123, 131, 132, 140

## GEOMETRY

## MEMBERS

	Chord	Diagonal 1	Diagonal 2	Post	
<b>Member no.:</b>	123	132	131	140	
<b>Section:</b>	SQUA 140x140x5	RECT 80x60x4	RECT 80x60x4	RECT 80x60x4	
	h	140	60	60	60 mm
	b <sub>f</sub>	140	80	80	80 mm
	t <sub>w</sub>	5	4	4	4 mm
	t <sub>f</sub>	5	4	4	4 mm
	r	5	4	4	4 mm
<b>Material:</b>	S 355	S 355	S 355	S 355	
	f <sub>y</sub>	355.00	355.00	355.00	355.00 MPa
	f <sub>u</sub>	470.00	470.00	470.00	470.00 MPa
<b>Angle</b>	θ	0.0	52.3	51.6	90.0 Deg
<b>Length</b>	l	13132	3069	3021	2397 mm

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Lapas	Lapų	Laida
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### OFFSET

$e_0 = 36$  [mm] Offset

### SPACINGS

$g_1 = 15$  [mm] Spacing of 1st diagonal

$g_2 = 16$  [mm] Spacing of 2nd diagonal

### WELDS

$a_d = 3$  [mm] Thickness of welds of diagonals and posts

### LOADS

Case: 71: ULS/61=1\*1.35 + 5\*0.78 + 4\*1.30 1\*1.35+5\*0.78+4\*1.30

### CHORD

$N_{01,Ed} = 479.93$  [kN] Axial force

$M_{01,Ed} = 0.10$  [kN\*m] Bending moment

$N_{02,Ed} = 551.32$  [kN] Axial force

$M_{02,Ed} = 0.11$  [kN\*m] Bending moment

### DIAGONAL 1

$N_1 = 80.71$  [kN] Axial force

$M_1 = 0.01$  [kN\*m] Bending moment

### DIAGONAL 2

$N_2 = -35.16$  [kN] Axial force

$M_2 = 0.01$  [kN\*m] Bending moment

### POST

$N_3 = -35.34$  [kN] Axial force

$M_3 = 0.01$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

### RESULTS

#### CONSIDER NON-AXIAL CONNECTION OF MEMBERS IN THE NODE

$M_0 = -2.60$  [kN\*m] Additional moment from eccentric connection of members

$M_0 = (N_{02} - N_{01}) * e_0$

$\Sigma E_{i,j} / L_i = 632274.74$  [kN\*m] Overall connection stiffness

$\Delta M_{01} = -1.04$  [kN\*m] Additional moment in the chord

$\Delta M_{02} = -1.04$  [kN\*m] Additional moment in the chord

$\Delta M_2 = -0.16$  [kN\*m] Additional moment in the diagonal

$\Delta M_1 = -0.16$  [kN\*m] Additional moment in the diagonal

$\Delta M_3 = -0.20$  [kN\*m] Additional moment in the diagonal

### CAPACITY VERIFICATION EUROCODE 3: EN 1993-1-8:2005

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$\gamma_{M5} = 1.00$  Partial safety factor [Table 2.1]

### FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS)

[Table 7.12] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

### GEOMETRICAL PARAMETERS

$\beta = 0.50$  Coefficient taking account of geometry of connection members  $\beta = (b_2 + h_2 + b_1 + h_1 + b_3 + h_3) / (6 \cdot b_0)$  [1.5 (6)]  
 $\gamma = 14.00$  Coefficient taking account of geometry of the chord  $\gamma = b_0 / (2 \cdot t_0)$  [1.5 (6)]  
 $k_n = 1.00$  Coefficient taking account of stresses in the chord  $k_n = 1.0$

### TUBE CHORD FACE FAILURE

#### DIAGONAL 2

$N_{2,Rd} = 188.46$  [kN] Compression capacity  $N_{2,Rd} = [8.9 \cdot k_n \cdot f_{y0} \cdot t_0^2 \cdot \sqrt{\gamma} / \sin(\theta_2)] \cdot \beta / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|-35.16| < 188.46$  **verified** (0.19)  
 $M_{2,Rd} = 2.58$  [kN\*m] Bending resistance  $M_{2,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_2 \cdot [1 / (2 \cdot \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_2 + \Delta M_2| \leq M_{2,Rd}$   $|-0.15| < 2.58$  **verified** (0.06)  
 $N_2 / N_{2,Rd} + (M_2 + \Delta M_2) / M_{2,Rd} \leq 1$   $0.25 < 1.00$  **verified** (0.25)

#### DIAGONAL 1

$N_{1,Rd} = 186.79$  [kN] Tension capacity  $N_{1,Rd} = [8.9 \cdot k_n \cdot f_{y0} \cdot t_0^2 \cdot \sqrt{\gamma} / \sin(\theta_1)] \cdot \beta / \gamma_{M5}$   
 $|N_1| \leq N_{1,Rd}$   $|80.71| < 186.79$  **verified** (0.43)  
 $M_{1,Rd} = 2.58$  [kN\*m] Bending resistance  $M_{1,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_1 \cdot [1 / (2 \cdot \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_1 + \Delta M_1| \leq M_{1,Rd}$   $|-0.15| < 2.58$  **verified** (0.06)  
 $N_1 / N_{1,Rd} + (M_1 + \Delta M_1) / M_{1,Rd} \leq 1$   $0.49 < 1.00$  **verified** (0.49)

#### POST

$N_{3,Rd} = 147.77$  [kN] Compression capacity  $N_{3,Rd} = [8.9 \cdot k_n \cdot f_{y0} \cdot t_0^2 \cdot \sqrt{\gamma} / \sin(\theta_3)] \cdot \beta / \gamma_{M5}$   
 $|N_3| \leq N_{3,Rd}$   $|-35.34| < 147.77$  **verified** (0.24)  
 $M_{3,Rd} = 2.58$  [kN\*m] Bending resistance  $M_{3,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_3 \cdot [1 / (2 \cdot \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_3 + \Delta M_3| \leq M_{3,Rd}$   $|-0.20| < 2.58$  **verified** (0.08)  
 $N_3 / N_{3,Rd} + (M_3 + \Delta M_3) / M_{3,Rd} \leq 1$   $0.31 < 1.00$  **verified** (0.31)

### TUBE BRACE FAILURE

#### DIAGONAL 2

$b_{eff} = 36$  [mm] Effective width in the connection of the diagonal to the chord  $b_{eff} = [10 / (b_0 / t_0)] \cdot [(f_{y0} \cdot t_0) / (f_{y2} \cdot t_2)] \cdot b_2$   
 $N_{2,Rd} = 311.99$  [kN] Compression capacity  $N_{2,Rd} = f_{y2} \cdot t_2 \cdot (2 \cdot h_2 - 4 \cdot t_2 + b_2 + b_{eff}) / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|-35.16| < 311.99$  **verified** (0.11)

#### DIAGONAL 1

$b_{eff} = 36$  [mm] Effective width in the connection of the diagonal to the chord  $b_{eff} = [10 / (b_0 / t_0)] \cdot [(f_{y0} \cdot t_0) / (f_{y1} \cdot t_1)] \cdot b_1$   
 $N_{1,Rd} = 311.99$  [kN] Tension capacity  $N_{1,Rd} = f_{y1} \cdot t_1 \cdot (2 \cdot h_1 - 4 \cdot t_1 + b_1 + b_{eff}) / \gamma_{M5}$   
 $|N_1| \leq N_{1,Rd}$   $|80.71| < 311.99$  **verified** (0.26)

#### POST

$b_{eff} = 36$  [mm] Effective width in the connection of the post to the chord  $b_{eff} = [10 / (b_0 / t_0)] \cdot [(f_{y0} \cdot t_0) / (f_{y3} \cdot t_3)] \cdot b_3$   
 $N_{3,Rd} = 311.99$  [kN] Compression capacity  $N_{3,Rd} = f_{y3} \cdot t_3 \cdot (2 \cdot h_3 - 4 \cdot t_3 + b_3 + b_{eff}) / \gamma_{M5}$   
 $|N_3| \leq N_{3,Rd}$   $|-35.34| < 311.99$  **verified** (0.11)

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	94	251	0

## CHORD SHEAR

### DIAGONAL 2

$A_v =$	14.33	[cm <sup>2</sup> ]	Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{2,Rd} =$	374.69	[kN]	Compression capacity	$N_{2,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_2)] / \gamma_{M5}$
$ N_2  \leq N_{2,Rd}$			$ -35.16  < 374.69$	verified (0.09)

### DIAGONAL 1

$A_v =$	14.33	[cm <sup>2</sup> ]	Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{1,Rd} =$	371.37	[kN]	Tension capacity	$N_{1,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_1)] / \gamma_{M5}$
$ N_1  \leq N_{1,Rd}$			$ 80.71  < 371.37$	verified (0.22)

### POST

$A_v =$	14.33	[cm <sup>2</sup> ]	Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{3,Rd} =$	293.79	[kN]	Compression capacity	$N_{3,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_3)] / \gamma_{M5}$
$ N_3  \leq N_{3,Rd}$			$ -35.34  < 293.79$	verified (0.12)

## CHORD RESISTANCE

$V_{pl,Rd} =$	293.79	[kN]	Plastic resistance for shear	$V_{pl,Rd} = (A_v \cdot f_{y0}) / (\sqrt{3} \cdot \gamma_{M0})$
$ V_{Ed}  \leq V_{pl,Rd}$			$ 63.85  < 293.79$	verified (0.22)
$N_{0,Rd} =$	923.48	[kN]	Tension capacity	$N_{0,Rd} = [(A_0 - A_v) \cdot f_{y0} + A_v \cdot f_{y0} \cdot \sqrt{1 - (V_{Ed} / V_{pl,Rd})^2}] / \gamma_{M5}$
$ N_{02}  \leq N_{0,Rd}$			$ 551.32  < 923.48$	verified (0.60)

## VERIFICATION OF WELDS

### DIAGONAL 2

$\beta_w =$	0.88		Correlation coefficient	[Table 4.1]
$\gamma_{M2} =$	1.25		Partial safety factor	[Table 2.1]
Longitudinal weld				
$\sigma_{\perp} =$	-20.85	[MPa]	Normal stress in a weld	
$\tau_{\perp} =$	-20.85	[MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	-24.25	[MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$			$ -20.85  < 338.40$	verified (0.06)
$\sqrt{[\sigma_{\perp}^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)]} \leq f_u / (\beta_w \cdot \gamma_{M2})$			$59.18 < 429.71$	verified (0.14)
Transverse inner weld				
$\sigma_{\perp} =$	-36.41	[MPa]	Normal stress in a weld	
$\tau_{\perp} =$	-19.58	[MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$			$ -36.41  < 338.40$	verified (0.11)
$\sqrt{[\sigma_{\perp}^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)]} \leq f_u / (\beta_w \cdot \gamma_{M2})$			$49.76 < 429.71$	verified (0.12)
Transverse outer weld				
$\sigma_{\perp} =$	-16.47	[MPa]	Normal stress in a weld	
$\tau_{\perp} =$	-34.91	[MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$			$ -16.47  < 338.40$	verified (0.05)
$\sqrt{[\sigma_{\perp}^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)]} \leq f_u / (\beta_w \cdot \gamma_{M2})$			$62.66 < 429.71$	verified (0.15)

### DIAGONAL 1

$\beta_w =$	0.88		Correlation coefficient	[Table 4.1]
$\gamma_{M2} =$	1.25		Partial safety factor	[Table 2.1]

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	95	251	0

**Longitudinal weld**

$\sigma_{\perp} =$	49.40	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	49.40	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	56.10	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ 49.40  < 338.40$	verified (0.15)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$138.58 < 429.71$	verified (0.32)

**Transverse inner weld**

$\sigma_{\perp} =$	86.72	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	49.36	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ 86.72  < 338.40$	verified (0.26)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$121.77 < 429.71$	verified (0.28)

**Transverse outer weld**

$\sigma_{\perp} =$	35.77	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	80.05	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ 35.77  < 338.40$	verified (0.11)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$143.18 < 429.71$	verified (0.33)

**POST**

$\beta_w =$	0.88	Correlation coefficient	[Table 4.1]
$\gamma_{M2} =$	1.25	Partial safety factor	[Table 2.1]

**Longitudinal weld**

$\sigma_{\perp} =$	-40.26	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-40.26	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	-0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -40.26  < 338.40$	verified (0.12)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$80.51 < 429.71$	verified (0.19)

**Transverse inner weld**

$\sigma_{\perp} =$	-67.05	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-67.05	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -67.05  < 338.40$	verified (0.20)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$134.09 < 429.71$	verified (0.31)

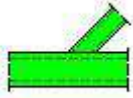
**REMARKS**

Eccentricity is too large.

36 [mm] &gt; 35 [mm]

**Connection conforms to the code Ratio 0.60**
**Išvada: sąlyga tenkinama**
**Mazgas NR. 11**

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	96	251	0



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## Design of truss node connection

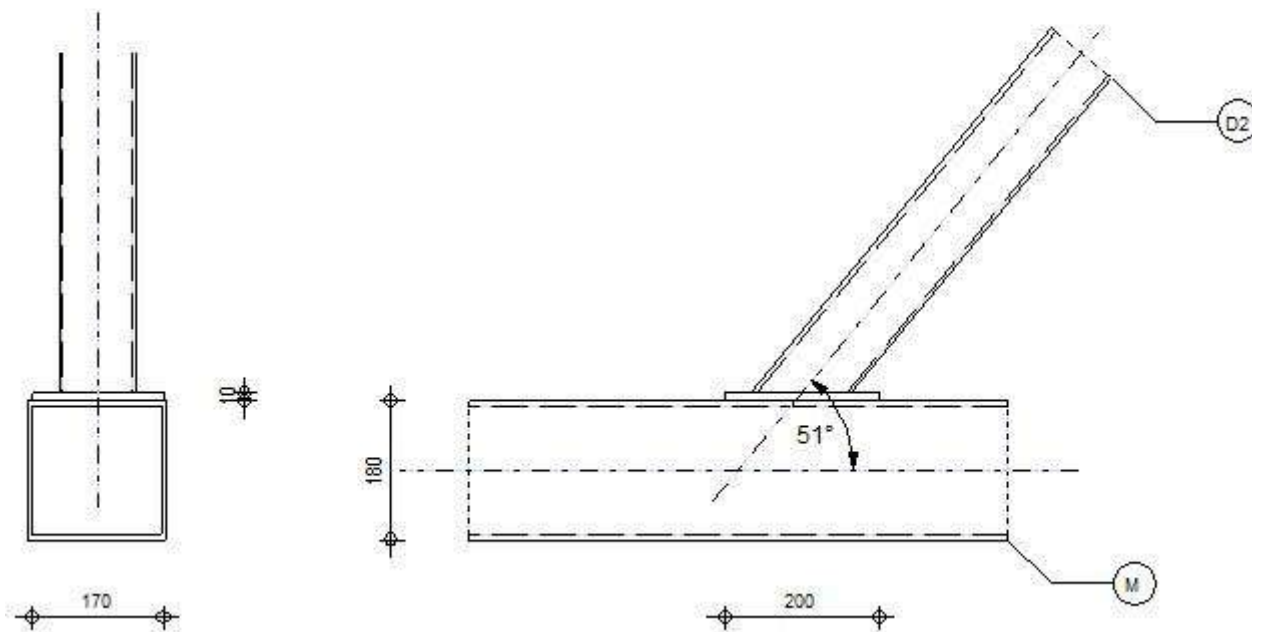
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Ratio  
**0.85**

D2 - SQUA 100x100x5

M - SQUA 180x180x6



### GENERAL

Connection no.: 11  
 Connection name: Tube  
 Structure node: 109  
 Structure members: 143, 136

### GEOMETRY

### MEMBERS

	Chord	Diagonal 1	Diagonal 2	Post	
<b>Member no.:</b>	143		136		
<b>Section:</b>	SQUA 180x180x6		SQUA 100x100x5		
h	180		100		mm
b <sub>f</sub>	180		100		mm
t <sub>w</sub>	6		5		mm
t <sub>f</sub>	6		5		mm
r	6		5		mm

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Lapas	Lapų	Laida
97	251	0

## MEMBERS

		Chord	Diagonal 1	Diagonal 2	Post
<b>Material:</b>		S 355		S 355	
	$f_y$	355.00		355.00	MPa
	$f_u$	470.00		470.00	MPa
<b>Angle</b>	$\theta$	0.0		50.5	Deg
<b>Length</b>	l	7653		2829	mm

## HORIZONTAL BRACKET

$b_{ph} = 170$  [mm] Width  
 $l_{ph} = 200$  [mm] Length  
 $t_{ph} = 10$  [mm] Thickness  
 Material: S 355  
 $f_{yph} = 355.00$  [MPa] Resistance

## WELDS

$a_d = 4$  [mm] Thickness of welds of diagonals and posts  
 $a_{st} = 4$  [mm] Thickness of stiffener welds

## LOADS

Case: 71: ULS/61=1\*1.35 + 5\*0.78 + 4\*1.30 1\*1.35+5\*0.78+4\*1.30

## CHORD

$N_{01,Ed} = 55.14$  [kN] Axial force  
 $M_{01,Ed} = -0.29$  [kN\*m] Bending moment  
 $N_{02,Ed} = -109.85$  [kN] Axial force  
 $M_{02,Ed} = -0.23$  [kN\*m] Bending moment

## DIAGONAL 2

$N_2 = 260.24$  [kN] Axial force  
 $M_2 = -0.10$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

## RESULTS

### CAPACITY VERIFICATION EUROCODE 3: EN 1993-1-8:2005

$\gamma_{M5} = 1.00$  Partial safety factor [Table 2.1]

### FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS)

[Table 7.10] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

### GEOMETRICAL PARAMETERS

$\beta = 0.59$  Coefficient taking account of geometry of connection members  $\beta = b_2/b_{ph}$  [1.5 (6)]  
 $\gamma = 9.00$  Coefficient taking account of geometry of the chord  $\gamma = b_0/(2*t_{ph})$  [1.5 (6)]  
 $n = 0.08$  Coefficient taking account of stresses in the chord  $n_0 = \sigma_{0,Ed}/f_{y0}$   
 $k_n = 1.00$  Coefficient taking account of stresses in the chord  $k_n = 1.0$

### TUBE CHORD FACE FAILURE

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	98	251	0

## DIAGONAL 2

$N_{2,Rd} = 457.03$ [kN] Tension capacity	$N_{2,Rd} = [(k_n * f_{yp} * t_{ph}^2) / (1 - \beta) * \sin(\theta_2)] * [2 * \beta / \sin(\theta_2) + 4 * \sqrt{1 - \beta}] / \gamma_{M5}$
$ N_2  \leq N_{2,Rd}$  260.24  < 457.03 <b>verified</b>	(0.57)
$M_{2,Rd} = 6.86$ [kN*m] Bending resistance	$M_{2,Rd} = k_n * f_{y0} * t_0^2 * h_2 * [1 / (2 * \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$
$ M_2  \leq M_{2,Rd}$  -0.10  < 6.86 <b>verified</b>	(0.02)
$N_2 / N_{2,Rd} + M_2 / M_{2,Rd} \leq 1$ 0.58 < 1.00 <b>verified</b>	(0.58)

## CHORD SHEAR

### DIAGONAL 2

$A_v = 21.60$ [cm <sup>2</sup> ] Shear area of the chord	$A_v = 2 * h_0 * t_0$
$N_{2,Rd} = 573.64$ [kN] Tension capacity	$N_{2,Rd} = f_{y0} * A_v / [\sqrt{3} * \sin(\theta_2)] / \gamma_{M5}$
$ N_2  \leq N_{2,Rd}$  260.24  < 573.64 <b>verified</b>	(0.45)

## CHORD RESISTANCE

$N_{0,Rd} = 1449.57$ [kN] Compression capacity	$N_{0,Rd} = (A_0 * f_{y0}) / \gamma_{M5}$
$ N_{02}  \leq N_{0,Rd}$  -109.85  < 1449.57 <b>verified</b>	(0.08)

## VERIFICATION OF WELDS

### DIAGONAL 2

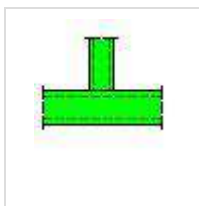
$\beta_w = 0.88$ Correlation coefficient	[Table 4.1]
$\gamma_{M2} = 1.25$ Partial safety factor	[Table 2.1]
Longitudinal weld	
$\sigma_{\perp} = 127.33$ [MPa] Normal stress in a weld	
$\tau_{\perp} = 127.33$ [MPa] Perpendicular tangent stress	
$\tau_{\parallel} = 152.04$ [MPa] Tangent stress	
$ \sigma_{\perp}  \leq 0.9 * f_u / \gamma_{M2}$  127.33  < 338.40 <b>verified</b>	(0.38)
$\sqrt{ \sigma_{\perp} ^2 + 3 * (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w * \gamma_{M2})$ 366.34 < 429.71 <b>verified</b>	(0.85)

**Connection conforms to the code**

Ratio 0.85

**Išvada: sąlyga tenkinama**

**Mazgas NR. 12**



Robot Structural Analysis Professional 2023

**Design of truss node connection**

EN 1993-1-8:2005/AC:2009

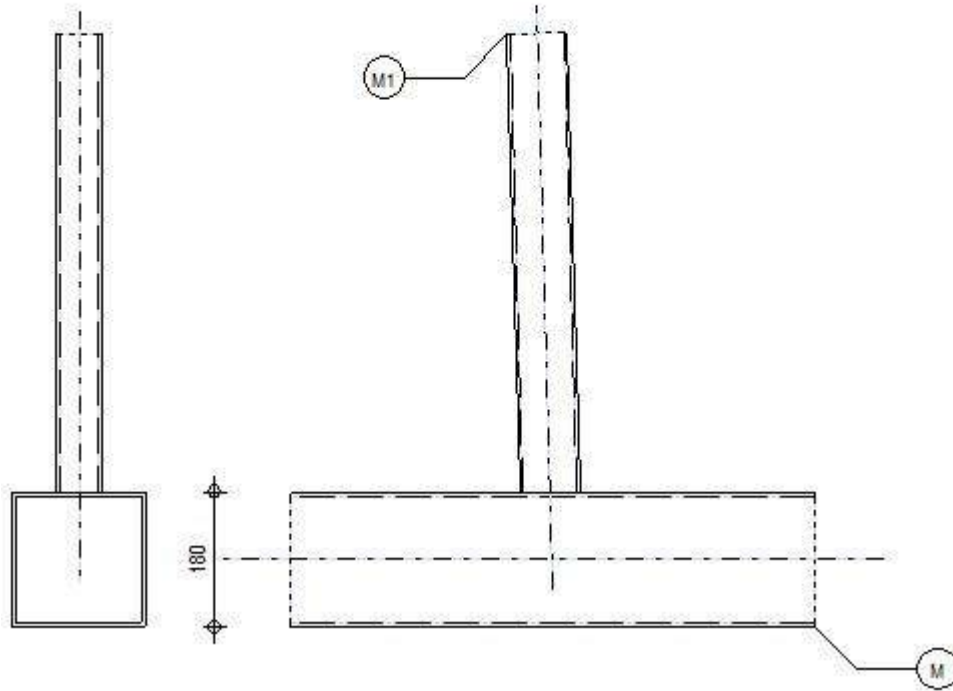


Ratio  
**0.28**

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	99	251	0

M1 - RECT 80x80x4

M - SQUA 180x180x6



## GENERAL

Connection no.: 12  
Connection name: Tube  
Structure node: 115  
Structure members: 143, 142

## GEOMETRY

## MEMBERS

	Chord	Diagonal 1	Diagonal 2	Post	
<b>Member no.:</b>	143			142	
<b>Section:</b>	SQUA 180x180x6			RECT 80x60x4	
h	180			80	mm
b <sub>f</sub>	180			60	mm
t <sub>w</sub>	6			4	mm
t <sub>f</sub>	6			4	mm
r	6			4	mm
<b>Material:</b>	S 355			S 355	
f <sub>y</sub>	355.00			355.00	MPa
f <sub>u</sub>	470.00			470.00	MPa
<b>Angle</b>	θ	0.0		91.7	Deg
<b>Length</b>	l	7653		2256	mm

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Lapas	Lapų	Laida
100	251	0

## WELDS

$a_d = 3$  [mm] Thickness of welds of diagonals and posts

## LOADS

Case: 66: ULS/56=1\*1.35 + 2\*0.91 + 5\*0.78 + 4\*1.30 1\*1.35+2\*0.91+5\*0.78+4\*1.30

## CHORD

$N_{01,Ed} = -108.77$  [kN] Axial force  
 $M_{01,Ed} = 0.00$  [kN\*m] Bending moment  
 $N_{02,Ed} = -109.97$  [kN] Axial force  
 $M_{02,Ed} = 0.00$  [kN\*m] Bending moment

## POST

$N_3 = -22.15$  [kN] Axial force  
 $M_3 = -0.03$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

## RESULTS

### CAPACITY VERIFICATION EUROCODE 3: EN 1993-1-8:2005

$\gamma_{M5} = 1.00$  Partial safety factor [Table 2.1]

**FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS)** [Table 7.11] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

#### GEOMETRICAL PARAMETERS

$\beta = 0.33$  Coefficient taking account of geometry of connection members  $\beta = b_3/b_0$  [1.5 (6)]  
 $\gamma = 15.00$  Coefficient taking account of geometry of the chord  $\gamma = b_0/(2*t_0)$  [1.5 (6)]  
 $n = 0.08$  Coefficient taking account of stresses in the chord  $n_0 = \sigma_{0,Ed}/f_{y0}$   
 $k_n = 1.00$  Coefficient taking account of stresses in the chord  $k_n = 1.0$

#### TUBE CHORD FACE FAILURE

##### POST

$\eta = 0.44$  Coefficient taking account of geometry of connection members  $\eta = h_3/b_0$   
 $N_{3,Rd} = 79.69$  [kN] Compression capacity  $N_{3,Rd} = [(k_n * f_{y0} * t_0^2) / (1 - \beta) * \sin(\theta_3)] * [2 * \eta / \sin(\theta_3) + 4 * \sqrt{1 - \beta}] / \gamma_{M5}$   
 $|N_3| \leq N_{3,Rd}$   $|-22.15| < 79.69$  **verified** (0.28)  
 $M_{3,Rd} = 4.34$  [kN\*m] Bending resistance  $M_{3,Rd} = k_n * f_{y0} * t_0^2 * h_3 * [1 / (2 * \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_3| \leq M_{3,Rd}$   $|-0.03| < 4.34$  **verified** (0.01)  
 $N_3/N_{3,Rd} + M_3/M_{3,Rd} \leq 1$   $0.28 < 1.00$  **verified** (0.28)

#### CHORD SHEAR

##### POST

$A_v = 21.60$  [cm<sup>2</sup>] Shear area of the chord  $A_v = 2 * h_0 * t_0$   
 $N_{3,Rd} = 442.91$  [kN] Compression capacity  $N_{3,Rd} = f_{y0} * A_v / [\sqrt{3} * \sin(\theta_3)] / \gamma_{M5}$   
 $|N_3| \leq N_{3,Rd}$   $|-22.15| < 442.91$  **verified** (0.05)

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	101	251	0

### CHORD RESISTANCE

$N_{0,Rd} = 1449.57$  [kN] Compression capacity  $N_{0,Rd} = (A_0 \cdot f_{y0}) / \gamma_{M5}$   
(0.08)  
 $|N_{02}| \leq N_{0,Rd}$   $|-109.97| < 1449.57$  **verified**

### VERIFICATION OF WELDS

#### POST

$\beta_w = 0.88$  Correlation coefficient [Table 4.1]  
 $\gamma_{M2} = 1.25$  Partial safety factor [Table 2.1]  
 Longitudinal weld  
 $\sigma_{\perp} = -29.57$  [MPa] Normal stress in a weld  
 $\tau_{\perp} = -29.57$  [MPa] Perpendicular tangent stress  
 $\tau_{\parallel} = 1.38$  [MPa] Tangent stress  
 $|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2}$   $|-29.57| < 338.40$  **verified** (0.09)  
 $\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$   $59.18 < 429.71$  **verified** (0.14)

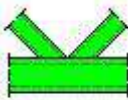

### REMARKS

Diagonal angle is too large.  $91.7$  [Deg] >  $90.0$  [Deg]

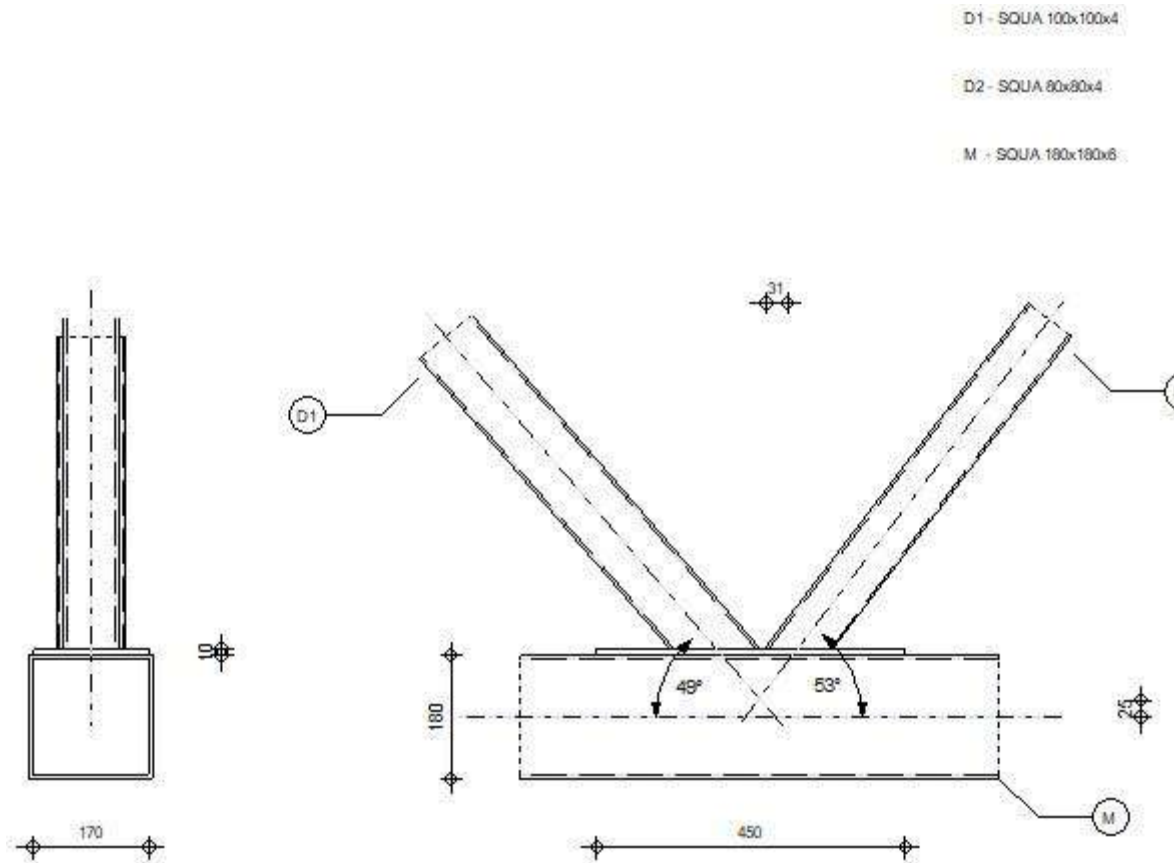
**Connection conforms to the code** Ratio 0.28

**Išvada: sąlyga tenkinama**

**Mazgas NR. 13**

	Robot Structural Analysis Professional 2023 <b>Design of truss node connection</b> EN 1993-1-8:2005/AC:2009	  Ratio <b>0.61</b>
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	102	251	0



## GENERAL

Connection no.: 13  
 Connection name: Tube  
 Structure node: 108  
 Structure members: 143, 134, 135

## GEOMETRY

## MEMBERS

	Chord	Diagonal 1	Diagonal 2	Post	
<b>Member no.:</b>	143	135	134		
<b>Section:</b>	SQUA 180x180x6	SQUA 100x100x4	SQUA 80x80x4		
h	180	100	80		mm
b <sub>f</sub>	180	100	80		mm
t <sub>w</sub>	6	4	4		mm
t <sub>f</sub>	6	4	4		mm
r	6	4	4		mm
<b>Material:</b>	S 355	S 355	S 355		
f <sub>y</sub>	355.00	355.00	355.00		MPa
f <sub>u</sub>	470.00	470.00	470.00		MPa
<b>Angle</b>	θ	49.2	52.7		Deg
<b>Length</b>	l	7653	2977		mm

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	103	251	0

### OFFSET

$e_0 = -25$  [mm] Offset

### SPACINGS

$g_2 = 31$  [mm] Spacing of 2nd diagonal

### HORIZONTAL BRACKET

$b_{ph} = 170$  [mm] Width  
 $l_{ph} = 450$  [mm] Length  
 $t_{ph} = 10$  [mm] Thickness  
 Material: S 355  
 $f_{yph} = 355.00$  [MPa] Resistance

### WELDS

$a_d = 3$  [mm] Thickness of welds of diagonals and posts  
 $a_{st} = 4$  [mm] Thickness of stiffener welds

### LOADS

Case: 71: ULS/61=1\*1.35 + 5\*0.78 + 4\*1.30 1\*1.35+5\*0.78+4\*1.30

### CHORD

$N_{01,Ed} = -107.57$  [kN] Axial force  
 $M_{01,Ed} = 0.21$  [kN\*m] Bending moment  
 $N_{02,Ed} = -349.92$  [kN] Axial force  
 $M_{02,Ed} = 0.22$  [kN\*m] Bending moment

### DIAGONAL 1

$N_1 = -223.38$  [kN] Axial force  
 $M_1 = -0.00$  [kN\*m] Bending moment

### DIAGONAL 2

$N_2 = 158.50$  [kN] Axial force  
 $M_2 = -0.02$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

### RESULTS

#### CONSIDER NON-AXIAL CONNECTION OF MEMBERS IN THE NODE

$M_0 = -6.06$  [kN\*m] Additional moment from eccentric connection of members  $M_0 = (N_{02}-N_{01}) * e_0$   
 $\Sigma E_i J_i / L_i = 2473166.12$  [kN\*m] Overall connection stiffness  
 $\Delta M_{01} = -2.74$  [kN\*m] Additional moment in the chord  
 $\Delta M_{02} = -2.74$  [kN\*m] Additional moment in the chord  
 $\Delta M_2 = -0.19$  [kN\*m] Additional moment in the diagonal  
 $\Delta M_1 = -0.39$  [kN\*m] Additional moment in the diagonal

### CAPACITY VERIFICATION EUROCODE 3: EN 1993-1-8:2005

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	104	251	0

$\gamma_{M5} = 1.00$  Partial safety factor [Table 2.1]

### FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS)

[Table 7.10] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

### GEOMETRICAL PARAMETERS

$\beta = 0.50$  Coefficient taking account of geometry of connection members  $\beta = (b_2 + b_1) / (2 \cdot b_0)$  [1.5 (6)]  
 $\gamma = 9.00$  Coefficient taking account of geometry of the chord  $\gamma = b_0 / (2 \cdot t_{ph})$  [1.5 (6)]  
 $n = 0.24$  Coefficient taking account of stresses in the chord  $n_0 = \sigma_{0,Ed} / f_{y0}$   
 $k_n = 1.00$  Coefficient taking account of stresses in the chord  $k_n = 1.0$

### TUBE CHORD FACE FAILURE

#### DIAGONAL 2

$N_{2,Rd} = 595.91$  [kN] Tension capacity  $N_{2,Rd} = 8.9 \cdot k_n \cdot f_{y0} \cdot t_{ph}^2 \cdot \sqrt{\gamma} / \sin(\theta_2) \cdot \beta$   
 $|N_2| \leq N_{2,Rd}$   $|158.50| < 595.91$  **verified** (0.27)  
 $M_{2,Rd} = 4.95$  [kN\*m] Bending resistance  $M_{2,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_2 \cdot [1 / (2 \cdot \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_2 + \Delta M_2| \leq M_{2,Rd}$   $|-0.21| < 4.95$  **verified** (0.04)  
 $N_2 / N_{2,Rd} + (M_2 + \Delta M_2) / M_{2,Rd} \leq 1$   $0.31 < 1.00$  **verified** (0.31)

#### DIAGONAL 1

$N_{1,Rd} = 625.63$  [kN] Compression capacity  $N_{1,Rd} = 8.9 \cdot k_n \cdot f_{y0} \cdot t_{ph}^2 \cdot \sqrt{\gamma} / \sin(\theta_1) \cdot \beta$   
 $|N_1| \leq N_{1,Rd}$   $|-223.38| < 625.63$  **verified** (0.36)  
 $M_{1,Rd} = 6.18$  [kN\*m] Bending resistance  $M_{1,Rd} = k_n \cdot f_{y0} \cdot t_0^2 \cdot h_1 \cdot [1 / (2 \cdot \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_1 + \Delta M_1| \leq M_{1,Rd}$   $|-0.39| < 6.18$  **verified** (0.06)  
 $N_1 / N_{1,Rd} + (M_1 + \Delta M_1) / M_{1,Rd} \leq 1$   $0.42 < 1.00$  **verified** (0.42)

### CHORD PUNCHING

#### DIAGONAL 2

$b_{e,p} = 44$  [mm] Effective width for punching shear  $b_{e,p} = (10 \cdot b_2) / (b_0 / t_0)$   
 $N_{2,Rd} = 839.20$  [kN] Tension capacity  $N_{2,Rd} = f_{y0} \cdot t_{ph} / (\sqrt{3} \cdot \sin(\theta_2)) \cdot [2 \cdot h_2 / \sin(\theta_2) + b_2 + b_{e,p}] / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|158.50| < 839.20$  **verified** (0.19)

#### DIAGONAL 1

$b_{e,p} = 56$  [mm] Effective width for punching shear  $b_{e,p} = (10 \cdot b_1) / (b_0 / t_0)$   
 $N_{1,Rd} = 1135.23$  [kN] Compression capacity  $N_{1,Rd} = f_{y0} \cdot t_{ph} / (\sqrt{3} \cdot \sin(\theta_1)) \cdot [2 \cdot h_1 / \sin(\theta_1) + b_1 + b_{e,p}] / \gamma_{M5}$   
 $|N_1| \leq N_{1,Rd}$   $|-223.38| < 1135.23$  **verified** (0.20)

### CHORD SHEAR

#### DIAGONAL 2

$A_v = 23.37$  [cm<sup>2</sup>] Shear area of the chord  $A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$   
 $N_{2,Rd} = 602.33$  [kN] Tension capacity  $N_{2,Rd} = f_{y0} \cdot A_v / (\sqrt{3} \cdot \sin(\theta_2)) / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|158.50| < 602.33$  **verified** (0.26)

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	105	251	0

## DIAGONAL 1

$A_v = 23.37$ [cm <sup>2</sup> ]	Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{1,Rd} = 632.37$ [kN]	Compression capacity	$N_{1,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_1)] / \gamma_{M5}$
$ N_1  \leq N_{1,Rd}$	$ -223.38  < 632.37$	verified (0.35)

## CHORD RESISTANCE

$V_{pl,Rd} = 479.03$ [kN]	Plastic resistance for shear	$V_{pl,Rd} = (A_v \cdot f_{y0}) / (\sqrt{3} \cdot \gamma_{M0})$
$ V_{Ed}  \leq V_{pl,Rd}$	$ 169.22  < 479.03$	verified (0.35)
$N_{0,Rd} = 1396.08$ [kN]	Compression capacity	$N_{0,Rd} = [(A_0 - A_v) \cdot f_{y0} + A_v \cdot f_{y0} \cdot \sqrt{1 - (V_{Ed}/V_{pl,Rd})^2}] / \gamma_{M5}$
$ N_{02}  \leq N_{0,Rd}$	$ -349.92  < 1396.08$	verified (0.25)

## VERIFICATION OF WELDS

### DIAGONAL 2

$\beta_w = 0.88$	Correlation coefficient	[Table 4.1]
$\gamma_{M2} = 1.25$	Partial safety factor	[Table 2.1]
Longitudinal weld		
$\sigma_{\perp} = 85.66$ [MPa]	Normal stress in a weld	
$\tau_{\perp} = 85.66$ [MPa]	Perpendicular tangent stress	
$\tau_{\parallel} = 94.28$ [MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ 85.66  < 338.40$	verified (0.25)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$236.69 < 429.71$	verified (0.55)
Transverse inner weld		
$\sigma_{\perp} = 146.24$ [MPa]	Normal stress in a weld	
$\tau_{\perp} = 82.87$ [MPa]	Perpendicular tangent stress	
$\tau_{\parallel} = 0.00$ [MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ 146.24  < 338.40$	verified (0.43)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$204.91 < 429.71$	verified (0.48)
Transverse outer weld		
$\sigma_{\perp} = 60.33$ [MPa]	Normal stress in a weld	
$\tau_{\perp} = 135.08$ [MPa]	Perpendicular tangent stress	
$\tau_{\parallel} = 0.00$ [MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ 60.33  < 338.40$	verified (0.18)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$241.62 < 429.71$	verified (0.56)

### DIAGONAL 1

$\beta_w = 0.88$	Correlation coefficient	[Table 4.1]
$\gamma_{M2} = 1.25$	Partial safety factor	[Table 2.1]
Longitudinal weld		
$\sigma_{\perp} = -85.95$ [MPa]	Normal stress in a weld	
$\tau_{\perp} = -85.95$ [MPa]	Perpendicular tangent stress	
$\tau_{\parallel} = -104.76$ [MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ -85.95  < 338.40$	verified (0.25)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$249.95 < 429.71$	verified (0.58)
Transverse inner weld		
$\sigma_{\perp} = -145.90$ [MPa]	Normal stress in a weld	
$\tau_{\perp} = -66.91$ [MPa]	Perpendicular tangent stress	
$\tau_{\parallel} = 0.00$ [MPa]	Tangent stress	

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	106	251	0

$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ -145.90  < 338.40$	verified	(0.43)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$186.33 < 429.71$	verified	(0.43)

Transverse outer weld

$\sigma_{\perp} =$	-66.80 [MPa]	Normal stress in a weld
$\tau_{\perp} =$	-145.85 [MPa]	Perpendicular tangent stress
$\tau_{\parallel} =$	0.00 [MPa]	Tangent stress

$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	$ -66.80  < 338.40$	verified	(0.20)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$	$261.31 < 429.71$	verified	(0.61)

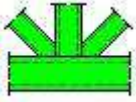

**REMARKS**

Ratio of the distance of members to the chord width is too small  $0.17 < 0.25$

<b>Connection conforms to the code</b>	Ratio	0.61
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**Išvada: sąlyga tenkinama**

**Mazgas NR. 14**

	Robot Structural Analysis Professional 2023 <b>Design of truss node connection</b> EN 1993-1-8:2005/AC:2009	
		Ratio <b>0.70</b>

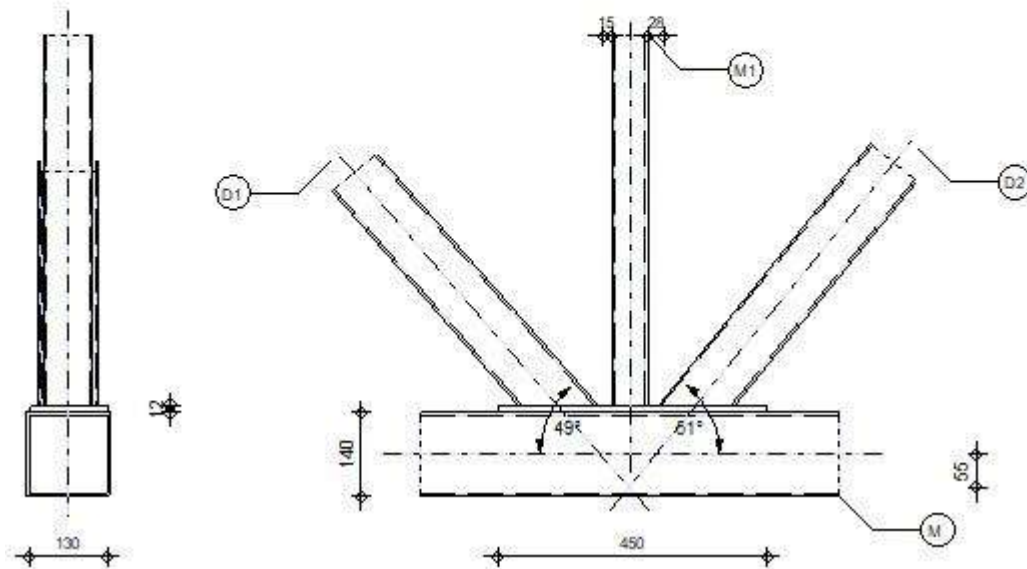
IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	107	251	0

M1 - RECT 80x80x4

D1 - SQUA 100x100x5

D2 - SQUA 100x100x4

M - SQUA 140x140x5



## GENERAL

Connection no.: 14  
Connection name: Tube  
Structure node: 62  
Structure members: 124, 135, 136, 142

## GEOMETRY

## MEMBERS

	Chord	Diagonal 1	Diagonal 2	Post	
<b>Member no.:</b>	124	136	135	142	
<b>Section:</b>	SQUA 140x140x5	SQUA 100x100x5	SQUA 100x100x4	RECT 80x60x4	
	h	140	100	100	60 mm
	b <sub>f</sub>	140	100	100	80 mm
	t <sub>w</sub>	5	5	4	4 mm
	t <sub>f</sub>	5	5	4	4 mm
	r	5	5	4	4 mm
<b>Material:</b>	S 355	S 355	S 355	S 355	
	f <sub>y</sub>	355.00	355.00	355.00	355.00 MPa
	f <sub>u</sub>	470.00	470.00	470.00	470.00 MPa
<b>Angle</b>	θ	0.0	48.8	51.0	90.0 Deg
<b>Length</b>	l	5618	2829	2977	2256 mm

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	108	251	0

### OFFSET

$e_0 = 55$  [mm] Offset

### SPACINGS

$g_1 = 15$  [mm] Spacing of 1st diagonal

$g_2 = 28$  [mm] Spacing of 2nd diagonal

### HORIZONTAL BRACKET

$b_{ph} = 130$  [mm] Width

$l_{ph} = 450$  [mm] Length

$t_{ph} = 12$  [mm] Thickness

Material: S 355

$f_{yph} = 355.00$  [MPa] Resistance

### WELDS

$a_d = 3$  [mm] Thickness of welds of diagonals and posts

$a_{st} = 5$  [mm] Thickness of stiffener welds

### LOADS

Case: 71: ULS/61=1\*1.35 + 5\*0.78 + 4\*1.30 1\*1.35+5\*0.78+4\*1.30

### CHORD

$N_{01,Ed} = 0.00$  [kN] Axial force

$M_{01,Ed} = 0.00$  [kN\*m] Bending moment

$N_{02,Ed} = 311.64$  [kN] Axial force

$M_{02,Ed} = -0.01$  [kN\*m] Bending moment

### DIAGONAL 1

$N_1 = 258.68$  [kN] Axial force

$M_1 = -0.01$  [kN\*m] Bending moment

### DIAGONAL 2

$N_2 = -223.74$  [kN] Axial force

$M_2 = 0.00$  [kN\*m] Bending moment

### POST

$N_3 = -20.12$  [kN] Axial force

$M_3 = -0.00$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

### RESULTS

#### CONSIDER NON-AXIAL CONNECTION OF MEMBERS IN THE NODE

$M_0 = -17.15$  [kN\*m] Additional moment from eccentric connection of members  $M_0 = (N_{02}-N_{01}) * e_0$

$\Sigma E_{ij}J_i/L_i = 1595115.69$  [kN\*m] Overall connection stiffness

$\Delta M_{01} = -6.36$  [kN\*m] Additional moment in the chord

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$\Delta M_{02} =$	-6.36 [kN*m]	Additional moment in the chord
$\Delta M_2 =$	-1.72 [kN*m]	Additional moment in the diagonal
$\Delta M_1 =$	-2.16 [kN*m]	Additional moment in the diagonal
$\Delta M_3 =$	-0.56 [kN*m]	Additional moment in the diagonal

## CAPACITY VERIFICATION EUROCODE 3: EN 1993-1-8:2005

$\gamma_{M5} =$	1.00	Partial safety factor	[Table 2.1]
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### FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS)

[Table 7.12] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

### GEOMETRICAL PARAMETERS

$\beta =$	0.6 4 members	Coefficient taking account of geometry of connection	$\beta = (b_2 + h_2 + b_1 + h_1 + b_3 + h_3) / (6 * b_0)$ [1.5 (6)]
$\gamma =$	5.8 3	Coefficient taking account of geometry of the chord	$\gamma = b_0 / (2 * t_{ph})$ [1.5 (6)]
$n =$	0.3 3	Coefficient taking account of stresses in the chord	$n_0 = \sigma_{0,Ed} / f_{y0}$
$k_n =$	1.0 0	Coefficient taking account of stresses in the chord	$k_n = 1.0$

## TUBE CHORD FACE FAILURE

### DIAGONAL 2

$N_{2,Rd} = 909.43$ [kN]	Compression capacity	$N_{2,Rd} = [8.9 * k_n * f_{y0} * t_{ph}^2 * \sqrt{\gamma} / \sin(\theta_2)] * \beta / \gamma_{M5}$
$ N_2  \leq N_{2,Rd}$	$ -223.74  < 909.43$ <b>verified</b>	(0.25)
$M_{2,Rd} = 5.37$ [kN*m]	Bending resistance	$M_{2,Rd} = k_n * f_{y0} * t_0^2 * h_2 * [1 / (2 * \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$
$ M_2 + \Delta M_2  \leq M_{2,Rd}$	$ -1.72  < 5.37$ <b>verified</b>	(0.32)
$N_2 / N_{2,Rd} + (M_2 + \Delta M_2) / M_{2,Rd} \leq 1$	$0.57 < 1.00$ <b>verified</b>	(0.57)

### DIAGONAL 1

$N_{1,Rd} = 938.94$ [kN]	Tension capacity	$N_{1,Rd} = [8.9 * k_n * f_{y0} * t_{ph}^2 * \sqrt{\gamma} / \sin(\theta_1)] * \beta / \gamma_{M5}$
$ N_1  \leq N_{1,Rd}$	$ 258.68  < 938.94$ <b>verified</b>	(0.28)
$M_{1,Rd} = 5.37$ [kN*m]	Bending resistance	$M_{1,Rd} = k_n * f_{y0} * t_0^2 * h_1 * [1 / (2 * \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$
$ M_1 + \Delta M_1  \leq M_{1,Rd}$	$ -2.17  < 5.37$ <b>verified</b>	(0.40)
$N_1 / N_{1,Rd} + (M_1 + \Delta M_1) / M_{1,Rd} \leq 1$	$0.68 < 1.00$ <b>verified</b>	(0.68)

### POST

$N_{3,Rd} = 706.40$ [kN]	Compression capacity	$N_{3,Rd} = [8.9 * k_n * f_{y0} * t_{ph}^2 * \sqrt{\gamma} / \sin(\theta_3)] * \beta / \gamma_{M5}$
$ N_3  \leq N_{3,Rd}$	$ -20.12  < 706.40$ <b>verified</b>	(0.03)
$M_{3,Rd} = 3.04$ [kN*m]	Bending resistance	$M_{3,Rd} = k_n * f_{y0} * t_0^2 * h_3 * [1 / (2 * \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$
$ M_3 + \Delta M_3  \leq M_{3,Rd}$	$ -0.56  < 3.04$ <b>verified</b>	(0.19)
$N_3 / N_{3,Rd} + (M_3 + \Delta M_3) / M_{3,Rd} \leq 1$	$0.21 < 1.00$ <b>verified</b>	(0.21)

## TUBE BRACE FAILURE

### DIAGONAL 2

$b_{eff} = 100$  [mm] Effective width in the connection of the diagonal to the chord

$b_{eff} = b_2$

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	110	251	0

$$N_{2,Rd} = 545.28 \text{ [kN]} \text{ Compression capacity} \quad N_{2,Rd} = f_{y2} \cdot t_2 \cdot (2 \cdot h_2 - 4 \cdot t_2 + b_2 + b_{eff}) / \gamma_{M5}$$

$$|N_2| \leq N_{2,Rd} \quad |-223.74| < 545.28 \text{ verified} \quad (0.41)$$

### DIAGONAL 1

$$b_{eff} = 100 \text{ [mm]} \text{ Effective width in the connection of the diagonal to the chord} \quad b_{eff} = b_1$$

$$N_{1,Rd} = 674.50 \text{ [kN]} \text{ Tension capacity} \quad N_{1,Rd} = f_{y1} \cdot t_1 \cdot (2 \cdot h_1 - 4 \cdot t_1 + b_1 + b_{eff}) / \gamma_{M5}$$

$$|N_1| \leq N_{1,Rd} \quad |258.68| < 674.50 \text{ verified} \quad (0.38)$$

### POST

$$b_{eff} = 80 \text{ [mm]} \text{ Effective width in the connection of the post to the chord} \quad b_{eff} = b_3$$

$$N_{3,Rd} = 374.88 \text{ [kN]} \text{ Compression capacity} \quad N_{3,Rd} = f_{y3} \cdot t_3 \cdot (2 \cdot h_3 - 4 \cdot t_3 + b_3 + b_{eff}) / \gamma_{M5}$$

$$|N_3| \leq N_{3,Rd} \quad |-20.12| < 374.88 \text{ verified} \quad (0.05)$$

## CHORD SHEAR

### DIAGONAL 2

$$A_v = 14.30 \text{ [cm}^2\text{]} \text{ Shear area of the chord} \quad A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$$

$$N_{2,Rd} = 377.20 \text{ [kN]} \text{ Compression capacity} \quad N_{2,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_2)] / \gamma_{M5}$$

$$|N_2| \leq N_{2,Rd} \quad |-223.74| < 377.20 \text{ verified} \quad (0.59)$$

### DIAGONAL 1

$$A_v = 14.30 \text{ [cm}^2\text{]} \text{ Shear area of the chord} \quad A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$$

$$N_{1,Rd} = 389.44 \text{ [kN]} \text{ Tension capacity} \quad N_{1,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_1)] / \gamma_{M5}$$

$$|N_1| \leq N_{1,Rd} \quad |258.68| < 389.44 \text{ verified} \quad (0.66)$$

### POST

$$A_v = 14.30 \text{ [cm}^2\text{]} \text{ Shear area of the chord} \quad A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$$

$$N_{3,Rd} = 292.99 \text{ [kN]} \text{ Compression capacity} \quad N_{3,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_3)] / \gamma_{M5}$$

$$|N_3| \leq N_{3,Rd} \quad |-20.12| < 292.99 \text{ verified} \quad (0.07)$$

## CHORD RESISTANCE

$$V_{pl,Rd} = 292.99 \text{ [kN]} \text{ Plastic resistance for shear} \quad V_{pl,Rd} = (A_v \cdot f_{y0}) / (\sqrt{3} \cdot \gamma_{M0})$$

$$|V_{Ed}| \leq V_{pl,Rd} \quad |194.62| < 292.99 \text{ verified} \quad (0.66)$$

$$N_{0,Rd} = 807.52 \text{ [kN]} \text{ Tension capacity} \quad N_{0,Rd} = [(A_0 - A_v) \cdot f_{y0} + A_v \cdot f_{y0} \cdot \sqrt{1 - (V_{Ed} / V_{pl,Rd})^2}] / \gamma_{M5}$$

$$|N_{02}| \leq N_{0,Rd} \quad |311.64| < 807.52 \text{ verified} \quad (0.39)$$

## VERIFICATION OF WELDS

### DIAGONAL 2

$$\beta_w = 0.88 \quad \text{Correlation coefficient} \quad [\text{Table 4.1}]$$

$$\gamma_{M2} = 1.25 \quad \text{Partial safety factor} \quad [\text{Table 2.1}]$$

#### Longitudinal weld

$$\sigma_{\perp} = -89.89 \text{ [MPa]} \text{ Normal stress in a weld}$$

$$\tau_{\perp} = -89.89 \text{ [MPa]} \text{ Perpendicular tangent stress}$$

$$\tau_{\parallel} = -104.88 \text{ [MPa]} \text{ Tangent stress}$$

$$|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2} \quad |-89.89| < 338.40 \text{ verified} \quad (0.27)$$

$$\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2}) \quad 255.59 < 429.71 \text{ verified} \quad (0.59)$$

#### Transverse inner weld

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	111	251	0

$\sigma_{\perp} =$	-153.55	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-78.39	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -153.55  < 338.40$	verified (0.45)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$204.97 < 429.71$	verified (0.48)

#### Transverse outer weld

$\sigma_{\perp} =$	-70.17	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-149.63	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -70.17  < 338.40$	verified (0.21)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$268.50 < 429.71$	verified (0.62)

### DIAGONAL 1

$\beta_w =$	0.88	Correlation coefficient	[Table 4.1]
$\gamma_{M2} =$	1.25	Partial safety factor	[Table 2.1]

#### Longitudinal weld

$\sigma_{\perp} =$	98.47	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	98.47	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	121.94	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ 98.47  < 338.40$	verified (0.29)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$288.78 < 429.71$	verified (0.67)

#### Transverse inner weld

$\sigma_{\perp} =$	168.53	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	76.36	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ 168.53  < 338.40$	verified (0.50)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$214.23 < 429.71$	verified (0.50)

#### Transverse outer weld

$\sigma_{\perp} =$	76.55	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	168.62	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ 76.55  < 338.40$	verified (0.23)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$301.92 < 429.71$	verified (0.70)

### POST

$\beta_w =$	0.88	Correlation coefficient	[Table 4.1]
$\gamma_{M2} =$	1.25	Partial safety factor	[Table 2.1]

#### Longitudinal weld

$\sigma_{\perp} =$	-22.92	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-22.92	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	-0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -22.92  < 338.40$	verified (0.07)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$45.84 < 429.71$	verified (0.11)

#### Transverse inner weld

$\sigma_{\perp} =$	-38.52	[MPa]	Normal stress in a weld		
$\tau_{\perp} =$	-38.52	[MPa]	Perpendicular tangent stress		
$\tau_{\parallel} =$	0.00	[MPa]	Tangent stress		
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$				$ -38.52  < 338.40$	verified (0.11)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$				$77.03 < 429.71$	verified (0.18)

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	112	251	0

## REMARKS

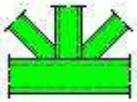

Eccentricity is too large.

55 [mm] > 35 [mm]

Connection conforms to the code	Ratio	0.70
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**Išvada: sąlyga tenkinama**

**Mazgas NR. 15**

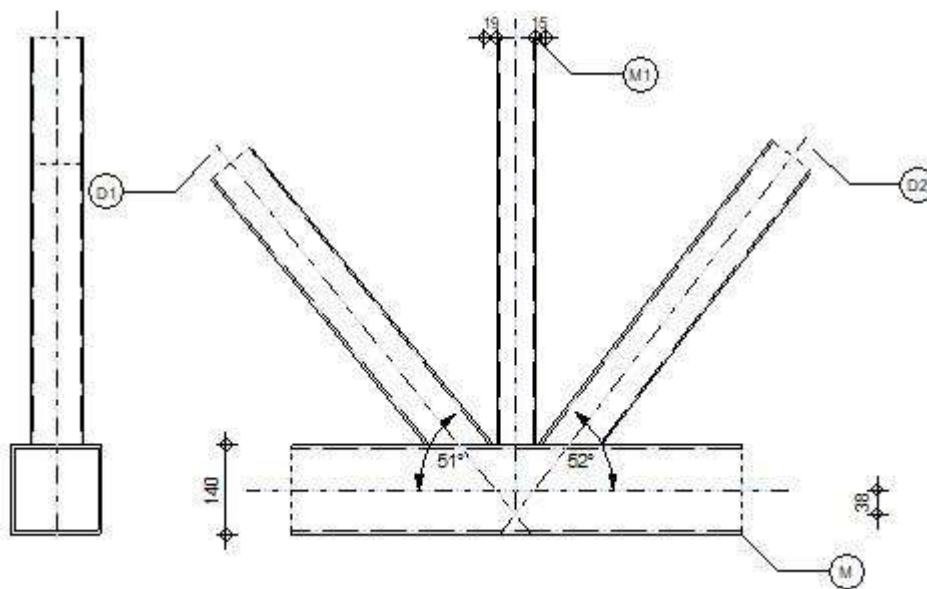
	Robot Structural Analysis Professional 2023 <b>Design of truss node connection</b> EN 1993-1-8:2005/AC:2009	
		Ratio <b>0.86</b>

M1 - RECT 80x80x4

D1 - SQUA 80x80x4

D2 - SQUA 80x80x4

M - SQUA 140x140x5



## GENERAL

Connection no.: 15  
 Connection name: Tube  
 Structure node: 107  
 Structure members: 124, 133, 134, 141

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	113	251	0

## GEOMETRY

### MEMBERS

	Chord	Diagonal 1	Diagonal 2	Post		
<b>Member no.:</b>	124	134	133	141		
<b>Section:</b>	SQUA 140x140x5	SQUA 80x80x4	SQUA 80x80x4	RECT 80x60x4		
h	140	80	80	60	mm	
b <sub>f</sub>	140	80	80	80	mm	
t <sub>w</sub>	5	4	4	4	mm	
t <sub>f</sub>	5	4	4	4	mm	
r	5	4	4	4	mm	
<b>Material:</b>	S 355	S 355	S 355	S 355		
f <sub>y</sub>	355.00	355.00	355.00	355.00	MPa	
f <sub>t</sub>	470.00	470.00	470.00	470.00	MPa	
<b>Angle</b>	θ	0.0	51.0	52.3	90.0	Deg
<b>Length</b>	l	5618	2977	3065	2369	mm

### OFFSET

e<sub>0</sub> = 38 [mm] Offset

### SPACINGS

g<sub>1</sub> = 19 [mm] Spacing of 1st diagonal

g<sub>2</sub> = 15 [mm] Spacing of 2nd diagonal

### WELDS

a<sub>d</sub> = 3 [mm] Thickness of welds of diagonals and posts

### LOADS

Case: 71: ULS/61=1\*1.35 + 5\*0.78 + 4\*1.30 1\*1.35+5\*0.78+4\*1.30

### CHORD

N<sub>01,Ed</sub> = 311.64 [kN] Axial force

M<sub>01,Ed</sub> = 0.16 [kN\*m] Bending moment

N<sub>02,Ed</sub> = 480.33 [kN] Axial force

M<sub>02,Ed</sub> = 0.15 [kN\*m] Bending moment

### DIAGONAL 1

N<sub>1</sub> = 158.22 [kN] Axial force

M<sub>1</sub> = 0.01 [kN\*m] Bending moment

### DIAGONAL 2

N<sub>2</sub> = -111.98 [kN] Axial force

M<sub>2</sub> = 0.02 [kN\*m] Bending moment

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	114	251	0

## POST

$N_3 = -33.47$  [kN] Axial force  
 $M_3 = 0.00$  [kN\*m] Bending moment

Shear forces were not included in the connection verification. The connection was designed as a truss node.

## RESULTS

### CONSIDER NON-AXIAL CONNECTION OF MEMBERS IN THE NODE

$M_0 = -6.42$  [kN\*m] Additional moment from eccentric connection of members  $M_0 = (N_{02} - N_{01}) * e_0$   
 $\Sigma E_i J_i / L_i = 1386139.83$  [kN\*m] Overall connection stiffness  
 $\Delta M_{01} = -2.74$  [kN\*m] Additional moment in the chord  
 $\Delta M_{02} = -2.74$  [kN\*m] Additional moment in the chord  
 $\Delta M_2 = -0.35$  [kN\*m] Additional moment in the diagonal  
 $\Delta M_1 = -0.36$  [kN\*m] Additional moment in the diagonal  
 $\Delta M_3 = -0.23$  [kN\*m] Additional moment in the diagonal

### CAPACITY VERIFICATION EUROCODE 3: EN 1993-1-8:2005

$\gamma_{M5} = 1.00$  Partial safety factor [Table 2.1]

FAILURE MODES FOR JOINTS (RHS CHORD MEMBERS) [Table 7.12] for  $N_{i,Rd}$  and [Table 7.14] for  $M_{i,Rd}$

### GEOMETRICAL PARAMETERS

$\beta = 0.55$  Coefficient taking account of geometry of connection members  $\beta = (b_2 + h_2 + b_1 + h_1 + b_3 + h_3) / (6 * b_0)$  [1.5 (6)]  
 $\gamma = \frac{14.0}{0}$  Coefficient taking account of geometry of the chord  $\gamma = b_0 / (2 * t_0)$  [1.5 (6)]  
 $k_n = 1.00$  Coefficient taking account of stresses in the chord  $k_n = 1.0$

### TUBE CHORD FACE FAILURE

#### DIAGONAL 2

$N_{2,Rd} = 204.58$  [kN] Compression capacity  $N_{2,Rd} = [8.9 * k_n * f_{y0} * t_0^2 * \sqrt{\gamma} / \sin(\theta_2)] * \beta / \gamma_{M5}$   
 $|N_2| \leq N_{2,Rd}$   $|-111.98| < 204.58$  **verified** (0.55)  
 $M_{2,Rd} = 3.63$  [kN\*m] Bending resistance  $M_{2,Rd} = k_n * f_{y0} * t_0^2 * h_2 * [1 / (2 * \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_2 + \Delta M_2| \leq M_{2,Rd}$   $|-0.33| < 3.63$  **verified** (0.09)  
 $N_2 / N_{2,Rd} + (M_2 + \Delta M_2) / M_{2,Rd} \leq 1$   $0.64 < 1.00$  **verified** (0.64)

#### DIAGONAL 1

$N_{1,Rd} = 208.36$  [kN] Tension capacity  $N_{1,Rd} = [8.9 * k_n * f_{y0} * t_0^2 * \sqrt{\gamma} / \sin(\theta_1)] * \beta / \gamma_{M5}$   
 $|N_1| \leq N_{1,Rd}$   $|158.22| < 208.36$  **verified** (0.76)  
 $M_{1,Rd} = 3.63$  [kN\*m] Bending resistance  $M_{1,Rd} = k_n * f_{y0} * t_0^2 * h_1 * [1 / (2 * \eta) + 2 / \sqrt{1 - \beta} + \eta / (1 - \beta)] / \gamma_{M5}$   
 $|M_1 + \Delta M_1| \leq M_{1,Rd}$   $|-0.36| < 3.63$  **verified** (0.10)  
 $N_1 / N_{1,Rd} + (M_1 + \Delta M_1) / M_{1,Rd} \leq 1$   $0.86 < 1.00$  **verified** (0.86)

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## POST

$N_{3,Rd} = 161.85$ [kN] Compression capacity	$N_{3,Rd} = [8.9 \cdot k_n \cdot f_{y0} \cdot t_0^{2 \cdot \sqrt{\gamma}} / \sin(\theta_3)] \cdot \beta / \gamma_{M5}$
$ N_3  \leq N_{3,Rd}$ $ -33.47  < 161.85$ <b>verified</b>	(0.21)
$M_{3,Rd} = 2.71$ [kN*m] Bending resistance	$M_{3,Rd} = k_n \cdot f_{y0} \cdot t_0^{2 \cdot h_3} \cdot [1 / (2 \cdot \eta) + 2 / \sqrt{1 - \beta}] + \eta / (1 - \beta) / \gamma_{M5}$
$ M_{3+\Delta M_3}  \leq M_{3,Rd}$ $ -0.23  < 2.71$ <b>verified</b>	(0.08)
$N_3 / N_{3,Rd} + (M_{3+\Delta M_3}) / M_{3,Rd} \leq 1$ $0.29 < 1.00$ <b>verified</b>	(0.29)

## TUBE BRACE FAILURE

### DIAGONAL 2

$b_{eff} = 3$ [mm Effective width in the connection of the diagonal to the = 6 ] chord	$b_{eff} = [10 / (b_0 / t_0)] \cdot [(f_{y0} \cdot t_0) / (f_{y2} \cdot t_2)] \cdot b_2$
$N_{2,Rd} = 368.79$ [kN] Compression capacity	$N_{2,Rd} = f_{y2} \cdot t_2 \cdot (2 \cdot h_2 - 4 \cdot t_2 + b_2 + b_{eff}) / \gamma_{M5}$
$ N_2  \leq N_{2,Rd}$ $ -111.98  < 368.79$ <b>verified</b>	(0.30)

### DIAGONAL 1

$b_{eff} = 3$ [mm Effective width in the connection of the diagonal to the = 6 ] chord	$b_{eff} = [10 / (b_0 / t_0)] \cdot [(f_{y0} \cdot t_0) / (f_{y1} \cdot t_1)] \cdot b_1$
$N_{1,Rd} = 368.79$ [kN] Tension capacity	$N_{1,Rd} = f_{y1} \cdot t_1 \cdot (2 \cdot h_1 - 4 \cdot t_1 + b_1 + b_{eff}) / \gamma_{M5}$
$ N_1  \leq N_{1,Rd}$ $ 158.22  < 368.79$ <b>verified</b>	(0.43)

## POST

$b_{eff} = 36$ [mm Effective width in the connection of the post to the chord	$b_{eff} = [10 / (b_0 / t_0)] \cdot [(f_{y0} \cdot t_0) / (f_{y3} \cdot t_3)] \cdot b_3$
$N_{3,Rd} = 311.99$ [kN] Compression capacity	$N_{3,Rd} = f_{y3} \cdot t_3 \cdot (2 \cdot h_3 - 4 \cdot t_3 + b_3 + b_{eff}) / \gamma_{M5}$
$ N_3  \leq N_{3,Rd}$ $ -33.47  < 311.99$ <b>verified</b>	(0.11)

## CHORD SHEAR

### DIAGONAL 2

$A_v = 14.32$ [cm <sup>2</sup> ] Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{2,Rd} = 371.02$ [kN] Compression capacity	$N_{2,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_2)] / \gamma_{M5}$
$ N_2  \leq N_{2,Rd}$ $ -111.98  < 371.02$ <b>verified</b>	(0.30)

### DIAGONAL 1

$A_v = 14.32$ [cm <sup>2</sup> ] Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{1,Rd} = 377.88$ [kN] Tension capacity	$N_{1,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_1)] / \gamma_{M5}$
$ N_1  \leq N_{1,Rd}$ $ 158.22  < 377.88$ <b>verified</b>	(0.42)

## POST

$A_v = 14.32$ [cm <sup>2</sup> ] Shear area of the chord	$A_v = (2 \cdot h_0 + \alpha \cdot b_0) \cdot t_0$
$N_{3,Rd} = 293.52$ [kN] Compression capacity	$N_{3,Rd} = f_{y0} \cdot A_v / [\sqrt{3} \cdot \sin(\theta_3)] / \gamma_{M5}$
$ N_3  \leq N_{3,Rd}$ $ -33.47  < 293.52$ <b>verified</b>	(0.11)

## CHORD RESISTANCE

$V_{pl,Rd} = 293.52$ [kN] Plastic resistance for shear	$V_{pl,Rd} = (A_v \cdot f_{y0}) / (\sqrt{3} \cdot \gamma_{M0})$
$ V_{Ed}  \leq V_{pl,Rd}$ $ 122.90  < 293.52$ <b>verified</b>	(0.42)

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$$N_{0,Rd} = 888.93 \text{ [kN]} \text{ Tension capacity} \quad N_{0,Rd} = [ (A_0 - A_v) \cdot f_{y0} + A_v \cdot f_{y0} \cdot \sqrt{1 - (V_{Ed}/V_{pl,Rd})^2} ] / \gamma_{M5}$$

$$|N_{02}| \leq N_{0,Rd} \quad |480.33| < 888.93 \text{ verified} \quad (0.54)$$

## VERIFICATION OF WELDS

### DIAGONAL 2

$$\beta_w = 0.88 \quad \text{Correlation coefficient} \quad [\text{Table 4.1}]$$

$$\gamma_{M2} = 1.25 \quad \text{Partial safety factor} \quad [\text{Table 2.1}]$$

#### Longitudinal weld

$$\sigma_{\perp} = -59.45 \text{ [MPa]} \quad \text{Normal stress in a weld}$$

$$\tau_{\perp} = -59.45 \text{ [MPa]} \quad \text{Perpendicular tangent stress}$$

$$\tau_{\parallel} = -66.39 \text{ [MPa]} \quad \text{Tangent stress}$$

$$|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2} \quad |-59.45| < 338.40 \quad \text{verified} \quad (0.18)$$

$$\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2}) \quad 165.40 < 429.71 \quad \text{verified} \quad (0.38)$$

#### Transverse inner weld

$$\sigma_{\perp} = -101.51 \text{ [MPa]} \quad \text{Normal stress in a weld}$$

$$\tau_{\perp} = -56.15 \text{ [MPa]} \quad \text{Perpendicular tangent stress}$$

$$\tau_{\parallel} = 0.00 \text{ [MPa]} \quad \text{Tangent stress}$$

$$|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2} \quad |-101.51| < 338.40 \quad \text{verified} \quad (0.30)$$

$$\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2}) \quad 140.58 < 429.71 \quad \text{verified} \quad (0.33)$$

#### Transverse outer weld

$$\sigma_{\perp} = -43.39 \text{ [MPa]} \quad \text{Normal stress in a weld}$$

$$\tau_{\perp} = -95.25 \text{ [MPa]} \quad \text{Perpendicular tangent stress}$$

$$\tau_{\parallel} = 0.00 \text{ [MPa]} \quad \text{Tangent stress}$$

$$|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2} \quad |-43.39| < 338.40 \quad \text{verified} \quad (0.13)$$

$$\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2}) \quad 170.59 < 429.71 \quad \text{verified} \quad (0.40)$$

### DIAGONAL 1

$$\beta_w = 0.88 \quad \text{Correlation coefficient} \quad [\text{Table 4.1}]$$

$$\gamma_{M2} = 1.25 \quad \text{Partial safety factor} \quad [\text{Table 2.1}]$$

#### Longitudinal weld

$$\sigma_{\perp} = 79.11 \text{ [MPa]} \quad \text{Normal stress in a weld}$$

$$\tau_{\perp} = 79.11 \text{ [MPa]} \quad \text{Perpendicular tangent stress}$$

$$\tau_{\parallel} = 92.71 \text{ [MPa]} \quad \text{Tangent stress}$$

$$|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2} \quad |79.11| < 338.40 \quad \text{verified} \quad (0.23)$$

$$\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2}) \quad 225.44 < 429.71 \quad \text{verified} \quad (0.52)$$

#### Transverse inner weld

$$\sigma_{\perp} = 136.10 \text{ [MPa]} \quad \text{Normal stress in a weld}$$

$$\tau_{\perp} = 70.07 \text{ [MPa]} \quad \text{Perpendicular tangent stress}$$

$$\tau_{\parallel} = 0.00 \text{ [MPa]} \quad \text{Tangent stress}$$

$$|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2} \quad |136.10| < 338.40 \quad \text{verified} \quad (0.40)$$

$$\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2}) \quad 182.35 < 429.71 \quad \text{verified} \quad (0.42)$$

#### Transverse outer weld

$$\sigma_{\perp} = 62.45 \text{ [MPa]} \quad \text{Normal stress in a weld}$$

$$\tau_{\perp} = 132.47 \text{ [MPa]} \quad \text{Perpendicular tangent stress}$$

$$\tau_{\parallel} = 0.00 \text{ [MPa]} \quad \text{Tangent stress}$$

$$|\sigma_{\perp}| \leq 0.9 \cdot f_u / \gamma_{M2} \quad |62.45| < 338.40 \quad \text{verified} \quad (0.18)$$

$$\sqrt{|\sigma_{\perp}|^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2}) \quad 237.78 < 429.71 \quad \text{verified} \quad (0.55)$$

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## POST

$\beta_w =$	0.88	Correlation coefficient	[Table 4.1]
$\gamma_{M2} =$	1.25	Partial safety factor	[Table 2.1]
<b>Longitudinal weld</b>			
$\sigma_{\perp} =$	-38.14 [MPa]	Normal stress in a weld	
$\tau_{\perp} =$	-38.14 [MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	-0.00 [MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$		$ -38.14  < 338.40$	verified (0.11)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$		$76.27 < 429.71$	verified (0.18)
<b>Transverse inner weld</b>			
$\sigma_{\perp} =$	-63.68 [MPa]	Normal stress in a weld	
$\tau_{\perp} =$	-63.68 [MPa]	Perpendicular tangent stress	
$\tau_{\parallel} =$	0.00 [MPa]	Tangent stress	
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$		$ -63.68  < 338.40$	verified (0.19)
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot (\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq f_u / (\beta_w \cdot \gamma_{M2})$		$127.35 < 429.71$	verified (0.30)



## REMARKS

Eccentricity is too large. 38 [mm] > 35 [mm]

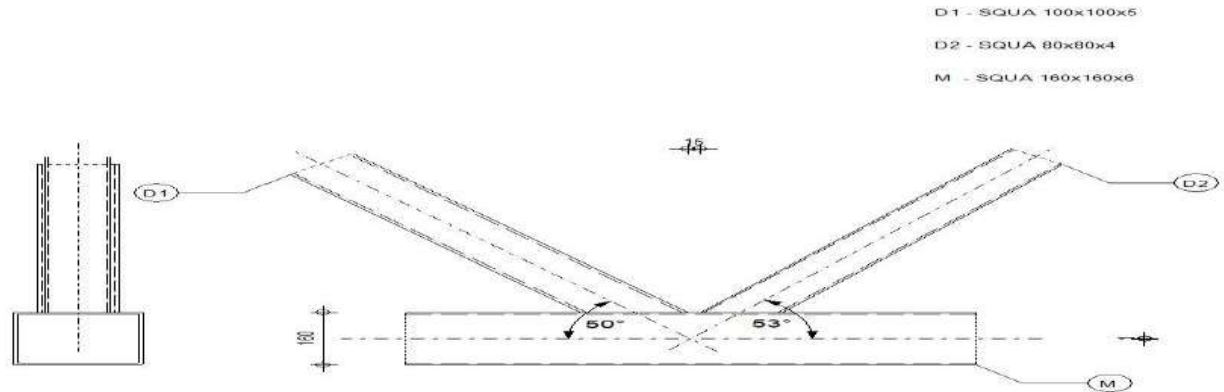
<b>Connection conforms to the code</b>	Ratio	0.86
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**Išvada: sąlyga tenkinama**

**Mazgas NR. 16**

	Robot Structural Analysis Professional 2023	
	<b>Calculation of the Hollow Section End Plate splices connection</b> EN 1993-1-8:2005/AC:2009 + SN044a	

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## GENERAL

Connection no.: 16  
Connection name: HS End Plate  
Structure node: 57  
Structure members: 123, 124

## RIGHT BEAM

Section: SQUA 140x140x5  
 $h_1 = 140$  [mm] Height of beam section  
 $b_1 = 140$  [mm] Width of beam section  
 $t_1 = 5$  [mm] Thickness of the web of beam section  
 $A_1 = 26.36$  [cm<sup>2</sup>] Cross-sectional area of a beam  
 Material: S 355  
 $f_{y1} = 355.00$  [MPa] Resistance  
 $f_{u1} = 470.00$  [MPa] Tensile resistance

## LEFT BEAM

Section: SQUA 140x140x5  
 $h_2 = 140$  [mm] Height of beam section  
 $b_2 = 140$  [mm] Width of beam section  
 $t_2 = 5$  [mm] Thickness of the web of beam section  
 $A_2 = 26.36$  [cm<sup>2</sup>] Cross-sectional area of a beam  
 Material: S 355  
 $f_{y2} = 355.00$  [MPa] Resistance  
 $f_{u2} = 470.00$  [MPa] Tensile resistance

## PLATE

$l_p = 316$  [mm] Plate length  
 $h_p = 316$  [mm] Plate height  
 $t_p = 20$  [mm] Plate thickness  
 Material: S 355  
 $f_{yp} = 355.00$  [MPa] Design resistance  
 $f_{up} = 470.00$  [MPa] Tensile resistance

## STIFFENER

$l_s = 150$  [mm] Stiffener length  
 $h_s = 110$  [mm] Stiffener height  
 $t_s = 10$  [mm] Stiffener thickness  
 $c_{1s} = 10$  [mm] Cut  
 $c_{2s} = 10$  [mm] Cut

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## BOLTS

Connection category D

Class =	8.8		Bolt class
d =	20	[mm]	Bolt diameter
d <sub>0</sub> =	22	[mm]	Bolt opening diameter
A <sub>s</sub> =	2.45	[cm <sup>2</sup> ]	Effective section area of a bolt
A <sub>v</sub> =	3.14	[cm <sup>2</sup> ]	Area of bolt section
f <sub>yb</sub> =	640.00	[MPa]	Yield strength of bolt
f <sub>ub</sub> =	800.00	[MPa]	Bolt tensile resistance
n <sub>H</sub> =	2		Number of bolt columns
e <sub>2V</sub> =	44	[mm]	Distance from horizontal edge of a plate
e <sub>2H</sub> =	20	[mm]	Distance from vertical edge of a section
p <sub>2</sub> =	100	[mm]	Horizontal spacing
n <sub>V</sub> =	2		Number of bolt rows
e <sub>1H</sub> =	44	[mm]	Distance from vertical edge of a plate
e <sub>1V</sub> =	20	[mm]	Distance from horizontal edge of a section
p <sub>1</sub> =	100	[mm]	Vertical spacing

## WELDS

a <sub>w</sub> =	3	[mm]
a <sub>s</sub> =	3	[mm]

## MATERIAL FACTORS

γ <sub>M0</sub> =	1.00	Partial safety factor	[2.2]
γ <sub>M1</sub> =	1.00	Partial safety factor	[2.2]
γ <sub>M2</sub> =	1.25	Partial safety factor	[2.2]
γ <sub>M3</sub> =	1.25	Partial safety factor	[2.2]

## LOADS

Case: 71: ULS/61=1\*1.35 + 5\*0.78 + 4\*1.30 1\*1.35+5\*0.78+4\*1.30

## ULTIMATE LIMIT STATE

N <sub>Ed1</sub> =	479.93	[kN]	Axial force
N <sub>Ed2</sub> =	479.93	[kN]	Axial force

Only axial forces are taken into account for the connection verification

## RESULTS

### RIGHT SIDE

### BOLTED CONNECTION CHECK - CATEGORY D

#### BOLT FAILURE

F <sub>t,Rd</sub> =	141.12 [kN]	Tensile resistance of a single bolt	F <sub>t,Rd</sub> = 0.9*f <sub>ub</sub> *A <sub>s</sub> /γ <sub>M2</sub>
B <sub>p,Rd</sub> =	446.15 [kN]	Design punching shear resistance of the bolt head and the nut	B <sub>p,Rd</sub> = (0.6*π*d <sub>m</sub> *t <sub>p</sub> *f <sub>up</sub> )/γ <sub>M2</sub>
N <sub>Ed</sub> ≤ n <sub>b</sub> *F <sub>t,Rd</sub>	479.93 < 1128.96	verified	(0.43)
N <sub>Ed</sub> ≤ n <sub>b</sub> *B <sub>p,Rd</sub>	479.93 < 3569.23	verified	(0.13)

#### BOLT FAILURE WITH ENDPLATE YIELDING

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## Calculation parameters according with NCCI: SN044a

$e_2 =$	44 [mm]	Distance from vertical edge of a plate	$e_2 = e_{1H}$
$e_1 =$	44 [mm]	Distance from vertical edge of a section	$e_1 = 0.5 \cdot (l_p - b) - e_2$
$b' =$	39 [mm]	Coefficient	$b' = e_1 - 0.5 \cdot d + t_i$
$\delta =$	0.78	Coefficient	$\delta = 1 - d_0/p_1$
$K =$	0.05 [cm <sup>2</sup> /kN]	Coefficient	$K = (4 \cdot b') / ((0.9 \cdot f_{yp} \cdot p_1) / \gamma_{M0})$
$e_{eff} =$	44 [mm]	Effective distance	$e_{eff} = \min(e_2; 1.25 \cdot e_1)$
$\alpha =$	0.54	Coefficient	$\alpha = \max[0.0; (((K \cdot F_{t,Rd}) / t_p^2) - 1) \cdot ((e_{eff} + 0.5 \cdot d) / (\delta \cdot (e_{eff} + e_1 + t_i)))]$
$P_f =$	59.99 [kN]	Design tensile force per bolt	$P_f = N_{Ed} / n_b$
$t_{min} =$	13 [mm]	Minimal required thickness of end plate	$t_{min} = \sqrt{[K \cdot P_f / (1 + \delta)]}$
$t_{max} =$	17 [mm]	Minimal required thickness of end plate	$t_{max} = \sqrt{[K \cdot P_f]}$
$N_{RdV} =$	372.15 [kN]	Design tensile resistance of splice	$N_{RdV} = t_p^2 \cdot (1 + \delta \cdot \alpha) \cdot n_b / (K \cdot \gamma_{M2})$

## Calculation parameters according with NCCI: SN044a

$e_2 =$	44 [mm]	Distance from horizontal edge of a plate	$e_2 = e_{2V}$
$e_1 =$	44 [mm]	Distance from horizontal edge of a section	$e_1 = 0.5 \cdot (h_p - h) - e_2$
$b' =$	39 [mm]	Coefficient	$b' = e_1 - 0.5 \cdot d + t_i$
$\delta =$	0.78	Coefficient	$\delta = 1 - d_0/p_2$
$K =$	0.05 [cm <sup>2</sup> /kN]	Coefficient	$K = (4 \cdot b') / ((0.9 \cdot f_{yp} \cdot p_2) / \gamma_{M0})$
$e_{eff} =$	44 [mm]	Effective distance	$e_{eff} = \min(e_2; 1.25 \cdot e_1)$
$\alpha =$	0.54	Coefficient	$\alpha = \max[0.0; (((K \cdot F_{t,Rd}) / t_p^2) - 1) \cdot ((e_{eff} + 0.5 \cdot d) / (\delta \cdot (e_{eff} + e_1 + t_i)))]$
$P_f =$	59.99 [kN]	Design tensile force per bolt	$P_f = N_{Ed} / n_b$
$t_{min} =$	13 [mm]	Minimal required thickness of end plate	$t_{min} = \sqrt{[K \cdot P_f / (1 + \delta)]}$
$t_{max} =$	17 [mm]	Minimal required thickness of end plate	$t_{max} = \sqrt{[K \cdot P_f]}$
$N_{RdH} =$	372.15 [kN]	Design tensile resistance of splice	$N_{RdH} = t_p^2 \cdot (1 + \delta \cdot \alpha) \cdot n_b / (K \cdot \gamma_{M2})$
$N_{Rd} =$	744.29 [kN]	Tensile resistance	$N_{Rd} = N_{RdV} + N_{RdH}$
$N_{Ed} \leq N_{Rd}$		479.93 < 744.29	verified (0.64)

## SECTION

$N_{t,Rd} =$	935.65 [kN]	Tension capacity	$N_{t,Rd} = A_i \cdot f_y$
$N_{Ed} \leq N_{t,Rd}$		479.93 < 935.65	verified (0.51)

## WELDS

### FILLET WELDS CONNECTING A PLATE WITH THE MEMBER AND STIFFENERS

$A_w =$	42.68 [cm <sup>2</sup> ]	Weld area	$A_w = 2 \cdot (h_1 + b_1 + r_1 \cdot (\pi - 4)) \cdot a_w + h_s \cdot n_s \cdot 2 \cdot a_s$
$\sigma =$	112.43 [MPa]	Normal stress in a weld	$N_{Ed} / A_w$
$\sigma_{\perp} =$	79.50 [MPa]	Normal perpendicular stress in the weld	$\sigma_{\perp} = \sigma / \sqrt{2}$
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$		79.50  < 338.40	verified (0.23)
$\tau_{\perp} =$	79.50 [MPa]	Perpendicular tangent stress	$\tau_{\perp} = \sigma_{\perp}$
$\beta_w =$	0.90	Correlation coefficient	[Table 4.1]
$\sqrt{ \sigma_{\perp} ^2 + 3 \cdot \tau_{\perp}^2} \leq f_u / (\beta_w \cdot \gamma_{M2})$		159.01 < 417.78	verified (0.38)

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## FILLET WELDS CONNECTING A STIFFENERS WITH THE MEMBER

$A_w =$	72.00	[cm <sup>2</sup> ]	Weld area	$A_w = n_s * l_s * 2 * a_s$
$\tau_{II} =$	50.94	[MPa]	Perpendicular tangent stress	$\tau_{II} = N_{Ed,s} / A_w$
$\beta_w =$	0.90		Correlation coefficient	[Table 4.1]
$\sqrt{[3 * \tau_{II}^2]} \leq f_u / (\beta_w * \gamma_{M2})$	88.24	<	417.78	verified (0.21)

## LEFT SIDE

## BOLTED CONNECTION CHECK - CATEGORY D

### BOLT FAILURE

$F_{t,Rd} =$	141.12	[kN]	Tensile resistance of a single bolt	$F_{t,Rd} = 0.9 * f_{ub} * A_s / \gamma_{M2}$
$B_{p,Rd} =$	446.15	[kN]	Design punching shear resistance of the bolt head and the nut	$B_{p,Rd} = (0.6 * \pi * d_m * t_p * f_{up}) / \gamma_{M2}$
$N_{Ed} \leq n_b * F_{t,Rd}$	479.93	<	1128.96	verified (0.43)
$N_{Ed} \leq n_b * B_{p,Rd}$	479.93	<	3569.23	verified (0.13)

### BOLT FAILURE WITH ENDPLATE YIELDING

Calculation parameters according with NCCI: SN044a

$e_2 =$	44	[mm]	Distance from vertical edge of a plate	$e_2 = e_{1H}$
$e_1 =$	44	[mm]	Distance from vertical edge of a section	$e_1 = 0.5 * (l_p - b) - e_2$
$b' =$	39	[mm]	Coefficient	$b' = e_1 - 0.5 * d + t_i$
$\delta =$	0.78		Coefficient	$\delta = 1 - d_0 / p_1$
$K =$	0.05	[cm <sup>2</sup> /kN]	Coefficient	$K = (4 * b') / ((0.9 * f_{yp} * p_1) / \gamma_{M0})$
$e_{eff} =$	44	[mm]	Effective distance	$e_{eff} = \min(e_2; 1.25 * e_1)$
$\alpha =$	0.54		Coefficient	$\alpha = \max[0.0; (((K * F_{t,Rd}) / t_p^2) - 1) * ((e_{eff} + 0.5 * d) / (\delta * (e_{eff} + e_1 + t_i)))]$
$P_f =$	59.99	[kN]	Design tensile force per bolt	$P_f = N_{Ed} / n_b$
$t_{min} =$	13	[mm]	Minimal required thickness of end plate	$t_{min} = \sqrt{[K * P_f / (1 + \delta)]}$
$t_{max} =$	17	[mm]	Minimal required thickness of end plate	$t_{max} = \sqrt{[K * P_f]}$
$N_{RdV} =$	372.15	[kN]	Design tensile resistance of splice	$N_{RdV} = t_p^{2 * (1 + \delta * \alpha)} * n_b / (K * \gamma_{M2})$

Calculation parameters according with NCCI: SN044a

$e_2 =$	44	[mm]	Distance from horizontal edge of a plate	$e_2 = e_{2V}$
$e_1 =$	44	[mm]	Distance from horizontal edge of a section	$e_1 = 0.5 * (h_p - h_i) - e_2$
$b' =$	39	[mm]	Coefficient	$b' = e_1 - 0.5 * d + t_i$
$\delta =$	0.78		Coefficient	$\delta = 1 - d_0 / p_2$
$K =$	0.05	[cm <sup>2</sup> /kN]	Coefficient	$K = (4 * b') / ((0.9 * f_{yp} * p_2) / \gamma_{M0})$
$e_{eff} =$	44	[mm]	Effective distance	$e_{eff} = \min(e_2; 1.25 * e_1)$
$\alpha =$	0.54		Coefficient	$\alpha = \max[0.0; (((K * F_{t,Rd}) / t_p^2) - 1) * ((e_{eff} + 0.5 * d) / (\delta * (e_{eff} + e_1 + t_i)))]$
$P_f =$	59.99	[kN]	Design tensile force per bolt	$P_f = N_{Ed} / n_b$
$t_{min} =$	13	[mm]	Minimal required thickness of end plate	$t_{min} = \sqrt{[K * P_f / (1 + \delta)]}$
$t_{max} =$	17	[mm]	Minimal required thickness of end plate	$t_{max} = \sqrt{[K * P_f]}$

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	122	251	0

Calculation parameters according with NCCI: SN044a

$e_2 =$	44 [mm]	Distance from horizontal edge of a plate	$e_2 = e_{2V}$
$N_{RdH} =$	$\frac{372.1}{5}$ [kN]	Design tensile resistance of splice	$N_{RdH} = t_p^2 \cdot (1 + \delta \cdot \alpha) \cdot n_b / (K \cdot \gamma_{M2})$
$N_{Rd} =$	744.29 [kN]	Tensile resistance	$N_{Rd} = N_{RdV} + N_{RdH}$
$N_{Ed} \leq N_{Rd}$	479.93 < 744.29	verified	(0.64)

## SECTION

$N_{t,Rd} =$	935.65 [kN]	Tension capacity	$N_{t,Rd} = A_i \cdot f_y$
$N_{Ed} \leq N_{t,Rd}$	479.93 < 935.65	verified	(0.51)

## WELDS

### FILLET WELDS CONNECTING A PLATE WITH THE MEMBER AND STIFFENERS

$A_w =$	42.68 [cm <sup>2</sup> ]	Weld area	$A_w = 2 \cdot (h_2 + b_2 + r_2 \cdot (\pi - 4)) \cdot a_w + h_s \cdot n_s \cdot 2 \cdot a_s$
$\sigma =$	112.43 [MPa]	Normal stress in a weld	$N_{Ed} / A_w$
$\sigma_{\perp} =$	79.50 [MPa]	Normal perpendicular stress in the weld	$\sigma_{\perp} = \sigma / \sqrt{2}$
$ \sigma_{\perp}  \leq 0.9 \cdot f_u / \gamma_{M2}$	79.50  < 338.40	verified	(0.23)
$\tau_{\perp} =$	79.50 [MPa]	Perpendicular tangent stress	$\tau_{\perp} = \sigma_{\perp}$
$\beta_w =$	0.90	Correlation coefficient	[Table 4.1]
$\sqrt{[\sigma_{\perp}^2 + 3 \cdot \tau_{\perp}^2]} \leq f_u / (\beta_w \cdot \gamma_{M2})$	159.01 < 417.78	verified	(0.38)

### FILLET WELDS CONNECTING A STIFFENERS WITH THE MEMBER

$A_w =$	72.00 [cm <sup>2</sup> ]	Weld area	$A_w = n_s \cdot l_s \cdot 2 \cdot a_s$
$\tau_{II} =$	50.94 [MPa]	Perpendicular tangent stress	$\tau_{II} = N_{Ed,s} / A_w$
$\beta_w =$	0.90	Correlation coefficient	[Table 4.1]
$\sqrt{3 \cdot \tau_{II}^2} \leq f_u / (\beta_w \cdot \gamma_{M2})$	88.24 < 417.78	verified	(0.21)

**Connection conforms to the code**

Ratio 0.64

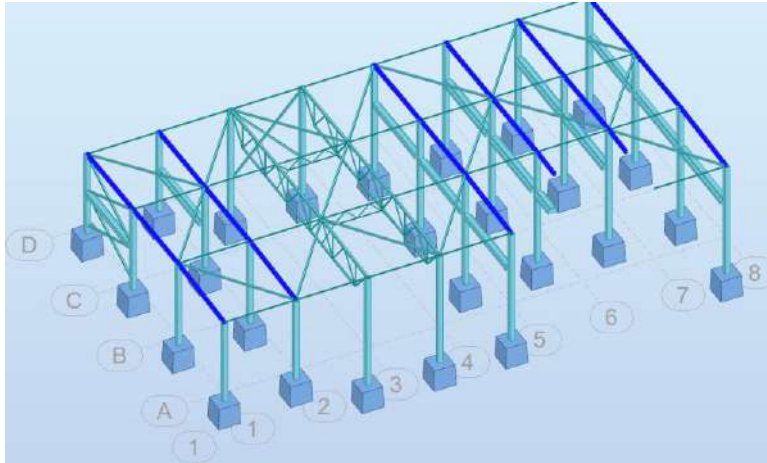
**Išvada: sąlyga tenkinama**

## Sijų projektavimas

Sijos projektuojamos iš dvitėjinių profilių, plieno klasė S355JR. Sijų atsparumas ugniai R20.

Sijų išdėstymas:

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	123	251	0



## Sijų projektavimas

**CODE:** EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

**CODE GROUP:**

**MEMBER:** 49 Sija\_49

**POINT:** 2

**COORDINATE:**  $x = 0.50 L = 3.825$

m

**LOADS:**

Governing Load Case: 67 ULS/57=1\*1.35 + 2\*0.91 + 6\*0.78 + 4\*1.30 1\*1.35+2\*0.91+6\*0.78+4\*1.30

**MATERIAL:**

S 355 ( S 355 )  $f_y = 355.00$  MPa



**SECTION PARAMETERS: HEA 260**

$h=25.0$  cm

$gM0=1.10$

$gM1=1.10$

$b=26.0$  cm

$A_y=73.54$  cm<sup>2</sup>

$A_z=28.76$  cm<sup>2</sup>

$A_x=86.82$  cm<sup>2</sup>

$tw=0.8$  cm

$I_y=10455.00$  cm<sup>4</sup>

$I_z=3667.56$  cm<sup>4</sup>

$I_x=46.30$  cm<sup>4</sup>

$tf=1.3$  cm

$W_{ely}=836.40$  cm<sup>3</sup>

$W_{elz}=282.12$  cm<sup>3</sup>

**INTERNAL FORCES AND CAPACITIES:**

$N_{,Ed} = 37.41$  kN

$M_{y,Ed} = 149.07$  kN\*m

$N_{c,Rd} = 2801.90$  kN

$M_{y,Ed,max} = 149.07$  kN\*m

$N_{b,Rd} = 845.44$  kN

$M_{y,c,Rd} = 269.93$  kN\*m

$M_{b,Rd} = 171.11$  kN\*m

Class of section = 3



**LATERAL BUCKLING PARAMETERS:**

$z = 1.00$

$M_{cr} = 231.59$  kN\*m

Curve,LT - b

$X_{LT} = 0.62$

$L_{cr,upp} = 7.651$  m

$\lambda_{m,LT} = 1.13$

$f_{i,LT} = 1.11$

$X_{LT,mod} = 0.63$

**BUCKLING PARAMETERS:**



About y axis:

$L_y = 7.651$  m

$\lambda_{m,y} = 0.91$

$L_{cr,y} = 7.651$  m

$X_y = 0.65$



About z axis:

$L_z = 7.651$  m

$\lambda_{m,z} = 1.54$

$L_{cr,z} = 7.651$  m

$X_z = 0.30$

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	124	251	0

Lamy = 69.72

kyy = 1.02

Lamz = 117.71

kzy = 1.01

#### VERIFICATION FORMULAS:

##### Section strength check:

$$M_{y,Ed}/M_{y,c,Rd} = 0.55 < 1.00 \quad (6.2.5.(1))$$

$$N_{y,Ed}/N_{c,Rd} + M_{y,Ed}/M_{y,c,Rd} = 0.57 < 1.00 \quad (6.2.1(7))$$

##### Global stability check of member:

$$\Lambda_{y} = 69.72 < \Lambda_{y,max} = 150.00 \quad \Lambda_{z} = 117.71 < \Lambda_{z,max} = 150.00 \quad \text{STABLE}$$

$$M_{y,Ed,max}/M_{b,Rd} = 0.87 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{y,Ed}/(X_{y} * N_{Rk}/gM1) + k_{yy} * M_{y,Ed,max}/(X_{LT} * M_{y,Rk}/gM1) = 0.91 < 1.00 \quad (6.3.3.(4))$$

$$N_{y,Ed}/(X_{z} * N_{Rk}/gM1) + k_{zy} * M_{y,Ed,max}/(X_{LT} * M_{y,Rk}/gM1) = 0.92 < 1.00 \quad (6.3.3.(4))$$

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

$$u_y = 0.00 \text{ cm} < u_{y,max} = L/213.00 = 3.59 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 112 \text{ SLS:CHR}/20 = 1 * 1.00 + 5 * 1.00 + 4 * 0.70 \quad (1+5) * 1.00 + 4 * 0.70$$

$$u_z = 3.13 \text{ cm} < u_{z,max} = L/213.00 = 3.59 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 122 \text{ SLS:CHR}/30 = 1 * 1.00 + 2 * 0.70 + 6 * 0.60 + 4 * 1.00 \quad (1+4) * 1.00 + 2 * 0.70 + 6 * 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

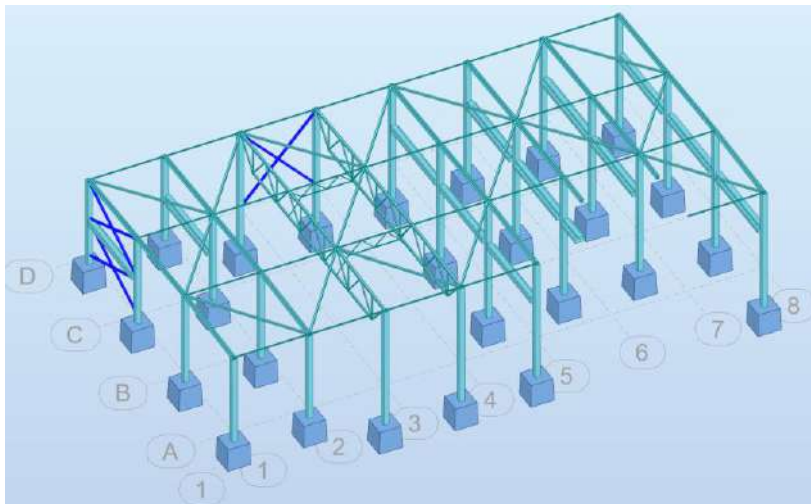
**Section OK !!!**

**Išvada: sąlyga tenkinama**

#### Ryšių projektavimas

Ryšių elementai projektuojami iš dėžinių tuščiavidurių profiliuotųjų, plieno klasė S355J2H. Ryšių atsparumas ugniai R45.

Vertikalių ryšių išdėstymas:



#### Vertikalių ryšių projektavimas

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	125	251	0

**CODE GROUP:**

**MEMBER:** 213 VR\_213  
m

**POINT:** 2

**COORDINATE:** x = 0.50 L = 4.460

**LOADS:**

Governing Load Case: 45 ULS/35=1\*1.35 + 7\*1.30 + 4\*0.91 1\*1.35+7\*1.30+4\*0.91

**MATERIAL:**

S 355 ( S 355 )  $f_y = 355.00$  MPa



**SECTION PARAMETERS: SQUA 150x150x5**

h=15.0 cm	gM0=1.10	gM1=1.10	
b=15.0 cm	Ay=14.18 cm <sup>2</sup>	Az=14.18 cm <sup>2</sup>	Ax=28.36 cm <sup>2</sup>
tw=0.5 cm	Iy=982.12 cm <sup>4</sup>	Iz=982.12 cm <sup>4</sup>	Ix=1526.73 cm <sup>4</sup>
tf=0.5 cm	Wply=152.98 cm <sup>3</sup>	Wplz=152.98 cm <sup>3</sup>	

**INTERNAL FORCES AND CAPACITIES:**

N,Ed = 48.14 kN	My,Ed = 1.97 kN*m
Nc,Rd = 915.13 kN	My,Ed,max = 1.97 kN*m
Nb,Rd = 207.11 kN	My,c,Rd = 49.37 kN*m
	MN,y,Rd = 49.37 kN*m
	Mb,Rd = 49.37 kN*m

Class of section = 1



**LATERAL BUCKLING PARAMETERS:**

z = 1.00	Mcr = 625.94 kN*m	Curve,LT - d	XLT = 1.00
Lcr,upp=8.920 m	Lam_LT = 0.29	fi,LT = 0.49	XLT,mod = 1.00

**BUCKLING PARAMETERS:**



About y axis:

Ly = 8.920 m	Lam_y = 1.98
Lcr,y = 8.920 m	Xy = 0.23
Lamy = 151.56	kyy = 1.11



About z axis:

Lz = 8.920 m	Lam_z = 1.98
Lcr,z = 8.920 m	Xz = 0.23
Lamz = 151.56	kzy = 0.80

**VERIFICATION FORMULAS:**

**Section strength check:**

N,Ed/Nc,Rd = 0.05 < 1.00 (6.2.4.(1))  
My,Ed/My,c,Rd = 0.04 < 1.00 (6.2.5.(1))

**Global stability check of member:**

Lambda,y = 151.56 < Lambda,max = 180.00      Lambda,z = 151.56 < Lambda,max = 180.00      STABLE  
My,Ed,max/Mb,Rd = 0.04 < 1.00 (6.3.2.1.(1))  
N,Ed/(Xy\*N,Rk/gM1) + kyy\*My,Ed,max/(XLT\*My,Rk/gM1) = 0.28 < 1.00 (6.3.3.(4))  
N,Ed/(Xz\*N,Rk/gM1) + kzy\*My,Ed,max/(XLT\*My,Rk/gM1) = 0.26 < 1.00 (6.3.3.(4))

**LIMIT DISPLACEMENTS**



**Deflections (LOCAL SYSTEM):**

uy = 0.00 cm < uy max = L/200.00 = 4.46 cm      Verified  
Governing Load Case: 93 SLS:CHR/1=1\*1.00 + 2\*1.00 + 4\*0.70 (1+2)\*1.00+4\*0.70  
uz = 0.59 cm < uz max = L/200.00 = 4.46 cm      Verified  
Governing Load Case: 115 SLS:CHR/23=1\*1.00 + 6\*1.00 (1+6)\*1.00



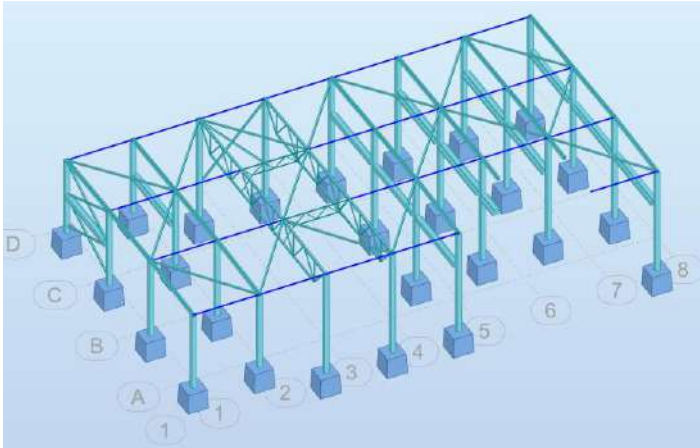
**Displacements (GLOBAL SYSTEM):** Not analyzed

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	126	251	0

**Section OK !!!**

**Išvada: sąlyga tenkinama**

Horizontalių ryšių santvarų viršutinės juostos lygyje išdėstymas:



**Horizontalių ryšių santvaros viršutinės juostos lygyje projektavimas**

**CODE:** EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

**CODE GROUP:**

**MEMBER:** 179 HR\_179  
m

**POINT:** 2

**COORDINATE:** x = 0.63 L = 3.750

**LOADS:**

Governing Load Case: 33 ULS/23=1\*1.35 + 2\*0.91 + 5\*1.30 + 4\*0.91 1\*1.35+(2+4)\*0.91+5\*1.30

**MATERIAL:**

S 355 ( S 355 ) fy = 355.00 MPa



**SECTION PARAMETERS: SQUA 80x80x4**

h=8.0 cm	gM0=1.10	gM1=1.10	
b=8.0 cm	Ay=5.87 cm <sup>2</sup>	Az=5.87 cm <sup>2</sup>	Ax=11.75 cm <sup>2</sup>
tw=0.4 cm	Iy=111.04 cm <sup>4</sup>	Iz=111.04 cm <sup>4</sup>	Ix=176.24 cm <sup>4</sup>
tf=0.4 cm	Wply=33.07 cm <sup>3</sup>	Wplz=33.07 cm <sup>3</sup>	

**INTERNAL FORCES AND CAPACITIES:**

N <sub>Ed</sub> = 42.83 kN	My <sub>Ed</sub> = 0.52 kN*m	
N <sub>c,Rd</sub> = 379.14 kN	My <sub>Ed,max</sub> = 0.55 kN*m	Vz <sub>Ed</sub> = -0.09 kN
N <sub>b,Rd</sub> = 53.41 kN	My <sub>c,Rd</sub> = 10.67 kN*m	Vz <sub>c,Rd</sub> = 109.45 kN
	MN <sub>y,Rd</sub> = 10.67 kN*m	
	Mb <sub>Rd</sub> = 10.67 kN*m	

Class of section = 1



**LATERAL BUCKLING PARAMETERS:**

z = 1.00 Mcr = 106.67 kN\*m Curve,LT - d XLT = 1.00

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	127	251	0

$L_{cr,upp} = 6.000 \text{ m}$ 
 $\lambda_{m,LT} = 0.33$ 
 $f_{i,LT} = 0.52$ 
 $X_{LT,mod} = 1.00$ 
**BUCKLING PARAMETERS:**


About y axis:

 $L_y = 6.000 \text{ m}$ 
 $\lambda_{m,y} = 2.55$ 
 $L_{cr,y} = 6.000 \text{ m}$ 
 $X_y = 0.14$ 
 $\lambda_{my} = 195.16$ 
 $k_{yy} = 1.34$ 


About z axis:

 $L_z = 6.000 \text{ m}$ 
 $\lambda_{m,z} = 2.55$ 
 $L_{cr,z} = 6.000 \text{ m}$ 
 $X_z = 0.14$ 
 $\lambda_{mz} = 195.16$ 
 $k_{zy} = 1.34$ 
**VERIFICATION FORMULAS:**
**Section strength check:**
 $N_{Ed}/N_{c,Rd} = 0.11 < 1.00 \quad (6.2.4.(1))$ 
 $M_{y,Ed}/M_{y,c,Rd} = 0.05 < 1.00 \quad (6.2.5.(1))$ 
 $V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$ 
**Global stability check of member:**
 $\lambda_{m,y} = 195.16 < \lambda_{m,max} = 200.00 \quad \lambda_{m,z} = 195.16 < \lambda_{m,max} = 200.00 \quad \text{STABLE}$ 
 $M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$ 
 $N_{Ed}/(X_y \cdot N_{Rk}/\gamma_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.87 < 1.00 \quad (6.3.3.(4))$ 
 $N_{Ed}/(X_z \cdot N_{Rk}/\gamma_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.87 < 1.00 \quad (6.3.3.(4))$ 
**LIMIT DISPLACEMENTS**

**Deflections (LOCAL SYSTEM):**
 $u_y = 0.00 \text{ cm} < u_{y,max} = L/200.00 = 3.00 \text{ cm}$ 

Verified

**Governing Load Case:** 115 SLS:CHR/23=1\*1.00 + 6\*1.00 (1+6)\*1.00

 $u_z = 0.65 \text{ cm} < u_{z,max} = L/200.00 = 3.00 \text{ cm}$ 

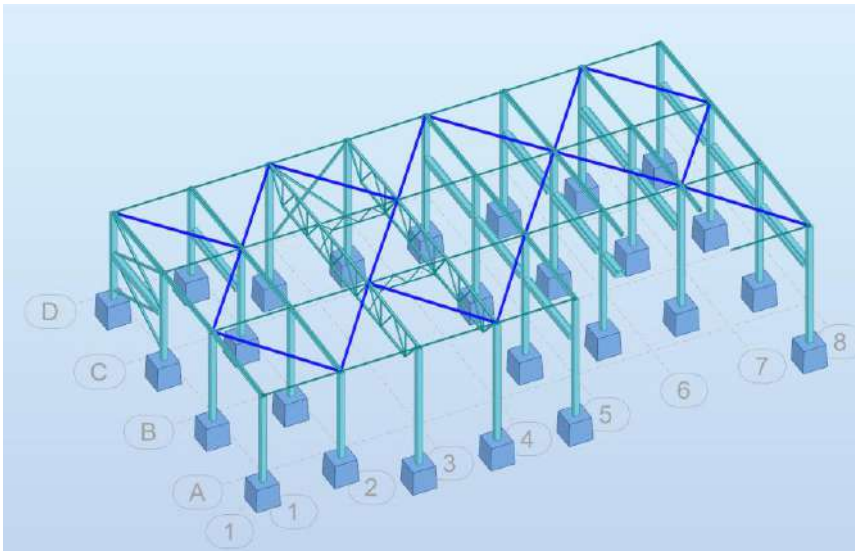
Verified

**Governing Load Case:** 101 SLS:CHR/9=1\*1.00 + 2\*1.00 + 8\*0.60 + 4\*0.70 (1+2)\*1.00+8\*0.60+4\*0.70

**Displacements (GLOBAL SYSTEM):** Not analyzed

**Section OK !!!**
**Išvada: sąlyga tenkinama**

Horizontalių įstrižių ryšių santvarų viršutinės juostos lygyje išdėstymas:


**Horizontalių įstrižių ryšių projektavimas**
**CODE:** EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	128	251	0

**ANALYSIS TYPE:** Member Verification

**CODE GROUP:**

**MEMBER:** 285 HR įstr.\_285  
m

**POINT:** 2

**COORDINATE:** x = 0.50 L = 4.861

**LOADS:**

Governing Load Case: 33 ULS/23=1\*1.35 + 2\*0.91 + 5\*1.30 + 4\*0.91 1\*1.35+(2+4)\*0.91+5\*1.30

**MATERIAL:**

S 355 ( S 355 )  $f_y = 355.00$  MPa



**SECTION PARAMETERS: SQUA 140x140x4**

h=14.0 cm	gM0=1.10	gM1=1.10	
b=14.0 cm	Ay=10.67 cm <sup>2</sup>	Az=10.67 cm <sup>2</sup>	Ax=21.35 cm <sup>2</sup>
tw=0.4 cm	Iy=651.62 cm <sup>4</sup>	Iz=651.62 cm <sup>4</sup>	Ix=1007.34 cm <sup>4</sup>
tf=0.4 cm	Wely=93.09 cm <sup>3</sup>	Welz=93.09 cm <sup>3</sup>	

**INTERNAL FORCES AND CAPACITIES:**

N,Ed = 64.75 kN	My,Ed = 2.62 kN*m
Nc,Rd = 688.96 kN	My,Ed,max = 2.62 kN*m
Nb,Rd = 118.02 kN	My,c,Rd = 30.04 kN*m
	Mb,Rd = 30.04 kN*m

Class of section = 3



**LATERAL BUCKLING PARAMETERS:**

z = 1.00	Mcr = 380.78 kN*m	Curve,LT - d	XLT = 1.00
Lcr,upp=9.723 m	Lam_LT = 0.29	fi,LT = 0.49	XLT,mod = 1.00

**BUCKLING PARAMETERS:**



About y axis:

Ly = 9.723 m	Lam_y = 2.30
Lcr,y = 9.723 m	Xy = 0.17
Lamy = 175.99	kyy = 1.10



About z axis:

Lz = 9.723 m	Lam_z = 2.30
Lcr,z = 9.723 m	Xz = 0.17
Lamz = 175.99	kyz = 1.10

**VERIFICATION FORMULAS:**

**Section strength check:**

$M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00$  (6.2.5.(1))  
 $N_{y,Ed}/N_{c,Rd} + M_{y,Ed}/M_{y,c,Rd} = 0.18 < 1.00$  (6.2.1(7))

**Global stability check of member:**

$\lambda_{y} = 175.99 < \lambda_{y,max} = 200.00$        $\lambda_{z} = 175.99 < \lambda_{z,max} = 200.00$       STABLE  
 $M_{y,Ed,max}/M_{b,Rd} = 0.09 < 1.00$  (6.3.2.1.(1))  
 $N_{y,Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.64 < 1.00$  (6.3.3.(4))  
 $N_{z,Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.64 < 1.00$  (6.3.3.(4))

**LIMIT DISPLACEMENTS**



**Deflections (LOCAL SYSTEM):**

$u_y = 0.00$  cm <  $u_y,max = L/200.00 = 4.86$  cm      Verified  
**Governing Load Case:** 106 SLS:CHR/14=1\*1.00 + 2\*0.70 + 6\*1.00 + 4\*0.70 (1+6)\*1.00+(2+4)\*0.70  
 $u_z = 1.40$  cm <  $u_z,max = L/200.00 = 4.86$  cm      Verified  
**Governing Load Case:** 123 SLS:CHR/31=1\*1.00 + 2\*0.70 + 7\*0.60 + 4\*1.00 (1+4)\*1.00+2\*0.70+7\*0.60



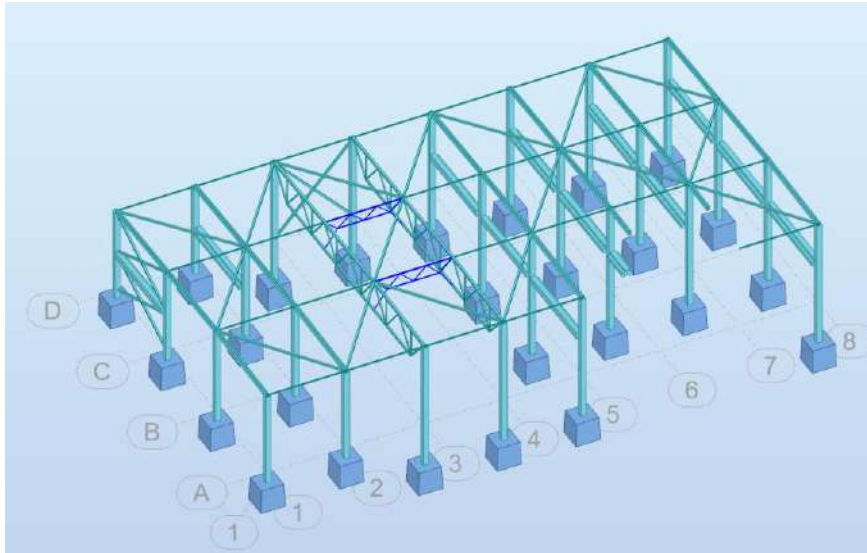
**Displacements (GLOBAL SYSTEM):** Not analyzed

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	129	251	0

**Section OK !!!**

**Išvada: sąlyga tenkinama**

Santvarų viršutinės ir apatinės juostos sujungimas ryšine santvara:



**Ryšinės santvaros viršutinės juostos projektavimas**

**CODE:** EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

**CODE GROUP:**

**MEMBER:** 181 HR V 1\_181

**POINT:** 3

**COORDINATE:** x = 0.33 L = 2.000 m

**LOADS:**

Governing Load Case: 43 ULS/33=1\*1.35 + 6\*1.30 + 4\*0.91 1\*1.35+6\*1.30+4\*0.91

**MATERIAL:**

S 355 ( S 355 )  $f_y = 355.00$  MPa



**SECTION PARAMETERS: SQUA 80x80x4**

h=8.0 cm

gM0=1.10

gM1=1.10

b=8.0 cm

Ay=5.87 cm<sup>2</sup>

Az=5.87 cm<sup>2</sup>

Ax=11.75 cm<sup>2</sup>

tw=0.4 cm

Iy=111.04 cm<sup>4</sup>

Iz=111.04 cm<sup>4</sup>

Ix=176.24 cm<sup>4</sup>

tf=0.4 cm

Wply=33.07 cm<sup>3</sup>

Wplz=33.07 cm<sup>3</sup>

**INTERNAL FORCES AND CAPACITIES:**

N,Ed = -56.37 kN

My,Ed = -0.11 kN\*m

Mz,Ed = -0.00 kN\*m

Vy,Ed = 0.00 kN

Nt,Rd = 379.14 kN

My,pl,Rd = 10.67 kN\*m

Mz,pl,Rd = 10.67 kN\*m

Vy,T,Rd = 109.45 kN

My,c,Rd = 10.67 kN\*m

Mz,c,Rd = 10.67 kN\*m

Vz,Ed = -0.18 kN

MN,y,Rd = 10.67 kN\*m

MN,z,Rd = 10.67 kN\*m

Vz,T,Rd = 109.45 kN

Tt,Ed = 0.00 kN\*m

Class of section = 1

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	130	251	0



### LATERAL BUCKLING PARAMETERS:

#### BUCKLING PARAMETERS:



About y axis:



About z axis:

#### VERIFICATION FORMULAS:

##### Section strength check:

$$N_{Ed}/N_{t,Rd} = 0.15 < 1.00 \quad (6.2.3.(1))$$

$$M_{y,Ed}/M_{N,y,Rd} = 0.01 < 1.00 \quad (6.2.9.1.(2))$$

$$M_{z,Ed}/M_{N,z,Rd} = 0.00 < 1.00 \quad (6.2.9.1.(2))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.70} + (M_{z,Ed}/M_{N,z,Rd})^{1.70} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(\tau_{xy}/(\sqrt{3} \cdot gM_0)) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(\tau_{xz}/(\sqrt{3} \cdot gM_0)) = 0.00 < 1.00 \quad (6.2.6)$$

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

$$u_y = 0.00 \text{ cm} < u_{y \text{ max}} = L/200.00 = 3.00 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 106 \text{ SLS: CHR}/14 = 1 \cdot 1.00 + 2 \cdot 0.70 + 6 \cdot 1.00 + 4 \cdot 0.70 \quad (1+6) \cdot 1.00 + (2+4) \cdot 0.70$$

$$u_z = 0.07 \text{ cm} < u_{z \text{ max}} = L/200.00 = 3.00 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 114 \text{ SLS: CHR}/22 = 1 \cdot 1.00 + 6 \cdot 1.00 + 4 \cdot 0.70 \quad (1+6) \cdot 1.00 + 4 \cdot 0.70$$



Displacements (GLOBAL SYSTEM): Not analyzed

**Section OK !!!**

**Išvada: sąlyga tenkinama**

## Ryšinės santvaros apatinės juostos projektavimas

**CODE:** EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

#### CODE GROUP:

**MEMBER:** 420 HR A 1\_420

**POINT:** 1

**COORDINATE:** x = 0.50 L = 2.005

m

#### LOADS:

$$\text{Governing Load Case: } 43 \text{ ULS}/33 = 1 \cdot 1.35 + 6 \cdot 1.30 + 4 \cdot 0.91 \quad 1 \cdot 1.35 + 6 \cdot 1.30 + 4 \cdot 0.91$$

#### MATERIAL:

S 355 ( S 355 )  $f_y = 355.00 \text{ MPa}$



#### SECTION PARAMETERS: SQUA 60x60x4

$$h = 6.0 \text{ cm}$$

$$gM_0 = 1.10$$

$$gM_1 = 1.10$$

$$b = 6.0 \text{ cm}$$

$$A_y = 4.27 \text{ cm}^2$$

$$A_z = 4.27 \text{ cm}^2$$

$$A_x = 8.55 \text{ cm}^2$$

$$t_w = 0.4 \text{ cm}$$

$$I_y = 43.55 \text{ cm}^4$$

$$I_z = 43.55 \text{ cm}^4$$

$$I_x = 70.72 \text{ cm}^4$$

$$t_f = 0.4 \text{ cm}$$

$$W_{ply} = 17.64 \text{ cm}^3$$

$$W_{plz} = 17.64 \text{ cm}^3$$

#### INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = -1.73 \text{ kN}$$

$$M_{y,Ed} = -0.06 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed} = 0.00 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = -0.00 \text{ kN}$$

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Nt,Rd = 275.87 kN      My,pl,Rd = 5.69 kN\*m      Mz,pl,Rd = 5.69 kN\*m      Vy,T,Rd = 79.63 kN  
My,c,Rd = 5.69 kN\*m      Mz,c,Rd = 5.69 kN\*m      Vz,Ed = 0.11 kN  
MN,y,Rd = 5.69 kN\*m      MN,z,Rd = 5.69 kN\*m      Vz,T,Rd = 79.63 kN  
Mb,Rd = 5.69 kN\*m      Tt,Ed = 0.00 kN\*m  
Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

z = 1.00      Mcr = 63.23 kN\*m      Curve,LT - d      XLT = 1.00  
Lcr,low=4.010 m      Lam\_LT = 0.31      fi,LT = 0.50      XLT,mod = 1.00

#### BUCKLING PARAMETERS:



About y axis:



About z axis:

#### VERIFICATION FORMULAS:

##### Section strength check:

N,Ed/Nt,Rd = 0.01 < 1.00 (6.2.3.(1))  
My,Ed/MN,y,Rd = 0.01 < 1.00 (6.2.9.1.(2))  
Mz,Ed/MN,z,Rd = 0.00 < 1.00 (6.2.9.1.(2))  
(My,Ed/MN,y,Rd)^1.66 + (Mz,Ed/MN,z,Rd)^1.66 = 0.00 < 1.00 (6.2.9.1.(6))  
Vy,Ed/Vy,T,Rd = 0.00 < 1.00 (6.2.6-7)  
Vz,Ed/Vz,T,Rd = 0.00 < 1.00 (6.2.6-7)  
Tau,ty,Ed/(fy/(sqrt(3)\*gM0)) = 0.00 < 1.00 (6.2.6)  
Tau,tz,Ed/(fy/(sqrt(3)\*gM0)) = 0.00 < 1.00 (6.2.6)

##### Global stability check of member:

My,Ed/Mb,Rd = 0.01 < 1.00 (6.3.2.1.(1))

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

uy = 0.00 cm < uy max = L/200.00 = 2.01 cm      Verified  
**Governing Load Case:** 126 SLS:CHR/34=1\*1.00 + 5\*0.60 + 4\*1.00 (1+4)\*1.00+5\*0.60  
uz = 0.03 cm < uz max = L/200.00 = 2.01 cm      Verified  
**Governing Load Case:** 114 SLS:CHR/22=1\*1.00 + 6\*1.00 + 4\*0.70 (1+6)\*1.00+4\*0.70



Displacements (GLOBAL SYSTEM): Not analyzed

**Section OK !!!**

**Išvada: sąlyga tenkinama**

## Ryšinės santvaros apatinių strypų projektavimas

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

#### CODE GROUP:

MEMBER: 298 HR ap.\_298

POINT: 2

COORDINATE: x = 0.50 L = 0.879 m

#### LOADS:

Governing Load Case: 37 ULS/27=1\*1.35 + 2\*0.91 + 7\*1.30 + 4\*0.91 1\*1.35+(2+4)\*0.91+7\*1.30

#### MATERIAL:

S 355 ( S 355 ) fy = 355.00 MPa

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**SECTION PARAMETERS: Q 40x40x4**

h=4.0 cm	gM0=1.10	gM1=1.10	
b=4.0 cm	Ay=2.67 cm <sup>2</sup>	Az=2.67 cm <sup>2</sup>	Ax=5.35 cm <sup>2</sup>
tw=0.4 cm	Iy=11.10 cm <sup>4</sup>	Iz=11.10 cm <sup>4</sup>	Ix=18.97 cm <sup>4</sup>
tf=0.4 cm	Wply=7.01 cm <sup>3</sup>	Wplz=7.01 cm <sup>3</sup>	

**INTERNAL FORCES AND CAPACITIES:**

N,Ed = 0.15 kN	My,Ed = 0.01 kN*m
Nc,Rd = 172.66 kN	My,Ed,max = 0.01 kN*m
Nb,Rd = 57.67 kN	My,c,Rd = 2.26 kN*m
	MN,y,Rd = 2.26 kN*m
	Mb,Rd = 2.26 kN*m

Class of section = 1



**LATERAL BUCKLING PARAMETERS:**

z = 1.00	Mcr = 37.45 kN*m	Curve,LT - d	XLT = 1.00
Lcr,upp=1.759 m	Lam_LT = 0.26	fi,LT = 0.47	XLT,mod = 1.00

**BUCKLING PARAMETERS:**



About y axis:

Ly = 1.759 m	Lam_y = 1.60
Lcr,y = 1.759 m	Xy = 0.33
Lamy = 122.09	kyy = 1.00



About z axis:

Lz = 1.759 m	Lam_z = 1.60
Lcr,z = 1.759 m	Xz = 0.33
Lamz = 122.09	kzy = 0.60

**VERIFICATION FORMULAS:**

**Section strength check:**

$N,Ed/Nc,Rd = 0.00 < 1.00$  (6.2.4.(1))  
 $My,Ed/My,c,Rd = 0.01 < 1.00$  (6.2.5.(1))

**Global stability check of member:**

$\Lambda_{b,y} = 122.09 < \Lambda_{b,max} = 150.00$        $\Lambda_{b,z} = 122.09 < \Lambda_{b,max} = 150.00$       STABLE  
 $My,Ed,max/Mb,Rd = 0.01 < 1.00$  (6.3.2.1.(1))  
 $N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.01 < 1.00$  (6.3.3.(4))  
 $N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.01 < 1.00$  (6.3.3.(4))

**LIMIT DISPLACEMENTS**



**Deflections (LOCAL SYSTEM):**

$u_y = 0.00 \text{ cm} < u_y \text{ max} = L/200.00 = 0.88 \text{ cm}$       Verified

**Governing Load Case:** 129 SLS:CHR/37=1\*1.00 + 8\*0.60 + 4\*1.00 (1+4)\*1.00+8\*0.60

$u_z = 0.01 \text{ cm} < u_z \text{ max} = L/200.00 = 0.88 \text{ cm}$       Verified

**Governing Load Case:** 97 SLS:CHR/5=1\*1.00 + 2\*1.00 + 6\*0.60 + 4\*0.70 (1+2)\*1.00+6\*0.60+4\*0.70



**Displacements (GLOBAL SYSTEM):** Not analyzed

**Section OK !!!**

**Išvada: sąlyga tenkinama**

**Ryšinės santvaros tinklelių projektavimas**

**CODE:** EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	133	251	0

**CODE GROUP:**

**MEMBER:** 235 HR ap. įstr. 235 **POINT:** 1  
m

**COORDINATE:** x = 0.00 L = 0.000

**LOADS:**

Governing Load Case: 43 ULS/33=1\*1.35 + 6\*1.30 + 4\*0.91 1\*1.35+6\*1.30+4\*0.91

**MATERIAL:**

S 355 ( S 355 )  $f_y = 355.00$  MPa



**SECTION PARAMETERS: Q 40x40x4**

h=4.0 cm	gM0=1.10	gM1=1.10	
b=4.0 cm	Ay=2.67 cm <sup>2</sup>	Az=2.67 cm <sup>2</sup>	Ax=5.35 cm <sup>2</sup>
tw=0.4 cm	Iy=11.10 cm <sup>4</sup>	Iz=11.10 cm <sup>4</sup>	Ix=18.97 cm <sup>4</sup>
tf=0.4 cm	Wply=7.01 cm <sup>3</sup>	Wplz=7.01 cm <sup>3</sup>	

**INTERNAL FORCES AND CAPACITIES:**

N,Ed = -1.17 kN	My,Ed = -0.03 kN*m	Mz,Ed = -0.00 kN*m	Vy,Ed = -0.00 kN
Nt,Rd = 172.66 kN	My,pl,Rd = 2.26 kN*m	Mz,pl,Rd = 2.26 kN*m	Vy,T,Rd = 49.83 kN
	My,c,Rd = 2.26 kN*m	Mz,c,Rd = 2.26 kN*m	Vz,Ed = 0.06 kN
	MN,y,Rd = 2.26 kN*m	MN,z,Rd = 2.26 kN*m	Vz,T,Rd = 49.83 kN
	Mb,Rd = 2.26 kN*m		Tt,Ed = 0.00 kN*m
			Class of section = 1



**LATERAL BUCKLING PARAMETERS:**

z = 1.00	Mcr = 47.03 kN*m	Curve,LT - d	XLT = 1.00
Lcr,low=1.393 m	Lam_LT = 0.23	fi,LT = 0.46	XLT,mod = 1.00

**BUCKLING PARAMETERS:**



About y axis:



About z axis:

**VERIFICATION FORMULAS:**

**Section strength check:**

N,Ed/Nt,Rd = 0.01 < 1.00 (6.2.3.(1))  
 My,Ed/MN,y,Rd = 0.02 < 1.00 (6.2.9.1.(2))  
 Mz,Ed/MN,z,Rd = 0.00 < 1.00 (6.2.9.1.(2))  
 (My,Ed/MN,y,Rd)^1.66 + (Mz,Ed/MN,z,Rd)^1.66 = 0.00 < 1.00 (6.2.9.1.(6))  
 Vy,Ed/Vy,T,Rd = 0.00 < 1.00 (6.2.6-7)  
 Vz,Ed/Vz,T,Rd = 0.00 < 1.00 (6.2.6-7)  
 Tau,ty,Ed/(fy/(sqrt(3)\*gM0)) = 0.00 < 1.00 (6.2.6)  
 Tau,tz,Ed/(fy/(sqrt(3)\*gM0)) = 0.00 < 1.00 (6.2.6)

**Global stability check of member:**

My,Ed/Mb,Rd = 0.02 < 1.00 (6.3.2.1.(1))

**LIMIT DISPLACEMENTS**



**Deflections (LOCAL SYSTEM):**

uy = 0.00 cm < uy max = L/200.00 = 0.70 cm Verified

Governing Load Case: 110 SLS:CHR/18=1\*1.00 + 2\*0.70 + 8\*1.00 + 4\*0.70 (1+8)\*1.00+(2+4)\*0.70

uz = 0.01 cm < uz max = L/200.00 = 0.70 cm Verified

Governing Load Case: 106 SLS:CHR/14=1\*1.00 + 2\*0.70 + 6\*1.00 + 4\*0.70 (1+6)\*1.00+(2+4)\*0.70



**Displacements (GLOBAL SYSTEM):** Not analyzed

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	134	251	0

*Section OK !!!*

**Išvada: sąlyga tenkinama**

### **1.7. Monolitinės priedangos perdangos plokštės projektavimas**

Projektuojama monolitinė GB priedangos perdanga.

Betonas: C30/37;

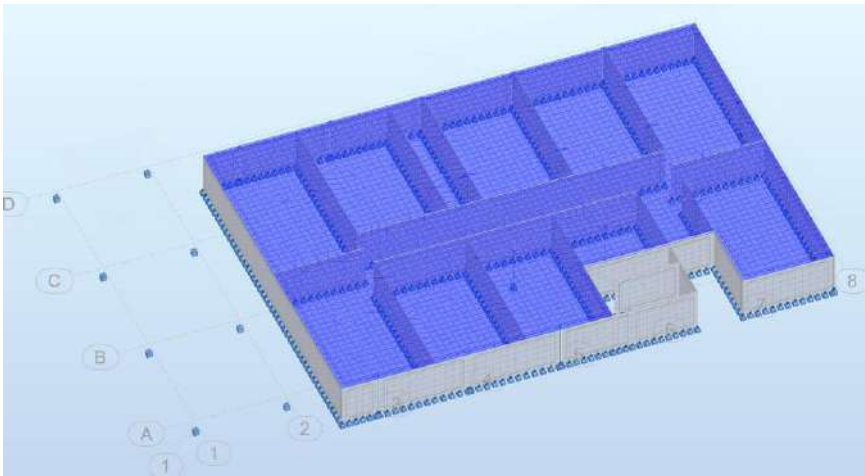
Aplinkos klasė XC1;

Kolonas su perdanga jungiasi standžiai. Perdanga remiasi ant monolitinių rūšio sienų standžiai.

Apsauginis betono sluoksnis: ne mažiau kaip armatūros skersmuo ir ne mažiau nei 25 mm iki pagrindinės armatūros centro. Ugniaatsparumas R90.

Projektuojamos perdangos storis: 300mm.

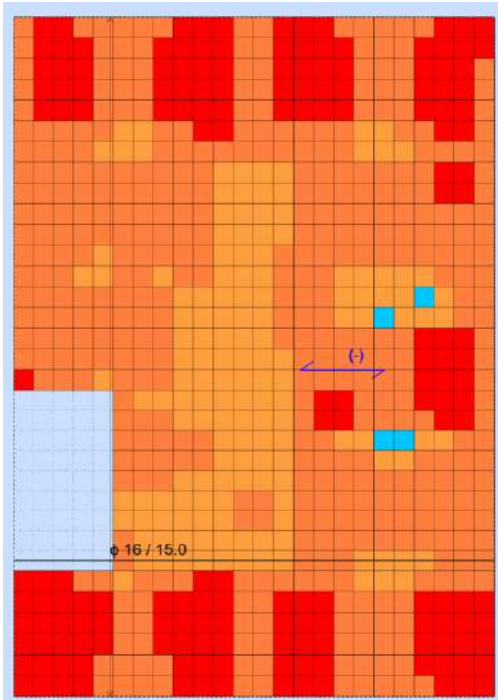
Skaičiuojamoji schema:



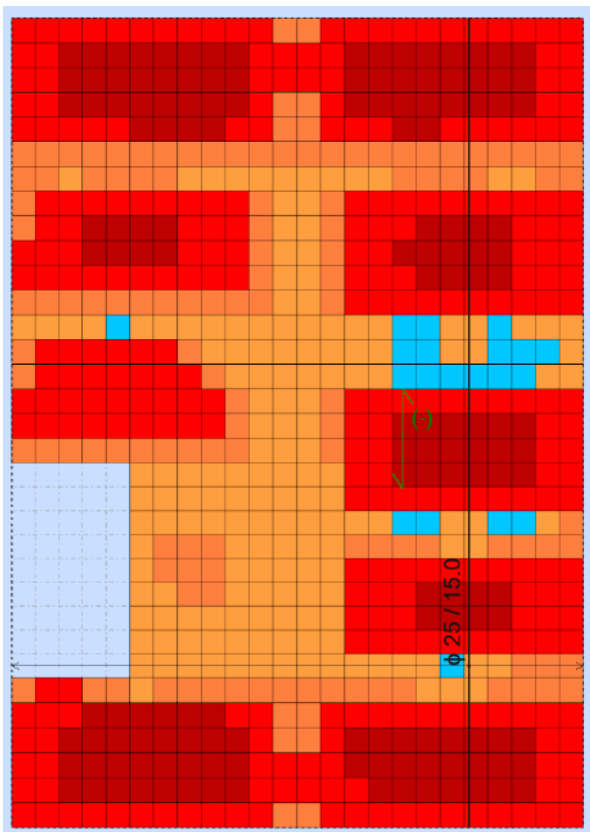
Reikalingas armavimas.

Apatinis armavimas X kryptimi:

	Lapas	Lapų	Laida
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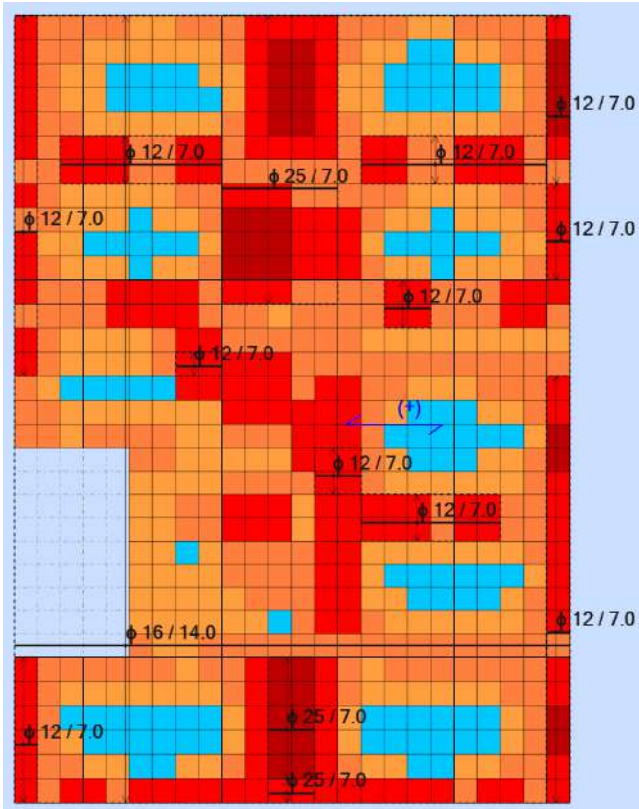


Apatinis armavimas Y kryptimi:

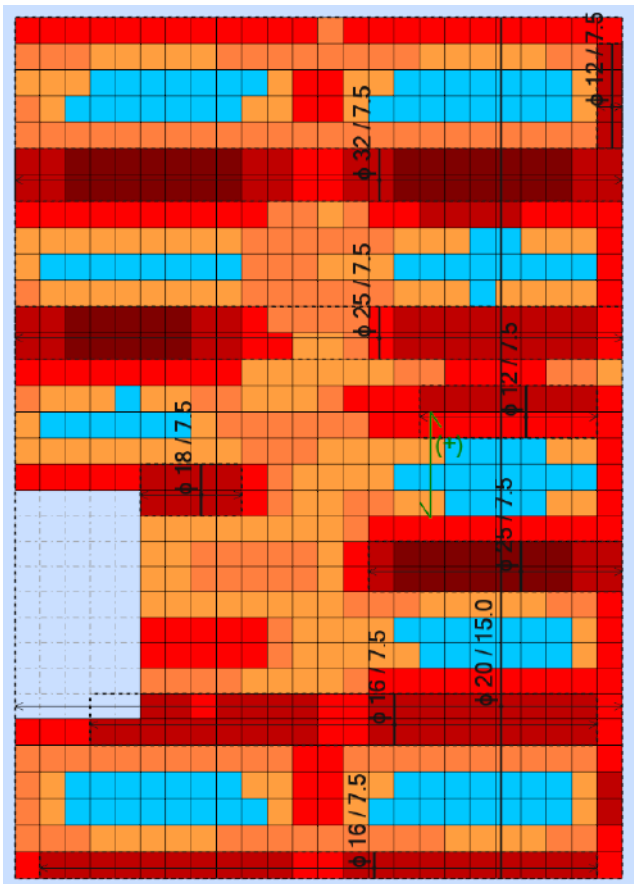


Viršutinis armavimas X kryptimi:

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	136	251	0



Viršutinis armavimas Y kryptimi:



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	137	251	0

## Valkšnumo koeficiento nustatymas su skaičiuoklę pagal EN1992-1-1:

Concrete characteristic strength	$f_{ck} =$ <input type="text" value="30"/>	MPa
Concrete cross-sectional area	$A_c =$ <input type="text" value="0.3"/>	m <sup>2</sup>
Part of cross-section perimeter exposed to drying	$u =$ <input type="text" value="2"/>	m
Age of concrete at loading	$t_0 =$ <input type="text" value="28"/>	days
Ambient temperature	$T =$ <input type="text" value="20"/>	°C
Relative humidity of ambient environment	$RH =$ <input type="text" value="80"/>	%
Cement type	= <input type="text" value="Class N"/>	▼
Age of concrete at end of curing	$t_s =$ <input type="text" value="7"/>	days

Final creep coefficient  
Final shrinkage strain

$$\varphi(\infty, t_0) = 1.679$$

$$\varepsilon_{cs}(\infty, t_s) = 25.17 \times 10^{-5}$$

The notional creep coefficient  $\varphi_0$  is calculated in accordance with [EN1992-1-1 equation \(B.2\)](#) as the product:

$$\varphi_0 = \varphi_{RH} \cdot \beta(f_{cm}) \cdot \beta(t_0) = 1.261 \cdot 2.725 \cdot 0.489 = 1.679$$

The autogenous shrinkage strain at infinite time  $\varepsilon_{ca}(\infty)$  is calculated in accordance with [EN1992-1-1 equation \(3.12\)](#) as:

$$\varepsilon_{ca}(\infty) = 2.5 \cdot (f_{ck} - 10 \text{ MPa}) \cdot 10^{-6} = 2.5 \cdot (30.00 \text{ MPa} - 10 \text{ MPa}) \cdot 10^{-6} = 5.00 \times 10^{-5}$$

The total shrinkage strain  $\varepsilon_{cs}$  is composed from the drying shrinkage strain  $\varepsilon_{cd}$  and the autogenous shrinkage strain  $\varepsilon_{ca}$  as specified in [\[EN1992-1-1 equation \(3.8\)\]](#):

$$\varepsilon_{cs} = \varepsilon_{cd} + \varepsilon_{ca}$$

The final total shrinkage strain  $\varepsilon_{cs}(\infty, t_s)$  at infinite time is obtained by setting  $t = \infty$  which corresponds to setting  $\beta_{ds}(t, t_s) = 1.0$  and  $\beta_{as}(t) = 1.0$ , and therefore:

$$\varepsilon_{cs}(\infty, t_s) = k_h \cdot \varepsilon_{cd,0} + \varepsilon_{ca}(\infty) = 0.75 \cdot 26.90 \times 10^{-5} + 5.00 \times 10^{-5} = 25.17 \times 10^{-5}$$

Therefore the final total shrinkage strain at infinite time is calculated as  $\varepsilon_{cs}(\infty, t_s) = 25.17 \times 10^{-5}$ .

Skaičiuoklėje gautas valkšnumo koeficientas 1,679.

Skaičiavimo programoje gautas valkšnumo koeficientas 1,68.

## 1. Slab: Slab116 - Panel no. 116

### 1.1. Reinforcement:

- Type : Perdanga4
- Main reinforcement direction : 0°
- Main reinforcement grade : B500B; Characteristic strength = 500.00 MPa  
Horizontal branch of the stress-strain diagram
- Ductility class : B
- Bar diameters : bottom d1 = 1.2 (cm) d2 = 1.2 (cm)  
top d1 = 1.2 (cm) d2 = 1.2 (cm)
- Cover : bottom c1 = 3.0 (cm)  
top c2 = 3.0 (cm)
- Cover deviations : Cdev = 1.0(cm), Cdur = 0.0(cm)

### 1.2. Concrete

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Class : C30/37; Characteristic strength = 30.00 MPa  
 Rectangular stress distribution [3.1.7(3)]

- Density : 2501.36 (kG/m3)
- Concrete creep coefficient : 1.68
- Cement class : N

### 1.3. Hypothesis

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Method of reinforcement area calculations : analytical
- Allowable cracking width
  - upper layer : 0.30 (mm)
  - lower layer : 0.30 (mm)
- Allowable deflection : 3.40 (cm)
- Verification of punching : yes
- Exposure
  - upper layer : XC1
  - lower layer : XC1
- Calculation type : simple bending
- Structure class : S4

Modified partial coefficients:

$a_{cc} = 0.9$  1992-1-1 3.1.6 (1)P

### 1.4. Slab geometry

Thickness 0.300 (m)

#### Contour:

edge	beginning		end		length (m)
	x1	y1	x2	y2	
1	0.000	17.775	22.800	17.775	22.800
2	22.800	17.775	22.800	-14.575	32.350
3	22.800	-14.575	0.000	-14.575	22.800
4	0.000	-14.575	0.000	-8.575	6.000
5	0.000	-8.575	4.700	-8.575	4.700
6	4.700	-8.575	4.700	-5.575	3.000
7	4.700	-5.575	4.700	-0.000	5.575
8	4.700	-0.000	0.000	-0.000	4.700
9	0.000	-0.000	0.000	17.775	17.775

#### Support:

n°	Name	dimensions (m)	coordinates		edge
			x	y	
142	point	0.400 / 0.400	22.800	15.425	—
142	point	0.400 / 0.400	22.800	15.425	—
238	point	0.400 / 0.400	22.800	3.425	—
238	point	0.400 / 0.400	22.800	3.425	—
0	linear	0.250 / 4.700	2.350	-0.000	—
0	linear	0.300 / 0.150	0.075	-0.000	—
0	linear	3.325 / 0.200	0.000	1.663	—
383	point	0.457 / 0.457	0.000	-0.000	—
416	point	0.400 / 0.400	22.800	9.425	—
416	point	0.400 / 0.400	22.800	9.425	—
0	linear	0.300 / 2.250	13.925	-8.575	—
0	linear	20.250 / 0.300	12.800	1.550	—

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	139	251	0



0	linear	0.300 / 2.250	13.925	-2.575	—
0	linear	0.300 / 2.250	13.925	3.425	—
0	linear	2.250 / 0.300	0.000	16.650	—
0	linear	0.300 / 22.800	11.400	17.775	—
0	linear	0.300 / 4.700	2.350	-8.575	—
0	linear	0.300 / 4.700	2.350	-8.575	—
0	linear	5.900 / 0.300	0.000	-11.525	—
0	linear	0.300 / 2.250	8.875	-8.575	—
740	point	0.400 / 0.400	0.000	3.425	—
740	point	0.400 / 0.400	0.000	3.425	—
742	point	0.400 / 0.400	0.000	9.425	—
742	point	0.400 / 0.400	0.000	9.425	—
751	point	0.400 / 0.400	0.000	15.425	—
751	point	0.400 / 0.400	0.000	15.425	—
752	point	0.400 / 0.400	0.000	-14.575	—
752	point	0.400 / 0.400	0.000	-14.575	—
754	point	0.400 / 0.400	7.650	-14.575	—
754	point	0.400 / 0.400	7.650	-14.575	—
755	point	0.400 / 0.400	22.800	-2.575	—
755	point	0.400 / 0.400	22.800	-2.575	—
756	point	0.400 / 0.400	22.800	-8.575	—
756	point	0.400 / 0.400	22.800	-8.575	—
758	point	0.400 / 0.400	15.150	-14.575	—
758	point	0.400 / 0.400	15.150	-14.575	—
759	point	0.400 / 0.400	7.650	-8.575	—
759	point	0.400 / 0.400	7.650	-8.575	—
763	point	0.400 / 0.400	15.150	-8.575	—
763	point	0.400 / 0.400	15.150	-8.575	—
764	point	0.400 / 0.400	15.150	-2.575	—
764	point	0.400 / 0.400	15.150	-2.575	—
765	point	0.400 / 0.400	7.650	-2.575	—
765	point	0.400 / 0.400	7.650	-2.575	—
767	point	0.400 / 0.400	7.650	3.425	—
767	point	0.400 / 0.400	7.650	3.425	—
768	point	0.400 / 0.400	15.150	3.425	—
768	point	0.400 / 0.400	15.150	3.425	—
769	point	0.400 / 0.400	22.800	-14.575	—
769	point	0.400 / 0.400	22.800	-14.575	—
0	linear	0.300 / 4.550	2.425	-0.000	—
0	linear	5.575 / 0.300	4.700	-2.788	—
0	linear	8.575 / 0.300	4.700	-4.288	—
0	linear	0.300 / 5.300	7.350	-0.000	—
0	linear	3.000 / 0.300	4.700	-7.075	—
0	linear	0.300 / 2.850	6.125	-8.575	—
0	linear	0.300 / 5.300	7.350	-5.575	—
0	linear	6.100 / 0.300	11.400	14.725	—
0	linear	2.250 / 0.300	22.800	16.650	—
0	linear	17.250 / 0.300	10.000	3.050	—
0	linear	0.300 / 10.000	5.000	11.675	—
0	linear	0.300 / 10.000	5.000	5.675	—
0	linear	0.300 / 10.000	17.800	11.675	—
0	linear	0.300 / 10.000	17.800	5.675	—
0	linear	0.300 / 7.450	18.975	-8.575	—
0	linear	0.300 / 7.450	18.975	-2.575	—
0	linear	0.300 / 7.450	18.975	3.425	—
0	linear	0.300 / 7.450	18.975	-14.575	—
0	linear	0.300 / 7.300	11.400	-14.575	—
0	linear	6.100 / 0.300	11.400	-11.525	—

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0	linear	0.300 / 7.450	3.825	-14.575	—
0	linear	5.800 / 0.300	22.800	6.425	—
0	linear	5.800 / 0.300	22.800	12.425	—
0	linear	5.800 / 0.300	0.000	12.425	—
0	linear	5.800 / 0.300	22.800	0.425	—
0	linear	5.800 / 0.300	22.800	-11.575	—
0	linear	5.800 / 0.300	0.000	6.425	—
0	linear	5.800 / 0.300	22.800	-5.575	—
725	linear	0.500 / 0.500	17.725	9.825	—
726	linear	0.500 / 0.500	17.725	7.425	—
727	linear	0.500 / 0.500	10.775	15.925	—
728	linear	0.500 / 0.500	10.775	13.525	—
729	linear	0.500 / 0.500	12.425	9.825	—
730	linear	0.500 / 0.500	12.425	7.425	—
736	linear	0.500 / 0.500	17.725	5.025	—
737	linear	0.500 / 0.500	12.425	5.025	—
9885	linear	0.500 / 0.500	5.775	15.925	—
9886	linear	0.500 / 0.500	5.775	13.525	—
721	linear	0.500 / 0.500	5.075	8.625	—
722	linear	0.500 / 0.500	5.075	6.225	—
731	linear	0.500 / 0.500	10.375	8.625	—
732	linear	0.500 / 0.500	10.375	6.225	—
733	linear	0.500 / 0.500	22.025	12.325	—
734	linear	0.500 / 0.500	22.025	14.725	—
735	linear	0.500 / 0.500	5.075	3.825	—
738	linear	0.500 / 0.500	10.375	3.825	—
9892	linear	0.500 / 0.500	17.025	12.325	—
9893	linear	0.500 / 0.500	17.025	14.725	—

\* - head present

## 1.5. Calculation results:

### 1.5.1. Maximum moments + reinforcement for bending

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Provided reinforcement (cm <sup>2</sup> /m):	47.15	13.40	70.79	32.72
Modified required reinforcement (cm <sup>2</sup> /m):	35.10	11.69	57.38	26.06
Original required reinforcement (cm <sup>2</sup> /m):	35.10	11.69	57.38	26.06
Coordinates (m):	11.400;14.834 17.025;14.725	2.235;-10.377	17.506;11.675	

### 1.5.2. Maximum moments + reinforcement for bending

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Symbol: required area/provided area				
Ax(+) (cm <sup>2</sup> /m)	<b>35.10/47.15</b> 0.00/14.36	2.69/14.36	9.00/14.36	
Ax(-) (cm <sup>2</sup> /m)	0.00/15.00	<b>11.69/13.40</b>	0.00/13.40	
Ay(+) (cm <sup>2</sup> /m)	8.77/13.40	1.49/20.94	<b>57.38/70.79</b>	
Ay(-) (cm <sup>2</sup> /m)	14.65/20.94	14.29/32.72	7.36/32.72	
	<b>26.06/32.72</b>			

### SLS

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Mxx (kN*m/m)	26.52	-7.13	8.72	-22.62
Myy (kN*m/m)	5.48	-10.45	46.77	-33.80
Mxy (kN*m/m)	-0.06	-5.62	-2.20	0.19
Nxx (kN/m)	-12.80	-17.98	-18.96	-17.60
Nyy (kN/m)	-17.04	-5.43	-18.97	-25.66
Nxy (kN/m)	0.57	-9.01	1.89	0.88
<b>ULS</b>				
Mxx (kN*m/m)	35.57	-9.49	11.63	-29.68
Myy (kN*m/m)	7.33	-13.91	62.31	-44.73
Mxy (kN*m/m)	-0.08	-7.48	-2.88	0.25
Nxx (kN/m)	-17.02	-23.73	-25.04	-23.32
Nyy (kN/m)	-22.75	-7.16	-25.23	-34.11
Nxy (kN/m)	0.75	-11.88	2.46	1.19
<b>ULS - accid. comb.</b>				
Mxx (kN*m/m)	374.73	-76.07	99.29	-106.72
Myy (kN*m/m)	71.82	-109.48	507.97	-277.56
Mxy (kN*m/m)	-0.22	-59.56	-7.08	1.70
Nxx (kN/m)	-91.83	-129.71	-101.58	-121.50
Nyy (kN/m)	-139.01	-51.90	-122.42	-151.55
Nxy (kN/m)	-7.15	31.16	-14.16	-10.24
Coordinates (m)	11.400;14.834	2.235;-10.377	17.506;11.675	
Coordinates* (m)	17.025;14.725	12.591;11.250;-0.470	37.802;2.085;-0.470	
		15.750;17.356;-0.470	12.700;16.875;-0.470	

\* - Coordinates in the structure global coordinate system

### 1.5.3. Punching

Support no. / Point	Location (m)		Geometry: (m)	a	b	d	h
	x	y					
S1 (714)	7.650	-2.575	Column		0.400	0.400	-
S3 (715)	7.650	3.425	Column		0.400	0.400	-
P1 (9900)	17.725	9.825	Force	0.500	0.500	-	-
P2 (9901)	17.725	7.425	Force	0.500	0.500	-	-
P3 (9902)	10.775	15.925	Force	0.500	0.500	-	-
P4 (9903)	10.775	13.525	Force	0.500	0.500	-	-
P5 (9904)	12.425	9.825	Force	0.500	0.500	-	-
P6 (9905)	12.425	7.425	Force	0.500	0.500	-	-
P7 (9911)	17.725	5.025	Force	0.500	0.500	-	-
P8 (9912)	12.425	5.025	Force	0.500	0.500	-	-
P9 (9885)	5.775	15.925	Force	0.500	0.500	-	-
P10 (9886)	5.775	13.525	Force	0.500	0.500	-	-
P11 (9897)	5.075	8.625	Force	0.500	0.500	-	-
P12 (9898)	5.075	6.225	Force	0.500	0.500	-	-
P13 (9906)	10.375	8.625	Force	0.500	0.500	-	-
P14 (9907)	10.375	6.225	Force	0.500	0.500	-	-
P15 (9908)	22.025	12.325	Force	0.500	0.500	-	-
P16 (9909)	22.025	14.725	Force	0.500	0.500	-	-
P17 (9910)	5.075	3.825	Force	0.500	0.500	-	-
P18 (9913)	10.375	3.825	Force	0.500	0.500	-	-
P19 (9892)	17.025	12.325	Force	0.500	0.500	-	-
P20 (9893)	17.025	14.725	Force	0.500	0.500	-	-
Support no. / Point	Loads: (kN)		Critical perimeter (m)	u	Qadm / Q		
	Q	Qadm					
S1 (714)	32.49	767.32	4.842	23.62 > 1			
S3 (715)	95.53	826.57	4.842	8.65 > 1			
P1 (9900)	65.00	884.62	5.242	13.61 > 1			
P2 (9901)	65.00	884.62	5.242	13.61 > 1			

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P3 (9902)	65.00	884.62	5.242	13.61 > 1
P4 (9903)	65.00	884.62	5.242	13.61 > 1
P5 (9904)	0.00	0.00	0.000	##### < 1
P6 (9905)	0.00	0.00	0.000	##### < 1
P7 (9911)	65.00	884.62	5.242	13.61 > 1
P8 (9912)	0.00	0.00	0.000	##### < 1
P9 (9885)	65.00	884.62	5.242	13.61 > 1
P10 (9886)	65.00	884.62	5.242	13.61 > 1
P11 (9897)	65.00	884.62	5.242	13.61 > 1
P12 (9898)	65.00	884.62	5.242	13.61 > 1
P13 (9906)	0.00	0.00	0.000	##### < 1
P14 (9907)	0.00	0.00	0.000	##### < 1
P15 (9908)	65.00	442.31	2.621	6.80 > 1
P16 (9909)	65.00	442.31	2.621	6.80 > 1
P17 (9910)	65.00	884.62	5.242	13.61 > 1
P18 (9913)	0.00	0.00	0.000	##### < 1
P19 (9892)	65.00	884.62	5.242	13.61 > 1
P20 (9893)	65.00	884.62	5.242	13.61 > 1

**Support no. / Point: S1 (714)**

$u_0 = 1.600$   
 $u_1 = 4.842$   
 $\rho_{Lx} = 0.01$   
 $\rho_{Ly} = 0.01$   
 $heff = 25.8 \text{ (cm)}$   
 $A_x = 14.36 \text{ (cm}^2\text{)}$   
 $A_y = 14.36 \text{ (cm}^2\text{)}$   
 $\alpha = 1.57$   
 $v = 0.53 \text{ ()}$   
 $\gamma_c = 1.50 \text{ ()}$   
 $f_{cd} = 20.00 \text{ (MPa)}$   
 $v_{Rdmax} = 4.22 \text{ (MPa)}$   
 $V = 25.15 \text{ (kN)}$   
 $M_x = 1.36 \text{ (kN}\cdot\text{m)}$   
 $M_y = 4.61 \text{ (kN}\cdot\text{m)}$   
 $A = 1.249 \text{ (m}^2\text{)}$   
 $K_x = 0.60$   
 $K_y = 0.60$   
 $W_x = 0.609$   
 $W_y = 0.609$   
 $v_{Rdc} = 0.61$   
 $v_{min} = 0.49$   
 $v_{Eds} = 0.08$   
 $c_{Rdc} = 0.12$   
 $k = 1.88$   
 $\rho_L = 0.01 \text{ ()}$   
 $v_{lim} = 0.61 \text{ (MPa)}$   
 $v = 0.03 \text{ (MPa)}$   
 $A = 1.249 \text{ (m}^2\text{)}$

**Support no. / Point: S3 (715)**

$u_0 = 1.600$   
 $u_1 = 4.842$   
 $\rho_{Lx} = 0.01$   
 $\rho_{Ly} = 0.01$   
 $heff = 25.8 \text{ (cm)}$   
 $A_x = 22.44 \text{ (cm}^2\text{)}$   
 $A_y = 22.44 \text{ (cm}^2\text{)}$   
 $\alpha = 1.57$   
 $v = 0.53 \text{ ()}$

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$\gamma_c = 1.50$  ()  
 $f_{cd} = 20.00$  (MPa)  
 $v_{Rdmax} = 4.22$  (MPa)  
 $V = 71.22$  (kN)  
 $M_x = 7.75$  (kN\*m)  
 $M_y = 12.03$  (kN\*m)  
 $A = 1.249$  (m<sup>2</sup>)  
 $K_x = 0.60$   
 $K_y = 0.60$   
 $W_x = 0.609$   
 $W_y = 0.609$

$v_{Rdc} = 0.66$   
 $v_{min} = 0.49$   
 $v_{Eds} = 0.23$   
 $c_{Rdc} = 0.12$   
 $k = 1.88$   
 $\rho_L = 0.01$  ()  
 $v_{lim} = 0.66$  (MPa)  
 $v = 0.08$  (MPa)  
 $A = 1.249$  (m<sup>2</sup>)

**Support no. / Point: P1 (9900)**

$u_0 = 2.000$   
 $u_1 = 5.242$   
 $\rho_{Lx} = 0.01$   
 $\rho_{Ly} = 0.01$   
 $h_{eff} = 25.8$  (cm)  
 $A_x = 13.40$  (cm<sup>2</sup>)  
 $A_y = 13.40$  (cm<sup>2</sup>)  
 $\alpha = 1.57$   
 $v = 0.53$  ()  
 $\gamma_c = 1.50$  ()  
 $f_{cd} = 20.00$  (MPa)  
 $v_{Rdmax} = 4.22$  (MPa)  
 $V = 65.00$  (kN)  
 $M_x = 0.00$  (kN\*m)  
 $M_y = 0.00$  (kN\*m)  
 $A = 1.352$  (m<sup>2</sup>)  
 $K_x = 0.60$   
 $K_y = 0.60$   
 $W_x = 0.713$   
 $W_y = 0.713$

$v_{Rdc} = 0.65$   
 $v_{min} = 0.49$   
 $v_{Eds} = 0.13$   
 $c_{Rdc} = 0.12$   
 $k = 1.88$   
 $\rho_L = 0.01$  ()  
 $v_{lim} = 0.65$  (MPa)  
 $v = 0.05$  (MPa)  
 $A = 1.352$  (m<sup>2</sup>)

**Support no. / Point: P2 (9901)**

$u_0 = 2.000$   
 $u_1 = 5.242$

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	144	251	0

$\rho_{Lx} = 0.01$   
 $\rho_{Ly} = 0.01$   
 $heff = 25.8 \text{ (cm)}$   
 $A_x = 13.40 \text{ (cm}^2\text{)}$   
 $A_y = 13.40 \text{ (cm}^2\text{)}$   
 $\alpha = 1.57$   
 $v = 0.53 \text{ ()}$   
 $\gamma_c = 1.50 \text{ ()}$   
 $f_{cd} = 20.00 \text{ (MPa)}$   
 $v_{Rdmax} = 4.22 \text{ (MPa)}$   
 $V = 65.00 \text{ (kN)}$   
 $M_x = 0.00 \text{ (kN}\cdot\text{m)}$   
 $M_y = 0.00 \text{ (kN}\cdot\text{m)}$   
 $A = 1.352 \text{ (m}^2\text{)}$   
 $K_x = 0.60$   
 $K_y = 0.60$   
 $W_x = 0.713$   
 $W_y = 0.713$

$v_{Rdc} = 0.65$   
 $v_{min} = 0.49$   
 $v_{Eds} = 0.13$   
 $c_{Rdc} = 0.12$   
 $k = 1.88$   
 $\rho_L = 0.01 \text{ ()}$   
 $v_{lim} = 0.65 \text{ (MPa)}$   
 $v = 0.05 \text{ (MPa)}$   
 $A = 1.352 \text{ (m}^2\text{)}$

**Support no. / Point: P3 (9902)**

$u_0 = 2.000$   
 $u_1 = 5.242$   
 $\rho_{Lx} = 0.01$   
 $\rho_{Ly} = 0.01$   
 $heff = 25.8 \text{ (cm)}$   
 $A_x = 13.40 \text{ (cm}^2\text{)}$   
 $A_y = 13.40 \text{ (cm}^2\text{)}$   
 $\alpha = 1.57$   
 $v = 0.53 \text{ ()}$   
 $\gamma_c = 1.50 \text{ ()}$   
 $f_{cd} = 20.00 \text{ (MPa)}$   
 $v_{Rdmax} = 4.22 \text{ (MPa)}$   
 $V = 65.00 \text{ (kN)}$   
 $M_x = 0.00 \text{ (kN}\cdot\text{m)}$   
 $M_y = 0.00 \text{ (kN}\cdot\text{m)}$   
 $A = 1.352 \text{ (m}^2\text{)}$   
 $K_x = 0.60$   
 $K_y = 0.60$   
 $W_x = 0.713$   
 $W_y = 0.713$

$v_{Rdc} = 0.65$   
 $v_{min} = 0.49$   
 $v_{Eds} = 0.13$   
 $c_{Rdc} = 0.12$   
 $k = 1.88$   
 $\rho_L = 0.01 \text{ ()}$

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vlim = 0.65 (MPa)  
v = 0.05 (MPa)  
A = 1.352 (m<sup>2</sup>)

**Support no. / Point: P4 (9903)**

uo = 2.000  
u1 = 5.242  
ρLx = 0.01  
ρLy = 0.01  
heff = 25.8 (cm)  
Ax = 13.40 (cm<sup>2</sup>)  
Ay = 13.40 (cm<sup>2</sup>)  
α = 1.57  
v = 0.53 ()  
γc = 1.50 ()  
fcd = 20.00 (MPa)  
vRdmax = 4.22 (MPa)  
V = 65.00 (kN)  
Mx = 0.00 (kN\*m)  
My = 0.00 (kN\*m)  
A = 1.352 (m<sup>2</sup>)  
Kx = 0.60  
Ky = 0.60  
Wx = 0.713  
Wy = 0.713

vRdc = 0.65  
vmin = 0.49  
vEds = 0.13  
cRdc = 0.12  
k = 1.88  
ρL = 0.01 ()  
vlim = 0.65 (MPa)  
v = 0.05 (MPa)  
A = 1.352 (m<sup>2</sup>)

**Support no. / Point: P5 (9904)**

uo = @VAL(Data\_p=Uo)@  
u1 = @VAL(Data\_p=U1)@  
ρLx = @VAL(Data\_p=RoLx)@  
ρLy = @VAL(Data\_p=RoLy)@  
heff = @V\_U(Data\_p=EffHeight)@  
Ax = @V\_U(Data\_p=Ax)@  
Ay = @V\_U(Data\_p=Ay)@  
α = @VAL(Data\_p=Alpha)@  
v = @V\_U(Data\_p=Ni)@  
γc = @V\_U(Data\_p=Gamma\_c)@  
fcd = @V\_U(Data\_p=Fcd)@  
vRdmax = @V\_U(Data\_p=VRdmax)@

vRdc = @VAL(Data\_p=VRdc)@  
vmin = @VAL(Data\_p=Ni\_min)@  
vEds = @VAL(Data\_p=VEds)@  
cRdc = @VAL(Data\_p=CRdc)@  
k = @VAL(Data\_p=K)@  
ρL = @V\_U(Data\_p=RoL)@  
vlim = @V\_U(Data\_p=StressLimit)@

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$v = @V\_U(Data\_p=Stress)@$   
 $A = @V\_U(Data\_p=ShearArea)@$

**Support no. / Point: P6 (9905)**

$u_0 = @VAL(Data\_p=U_0)@$   
 $u_1 = @VAL(Data\_p=U_1)@$   
 $\rho_{Lx} = @VAL(Data\_p=RoLx)@$   
 $\rho_{Ly} = @VAL(Data\_p=RoLy)@$   
 $heff = @V\_U(Data\_p=EffHeight)@$   
 $A_x = @V\_U(Data\_p=A_x)@$   
 $A_y = @V\_U(Data\_p=A_y)@$   
 $\alpha = @VAL(Data\_p=Alpha)@$   
 $v = @V\_U(Data\_p=Ni)@$   
 $\gamma_c = @V\_U(Data\_p=Gamma\_c)@$   
 $f_{cd} = @V\_U(Data\_p=F_{cd})@$   
 $v_{Rdmax} = @V\_U(Data\_p=VRdmax)@$

$v_{Rdc} = @VAL(Data\_p=VRdc)@$   
 $v_{min} = @VAL(Data\_p=Ni\_min)@$   
 $v_{Eds} = @VAL(Data\_p=VEds)@$   
 $c_{Rdc} = @VAL(Data\_p=CRdc)@$   
 $k = @VAL(Data\_p=K)@$   
 $\rho_L = @V\_U(Data\_p=RoL)@$   
 $v_{lim} = @V\_U(Data\_p=StressLimit)@$   
 $v = @V\_U(Data\_p=Stress)@$   
 $A = @V\_U(Data\_p=ShearArea)@$

**Support no. / Point: P7 (9911)**

$u_0 = 2.000$   
 $u_1 = 5.242$   
 $\rho_{Lx} = 0.01$   
 $\rho_{Ly} = 0.01$   
 $heff = 25.8 \text{ (cm)}$   
 $A_x = 13.40 \text{ (cm}^2\text{)}$   
 $A_y = 13.40 \text{ (cm}^2\text{)}$   
 $\alpha = 1.57$   
 $v = 0.53 \text{ ()}$   
 $\gamma_c = 1.50 \text{ ()}$   
 $f_{cd} = 20.00 \text{ (MPa)}$   
 $v_{Rdmax} = 4.22 \text{ (MPa)}$   
 $V = 65.00 \text{ (kN)}$   
 $M_x = 0.00 \text{ (kN}\cdot\text{m)}$   
 $M_y = 0.00 \text{ (kN}\cdot\text{m)}$   
 $A = 1.352 \text{ (m}^2\text{)}$   
 $K_x = 0.60$   
 $K_y = 0.60$   
 $W_x = 0.713$   
 $W_y = 0.713$   
  
 $v_{Rdc} = 0.65$   
 $v_{min} = 0.49$   
 $v_{Eds} = 0.13$   
 $c_{Rdc} = 0.12$   
 $k = 1.88$   
 $\rho_L = 0.01 \text{ ()}$   
 $v_{lim} = 0.65 \text{ (MPa)}$   
 $v = 0.05 \text{ (MPa)}$

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	147	251	0

$$A = 1.352 \text{ (m}^2\text{)}$$

**Support no. / Point: P8 (9912)**

$$\begin{aligned} u_0 &= @VAL(Data\_p=U_0)@ \\ u_1 &= @VAL(Data\_p=U_1)@ \\ \rho_{Lx} &= @VAL(Data\_p=RoLx)@ \\ \rho_{Ly} &= @VAL(Data\_p=RoLy)@ \\ heff &= @V\_U(Data\_p=EffHeight)@ \\ A_x &= @V\_U(Data\_p=A_x)@ \\ A_y &= @V\_U(Data\_p=A_y)@ \\ \alpha &= @VAL(Data\_p=Alpha)@ \\ v &= @V\_U(Data\_p=Ni)@ \\ \gamma_c &= @V\_U(Data\_p=Gamma\_c)@ \\ f_{cd} &= @V\_U(Data\_p=F_{cd})@ \\ v_{Rdmax} &= @V\_U(Data\_p=VRdmax)@ \end{aligned}$$

$$\begin{aligned} v_{Rdc} &= @VAL(Data\_p=VRdc)@ \\ v_{min} &= @VAL(Data\_p=Ni\_min)@ \\ v_{Eds} &= @VAL(Data\_p=VEds)@ \\ c_{Rdc} &= @VAL(Data\_p=CRdc)@ \\ k &= @VAL(Data\_p=K)@ \\ \rho_L &= @V\_U(Data\_p=RoL)@ \\ v_{lim} &= @V\_U(Data\_p=StressLimit)@ \\ v &= @V\_U(Data\_p=Stress)@ \\ A &= @V\_U(Data\_p=ShearArea)@ \end{aligned}$$

**Support no. / Point: P9 (9885)**

$$\begin{aligned} u_0 &= 2.000 \\ u_1 &= 5.242 \\ \rho_{Lx} &= 0.01 \\ \rho_{Ly} &= 0.01 \\ heff &= 25.8 \text{ (cm)} \\ A_x &= 13.40 \text{ (cm}^2\text{)} \\ A_y &= 13.40 \text{ (cm}^2\text{)} \\ \alpha &= 1.57 \\ v &= 0.53 \text{ ()} \\ \gamma_c &= 1.50 \text{ ()} \\ f_{cd} &= 20.00 \text{ (MPa)} \\ v_{Rdmax} &= 4.22 \text{ (MPa)} \\ V &= 65.00 \text{ (kN)} \\ M_x &= 0.00 \text{ (kN}\cdot\text{m)} \\ M_y &= 0.00 \text{ (kN}\cdot\text{m)} \\ A &= 1.352 \text{ (m}^2\text{)} \\ K_x &= 0.60 \\ K_y &= 0.60 \\ W_x &= 0.713 \\ W_y &= 0.713 \\ v_{Rdc} &= 0.65 \\ v_{min} &= 0.49 \\ v_{Eds} &= 0.13 \\ c_{Rdc} &= 0.12 \\ k &= 1.88 \\ \rho_L &= 0.01 \text{ ()} \\ v_{lim} &= 0.65 \text{ (MPa)} \\ v &= 0.05 \text{ (MPa)} \\ A &= 1.352 \text{ (m}^2\text{)} \end{aligned}$$

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	148	251	0

**Support no. / Point: P10 (9886)**

$u_0 = 2.000$   
 $u_1 = 5.242$   
 $\rho_{Lx} = 0.01$   
 $\rho_{Ly} = 0.01$   
 $h_{eff} = 25.8 \text{ (cm)}$   
 $A_x = 13.40 \text{ (cm}^2\text{)}$   
 $A_y = 13.40 \text{ (cm}^2\text{)}$   
 $\alpha = 1.57$   
 $v = 0.53 \text{ ()}$   
 $\gamma_c = 1.50 \text{ ()}$   
 $f_{cd} = 20.00 \text{ (MPa)}$   
 $v_{Rdmax} = 4.22 \text{ (MPa)}$   
 $V = 65.00 \text{ (kN)}$   
 $M_x = 0.00 \text{ (kN}\cdot\text{m)}$   
 $M_y = 0.00 \text{ (kN}\cdot\text{m)}$   
 $A = 1.352 \text{ (m}^2\text{)}$   
 $K_x = 0.60$   
 $K_y = 0.60$   
 $W_x = 0.713$   
 $W_y = 0.713$   
  
 $v_{Rdc} = 0.65$   
 $v_{min} = 0.49$   
 $v_{Eds} = 0.13$   
 $c_{Rdc} = 0.12$   
 $k = 1.88$   
 $\rho_L = 0.01 \text{ ()}$   
 $v_{lim} = 0.65 \text{ (MPa)}$   
 $v = 0.05 \text{ (MPa)}$   
 $A = 1.352 \text{ (m}^2\text{)}$

**Support no. / Point: P11 (9897)**

$u_0 = 2.000$   
 $u_1 = 5.242$   
 $\rho_{Lx} = 0.01$   
 $\rho_{Ly} = 0.01$   
 $h_{eff} = 25.8 \text{ (cm)}$   
 $A_x = 13.40 \text{ (cm}^2\text{)}$   
 $A_y = 13.40 \text{ (cm}^2\text{)}$   
 $\alpha = 1.57$   
 $v = 0.53 \text{ ()}$   
 $\gamma_c = 1.50 \text{ ()}$   
 $f_{cd} = 20.00 \text{ (MPa)}$   
 $v_{Rdmax} = 4.22 \text{ (MPa)}$   
 $V = 65.00 \text{ (kN)}$   
 $M_x = 0.00 \text{ (kN}\cdot\text{m)}$   
 $M_y = 0.00 \text{ (kN}\cdot\text{m)}$   
 $A = 1.352 \text{ (m}^2\text{)}$   
 $K_x = 0.60$   
 $K_y = 0.60$   
 $W_x = 0.713$   
 $W_y = 0.713$   
  
 $v_{Rdc} = 0.65$   
 $v_{min} = 0.49$

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	149	251	0

vEds = 0.13  
cRdc= 0.12  
k = 1.88  
 $\rho_L$  = 0.01 ()  
vlim = 0.65 (MPa)  
v = 0.05 (MPa)  
A = 1.352 (m2)

**Support no. / Point: P12 (9898)**

uo = 2.000  
u1 = 5.242  
 $\rho_{Lx}$  = 0.01  
 $\rho_{Ly}$  = 0.01  
heff = 25.8 (cm)  
Ax = 13.40 (cm2)  
Ay = 13.40 (cm2)  
 $\alpha$  = 1.57  
v = 0.53 ()  
 $\gamma_c$  = 1.50 ()  
fcd = 20.00 (MPa)  
vRdmax = 4.22 (MPa)  
V = 65.00 (kN)  
Mx = 0.00 (kN\*m)  
My = 0.00 (kN\*m)  
A = 1.352 (m2)  
Kx = 0.60  
Ky = 0.60  
Wx = 0.713  
Wy = 0.713

vRdc = 0.65  
vmin = 0.49  
vEds = 0.13  
cRdc= 0.12  
k = 1.88  
 $\rho_L$  = 0.01 ()  
vlim = 0.65 (MPa)  
v = 0.05 (MPa)  
A = 1.352 (m2)

**Support no. / Point: P13 (9906)**

uo = @VAL(Data\_p=Uo)@  
u1 = @VAL(Data\_p=U1)@  
 $\rho_{Lx}$  = @VAL(Data\_p=RoLx)@  
 $\rho_{Ly}$  = @VAL(Data\_p=RoLy)@  
heff = @V\_U(Data\_p=EffHeight)@  
Ax = @V\_U(Data\_p=Ax)@  
Ay = @V\_U(Data\_p=Ay)@  
 $\alpha$  = @VAL(Data\_p=Alpha)@  
v = @V\_U(Data\_p=Ni)@  
 $\gamma_c$  = @V\_U(Data\_p=Gamma\_c)@  
fcd = @V\_U(Data\_p=Fcd)@  
vRdmax = @V\_U(Data\_p=VRdmax)@  
  
vRdc = @VAL(Data\_p=VRdc)@  
vmin = @VAL(Data\_p=Ni\_min)@  
vEds = @VAL(Data\_p=VEds)@

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	150	251	0

cRdc= @VAL(Data\_p=CRdc)@  
k = @VAL(Data\_p=K)@  
 $\rho_L$  = @V\_U(Data\_p=RoL)@  
vlim = @V\_U(Data\_p=StressLimit)@  
v = @V\_U(Data\_p=Stress)@  
A = @V\_U(Data\_p=ShearArea)@

**Support no. / Point: P14 (9907)**

uo = @VAL(Data\_p=Uo)@  
u1 = @VAL(Data\_p=U1)@  
 $\rho_{Lx}$  = @VAL(Data\_p=RoLx)@  
 $\rho_{Ly}$  = @VAL(Data\_p=RoLy)@  
heff = @V\_U(Data\_p=EffHeight)@  
Ax = @V\_U(Data\_p=Ax)@  
Ay = @V\_U(Data\_p=Ay)@  
 $\alpha$  = @VAL(Data\_p=Alpha)@  
v = @V\_U(Data\_p=Ni)@  
 $\gamma_c$  = @V\_U(Data\_p=Gamma\_c)@  
fcd = @V\_U(Data\_p=Fcd)@  
vRdmax = @V\_U(Data\_p=VRdmax)@

vRdc = @VAL(Data\_p=VRdc)@  
vmin = @VAL(Data\_p=Ni\_min)@  
vEds = @VAL(Data\_p=VEds)@  
cRdc= @VAL(Data\_p=CRdc)@  
k = @VAL(Data\_p=K)@  
 $\rho_L$  = @V\_U(Data\_p=RoL)@  
vlim = @V\_U(Data\_p=StressLimit)@  
v = @V\_U(Data\_p=Stress)@  
A = @V\_U(Data\_p=ShearArea)@

**Support no. / Point: P15 (9908)**

uo = 1.274  
u1 = 2.621  
 $\rho_{Lx}$  = 0.01  
 $\rho_{Ly}$  = 0.01  
heff = 25.8 (cm)  
Ax = 13.40 (cm<sup>2</sup>)  
Ay = 13.40 (cm<sup>2</sup>)  
 $\alpha$  = 1.57  
v = 0.53 ()  
 $\gamma_c$  = 1.50 ()  
fcd = 20.00 (MPa)  
vRdmax = 4.22 (MPa)  
V = 65.00 (kN)  
Mx = 0.00 (kN\*m)  
My = 0.00 (kN\*m)  
A = 1.076 (m<sup>2</sup>)  
Kx = 0.60  
Ky = 0.60  
Wx = 0.663  
Wy = 0.478  
  
vRdc = 0.65  
vmin = 0.49  
vEds = 0.20  
cRdc= 0.12

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	151	251	0

$k = 1.88$   
 $\rho_L = 0.01$  ()  
 $v_{lim} = 0.65$  (MPa)  
 $v = 0.10$  (MPa)  
 $A = 0.676$  (m<sup>2</sup>)

**Support no. / Point: P16 (9909)**

$u_0 = 1.274$   
 $u_1 = 2.621$   
 $\rho_{Lx} = 0.01$   
 $\rho_{Ly} = 0.01$   
 $h_{eff} = 25.8$  (cm)  
 $A_x = 13.40$  (cm<sup>2</sup>)  
 $A_y = 13.40$  (cm<sup>2</sup>)  
 $\alpha = 1.57$   
 $v = 0.53$  ()  
 $\gamma_c = 1.50$  ()  
 $f_{cd} = 20.00$  (MPa)  
 $v_{Rdmax} = 4.22$  (MPa)  
 $V = 65.00$  (kN)  
 $M_x = 0.00$  (kN\*m)  
 $M_y = 0.00$  (kN\*m)  
 $A = 1.076$  (m<sup>2</sup>)  
 $K_x = 0.60$   
 $K_y = 0.60$   
 $W_x = 0.663$   
 $W_y = 0.478$

$v_{Rdc} = 0.65$   
 $v_{min} = 0.49$   
 $v_{Eds} = 0.20$   
 $c_{Rdc} = 0.12$   
 $k = 1.88$   
 $\rho_L = 0.01$  ()  
 $v_{lim} = 0.65$  (MPa)  
 $v = 0.10$  (MPa)  
 $A = 0.676$  (m<sup>2</sup>)

**Support no. / Point: P17 (9910)**

$u_0 = 2.000$   
 $u_1 = 5.242$   
 $\rho_{Lx} = 0.01$   
 $\rho_{Ly} = 0.01$   
 $h_{eff} = 25.8$  (cm)  
 $A_x = 13.40$  (cm<sup>2</sup>)  
 $A_y = 13.40$  (cm<sup>2</sup>)  
 $\alpha = 1.57$   
 $v = 0.53$  ()  
 $\gamma_c = 1.50$  ()  
 $f_{cd} = 20.00$  (MPa)  
 $v_{Rdmax} = 4.22$  (MPa)  
 $V = 65.00$  (kN)  
 $M_x = 0.00$  (kN\*m)  
 $M_y = 0.00$  (kN\*m)  
 $A = 1.352$  (m<sup>2</sup>)  
 $K_x = 0.60$   
 $K_y = 0.60$

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	152	251	0

$$W_x = 0.713$$

$$W_y = 0.713$$

$$v_{Rdc} = 0.65$$

$$v_{min} = 0.49$$

$$v_{Eds} = 0.13$$

$$c_{Rdc} = 0.12$$

$$k = 1.88$$

$$\rho_L = 0.01$$

$$v_{lim} = 0.65 \text{ (MPa)}$$

$$v = 0.05 \text{ (MPa)}$$

$$A = 1.352 \text{ (m}^2\text{)}$$

**Support no. / Point: P18 (9913)**

$$u_o = @VAL(Data\_p=Uo)@$$

$$u_1 = @VAL(Data\_p=U1)@$$

$$\rho_{Lx} = @VAL(Data\_p=RoLx)@$$

$$\rho_{Ly} = @VAL(Data\_p=RoLy)@$$

$$heff = @V\_U(Data\_p=EffHeight)@$$

$$A_x = @V\_U(Data\_p=Ax)@$$

$$A_y = @V\_U(Data\_p=Ay)@$$

$$\alpha = @VAL(Data\_p=Alpha)@$$

$$v = @V\_U(Data\_p=Ni)@$$

$$\gamma_c = @V\_U(Data\_p=Gamma\_c)@$$

$$f_{cd} = @V\_U(Data\_p=Fcd)@$$

$$v_{Rdmax} = @V\_U(Data\_p=VRdmax)@$$

$$v_{Rdc} = @VAL(Data\_p=VRdc)@$$

$$v_{min} = @VAL(Data\_p=Ni\_min)@$$

$$v_{Eds} = @VAL(Data\_p=VEds)@$$

$$c_{Rdc} = @VAL(Data\_p=CRdc)@$$

$$k = @VAL(Data\_p=K)@$$

$$\rho_L = @V\_U(Data\_p=RoL)@$$

$$v_{lim} = @V\_U(Data\_p=StressLimit)@$$

$$v = @V\_U(Data\_p=Stress)@$$

$$A = @V\_U(Data\_p=ShearArea)@$$

**Support no. / Point: P19 (9892)**

$$u_o = 2.000$$

$$u_1 = 5.242$$

$$\rho_{Lx} = 0.01$$

$$\rho_{Ly} = 0.01$$

$$heff = 25.8 \text{ (cm)}$$

$$A_x = 13.40 \text{ (cm}^2\text{)}$$

$$A_y = 13.40 \text{ (cm}^2\text{)}$$

$$\alpha = 1.57$$

$$v = 0.53$$

$$\gamma_c = 1.50$$

$$f_{cd} = 20.00 \text{ (MPa)}$$

$$v_{Rdmax} = 4.22 \text{ (MPa)}$$

$$V = 65.00 \text{ (kN)}$$

$$M_x = 0.00 \text{ (kN*m)}$$

$$M_y = 0.00 \text{ (kN*m)}$$

$$A = 1.352 \text{ (m}^2\text{)}$$

$$K_x = 0.60$$

$$K_y = 0.60$$

$$W_x = 0.713$$

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	153	251	0

$$W_y = 0.713$$

$$\begin{aligned} v_{Rdc} &= 0.65 \\ v_{min} &= 0.49 \\ v_{Eds} &= 0.13 \\ c_{Rdc} &= 0.12 \\ k &= 1.88 \\ \rho_L &= 0.01 () \\ v_{lim} &= 0.65 \text{ (MPa)} \\ v &= 0.05 \text{ (MPa)} \\ A &= 1.352 \text{ (m}^2\text{)} \end{aligned}$$

#### Support no. / Point: P20 (9893)

$$\begin{aligned} u_0 &= 2.000 \\ u_1 &= 5.242 \\ \rho_{Lx} &= 0.01 \\ \rho_{Ly} &= 0.01 \\ h_{eff} &= 25.8 \text{ (cm)} \\ A_x &= 13.40 \text{ (cm}^2\text{)} \\ A_y &= 13.40 \text{ (cm}^2\text{)} \\ \alpha &= 1.57 \\ v &= 0.53 () \\ \gamma_c &= 1.50 () \\ f_{cd} &= 20.00 \text{ (MPa)} \\ v_{Rdmax} &= 4.22 \text{ (MPa)} \\ V &= 65.00 \text{ (kN)} \\ M_x &= 0.00 \text{ (kN}\cdot\text{m)} \\ M_y &= 0.00 \text{ (kN}\cdot\text{m)} \\ A &= 1.352 \text{ (m}^2\text{)} \\ K_x &= 0.60 \\ K_y &= 0.60 \\ W_x &= 0.713 \\ W_y &= 0.713 \end{aligned}$$

$$\begin{aligned} v_{Rdc} &= 0.65 \\ v_{min} &= 0.49 \\ v_{Eds} &= 0.13 \\ c_{Rdc} &= 0.12 \\ k &= 1.88 \\ \rho_L &= 0.01 () \\ v_{lim} &= 0.65 \text{ (MPa)} \\ v &= 0.05 \text{ (MPa)} \\ A &= 1.352 \text{ (m}^2\text{)} \end{aligned}$$

#### 1.5.4. Deflection

$$\begin{aligned} |f(+)| &= 0.01 \text{ (cm)} \leq f_{dop(+)} = 3.40 \text{ (cm)} \\ |f(-)| &= 0.19 \text{ (cm)} \leq f_{dop(-)} = 3.40 \text{ (cm)} \end{aligned}$$

#### 1.5.5. Cracking

upper layer

$$\begin{aligned} a_x &= 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)} \\ a_y &= 0.02 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)} \end{aligned}$$

lower layer

$$\begin{aligned} a_x &= 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)} \\ a_y &= 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)} \end{aligned}$$

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	154	251	0

### 3. Results - detailing

List of solutions:

Reinforcement: bars

Solution no.	Reinforcement range Diameter / Weight	Total weight (kG)
1	-	51371.18

Results for the solution no. 1

Reinforcement zones

Bottom reinforcement

Name	coordinates				Provided reinforcement	At
	Ar				φ (mm) / (cm)	(cm2/m)
	x1	y1	x2	y2		
1/1- Ax Main	0.000	-14.575	22.800	17.775	16.0 / 15.0	11.69 <
	13.40					
1/2- Ay Perpendicular	0.000	-14.575	22.800	17.775	25.0 / 15.0	26.06 <
	32.72					

Top reinforcement

Name	coordinates				Provided reinforcement	At
	Ar				φ (mm) / (cm)	(cm2/m)
	x1	y1	x2	y2		
1/3+ Ax Main	0.000	-14.575	22.800	17.775	16.0 / 14.0	13.48 <
	14.36					
1/4+(1/3+) Ax Main	0.000	2.963	0.940	17.775	12.0 / 7.0	16.52 <
	22.44					
1/5+(1/3+) Ax Main	8.511	5.925	13.274	17.775	25.0 / 7.0	35.10 <
	49.42					
1/6+(1/3+) Ax Main	1.880	10.863	8.511	12.838	12.0 / 7.0	17.98 <
	22.44					
1/7+(1/3+) Ax Main	14.226	10.863	21.847	12.838	12.0 / 7.0	18.32 <
	22.44					
1/8+(1/3+) Ax Main	21.847	6.913	22.800	10.863	12.0 / 7.0	18.15 <
	22.44					
1/9+(1/3+) Ax Main	15.179	4.938	17.084	6.913	12.0 / 7.0	13.48 <
	22.44					
1/10+(1/3+) Ax Main	21.847	-14.575	22.800	2.963	12.0 / 7.0	19.88 <
	22.44					
1/11+(1/3+) Ax Main	0.000	-14.575	0.940	-8.575	12.0 / 7.0	15.54 <
	22.44					
1/12+(1/3+) Ax Main	10.416	-13.575	12.321	-8.575	25.0 / 7.0	34.83 <
	49.42					
1/13+(1/3+) Ax Main	14.226	-3.811	19.942	-1.906	12.0 / 7.0	17.91 <
	22.44					
1/14+(1/3+) Ax Main	12.321	-1.906	14.226	0.000	12.0 / 7.0	15.33 <
	22.44					
1/15+(1/3+) Ax Main	6.605	2.963	8.511	3.950	12.0 / 7.0	15.48 <
	22.44					
1/16+(1/3+) Ax Main	21.847	10.863	22.800	17.775	12.0 / 7.0	22.31 <
	22.44					
1/17+(1/3+) Ax Main	10.416	-14.575	12.321	-13.575	25.0 / 7.0	16.36 <
	49.42					

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1/18+ Ay Perpendicular	0.000	-14.575	22.800	17.775	20.0 / 15.0	19.85 <
	20.94					
1/19+(1/18+) Ay Perpendicular	0.000		10.863	22.800	12.838	32.0 / 7.5
	57.38 <		74.56			
1/20+(1/18+) Ay Perpendicular	0.000		4.938	22.800	6.913	25.0 / 7.5
	46.03 <		53.67			
1/21+(1/18+) Ay Perpendicular	4.700	-0.953		8.511	0.988	18.0 / 7.5
	29.75 <		37.91			
1/22+(1/18+) Ay Perpendicular	15.179	1.975		21.847	3.950	12.0 / 7.5
	21.08 <		28.48			
1/23+(1/18+) Ay Perpendicular	13.274	-3.811		22.800	-1.906	25.0 / 7.5
	51.08 <		53.67			
1/24+(1/18+) Ay Perpendicular	2.820	-9.575		21.847	-7.622	16.0 / 7.5
	31.50 <		34.35			
1/25+(1/18+) Ay Perpendicular	0.940	-14.575		21.847	-13.575	16.0 / 7.5
	31.44 <		34.35			
1/26+(1/18+) Ay Perpendicular	21.847	12.838		22.800	16.788	12.0 / 7.5
	22.85 <		28.48			

#### 4. Material survey

- Concrete volume = 209.183 (m3)
- Formwork = 697.278 (m2)
- Slab circumference = 119.700 (m)
- Area of openings = 0.000 (m2)
  
- Steel B500B
- Total weight = 60870.50 (kG)
- Density = 290.99 (kG/m3)
- Average diameter = 19.5 (mm)
- Survey according to diameters:

Diameter	Length (m)	Number of identical elements:
12	2.204	128
12	2.217	171
12	4.493	33
12	5.288	44
12	6.564	7
12	9.775	13
12	9.838	26
16	2.626	149
16	5.265	114
16	9.305	236
16	11.655	654
18	5.253	25
20	5.940	32
20	9.213	64
20	11.118	239
20	11.473	116
25	3.743	42
25	5.218	64
25	5.288	148
25	5.940	31
25	7.351	84
25	9.303	62

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	156	251	0

25	11.208	242
25	11.653	117
32	4.790	150

**Išvada: laikomoji galia pakankama**

### 1.8. Monolitinės įėjimo į priedangą laiptinės denginio perdangos projektavimas

Projektuojama monolitinė GB įėjimo į priedangą laiptinės denginio perdanga.

Betonas: C30/37;

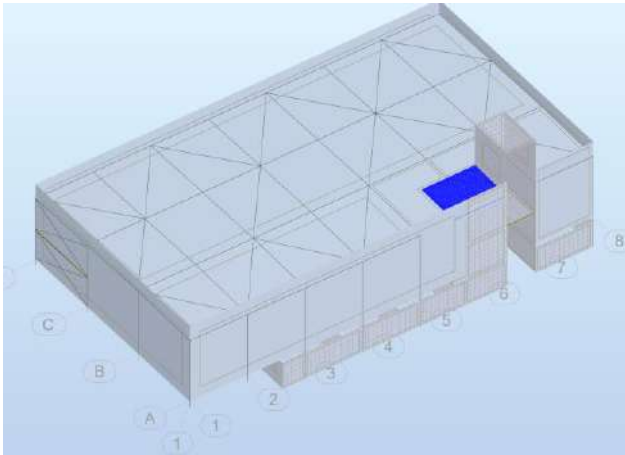
Aplinkos klasė XC2;

Sienos su perdanga jungiasi standžiai. Sienos su poliais jungiami lanksčiai.

Apsauginis betono sluoksnis: ne mažiau kaip armatūros skersmuo ir ne mažiau nei 25 mm iki pagrindinės armatūros centro. Ugniaatsparumas R90.

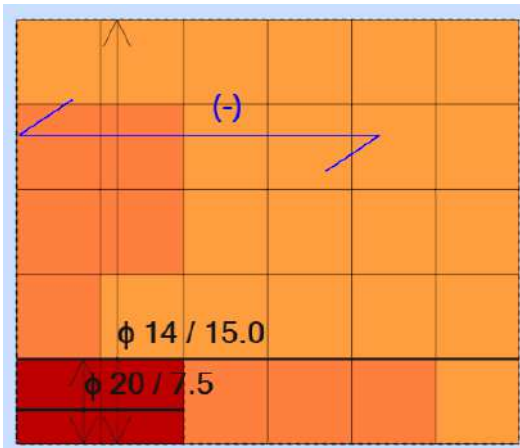
Projektuojamos perdangos storis: 300mm.

Skaičiuojamoji schema:



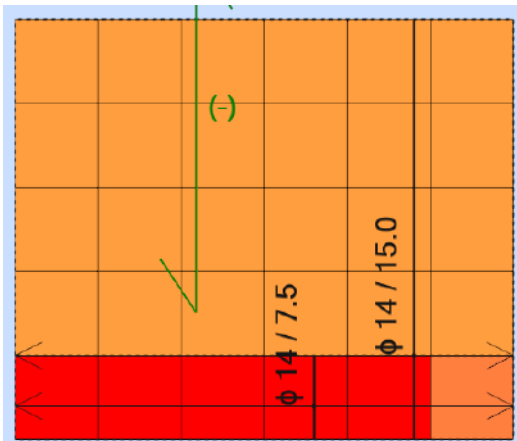
Reikalingas armavimas.

Apatinis armavimas X kryptimi:

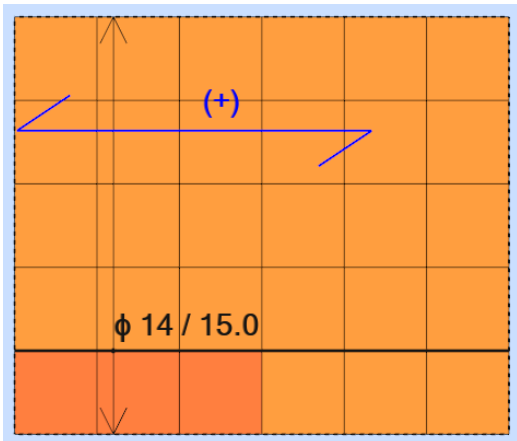


IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	157	251	0

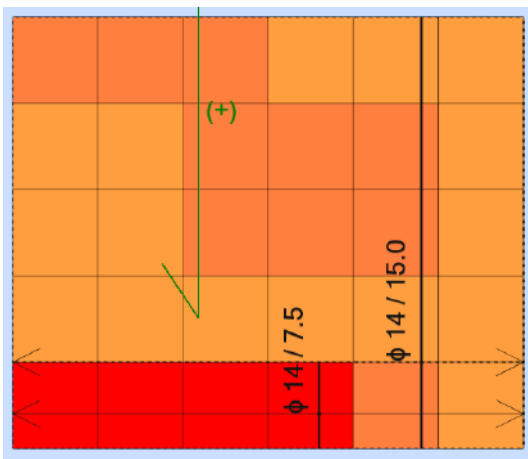
Apatinis armavimas Y kryptimi:



Viršutinis armavimas X kryptimi:



Viršutinis armavimas Y kryptimi:



## 1. Slab: Slab219 - Panel no. 219

### 1.1. Reinforcement:

- Type

: Perdanga

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	158	251	0

- Main reinforcement direction : 0°
- Main reinforcement grade : B500B; Characteristic strength = 500.00 MPa  
Horizontal branch of the stress-strain diagram : B
- Ductility class : B
- Bar diameters bottom d1 = 1.2 (cm) d2 = 1.2 (cm)  
top d1 = 1.2 (cm) d2 = 1.2 (cm)
- Cover bottom c1 = 4.0 (cm)  
top c2 = 4.0 (cm)
- Cover deviations Cdev = 1.0(cm), Cdur = 0.0(cm)

## 1.2. Concrete

- Class : C30/37; Characteristic strength = 30.00 MPa  
Rectangular stress distribution [3.1.7(3)]
- Density : 2501.36 (kG/m3)
- Concrete creep coefficient : 1.68
- Cement class : N

## 1.3. Hypothesis

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Method of reinforcement area calculations : analytical
- Allowable cracking width : 0.30 (mm)
  - upper layer : 0.30 (mm)
  - lower layer : 0.30 (mm)
- Allowable deflection : 2.00 (cm)
- Verification of punching : no
- Exposure :
  - upper layer : XC1
  - lower layer : XC1
- Calculation type : simple bending
- Structure class : S4

Modified partial coefficients:

$$a_{cc} = 0.9 \quad 1992-1-1 \ 3.1.6 \ (1)P$$

## 1.4. Slab geometry

Thickness 0.300 (m)

### Contour:

edge	beginning		end		length (m)
	x1	y1	x2	y2	
1	0.000	4.702	5.575	4.702	5.575
2	5.575	4.702	5.575	0.000	4.702
3	5.575	0.000	0.000	0.000	5.575
4	0.000	0.000	0.000	4.702	4.702

### Support:

n°	Name	dimensions	coordinates		edge
		(m)	x	y	
0	linear	0.300 / 5.575	2.788	4.702	—
0	linear	4.702 / 0.250	0.000	2.351	—
0	linear	0.250 / 4.275	3.438	0.000	—
0	linear	0.150 / 0.300	5.575	0.075	—
0	linear	4.552 / 0.300	5.575	2.426	—

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	159	251	0

0 linear 0.250 / 4.275 3.438 2.901 —  
 \* - head present

## 1.5. Calculation results:

### 1.5.1. Maximum moments + reinforcement for bending

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Provided reinforcement (cm <sup>2</sup> /m):	10.26	30.26	20.53	20.53
Modified required reinforcement (cm <sup>2</sup> /m):	5.59	29.82	16.53	16.49
Original required reinforcement (cm <sup>2</sup> /m):	4.52	29.82	14.69	16.49
Coordinates (m):	2.250;-0.000	1.300;-0.000	1.858;0.423	2.250;-0.000

### 1.5.2. Maximum moments + reinforcement for bending

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Symbol: required area/provided area				
Ax(+) (cm <sup>2</sup> /m)	<b>5.59/10.26</b> 5.10/10.26	4.52/10.26	5.59/10.26	
Ax(-) (cm <sup>2</sup> /m)	5.84/30.26 5.84/30.26	<b>29.82/30.26</b>	5.84/30.26	
Ay(+) (cm <sup>2</sup> /m)	16.53/20.53 15.10/20.53	14.21/20.53	<b>16.53/20.53</b>	
Ay(-) (cm <sup>2</sup> /m)	16.49/20.53 <b>16.49/20.53</b>	10.85/20.53	16.49/20.53	
<b>SLS</b>				
Mxx (kN*m/m)	1.39	10.86	-4.88	1.39
Myy (kN*m/m)	7.13	-15.41	-8.02	7.13
Mxy (kN*m/m)	1.28	4.21	1.51	1.28
Nxx (kN/m)	15.23	-48.87	13.08	15.23
Nyy (kN/m)	-12.03	-71.01	-28.53	-12.03
Nxy (kN/m)	8.75	23.77	12.20	8.75
<b>ULS</b>				
Mxx (kN*m/m)	1.84	14.19	-6.36	1.84
Myy (kN*m/m)	9.41	-20.49	-10.49	9.41
Mxy (kN*m/m)	1.67	5.53	1.98	1.67
Nxx (kN/m)	19.85	-63.61	17.00	19.85
Nyy (kN/m)	-15.67	-92.36	-37.13	-15.67
Nxy (kN/m)	11.44	31.02	15.93	11.44
<b>ULS - accid. comb.</b>				
Mxx (kN*m/m)	57.70	-186.86	24.43	57.70
Myy (kN*m/m)	297.79	248.35	157.68	297.79
Mxy (kN*m/m)	32.20	-28.12	11.97	32.20
Nxx (kN/m)	-520.91	-835.03	-338.90	-520.91
Nyy (kN/m)	-743.14	-630.77	-792.44	-743.14
Nxy (kN/m)	160.85	541.61	208.75	160.85
Coordinates (m)	2.250;-0.000	1.300;-0.000	1.858;0.423	2.250;-0.000

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	160	251	0

Coordinates\* (m)  
 0.150;6.796

29.675;-0.150;6.79628.725;-0.150;6.79629.283;0.273;6.808 29.675;-

\* - Coordinates in the structure global coordinate system

#### 1.5.4. Deflection

 $|f(+)| = 0.00 \text{ (cm)} \leq f_{dop(+)} = 2.00 \text{ (cm)}$ 
 $|f(-)| = 0.03 \text{ (cm)} \leq f_{dop(-)} = 2.00 \text{ (cm)}$ 

#### 1.5.5. Cracking

upper layer

 $a_x = 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)}$ 
 $a_y = 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)}$ 

lower layer

 $a_x = 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)}$ 
 $a_y = 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)}$ 

### 3. Results - detailing

List of solutions:

Reinforcement: bars

Solution no.	Reinforcement range Diameter / Weight	Total weight (kG)
1	-	958.27

Results for the solution no. 1

Reinforcement zones

Bottom reinforcement

Name	coordinates				Provided reinforcement At	
	x1	y1	x2	y2	$\phi$ (mm) / (cm)	(cm <sup>2</sup> /m)
1/1- Ax Main	0.000	0.000	5.575	4.702	14.0 / 15.0	7.25 <
1/2-(1/1-) Ax Main	0.000	0.000	1.858	0.940	20.0 / 7.5	29.82 <
1/3- Ay Perpendicular	0.000	0.000	5.575	4.702	14.0 / 15.0	4.52 <
1/4-(1/3-) Ay Perpendicular	0.000	0.000	5.575	0.940	14.0 / 7.5	14.0 / 7.5

Top reinforcement

Name	coordinates				Provided reinforcement At	
	x1	y1	x2	y2	$\phi$ (mm) / (cm)	(cm <sup>2</sup> /m)
1/5+ Ax Main	0.000	0.000	5.575	4.702	14.0 / 15.0	5.59 <
1/6+ Ay Perpendicular	0.000	0.000	5.575	4.702	14.0 / 15.0	5.72 <
1/7+(1/6+) Ay Perpendicular	0.000	0.000	5.575	0.940	14.0 / 7.5	14.0 / 7.5

### 4. Material survey

- Concrete volume = 7.864 (m<sup>3</sup>)

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		161	251

- Formwork = 26.214 (m<sup>2</sup>)
- Slab circumference = 20.554 (m)
- Area of openings = 0.000 (m<sup>2</sup>)

- Steel B500B
- Total weight = 955.62 (kG)
- Density = 121.51 (kG/m<sup>3</sup>)
- Average diameter = 14.1 (mm)
- Survey according to diameters:

Diameter	Length (m)	Number of identical elements:
14	1.408	35
14	1.625	35
14	4.622	70
14	5.495	60
20	2.543	6

**Išvada: laikomoji galia pakankama**

### 1.9. Monolitinės priedangos sienos projektavimas

Projektuojamos monolitinės GB priedangos sienos.

Betonas: C30/37;

Aplinkos klasė XC2;

Sienos su perdanga jungiasi standžiai. Sienos su poliais jungiami lanksčiai.

Apsauginis betono sluoksnis: ne mažiau kaip armatūros skersmuo ir ne mažiau nei 25 mm iki pagrindinės armatūros centr. Ugniaatsparumas R90.

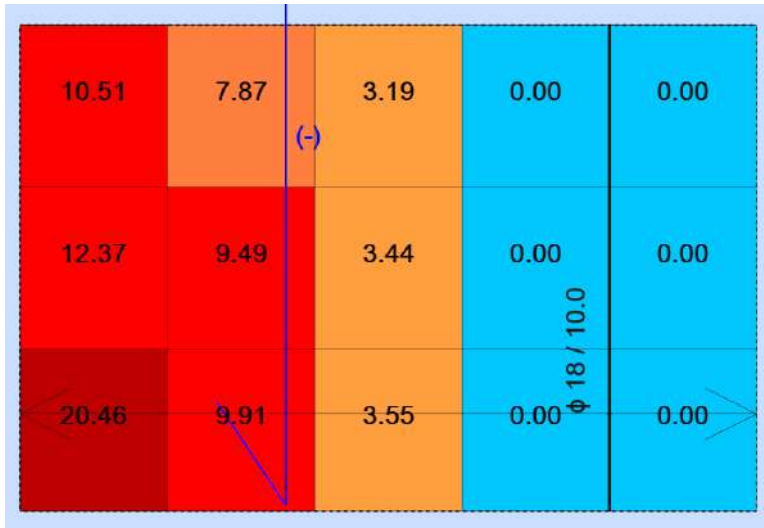
Projektuojamos perdangos storis: 300mm.

Skaičiuojamoji schema:

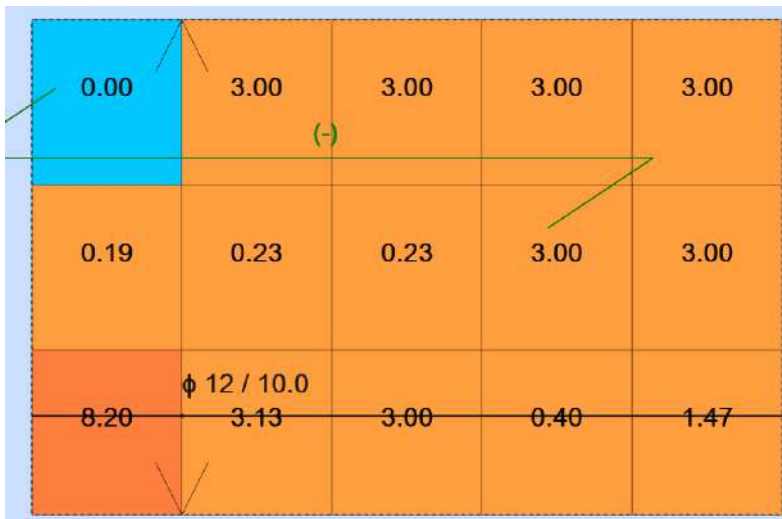
Reikalingas armavimas.

Apatinis armavimas X kryptimi:

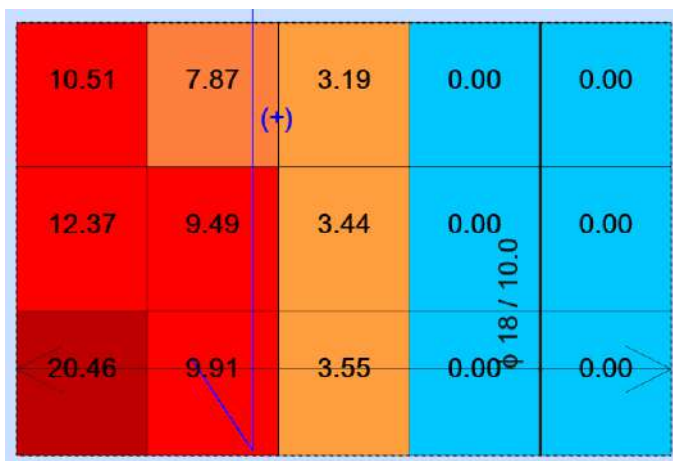
IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	162	251	0



Apatinis armavimas Y kryptimi:

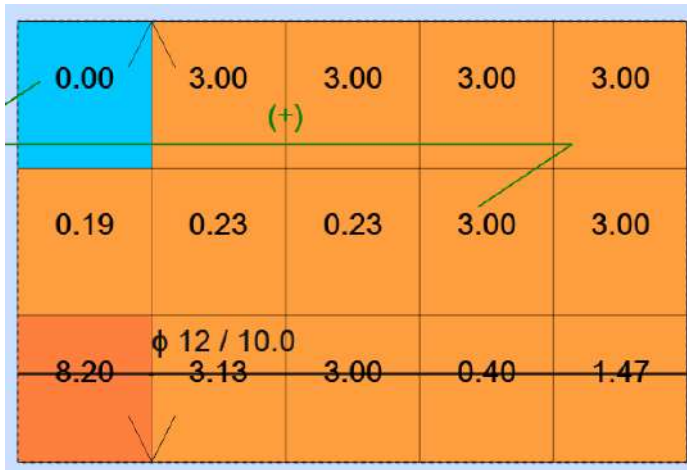


Viršutinis armavimas X kryptimi:



Viršutinis armavimas Y kryptimi:

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	163	251	0



## 1. Wall: Slab277 - Panel no. 277

### 1.1. Reinforcement:

- Type : siena
- Main reinforcement direction : 0°
- Main reinforcement grade : B500B; Characteristic strength = 500.00 MPa  
Horizontal branch of the stress-strain diagram
- Ductility class : B
- Bar diameters  
bottom d1 = 1.2 (cm) d2 = 1.2 (cm)  
top d1 = 1.2 (cm) d2 = 1.2 (cm)
- Cover  
bottom c1 = 6.5 (cm)  
top c2 = 6.5 (cm)
- Cover deviations  
Cdev = 1.0(cm), Cdur = 0.0(cm)

### 1.2. Concrete

- Class : C30/37; Characteristic strength = 30.00 MPa  
Rectangular stress distribution [3.1.7(3)]
- Density : 2501.36 (kG/m3)
- Concrete creep coefficient : 1.34
- Cement class : N

### 1.3. Hypothesis

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Method of reinforcement area calculations : analytical
- Allowable cracking width  
- upper layer : 0.30 (mm)  
- lower layer : 0.30 (mm)
- Verification of punching : no
- Exposure  
- upper layer : XC2  
- lower layer : XC2
- Calculation type : compression/tension
- Structure class : S4

Modified partial coefficients:

$$a_{cc} = 0.9 \quad 1992-1-1 \quad 3.1.6 \quad (1)P$$

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	164	251	0

## 1.4. Slab geometry

Thickness 0.300 (m)

### Contour:

edge	beginning		end		length (m)
	x1	y1	x2	y2	
1	0.000	2.820	4.275	2.820	4.275
2	4.275	2.820	4.275	0.000	2.820
3	4.275	0.000	0.000	0.000	4.275
4	0.000	0.000	0.000	2.820	2.820

### Support:

n°	Name	dimensions (m)		coordinates x y		edge
0	linear	2.820	0.300	0.000	1.410	—
* - head present						

## 1.5. Calculation results:

### 1.5.1. Maximum forces + reinforcement

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Provided reinforcement (cm2/m):	25.45	25.45	11.31	11.31
Modified required reinforcement (cm2/m):	20.46	20.46	8.20	8.20
Original required reinforcement (cm2/m):	20.46	20.46	8.20	8.20
Coordinates (m):	0.000;0.000 0.000;0.000	0.000;0.000	0.000;0.000	

### 1.5.2. Maximum forces + reinforcement

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Symbol: required area/provided area				
Ax(+) (cm2/m)	<b>20.46/25.45</b>	20.46/25.45	20.46/25.45	
Ax(-) (cm2/m)	20.46/25.45	<b>20.46/25.45</b>	20.46/25.45	
Ay(+) (cm2/m)	8.20/11.31	8.20/11.31	<b>8.20/11.31</b>	
Ay(-) (cm2/m)	8.20/11.31	8.20/11.31	8.20/11.31	<b>8.20/11.31</b>
<b>SLS</b>				
Mxx (kN*m/m)	8.06	8.06	8.06	8.06
Myy (kN*m/m)	16.03	16.03	16.03	16.03
Mxy (kN*m/m)	-6.49	-6.49	-6.49	-6.49
Nxx (kN/m)	-60.07	-60.07	-60.07	-60.07
Nyy (kN/m)	-199.28	-199.28	-199.28	-199.28
Nxy (kN/m)	-11.72	-11.72	-11.72	-11.72
<b>ULS</b>				
Mxx (kN*m/m)	10.74	10.74	10.74	10.74

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	165	251	0

Myy (kN*m/m)	21.37	21.37	21.37	21.37
Mxy (kN*m/m)	-8.60	-8.60	-8.60	-8.60
Nxx (kN/m)	-79.84	-79.84	-79.84	-79.84
Nyy (kN/m)	-264.92	-264.92	-264.92	-264.92
Nxy (kN/m)	-15.56	-15.56	-15.56	-15.56
<b>ULS - accid. comb.</b>				
Mxx (kN*m/m)	50.78	50.78	50.78	50.78
Myy (kN*m/m)	25.16	25.16	25.16	25.16
Mxy (kN*m/m)	-80.37	-80.37	-80.37	-80.37
Nxx (kN/m)	506.50	506.50	506.50	506.50
Nyy (kN/m)	1662.37	1662.37	1662.37	1662.37
Nxy (kN/m)	321.17	321.17	321.17	321.17
Coordinates (m)	0.000;0.000	0.000;0.000	0.000;0.000	
Coordinates* (m)	0.000;0.000		33.000;-0.150;-3.290	
	33.000;-0.150;-3.290		33.000;-0.150;-3.290	

\* - Coordinates in the structure global coordinate system

### 3. Results - detailing

List of solutions:

Reinforcement: bars

Solution no.	Reinforcement range Diameter / Weight	Total weight (kg)
1	-	695.94

Results for the solution no. 1

Reinforcement zones

Bottom reinforcement

Name	coordinates				Provided reinforcement At	
	Ar		x2	y2	φ (mm) / (cm)	(cm <sup>2</sup> /m)
	x1	y1				
1/1- Ax Main	4.275	0.000	0.000	2.820	18.0 / 10.0	20.46 <
	25.45					
1/2- Ay Perpendicular	4.275	0.000	0.000	2.820	12.0 / 10.0	8.20 <
	11.31					

Top reinforcement

Name	coordinates				Provided reinforcement At	
	Ar		x2	y2	φ (mm) / (cm)	(cm <sup>2</sup> /m)
	x1	y1				
1/3+ Ax Main	4.275	0.000	0.000	2.820	18.0 / 10.0	20.46 <
	25.45					
1/4+ Ay Perpendicular	4.275	0.000	0.000	2.820	12.0 / 10.0	8.20 <
	11.31					

### 4. Material survey

- Concrete volume = 3.617 (m<sup>3</sup>)
- Formwork = 12.056 (m<sup>2</sup>)

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	166	251	0

- Slab circumference = 14.190 (m)
- Area of openings = 0.000 (m<sup>2</sup>)

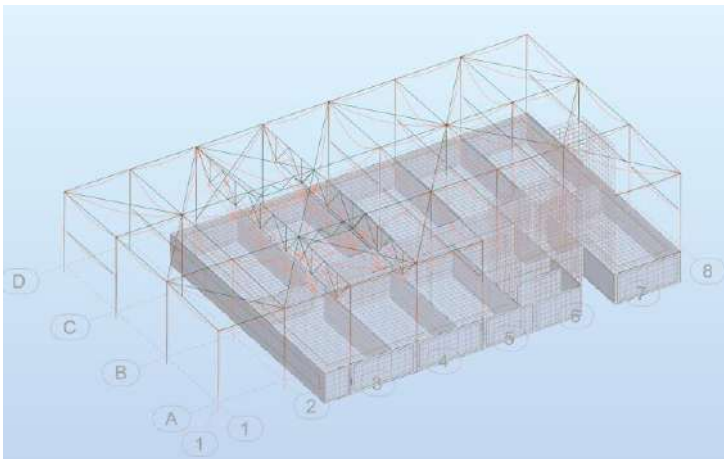
- Steel B500B
- Total weight = 650.32 (kG)
- Density = 179.81 (kG/m<sup>3</sup>)
- Average diameter = 15.0 (mm)
- Survey according to diameters:

Diameter	Length (m)	Number of identical elements:
12	4.145	54
18	2.690	84

**Išvada: laikomoji galia pakankama**

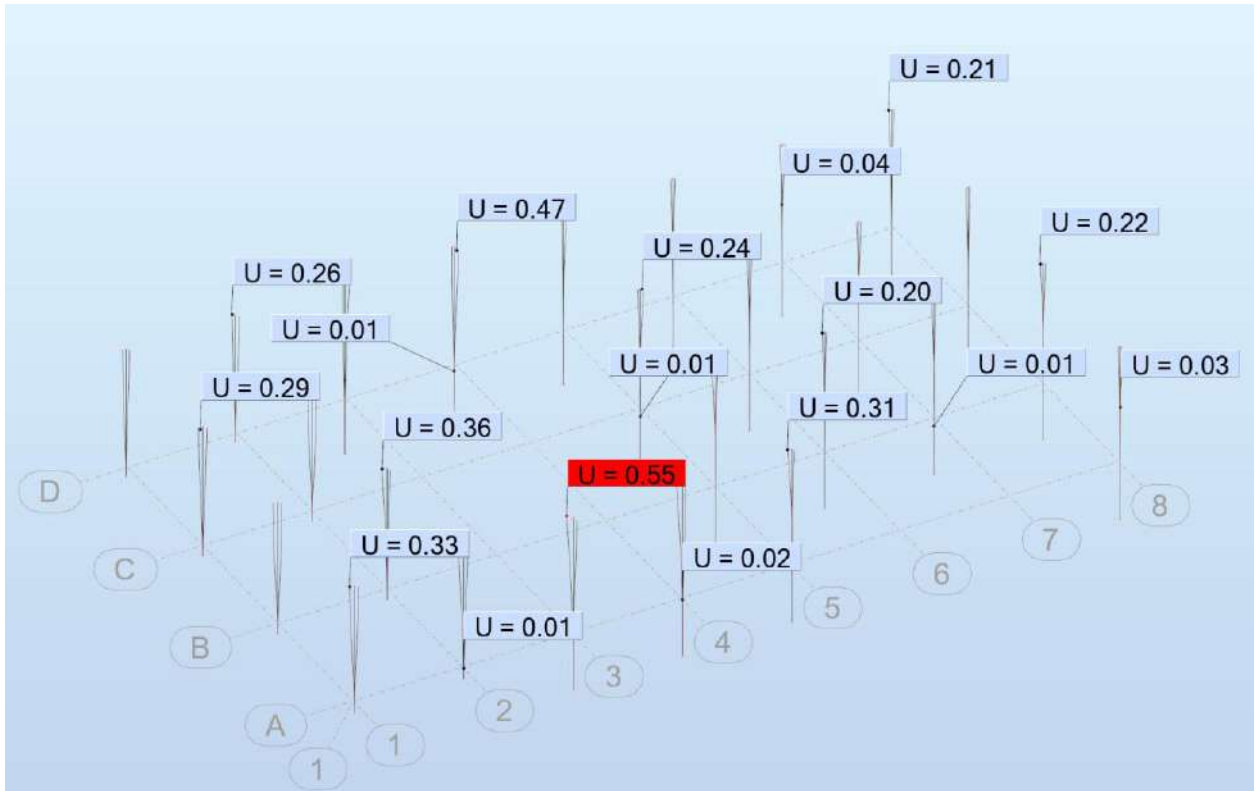
### 1.10. Statinio tinkamumo ribinis būvis

Pastato deformuota schema veikiant tinkamumo ribinio būvio apkrovų deriniui:



Kolonų deformuota schema veikiant pavojingiausiam tinkamumo ribinio būvio apkrovų deriniui:

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	167	251	0



Santvarų kolonos:

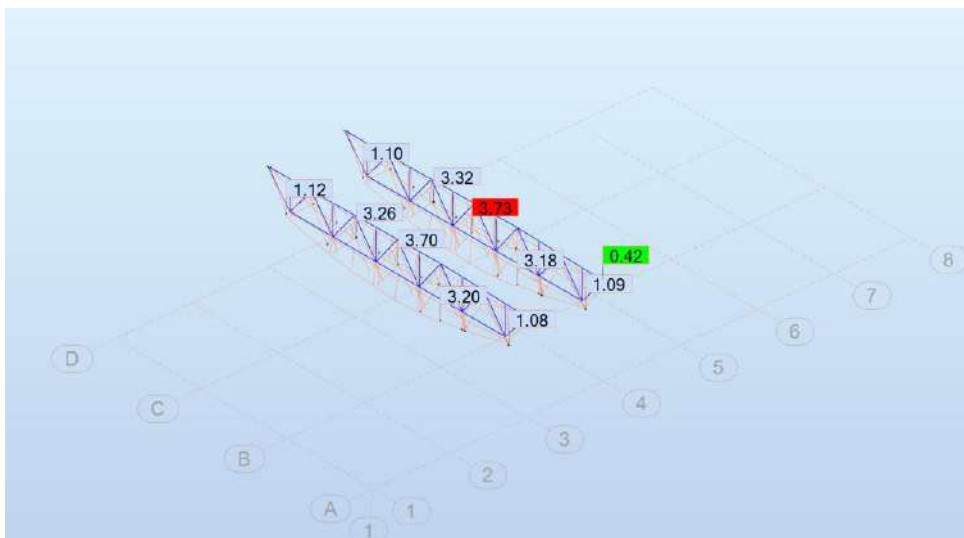
$$U_{\max} = 0,55 \text{ cm} \leq h_s / 200 = 7,27 / 200 = 3,6 \text{ cm.}$$

Kitos kolonos:

$$U_{\max} = 0,29 \text{ cm} \leq h / 500 = 7,27 / 500 = 1,5 \text{ cm.}$$

**IŠVADA:** Kolonų horizontalios deformacijos neviršija ribinių.

Santvarų deformuota schema veikiant pavojingiausiajam tinkamumo ribinio būvio apkrovų deriniui:

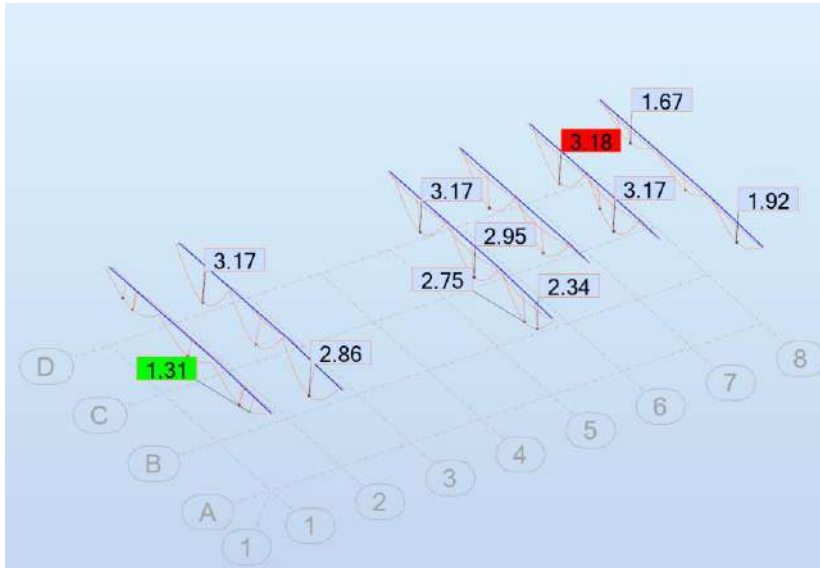


$$U_{\max} = 3,73 \text{ cm} \leq L / 250 = 22,8 / 250 = 9,1 \text{ cm.}$$

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	168	251	0

**IŠVADA:** Santvarų vertikalios deformacijos neviršija ribinių.

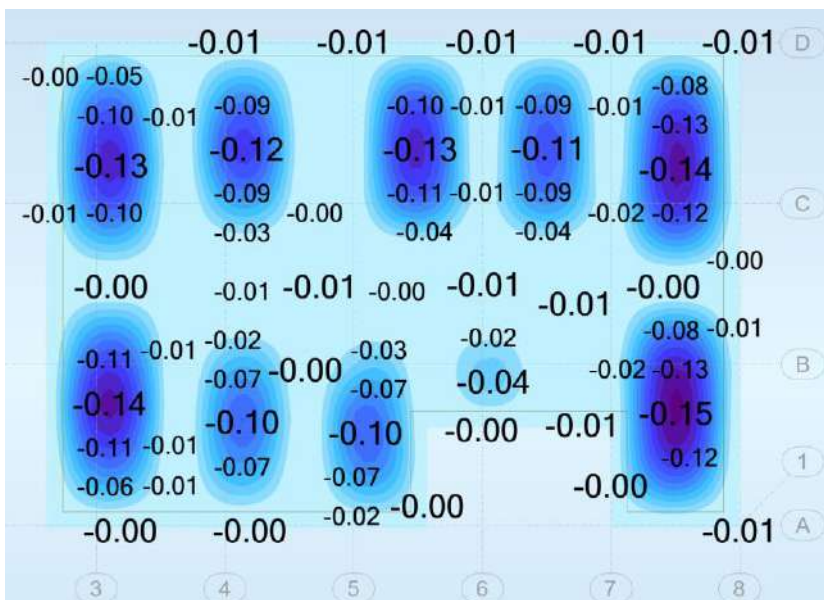
Sijų deformuota schema veikiant pavojingiausiam tinkamumo ribinio būvio apkrovų deriniui:



$U_{\max}=3.18 \text{ cm} \leq L/214=7,65/214=3,6 \text{ cm}.$

**IŠVADA:** Sijų vertikalios deformacijos neviršija ribinių.

Priedangos perdangos įlinkiai:

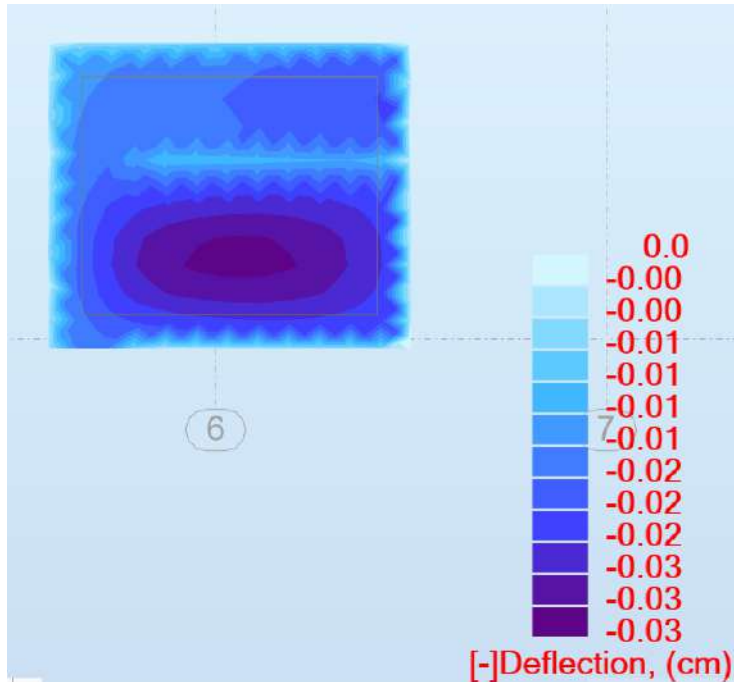


$U_{\max}=0,15 \text{ cm} \leq L/200=6,0/200=3,0 \text{ cm}.$

**IŠVADA:** Perdangos vertikalios deformacijos neviršija ribinių.

Laiptinės ir lifto denginio perdangos įlinkiai:

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	169	251	0



$$U_{\max}=0,03 \text{ cm} \leq L/150=2,90/150=1,9 \text{ cm.}$$

**IŠVADA:** Perdangos vertikalios deformacijos neviršija ribinių.

### 1.11. Pamatų projektavimas

Pamatų sprendinius tikslinti pamatų Darbo projekte. Pamatų betonas ne žemesnės klasės nei C25/30, W6, XC2, F100. Armatūra S500. Pamatų atramines reakcijas žiūrėti kartu su atraminių reakcijų planu.

### Pamatų reakcijos

Sienų pamatų reakcijos nurodytos reakcijų plane.

Kolonų reakcijų numeriai ir kryptys pagal globalias koordinačių ašis, pateikti kolonų pamatų išdėstymo schemeje:

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	170	251	0



Poveikis		Žymuo	Apkrovimo grupė	
			A1	A2
Nuolatinis	Nepalankus	$\gamma_G$	1,35	1,0
	Palankus		1,0	1,0
Kintamasis	Nepalankus	$\gamma_Q$	1,3	1,3
	Palankus		0	0

### Kolonų pamatų reakcijos A1 derinys:

Taškas/ kombinacija	F <sub>x</sub> , kN	F <sub>y</sub> , kN	F <sub>z</sub> , kN	M <sub>x</sub> , kNm	M <sub>y</sub> , kNm	M <sub>z</sub> , kNm
1/ 59 (C)	-0.10>>	-0.86	101.55	0.82	0.06	0
1/ 14 (C)	-2.58<<	-1.07	208.45	0.99	-1.84	-0.03
1/ 62 (C)	-0.89	-0.36>>	88.47	0.36	-0.51	-0.04
1/ 35 (C)	-1.03	-1.27<<	187.18	1.21	-0.54	-0.02
1/ 13 (C)	-2.38	-1.1	218.51>>	1.02	-1.65	-0.03
1/ 62 (C)	-0.89	-0.36	88.47<<	0.36	-0.51	-0.04
1/ 35 (C)	-1.03	-1.27	187.18	1.21>>	-0.54	-0.02
1/ 62 (C)	-0.89	-0.36	88.47	0.36<<	-0.51	-0.04
1/ 59 (C)	-0.1	-0.86	101.55	0.82	0.06>>	0
1/ 34 (C)	-2.56	-1.02	188.25	0.94	-1.92<<	-0.02
1/ 60 (C)	-0.3	-0.82	91.48	0.79	-0.13	-0.00>>
1/ 37 (C)	-1.62	-0.81	184.16	0.78	-0.92	-0.06<<
2/ 59 (C)	0.68>>	0.32	111.51	-0.3	0.82	0.06
2/ 18 (C)	-2.32<<	1.23	199.94	-1.19	-1.55	0.02

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2/ 17 (C)	-2.17	1.24>>	209.1	-1.2	-1.41	0.02
2/ 58 (C)	-1.2	0.30<<	102.81	-0.3	-0.89	0.04
2/ 13 (C)	-2.05	1.04	217.68>>	-1.01	-1.32	0.06
2/ 62 (C)	-1.41	0.64	88.50<<	-0.61	-1.03	-0.01
2/ 60 (C)	0.52	0.31	102.35	-0.29>>	0.67	0.06
2/ 17 (C)	-2.17	1.24	209.1	-1.20<<	-1.41	0.02
2/ 59 (C)	0.68	0.32	111.51	-0.3	0.82>>	0.06
2/ 38 (C)	-2.26	1.14	174.07	-1.1	-1.56<<	0
2/ 35 (C)	-0.18	0.82	197.09	-0.79	0.28	0.08>>
2/ 62 (C)	-1.41	0.64	88.5	-0.61	-1.03	-0.01<<
3/ 17 (C)	6.25>>	-2.69	234.63	2.58	6.17	0
3/ 58 (C)	1.41<<	-1.12	109.3	1.03	1.34	0
3/ 64 (C)	2.09	-0.92>>	97.08	0.78	2.03	-0.01
3/ 15 (C)	5.37	-2.79<<	235.77	2.67	5.25	0
3/ 13 (C)	4.84	-2.74	242.98>>	2.59	4.74	0
3/ 62 (C)	3.76	-1.03	95.40<<	1.02	3.71	0
3/ 15 (C)	5.37	-2.79	235.77	2.67>>	5.25	0
3/ 64 (C)	2.09	-0.92	97.08	0.78<<	2.03	-0.01
3/ 17 (C)	6.25	-2.69	234.63	2.58	6.17>>	0
3/ 58 (C)	1.41	-1.12	109.3	1.03	1.34<<	0
3/ 35 (C)	4.65	-2.46	207.32	2.38	4.51	0.01>>
3/ 64 (C)	2.09	-0.92	97.08	0.78	2.03	-0.01<<
4/ 38 (C)	2.87>>	0.6	254.98	-0.63	2.92	-0.02
4/ 57 (C)	0.07<<	0.2	158.69	-0.23	0.17	0
4/ 20 (C)	2.16	0.69>>	295.69	-0.76	2.26	-0.02
4/ 57 (C)	0.07	0.20<<	158.69	-0.23	0.17	0
4/ 13 (C)	1.68	0.6	324.51>>	-0.66	1.82	-0.01
4/ 64 (C)	0.86	0.34	121.33<<	-0.4	0.9	-0.01
4/ 57 (C)	0.07	0.2	158.69	-0.23>>	0.17	0
4/ 20 (C)	2.16	0.69	295.69	-0.76<<	2.26	-0.02
4/ 38 (C)	2.87	0.6	254.98	-0.63	2.92>>	-0.02
4/ 57 (C)	0.07	0.2	158.69	-0.23	0.17<<	0
4/ 59 (C)	1.19	0.24	155.41	-0.24	1.19	0.00>>
4/ 38 (C)	2.87	0.6	254.98	-0.63	2.92	-0.02<<
5/ 37 (C)	2.59>>	-3.77	540.87	3.46	2.57	-0.02
5/ 58 (C)	-0.30<<	-1.73	280.41	1.61	-0.35	0.01
5/ 64 (C)	0.48	-1.59>>	244.07	1.37	0.42	-0.01
5/ 17 (C)	2.32	-4.32<<	617.01	3.98	2.29	-0.01
5/ 13 (C)	1.04	-4.28	633.61>>	3.96	0.98	0
5/ 64 (C)	0.48	-1.59	244.07<<	1.37	0.42	-0.01
5/ 15 (C)	1.73	-4.29	613.87	4.02>>	1.64	0.01
5/ 64 (C)	0.48	-1.59	244.07	1.37<<	0.42	-0.01
5/ 37 (C)	2.59	-3.77	540.87	3.46	2.57>>	-0.02
5/ 58 (C)	-0.3	-1.73	280.41	1.61	-0.35<<	0.01
5/ 59 (C)	0.95	-1.77	276.09	1.73	0.86	0.02>>

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5/ 38 (C)	2.48	-3.74	512.28	3.44	2.47	-0.02<<
6/ 62 (C)	0.47>>	0.18	127.12	-0.21	0.47	-0.01
6/ 33 (C)	-1.45<<	0.57	287.37	-0.63	-1.3	0.01
6/ 20 (C)	-0.44	0.84>>	292.26	-0.92	-0.36	0
6/ 61 (C)	0.44	0.17<<	142.36	-0.21	0.44	-0.01
6/ 13 (C)	-1.12	0.68	320.23>>	-0.74	-0.99	0.01
6/ 64 (C)	-0.11	0.52	120.18<<	-0.57	-0.09	0
6/ 61 (C)	0.44	0.17	142.36	-0.21>>	0.44	-0.01
6/ 20 (C)	-0.44	0.84	292.26	-0.92<<	-0.36	0
6/ 62 (C)	0.47	0.18	127.12	-0.21	0.47>>	-0.01
6/ 33 (C)	-1.45	0.57	287.37	-0.63	-1.30<<	0.01
6/ 35 (C)	-0.04	0.62	283.99	-0.64	0	0.02>>
6/ 62 (C)	0.47	0.18	127.12	-0.21	0.47	-0.01<<
7/ 17 (C)	4.67>>	-6.06	562.67	5.72	4.36	0
7/ 58 (C)	0.69<<	-2.52	278.88	2.41	0.61	0.01
7/ 64 (C)	1.66	-1.11>>	240.76	1	1.49	-0.01
7/ 17 (C)	4.67	-6.06<<	562.67	5.72	4.36	0
7/ 13 (C)	3.44	-5.96	583.65>>	5.66	3.17	0.01
7/ 60 (C)	2.24	-2.62	228.45<<	2.58	2.07	0.01
7/ 15 (C)	4.37	-6.02	553.39	5.77>>	4.05	0.01
7/ 64 (C)	1.66	-1.11	240.76	1.00<<	1.49	-0.01
7/ 17 (C)	4.67	-6.06	562.67	5.72	4.36>>	0
7/ 58 (C)	0.69	-2.52	278.88	2.41	0.61<<	0.01
7/ 51 (C)	3.51	-4.6	395.68	4.45	3.25	0.01>>
7/ 46 (C)	3.36	-3.48	334.69	3.25	3.16	-0.01<<
8/ 16 (C)	5.07>>	0.35	182.25	-0.39	4.71	-0.04
8/ 57 (C)	0.92<<	0	111.97	-0.04	0.85	-0.01
8/ 40 (C)	4.32	1.29>>	149.44	-1.31	4.01	-0.04
8/ 61 (C)	2.52	-0.23<<	98.54	0.17	2.36	-0.03
8/ 13 (C)	3.82	0.39	198.61>>	-0.45	3.55	-0.04
8/ 64 (C)	2.35	1.04	77.28<<	-1.04	2.17	-0.02
8/ 61 (C)	2.52	-0.23	98.54	0.17>>	2.36	-0.03
8/ 40 (C)	4.32	1.29	149.44	-1.31<<	4.01	-0.04
8/ 16 (C)	5.07	0.35	182.25	-0.39	4.71>>	-0.04
8/ 57 (C)	0.92	0	111.97	-0.04	0.85<<	-0.01
8/ 57 (C)	0.92	0	111.97	-0.04	0.85	-0.01>>
8/ 18 (C)	4.9	0.3	175.99	-0.36	4.57	-0.05<<
9/ 47 (C)	15.73>>	17.64	216.27	-38.87	39.97	1.92
9/ 50 (C)	-					
9/ 50 (C)	14.92<<	0.87	188.34	5.97	-39.04	-1.4
9/ 39 (C)	15.72	22.14>>	276.77	-44.67	39.94	1.92
9/ 58 (C)	-14.91	-3.63<<	127.84	11.76	-39.02	-1.4
9/ 15 (C)	6.29	12.18	355.76>>	-11.31	17.71	0.19
9/ 64 (C)	15.66	15.49	111.99<<	-34.76	39.22	1.71
9/ 58 (C)	-14.91	-3.63	127.84	11.76>>	-39.02	-1.4

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9/ 39 (C)	15.72	22.14	276.77	-	44.67<<	39.94	1.92
9/ 47 (C)	15.73	17.64	216.27	-38.87	39.97>>		1.92
9/ 50 (C)	-14.92	0.87	188.34	5.97	-	39.04<<	-1.4
9/ 47 (C)	15.73	17.64	216.27	-38.87	39.97	1.92>>	
9/ 50 (C)	-14.92	0.87	188.34	5.97	-39.04	-1.40<<	
10/ 47 (C)	24.48>>	49.31	250.22	-41.73	45.59		1.92
10/ 50 (C)	-	23.29<<	2.02	168.1	-6.86	-44.44	-1.4
10/ 39 (C)	24.47	52.76>>	310.67	-46.96	45.57		1.92
10/ 60 (C)	18.87	-	50.04<<	58.25	35.25	33.55	-0.13
10/ 19 (C)	14.73	38.73	321.64>>	-37.33	27.85		1.29
10/ 60 (C)	18.87	-50.04	58.25<<	35.25	33.55		-0.13
10/ 60 (C)	18.87	-50.04	58.25	35.25>>	33.55		-0.13
10/ 39 (C)	24.47	52.76	310.67	-	46.96<<	45.57	1.92
10/ 47 (C)	24.48	49.31	250.22	-41.73	45.59>>		1.92
10/ 50 (C)	-23.29	2.02	168.1	-6.86	-	44.44<<	-1.4
10/ 47 (C)	24.48	49.31	250.22	-41.73	45.59	1.92>>	
10/ 50 (C)	-23.29	2.02	168.1	-6.86	-44.44	-1.40<<	
11/ 35 (C)	38.98>>	-0.98	84.71	7.49	77.9		0
11/ 58 (C)	-	36.76<<	0.03	33.77	-0.23	-71.29	0
11/ 47 (C)	37.02	0.84>>	94.83	-6.43	73.29		0
11/ 52 (C)	38.61	-1.04<<	38.69	7.91	75.01		0
11/ 65 (C)	0.79	0.11	116.62>>	-0.85	6.03		0
11/ 58 (C)	-36.76	0.03	33.77<<	-0.23	-71.29		0
11/ 52 (C)	38.61	-1.04	38.69	7.91>>	75.01		0
11/ 47 (C)	37.02	0.84	94.83	-6.43<<	73.29		0
11/ 35 (C)	38.98	-0.98	84.71	7.49	77.90>>		0
11/ 58 (C)	-36.76	0.03	33.77	-0.23	-	71.29<<	0
11/ 35 (C)	38.98	-0.98	84.71	7.49	77.9	0.00>>	
11/ 58 (C)	-36.76	0.03	33.77	-0.23	-71.29	-0.00<<	
12/ 37 (C)	2.02>>	-0.14	137.49	1.04	15.38		0
12/ 58 (C)	-1.08<<	0.03	53.01	-0.24	-8.22		0
12/ 39 (C)	1.51	1.35>>	133.22	-10.31	11.53		0
12/ 60 (C)	1.4	-1.41<<	40.73	10.75	10.71		0
12/ 65 (C)	1.02	0.35	178.40>>	-2.64	7.81		0
12/ 60 (C)	1.4	-1.41	40.73<<	10.75	10.71		0
12/ 60 (C)	1.4	-1.41	40.73	10.75>>	10.71		0
12/ 39 (C)	1.51	1.35	133.22	-	10.31<<	11.53	0

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12/ 37 (C)	2.02	-0.14	137.49	1.04	15.38>>	0	
12/ 58 (C)	-1.08	0.03	53.01	-0.24	-8.22<<	0	
12/ 11 (C)	0.87	0.29	157.41	-2.25	6.65	0.0>>	
12/ 11 (C)	0.87	0.29	157.41	-2.25	6.65	0.0<<	
13/ 37 (C)	2.04>>	-3.22	109.27	3.14	1.9	0.91	
13/ 58 (C)	-1.16<<	-2.12	66.91	2.13	-1.19	-0.49	
13/ 64 (C)	0.72	0.41>>	58.57	-0.36	0.65	0.28	
13/ 33 (C)	-0.74	-3.31<<	115.61	3.39	-0.84	-0.3	
13/ 13 (C)	-0.13	-3.07	121.71>>	3.19	-0.26	-0.05	
13/ 60 (C)	1.19	-0.23	53.09<<	0.51	1.04	0.64	
13/ 33 (C)	-0.74	-3.31	115.61	3.39>>	-0.84	-0.3	
13/ 64 (C)	0.72	0.41	58.57	-0.36<<	0.65	0.28	
13/ 45 (C)	2.02	-2.55	90.65	2.43	1.90>>	0.93	
13/ 50 (C)	-1.13	-2.79	85.53	2.85	-1.20<<	-0.5	
13/ 45 (C)	2.02	-2.55	90.65	2.43	1.9	0.93>>	
13/ 50 (C)	-1.13	-2.79	85.53	2.85	-1.2	-0.50<<	
14/ 35 (C)	25.25>>	-14.59	54.83	30.47	53.26	0	
14/ 58 (C)	-	19.02<<	19.05	27.58	-31.93	-41.91	0
14/ 41 (C)	-18.69	19.11>>	55.29	-32.37	-39.45	0	
14/ 52 (C)	24.92	-	14.65<<	27.12	30.91	50.81	0
14/ 70 (C)	0.69	0.12	76.42>>	-0.92	5.11	0	
14/ 52 (C)	24.92	-14.65	27.12<<	30.91	50.81	0	
14/ 52 (C)	24.92	-14.65	27.12	30.91>>	50.81	0	
14/ 41 (C)	-18.69	19.11	55.29	-	32.37<<	-39.45	0
14/ 35 (C)	25.25	-14.59	54.83	30.47	53.26>>	0	
14/ 58 (C)	-19.02	19.05	27.58	-31.93	-	41.91<<	0
14/ 11 (C)	0.6	0.1	71.05	-0.76	4.41	0.0>>	
14/ 11 (C)	0.6	0.1	71.05	-0.76	4.41	0.0<<	
15/ 37 (C)	2.02>>	18.65	90.75	-29.83	14.95	0	
15/ 58 (C)	-1.59<<	27.04	41.88	-45.08	-11.79	0	
15/ 33 (C)	-1.25	27.18>>	86.79	-46.11	-9.26	0	
15/ 60 (C)	1.35	-	28.61<<	27.85	56.66	9.99	0
15/ 65 (C)	0.71	0.29	112.35>>	-2.14	5.22	0	
15/ 60 (C)	1.35	-28.61	27.85<<	56.66	9.99	0	
15/ 60 (C)	1.35	-28.61	27.85	56.66>>	9.99	0	
15/ 33 (C)	-1.25	27.18	86.79	-	46.11<<	-9.26	0
15/ 37 (C)	2.02	18.65	90.75	-29.83	14.95>>	0	
15/ 58 (C)	-1.59	27.04	41.88	-45.08	-	11.79<<	0
15/ 11 (C)	0.6	0.25	101.6	-1.83	4.46	0.0>>	

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15/ 11 (C)	0.6	0.25	101.6	-1.83	4.46	0.0<<	
16/ 58 (C)	1.43>>	-8.83	77.7	8.26	1.21	-0.07	
16/ 37 (C)	-3.11<<	-6.86	97.9	6.59	-3.15	0	
16/ 44 (C)	-2.41	14.63>>	52.86	-13.31	-2.44	0.01	
16/ 55 (C)	-2.07	-	76.67	10.69	-2.14	0.02	
16/ 71 (C)	-0.15	-6.64	129.20>>	6.31	-0.31	-0.08	
16/ 52 (C)	-2.41	13.95	31.68<<	-12.63	-2.48	0.02	
16/ 55 (C)	-2.07	-11.33	76.67	10.69>>	-2.14	0.02	
16/ 44 (C)	-2.41	14.63	52.86	-	13.31<<	-2.44	0.01
16/ 58 (C)	1.43	-8.83	77.7	8.26	1.21>>	-0.07	
16/ 37 (C)	-3.11	-6.86	97.9	6.59	-3.15<<	0	
16/ 64 (C)	-1.47	-9.65	50.24	9.03	-1.5	0.04>>	
16/ 33 (C)	0.61	-10.39	124.53	9.85	0.32	-0.10<<	
17/ 58 (C)	1.36>>	-6.97	75.82	6.57	1.18	-0.04	
17/ 35 (C)	-2.94<<	11.12	79.6	-9.94	-2.89	-0.01	
17/ 60 (C)	-2.27	13.36>>	32.19	-12.17	-2.2	0.01	
17/ 39 (C)	-1.14	-	96.46	11.23	-1.2	-0.01	
17/ 71 (C)	-0.04	-6.71	127.83>>	6.4	-0.14	-0.05	
17/ 52 (C)	-2.41	12.8	32.09<<	-11.55	-2.38	0	
17/ 39 (C)	-1.14	-11.86	96.46	11.23>>	-1.2	-0.01	
17/ 60 (C)	-2.27	13.36	32.19	-	12.17<<	-2.2	0.01
17/ 58 (C)	1.36	-6.97	75.82	6.57	1.18>>	-0.04	
17/ 35 (C)	-2.94	11.12	79.6	-9.94	-2.89<<	-0.01	
17/ 62 (C)	-1.8	-5.95	50.28	5.6	-1.72	0.03>>	
17/ 33 (C)	0.69	-9.2	123.23	8.79	0.5	-0.07<<	
18/ 35 (C)	3.88>>	-4.51	129.98	4.44	3.67	-7.53	
18/ 62 (C)	-0.74<<	-3.81	62.04	3.44	-0.32	6.52	
18/ 60 (C)	3.1	-1.75>>	64.96	1.84	2.81	-7.66	
18/ 17 (C)	0.82	-6.80<<	144.13	6.31	1.22	4.09	
18/ 13 (C)	2.21	-6.61	154.07>>	6.21	2.28	-2.58	
18/ 62 (C)	-0.74	-3.81	62.04<<	3.44	-0.32	6.52	
18/ 17 (C)	0.82	-6.8	144.13	6.31>>	1.22	4.09	
18/ 60 (C)	3.1	-1.75	64.96	1.84<<	2.81	-7.66	
18/ 35 (C)	3.88	-4.51	129.98	4.44	3.67>>	-7.53	
18/ 62 (C)	-0.74	-3.81	62.04	3.44	-0.32<<	6.52	
18/ 37 (C)	0.04	-6.57	127.06	6.04	0.54	6.64>>	
18/ 60 (C)	3.1	-1.75	64.96	1.84	2.81	-7.66<<	
19/ 39 (C)	4.38>>	4.33	127.52	-4.31	4.1	6.67	
19/ 62 (C)	-1.55<<	3.7	62.71	-3.31	-1.17	-7.33	
19/ 17 (C)	0.3	6.87>>	142.25	-6.39	0.64	-4.51	
19/ 64 (C)	3.62	1.51<<	64.83	-1.64	3.28	6.74	

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19/ 15 (C)	3.28	6.22	151.70>>	-5.92	3.21	2.92
19/ 62 (C)	-1.55	3.7	62.71<<	-3.31	-1.17	-7.33
19/ 64 (C)	3.62	1.51	64.83	-1.64>>	3.28	6.74
19/ 17 (C)	0.3	6.87	142.25	-6.39<<	0.64	-4.51
19/ 39 (C)	4.38	4.33	127.52	-4.31	4.10>>	6.67
19/ 62 (C)	-1.55	3.7	62.71	-3.31	-1.17<<	-7.33
19/ 63 (C)	3.72	1.54	71.57	-1.66	3.37	6.76>>
19/ 38 (C)	-0.89	6.49	118.66	-5.95	-0.43	-7.41<<
20/ 35 (C)	0.88>>	9.42	174.48	-8.82	0.93	0.19
20/ 58 (C)	-0.29<<	4.54	88.8	-4.25	-0.22	1.94
20/ 17 (C)	0.56	10.50>>	184.69	-9.86	0.69	-1.08
20/ 64 (C)	0.18	2.36<<	70.51	-2.3	0.22	-0.14
20/ 15 (C)	0.76	10.38	192.03>>	-9.74	0.85	0.11
20/ 64 (C)	0.18	2.36	70.51<<	-2.3	0.22	-0.14
20/ 64 (C)	0.18	2.36	70.51	-2.30>>	0.22	-0.14
20/ 17 (C)	0.56	10.5	184.69	-9.86<<	0.69	-1.08
20/ 35 (C)	0.88	9.42	174.48	-8.82	0.93>>	0.19
20/ 58 (C)	-0.29	4.54	88.8	-4.25	-0.22<<	1.94
20/ 57 (C)	-0.26	4.64	98.22	-4.34	-0.19	1.95>>
20/ 38 (C)	0.51	9.51	152.83	-8.93	0.63	-1.81<<
21/ 35 (C)	0.74>>	9.56	173.48	-8.98	0.72	0
21/ 58 (C)	-0.30<<	4.64	88.12	-4.36	-0.28	1.71
21/ 15 (C)	0.54	10.50>>	190.95	-9.88	0.55	-0.03
21/ 64 (C)	0.36	2.60<<	71.14	-2.54	0.35	-0.7
21/ 15 (C)	0.54	10.5	190.95>>	-9.88	0.55	-0.03
21/ 64 (C)	0.36	2.6	71.14<<	-2.54	0.35	-0.7
21/ 64 (C)	0.36	2.6	71.14	-2.54>>	0.35	-0.7
21/ 15 (C)	0.54	10.5	190.95	-9.88<<	0.55	-0.03
21/ 35 (C)	0.74	9.56	173.48	-8.98	0.72>>	0
21/ 58 (C)	-0.3	4.64	88.12	-4.36	-0.28<<	1.71
21/ 58 (C)	-0.3	4.64	88.12	-4.36	-0.28	1.71>>
21/ 37 (C)	0.04	9.42	164.5	-8.86	0.1	-1.36<<
22/ 35 (C)	0.92>>	5.43	121.3	-5.15	0.81	-0.13
22/ 62 (C)	-0.24<<	2.29	57.91	-2.17	-0.23	-0.91
22/ 13 (C)	0.11	6.09>>	128.82	-5.81	0.03	0.92
22/ 62 (C)	-0.24	2.29<<	57.91	-2.17	-0.23	-0.91
22/ 15 (C)	0.7	5.99	128.96>>	-5.71	0.6	-0.1
22/ 64 (C)	0.75	2.68	51.94<<	-2.59	0.69	-1.28
22/ 62 (C)	-0.24	2.29	57.91	-2.17>>	-0.23	-0.91
22/ 13 (C)	0.11	6.09	128.82	-5.81<<	0.03	0.92
22/ 39 (C)	0.92	5.3	105.99	-5.1	0.82>>	-1.31
22/ 58 (C)	-0.23	2.96	67.02	-2.8	-0.27<<	1.6
22/ 50 (C)	-0.17	4.72	90.15	-4.49	-0.23	1.61>>
22/ 47 (C)	0.85	3.54	82.86	-3.41	0.77	-1.32<<
23/ 56 (C)	16.34>>	36.69	97.25	-22.9	28.3	-4.08

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23/ 41 (C)	-	12.72<<	-15.61	154.08	16.46	-27.25	3.18
23/ 63 (C)	16.3	41.46>>	-	48.71	-29.08	27.89	-4.07
23/ 36 (C)	15.83	67.04<<	-	309.34	57.75	33.28	-1.11
23/ 35 (C)	15.81	-65.71	319.11>>	56.67	32.91	-1.09	
23/ 64 (C)	16.32	40.14	38.94<<	-28	28.27	-4.09	
23/ 36 (C)	15.83	-67.04	309.34	57.75>>	33.28	-1.11	
23/ 63 (C)	16.3	41.46	48.71	-	29.08<<	27.89	-4.07
23/ 52 (C)	15.83	-65.97	268.71	55.93	33.42>>	-1.12	
23/ 41 (C)	-12.72	-15.61	154.08	16.46	-	27.25<<	3.18
23/ 33 (C)	-12.7	-19.06	212.38	21.55	-27.22	3.19>>	
23/ 64 (C)	16.32	40.14	38.94	-28	28.27	-4.09<<	
24/ 52 (C)	11.16>>	-18.59	197.29	31.33	28.33	5.39	
24/ 41 (C)	-6.97<<	-24.6	181.09	33.26	-20.97	-3.05	
24/ 63 (C)	7.42	13.09>>	122.47	-28.33	18.13	3.66	
24/ 34 (C)	-6.9	29.15<<	214.28	40.15	-20.52	-3.04	
24/ 15 (C)	6.62	-18.56	286.51>>	26.65	16.29	3.25	
24/ 64 (C)	7.47	12.93	97.41<<	-27.15	18.54	3.65	
24/ 34 (C)	-6.9	-29.15	214.28	40.15>>	-20.52	-3.04	
24/ 63 (C)	7.42	13.09	122.47	-	28.33<<	18.13	3.66
24/ 52 (C)	11.16	-18.59	197.29	31.33	28.33>>	5.39	
24/ 41 (C)	-6.97	-24.6	181.09	33.26	-	20.97<<	-3.05
24/ 35 (C)	11.09	-20.27	266.6	32.16	27.77	5.40>>	
24/ 58 (C)	-6.9	-22.93	111.79	32.43	-20.4	-3.05<<	
25/ 50 (C)	4.30>>	12.76	56.81	-11.98	3.68	0.16	
25/ 45 (C)	-4.61<<	10.14	138.71	-9.55	-4.33	-0.41	
25/ 41 (C)	4.1	14.96>>	104.98	-13.97	3.54	0.05	
25/ 56 (C)	-2.82	16.65<<	50.67	15.12	-2.78	-0.13	
25/ 67 (C)	-1.34	9.8	149.41>>	-9.34	-1.46	-0.21	
25/ 64 (C)	-2.82	-16.25	46.51<<	14.85	-2.7	-0.13	
25/ 56 (C)	-2.82	-16.65	50.67	15.12>>	-2.78	-0.13	
25/ 41 (C)	4.1	14.96	104.98	-	13.97<<	3.54	0.05
25/ 58 (C)	4.29	13.15	52.65	-12.25	3.75>>	0.16	
25/ 37 (C)	-4.61	9.75	142.87	-9.28	-4.40<<	-0.41	
25/ 50 (C)	4.3	12.76	56.81	-11.98	3.68	0.16>>	
25/ 45 (C)	-4.61	10.14	138.71	-9.55	-4.33	-0.41<<	
26/ 41 (C)	7.20>>	11.78	180.16	-11.08	6.46	0.3	
26/ 54 (C)	-4.33<<	7.96	27.45	-7.54	-4.02	-0.34	

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26/ 35 (C)	-1.77	13.72>>	119.26	-12.94	-1.7	-0.24
		-				
26/ 64 (C)	-2.39	16.36<<	12.02	14.97	-2.22	-0.22
26/ 41 (C)	7.2	11.78	180.16>>	-11.08	6.46	0.3
26/ 56 (C)	-2.44	-16.04	11.98<<	14.58	-2.31	-0.21
26/ 64 (C)	-2.39	-16.36	12.02	14.97>>	-2.22	-0.22
				-		
26/ 35 (C)	-1.77	13.72	119.26	12.94<<	-1.7	-0.24
26/ 41 (C)	7.2	11.78	180.16	-11.08	6.46>>	0.3
26/ 54 (C)	-4.33	7.96	27.45	-7.54	-4.02<<	-0.34
26/ 50 (C)	6.21	10.73	122.93	-10.15	5.54	0.35>>
26/ 45 (C)	-3.34	9	84.68	-8.47	-3.1	-0.38<<

### Kolonų pamatų reakcijos A2 derinys:

Taškas/ kombinacija	Fx, kN	Fy, kN	Fz, kN	Mx, kNm	My, kNm	Mz, kNm
1/ 161 (C)	-0.10>>	-0.86	101.55	0.82	0.06	0
1/ 143 (C)	-2.20<<	-0.91	174.08	0.84	-1.57	-0.03
1/ 164 (C)	-0.89	-0.36>>	88.47	0.36	-0.51	-0.04
1/ 153 (C)	-0.65	-1.11<<	152.81	1.07	-0.27	-0.01
1/ 142 (C)	-2	-0.94	184.15>>	0.87	-1.38	-0.03
1/ 164 (C)	-0.89	-0.36	88.47<<	0.36	-0.51	-0.04
1/ 153 (C)	-0.65	-1.11	152.81	1.07>>	-0.27	-0.01
1/ 164 (C)	-0.89	-0.36	88.47	0.36<<	-0.51	-0.04
1/ 161 (C)	-0.1	-0.86	101.55	0.82	0.06>>	0
1/ 152 (C)	-2.17	-0.86	153.89	0.79	-1.65<<	-0.02
1/ 162 (C)	-0.3	-0.82	91.48	0.79	-0.13	-0.00>>
1/ 155 (C)	-1.24	-0.65	149.8	0.63	-0.65	-0.05<<
2/ 161 (C)	0.68>>	0.32	111.51	-0.3	0.82	0.06
2/ 147 (C)	-1.97<<	1.05	165.51	-1.01	-1.31	0.01
2/ 146 (C)	-1.81	1.06>>	174.67	-1.02	-1.16	0.02
2/ 160 (C)	-1.2	0.30<<	102.81	-0.3	-0.89	0.04
2/ 142 (C)	-1.69	0.85	183.26>>	-0.83	-1.07	0.05
2/ 164 (C)	-1.41	0.64	88.50<<	-0.61	-1.03	-0.01
2/ 162 (C)	0.52	0.31	102.35	-0.29>>	0.67	0.06
2/ 146 (C)	-1.81	1.06	174.67	-1.02<<	-1.16	0.02
2/ 161 (C)	0.68	0.32	111.51	-0.3	0.82>>	0.06
2/ 156 (C)	-1.91	0.96	139.64	-0.92	-1.32<<	0
2/ 153 (C)	0.18	0.63	162.66	-0.61	0.53	0.07>>
2/ 164 (C)	-1.41	0.64	88.5	-0.61	-1.03	-0.01<<
3/ 146 (C)	5.37>>	-2.33	198.43	2.23	5.3	0
3/ 160 (C)	1.41<<	-1.12	109.3	1.03	1.34	0
3/ 166 (C)	2.09	-0.92>>	97.08	0.78	2.03	-0.01
3/ 144 (C)	4.48	-2.42<<	199.57	2.33	4.38	0

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3/ 142 (C)	3.95	-2.38	206.78>>	2.24	3.88	0
3/ 164 (C)	3.76	-1.03	95.40<<	1.02	3.71	0
3/ 144 (C)	4.48	-2.42	199.57	2.33>>	4.38	0
3/ 166 (C)	2.09	-0.92	97.08	0.78<<	2.03	-0.01
3/ 146 (C)	5.37	-2.33	198.43	2.23	5.30>>	0
3/ 160 (C)	1.41	-1.12	109.3	1.03	1.34<<	0
3/ 153 (C)	3.77	-2.09	171.12	2.04	3.65	0.01>>
3/ 166 (C)	2.09	-0.92	97.08	0.78	2.03	-0.01<<
4/ 156 (C)	2.50>>	0.49	207.79	-0.52	2.54	-0.02
4/ 159 (C)	0.07<<	0.2	158.69	-0.23	0.17	0
4/ 149 (C)	1.79	0.58>>	248.5	-0.65	1.88	-0.02
4/ 159 (C)	0.07	0.20<<	158.69	-0.23	0.17	0
4/ 142 (C)	1.31	0.49	277.31>>	-0.54	1.44	-0.01
4/ 166 (C)	0.86	0.34	121.33<<	-0.4	0.9	-0.01
4/ 159 (C)	0.07	0.2	158.69	-0.23>>	0.17	0
4/ 149 (C)	1.79	0.58	248.5	-0.65<<	1.88	-0.02
4/ 156 (C)	2.5	0.49	207.79	-0.52	2.54>>	-0.02
4/ 159 (C)	0.07	0.2	158.69	-0.23	0.17<<	0
4/ 161 (C)	1.19	0.24	155.41	-0.24	1.19	0.00>>
4/ 156 (C)	2.5	0.49	207.79	-0.52	2.54	-0.02<<
5/ 155 (C)	2.33>>	-3.17	448.46	2.91	2.32	-0.02
5/ 160 (C)	-0.30<<	-1.73	280.41	1.61	-0.35	0.01
5/ 166 (C)	0.48	-1.59>>	244.07	1.37	0.42	-0.01
5/ 146 (C)	2.06	-3.71<<	524.6	3.42	2.04	-0.01
5/ 142 (C)	0.78	-3.67	541.20>>	3.4	0.73	0
5/ 166 (C)	0.48	-1.59	244.07<<	1.37	0.42	-0.01
5/ 144 (C)	1.47	-3.68	521.45	3.46>>	1.39	0.01
5/ 166 (C)	0.48	-1.59	244.07	1.37<<	0.42	-0.01
5/ 155 (C)	2.33	-3.17	448.46	2.91	2.32>>	-0.02
5/ 160 (C)	-0.3	-1.73	280.41	1.61	-0.35<<	0.01
5/ 161 (C)	0.95	-1.77	276.09	1.73	0.86	0.02>>
5/ 156 (C)	2.22	-3.14	419.86	2.88	2.22	-0.02<<
6/ 164 (C)	0.47>>	0.18	127.12	-0.21	0.47	-0.01
6/ 151 (C)	-1.36<<	0.45	240.64	-0.5	-1.23	0.01
6/ 149 (C)	-0.36	0.72>>	245.53	-0.79	-0.29	0
6/ 163 (C)	0.44	0.17<<	142.36	-0.21	0.44	-0.01
6/ 142 (C)	-1.04	0.56	273.50>>	-0.62	-0.92	0.01
6/ 166 (C)	-0.11	0.52	120.18<<	-0.57	-0.09	0
6/ 163 (C)	0.44	0.17	142.36	-0.21>>	0.44	-0.01
6/ 149 (C)	-0.36	0.72	245.53	-0.79<<	-0.29	0
6/ 164 (C)	0.47	0.18	127.12	-0.21	0.47>>	-0.01
6/ 151 (C)	-1.36	0.45	240.64	-0.5	-1.23<<	0.01
6/ 153 (C)	0.04	0.51	237.26	-0.52	0.07	0.01>>
6/ 164 (C)	0.47	0.18	127.12	-0.21	0.47	-0.01<<
7/ 146 (C)	4.06>>	-5.26	471.9	4.96	3.79	0

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7/ 160 (C)	0.69<<	-2.52	278.88	2.41	0.61	0.01	
7/ 166 (C)	1.66	-1.11>>	240.76	1	1.49	-0.01	
7/ 146 (C)	4.06	-5.26<<	471.9	4.96	3.79	0	
7/ 142 (C)	2.83	-5.16	492.88>>	4.91	2.6	0.01	
7/ 162 (C)	2.24	-2.62	228.45<<	2.58	2.07	0.01	
7/ 144 (C)	3.76	-5.23	462.62	5.01>>	3.48	0.01	
7/ 166 (C)	1.66	-1.11	240.76	1.00<<	1.49	-0.01	
7/ 146 (C)	4.06	-5.26	471.9	4.96	3.79>>	0	
7/ 160 (C)	0.69	-2.52	278.88	2.41	0.61<<	0.01	
7/ 153 (C)	3.51	-4.6	395.68	4.45	3.25	0.01>>	
7/ 164 (C)	2.75	-2.68	243.92	2.5	2.59	-0.01<<	
8/ 145 (C)	4.38>>	0.28	150.74	-0.31	4.07	-0.03	
8/ 159 (C)	0.92<<	0	111.97	-0.04	0.85	-0.01	
8/ 158 (C)	3.64	1.22>>	117.94	-1.22	3.37	-0.04	
8/ 163 (C)	2.52	-0.23<<	98.54	0.17	2.36	-0.03	
8/ 142 (C)	3.13	0.31	167.10>>	-0.36	2.91	-0.03	
8/ 166 (C)	2.35	1.04	77.28<<	-1.04	2.17	-0.02	
8/ 163 (C)	2.52	-0.23	98.54	0.17>>	2.36	-0.03	
8/ 158 (C)	3.64	1.22	117.94	-1.22<<	3.37	-0.04	
8/ 145 (C)	4.38	0.28	150.74	-0.31	4.07>>	-0.03	
8/ 159 (C)	0.92	0	111.97	-0.04	0.85<<	-0.01	
8/ 159 (C)	0.92	0	111.97	-0.04	0.85	-0.01>>	
8/ 147 (C)	4.21	0.23	144.48	-0.28	3.93	-0.04<<	
9/ 165 (C)	15.71>>	15.67	161.63	-35.97	39.78	1.86	
9/ 152 (C)	-	14.92<<	0.87	188.34	5.97	-39.04	-1.4
9/ 157 (C)	15.7	20.17>>	222.13	-41.76	39.76	1.86	
9/ 160 (C)	-14.91	-3.63<<	127.84	11.76	-39.02	-1.4	
9/ 144 (C)	6.27	10.21	301.11>>	-8.4	17.53	0.13	
9/ 166 (C)	15.66	15.49	111.99<<	-34.76	39.22	1.71	
9/ 160 (C)	-14.91	-3.63	127.84	11.76>>	-39.02	-1.4	
9/ 157 (C)	15.7	20.17	222.13	-	41.76<<	39.76	1.86
9/ 165 (C)	15.71	15.67	161.63	-35.97	39.78>>	1.86	
9/ 152 (C)	-	-14.92	0.87	188.34	5.97	-39.04<<	-1.4
9/ 165 (C)	15.71	15.67	161.63	-35.97	39.78	1.86>>	
9/ 152 (C)	-14.92	0.87	188.34	5.97	-39.04	-1.40<<	
10/ 165 (C)	24.47>>	47.04	202.17	-38.95	45.4	1.86	
10/ 152 (C)	-	23.29<<	2.02	168.1	-6.86	-44.44	-1.4
10/ 157 (C)	24.45	50.49>>	262.62	-44.18	45.38	1.86	
10/ 162 (C)	18.87	-	50.04<<	58.25	35.25	33.55	-0.13
10/ 148 (C)	14.71	36.47	273.59>>	-34.55	27.66	1.24	
10/ 162 (C)	18.87	-50.04	58.25<<	35.25	33.55	-0.13	

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10/ 162 (C)	18.87	-50.04	58.25	35.25>>	33.55	-0.13
10/ 157 (C)	24.45	50.49	262.62	-	44.18<<	45.38
10/ 165 (C)	24.47	47.04	202.17	-38.95	45.40>>	1.86
10/ 152 (C)	-23.29	2.02	168.1	-6.86	-	44.44<<
10/ 165 (C)	24.47	47.04	202.17	-38.95	45.4	1.86>>
10/ 152 (C)	-23.29	2.02	168.1	-6.86	-44.44	-1.40<<
11/ 153 (C)	38.88>>	-1	63.76	7.61	77.13	0
11/ 160 (C)	-	36.76<<	0.03	33.77	-0.23	-71.29
11/ 165 (C)	36.92	0.83>>	73.88	-6.32	72.51	0
11/ 154 (C)	38.61	-1.04<<	38.69	7.91	75.01	0
11/ 167 (C)	0.69	0.1	95.67>>	-0.74	5.25	0
11/ 160 (C)	-36.76	0.03	33.77<<	-0.23	-71.29	0
11/ 154 (C)	38.61	-1.04	38.69	7.91>>	75.01	0
11/ 165 (C)	36.92	0.83	73.88	-6.32<<	72.51	0
11/ 153 (C)	38.88	-1	63.76	7.61	77.13>>	0
11/ 160 (C)	-36.76	0.03	33.77	-0.23	-	71.29<<
11/ 153 (C)	38.88	-1	63.76	7.61	77.13	0.00>>
11/ 160 (C)	-36.76	0.03	33.77	-0.23	-71.29	-0.00<<
12/ 155 (C)	1.88>>	-0.18	109.39	1.38	14.37	0
12/ 160 (C)	-1.08<<	0.03	53.01	-0.24	-8.22	0
12/ 157 (C)	1.38	1.31>>	105.11	-9.97	10.52	0
12/ 162 (C)	1.4	-1.41<<	40.73	10.75	10.71	0
12/ 167 (C)	0.89	0.3	150.29>>	-2.29	6.81	0
12/ 162 (C)	1.4	-1.41	40.73<<	10.75	10.71	0
12/ 162 (C)	1.4	-1.41	40.73	10.75>>	10.71	0
12/ 157 (C)	1.38	1.31	105.11	-9.97<<	10.52	0
12/ 155 (C)	1.88	-0.18	109.39	1.38	14.37>>	0
12/ 160 (C)	-1.08	0.03	53.01	-0.24	-8.22<<	0
12/ 140 (C)	0.74	0.25	129.3	-1.9	5.65	0.0>>
12/ 140 (C)	0.74	0.25	129.3	-1.9	5.65	0.0<<
13/ 155 (C)	1.93>>	-2.94	87.49	2.85	1.8	0.86
13/ 160 (C)	-1.16<<	-2.12	66.91	2.13	-1.19	-0.49
13/ 166 (C)	0.72	0.41>>	58.57	-0.36	0.65	0.28
13/ 151 (C)	-0.85	-3.04<<	93.83	3.09	-0.94	-0.35
13/ 142 (C)	-0.25	-2.79	99.94>>	2.89	-0.35	-0.11
13/ 162 (C)	1.19	-0.23	53.09<<	0.51	1.04	0.64
13/ 151 (C)	-0.85	-3.04	93.83	3.09>>	-0.94	-0.35
13/ 166 (C)	0.72	0.41	58.57	-0.36<<	0.65	0.28
13/ 163 (C)	1.91	-2.27	68.87	2.13	1.81>>	0.87
13/ 152 (C)	-1.13	-2.79	85.53	2.85	-1.20<<	-0.5
13/ 163 (C)	1.91	-2.27	68.87	2.13	1.81	0.87>>

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13/ 152 (C)	-1.13	-2.79	85.53	2.85	-1.2	-0.50<<	
14/ 153 (C)	25.16>>	-14.61	39.66	30.59	52.6	0	
	-						
14/ 160 (C)	19.02<<	19.05	27.58	-31.93	-41.91	0	
14/ 159 (C)	-18.78	19.09>>	40.12	-32.26	-40.12	0	
		-					
14/ 154 (C)	24.92	14.65<<	27.12	30.91	50.81	0	
14/ 172 (C)	0.6	0.11	61.25>>	-0.8	4.45	0	
14/ 154 (C)	24.92	-14.65	27.12<<	30.91	50.81	0	
14/ 154 (C)	24.92	-14.65	27.12	30.91>>	50.81	0	
				-			
14/ 159 (C)	-18.78	19.09	40.12	32.26<<	-40.12	0	
14/ 153 (C)	25.16	-14.61	39.66	30.59	52.60>>	0	
					-		
14/ 160 (C)	-19.02	19.05	27.58	-31.93	41.91<<	0	
14/ 140 (C)	0.51	0.09	55.88	-0.64	3.74	0.0>>	
14/ 140 (C)	0.51	0.09	55.88	-0.64	3.74	0.0<<	
15/ 155 (C)	1.93>>	18.61	70.91	-29.55	14.27	0	
15/ 160 (C)	-1.59<<	27.04	41.88	-45.08	-11.79	0	
15/ 151 (C)	-1.34	27.14>>	66.95	-45.83	-9.94	0	
		-					
15/ 162 (C)	1.35	28.61<<	27.85	56.66	9.99	0	
15/ 167 (C)	0.62	0.25	92.51>>	-1.86	4.55	0	
15/ 162 (C)	1.35	-28.61	27.85<<	56.66	9.99	0	
15/ 162 (C)	1.35	-28.61	27.85	56.66>>	9.99	0	
				-			
15/ 151 (C)	-1.34	27.14	66.95	45.83<<	-9.94	0	
15/ 155 (C)	1.93	18.61	70.91	-29.55	14.27>>	0	
					-		
15/ 160 (C)	-1.59	27.04	41.88	-45.08	11.79<<	0	
15/ 140 (C)	0.51	0.21	81.76	-1.55	3.79	0.0>>	
15/ 140 (C)	0.51	0.21	81.76	-1.55	3.79	0.0<<	
16/ 160 (C)	1.43>>	-8.83	77.7	8.26	1.21	-0.07	
16/ 155 (C)	-2.89<<	-6.99	77.5	6.66	-2.89	0.01	
16/ 162 (C)	-2.19	14.50>>	32.46	-13.24	-2.19	0.02	
		-					
16/ 157 (C)	-2.07	11.33<<	76.67	10.69	-2.14	0.02	
16/ 173 (C)	0.07	-6.77	108.80>>	6.38	-0.06	-0.07	
16/ 154 (C)	-2.41	13.95	31.68<<	-12.63	-2.48	0.02	
16/ 157 (C)	-2.07	-11.33	76.67	10.69>>	-2.14	0.02	
				-			
16/ 162 (C)	-2.19	14.5	32.46	13.24<<	-2.19	0.02	
16/ 160 (C)	1.43	-8.83	77.7	8.26	1.21>>	-0.07	
16/ 155 (C)	-2.89	-6.99	77.5	6.66	-2.89<<	0.01	
16/ 166 (C)	-1.47	-9.65	50.24	9.03	-1.5	0.04>>	
16/ 151 (C)	0.84	-10.51	104.13	9.92	0.57	-0.09<<	

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17/ 160 (C)	1.36>>	-6.97	75.82	6.57	1.18	-0.04	
17/ 153 (C)	-2.79<<	11.3	59.34	-10.15	-2.73	-0.01	
17/ 162 (C)	-2.27	13.36>>	32.19	-12.17	-2.2	0.01	
17/ 157 (C)	-0.99	-	76.2	11.02	-1.04	-0.01	
17/ 173 (C)	0.11	-6.53	107.57>>	6.19	0.02	-0.04	
17/ 154 (C)	-2.41	12.8	32.09<<	-11.55	-2.38	0	
17/ 157 (C)	-0.99	-11.68	76.2	11.02>>	-1.04	-0.01	
17/ 162 (C)	-2.27	13.36	32.19	-	12.17<<	-2.2	0.01
17/ 160 (C)	1.36	-6.97	75.82	6.57	1.18>>	-0.04	
17/ 153 (C)	-2.79	11.3	59.34	-10.15	-2.73<<	-0.01	
17/ 164 (C)	-1.8	-5.95	50.28	5.6	-1.72	0.03>>	
17/ 151 (C)	0.84	-9.03	102.97	8.58	0.66	-0.06<<	
18/ 153 (C)	3.60>>	-3.65	104.8	3.64	3.36	-7.56	
18/ 164 (C)	-0.74<<	-3.81	62.04	3.44	-0.32	6.52	
18/ 162 (C)	3.1	-1.75>>	64.96	1.84	2.81	-7.66	
18/ 146 (C)	0.55	-5.95<<	118.94	5.51	0.92	4.06	
18/ 142 (C)	1.93	-5.76	128.88>>	5.41	1.98	-2.61	
18/ 164 (C)	-0.74	-3.81	62.04<<	3.44	-0.32	6.52	
18/ 146 (C)	0.55	-5.95	118.94	5.51>>	0.92	4.06	
18/ 162 (C)	3.1	-1.75	64.96	1.84<<	2.81	-7.66	
18/ 153 (C)	3.6	-3.65	104.8	3.64	3.36>>	-7.56	
18/ 164 (C)	-0.74	-3.81	62.04	3.44	-0.32<<	6.52	
18/ 155 (C)	-0.24	-5.72	101.87	5.24	0.24	6.61>>	
18/ 162 (C)	3.1	-1.75	64.96	1.84	2.81	-7.66<<	
19/ 157 (C)	4.11>>	3.45	102.39	-3.47	3.81	6.69	
19/ 164 (C)	-1.55<<	3.7	62.71	-3.31	-1.17	-7.33	
19/ 146 (C)	0.04	5.99>>	117.12	-5.55	0.35	-4.49	
19/ 166 (C)	3.62	1.51<<	64.83	-1.64	3.28	6.74	
19/ 144 (C)	3.01	5.33	126.56>>	-5.09	2.92	2.93	
19/ 164 (C)	-1.55	3.7	62.71<<	-3.31	-1.17	-7.33	
19/ 166 (C)	3.62	1.51	64.83	-1.64>>	3.28	6.74	
19/ 146 (C)	0.04	5.99	117.12	-5.55<<	0.35	-4.49	
19/ 157 (C)	4.11	3.45	102.39	-3.47	3.81>>	6.69	
19/ 164 (C)	-1.55	3.7	62.71	-3.31	-1.17<<	-7.33	
19/ 165 (C)	3.72	1.54	71.57	-1.66	3.37	6.76>>	
19/ 156 (C)	-1.16	5.6	93.53	-5.12	-0.72	-7.40<<	
20/ 153 (C)	0.80>>	8.1	145.37	-7.57	0.84	0.19	
20/ 160 (C)	-0.29<<	4.54	88.8	-4.25	-0.22	1.94	
20/ 146 (C)	0.49	9.18>>	155.58	-8.61	0.59	-1.08	
20/ 166 (C)	0.18	2.36<<	70.51	-2.3	0.22	-0.14	
20/ 144 (C)	0.68	9.06	162.91>>	-8.5	0.76	0.11	
20/ 166 (C)	0.18	2.36	70.51<<	-2.3	0.22	-0.14	
20/ 166 (C)	0.18	2.36	70.51	-2.30>>	0.22	-0.14	

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20/ 146 (C)	0.49	9.18	155.58	-8.61<<	0.59	-1.08
20/ 153 (C)	0.8	8.1	145.37	-7.57	0.84>>	0.19
20/ 160 (C)	-0.29	4.54	88.8	-4.25	-0.22<<	1.94
20/ 159 (C)	-0.26	4.64	98.22	-4.34	-0.19	1.95>>
20/ 156 (C)	0.44	8.19	123.71	-7.68	0.54	-1.80<<
21/ 153 (C)	0.70>>	8.23	144.62	-7.72	0.69	0
21/ 160 (C)	-0.30<<	4.64	88.12	-4.36	-0.28	1.71
21/ 144 (C)	0.51	9.17>>	162.1	-8.63	0.51	-0.02
21/ 166 (C)	0.36	2.60<<	71.14	-2.54	0.35	-0.7
21/ 144 (C)	0.51	9.17	162.10>>	-8.63	0.51	-0.02
21/ 166 (C)	0.36	2.6	71.14<<	-2.54	0.35	-0.7
21/ 166 (C)	0.36	2.6	71.14	-2.54>>	0.35	-0.7
21/ 144 (C)	0.51	9.17	162.1	-8.63<<	0.51	-0.02
21/ 153 (C)	0.7	8.23	144.62	-7.72	0.69>>	0
21/ 160 (C)	-0.3	4.64	88.12	-4.36	-0.28<<	1.71
21/ 160 (C)	-0.3	4.64	88.12	-4.36	-0.28	1.71>>
21/ 155 (C)	0.01	8.09	135.65	-7.6	0.06	-1.35<<
22/ 153 (C)	0.87>>	4.62	99.73	-4.37	0.78	-0.13
22/ 164 (C)	-0.24<<	2.29	57.91	-2.17	-0.23	-0.91
22/ 142 (C)	0.06	5.27>>	107.26	-5.03	-0.01	0.93
22/ 164 (C)	-0.24	2.29<<	57.91	-2.17	-0.23	-0.91
22/ 144 (C)	0.65	5.18	107.39>>	-4.93	0.56	-0.09
22/ 166 (C)	0.75	2.68	51.94<<	-2.59	0.69	-1.28
22/ 164 (C)	-0.24	2.29	57.91	-2.17>>	-0.23	-0.91
22/ 142 (C)	0.06	5.27	107.26	-5.03<<	-0.01	0.93
22/ 157 (C)	0.87	4.48	84.43	-4.32	0.78>>	-1.31
22/ 160 (C)	-0.23	2.96	67.02	-2.8	-0.27<<	1.6
22/ 152 (C)	-0.17	4.72	90.15	-4.49	-0.23	1.61>>
22/ 165 (C)	0.81	2.73	61.29	-2.63	0.74	-1.31<<
23/ 158 (C)	16.34>>	36.69	97.25	-22.9	28.3	-4.08
	-					
23/ 159 (C)	12.71<<	-14.54	113.45	14.63	-27.12	3.17
23/ 165 (C)	16.3	41.46>>	48.71	-29.08	27.89	-4.07
		-				
23/ 154 (C)	15.83	65.97<<	268.71	55.93	33.42	-1.12
23/ 153 (C)	15.81	-64.64	278.48>>	54.84	33.04	-1.1
23/ 166 (C)	16.32	40.14	38.94<<	-28	28.27	-4.09
23/ 154 (C)	15.83	-65.97	268.71	55.93>>	33.42	-1.12
				-		
23/ 165 (C)	16.3	41.46	48.71	29.08<<	27.89	-4.07
23/ 154 (C)	15.83	-65.97	268.71	55.93	33.42>>	-1.12
					-	
23/ 159 (C)	-12.71	-14.54	113.45	14.63	27.12<<	3.17
23/ 151 (C)	-12.7	-17.99	171.75	19.73	-27.08	3.18>>
23/ 166 (C)	16.32	40.14	38.94	-28	28.27	-4.09<<

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24/ 154 (C)	11.16>>	-18.59	197.29	31.33	28.33	5.39
24/ 159 (C)	-6.96<<	-22.78	136.85	31.25	-20.81	-3.05
24/ 165 (C)	7.42	13.09>>	122.47	-28.33	18.13	3.66
24/ 152 (C)	-6.88	-	170.04	38.14	-20.37	-3.04
24/ 144 (C)	6.63	-16.73	242.26>>	24.65	16.44	3.25
24/ 166 (C)	7.47	12.93	97.41<<	-27.15	18.54	3.65
24/ 152 (C)	-6.88	-27.33	170.04	38.14>>	-20.37	-3.04
24/ 165 (C)	7.42	13.09	122.47	-	18.13	3.66
24/ 154 (C)	11.16	-18.59	197.29	31.33	28.33>>	5.39
24/ 159 (C)	-6.96	-22.78	136.85	31.25	-	-3.05
24/ 153 (C)	11.1	-18.44	222.35	30.15	20.81<<	5.40>>
24/ 160 (C)	-6.9	-22.93	111.79	32.43	27.92	-3.05<<
25/ 152 (C)	4.30>>	12.76	56.81	-11.98	-20.4	0.16
25/ 163 (C)	-4.50<<	9.99	116.45	-9.36	3.68	-0.38
25/ 159 (C)	4.21	14.81>>	82.72	-13.78	-4.18	0.08
25/ 158 (C)	-2.82	-	50.67	15.12	3.69	-0.13
25/ 169 (C)	-1.23	9.64	127.15>>	-9.15	-2.78	-0.18
25/ 166 (C)	-2.82	-16.25	46.51<<	14.85	-1.31	-0.13
25/ 158 (C)	-2.82	-16.65	50.67	15.12>>	-2.7	-0.13
25/ 159 (C)	4.21	14.81	82.72	-	3.69	0.08
25/ 160 (C)	4.29	13.15	52.65	13.78<<	3.75>>	0.16
25/ 155 (C)	-4.49	9.59	120.61	-9.09	-4.26<<	-0.38
25/ 152 (C)	4.3	12.76	56.81	-11.98	3.68	0.16>>
25/ 163 (C)	-4.5	9.99	116.45	-9.36	-4.18	-0.38<<
26/ 159 (C)	6.93>>	11.68	156.7	-10.94	6.23	0.31
26/ 156 (C)	-4.33<<	7.96	27.45	-7.54	-4.02	-0.34
26/ 153 (C)	-2.04	13.62>>	95.8	-12.8	-1.93	-0.23
26/ 166 (C)	-2.39	-	12.02	14.97	-2.22	-0.22
26/ 159 (C)	6.93	11.68	156.70>>	-10.94	6.23	0.31
26/ 158 (C)	-2.44	-16.04	11.98<<	14.58	-2.31	-0.21
26/ 166 (C)	-2.39	-16.36	12.02	14.97>>	-2.22	-0.22
26/ 153 (C)	-2.04	13.62	95.8	-	-1.93	-0.23
26/ 159 (C)	6.93	11.68	156.7	12.80<<	6.23>>	0.31
26/ 156 (C)	-4.33	7.96	27.45	-7.54	-4.02<<	-0.34
26/ 152 (C)	6.21	10.73	122.93	-10.15	5.54	0.35>>
26/ 163 (C)	-3.61	8.9	61.22	-8.33	-3.33	-0.38<<

### Kolonų pamatų reakcijos ACC derinys:

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Taškas/ kombinacija	Fx, kN	Fy, kN	Fz, kN	Mx, kNm	My, kNm	Mz, kNm	
1/ 205 (C)	-1.09>>	-0.46	98.19	0.42	-0.77	-0.02	
1/ 226 (C)	-	55.82<<	-8.36	346.51	8.12	-51.37	-0.37
1/ 205 (C)	-1.09	-0.46>>	98.19	0.42	-0.77	-0.02	
1/ 211 (C)	-48.25	-8.82<<	340.16	8.65	-42.84	0	
1/ 206 (C)	-55.75	-8.37	353.67>>	8.13	-51.28	-0.38	
1/ 205 (C)	-1.09	-0.46	98.19<<	0.42	-0.77	-0.02	
1/ 211 (C)	-48.25	-8.82	340.16	8.65>>	-42.84	0	
1/ 205 (C)	-1.09	-0.46	98.19	0.42<<	-0.77	-0.02	
1/ 205 (C)	-1.09	-0.46	98.19	0.42	-0.77>>	-0.02	
1/ 226 (C)	-55.82	-8.36	346.51	8.12	-	51.37<<	-0.37
1/ 220 (C)	-47.93	-8.65	304.15	8.48	-42.66	0.01>>	
1/ 229 (C)	-55.66	-8.33	346.55	8.1	-51.2	-0.38<<	
2/ 205 (C)	-1.02>>	0.53	98.37	-0.52	-0.7	0.02	
2/ 230 (C)	-	53.81<<	7.6	340.29	-7.04	-49.4	0.32
2/ 206 (C)	-53.77	7.62>>	349.44	-7.06	-49.35	0.32	
2/ 205 (C)	-1.02	0.53<<	98.37	-0.52	-0.7	0.02	
2/ 206 (C)	-53.77	7.62	349.44>>	-7.06	-49.35	0.32	
2/ 205 (C)	-1.02	0.53	98.37<<	-0.52	-0.7	0.02	
2/ 205 (C)	-1.02	0.53	98.37	-0.52>>	-0.7	0.02	
2/ 206 (C)	-53.77	7.62	349.44	-7.06<<	-49.35	0.32	
2/ 205 (C)	-1.02	0.53	98.37	-0.52	-0.70>>	0.02	
2/ 230 (C)	-53.81	7.6	340.29	-7.04	-	49.40<<	0.32
2/ 211 (C)	-43.02	6.59	340.32	-6.18	-38.31	0.54>>	
2/ 205 (C)	-1.02	0.53	98.37	-0.52	-0.7	0.02<<	
3/ 213 (C)	42.25>>	-5.26	431.53	6.07	41.12	0.25	
3/ 205 (C)	2.54<<	-1.05	103.43	0.99	2.48	0	
3/ 205 (C)	2.54	-1.05>>	103.43	0.99	2.48	0	
3/ 202 (C)	42.22	-5.36<<	439.43	6.16	41.09	0.25	
3/ 202 (C)	42.22	-5.36	439.43>>	6.16	41.09	0.25	
3/ 205 (C)	2.54	-1.05	103.43<<	0.99	2.48	0	
3/ 202 (C)	42.22	-5.36	439.43	6.16>>	41.09	0.25	
3/ 205 (C)	2.54	-1.05	103.43	0.99<<	2.48	0	
3/ 213 (C)	42.25	-5.26	431.53	6.07	41.12>>	0.25	
3/ 205 (C)	2.54	-1.05	103.43	0.99	2.48<<	0	
3/ 211 (C)	42.02	-5.28	431.82	6.1	40.88	0.26>>	
3/ 205 (C)	2.54	-1.05	103.43	0.99	2.48	0.00<<	
4/ 214 (C)	21.66>>	4.27	502.92	-3.97	21.33	0.06	
4/ 205 (C)	1.05<<	0.3	134.84	-0.32	1.09	-0.01	
4/ 203 (C)	21.6	4.29>>	514.18	-3.99	21.28	0.06	
4/ 205 (C)	1.05	0.30<<	134.84	-0.32	1.09	-0.01	

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4/ 206 (C)	18.61	3.28	519.83>>	-3.06	17.98	-0.07
4/ 205 (C)	1.05	0.3	134.84<<	-0.32	1.09	-0.01
4/ 205 (C)	1.05	0.3	134.84	-0.32>>	1.09	-0.01
4/ 203 (C)	21.6	4.29	514.18	-3.99<<	21.28	0.06
4/ 214 (C)	21.66	4.27	502.92	-3.97	21.33>>	0.06
4/ 205 (C)	1.05	0.3	134.84	-0.32	1.09<<	-0.01
4/ 219 (C)	21.16	4.14	452.83	-3.83	20.81	0.06>>
4/ 230 (C)	18.68	3.26	505.06	-3.04	18.04	-0.07<<
5/ 213 (C)	9.52>>	-9.47	1185.92	10.03	9.91	0.18
5/ 205 (C)	0.74<<	-1.72	264.04	1.58	0.71	0
5/ 205 (C)	0.74	-1.72>>	264.04	1.58	0.71	0
5/ 202 (C)	9.39	-9.60<<	1206.02	10.16	9.78	0.18
5/ 202 (C)	9.39	-9.6	1206.02>>	10.16	9.78	0.18
5/ 205 (C)	0.74	-1.72	264.04<<	1.58	0.71	0
5/ 202 (C)	9.39	-9.6	1206.02	10.16>>	9.78	0.18
5/ 205 (C)	0.74	-1.72	264.04	1.58<<	0.71	0
5/ 213 (C)	9.52	-9.47	1185.92	10.03	9.91>>	0.18
5/ 205 (C)	0.74	-1.72	264.04	1.58	0.71<<	0
5/ 219 (C)	9.11	-8.57	1074.92	9.22	9.49	0.19>>
5/ 230 (C)	8	-9.12	1156.99	8.79	7.63	-0.01<<
6/ 222 (C)	0.36>>	5.75	405.43	-5.27	0.7	0.17
6/ 225 (C)	-3.44<<	3.73	466.19	-3.51	-3.08	0.04
6/ 216 (C)	0.18	5.93>>	459.76	-5.47	0.55	0.17
6/ 205 (C)	-0.24	0.33<<	133.52	-0.36	-0.2	0
6/ 202 (C)	0.14	5.92	474.39>>	-5.46	0.51	0.17
6/ 205 (C)	-0.24	0.33	133.52<<	-0.36	-0.2	0
6/ 205 (C)	-0.24	0.33	133.52	-0.36>>	-0.2	0
6/ 216 (C)	0.18	5.93	459.76	-5.47<<	0.55	0.17
6/ 222 (C)	0.36	5.75	405.43	-5.27	0.70>>	0.17
6/ 225 (C)	-3.44	3.73	466.19	-3.51	-3.08<<	0.04
6/ 211 (C)	0.22	5.9	465.85	-5.43	0.59	0.17>>
6/ 205 (C)	-0.24	0.33	133.52	-0.36	-0.2	0.00<<
7/ 213 (C)	23.06>>	-25.86	1346.51	25.57	22.31	0.08
7/ 205 (C)	1.74<<	-2.28	259.35	2.16	1.62	0
7/ 205 (C)	1.74	-2.28>>	259.35	2.16	1.62	0
7/ 206 (C)	22.18	29.63<<	1364.73	28.28	20.87	-0.02
7/ 206 (C)	22.18	-29.63	1364.73>>	28.28	20.87	-0.02
7/ 205 (C)	1.74	-2.28	259.35<<	2.16	1.62	0
7/ 206 (C)	22.18	-29.63	1364.73	28.28>>	20.87	-0.02
7/ 205 (C)	1.74	-2.28	259.35	2.16<<	1.62	0
7/ 213 (C)	23.06	-25.86	1346.51	25.57	22.31>>	0.08
7/ 205 (C)	1.74	-2.28	259.35	2.16	1.62<<	0
7/ 211 (C)	22.98	-25.85	1344.13	25.58	22.23	0.09>>
7/ 238 (C)	21.48	-28.27	1255.63	26.99	20.22	-0.03<<

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8/ 212 (C)	36.20>>	6.19	311.75	-5.74	34.01	-0.25
8/ 205 (C)	1.97<<	0.21	90.01	-0.23	1.83	-0.02
8/ 216 (C)	36.12	6.36>>	309.11	-5.91	33.93	-0.25
8/ 205 (C)	1.97	0.21<<	90.01	-0.23	1.83	-0.02
8/ 241 (C)	36	6.21	319.07>>	-5.76	33.82	-0.25
8/ 205 (C)	1.97	0.21	90.01<<	-0.23	1.83	-0.02
8/ 205 (C)	1.97	0.21	90.01	-0.23>>	1.83	-0.02
8/ 216 (C)	36.12	6.36	309.11	-5.91<<	33.93	-0.25
8/ 212 (C)	36.2	6.19	311.75	-5.74	34.01>>	-0.25
8/ 205 (C)	1.97	0.21	90.01	-0.23	1.83<<	-0.02
8/ 205 (C)	1.97	0.21	90.01	-0.23	1.83	-0.02>>
8/ 230 (C)	33.27	2.6	309.71	-2.46	31.2	-0.33<<
9/ 239 (C)	2.45>>	7.17	160.24	-12.5	6.55	0.42
9/ 210 (C)	-2.52<<	6.58	191.67	-5.51	-8.4	-0.42
9/ 231 (C)	2.44	10.14>>	200.13	-16.32	6.54	0.42
9/ 218 (C)	-2.51	3.61<<	151.78	-1.69	-8.38	-0.42
9/ 241 (C)	-0.19	8.11	223.29>>	-9.26	-2	-0.1
9/ 240 (C)	2.44	7.13	149.33<<	-12.23	6.43	0.39
9/ 218 (C)	-2.51	3.61	151.78	-1.69>>	-8.38	-0.42
9/ 231 (C)	2.44	10.14	200.13	-	6.54	0.42
9/ 239 (C)	2.45	7.17	160.24	-12.5	6.55>>	0.42
9/ 210 (C)	-2.52	6.58	191.67	-5.51	-8.40<<	-0.42
9/ 239 (C)	2.45	7.17	160.24	-12.5	6.55	0.42>>
9/ 210 (C)	-2.52	6.58	191.67	-5.51	-8.4	-0.42<<
10/ 239 (C)	3.81>>	12.44	148.42	-12.51	7.43	0.42
10/ 210 (C)	-3.84<<	0.5	160.18	-5.12	-9.27	-0.42
10/ 231 (C)	3.8	14.72>>	188.27	-15.96	7.41	0.42
10/ 220 (C)	2.65	-9.25<<	112.72	4	2.74	-0.22
10/ 243 (C)	0.07	9.35	191.61>>	-11.83	0.79	0.23
10/ 220 (C)	2.65	-9.25	112.72<<	4	2.74	-0.22
10/ 220 (C)	2.65	-9.25	112.72	4.00>>	2.74	-0.22
10/ 231 (C)	3.8	14.72	188.27	-	7.41	0.42
10/ 239 (C)	3.81	12.44	148.42	-12.51	7.43>>	0.42
10/ 210 (C)	-3.84	0.5	160.18	-5.12	-9.27<<	-0.42
10/ 239 (C)	3.81	12.44	148.42	-12.51	7.43	0.42>>
10/ 210 (C)	-3.84	0.5	160.18	-5.12	-9.27	-0.42<<
11/ 227 (C)	6.24>>	-0.13	62.1	0.95	13.84	0
11/ 218 (C)	-5.88<<	-0.13	55.71	0.97	-12.72	0
11/ 239 (C)	5.94	0.16>>	63.66	-1.19	13.12	0
11/ 212 (C)	5.71	-0.29<<	56.47	2.22	9.8	0
11/ 243 (C)	0.44	0.05	73.63>>	-0.41	3.34	0
11/ 218 (C)	-5.88	-0.13	55.71<<	0.97	-12.72	0
11/ 212 (C)	5.71	-0.29	56.47	2.22>>	9.8	0

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11/ 239 (C)	5.94	0.16	63.66	-1.19<<	13.12	0
11/ 227 (C)	6.24	-0.13	62.1	0.95	13.84>>	0
11/ 218 (C)	-5.88	-0.13	55.71	0.97	12.72<<	0
11/ 227 (C)	6.24	-0.13	62.1	0.95	13.84	0.00>>
11/ 218 (C)	-5.88	-0.13	55.71	0.97	-12.72	-0.00<<
12/ 229 (C)	0.63>>	0.07	87.99	-0.54	4.82	0
12/ 218 (C)	-0.26<<	-0.3	75.9	2.26	-1.96	0
12/ 231 (C)	0.55	0.30>>	87.33	-2.29	4.23	0
12/ 220 (C)	0.12	-0.52<<	74.01	3.95	0.95	0
12/ 243 (C)	0.57	0.18	107.21>>	-1.35	4.38	0
12/ 220 (C)	0.12	-0.52	74.01<<	3.95	0.95	0
12/ 220 (C)	0.12	-0.52	74.01	3.95>>	0.95	0
12/ 231 (C)	0.55	0.3	87.33	-2.29<<	4.23	0
12/ 229 (C)	0.63	0.07	87.99	-0.54	4.82>>	0
12/ 218 (C)	-0.26	-0.3	75.9	2.26	-1.96<<	0
12/ 202 (C)	0.05	-0.25	90.86	1.94	0.37	0.0>>
12/ 202 (C)	0.05	-0.25	90.86	1.94	0.37	0.0<<
13/ 229 (C)	1.63>>	22.96	225.44	-20.13	1.53	0.56
13/ 218 (C)	-2.99<<	29.48	196.97	-24.98	-2.84	-0.94
13/ 224 (C)	-2.71	29.87>>	195.69	-25.37	-2.56	-0.82
13/ 205 (C)	0.33	-0.78<<	62.22	0.85	0.27	0.15
13/ 243 (C)	1.52	23.06	228.43>>	-20.21	1.42	0.52
13/ 205 (C)	0.33	-0.78	62.22<<	0.85	0.27	0.15
13/ 205 (C)	0.33	-0.78	62.22	0.85>>	0.27	0.15
13/ 224 (C)	-2.71	29.87	195.69	25.37<<	-2.56	-0.82
13/ 237 (C)	1.61	23.4	213.16	-20.6	1.53>>	0.57
13/ 210 (C)	-2.98	29.04	209.25	-24.51	-2.84<<	-0.95
13/ 237 (C)	1.61	23.4	213.16	-20.6	1.53	0.57>>
13/ 210 (C)	-2.98	29.04	209.25	-24.51	-2.84	-0.95<<
14/ 227 (C)	4.09>>	-2.22	43.6	4.47	9.69	0
14/ 218 (C)	-3.50<<	2.79	40.91	-3.85	-10.72	0
14/ 233 (C)	-2.68	2.97>>	43.67	-5.2	-4.6	0
14/ 212 (C)	3.26	-2.40<<	40.84	5.82	3.57	0
14/ 244 (C)	0.37	0.06	50.23>>	-0.44	2.73	0
14/ 212 (C)	3.26	-2.4	40.84<<	5.82	3.57	0
14/ 212 (C)	3.26	-2.4	40.84	5.82>>	3.57	0
14/ 233 (C)	-2.68	2.97	43.67	-5.20<<	-4.6	0
14/ 227 (C)	4.09	-2.22	43.6	4.47	9.69>>	0
14/ 218 (C)	-3.5	2.79	40.91	-3.85	10.72<<	0
14/ 202 (C)	-0.48	-0.13	46.09	0.94	-3.55	0.0>>
14/ 202 (C)	-0.48	-0.13	46.09	0.94	-3.55	0.0<<
15/ 229 (C)	0.52>>	2.94	60.53	-5.12	3.81	0

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15/ 218 (C)	-0.83<<	3.79	54.4	-4.21	-6.14	0
15/ 225 (C)	0.01	4.25>>	59.92	-7.63	0.09	0
15/ 220 (C)	-0.38	-4.77<<	52.24	11.44	-2.79	0
15/ 243 (C)	0.38	0.14	70.46>>	-1.06	2.79	0
15/ 220 (C)	-0.38	-4.77	52.24<<	11.44	-2.79	0
15/ 220 (C)	-0.38	-4.77	52.24	11.44>>	-2.79	0
15/ 225 (C)	0.01	4.25	59.92	-7.63<<	0.09	0
15/ 229 (C)	0.52	2.94	60.53	-5.12	3.81>>	0
15/ 218 (C)	-0.83	3.79	54.4	-4.21	-6.14<<	0
15/ 202 (C)	-0.49	-0.33	62.18	2.44	-3.6	0.0>>
15/ 202 (C)	-0.49	-0.33	62.18	2.44	-3.6	0.0<<
16/ 234 (C)	-0.14>>	38.63	214.36	-34.74	-0.66	0.09
16/ 213 (C)	-1.03<<	39.49	207.99	-35.61	-1.95	0.08
16/ 220 (C)	-0.79	43.15>>	199.66	-39.04	-1.67	0.09
16/ 205 (C)	-0.64	0.36<<	58.28	-0.2	-0.72	-0.02
16/ 244 (C)	-0.67	39.42	226.32>>	-35.47	-1.15	0.09
16/ 205 (C)	-0.64	0.36	58.28<<	-0.2	-0.72	-0.02
16/ 205 (C)	-0.64	0.36	58.28	-0.20>>	-0.72	-0.02
				-		
16/ 220 (C)	-0.79	43.15	199.66	39.04<<	-1.67	0.09
16/ 234 (C)	-0.14	38.63	214.36	-34.74	-0.66>>	0.09
16/ 213 (C)	-1.03	39.49	207.99	-35.61	-1.95<<	0.08
16/ 240 (C)	-0.59	38.5	210.14	-34.62	-1.08	0.10>>
16/ 205 (C)	-0.64	0.36	58.28	-0.2	-0.72	-0.02<<
17/ 218 (C)	2.45>>	29.12	177.9	-25.82	1.97	-0.01
17/ 205 (C)	-0.42<<	-0.5	57.87	0.61	-0.45	-0.02
17/ 220 (C)	1.9	32.25>>	171.19	-28.7	1.45	0
17/ 205 (C)	-0.42	-0.50<<	57.87	0.61	-0.45	-0.02
17/ 244 (C)	1.61	27	191.13>>	-23.81	1.31	0.07
17/ 205 (C)	-0.42	-0.5	57.87<<	0.61	-0.45	-0.02
17/ 205 (C)	-0.42	-0.5	57.87	0.61>>	-0.45	-0.02
				-		
17/ 220 (C)	1.9	32.25	171.19	28.70<<	1.45	0
17/ 218 (C)	2.45	29.12	177.9	-25.82	1.97>>	-0.01
17/ 205 (C)	-0.42	-0.5	57.87	0.61	-0.45<<	-0.02
17/ 238 (C)	1.6	26.99	174.99	-23.81	1.31	0.08>>
17/ 209 (C)	2.28	28.43	183.82	-25.11	1.78	-0.02<<
18/ 205 (C)	0.79>>	-2.44	71.96	2.28	0.87	0.07
18/ 222 (C)	-2.92<<	-3.74	16.21	5.05	-0.77	1.25
18/ 236 (C)	-1.5	-0.55>>	35.13	1.56	-0.74	-0.28
18/ 213 (C)	-2.63	-4.96<<	38.41	6.2	-0.43	1.3
18/ 205 (C)	0.79	-2.44	71.96>>	2.28	0.87	0.07
18/ 222 (C)	-2.92	-3.74	16.21<<	5.05	-0.77	1.25
18/ 202 (C)	-2.35	-4.95	43.29	6.21>>	-0.2	0.31
18/ 236 (C)	-1.5	-0.55	35.13	1.56<<	-0.74	-0.28

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18/ 205 (C)	0.79	-2.44	71.96	2.28	0.87>>	0.07
18/ 238 (C)	-2.09	-0.86	34.68	1.81	-1.22<<	1.9
18/ 229 (C)	-1.8	-2.08	56.88	2.96	-0.88	1.95>>
18/ 220 (C)	-2.33	-3.43	16.66	4.8	-0.29	-0.93<<
19/ 215 (C)	8.66>>	1.52	65.24	-2.44	9.29	-2.89
19/ 238 (C)	-2.89<<	-0.04	39.48	-0.35	-2.07	-1.71
19/ 205 (C)	0.77	2.53>>	71.81	-2.39	0.82	-0.05
19/ 240 (C)	-2.09	-0.38<<	39.8	-0.1	-1.39	0.45
19/ 205 (C)	0.77	2.53	71.81>>	-2.39	0.82	-0.05
19/ 238 (C)	-2.89	-0.04	39.48<<	-0.35	-2.07	-1.71
19/ 240 (C)	-2.09	-0.38	39.8	-0.10>>	-1.39	0.45
19/ 202 (C)	8.27	1.88	69.7	-2.75<<	8.96	-3.94
19/ 215 (C)	8.66	1.52	65.24	-2.44	9.29>>	-2.89
19/ 238 (C)	-2.89	-0.04	39.48	-0.35	-2.07<<	-1.71
19/ 239 (C)	-2.07	-0.37	41.28	-0.1	-1.37	0.45>>
19/ 214 (C)	7.85	1.85	63.43	-2.69	8.59	-5.06<<
20/ 211 (C)	8.38>>	6.89	134.9	-7.2	8.47	-3
20/ 205 (C)	0.22<<	3.77	83.18	-3.56	0.27	0
20/ 202 (C)	8.33	7.08>>	139.09	-7.39	8.43	-3.03
20/ 240 (C)	1.05	-0.30<<	96.32	0	1.28	0.04
20/ 202 (C)	8.33	7.08	139.09>>	-7.39	8.43	-3.03
20/ 205 (C)	0.22	3.77	83.18<<	-3.56	0.27	0
20/ 240 (C)	1.05	-0.3	96.32	0.00>>	1.28	0.04
20/ 202 (C)	8.33	7.08	139.09	-7.39<<	8.43	-3.03
20/ 211 (C)	8.38	6.89	134.9	-7.2	8.47>>	-3
20/ 205 (C)	0.22	3.77	83.18	-3.56	0.27<<	0
20/ 233 (C)	0.99	0.06	101.2	-0.32	1.22	0.36>>
20/ 214 (C)	8.33	6.89	130.95	-7.21	8.42	-3.31<<
21/ 211 (C)	7.46>>	9.55	136.56	-9.73	7.23	-3.76
21/ 205 (C)	0.10<<	3.8	82.44	-3.6	0.11	-0.03
21/ 202 (C)	7.38	9.74>>	140.72	-9.91	7.16	-3.77
21/ 240 (C)	0.23	-0.07<<	96.09	-0.27	0.33	-0.15
21/ 202 (C)	7.38	9.74	140.72>>	-9.91	7.16	-3.77
21/ 205 (C)	0.1	3.8	82.44<<	-3.6	0.11	-0.03
21/ 240 (C)	0.23	-0.07	96.09	-0.27>>	0.33	-0.15
21/ 202 (C)	7.38	9.74	140.72	-9.91<<	7.16	-3.77
21/ 211 (C)	7.46	9.55	136.56	-9.73	7.23>>	-3.76
21/ 205 (C)	0.1	3.8	82.44	-3.6	0.11<<	-0.03
21/ 234 (C)	0.13	0.24	98.7	-0.55	0.23	0.22>>
21/ 213 (C)	7.35	9.53	135.18	-9.71	7.13	-3.97<<
22/ 211 (C)	9.67>>	11.83	106.03	-11.74	8.93	-4.26
22/ 205 (C)	0.14<<	2.33	61.62	-2.23	0.11	-0.02
22/ 202 (C)	9.58	11.95>>	107.71	-11.87	8.85	-4.25
22/ 238 (C)	2.33	-0.08<<	79.12	-0.21	2.1	0.1
22/ 241 (C)	9.59	11.77	108.25>>	-11.69	8.86	-4.26

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22/ 205 (C)	0.14	2.33	61.62<<	-2.23	0.11	-0.02
22/ 238 (C)	2.33	-0.08	79.12	-0.21>>	2.1	0.1
22/ 202 (C)	9.58	11.95	107.71	11.87<<	8.85	-4.25
22/ 215 (C)	9.67	11.81	103.68	-11.73	8.93>>	-4.44
22/ 205 (C)	0.14	2.33	61.62	-2.23	0.11<<	-0.02
22/ 226 (C)	2.37	1.19	95.77	-1.42	2.12	0.49>>
22/ 223 (C)	9.63	10.65	88.43	-10.62	8.9	-4.45<<
23/ 232 (C)	2.50>>	0.93	143.36	3.75	4.04	-0.6
23/ 217 (C)	-2.23<<	-11.79	128.96	11.93	-5.54	0.42
23/ 239 (C)	2.49	3.49>>	107.06	0.15	3.93	-0.6
23/ 212 (C)	2.17	21.53<<	181.68	20.93	3.81	-0.24
23/ 211 (C)	2.16	-21.24	183.83>>	20.69	3.73	-0.23
23/ 240 (C)	2.49	3.2	104.92<<	0.39	4.02	-0.61
23/ 212 (C)	2.17	-21.53	181.68	20.93>>	3.81	-0.24
23/ 239 (C)	2.49	3.49	107.06	0.15<<	3.93	-0.6
23/ 228 (C)	2.43	-14.87	169.74	15.88	4.83>>	-0.15
23/ 217 (C)	-2.23	-11.79	128.96	11.93	-5.54<<	0.42
23/ 225 (C)	-1.96	-7.4	155.46	10.24	-4.51	0.51>>
23/ 224 (C)	2.23	-3.46	116.86	5.44	3	-0.70<<
24/ 228 (C)	1.69>>	-9.51	166.76	12.7	4.02	0.84
24/ 217 (C)	-1.32<<	-8.44	129.67	13.02	-4.54	-0.52
24/ 239 (C)	1.1	-2.41>>	127.45	0.55	2.41	0.57
24/ 210 (C)	-1.3	11.37<<	162.57	17.05	-4.43	-0.51
24/ 241 (C)	-0.27	-8.56	178.59>>	12.29	-1.58	-0.04
24/ 240 (C)	1.11	-2.44	121.94<<	0.81	2.5	0.57
24/ 210 (C)	-1.3	-11.37	162.57	17.05>>	-4.43	-0.51
24/ 239 (C)	1.1	-2.41	127.45	0.55<<	2.41	0.57
24/ 228 (C)	1.69	-9.51	166.76	12.7	4.02>>	0.84
24/ 217 (C)	-1.32	-8.44	129.67	13.02	-4.54<<	-0.52
24/ 227 (C)	1.68	-9.48	172.26	12.44	3.93	0.84>>
24/ 218 (C)	-1.31	-8.47	124.16	13.28	-4.45	-0.52<<
25/ 210 (C)	1.28>>	-28.01	196.34	25.01	0.07	-0.06
25/ 205 (C)	-0.33<<	0.45	63.6	-0.55	-0.42	-0.09
25/ 205 (C)	-0.33	0.45>>	63.6	-0.55	-0.42	-0.09
25/ 232 (C)	0	39.55<<	210.76	36.38	-0.52	-0.15
25/ 243 (C)	0.34	-36.07	229.92>>	33.17	-0.21	-0.18
25/ 205 (C)	-0.33	0.45	63.60<<	-0.55	-0.42	-0.09
25/ 232 (C)	0	-39.55	210.76	36.38>>	-0.52	-0.15
25/ 205 (C)	-0.33	0.45	63.6	-0.55<<	-0.42	-0.09
25/ 234 (C)	1.09	-34.76	208.97	32.03	0.52>>	-0.1
25/ 213 (C)	-0.08	-28.39	208.13	25.35	-1.15<<	-0.15

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25/ 210 (C)	1.28	-28.01	196.34	25.01	0.07	-0.06>>
25/ 237 (C)	-0.27	-35.14	220.77	32.37	-0.7	-0.19<<
26/ 217 (C)	4.27>>	-20.84	209.65	18.42	3.51	-0.1
26/ 205 (C)	0.78<<	0.29	67.02	-0.41	0.65	-0.02
26/ 205 (C)	0.78	0.29>>	67.02	-0.41	0.65	-0.02
		-				
26/ 240 (C)	2.55	31.80<<	177.76	29.22	2.14	-0.18
26/ 242 (C)	3.64	-21.98	212.17>>	19.47	2.94	-0.17
26/ 205 (C)	0.78	0.29	67.02<<	-0.41	0.65	-0.02
26/ 240 (C)	2.55	-31.8	177.76	29.22>>	2.14	-0.18
26/ 205 (C)	0.78	0.29	67.02	-0.41<<	0.65	-0.02
26/ 217 (C)	4.27	-20.84	209.65	18.42	3.51>>	-0.1
26/ 205 (C)	0.78	0.29	67.02	-0.41	0.65<<	-0.02
26/ 205 (C)	0.78	0.29	67.02	-0.41	0.65	-0.02>>
26/ 221 (C)	2.64	-21.27	194.96	18.82	2.04	-0.21<<

## 1.12. Pamatų geometrijos parinkimas

### 1.12.1. Pastato dalies be rūsio kolonų polių parinkimas

Projektuojami poliniai pamatai po pastato dalies be rūsio kolonomis. Poliai 600mm skersmens. Poliai remiami į abs. Alt +35.23 (IGS 5, IGS6, IGS7) polių geometrinis ilgis 6,6m. Mažiausias grunto kūginis stipris 3m gylyje nuo poliaus pado pagal GR. Nr. 4  $q_c=2,5\text{MPa}$ ; šoninė trintis pagal GR Nr. 1  $f_s=50-90\text{ kPa}$  pagal sluoksnius.

Reakcijos po kolonomis pateiktos reakcijų plane ir gaubtinėje.

Gniuždomo poliaus laikomosios galios skaičiavimas:

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	194	251	0

## Polio laikomosios galios skaičiavimas

### Veikiančios jėgos:

$$N_{Ed,1} := 356 \cdot 10^{-3} = 0.356 \quad \text{MN}$$

$$N_{Ed,2} := 301 \cdot 10^{-3} = 0.301 \quad \text{MN}$$

### Daliniai koeficientai:

Daliniai medžiagų patikimumo koef. atvejui M1:

$$\gamma_{\varphi,1} := 1$$

$$\gamma_{c,1} := 1$$

$$\gamma_{cu,1} := 1$$

$$\gamma_{qu,1} := 1$$

$$\gamma_{\gamma,1} := 1$$

Daliniai medžiagų patikimumo koef. atvejui M2:

$$\gamma_{\varphi,2} := 1.25$$

$$\gamma_{c,2} := 1.25$$

$$\gamma_{cu,2} := 1.4$$

$$\gamma_{qu,2} := 1.4$$

$$\gamma_{\gamma,2} := 1$$

Daliniai koeficientai CFA polių pagrindo atsparumui

	R1	R2	R3	R4
Polio pado laikomoji galia	$\gamma_{b1} := 1.1$	$\gamma_{b2} := 1.1$	$\gamma_{b3} := 1.0$	$\gamma_{b4} := 1.45$
Polio kamieno šoninio paviršiaus alikomoji galia gniuždymui	$\gamma_{s1} := 1.0$	$\gamma_{s2} := 1.1$	$\gamma_{s3} := 1.0$	$\gamma_{s4} := 1.30$
Polio pado suminis atsparumas gniuždymui	$\gamma_{t1} := 1.1$	$\gamma_{t2} := 1.1$	$\gamma_{t3} := 1.0$	$\gamma_{t4} := 1.40$
Polio laikomoji galia tempimui	$\gamma_{st1} := 1.25$	$\gamma_{st2} := 1.15$	$\gamma_{st3} := 1.1$	$\gamma_{st4} := 1.60$

$$\alpha_b := 0.5$$

**Grunto rodikliai:**  $\xi_3 := 1.4$

$$\rho := 21 \frac{\text{kN}}{\text{m}^3}$$

$$q_c := 2.5 \quad \text{MPa}$$

$$f_{s1} := 0.05 \quad \text{MPa} \quad f_{s2} := 0.09 \quad \text{MPa} \quad f_{s3} := 0.06 \quad \text{MPa} \quad f_{s4} := 0. \quad \text{MPa} \quad f_{s5} := 0.0 \quad \text{MPa} \quad f_{s6} := 0.0 \quad \text{MPa} \quad f_{s7} := 0.0 \quad \text{MPa}$$

**Geometriniai rodikliai:**  $f_{s8} := 0.0 \quad \text{MPa}$

$$h_1 := 0.7 \quad \text{m} \quad h_2 := 4.0 \quad \text{m} \quad h_3 := 1.0 \quad \text{m} \quad h_4 := 0. \quad \text{m} \quad h_5 := 0. \quad \text{m} \quad h_6 := 0 \quad \text{m} \quad h_7 := 0.0 \quad \text{m} \quad h_8 := 0.0 \quad \text{m}$$

$$d := 0.6 \quad \text{m}$$

$$A_p := \frac{\pi \cdot d^2}{4} = 0.283 \quad \text{m}^2$$

$$A_{s1} := \pi \cdot d \cdot h_1 = 1.319 \quad \text{m}^2 \quad A_{s2} := \pi \cdot d \cdot h_2 = 7.54 \quad \text{m}^2 \quad A_{s3} := \pi \cdot d \cdot h_3 = 1.885 \quad \text{m}^2$$

$$A_{s4} := \pi \cdot d \cdot h_4 = 0 \quad \text{m}^2 \quad A_{s5} := \pi \cdot d \cdot h_5 = 0 \quad \text{m}^2 \quad A_{s6} := \pi \cdot d \cdot h_6 = 0 \quad \text{m}^2$$

$$A_{s7} := \pi \cdot d \cdot h_7 = 0 \quad \text{m}^2 \quad A_{s8} := \pi \cdot d \cdot h_8 = 0 \quad \text{m}^2$$

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	195	251	0

### Pirmas projektavimo atvejis: A1+M1+R1

$$q_b := \alpha_b \cdot q_c = 1.25 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.353 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.858$$

$$R_{c.cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 1.179 \quad \text{MN}$$

$$R_{c.k1} := \frac{R_{c.cal1}}{\xi_3} = 0.842 \quad \text{MN}$$

$$R_{c.d1} := \frac{R_{c.k1}}{\gamma_{t1}} = 0.766 \quad \text{MN}$$

$$\frac{N_{Ed.1}}{R_{c.d1}} = 0.465$$

### Antras projektavimo atvejis: A2+M1+R4

$$R_{c.cal2} := \frac{R_b}{\gamma_{b4}} + \frac{R_s}{\gamma_{s4}} = 0.903 \quad \text{MN}$$

$$R_{c.k2} := \frac{R_{c.cal2}}{\xi_3} = 0.645 \quad \text{MN}$$

$$R_{c.d2} := \frac{R_{c.k2}}{\gamma_{t4}} = 0.461 \quad \text{MN}$$

$$\frac{N_{Ed.2}}{R_{c.d2}} = 0.653$$

**Išvada: gniuždomoji galia pakankama**

Lenkiamo poliaus laikomosios galios skaičiavimas:

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	196	251	0

$$q_c := 2500 \text{ kPa} \quad f_{si1} := 50 \text{ kPa} \quad f_{si2} := 90 \quad f_{si3} := 60 \quad f_{si4} := 0 \quad f_{si5} := 0 \quad f_{si6} := 0 \quad f_{si7} := 0 \quad f_{si8} := 0$$

$$N_d := 84 \text{ kN} \quad h_1 := 0.7 \quad h_2 := 4.0 \quad h_3 := 1.0 \quad h_4 := 0.0 \quad h_5 := 0.0 \quad h_6 := 0.0 \quad h_7 := 0.0 \quad h_8 := 0.0$$

$$M_d := 78 \text{ kNm}$$

$$Q_d := 39 \text{ kN} \quad \text{Nevertinamo sluoksnio gylis: Max leistinas nuosėdis:}$$

$$d := 0.6 \text{ m} \quad h_s := 1.1 \text{ m} \quad s_w := 0.12 \text{ m}$$

Poliaus geometrinis ilgis:

Grafiko Rsn numeris pagal santyki:

$$h := 6.6 \text{ m}$$

$$n := 100 \cdot \frac{s}{d} = 20 \%$$

Pagrindo stiprumas po pamato padu:

iš 6.22, 6.23 grafikų

$$R_{s2} := 0.12 \cdot q_c \cdot 10^{-3} + 0.24 = 0.54 \text{ MPa}$$

$$A_b := 3.14 \cdot \frac{(d^2)}{4} = 0.283$$

Trinties jėga prie pamato šonų:

$$F_f := 3.14 \cdot d \cdot \left( h_1 \cdot \frac{f_{si1}}{3} + h_2 \cdot \frac{f_{si2}}{3} + h_3 \cdot \frac{f_{si3}}{3} + h_4 \cdot \frac{f_{si4}}{3} + h_5 \cdot \frac{f_{si5}}{3} + h_6 \cdot \frac{f_{si6}}{3} + h_7 \cdot \frac{f_{si7}}{3} + h_8 \cdot \frac{f_{si8}}{3} \right) = 285.74 \text{ kN}$$

Slėgis po pamato padu:

$$p := \frac{(N - F_f)}{A_b} = -713.871 \text{ kPa} \quad \text{ne daugiau nei } R_{s2}$$

#### Pasisukimas ir pasislinkimas

Skaičiuojamasis pamato gylis:

$$d_d := h_1 + h_2 + h_3 + h_4 + h_5 + h_6 + h_7 + h_8 = 5.7 \text{ m}$$

Horizontalios jėgos nuo momento aukštis virš pamato

$$h_m := \frac{M_d}{Q_d} = 2$$

Horizontalios jėgos pridėties taško skaičiuojamasis aukštis:

$$h_d := h - d_d + h_m = 2.9 \text{ m}$$

$$\eta := \frac{(1.5 \cdot h_d + 0.5 \cdot d_d)}{1.5 \cdot h_d + d_d} = 0.716 \quad \mu := 0.5$$

Kai  $F_f > N$

Pamato posūkiui besipriešinančių jėgų atstojamoji:

$$F_Q := \frac{\left( 10 + 1.5 \cdot F_f \cdot \frac{d}{\pi} \right)}{2 \cdot (1.5 \cdot h_d + d_d)} = 4.57 \text{ kN}$$

$$\text{pamatas} := \text{if} \left[ F_Q \geq 0.5 \cdot (\eta + 1) \cdot Q_d, \text{"nepasisuka"}, \text{"pasisuka"} \right] = \text{"pasisuka"}$$

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	197	251	0

Pamato posukio centro gylis nuo skaičiuojamojo pagrindo paviršiaus  $z_0$ :

$$z_0 := \frac{d_d}{1 + \frac{(Q_d \cdot \eta - F_Q)}{Q_d - F_Q}} = 3.395 \quad \text{m}$$

kadangi := if( $z_0 < d_d$ , "u formuletinka", "netinka") = "u formuletinka"

$$R_{s0.5} := 0.04q_c \cdot 10^{-3} + 0.1 = 0.2$$

Horizontalus pagrindo standumo modulis:

$$C_h := \frac{R_{s0.5} \cdot 10^3}{0.005 \cdot d} = 6.667 \times 10^4$$

$$u_u := 0.01 \cdot d = 6 \times 10^{-3} \quad \text{m}$$

$$i_u := 0.005 \quad \text{m}$$

$$u := \left[ 4Q_d \frac{(1.5h_d + d_d)}{C_h \cdot d \cdot d_d^2} \right] \cdot \left[ 1 + \frac{(h - d_d)}{z_0} \right] \cdot \left( 1 - \frac{F_Q}{Q_d} \right) = 1.347 \times 10^{-3} \quad \text{m}$$

poslinkis := if( $u < u_u$ , "poslinkis leistinas", "poslinkis neleistinas") = "poslinkis leistinas"

$$i := \frac{u}{(z_0 + h - d_d)} = 3.137 \times 10^{-4} \quad \text{m}$$

pasisukimas := if( $i < i_u$ , "pasisukimas leistinas", "pasisukimas neleistinas") = "pasisukimas leistinas"

#### Gylis kuriame veikia didžiausias lenkimo momentas

Grunto prie pamato šoninio paviršiaus vidutinis stipris:

$$R_f := \frac{F_f}{\pi \cdot d \cdot d_d} = 26.595 \quad \text{kN}$$

Gylis, kuriame veikia didžiausias lenkimo momentas:

$$z_m := z_0 - \sqrt{z_0^2 - \frac{\left( 1 - \frac{d^2 \cdot R_f}{2 \cdot Q_d} \right) \cdot d_d^2 \cdot z_0}{2 \cdot (1.5 \cdot h_d + d_d)}} = 0.804 \quad \text{m}$$

Didžiausias polių veikiantis lenkimo momentas:

$$M := Q_d \cdot (h_d + z_m) - \frac{2 \cdot Q_d}{3 \cdot d_d^2 \cdot z_0} \cdot (1.5 \cdot h_d + d_d) \cdot (3 \cdot z_0 - z_m) \cdot z_m^2 - \frac{d^2}{2} \cdot R_f \cdot z_m = 126.24 \text{ kNm}$$

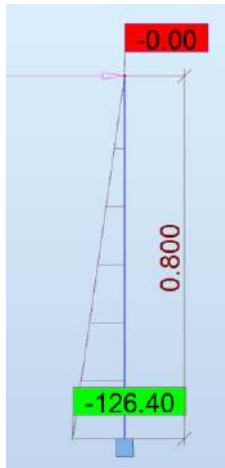
### Išvada: lenkiamoji galia pakankama

#### Poliaus armavimo skaičiavimas.

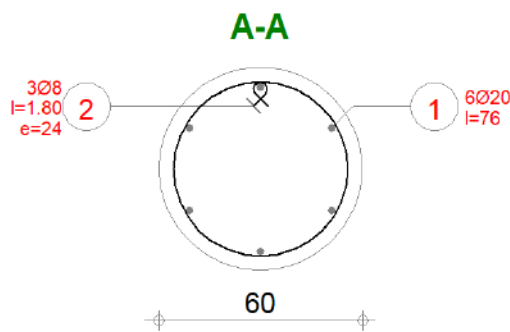
Skaičiuojamas poliaus armavimas nuo gilyje  $z_m$  veikiančio didžiausio lenkimo momento. Poliaus ilgis –  $z_m$  gylis, kuriame veikia didžiausias momentas. Pridėta horizontali apkrova, nuo kurios susidaro didžiausias veikiantis momentas.

Poliaus skaičiuojamoji schema ir veikiantis momentas:

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	198	251	0



Reikalingas armavimas:



## 1 Level:

- Name :
- Reference level : 0.000 (m)
- Concrete creep coefficient :  $\varphi_p = 2.60$
- Cement class : N
- Environment class : XC2
- Structure class : S4

## 2 Column: Column1

Number of identical elements: 1

### 2.1 Material properties:

- Concrete : C25/30  $f_{ck} = 25.00$  (MPa)
- Unit weight : 2501.36 (kG/m3)
- Aggregate size : 20.0 (mm)
- Longitudinal reinforcement: : B500B  $f_{yk} = 500.00$  (MPa)
- Ductility class : B
- Transversal reinforcement: : B500B  $f_{yk} = 500.00$  (MPa)
- Modified partial coefficients:  
 $\alpha_{cc} = 0.9$  1992-1-1 3.1.6 (1)P

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	199	251	0

## 2.2 Geometry:

2.2.1	C	
	Diameter	= 60.0 (cm)
2.2.2	Height: L	= 0.800 (m)
2.2.3	Slab thickness	= 0.000 (m)
2.2.4	Beam height	= 0.000 (m)
2.2.5	Cover	= 4.0 (cm)

## 2.3 Calculation options:

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Seismic dispositions : No requirements
- Precast column : yes
- Pre-design : no
- Slenderness taken into account : yes
- Compression : with bending
- Ties : to slab
- Fire resistance class : No requirements

## 2.4 Calculation results:

Safety factors  $Rd/Ed = 1.48 > 1.0$

### 2.4.1 ULS/ALS Analysis

Design combination: COMB1 (B)

Combination type: ULS

Internal forces:

$N_{sd} = 7.49$  (kN)       $M_{sdy} = 126.40$  (kN\*m)       $M_{sdz} = 0.00$  (kN\*m)

Design forces:

Lower node

$N = 7.49$  (kN)       $N^{*etotz} = 126.43$  (kN\*m)       $N^{*etoty} = 0.15$  (kN\*m)

Eccentricity:

		$e_z$ (My/N) (cm)	$e_y$ (Mz/N) (cm)
Initial	$e_0$ :	1687.5	0.0
Imperfection	$e_i$ :	0.4	0.0
1 order ( $e_0 + e_i$ )	$e_{0Ed}$ :	1687.9	0.0
Minimal	$e_{Edmin}$ :	2.0	2.0
Total	$e_{Ed}$ :	1687.9	2.0

#### 2.4.1.1. Detailed analysis-Direction Y:

##### 2.4.1.1.1 Slenderness analysis

Non-sway structure

L (m)	$L_0$ (m)	$\lambda$	$\lambda_{lim}$	
0.800	1.600	10.67	257.99	Short column

##### 2.4.1.1.2 Buckling analysis

$M_A = 0.00$  (kN\*m)       $M_B = 126.40$  (kN\*m)

Case: Cross-section at the column end (Lower node), Slenderness not taken into account

$M_0 = 126.40$  (kN\*m)

$e_i = \theta_1 \cdot l_0 / 2 = 0.4$  (cm)

$\theta_1 = \theta_0 \cdot \alpha_\eta \cdot \alpha_m = 0.01$

$\theta_0 = 0.01$

$\alpha_h = 1.00$

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	200	251	0

$$\alpha_m = (0,5(1+1/m))^{0.5} = 1.00$$

$$m = 1.00$$

$$M_a = N \cdot e_i = 0.03 \text{ (kN} \cdot \text{m)}$$

$$M_{Edmin} = 0.15 \text{ (kN} \cdot \text{m)}$$

$$M_{0Ed} = \max(M_{Edmin}, M_0 + M_a) = 126.43 \text{ (kN} \cdot \text{m)}$$

### 2.4.1.2. Detailed analysis-Direction Z:

#### 2.4.1.2.1 Slenderness analysis

Non-sway structure

L (m)	Lo (m)	$\lambda$	$\lambda_{lim}$	
0.800	1.600	10.67	257.99	Short column

#### 2.4.1.2.2 Buckling analysis

$$M_A = 0.00 \text{ (kN} \cdot \text{m)} \quad M_B = 0.00 \text{ (kN} \cdot \text{m)}$$

Case: Cross-section at the column end (Lower node), Slenderness not taken into account

$$M_0 = 0.00 \text{ (kN} \cdot \text{m)}$$

$$e_i = 0.0 \text{ (cm)}$$

$$M_a = N \cdot e_i = 0.00 \text{ (kN} \cdot \text{m)}$$

$$M_{Edmin} = 0.15 \text{ (kN} \cdot \text{m)}$$

$$M_{0Ed} = \max(M_{Edmin}, M_0 + M_a) = 0.15 \text{ (kN} \cdot \text{m)}$$

### 2.4.2 Reinforcement:

Real (provided) area  $A_{sr} = 18.85 \text{ (cm}^2\text{)}$   
 Ratio:  $\rho = 0.67 \%$

## 2.5 Reinforcement:

#### Main bars (B500B):

- 6  $\phi 20$  l = 0.760 (m)

#### Transversal reinforcement: (B500B):

stirrups: 3  $\phi 8$  l = 1.803 (m)

## 3 Material survey:

- Concrete volume = 0.226 (m<sup>3</sup>)
- Formwork = 1.508 (m<sup>2</sup>)
- Steel B500B
  - Total weight = 13.38 (kG)
  - Density = 59.17 (kG/m<sup>3</sup>)
  - Average diameter = 13.5 (mm)
  - Reinforcement survey:

Diameter	Length (m)	Weight (kG)	Number (No.)	Total weight (kG)
8	1.803	0.71	3	2.13
20	0.760	1.87	6	11.25

Reikalingas minimalus armavimas:

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	201	251	0

Polius			
d=	600 mm	Ac=	0.2826 m <sup>2</sup>
Armatūra			
d=	20 mm	As=	18.84 cm <sup>2</sup>
n=	6 vnt		
		Reikalingas armatūros plotas	
		Asreik=0,005*Ac=	14.13 cm <sup>2</sup>

**Išvada: laikomoji galia pakankama.**

### 1.12.2. Pastato dalies su rūsiu perimetro kolonų polių parinkimas

Projektuojami poliniai pamatai po pastato dalies su rūsiu perimetro kolonomis. Poliai 600mm skersmens. Poliai remiami į abs. Alt +35.23 (IGS 5, IGS6, IGS7) polių geometrinis ilgis 3,9m. Mažiausias grunto kūginis stipris 3m gylyje nuo poliaus pado pagal GR. Nr. 4  $q_c=2,5\text{MPa}$ ; šoninė trintis pagal GR Nr. 1  $f_s=50-90\text{ kPa}$  pagal sluoksnius.

Reakcijos po kolonomis pateiktos reakcijų plane ir gaubtinėje.

Gniuždomo poliaus laikomosios galios skaičiavimas:

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	202	251	0

**Veikiančios jėgos:**

$$N_{Ed,1} := 219 \cdot 10^{-3} = 0.219 \quad \text{MN}$$

$$N_{Ed,2} := 185 \cdot 10^{-3} = 0.185 \quad \text{MN}$$

$$N_{Ed,3} := 354 \cdot 10^{-3} = 0.354 \quad \text{MN}$$

**Daliniai koeficientai:**

Daliniai medžiagų patikimumo koef. atvejui M1:

$$\gamma_{\varphi,1} := 1$$

$$\gamma_{c,1} := 1$$

$$\gamma_{cu,1} := 1$$

$$\gamma_{qu,1} := 1$$

$$\gamma_{\gamma,1} := 1$$

Daliniai medžiagų patikimumo koef. atvejui M2:

$$\gamma_{\varphi,2} := 1.25$$

$$\gamma_{c,2} := 1.25$$

$$\gamma_{cu,2} := 1.4$$

$$\gamma_{qu,2} := 1.4$$

$$\gamma_{\gamma,2} := 1$$

Daliniai koeficientai CFA polių pagrindo atsparumui

	R1	R2	R3	R4
Polio pado laikomoji galia	$\gamma_{b1} := 1.1$	$\gamma_{b2} := 1.1$	$\gamma_{b3} := 1.0$	$\gamma_{b4} := 1.45$
Polio kamieno šoninio paviršiaus alikomoji galia gniuždymui	$\gamma_{s1} := 1.0$	$\gamma_{s2} := 1.1$	$\gamma_{s3} := 1.0$	$\gamma_{s4} := 1.30$
Polio pado suminis atsparumas gniuždymui	$\gamma_{t1} := 1.1$	$\gamma_{t2} := 1.1$	$\gamma_{t3} := 1.0$	$\gamma_{t4} := 1.40$
Polio laikomoji galia tempimui	$\gamma_{st1} := 1.25$	$\gamma_{st2} := 1.15$	$\gamma_{st3} := 1.1$	$\gamma_{st4} := 1.60$

$$\alpha_b := 0.5$$

**Grunto rodikliai:**  $\xi_3 := 1.4$ 

$$\rho := 21 \frac{\text{kN}}{\text{m}^3}$$

$$q_c := 2.5 \quad \text{MPa}$$

$$f_{s1} := 0.05 \quad \text{MPa} \quad f_{s2} := 0.09 \quad \text{MPa} \quad f_{s3} := 0.06 \quad \text{MPa} \quad f_{s4} := 0. \quad \text{MPa} \quad f_{s5} := 0.0 \quad \text{MPa} \quad f_{s6} := 0.0 \quad \text{MPa} \quad f_{s7} := 0.0 \quad \text{MPa}$$

**Geometriniai rodikliai:**  $f_{s8} := 0.0 \quad \text{MPa}$ 

$$h_1 := 0. \quad \text{m} \quad h_2 := 2.9 \quad \text{m} \quad h_3 := 1.0 \quad \text{m} \quad h_4 := 0. \quad \text{m} \quad h_5 := 0. \quad \text{m} \quad h_6 := 0 \quad \text{m} \quad h_7 := 0.0 \quad \text{m} \quad h_8 := 0.0 \quad \text{m}$$

$$d := 0.6 \quad \text{m}$$

$$A_p := \frac{\pi \cdot d^2}{4} = 0.283 \quad \text{m}^2$$

$$A_{s1} := \pi \cdot d \cdot h_1 = 0 \quad \text{m}^2 \quad A_{s2} := \pi \cdot d \cdot h_2 = 5.466 \quad \text{m}^2 \quad A_{s3} := \pi \cdot d \cdot h_3 = 1.885 \quad \text{m}^2$$

$$A_{s4} := \pi \cdot d \cdot h_4 = 0 \quad \text{m}^2 \quad A_{s5} := \pi \cdot d \cdot h_5 = 0 \quad \text{m}^2 \quad A_{s6} := \pi \cdot d \cdot h_6 = 0 \quad \text{m}^2$$

$$A_{s7} := \pi \cdot d \cdot h_7 = 0 \quad \text{m}^2 \quad A_{s8} := \pi \cdot d \cdot h_8 = 0 \quad \text{m}^2$$

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	203	251	0

### Pirmas projektavimo atvejis: A1+M1+R1

$$q_b := \alpha_b \cdot q_c = 1.25 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.353 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.605$$

$$R_{c,cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 0.926 \quad \text{MN}$$

$$R_{c,k1} := \frac{R_{c,cal1}}{\xi_3} = 0.662 \quad \text{MN}$$

$$R_{c,d1} := \frac{R_{c,k1}}{\gamma_{t1}} = 0.602 \quad \text{MN}$$

$$\frac{N_{Ed,1}}{R_{c,d1}} = 0.364$$

### Antras projektavimo atvejis: A2+M1+R4

$$R_{c,cal2} := \frac{R_b}{\gamma_{b4}} + \frac{R_s}{\gamma_{s4}} = 0.709 \quad \text{MN}$$

$$R_{c,k2} := \frac{R_{c,cal2}}{\xi_3} = 0.507 \quad \text{MN}$$

$$R_{c,d2} := \frac{R_{c,k2}}{\gamma_{t4}} = 0.362 \quad \text{MN}$$

$$\frac{N_{Ed,2}}{R_{c,d2}} = 0.511$$

### ACC projektavimo atvejis: A1+M1+R1

$$q_b := \alpha_b \cdot q_c = 1.25 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.353 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.605$$

$$R_{c,cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 0.926 \quad \text{MN}$$

$$R_{c,k1} := \frac{R_{c,cal1}}{\xi_3} = 0.662 \quad \text{MN}$$

$$R_{c,d1} := \frac{R_{c,k1}}{\gamma_{t1}} = 0.602 \quad \text{MN}$$

$$\frac{N_{Ed,3}}{R_{c,d1}} = 0.588$$

Išvada: gniuždomoji galia pakankama

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	204	251	0

### Lenkiamo poliaus laikomosios galios skaičiavimas:

$$q_c := 2500 \text{ kPa} \quad f_{si1} := 50 \text{ kPa} \quad f_{si2} := 90 \quad f_{si3} := 60 \quad f_{si4} := 0 \quad f_{si5} := 0 \quad f_{si6} := 0 \quad f_{si7} := 0 \quad f_{si8} := 0$$

$$N := 199 \text{ kN} \quad h_1 := 0. \quad h_2 := 2.9 \quad h_3 := 1.0 \quad h_4 := 0.0 \quad h_5 := 0.0 \quad h_6 := 0.0 \quad h_7 := 0.0 \quad h_8 := 0.0$$

$$M_d := 39 \text{ kNm}$$

$$Q_d := 43 \text{ kN} \quad \text{Nevertinamo sluoksnio gylis:} \quad \text{Max leistinas nuosėdis:}$$

$$d := 0.6 \text{ m} \quad h_s := 1.1 \text{ m} \quad s := 0.12 \text{ m}$$

Poliaus geometrinis ilgis:

Grafiko Rsn numeris pagal santyki:

$$h := 3.90 \text{ m} \quad n := 100 \cdot \frac{s}{d} = 20 \%$$

Pagrindo stiprumas po pamato padu:

iš 6.22, 6.23 grafikų

$$R_{s2} := 0.12 \cdot q_c \cdot 10^{-3} + 0.24 = 0.54 \text{ MPa}$$

$$A_b := 3.14 \cdot \frac{(d^2)}{4} = 0.283$$

Trinties jėga prie pamato šonų

$$F_f := 3.14 \cdot d \cdot \left( h_1 \cdot \frac{f_{si1}}{3} + h_2 \cdot \frac{f_{si2}}{3} + h_3 \cdot \frac{f_{si3}}{3} + h_4 \cdot \frac{f_{si4}}{3} + h_5 \cdot \frac{f_{si5}}{3} + h_6 \cdot \frac{f_{si6}}{3} + h_7 \cdot \frac{f_{si7}}{3} + h_8 \cdot \frac{f_{si8}}{3} \right) = 201.588 \text{ kN}$$

Slėgis po pamato padu:

$$p := \frac{(N - F_f)}{A_b} = -9.158 \text{ kPa} \quad \text{ne daugiau nei } R_{s2}$$

#### Pasisukimas ir pasislinkimas

Skaičiuojamasis pamato gylis:

$$d_d := h_1 + h_2 + h_3 + h_4 + h_5 + h_6 + h_7 + h_8 = 3.9 \text{ m}$$

Horizontalsios jėgos nuo momento aukštis virš pamato

$$h_m := \frac{M_d}{Q_d} = 0.907$$

Horizontalios jėgos pridėties taško skaičiuojamasis aukštis:

$$h_d := h - d_d + h_m = 0.907 \text{ m}$$

$$\eta := \frac{(1.5 \cdot h_d + 0.5 \cdot d_d)}{1.5 \cdot h_d + d_d} = 0.629 \quad \mu := 0.5$$

Kai  $F_f > N$

Pamato posūkiui besipriešinančių jėgų atstojamoji:

$$F_Q := \frac{\left( 10 + 1.5 \cdot F_f \cdot \frac{d}{\pi} \right)}{2 \cdot (1.5 \cdot h_d + d_d)} = 6.44 \text{ kN}$$

$$\text{pamatas} := \text{if}[F_Q \geq 0.5 \cdot (\eta + 1) \cdot Q_d, \text{"nepasisuka"}, \text{"pasisuka"}] = \text{"pasisuka"}$$

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	205	251	0

Pamato posukio centro gylis nuo skaičiuojamojo pagrindo paviršiaus  $z_0$ :

$$z_0 := \frac{d_d}{1 + \frac{(Q_d \cdot 1) - F_Q}{Q_d - F_Q}} = 2.494 \quad \text{m}$$

kadangi := if( $z_0 < d_d$ , "u formule tinka", "netinka") = "u formule tinka"

$$R_{s0.5} := 0.04q_c \cdot 10^{-3} + 0.1 = 0.2$$

Horizontalus pagrindo standumo modulis:

$$u_u := 0.01 \cdot d = 6 \times 10^{-3} \quad \text{m}$$

$$C_h := \frac{R_{s0.5} \cdot 10^3}{0.005 \cdot d} = 6.667 \times 10^4$$

$$i_u := 0.005 \quad \text{m}$$

$$u := \left[ 4Q_d \frac{(1.5h_d + d_d)}{C_h \cdot d \cdot d_d^2} \right] \left[ 1 + \frac{(h - d_d)}{z_0} \right] \left( 1 - \frac{F_Q}{Q_d} \right) = 1.264 \times 10^{-3} \quad \text{m}$$

poslinkis := if( $u < u_u$ , "poslinkis leistinas", "poslinkis neleistinas") = "poslinkis leistinas"

$$i := \frac{u}{(z_0 + h - d_d)} = 5.071 \times 10^{-4} \quad \text{m}$$

pasisukimas := if( $i < i_u$ , "pasisukimas leistinas", "pasisukimas neleistinas") = "pasisukimas leistinas"

#### Gylis kuriam e veikia didžiausias lenkimo momentas

Grunto prie pamato šoninio paviršiaus vidutinis stipris:

$$R_f := \frac{F_f}{\pi \cdot d \cdot d_d} = 27.422 \quad \text{kN}$$

Gylis, kuriame veikia didžiausias lenkimo momentas:

$$z_m := z_0 - \sqrt{z_0^2 - \frac{\left( 1 - \frac{d^2 \cdot R_f}{2 \cdot Q_d} \right) \cdot d_d^2 \cdot z_0}{2 \cdot (1.5 \cdot h_d + d_d)}} = 0.754 \quad \text{m}$$

Didžiausias polių veikiantis lenkimo momentas:

$$M := Q_d \cdot (h_d + z_m) - \frac{2 \cdot Q_d}{3 \cdot d_d^2 \cdot z_0} \cdot (1.5 \cdot h_d + d_d) \cdot (3 \cdot z_0 - z_m) \cdot z_m^2 - \frac{d^2}{2} \cdot R_f \cdot z_m = 52.495 \quad \text{kNm}$$

### Išvada: lenkiamoji galia pakankama

#### 1.12.3. Pastato dalies su rūsiu vidinių kolonų polių ant C ašies parinkimas

Projektuojami poliniai pamatai po pastato dalies su rūsiu vidinėmis kolonomis. Poliai 600mm skersmens. Poliai remiami į abs. Alt +35.23 (IGS 5, IGS6, IGS7) polių geometrinis ilgis 3,9m. Mažiausias grunto kūginis stipris 3m gylyje nuo poliaus pado pagal GR. Nr. 4  $q_c=2,5\text{MPa}$ ; šoninė trintis pagal GR Nr. 1  $f_s=50-90 \text{ kPa}$  pagal sluoksnius.

Reakcijos po kolonomis pateiktos reakcijų plane ir gaubtinėje.

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	206	251	0

**Gniuždomo poliaus laikomosios galios skaičiavimas:**
**Veikiančios jėgos:**

$$N_{Ed,1} := 325 \cdot 10^{-3} = 0.325 \quad \text{MN}$$

$$N_{Ed,2} := 278 \cdot 10^{-3} = 0.278 \quad \text{MN}$$

$$N_{Ed,3} := 519 \cdot 10^{-3} = 0.519 \quad \text{MN}$$

**Daliniai koeficientai:**

Daliniai medžiagų patikimumo koef. atvejui M1:

$$\gamma_{\varphi,1} := 1$$

$$\gamma_{c,1} := 1$$

$$\gamma_{cu,1} := 1$$

$$\gamma_{qu,1} := 1$$

$$\gamma_{\gamma,1} := 1$$

Daliniai medžiagų patikimumo koef. atvejui M2:

$$\gamma_{\varphi,2} := 1.25$$

$$\gamma_{c,2} := 1.25$$

$$\gamma_{cu,2} := 1.4$$

$$\gamma_{qu,2} := 1.4$$

$$\gamma_{\gamma,2} := 1$$

Daliniai koeficientai CFA polių pagrindo atsparumui

	R1	R2	R3	R4
Polio pado laikomoji galia	$\gamma_{b1} := 1.1$	$\gamma_{b2} := 1.1$	$\gamma_{b3} := 1.0$	$\gamma_{b4} := 1.45$
Polio kamieno šoninio paviršiaus alikomoji galia gniuždymui	$\gamma_{s1} := 1.0$	$\gamma_{s2} := 1.1$	$\gamma_{s3} := 1.0$	$\gamma_{s4} := 1.30$
Polio pado suminis atsparumas gniuždymui	$\gamma_{t1} := 1.1$	$\gamma_{t2} := 1.1$	$\gamma_{t3} := 1.0$	$\gamma_{t4} := 1.40$
Polio laikomoji galia tempimui	$\gamma_{st1} := 1.25$	$\gamma_{st2} := 1.15$	$\gamma_{st3} := 1.1$	$\gamma_{st4} := 1.60$
	$\alpha_b := 0.5$			

**Grunto rodikliai:**  $\xi_3 := 1.4$ 

$$\rho := 21 \frac{\text{kN}}{\text{m}^3}$$

$$q_c := 2.5 \quad \text{MPa}$$

$$f_{s1} := 0.05 \quad \text{MPa} \quad f_{s2} := 0.09 \quad \text{MPa} \quad f_{s3} := 0.06 \quad \text{MPa} \quad f_{s4} := 0. \quad \text{MPa} \quad f_{s5} := 0.0 \quad \text{MPa} \quad f_{s6} := 0.0 \quad \text{MPa} \quad f_{s7} := 0.0 \quad \text{MPa}$$

**Geometriniai rodikliai:**  $f_{s8} := 0.0 \quad \text{MPa}$ 

$$h_1 := 0. \quad \text{m} \quad h_2 := 2.9 \quad \text{m} \quad h_3 := 1.0 \quad \text{m} \quad h_4 := 0. \quad \text{m} \quad h_5 := 0. \quad \text{m} \quad h_6 := 0 \quad \text{m} \quad h_7 := 0.0 \quad \text{m} \quad h_8 := 0.0 \quad \text{m}$$

$$d := 0.6 \quad \text{m}$$

$$A_p := \frac{\pi \cdot d^2}{4} = 0.283 \quad \text{m}^2$$

$$A_{s1} := \pi \cdot d \cdot h_1 = 0 \quad \text{m}^2$$

$$A_{s4} := \pi \cdot d \cdot h_4 = 0 \quad \text{m}^2$$

$$A_{s7} := \pi \cdot d \cdot h_7 = 0 \quad \text{m}^2$$

$$A_{s2} := \pi \cdot d \cdot h_2 = 5.466 \quad \text{m}^2$$

$$A_{s3} := \pi \cdot d \cdot h_3 = 1.885 \quad \text{m}^2$$

$$A_{s5} := \pi \cdot d \cdot h_5 = 0 \quad \text{m}^2$$

$$A_{s6} := \pi \cdot d \cdot h_6 = 0 \quad \text{m}^2$$

$$A_{s8} := \pi \cdot d \cdot h_8 = 0 \quad \text{m}^2$$

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	207	251	0

### Pirmas projektavimo atvejis: A1+M1+R1

$$q_b := \alpha_b \cdot q_c = 1.25 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.353 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.605$$

$$R_{c,cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 0.926 \quad \text{MN}$$

$$R_{c,k1} := \frac{R_{c,cal1}}{\xi_3} = 0.662 \quad \text{MN}$$

$$R_{c,d1} := \frac{R_{c,k1}}{\gamma_{t1}} = 0.602 \quad \text{MN}$$

$$\frac{N_{Ed,1}}{R_{c,d1}} = 0.54$$

### Antras projektavimo atvejis: A2+M1+R4

$$R_{c,cal2} := \frac{R_b}{\gamma_{b4}} + \frac{R_s}{\gamma_{s4}} = 0.709 \quad \text{MN}$$

$$R_{c,k2} := \frac{R_{c,cal2}}{\xi_3} = 0.507 \quad \text{MN}$$

$$R_{c,d2} := \frac{R_{c,k2}}{\gamma_{t4}} = 0.362 \quad \text{MN}$$

$$\frac{N_{Ed,2}}{R_{c,d2}} = 0.768$$

### ACC projektavimo atvejis: A1+M1+R1

$$q_{b,acc} := \alpha_b \cdot q_c = 1.25 \quad \text{MPa}$$

$$R_{b,acc} := q_b \cdot A_p = 0.353 \quad \text{MN}$$

$$R_{s,acc} := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.605$$

$$R_{c,cal1,acc} := \frac{R_{b,acc}}{\gamma_{b1}} + \frac{R_{s,acc}}{\gamma_{s1}} = 0.926 \quad \text{MN}$$

$$R_{c,k1,acc} := \frac{R_{c,cal1,acc}}{\xi_3} = 0.662 \quad \text{MN}$$

$$R_{c,d1,acc} := \frac{R_{c,k1,acc}}{\gamma_{t1}} = 0.602 \quad \text{MN}$$

$$\frac{N_{Ed,3}}{R_{c,d1,acc}} = 0.863$$

Išvada: gniuždomoji galia pakankama

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	208	251	0

### Lenkiamo poliaus laikomosios galios skaičiavimas:

$$q_c := 2500 \text{ kPa} \quad f_{si1} := 50 \text{ kPa} \quad f_{si2} := 90 \quad f_{si3} := 60 \quad f_{si4} := 0 \quad f_{si5} := 0 \quad f_{si6} := 0 \quad f_{si7} := 0 \quad f_{si8} := 0$$

$$N := 311 \text{ kN} \quad h_1 := 0 \quad h_2 := 2.9 \quad h_3 := 1.0 \quad h_4 := 0.0 \quad h_5 := 0.0 \quad h_6 := 0.0 \quad h_7 := 0.0 \quad h_8 := 0.0$$

$$M_d := 34 \text{ kNm}$$

$$Q_d := 37 \text{ kN} \quad \text{Nvertinamo sluoksnio gylis:} \quad \text{Max leistinas nuosėdis:}$$

$$d := 0.6 \text{ m} \quad h_s := 1.1 \text{ m} \quad s_w := 0.12 \text{ m}$$

Poliaus geometrinis ilgis:

Grafiko Rsn numeris pagal santyki:

$$h := 3.90 \text{ m}$$

$$n := 100 \cdot \frac{s}{d} = 20 \%$$

Pagrindo stiprumas po pamato padu:

iš 6.22, 6.23 grafikų

$$R_{s2} := 0.12 \cdot q_c \cdot 10^{-3} + 0.24 = 0.54 \text{ MPa}$$

$$A_b := 3.14 \cdot \frac{(d^2)}{4} = 0.283$$

Trinties jėga prie pamato šonų:

$$F_f := 3.14 \cdot d \cdot \left( h_1 \cdot \frac{f_{si1}}{3} + h_2 \cdot \frac{f_{si2}}{3} + h_3 \cdot \frac{f_{si3}}{3} + h_4 \cdot \frac{f_{si4}}{3} + h_5 \cdot \frac{f_{si5}}{3} + h_6 \cdot \frac{f_{si6}}{3} + h_7 \cdot \frac{f_{si7}}{3} + h_8 \cdot \frac{f_{si8}}{3} \right) = 201.588 \text{ kN}$$

Slėgis po pamato padu:

$$p := \frac{(N - F_f)}{A_b} = 387.162 \text{ kPa} \quad \text{ne daugiau nei } R_{s2}$$

#### Pasisukimas ir pasislinkimas

Skaičiuojamasis pamato gylis:

$$d_d := h_1 + h_2 + h_3 + h_4 + h_5 + h_6 + h_7 + h_8 = 3.9 \text{ m}$$

Horizontalaus jėgos nuo momento aukštis virš pamato

$$h_m := \frac{M_d}{Q_d} = 0.919$$

Horizontalaus jėgos pridėties taško skaičiuojamasis aukštis:

$$h_d := h - d_d + h_m = 0.919 \text{ m}$$

$$\eta := \frac{(1.5 \cdot h_d + 0.5 \cdot d_d)}{1.5 \cdot h_d + d_d} = 0.631 \quad \mu := 0.5$$

Kai  $F_f > N$

Pamato posūkiui besipriešinančių jėgų atstojamoji:

$$F_Q := \frac{\left( 10 + 1.5 \cdot F_f \cdot \frac{d}{\pi} \right)}{2 \cdot (1.5 \cdot h_d + d_d)} = 6.418 \text{ kN}$$

$$\text{pamatas} := \text{if} \left[ F_Q \geq 0.5 \cdot (\eta + 1) \cdot Q_d, \text{"nepasisuka"}, \text{"pasisuka"} \right] = \text{"pasisuka"}$$

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	209	251	0

Pamato posukio centro gylis nuo skaičiuojamojo pagrindo paviršiaus  $z_0$ :

$$z_0 := \frac{d_d}{1 + \frac{(Q_d^{1.1} - F_Q)}{Q_d - F_Q}} = 2.511 \quad \text{m}$$

kadangi := if( $z_0 < d_d$ , "u formule tinka", "netinka") = "u formule tinka"

$$R_{s0.5} := 0.04q_c \cdot 10^{-3} + 0.1 = 0.2$$

Horizontalus pagrindo standumo modulis:

$$C_h := \frac{R_{s0.5} \cdot 10^3}{0.005 d} = 6.667 \times 10^4$$

$$u_u := 0.01 \cdot d = 6 \times 10^{-3} \quad \text{m}$$

$$i_u := 0.005 \quad \text{m}$$

$$u := \left[ 4Q_d \frac{(1.5h_d + d_d)}{C_h \cdot d \cdot d_d^2} \right] \left[ 1 + \frac{(h - d_d)}{z_0} \right] \left( 1 - \frac{F_Q}{Q_d} \right) = 1.061 \times 10^{-3} \quad \text{m}$$

poslinkis := if( $u < u_u$ , "poslinkis leistinas", "poslinkis neleistinas") = "poslinkis leistinas"

$$i := \frac{u}{(z_0 + h - d_d)} = 4.226 \times 10^{-4} \quad \text{m}$$

pasisukimas := if( $i < i_u$ , "pasisukimas leistinas", "pasisukimas neleistinas") = "pasisukimas leistinas"

#### Gylis kuriam e veikia didžiausias lenkimo momentas

Grunto prie pamato šoninio paviršiaus vidutinis stipris:

$$R_f := \frac{F_f}{\pi \cdot d \cdot d_d} = 27.422 \quad \text{kN}$$

Gylis, kuriame veikia didžiausias lenkimo momentas:

$$z_m := z_0 - \sqrt{z_0^2 - \frac{\left( 1 - \frac{d^2 \cdot R_f}{2 \cdot Q_d} \right) \cdot d_d^2 \cdot z_0}{2 \cdot (1.5 \cdot h_d + d_d)}} = 0.731 \quad \text{m}$$

Didžiausias polių veikiantis lenkimo momentas:

$$M := Q_d (h_d + z_m) - \frac{2 \cdot Q_d}{3 \cdot d_d^2 \cdot z_0} \cdot (1.5 \cdot h_d + d_d) (3 \cdot z_0 - z_m) \cdot z_m^2 - \frac{d^2}{2} \cdot R_f \cdot z_m = 45.048 \quad \text{kNm}$$

### Išvada: lenkiamoji galia pakankama

#### 1.12.4. Pastato dalies su rūsiu vidinių kolonų polių ant B ašies parinkimas

Projektuojami poliniai pamatai apjungti galvena po pastato dalies su rūsiu vidinėmis kolonomis. Galvenos dydis 2,1m x 2,1m x 0,8m. Poliai 4 vnt. 500mm skersmens. Poliai remiami į abs. Alt +35.23 (IGS 5, IGS6, IGS7) polių geometrinis ilgis 3,9m. Mažiausias grunto kūginis stipris 3m gylyje nuo poliaus pado pagal GR. Nr. 4  $q_c=2,5\text{MPa}$ ; šoninė trintis pagal GR Nr. 1  $f_s=50-90 \text{ kPa}$  pagal sluoksnius.

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	210	251	0

Reakcijos po kolonomis pateiktos reakcijų plane ir gaubtinėje.

Polių reakcijos:

Galvenos matmenys:

$$\begin{aligned} b &:= 2.1 \text{ m} \\ h &:= 0.8 \text{ m} \\ l_{\text{poli}} &:= 2.1 \text{ m} \end{aligned}$$

Pamato galvenos svoris:

$$N_p := 24 \cdot b \cdot h \cdot l = 84.672 \text{ kN}$$

Jėgos pečiai pagal polių išdėstymą:

$$x := 0.75 \text{ m}$$

$$y := 0.75 \text{ m}$$

Polių skaičius:

$$n := 4$$

**A1 projektavimo atvejis:**

**Veikiant didžiausiai ašinei jėgai:**

Pamato viršuje veikiančios įrašos:

$$N_{Ed} := 633 \text{ kN}$$

$$M_{Ed,x} := 4 \text{ kNm}$$

$$M_{Ed,y} := 1 \text{ kNm}$$

$$V_{Ed,x} := 1 \text{ kN}$$

$$V_{Ed,y} := 4 \text{ kN}$$

Didžiausia polio ašinė jėga:

$$F_{Ed,1} := \frac{N_{Ed} + N_p}{n} + \frac{(M_{Ed,x} + V_{Ed,y} \cdot h) \cdot y}{y^2 + y^2} + \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 185.418 \text{ kN}$$

Mažiausia polio ašinė jėga:

$$F_{Ed,2} := \frac{N_{Ed} + N_p}{n} - \frac{(M_{Ed,x} + V_{Ed,y} \cdot h) \cdot y}{y^2 + y^2} - \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 173.418 \text{ kN}$$

**Veikiant didžiausiam momentui ir skersinei jėgai:**

Pamato viršuje veikiančios įrašos:

$$N_{Ed} := 234 \text{ kN}$$

$$M_{Ed,x} := 4 \text{ kNm}$$

$$M_{Ed,y} := 7 \text{ kNm}$$

$$V_{Ed,x} := 7 \text{ kN}$$

$$V_{Ed,y} := 5 \text{ kN}$$

Didžiausia polio ašinė jėga:

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$$F_{Ed,1} := \frac{N_{Ed} + N_p}{n} + \frac{(M_{Ed,x} + V_{Ed,y} \cdot h) \cdot y}{y^2 + y^2} + \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 93.401 \quad \text{kN}$$

Mažiausia polio ašinė jėga:

$$F_{Ed,2} := \frac{N_{Ed} + N_p}{n} - \frac{(M_{Ed,x} + V_{Ed,y} \cdot h) \cdot y}{y^2 + y^2} - \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 65.935 \quad \text{kN}$$

**A2 projektavimo atvejis:**

**Veikiant didžiausiai ašinei jėgai:**

Pamato viršuje veikiančios jėgos:

$$N_{Ed} := 541 \quad \text{kN}$$

$$M_{Ed,x} := 3 \quad \text{kNm}$$

$$M_{Ed,y} := 1 \quad \text{kNm}$$

$$V_{Ed,x} := 1 \quad \text{kN}$$

$$V_{Ed,y} := 3 \quad \text{kN}$$

Didžiausia polio ašinė jėga:

$$F_{Ed,1} := \frac{N_{Ed} + N_p}{n} + \frac{(M_{Ed,x} + V_{Ed,y} \cdot h) \cdot y}{y^2 + y^2} + \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 161.218 \quad \text{kN}$$

Mažiausia polio ašinė jėga:

$$F_{Ed,2} := \frac{N_{Ed} + N_p}{n} - \frac{(M_{Ed,x} + V_{Ed,y} \cdot h) \cdot y}{y^2 + y^2} - \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 151.618 \quad \text{kN}$$

**Veikiant didžiausiam momentui ir skersinei jėgai:**

Pamato viršuje veikiančios jėgos:

$$N_{Ed} := 198 \quad \text{kN}$$

$$M_{Ed,x} := 4 \quad \text{kNm}$$

$$M_{Ed,y} := 6 \quad \text{kNm}$$

$$V_{Ed,x} := 6 \quad \text{kN}$$

$$V_{Ed,y} := 4 \quad \text{kN}$$

Didžiausia polio ašinė jėga:

$$F_{Ed,1} := \frac{N_{Ed} + N_p}{n} + \frac{(M_{Ed,x} + V_{Ed,y} \cdot h) \cdot y}{y^2 + y^2} + \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 82.668 \quad \text{kN}$$

Mažiausia polio ašinė jėga:

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$$F_{Ed,2} := \frac{N_{Ed} + N_p}{n} - \frac{(M_{Ed,x} + V_{Ed,y} \cdot h) \cdot y}{y^2 + y^2} - \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 58.668 \quad \text{kN}$$

#### ACC projektavimo atvejis:

##### Veikiant didžiausiai ašinei jėgai:

Pamato viršuje veikiančios jėgos:

$$N_{Ed} := 1365 \quad \text{kN}$$

$$M_{Ed,x} := 29 \quad \text{kNm}$$

$$M_{Ed,y} := 21 \quad \text{kNm}$$

$$V_{Ed,x} := 23 \quad \text{kN}$$

$$V_{Ed,y} := 30 \quad \text{kN}$$

Didžiausia polio ašinė jėga:

$$F_{Ed,1} := \frac{N_{Ed} + N_p}{n} + \frac{(M_{Ed,x} + V_{Ed,y} \cdot h) \cdot y}{y^2 + y^2} + \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 424.018 \quad \text{kN}$$

Mažiausia polio ašinė jėga:

$$F_{Ed,2} := \frac{N_{Ed} + N_p}{n} - \frac{(M_{Ed,x} + V_{Ed,y} \cdot h) \cdot y}{y^2 + y^2} - \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 300.818 \quad \text{kN}$$

##### Veikiant didžiausiam momentui ir skersinei jėgai:

Pamato viršuje veikiančios jėgos:

$$N_{Ed} := 431 \quad \text{kN}$$

$$M_{Ed,x} := 7 \quad \text{kNm}$$

$$M_{Ed,y} := 42 \quad \text{kNm}$$

$$V_{Ed,x} := 43 \quad \text{kN}$$

$$V_{Ed,y} := 7 \quad \text{kN}$$

Didžiausia polio ašinė jėga:

$$F_{Ed,1} := \frac{N_{Ed} + N_p}{n} + \frac{(M_{Ed,x} + V_{Ed,y} \cdot h) \cdot y}{y^2 + y^2} + \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 188.251 \quad \text{kN}$$

Mažiausia polio ašinė jėga:

$$F_{Ed,2} := \frac{N_{Ed} + N_p}{n} - \frac{(M_{Ed,x} + V_{Ed,y} \cdot h) \cdot y}{y^2 + y^2} - \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 69.585 \quad \text{kN}$$

**Išvada: tempiamų polių nėra. Didžiausias gniuždymas A1 atveju 186 kN, didžiausias gniuždymas A2 atveju 162 kN, didžiausias gniuždymas ACC atveju 425 kN. Polių grupės polių laikomoji galia skaičiuojama veikiant šioms apkrovoms.**

Gniuždomo poliaus laikomosios galios skaičiavimas:

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	213	251	0

**Veikiančios jėgos:**

$$N_{Ed,1} := 186 \cdot 10^{-3} = 0.186 \quad \text{MN}$$

$$N_{Ed,2} := 162 \cdot 10^{-3} = 0.162 \quad \text{MN}$$

$$N_{Ed,3} := 425 \cdot 10^{-3} = 0.425 \quad \text{MN}$$

**Daliniai koeficientai:**

Daliniai medžiagų patikimumo koef. atvejui M1:

$$\gamma_{\varphi,1} := 1$$

$$\gamma_{c,1} := 1$$

$$\gamma_{cu,1} := 1$$

$$\gamma_{qu,1} := 1$$

$$\gamma_{\gamma,1} := 1$$

Daliniai medžiagų patikimumo koef. atvejui M2:

$$\gamma_{\varphi,2} := 1.25$$

$$\gamma_{c,2} := 1.25$$

$$\gamma_{cu,2} := 1.4$$

$$\gamma_{qu,2} := 1.4$$

$$\gamma_{\gamma,2} := 1$$

Daliniai koeficientai CFA polių pagrindo atsparumui

	R1	R2	R3	R4
Polio pado laikomoji galia	$\gamma_{b1} := 1.1$	$\gamma_{b2} := 1.1$	$\gamma_{b3} := 1.0$	$\gamma_{b4} := 1.45$
Polio kamieno šoninio paviršiaus alikomoji galia gniuždymui	$\gamma_{s1} := 1.0$	$\gamma_{s2} := 1.1$	$\gamma_{s3} := 1.0$	$\gamma_{s4} := 1.30$
Polio pado suminis atsparumas gniuždymui	$\gamma_{t1} := 1.1$	$\gamma_{t2} := 1.1$	$\gamma_{t3} := 1.0$	$\gamma_{t4} := 1.40$
Polio laikomoji galia tempimui	$\gamma_{st1} := 1.25$	$\gamma_{st2} := 1.15$	$\gamma_{st3} := 1.1$	$\gamma_{st4} := 1.60$

$$\alpha_b := 0.5$$

**Grunto rodikliai:**  $\xi_3 := 1.4$

$$\rho := 21 \frac{\text{kN}}{\text{m}^3}$$

$$q_c := 2.5 \quad \text{MPa}$$

$$f_{s1} := 0.05 \quad \text{MPa} \quad f_{s2} := 0.09 \quad \text{MPa} \quad f_{s3} := 0.06 \quad \text{MPa} \quad f_{s4} := 0. \quad \text{MPa} \quad f_{s5} := 0.0 \quad \text{MPa} \quad f_{s6} := 0.0 \quad \text{MPa} \quad f_{s7} := 0.0 \quad \text{MPa}$$

**Geometriniai rodikliai:**  $f_{s8} := 0.0 \quad \text{MPa}$

$$h_1 := 0. \quad \text{m} \quad h_2 := 2.9 \quad \text{m} \quad h_3 := 1.0 \quad \text{m} \quad h_4 := 0. \quad \text{m} \quad h_5 := 0. \quad \text{m} \quad h_6 := 0 \quad \text{m} \quad h_7 := 0.0 \quad \text{m} \quad h_8 := 0.0 \quad \text{m}$$

$$d := 0.5 \quad \text{m}$$

$$A_p := \frac{\pi \cdot d^2}{4} = 0.196 \quad \text{m}^2$$

$$A_{s1} := \pi \cdot d \cdot h_1 = 0 \quad \text{m}^2 \quad A_{s2} := \pi \cdot d \cdot h_2 = 4.555 \quad \text{m}^2 \quad A_{s3} := \pi \cdot d \cdot h_3 = 1.571 \quad \text{m}^2$$

$$A_{s4} := \pi \cdot d \cdot h_4 = 0 \quad \text{m}^2 \quad A_{s5} := \pi \cdot d \cdot h_5 = 0 \quad \text{m}^2 \quad A_{s6} := \pi \cdot d \cdot h_6 = 0 \quad \text{m}^2$$

$$A_{s7} := \pi \cdot d \cdot h_7 = 0 \quad \text{m}^2 \quad A_{s8} := \pi \cdot d \cdot h_8 = 0 \quad \text{m}^2$$

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	214	251	0

### Pirmas projektavimo atvejis: A1+M1+R1

$$q_b := \alpha_b \cdot q_c = 1.25 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.245 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.504$$

$$R_{c,cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 0.727 \quad \text{MN}$$

$$R_{c,k1} := \frac{R_{c,cal1}}{\xi_3} = 0.52 \quad \text{MN}$$

$$R_{c,d1} := \frac{R_{c,k1}}{\gamma_{t1}} = 0.472 \quad \text{MN}$$

$$\frac{N_{Ed,1}}{R_{c,d1}} = 0.394$$

### Antras projektavimo atvejis: A2+M1+R4

$$R_{c,cal2} := \frac{R_b}{\gamma_{b4}} + \frac{R_s}{\gamma_{s4}} = 0.557 \quad \text{MN}$$

$$R_{c,k2} := \frac{R_{c,cal2}}{\xi_3} = 0.398 \quad \text{MN}$$

$$R_{c,d2} := \frac{R_{c,k2}}{\gamma_{t4}} = 0.284 \quad \text{MN}$$

$$\frac{N_{Ed,2}}{R_{c,d2}} = 0.57$$

### ACC projektavimo atvejis: A1+M1+R1

$$q_b := \alpha_b \cdot q_c = 1.25 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.245 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.504$$

$$R_{c,cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 0.727 \quad \text{MN}$$

$$R_{c,k1} := \frac{R_{c,cal1}}{\xi_3} = 0.52 \quad \text{MN}$$

$$R_{c,d1} := \frac{R_{c,k1}}{\gamma_{t1}} = 0.472 \quad \text{MN}$$

$$\frac{N_{Ed,3}}{R_{c,d1}} = 0.9$$

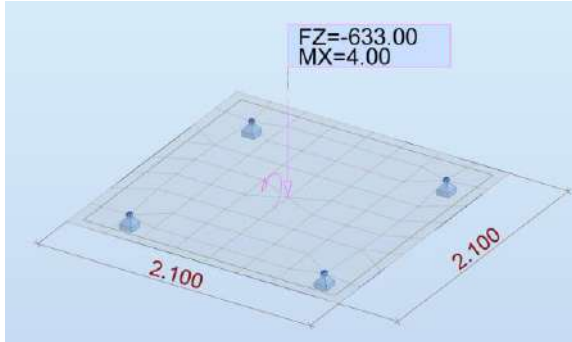
Išvada: gniuždomoji galia pakankama

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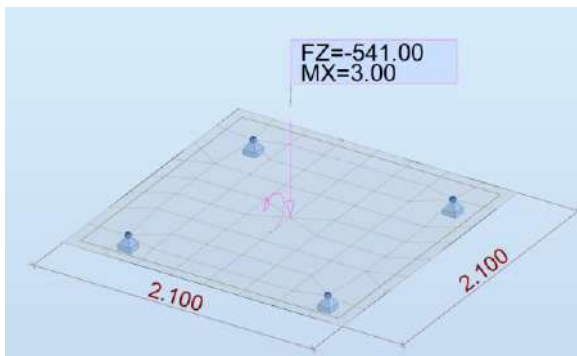
Poliaus galvenos armavimo skaičiavimas.

Galvena atremta ant 4 polių lanksčiai. Galvenos skaičiuojamoji schema su veikiančiomis apkrovomis.

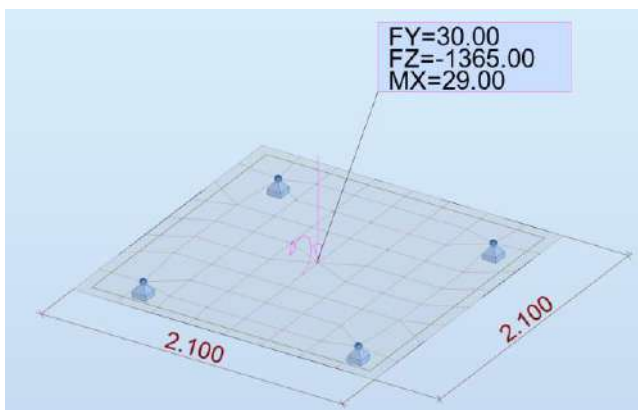
A1 derinys:



A2 derinys:

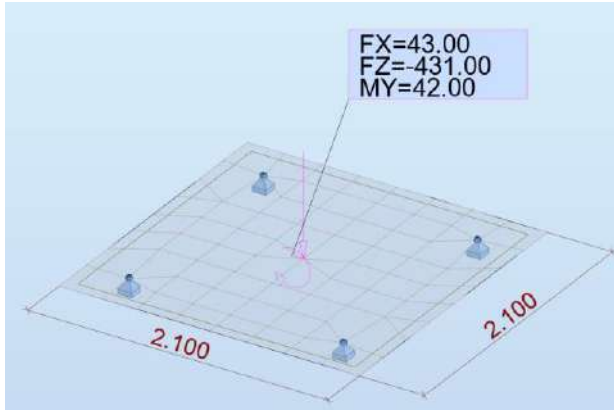


Ypatingųjų poveikių derinys, kai maksimali ašinė jėga:



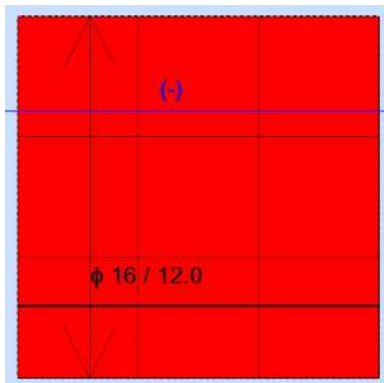
Ypatingųjų poveikių derinys, kai maksimalus lenkimo momentas:

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	216	251	0

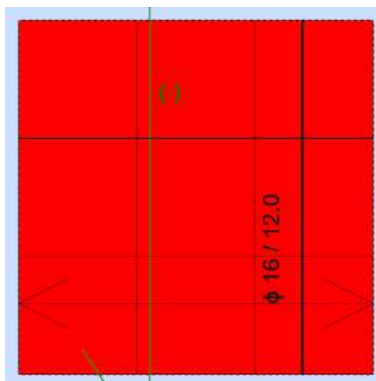


Reikalingas armavimas:

Apatinis armavimas X kryptimi:

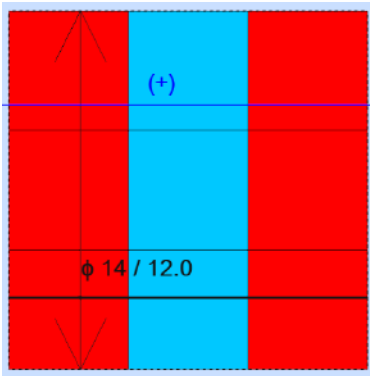


Apatinis armavimas Y kryptimi:

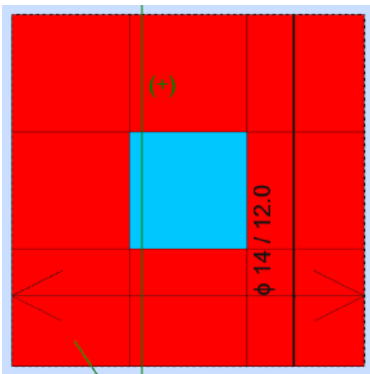


Apatinis armavimas X kryptimi:

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	217	251	0



Apatinis armavimas Y kryptimi:



## 1. Slab: Slab1 - Panel no. 1

### 1.1. Reinforcement:

- Type : galvena
- Main reinforcement direction : 0°
- Main reinforcement grade : B500B; Characteristic strength = 500.00 MPa  
Horizontal branch of the stress-strain diagram : B
- Ductility class : B
- Bar diameters : bottom d1 = 1.2 (cm) d2 = 1.2 (cm)  
top d1 = 1.2 (cm) d2 = 1.2 (cm)
- Cover : bottom c1 = 4.0 (cm)  
top c2 = 4.0 (cm)
- Cover deviations : Cdev = 1.0(cm), Cdur = 0.0(cm)

### 1.2. Concrete

- Class : C25/30; Characteristic strength = 25.00 MPa  
Rectangular stress distribution [3.1.7(3)]
- Density : 2501.36 (kg/m3)
- Concrete creep coefficient : 1.38
- Cement class : N

### 1.3. Hypothesis

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Method of reinforcement area calculations : analytical
- Allowable cracking width

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- upper layer	: 0.30 (mm)
- lower layer	: 0.30 (mm)
• Allowable deflection	: 1.10 (cm)
• Verification of punching	: yes
• Exposure	
- upper layer	: XC2
- lower layer	: XC2
• Calculation type	: simple bending
• Structure class	: S4

Modified partial coefficients:  
 $a_{cc} = 0.9$  1992-1-1 3.1.6 (1)P

## 1.4. Slab geometry

Thickness 0.900 (m)

### Contour:

edge	beginning		end		length (m)
	x1	y1	x2	y2	
1	0.000	-2.100	2.100	-2.100	2.100
2	2.100	-2.100	2.100	0.000	2.100
3	2.100	0.000	0.000	0.000	2.100
4	0.000	0.000	0.000	-2.100	2.100

### Support:

n°	Name	dimensions (m)	coordinates		edge
			x	y	
5	linear	0.500 / 0.500	1.050	-1.050	—

\* - head present

## 1.5. Calculation results:

### 1.5.1. Maximum moments + reinforcement for bending

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Provided reinforcement (cm <sup>2</sup> /m):	12.83	16.76	12.83	16.76
Modified required reinforcement (cm <sup>2</sup> /m):	11.41	15.34	11.25	15.69
Original required reinforcement (cm <sup>2</sup> /m):	11.41	15.34	11.25	15.69
Coordinates (m):	0.000;-0.525	1.050;-1.050	0.300;-1.800	1.050;-1.050

### 1.5.2. Maximum moments + reinforcement for bending

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Symbol: required area/provided area				
Ax(+) (cm <sup>2</sup> /m)	11.41/12.83	0.00/12.83	11.41/12.83	
Ax(-) (cm <sup>2</sup> /m)	11.41/16.76	15.34/16.76	11.41/16.76	
Ay(+) (cm <sup>2</sup> /m)	0.00/12.83	0.00/12.83	11.25/12.83	
	0.00/12.83			

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	219	251	0

Ay(-) (cm <sup>2</sup> /m)	11.25/16.76 15.69/16.76	15.69/16.76	11.25/16.76	
<b>ULS</b>				
Mxx (kN*m/m)	40.11	-547.03	63.89	-547.03
Myy (kN*m/m)	-47.73	-551.97	67.45	-551.97
Mxy (kN*m/m)	-8.05	0.05	8.34	0.05
Nxx (kN/m)	8.33	0.07	6.22	0.07
Nyy (kN/m)	-4.23	0.05	3.23	0.05
Nxy (kN/m)	2.48	0.02	4.66	0.02
Coordinates (m)	0.000;-0.525	1.050;-1.050	0.300;-1.800	1.050;-
Coordinates* (m)	0.000;1.575;0.000	1.050;1.050;0.000	0.300;0.300;0.000	1.050;1.050;0.000
	* - Coordinates in the structure global coordinate system			

### 1.5.3. Punching

Support no. / Point	Location (m)		Geometry: (m)				
	x	y	a	b	d	h	
P1 (5)	1.050	-1.050	Force	0.500	0.500	-	-
Support no. / Point	Loads: (kN)		Critical perimeter (m)		Qadm / Q		
P1 (5)	Q	Qadm	u		#####	< 1	
	0.00	0.00	0.000				

#### Support no. / Point: P1 (5)

$u_0 = 2.000$   
 $u_1 = 0.000$   
 $\rho_L x = 0.00$   
 $\rho_L y = 0.00$   
 $h_{eff} = 84.8 \text{ (cm)}$   
 $A_x = 16.76 \text{ (cm}^2\text{)}$   
 $A_y = 16.76 \text{ (cm}^2\text{)}$   
 $\alpha = 1.57$   
 $v = 0.54 \text{ ()}$   
 $\gamma_c = 1.50 \text{ ()}$   
 $f_{cd} = 16.67 \text{ (MPa)}$   
 $v_{Rdmax} = 3.60 \text{ (MPa)}$

$v_{Rdc} = 0.30$   
 $v_{min} = 0.32$   
 $v_{Eds} = 0.00$   
 $c_{Rdc} = 0.12$   
 $k = 1.49$   
 $\rho_L = 0.00 \text{ ()}$   
 $v_{lim} = 0.32 \text{ (MPa)}$   
 $v = ##### \text{ (MPa)}$   
 $A = 0.000 \text{ (m}^2\text{)}$

#### 1.5.4. Deflection

$|f(+)| = 0.00 \text{ (cm)} \leq f_{dop(+)} = 1.10 \text{ (cm)}$   
 $|f(-)| = 0.00 \text{ (cm)} \leq f_{dop(-)} = 1.10 \text{ (cm)}$

#### 1.5.5. Cracking

upper layer  
 $a_x = 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)}$

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$a_y = 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)}$   
 lower layer  
 $a_x = 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)}$   
 $a_y = 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)}$

### 3. Results - detailing

List of solutions:

Reinforcement: bars

Solution no.	Reinforcement range Diameter / Weight	Total weight (kG)
1	-	204.90

Results for the solution no. 1

Reinforcement zones

Bottom reinforcement

Name	coordinates				Provided reinforcement $\phi$ (mm) / (cm)	At (cm <sup>2</sup> /m)
	x1	y1	x2	y2		
1/1- Ax Main	0.000	-2.100	2.100	0.000	16.0 / 12.0	15.34 <
	Ar (cm <sup>2</sup> /m)					16.76
1/2- Ay Perpendicular	0.000	-2.100	2.100	0.000	16.0 / 12.0	15.69 <
	Ar (cm <sup>2</sup> /m)					16.76

Top reinforcement

Name	coordinates				Provided reinforcement $\phi$ (mm) / (cm)	At (cm <sup>2</sup> /m)
	x1	y1	x2	y2		
1/3+ Ax Main	0.000	-2.100	2.100	0.000	14.0 / 12.0	11.41 <
	Ar (cm <sup>2</sup> /m)					12.83
1/4+ Ay Perpendicular	0.000	-2.100	2.100	0.000	14.0 / 12.0	11.25 <
	Ar (cm <sup>2</sup> /m)					12.83

### 4. Material survey

- Concrete volume = 3.969 (m<sup>3</sup>)
- Formwork = 4.410 (m<sup>2</sup>)
- Slab circumference = 8.400 (m)
- Area of openings = 0.000 (m<sup>2</sup>)

- Steel B500B
- Total weight = 191.46 (kG)
- Density = 48.24 (kG/m<sup>3</sup>)
- Average diameter = 15.0 (mm)
- Survey according to diameters:

Diameter	Length (m)	Number of identical elements:
14	2.020	34
16	2.020	34

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	221	251	0

**Išvada : laikomoji galia pakankama**

### **1.12.5. Pastato dalies su rūsiu polių po sienomis parinkimas**

Projektuojami poliniai pamatai po pastato dalies su rūsiu sienomis, kurių ACC derinio apkrova neviršija . Poliai 500mm skersmens. Poliai remiami į abs. Alt +35.23 (IGS 5, IGS6, IGS7) polių geometrinis ilgis 3,9m. Mažiausias grunto kūginis stipris 3m gylyje nuo poliaus pado pagal GR. Nr. 4  $q_c=2,5\text{MPa}$ ; šoninė trintis pagal GR Nr. 1  $f_s=50-90\text{ kPa}$  pagal sluoksnius.

Reakcijos po sienomis pateiktos reakcijų plane.

Gniuždomo poliaus laikomosios galios skaičiavimas:

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**Veikiančios jėgos:**

$$N_{Ed,1} := 267 \cdot 10^{-3} = 0.267 \quad \text{MN}$$

$$N_{Ed,2} := 215 \cdot 10^{-3} = 0.215 \quad \text{MN}$$

$$N_{Ed,3} := 465 \cdot 10^{-3} = 0.465 \quad \text{MN}$$

**Daliniai koeficientai:**

Daliniai medžiagų patikimumo koef. atvejui M1:

$$\gamma_{\varphi,1} := 1$$

$$\gamma_{c,1} := 1$$

$$\gamma_{cu,1} := 1$$

$$\gamma_{qu,1} := 1$$

$$\gamma_{\gamma,1} := 1$$

Daliniai medžiagų patikimumo koef. atvejui M2:

$$\gamma_{\varphi,2} := 1.25$$

$$\gamma_{c,2} := 1.25$$

$$\gamma_{cu,2} := 1.4$$

$$\gamma_{qu,2} := 1.4$$

$$\gamma_{\gamma,2} := 1$$

Daliniai koeficientai CFA polių pagrindo atsparumui

	R1	R2	R3	R4
Polio pado laikomoji galia	$\gamma_{b1} := 1.1$	$\gamma_{b2} := 1.1$	$\gamma_{b3} := 1.0$	$\gamma_{b4} := 1.45$
Polio kamieno šoninio paviršiaus alikomoji galia gniuždymui	$\gamma_{s1} := 1.0$	$\gamma_{s2} := 1.1$	$\gamma_{s3} := 1.0$	$\gamma_{s4} := 1.30$
Polio pado suminis atsparumas gniuždymui	$\gamma_{t1} := 1.1$	$\gamma_{t2} := 1.1$	$\gamma_{t3} := 1.0$	$\gamma_{t4} := 1.40$
Polio laikomoji galia tempimui	$\gamma_{st1} := 1.25$	$\gamma_{st2} := 1.15$	$\gamma_{st3} := 1.1$	$\gamma_{st4} := 1.60$
	$\alpha_b := 0.5$			

**Grunto rodikliai:**  $\xi_3 := 1.4$ 

$$\rho := 21 \frac{\text{kN}}{\text{m}^3}$$

$$q_c := 2.5 \quad \text{MPa}$$

$$f_{t1} := 0.05 \quad \text{MPa} \quad f_{t2} := 0.09 \quad \text{MPa} \quad f_{t3} := 0.06 \quad \text{MPa} \quad f_{t4} := 0. \quad \text{MPa} \quad f_{t5} := 0.0 \quad \text{MPa} \quad f_{t6} := 0.0 \quad \text{MPa} \quad f_{t7} := 0.0 \quad \text{MPa}$$

**Geometriniai rodikliai:**  $f_{t8} := 0.0 \quad \text{MPa}$ 

$$h_1 := 0. \quad \text{m} \quad h_2 := 2.9 \quad \text{m} \quad h_3 := 1.0 \quad \text{m} \quad h_4 := 0. \quad \text{m} \quad h_5 := 0. \quad \text{m} \quad h_6 := 0 \quad \text{m} \quad h_7 := 0.0 \quad \text{m} \quad h_8 := 0.0 \quad \text{m}$$

$$d := 0.5 \quad \text{m}$$

$$A_p := \frac{\pi \cdot d^2}{4} = 0.196 \quad \text{m}^2$$

$$A_{s1} := \pi \cdot d \cdot h_1 = 0 \quad \text{m}^2 \quad A_{s2} := \pi \cdot d \cdot h_2 = 4.555 \quad \text{m}^2 \quad A_{s3} := \pi \cdot d \cdot h_3 = 1.571 \quad \text{m}^2$$

$$A_{s4} := \pi \cdot d \cdot h_4 = 0 \quad \text{m}^2 \quad A_{s5} := \pi \cdot d \cdot h_5 = 0 \quad \text{m}^2 \quad A_{s6} := \pi \cdot d \cdot h_6 = 0 \quad \text{m}^2$$

$$A_{s7} := \pi \cdot d \cdot h_7 = 0 \quad \text{m}^2 \quad A_{s8} := \pi \cdot d \cdot h_8 = 0 \quad \text{m}^2$$

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### Pirmas projektavimo atvejis: A1+M1+R1

$$q_b := \alpha_b \cdot q_c = 1.25 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.245 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.504$$

$$R_{c,cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 0.727 \quad \text{MN}$$

$$R_{c,k1} := \frac{R_{c,cal1}}{\xi_3} = 0.52 \quad \text{MN}$$

$$R_{c,d1} := \frac{R_{c,k1}}{\gamma_{t1}} = 0.472 \quad \text{MN}$$

$$\frac{N_{Ed,1}}{R_{c,d1}} = 0.565$$

### Antras projektavimo atvejis: A2+M1+R4

$$R_{c,cal2} := \frac{R_b}{\gamma_{b4}} + \frac{R_s}{\gamma_{s4}} = 0.557 \quad \text{MN}$$

$$R_{c,k2} := \frac{R_{c,cal2}}{\xi_3} = 0.398 \quad \text{MN}$$

$$R_{c,d2} := \frac{R_{c,k2}}{\gamma_{t4}} = 0.284 \quad \text{MN}$$

$$\frac{N_{Ed,2}}{R_{c,d2}} = 0.756$$

### ACC projektavimo atvejis: A1+M1+R1

$$q_b := \alpha_b \cdot q_c = 1.25 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.245 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.504$$

$$R_{c,cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 0.727 \quad \text{MN}$$

$$R_{c,k1} := \frac{R_{c,cal1}}{\xi_3} = 0.52 \quad \text{MN}$$

$$R_{c,d1} := \frac{R_{c,k1}}{\gamma_{t1}} = 0.472 \quad \text{MN}$$

$$\frac{N_{Ed,3}}{R_{c,d1}} = 0.985$$

Išvada: gniuždomoji galia pakankama

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### Lenkiamo poliaus laikomosios galios skaičiavimas:

$$q_c := 2500 \text{ kPa} \quad f_{si1} := 50 \text{ kPa} \quad f_{si2} := 90 \quad f_{si3} := 60 \quad f_{si4} := 0 \quad f_{si5} := 0 \quad f_{si6} := 0 \quad f_{si7} := 0 \quad f_{si8} := 0$$

$$N := 180 \text{ kN} \quad h_1 := 0 \quad h_2 := 2.9 \quad h_3 := 1.0 \quad h_4 := 0.0 \quad h_5 := 0.0 \quad h_6 := 0.0 \quad h_7 := 0.0 \quad h_8 := 0.0$$

$$M_d := 0.1 \text{ kNm}$$

$$Q_d := 53 \text{ kN} \quad \text{Nevertinamo sluoksnio gylis:} \quad \text{Max leistinas nuosėdis:}$$

$$d := 0.5 \text{ m} \quad h_s := 1.1 \text{ m} \quad s := 0.12 \text{ m}$$

Poliaus geometrinis ilgis:

Grafiko Rsn numeris pagal santyki:

$$h := 3.90 \text{ m}$$

$$n := 100 \cdot \frac{s}{d} = 24 \%$$

Pagrindo stiprumas po pamato padu:

iš 6.22, 6.23 grafikų

$$R_{s2} := 0.12 \cdot q_c \cdot 10^{-3} + 0.24 = 0.54 \text{ MPa}$$

$$A_b := 3.14 \cdot \frac{(d^2)}{4} = 0.196$$

Trinties jėga prie pamato šonų:

$$F_f := 3.14 \cdot d \cdot \left( h_1 \cdot \frac{f_{si1}}{3} + h_2 \cdot \frac{f_{si2}}{3} + h_3 \cdot \frac{f_{si3}}{3} + h_4 \cdot \frac{f_{si4}}{3} + h_5 \cdot \frac{f_{si5}}{3} + h_6 \cdot \frac{f_{si6}}{3} + h_7 \cdot \frac{f_{si7}}{3} + h_8 \cdot \frac{f_{si8}}{3} \right) = 167.99 \text{ kN}$$

Slėgis po pamato padu:

$$p := \frac{(N - F_f)}{A_b} = 61.197 \text{ kPa} \quad \text{ne daugiau nei } R_{s2}$$

### Pasisukimas ir pasislinkimas

Skaičiuojamasis pamato gylis:

$$d_d := h_1 + h_2 + h_3 + h_4 + h_5 + h_6 + h_7 + h_8 = 3.9 \text{ m}$$

Horizontalios jėgos nuo momento aukštis virš pamato

$$h_m := \frac{M_d}{Q_d} = 1.887 \times 10^{-3}$$

Horizontalios jėgos pridėties taško skaičiuojamasis aukštis:

$$h_d := h - d_d + h_m = 1.887 \times 10^{-3} \text{ m}$$

$$\eta := \frac{(1.5 \cdot h_d + 0.5 \cdot d_d)}{1.5 \cdot h_d + d_d} = 0.5 \quad \mu := 0.5$$

kai  $F_f < N$ :

Pamato posūkiui besipriešinančių jėgų atstojamoji:

$$F_Q := \frac{\left[ (N - F_f) \cdot \mu \cdot d_d + 1.5 \cdot F_f \cdot \frac{d}{\pi} \right]}{2 \cdot (1.5 \cdot h_d + d_d)} = 8.138 \text{ kN}$$

$$\text{pamatas} := \text{if}[F_Q \geq 0.5 \cdot (\eta + 1) \cdot Q_d, \text{"nepasisuka"}, \text{"pasisuka"}] = \text{"pasisuka"}$$

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Pamato posukio centro gylis nuo skaičiuojamojo pagrindo paviršiaus  $z_0$ :

$$z_0 := \frac{d_d}{1 + \frac{(Q_d \cdot \eta - F_Q)}{Q_d - F_Q}} = 2.766 \quad \text{m}$$

kadangi := if( $z_0 < d_d$ , "u formule tinka", "netinka") = "u formule tinka"

$$R_{s0.5} := 0.04q_c \cdot 10^{-3} + 0.1 = 0.2$$

Horizontalus pagrindo standumo modulis:

$$C_h := \frac{R_{s0.5} \cdot 10^3}{0.005 d} = 8 \times 10^4$$

$$u_u := 0.01 \cdot d = 5 \times 10^{-3} \quad \text{m}$$

$$i_u := 0.005 \quad \text{m}$$

$$u := \left[ 4Q_d \frac{(1.5h_d + d_d)}{C_h \cdot d \cdot d_d^2} \right] \cdot \left[ 1 + \frac{(h - d_d)}{z_0} \right] \cdot \left( 1 - \frac{F_Q}{Q_d} \right) = 1.151 \times 10^{-3} \quad \text{m}$$

poslinkis := if( $u < u_u$ , "poslinkis leistinas", "poslinkis neleistinas") = "poslinkis leistinas"

$$i := \frac{u}{(z_0 + h - d_d)} = 4.161 \times 10^{-4} \quad \text{m}$$

pasisukimas := if( $i < i_u$ , "pasisukimas leistinas", "pasisukimas neleistinas") = "pasisukimas leistinas"

#### Gylis kuriam e veikia didžiausias lenkimo momentas

Grunto prie pamato šoninio paviršiaus vidutinis stipris:

$$R_f := \frac{F_f}{\pi \cdot d \cdot d_d} = 27.422 \quad \text{kN}$$

Gylis, kuriame veikia didžiausias lenkimo momentas:

$$z_m := z_0 - \sqrt{z_0^2 - \frac{\left( 1 - \frac{d^2 \cdot R_f}{2 \cdot Q_d} \right) \cdot d_d^2 \cdot z_0}{2 \cdot (1.5 \cdot h_d + d_d)}} = 1.151 \quad \text{m}$$

Didžiausias polių veikiantis lenkimo momentas:

$$M := Q_d \cdot (h_d + z_m) - \frac{2 \cdot Q_d}{3 \cdot d_d^2 \cdot z_0} \cdot (1.5 \cdot h_d + d_d) \cdot (3 \cdot z_0 - z_m) \cdot z_m^2 - \frac{d^2}{2} \cdot R_f \cdot z_m = 26.121 \quad \text{kNm}$$

### Išvada: lenkiamoji galia pakankama

#### 1.12.6. Pastato dalies su rūsiu polių po sienomis parinkimas

Projektuojami poliniai pamatai apjungti galvena po pastato dalies su rūsiu sienomis, kurių ACC derinio apkrova neviršija. Galvenos plotis 1,7m, aukštis 0,8m. Poliai 2 vnt. 400mm skersmens 1m ir 0,9m žingsniais. Poliai remiami į abs. Alt +35.23 (IGS 5, IGS6, IGS7) polių geometrinis ilgis 3,9m. Mažiausias grunto kūginis stipris 3m gylyje nuo poliaus pado pagal GR. Nr. 4  $q_c=2,5\text{MPa}$ ; šoninė trintis pagal GR Nr. 1  $f_s=50-90\text{ kPa}$  pagal sluoksnius.

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Reakcijos po sienomis pateiktos reakcijų plane.

Polių reakcijos:

Galvenos matmenys:

$$b := 1.7 \quad \text{m}$$

$$h := 0.8 \quad \text{m}$$

$$l := 1.0 \quad \text{m}$$

Pamato galvenos svoris:

$$N_p := 24 \cdot b \cdot h \cdot l = 32.64 \quad \text{kN}$$

Jėgos pečiai apagal polių išdėstymą:

$$x := 0.6 \quad \text{m}$$

Polių skaičius:

$$n := 2$$

**A1 projektavimo atvejis:**

**Veikiant didžiausiai ašinei jėgai ir skersinei jėgai:**

Pamato viršuje veikiančios jėgos:

$$N_{Ed} := 119 \quad \text{kN}$$

$$M_{Ed,x} := 0.1 \quad \text{kNm}$$

$$M_{Ed,y} := 0.1 \quad \text{kNm}$$

$$V_{Ed,x} := 5 \quad \text{kN}$$

Didžiausia polio ašinė jėga:

$$F_{Ed,1} := \frac{N_{Ed} + N_p}{n} + \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 79.237 \quad \text{kN}$$

Mažiausia polio ašinė jėga:

$$F_{Ed,2} := \frac{N_{Ed} + N_p}{n} - \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 72.403 \quad \text{kN}$$

**A2 projektavimo atvejis:**

**Veikiant didžiausiai ašinei jėgai:**

Pamato viršuje veikiančios jėgos:

$$N_{Ed} := 97 \quad \text{kN}$$

$$M_{Ed,x} := 0.1 \quad \text{kNm}$$

$$M_{Ed,y} := 0.1 \quad \text{kNm}$$

$$V_{Ed,x} := 4 \quad \text{kN}$$

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Didžiausia polio ašinė jėga:

$$F_{Ed,1} := \frac{N_{Ed} + N_p}{n} + \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 67.57 \quad \text{kN}$$

Mažiausia polio ašinė jėga:

$$F_{Ed,2} := \frac{N_{Ed} + N_p}{n} - \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 62.07 \quad \text{kN}$$

**ACC projektavimo atvejis:**

**Veikiant didžiausiai ašinei jėgai/ didžiausiai skersinei jėgai:**

Pamato viršuje veikiančios jėgos:

$$N_{Ed} := 624 \quad \text{kN}$$

$$M_{Ed,x} := 0.1 \quad \text{kNm}$$

$$M_{Ed,y} := 0.1 \quad \text{kNm}$$

$$V_{Ed,w} := 37 \quad \text{kN}$$

Didžiausia polio ašinė jėga:

$$F_{Ed,1} := \frac{N_{Ed} + N_p}{n} + \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 353.07 \quad \text{kN}$$

Mažiausia polio ašinė jėga:

$$F_{Ed,2} := \frac{N_{Ed} + N_p}{n} - \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 303.57 \quad \text{kN}$$

**Išvada: tempiamų polių nėra. Didžiausias gniuždymas A1 atveju 80 kN, didžiausias gniuždymas A2 atveju 68 kN, didžiausias gniuždymas ACC atveju 353 kN. Polių grupės polių laikomoji galia skaičiuojama veikiant šioms apkrovoms.**

Gniuždomo poliaus laikomosios galios skaičiavimas:

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**Veikiančios įrašos:**

$$N_{Ed,1} := 80 \cdot 10^{-3} = 0.08 \quad \text{MN}$$

$$N_{Ed,2} := 68 \cdot 10^{-3} = 0.068 \quad \text{MN}$$

$$N_{Ed,3} := 353 \cdot 10^{-3} = 0.353 \quad \text{MN}$$

**Daliniai koeficientai:**

Daliniai medžiagų patikimumo koef. atvejui M1:

$$\gamma_{\varphi,1} := 1$$

$$\gamma_{c,1} := 1$$

$$\gamma_{cu,1} := 1$$

$$\gamma_{qu,1} := 1$$

$$\gamma_{\gamma,1} := 1$$

Daliniai medžiagų patikimumo koef. atvejui M2:

$$\gamma_{\varphi,2} := 1.25$$

$$\gamma_{c,2} := 1.25$$

$$\gamma_{cu,2} := 1.4$$

$$\gamma_{qu,2} := 1.4$$

$$\gamma_{\gamma,2} := 1$$

Daliniai koeficientai CFA polių pagrindo atsparumui

	R1	R2	R3	R4
Polio pado laikomoji galia	$\gamma_{b1} := 1.1$	$\gamma_{b2} := 1.1$	$\gamma_{b3} := 1.0$	$\gamma_{b4} := 1.45$
Polio kamieno šoninio paviršiaus alikomoji galia gniuždynui	$\gamma_{s1} := 1.0$	$\gamma_{s2} := 1.1$	$\gamma_{s3} := 1.0$	$\gamma_{s4} := 1.30$
Polio pado suminis atsparumas gniuždynui	$\gamma_{t1} := 1.1$	$\gamma_{t2} := 1.1$	$\gamma_{t3} := 1.0$	$\gamma_{t4} := 1.40$
Polio laikomoji galia tempimui	$\gamma_{st1} := 1.25$	$\gamma_{st2} := 1.15$	$\gamma_{st3} := 1.1$	$\gamma_{st4} := 1.60$

$$\alpha_b := 0.5$$

**Grunto rodikliai:**  $\xi_3 := 1.4$ 

$$\rho := 21 \frac{\text{kN}}{\text{m}^3}$$

$$q_c := 2.5 \quad \text{MPa}$$

$$f_{s1} := 0.05 \quad \text{MPa} \quad f_{s2} := 0.09 \quad \text{MPa} \quad f_{s3} := 0.06 \quad \text{MPa} \quad f_{s4} := 0. \quad \text{MPa} \quad f_{s5} := 0.0 \quad \text{MPa} \quad f_{s6} := 0.0 \quad \text{MPa} \quad f_{s7} := 0.0 \quad \text{MPa}$$

**Geometriniai rodikliai:**  $f_{s8} := 0.0 \quad \text{MPa}$ 

$$h_1 := 0. \quad \text{m} \quad h_2 := 2.9 \quad \text{m} \quad h_3 := 1.0 \quad \text{m} \quad h_4 := 0. \quad \text{m} \quad h_5 := 0. \quad \text{m} \quad h_6 := 0 \quad \text{m} \quad h_7 := 0.0 \quad \text{m} \quad h_8 := 0.0 \quad \text{m}$$

$$d := 0.4 \quad \text{m}$$

$$A_p := \frac{\pi \cdot d^2}{4} = 0.126 \quad \text{m}^2$$

$$A_{s1} := \pi \cdot d \cdot h_1 = 0 \quad \text{m}^2$$

$$A_{s4} := \pi \cdot d \cdot h_4 = 0 \quad \text{m}^2$$

$$A_{s7} := \pi \cdot d \cdot h_7 = 0 \quad \text{m}^2$$

$$A_{s2} := \pi \cdot d \cdot h_2 = 3.644 \quad \text{m}^2$$

$$A_{s5} := \pi \cdot d \cdot h_5 = 0 \quad \text{m}^2$$

$$A_{s8} := \pi \cdot d \cdot h_8 = 0 \quad \text{m}^2$$

$$A_{s3} := \pi \cdot d \cdot h_3 = 1.257 \quad \text{m}^2$$

$$A_{s6} := \pi \cdot d \cdot h_6 = 0 \quad \text{m}^2$$

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### Pirmas projektavimo atvejis: A1+M1+R1

$$q_b := \alpha_b \cdot q_c = 1.25 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.157 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.403$$

$$R_{c,cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 0.546 \quad \text{MN}$$

$$R_{c,k1} := \frac{R_{c,cal1}}{\xi_3} = 0.39 \quad \text{MN}$$

$$R_{c,d1} := \frac{R_{c,k1}}{\gamma_{t1}} = 0.355 \quad \text{MN}$$

$$\frac{N_{Ed,1}}{R_{c,d1}} = 0.226$$

### Antras projektavimo atvejis: A2+M1+R4

$$R_{c,cal2} := \frac{R_b}{\gamma_{b4}} + \frac{R_s}{\gamma_{s4}} = 0.419 \quad \text{MN}$$

$$R_{c,k2} := \frac{R_{c,cal2}}{\xi_3} = 0.299 \quad \text{MN}$$

$$R_{c,d2} := \frac{R_{c,k2}}{\gamma_{t4}} = 0.214 \quad \text{MN}$$

$$\frac{N_{Ed,2}}{R_{c,d2}} = 0.318$$

### ACC projektavimo atvejis: A1+M1+R1

$$q_b := \alpha_b \cdot q_c = 1.25 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.157 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.403$$

$$R_{c,cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 0.546 \quad \text{MN}$$

$$R_{c,k1} := \frac{R_{c,cal1}}{\xi_3} = 0.39 \quad \text{MN}$$

$$R_{c,d1} := \frac{R_{c,k1}}{\gamma_{t1}} = 0.355 \quad \text{MN}$$

$$\frac{N_{Ed,3}}{R_{c,d1}} = 0.995$$

Išvada: gniuždomoji galia pakankama

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### **1.12.7. Pastato dalies su rūsiu polių po sienomis parinkimas**

Projektuojami poliniai pamatai apjungti galvena po pastato dalies su rūsiu sienomis, kurių ACC derinio apkrova neviršija . Galvenos plotis 2,5m, aukštis 0,6m. Poliai 4 vnt. 600mm skersmens 1,3m žingsniu. Poliai remiami į abs. Alt +35.23 (IGS 5, IGS6, IGS7) polių geometrinis ilgis 3,9m. Mažiausias grunto kūginis stipris 3m gylyje nuo poliaus pado pagal GR. Nr. 4  $q_c=2,5\text{MPa}$ ; šoninė trintis pagal GR Nr. 1  $f_s=50-90\text{ kPa}$  pagal sluoksnius.

Reakcijos po sienomis pateiktos reakcijų plane.

Polių reakcijos:

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Galvenos matmenys:

$$b := 2.5 \text{ m}$$

$$h := 0.8 \text{ m}$$

$$l_w := 1.3 \text{ m}$$

Pamato galvenos svoris:

$$N_p := 24 \cdot b \cdot h \cdot l = 62.4 \text{ kN}$$

Jėgos pečiai apagal polių išdėstymą:

$$x := 0.9 \text{ m}$$

Polių skaičius:

$$n := 2$$

**A1 projektavimo atvejis:**

**Veikiant didžiausiai ašinei jėgai:**

Pamato viršuje veikiančios įrašos:

$$N_{Ed} := 287 \text{ kN}$$

$$M_{Ed,x} := 0.1 \text{ kNm}$$

$$M_{Ed,y} := 0.1 \text{ kNm}$$

$$V_{Ed,x} := 6 \text{ kN}$$

Didžiausia polio ašinė jėga:

$$F_{Ed,1} := \frac{N_{Ed} + N_p}{n} + \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 177.422 \text{ kN}$$

Mažiausia polio ašinė jėga:

$$F_{Ed,2} := \frac{N_{Ed} + N_p}{n} - \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 171.978 \text{ kN}$$

**A2 projektavimo atvejis:**

**Veikiant didžiausiai ašinei jėgai:**

Pamato viršuje veikiančios įrašos:

$$N_{Ed} := 232 \text{ kN}$$

$$M_{Ed,x} := 0.1 \text{ kNm}$$

$$M_{Ed,y} := 0.1 \text{ kNm}$$

$$V_{Ed,x} := 4 \text{ kN}$$

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	232	251	0

Didžiausia polio ašinė jėga:

$$F_{Ed,1} := \frac{N_{Ed} + N_p}{n} + \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 149.033 \quad \text{kN}$$

Mažiausia polio ašinė jėga:

$$F_{Ed,2} := \frac{N_{Ed} + N_p}{n} - \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 145.367 \quad \text{kN}$$

**ACC projektavimo atvejis:**

**Veikiant didžiausiai ašinei jėgai/ didžiausiai skersinei jėgai:**

Pamato viršuje veikiančios jėgos:

$$N_{Ed} := 1082 \quad \text{kN}$$

$$M_{Ed,x} := 0.1 \quad \text{kNm}$$

$$M_{Ed,y} := 0.1 \quad \text{kNm}$$

$$V_{Ed,x} := 31 \quad \text{kN}$$

Didžiausia polio ašinė jėga:

$$F_{Ed,1} := \frac{N_{Ed} + N_p}{n} + \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 586.033 \quad \text{kN}$$

Mažiausia polio ašinė jėga:

$$F_{Ed,2} := \frac{N_{Ed} + N_p}{n} - \frac{(M_{Ed,y} + V_{Ed,x} \cdot h) \cdot x}{x^2 + x^2} = 558.367 \quad \text{kN}$$

**Išvada: tempiamų polių nėra. Didžiausias gniuždymas A1 atveju 178 kN, didžiausias gniuždymas A2 atveju 149 kN, didžiausias gniuždymas ACC atveju 586 kN. Polių grupės polių laikomoji galia skaičiuojama veikiant šioms apkrovoms.**

Gniuždomo poliaus laikomosios galios skaičiavimas:

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**Veikiančios įrašos:**

$$N_{Ed,1} := 178 \cdot 10^{-3} = 0.178 \quad \text{MN}$$

$$N_{Ed,2} := 149 \cdot 10^{-3} = 0.149 \quad \text{MN}$$

$$N_{Ed,3} := 586 \cdot 10^{-3} = 0.586 \quad \text{MN}$$

**Daliniai koeficientai:**

Daliniai medžiagų patikimumo koef. atvejui M1:

$$\gamma_{\varphi,1} := 1$$

$$\gamma_{c,1} := 1$$

$$\gamma_{cu,1} := 1$$

$$\gamma_{qu,1} := 1$$

$$\gamma_{\gamma,1} := 1$$

Daliniai medžiagų patikimumo koef. atvejui M2:

$$\gamma_{\varphi,2} := 1.25$$

$$\gamma_{c,2} := 1.25$$

$$\gamma_{cu,2} := 1.4$$

$$\gamma_{qu,2} := 1.4$$

$$\gamma_{\gamma,2} := 1$$

Daliniai koeficientai CFA polių pagrindo atsparumui

	R1	R2	R3	R4
Polio pado laikomoji galia	$\gamma_{b1} := 1.1$	$\gamma_{b2} := 1.1$	$\gamma_{b3} := 1.0$	$\gamma_{b4} := 1.45$
Polio kamieno šoninio paviršiaus alikomoji galia gniuždymui	$\gamma_{s1} := 1.0$	$\gamma_{s2} := 1.1$	$\gamma_{s3} := 1.0$	$\gamma_{s4} := 1.30$
Polio pado suminis atsparumas gniuždymui	$\gamma_{t1} := 1.1$	$\gamma_{t2} := 1.1$	$\gamma_{t3} := 1.0$	$\gamma_{t4} := 1.40$
Polio laikomoji galia tempimui	$\gamma_{st1} := 1.25$	$\gamma_{st2} := 1.15$	$\gamma_{st3} := 1.1$	$\gamma_{st4} := 1.60$

$$\alpha_b := 0.5$$

**Grunto rodikliai:**  $\xi_3 := 1.4$ 

$$\rho := 21 \frac{\text{kN}}{\text{m}^3}$$

$$q_c := 2.5 \quad \text{MPa}$$

$$f_{s1} := 0.05 \quad \text{MPa} \quad f_{s2} := 0.09 \quad \text{MPa} \quad f_{s3} := 0.06 \quad \text{MPa} \quad f_{s4} := 0. \quad \text{MPa} \quad f_{s5} := 0.0 \quad \text{MPa} \quad f_{s6} := 0.0 \quad \text{MPa} \quad f_{s7} := 0.0 \quad \text{MPa}$$

**Geometriniai rodikliai:**  $f_{s8} := 0.0 \quad \text{MPa}$ 

$$h_1 := 0. \quad \text{m} \quad h_2 := 2.9 \quad \text{m} \quad h_3 := 1.0 \quad \text{m} \quad h_4 := 0. \quad \text{m} \quad h_5 := 0. \quad \text{m} \quad h_6 := 0 \quad \text{m} \quad h_7 := 0.0 \quad \text{m} \quad h_8 := 0.0 \quad \text{m}$$

$$d := 0.6 \quad \text{m}$$

$$A_p := \frac{\pi \cdot d^2}{4} = 0.283 \quad \text{m}^2$$

$$A_{s1} := \pi \cdot d \cdot h_1 = 0 \quad \text{m}^2 \quad A_{s2} := \pi \cdot d \cdot h_2 = 5.466 \quad \text{m}^2 \quad A_{s3} := \pi \cdot d \cdot h_3 = 1.885 \quad \text{m}^2$$

$$A_{s4} := \pi \cdot d \cdot h_4 = 0 \quad \text{m}^2 \quad A_{s5} := \pi \cdot d \cdot h_5 = 0 \quad \text{m}^2 \quad A_{s6} := \pi \cdot d \cdot h_6 = 0 \quad \text{m}^2$$

$$A_{s7} := \pi \cdot d \cdot h_7 = 0 \quad \text{m}^2 \quad A_{s8} := \pi \cdot d \cdot h_8 = 0 \quad \text{m}^2$$

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	234	251	0

### Pirmas projektavimo atvejis: A1+M1+R1

$$q_b := \alpha_b \cdot q_c = 1.25 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.353 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.605$$

$$R_{c.cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 0.926 \quad \text{MN}$$

$$R_{c.k1} := \frac{R_{c.cal1}}{\xi_3} = 0.662 \quad \text{MN}$$

$$R_{c.d1} := \frac{R_{c.k1}}{\gamma_{t1}} = 0.602 \quad \text{MN}$$

$$\frac{N_{Ed.1}}{R_{c.d1}} = 0.296$$

### Antras projektavimo atvejis: A2+M1+R4

$$R_{c.cal2} := \frac{R_b}{\gamma_{b4}} + \frac{R_s}{\gamma_{s4}} = 0.709 \quad \text{MN}$$

$$R_{c.k2} := \frac{R_{c.cal2}}{\xi_3} = 0.507 \quad \text{MN}$$

$$R_{c.d2} := \frac{R_{c.k2}}{\gamma_{t4}} = 0.362 \quad \text{MN}$$

$$\frac{N_{Ed.2}}{R_{c.d2}} = 0.412$$

### ACC projektavimo atvejis: A1+M1+R1

$$q_{b,acc} := \alpha_b \cdot q_c = 1.25 \quad \text{MPa}$$

$$R_{b,acc} := q_b \cdot A_p = 0.353 \quad \text{MN}$$

$$R_{s,acc} := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.605$$

$$R_{c.cal1,acc} := \frac{R_{b,acc}}{\gamma_{b1}} + \frac{R_{s,acc}}{\gamma_{s1}} = 0.926 \quad \text{MN}$$

$$R_{c.k1,acc} := \frac{R_{c.cal1,acc}}{\xi_3} = 0.662 \quad \text{MN}$$

$$R_{c.d1,acc} := \frac{R_{c.k1,acc}}{\gamma_{t1}} = 0.602 \quad \text{MN}$$

$$\frac{N_{Ed.3}}{R_{c.d1}} = 0.974$$

Išvada: gniuždomoji galia pakankama

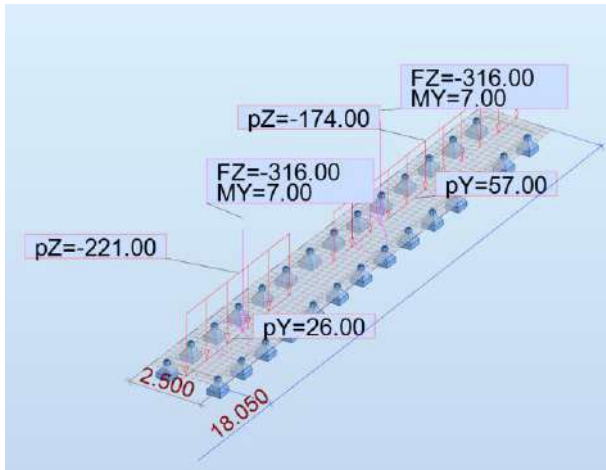
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Galvenos po siena armavimo skaičiavimas.

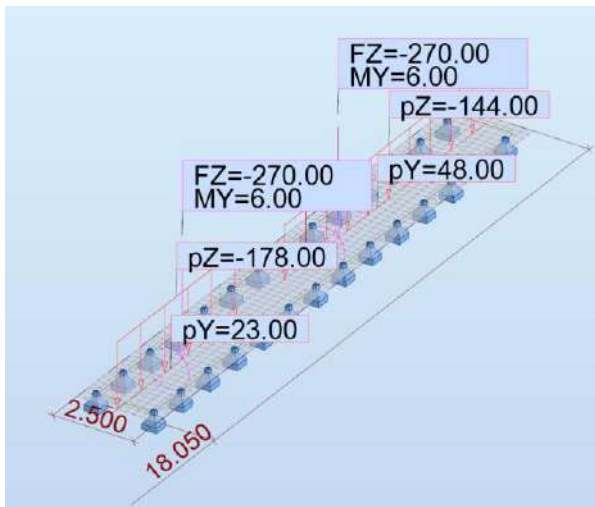
Galvenos atramos – lankstai ties polių vietomis.

Galvenos skaičiuojamoji schema su veikiančiomis apkrovomis.

A1 derinys:

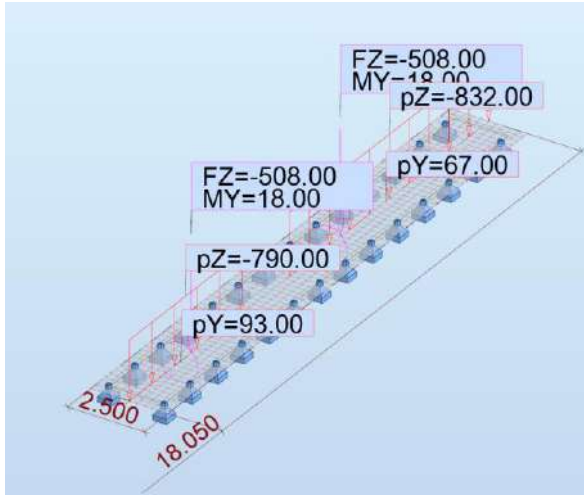


A2 derinys:



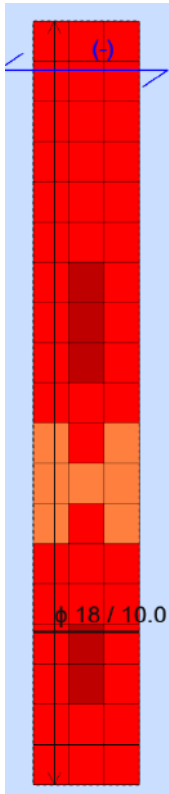
Ypatingųjų poveikių derinys:

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	236	251	0



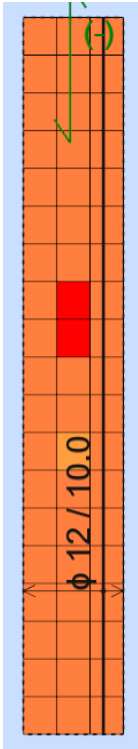
Reikalingas armavimas.

Apatinis armavimas X kryptimi:

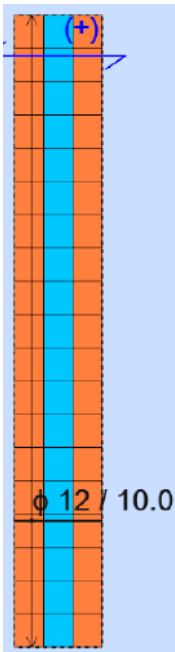


Apatinis armavimas Y kryptimi:

	Lapas	Lapų	Laida
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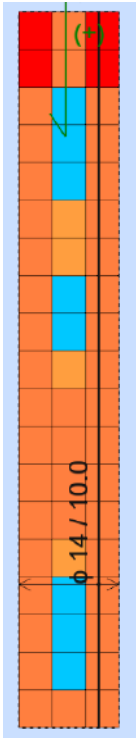


Viršutinis armavimas X kryptimi:



Viršutinis armavimas Y kryptimi:

	Lapas	Lapų	Laida
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## 1. Slab: Slab1 - Panel no. 1

### 1.1. Reinforcement:

- Type : galvena
- Main reinforcement direction : 0°
- Main reinforcement grade : B500B; Characteristic strength = 500.00 MPa  
Horizontal branch of the stress-strain diagram
- Ductility class : B
- Bar diameters bottom d1 = 1.2 (cm) d2 = 1.2 (cm)  
top d1 = 1.2 (cm) d2 = 1.2 (cm)
- Cover bottom c1 = 4.0 (cm)  
top c2 = 4.0 (cm)
- Cover deviations Cdev = 1.0(cm), Cdur = 0.0(cm)

### 1.2. Concrete

- Class : C25/30; Characteristic strength = 25.00 MPa  
Rectangular stress distribution [3.1.7(3)]
- Density : 2501.36 (kG/m3)
- Concrete creep coefficient : 1.41
- Cement class : N

### 1.3. Hypothesis

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Method of reinforcement area calculations : analytical
- Allowable cracking width : 0.30 (mm)  
- upper layer : 0.30 (mm)  
- lower layer : 1.10 (cm)
- Allowable deflection : 1.10 (cm)
- Verification of punching : no

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- Exposure
    - upper layer : XC2
    - lower layer : XC2
  - Calculation type : simple bending
  - Structure class : S4
- Modified partial coefficients:  
 $a_{cc} = 0.9$  1992-1-1 3.1.6 (1)P

## 1.4. Slab geometry

Thickness 0.600 (m)

### Contour:

edge	beginning		end		length (m)
	x1	y1	x2	y2	
1	0.000	-18.050	2.500	-18.050	2.500
2	2.500	-18.050	2.500	0.000	18.050
3	2.500	0.000	0.000	0.000	2.500
4	0.000	0.000	0.000	-18.050	18.050

### Support:

n°	Name	dimensions (m)	coordinates		edge
			x	y	
1	linear	5.650 / 0.178	1.250	-15.225	—
3	linear	10.000 / 0.178	1.250	-5.000	—

\* - head present

## 1.5. Calculation results:

### 1.5.1. Maximum moments + reinforcement for bending

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Provided reinforcement (cm2/m):	11.31	25.45	15.39	11.31
Modified required reinforcement (cm2/m):	7.35	23.63	12.12	9.61
Original required reinforcement (cm2/m):	7.35	23.63	12.12	9.61
Coordinates (m):	0.000;-17.549	1.250;-7.450	0.350;-0.800	1.250;-7.450

### 1.5.2. Maximum moments + reinforcement for bending

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Symbol: required area/provided area				
Ax(+) (cm2/m)	7.35/11.31	0.00/11.31	7.35/11.31	
Ax(-) (cm2/m)	7.35/25.45	23.63/25.45	7.35/25.45	
Ay(+) (cm2/m)	7.19/15.39	0.00/15.39	12.12/15.39	
Ay(-) (cm2/m)	7.19/11.31	9.61/11.31	0.00/11.31	

### ULS

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Mxx (kN*m/m)	23.89	-522.48	146.47	-522.48
Myy (kN*m/m)	29.44	-216.54	271.18	-216.54
Mxy (kN*m/m)	4.99	-0.52	1.19	-0.52
Nxx (kN/m)	4.90	-0.53	0.63	-0.53
Nyy (kN/m)	27.60	2.94	-0.49	2.94
Nxy (kN/m)	9.71	0.00	25.68	0.00
Coordinates (m)	0.000;-17.549	1.250;-7.450	0.350;-0.800	1.250;-7.450
Coordinates* (m)	0.000;0.501;0.000	1.250;10.600;0.000	0.350;17.250;0.000	1.250;10.600;0.000

\* - Coordinates in the structure global coordinate system

#### 1.5.4. Deflection

$|f(+)| = 0.00 \text{ (cm)} \leq f_{dop}(+) = 1.10 \text{ (cm)}$   
 $|f(-)| = 0.00 \text{ (cm)} \leq f_{dop}(-) = 1.10 \text{ (cm)}$

#### 1.5.5. Cracking

upper layer

$a_x = 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)}$   
 $a_y = 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)}$

lower layer

$a_x = 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)}$   
 $a_y = 0.00 \text{ (mm)} \leq a_{dop} = 0.30 \text{ (mm)}$

### 3. Results - detailing

List of solutions:

Reinforcement: bars

Solution no.	Reinforcement range Diameter / Weight	Total weight (kG)
1	-	2248.73

Results for the solution no. 1

Reinforcement zones

Bottom reinforcement

Name	coordinates				Provided reinforcement At	
	x1	y1	x2	y2	$\phi$ (mm) / (cm)	(cm <sup>2</sup> /m)
1/1- Ax Main	0.000	-18.050	2.500	0.000	18.0 / 10.0	23.63 <
1/2- Ay Perpendicular	0.000	-18.050	2.500	0.000	12.0 / 10.0	9.61 <

Top reinforcement

Name	coordinates				Provided reinforcement At	
	x1	y1	x2	y2	$\phi$ (mm) / (cm)	(cm <sup>2</sup> /m)
1/3+ Ax Main	0.000	-18.050	2.500	0.000	12.0 / 10.0	7.35 <
1/4+ Ay Perpendicular	0.000	-18.050	2.500	0.000	14.0 / 10.0	12.12 <

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	241	251	0

## 4. Material survey

- Concrete volume = 27.075 (m<sup>3</sup>)
- Formwork = 45.125 (m<sup>2</sup>)
- Slab circumference = 41.100 (m)
- Area of openings = 0.000 (m<sup>2</sup>)

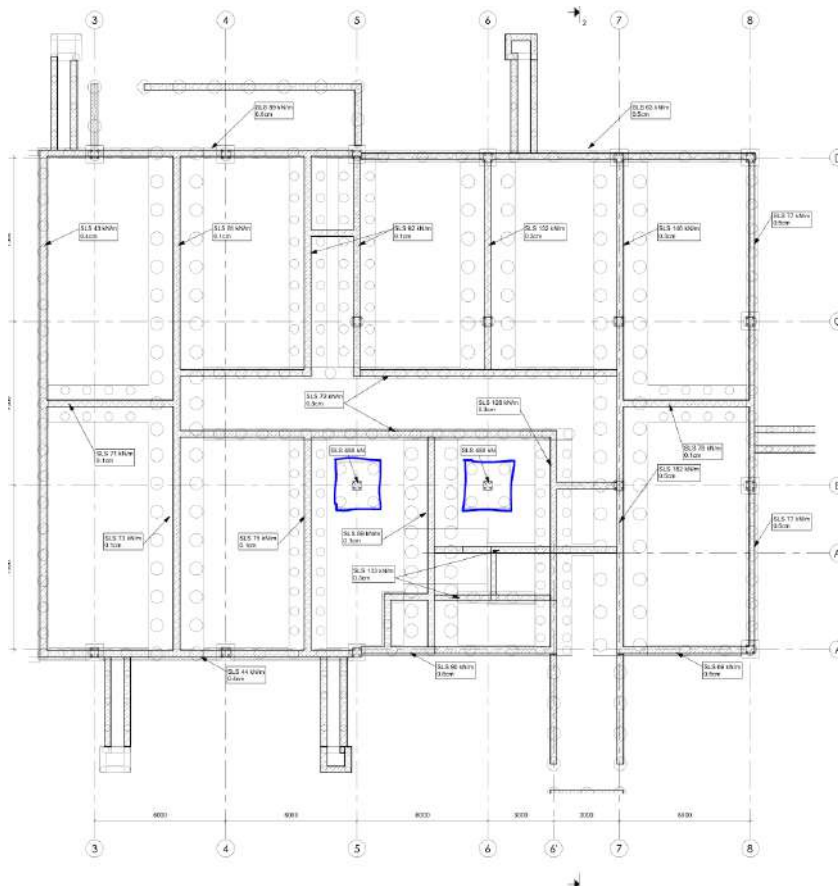
- Steel B500B
- Total weight = 2226.94 (kG)
- Density = 82.25 (kG/m<sup>3</sup>)
- Average diameter = 14.0 (mm)
- Survey according to diameters:

Diameter	Length (m)	Number of identical elements:
12	2.420	180
12	9.225	50
14	9.265	50
18	2.420	180

**Išvada: laikomoji galia pakankama**

### 1.12.8. Juostinių polinių pamatų nuosėdžių skaičiavimai

Skaičiuojamas nuosėdis pamato po kolona nesujungta su rūšio siena su didžiausia tinkamumo ribinio būvio apkrova 448kN. Pamato vieta plane:



IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	242	251	0

Sąlyginis pamato pado plotis ir ilgis nustatomi pagal šias formules:

$$B_s = (m-1)a + D + 2 \cdot l \cdot \operatorname{tg} \varphi'_{dm},$$

$$L_s = (m-1)a + D + 2 \cdot l \cdot \operatorname{tg} \varphi'_{dm},$$

Polis remiamas į molinius gruntus, todėl vidinis trinties kampas  $\varphi$  imamas 0.

Ned	448	kN		Polių eilių skaičius B kryptimi mB	2	vnt
B	2	m		Polių eilių skaičius L kryptimi mL	2	vnt
L	2	m		Atstumas tarp polių ašių B kryptimi aB	1.5	m
A	4	m <sup>2</sup>		Atstumas tarp polių ašių L kryptimi aL	1.5	m
L1	1	m		Polio skersmuo	0.5	m
B1	1	m		Grunto vidinis trinties kampas	0	
				Polių skaičius n	4	vnt
				Poliaus ilgis l	3.2	m
				Grunto vidinis trinties kampas $\varphi$	0	

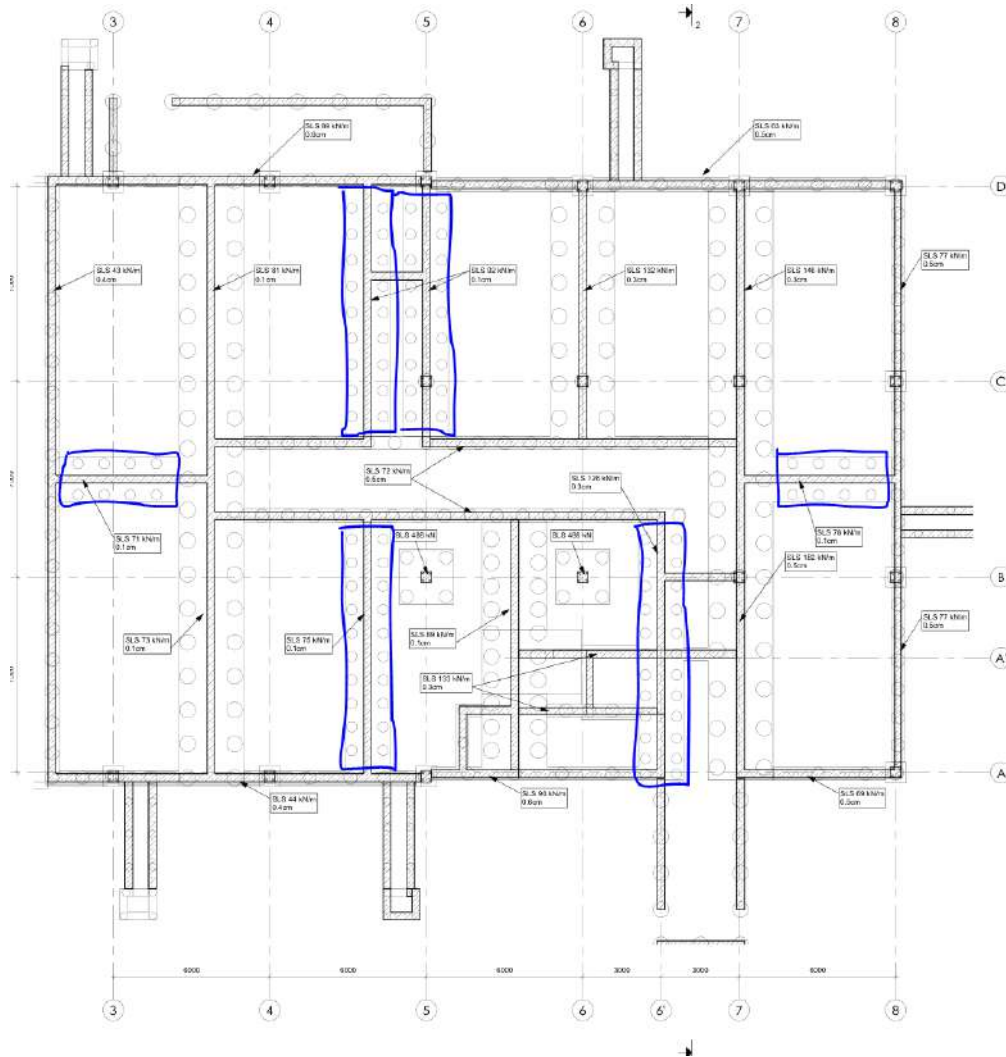
Eil. Nr.	d, m	$\gamma$ , kN/m <sup>3</sup>	$\sigma_{zg}$ , kPa	$0,2\sigma_{zg}$ , kPa	z, m	$\xi=2z/b$	$\eta=l/b$	K	$\sigma_{zp}$ , kPa	$\sigma_{zp,vid}$ , kPa	$H_i$ , m	E, Mpa	$S_i$ , m
1	7.8	22	171.6	34.32	0	0	1	1	112.20		0.4		
2	8.01	22	176.2	35.24	0.21	0.21	1	0.98	109.95	111.1	0.21	13	0.0018
3	8.22	22	180.8	36.17	0.42	0.42	1	0.96	107.71	108.8	0.21	13	0.0018
4	8.58	22	188.8	37.75	0.78	0.78	1	0.799	89.64	98.68	0.36	50	0.0007
5	8.94	22	196.7	39.34	1.14	1.14	1	0.7	78.54	84.09	0.36	50	0.0006
6	9.3	22	204.6	40.92	1.5	1.5	1	0.5	56.10	67.32	0.36	50	0.0005
7	9.66	22	212.5	42.5	1.86	1.86	1	0.410	46.00	51.05	0.36	50	0.0004
8	10.02	22	220.4	<b>44.09</b>	2.22	2.22	1	0.301	<b>33.77</b>	39.89	0.36	50	0.0003
													$\Sigma S_i = 0.006$

**0,2  $\sigma_{zg} > \sigma_{zp}$**

**Išvada: pamato nuosėdis  $0,6\text{cm} < 0,03b = 0,03 \cdot 0,5 = 1,50\text{cm}$ . Sąlyga tenkinama**

Skaičiuojamas nuosėdis vienodos geometrijos pamatų po siena tarp 4 ir 5 ašies tinkamumo ribinio būvio apkrova 75kN/m, 73kN/m ir 92 kN/m, 126kN/m. Pamatų vieta plane:

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	243	251	0



Skaičiuojamas ruožas tarp dviejų polių. Sąlyginis pamato pado plotis ir ilgis nustatomi pagal šias formules:

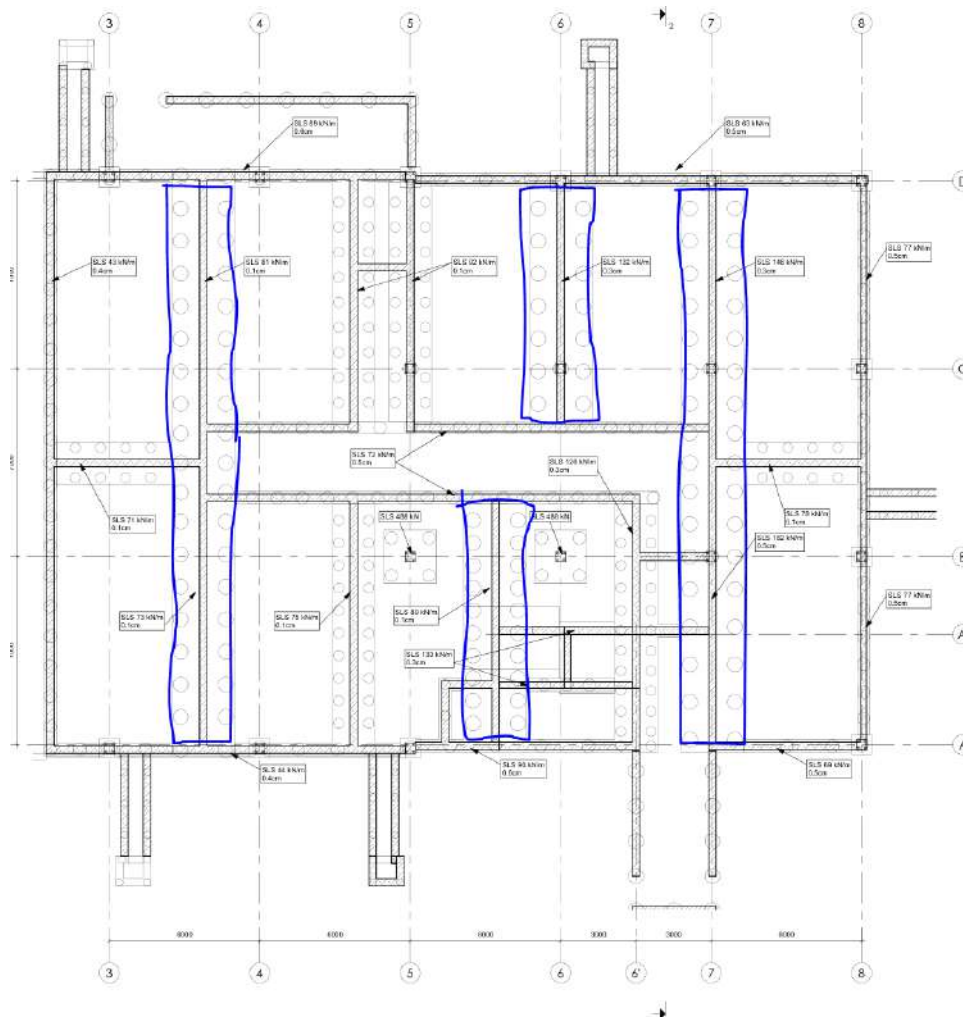
$$B_s = (m - 1)a + D + 2 \cdot l \cdot \operatorname{tg} \varphi'_{dm},$$

$$L_s = (m - 1)a + D + 2 \cdot l \cdot \operatorname{tg} \varphi'_{dm},$$

Polis remiamas į molinius gruntus, todėl vidinis trinties kampas  $\varphi$  imamas 0.

Ned	90	kN	Polių eilių skaičius B kryptimi mB	2	vnt
B	1.6	m	Polių eilių skaičius L kryptimi mL	2	vnt
L	1.4	m	Atstumas tarp polių ašių B kryptimi aB	1.2	m
A	2.24	m <sup>2</sup>	Atstumas tarp polių ašių L kryptimi aL	1	m
L1	0.7	m	Polio skersmuo	0.4	m
B1	0.8	m	Grunto vidinis trinties kampas	0	
			Polio skaičius n	4	vnt
			Poliaus ilgis l	3.5	m
			Grunto vidinis trinties kampas $\phi$	0	





Skaičiuojamas ruožas tarp dviejų polių. Sąlyginis pamato pado plotis ir ilgis nustatomi pagal šias formules:

$$B_s = (m-1)a + D + 2 \cdot l \cdot \operatorname{tg} \varphi'_{dm},$$

$$L_s = (m-1)a + D + 2 \cdot l \cdot \operatorname{tg} \varphi'_{dm},$$

Polis remiamas į molinius gruntuos, todėl vidinis trinties kampas  $\varphi$  imamas 0.

Ned	346	kN	Polių eilių skičias B kryptimi mB	2	vnt
B	2.4	m	Polių eilių skičias L kryptimi mL	2	vnt
L	1.9	m	Atstumas tarp polių ašii B kryptimi aB	1.8	m
A	4.56	m <sup>2</sup>	Atstumas tarp polių ašii L kryptimi aL	1.3	m
L1	0.95	m	Polio skersmuo	0.6	m
B1	1.2	m	Grunto vidinis trinties kampas	0	
			Polių skičias n	4	vnt
			Poliaus ilgis l	3.5	m
			Grunto vidinis trinties kampas $\varphi$	0	

Eil. Nr.	d,m	$\gamma$ , kN/m <sup>3</sup>	$\sigma_{zg}$ , kPa	$0,2\sigma_{zg}$ , kPa	z,m	$\xi=2z/b$	$\eta=l/b$	K	$\sigma_{zp}$ , kPa	$\sigma_{zp,vid}$ , kPa	$H_i$ m	E, Mpa	$S_i$ m
1	7.8	22	171.6	34.32	0	0	0.792	1	76.13		0.48		
2	8.01	22	176.2	35.24	0.21	0.175	0.792	0.99	75.36	75.74	0.21	13	0.0012
3	8.22	22	180.8	36.17	0.42	0.35	0.792	0.97	73.84	74.6	0.21	13	0.0012
4	8.58	22	188.8	37.75	0.78	0.65	0.792	0.91	69.27	71.56	0.36	50	0.0005
4	8.94	22	196.7	39.34	1.14	0.95	0.792	0.85	64.71	66.99	0.36	50	0.0005
4	9.3	22	204.6	40.92	1.5	1.25	0.792	0.755	57.47	61.09	0.36	50	0.0004
4	9.66	22	212.5	42.5	1.86	1.55	0.792	0.65	49.48	53.48	0.36	50	0.0004
4	10.02	22	220.4	44.09	2.22	1.85	0.792	0.6	45.68	47.58	0.36	50	0.0003
4	10.38	22	228.4	<b>45.67</b>	2.58	2.15	0.792	0.53	<b>40.35</b>	43.01	0.36	50	0.0003
												$\Sigma S_i =$	0.0049

**0,2  $\sigma_{zg} > \sigma_{zp}$**

**Išvada: pamato nuosėdis  $0,5\text{cm} < 0,03b = 0,03 \cdot 0,6 = 1,80\text{cm}$ . Sąlyga tenkinama**

Ned	277	kN		Polių eilių skičias B kryptimi mB	2	vnt
B	2.4	m		Polių eilių skičias L kryptimi mL	2	vnt
L	1.9	m		Atstumas tarp polių ašių B kryptimi aB	1.8	m
A	4.56	m <sup>2</sup>		Atstumas tarp polių ašių L kryptimi aL	1.3	m
L1	0.95	m		Polio skersmuo	0.6	m
B1	1.2	m		Grunto vidinis trinties kampas	0	
				Polių skaičius n	4	vnt
				Poliaus ilgis l	3.5	m
				Grunto vidinis trinties kampas $\phi$	0	

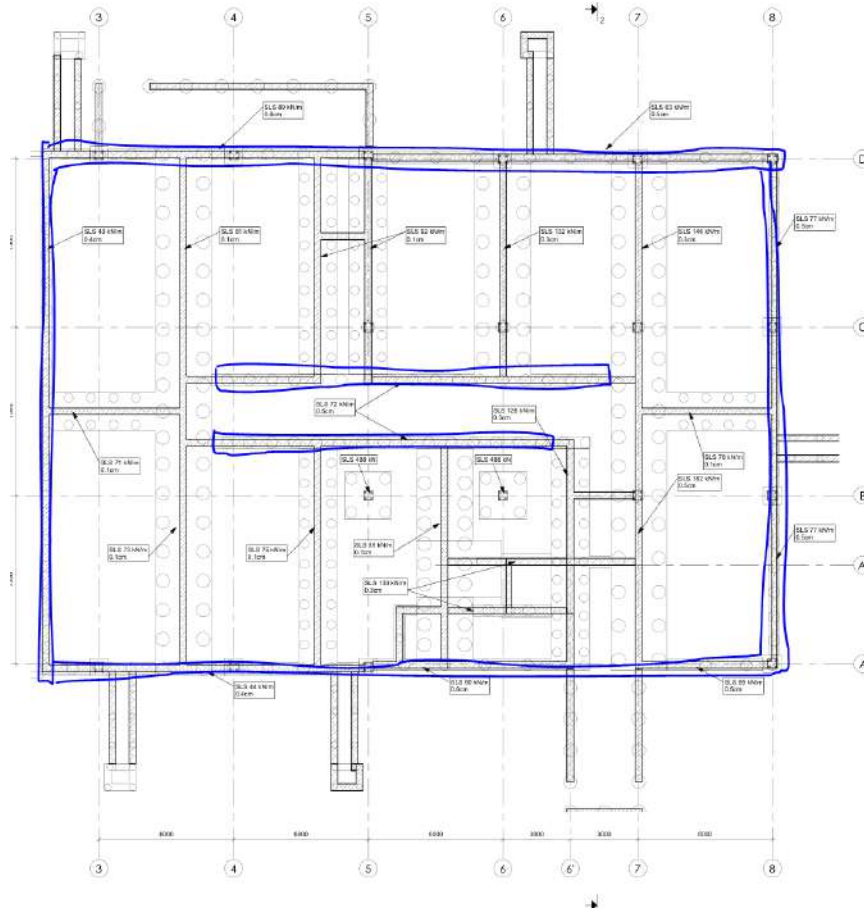
Eil. Nr.	d,m	$\gamma$ , kN/m <sup>3</sup>	$\sigma_{zg}$ , kPa	$0,2\sigma_{zg}$ , kPa	z,m	$\xi=2z/b$	$\eta=l/b$	K	$\sigma_{zp}$ , kPa	$\sigma_{zp,vid}$ , kPa	$H_i$ m	E, Mpa	$S_i$ m
1	7.8	22	171.6	34.32	0	0	0.792	1	60.99		0.48		
2	8.01	22	176.2	35.24	0.21	0.175	0.792	0.99	60.38	60.69	0.21	13	0.001
3	8.22	22	180.8	36.17	0.42	0.35	0.792	0.97	59.16	59.77	0.21	13	0.001
4	8.58	22	188.8	37.75	0.78	0.65	0.792	0.91	55.50	57.33	0.36	50	0.0004
4	8.94	22	196.7	39.34	1.14	0.95	0.792	0.85	51.84	53.67	0.36	50	0.0004
4	9.3	22	204.6	40.92	1.5	1.25	0.792	0.755	46.05	48.95	0.36	50	0.0004
4	9.66	22	212.5	42.5	1.86	1.55	0.792	0.65	39.65	42.85	0.36	50	0.0003
												$\Sigma S_i =$	0.0034

**0,2  $\sigma_{zg} > \sigma_{zp}$**

**Išvada: pamato nuosėdis  $0,3\text{cm} < 0,03b = 0,03 \cdot 0,6 = 1,80\text{cm}$ . Sąlyga tenkinama**

Skaičiuojamas nuosėdis vienodos geometrijos pamatų po perimetro ir vidinėmis koridoriaus sienomis tinkamumo ribinio būvio apkrova 43 kN/m, 63kN/m, 77kN/m, 90kN/m. Pamatų vieta plane:

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	247	251	0



Skaičiuojamas ruožas tarp dviejų polių. Sąlyginis pamato pado plotis ir ilgis nustatomi pagal šias formules:

$$B_s = (m - 1)a + D + 2 \cdot l \cdot \operatorname{tg} \varphi'_{dm},$$

$$L_s = (m - 1)a + D + 2 \cdot l \cdot \operatorname{tg} \varphi'_{dm},$$

Polis remiamas į molinius gruntuos, todėl vidinis trinties kampas  $\varphi$  imamas 0.

Ned	153	kN		Polių eilių skaičius B kryptimi mB	1	vnt
B	0.5	m		Polių eilių skaičius L kryptimi mL	2	vnt
L	1.7	m		Atstumas tarp polių ašių B kryptimi aB	0	m
A	0.85	m <sup>2</sup>		Atstumas tarp polių ašių L kryptimi aL	1.2	m
L1	0.85	m		Polio skersmuo	0.5	m
B1	0.25	m		Grunto vidinis trinties kampas	0	
				Poliaus ilgis l	3.5	m
				Grunto vidinis trinties kampas $\varphi$	0	



Aukštis h [m]	Vietovės tipas	Atvira sienos dalis mažesnė nei 5 %	Vėjo stiprumas $v_{ref,0}$ [m/s]	Skaičiuojama vieta
10.83	B	Taip	24	Kampas

$c(z)$	$c_i$	$c_e$
0.6666	0.2	-3

Vėdinamos sistemos atplėšimo nuo pagrindo stipris  $R_{vent}$  (kPa) turi būti ne mažesnis užprojektinę vėjo apkrovą  $s_{ds}$  (kPa):  $R_{vent} \geq s_{ds}$

kur:

projektinė vėjo apkrova:  $s_{ds} = 0,001 \cdot |w_{sum}| \cdot \gamma_Q = -1.08$  [kPa];

suminis vėjo slėgis į atitvaros paviršių:  $w_{sum} = w_{me} - w_i = -830.59$  [Pa];

vėjo slėgis į išorinį (priešvėjinį) atitvaros paviršių:  $w_{me} = q_{ref} \cdot c(z) \cdot c_e = -778.67$  [Pa];

vėjo slėgis į vidinį (pavėjinį) atitvaros paviršių:  $w_{me} = q_{ref} \cdot c(z) \cdot c_i = 51.91$  [Pa];

atskaitinis vėjo slėgis:  $q_{ref} = \frac{\rho}{2} \cdot v_{ref}^2 = 389.38$  [Pa];

atskaitinis vėjo greitis:  $v_{ref} = c_{DIR} \cdot c_{TEM} \cdot c_{ALT} \cdot v_{ref,0} \cdot 1,04 = 24.96$  [m/s];

čia:  $\rho = 1,25 \text{ kg/m}^3$ ;  $c_{DIR} = 1,0$ ;  $c_{TEM} = 1,0$ ;  $c_{ALT} = 1,0$ ;  $\gamma_Q = 1,3$ .

Vėdinamos sistemos tvirtinimo elemento prie pagrindo ištraukimo iš pagrindo jėga arba nutraukimo jėga skaičiuojama pagal:

$$s_{ds} = \frac{N_{(Rt;tv)} \cdot n_{vent}}{\gamma_{vent}} \rightarrow N_{(Rt;tv)} = \frac{s_{ds} \cdot \gamma_{vent}}{n_{vent}} = -0.71984 \text{ [kN];}$$

čia:

vėdinamos sistemos tvirtinimo prie pagrindo elementų kiekis:  $n_{vent} = 3$  [vnt./m<sup>2</sup>];

atsargos koeficientas vėdinamai sistemai:  $\gamma_{vent} = 2$ .

Vėdinamos sistemos tvirtinimo elemento prie pagrindo ištraukimo iš pagrindo jėga  $N_{Rt}$  ir tvirtinimo elemento, naudojamo tvirtinti vėdinamą sistemą prie pagrindo, nutraukimo jėga  $N_{tv}$  pateikiama gamintojo arba nustatoma bandymu statybos aikštelėje negali būti mažesnė nei apskaičiuota –  $s_{ds} = 0,72$  kN.

#### 1.14. Stogo smeigių skaičiavimas

Stogo izoliacijos tvirtinimui naudojamų smeigių kiekis apskaičiuojamas pagal STR 2.04.01:2018 3 priedo 1.1 p. formulę:

$$n_f = \frac{w_{sum}}{W_f} \cdot \gamma_Q; \quad (3.1)$$

čia:  $n_f$  – tvirtinimo elementų kiekis (vnt./m<sup>2</sup>);

$w_{sum}$  – suminis vėjo slėgis į stogo paviršių atitinkamoje stogo zonoje (kPa);

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	250	251	0

$W_f$  – vieno tvirtinimo elemento projektinis stipris (kN).  $W_f = 0,6$  kN;

$\gamma_Q$  – vėjo poveikio dalinio patikimumo koeficientas ( $\gamma_Q = 1,3$ ).

#### Kampų zonos:

$c_e = -3,0$  (STR 2.04.01: 2018 3 priedo 3.1 pav.).

$$w_{sum1} = q_{ref} \cdot c(8,0) \cdot (c_e + c_i) = 0,335 \cdot 2,38 \cdot (-3 - 0,2) = -2,55 \text{ kPa};$$

$$n_f = \frac{w_{sum1}}{W_f} \cdot \gamma_Q = \frac{2,55}{0,6} \cdot 1,3 = 5,53 \rightarrow \text{priimamas smeigių skaičius: } 6 \text{ vnt. m}^2.$$

#### Pakraščių zonos:

$c_e = -2,0$  (STR 2.04.01: 2018 3 priedo 3.1 pav.).

$$w_{sum1} = q_{ref} \cdot c(8,0) \cdot (c_e + c_i) = 0,335 \cdot 2,38 \cdot (-2 - 0,2) = -1,75 \text{ kPa};$$

$$n_f = \frac{w_{sum1}}{W_f} \cdot \gamma_Q = \frac{1,75}{0,6} \cdot 1,3 = 3,8 \rightarrow \text{priimamas smeigių skaičius: } 4 \text{ vnt. m}^2.$$

#### Centrinė zona:

$c_e = -1,0$  (STR 2.04.01: 2018 3 priedo 3.1 pav.).

$$w_{sum1} = q_{ref} \cdot c(8,0) \cdot (c_e + c_i) = 0,335 \cdot 2,38 \cdot (-1 - 0,2) = -0,96 \text{ kPa};$$

$$n_f = \frac{w_{sum1}}{W_f} \cdot \gamma_Q = \frac{0,96}{0,6} \cdot 1,3 = 2,08 \rightarrow \text{priimamas smeigių skaičius: } 2 \text{ vnt. m}^2.$$

### 1.15. Projekte atliktų skaičiavimų atitiktis projekto rengimo dokumentams, normatyvinių statybos techninių dokumentų reikalavimams

Projekte atliktų skaičiavimų rezultatai atitinka projekto rengimo dokumentų reikalavimus, normatyvinių statybos techninių dokumentų reikalavimus, o konstrukcinių elementų ir jungčių laikomosios galios išnaudojimas neviršija ribinių verčių.

IN2410-01-TP-SK-S	Lapas	Lapų	Laida
	251	251	0