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# KONSTRUKCIJŲ SKAIČIAVIMAI

MTEP TECHNOLOGINIO CENTRO MOLĖTŲ R. SAV. JONIŠKIS

## Ivadas

Skaičiavimai atliekami MTEP Technologinio centro Molėtų r. sav. Joniškis Statybos projektui.

Skaičiavimo rezultatai atitinka projekto rengimo dokumentų reikalavimus, normatyvinių statybos dokumentų reikalavimus. Konstrukcinių elementų ir jų jungčių laikomosios galios išnaudojimas atitinka normatyvinių statybos dokumentų reikalavimus.

## Projektavimo normos

EN1991-1-3/4:2005 Apkrovos (sniegas / vejas)

EN 1993-1-8:2005/A1:2009 Metalo konstrukcijos

EN 1992-1-1:2004/AC:2008 Betoninės konstrukcijos

## Apkrovos

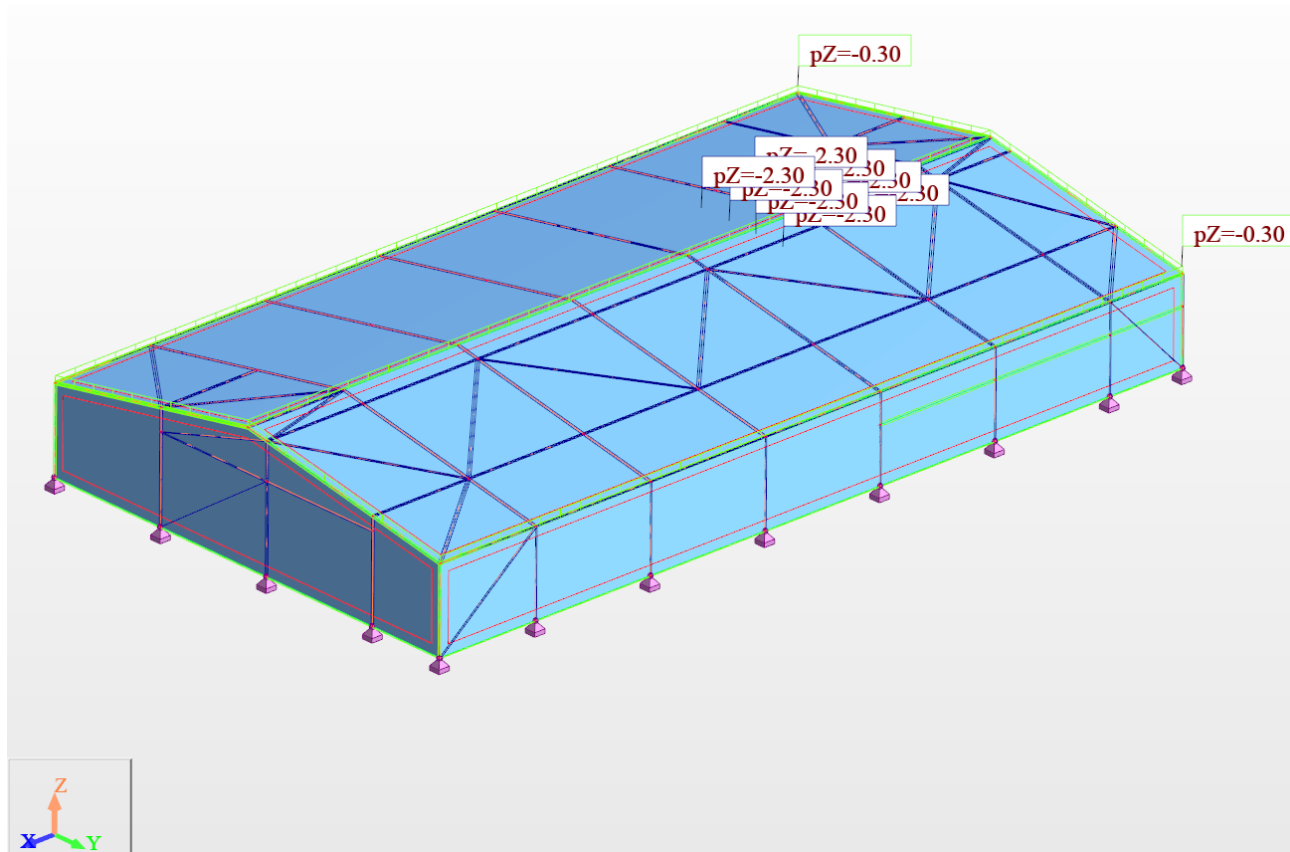
1. Pastovi apkrova, savasis svoris DL1, (1pav.);
2. Laikina apkrova LL1, (2pav.);
3. Sniego apkrova SN (1,60\*0,8=1,28 kPa ), (3 pav.);
4. Vejo apkrova X+ kryptimi 24m/s (4 pav.);
5. Vejo apkrova Y+ kryptimi 24m/s (5 pav.);
6. Vejo apkrova X- kryptimi 24m/s (6 pav.);
7. Vejo apkrova Y- kryptimi 24m/s (7 pav.);

1 Table. Apkrovų kombinacijos

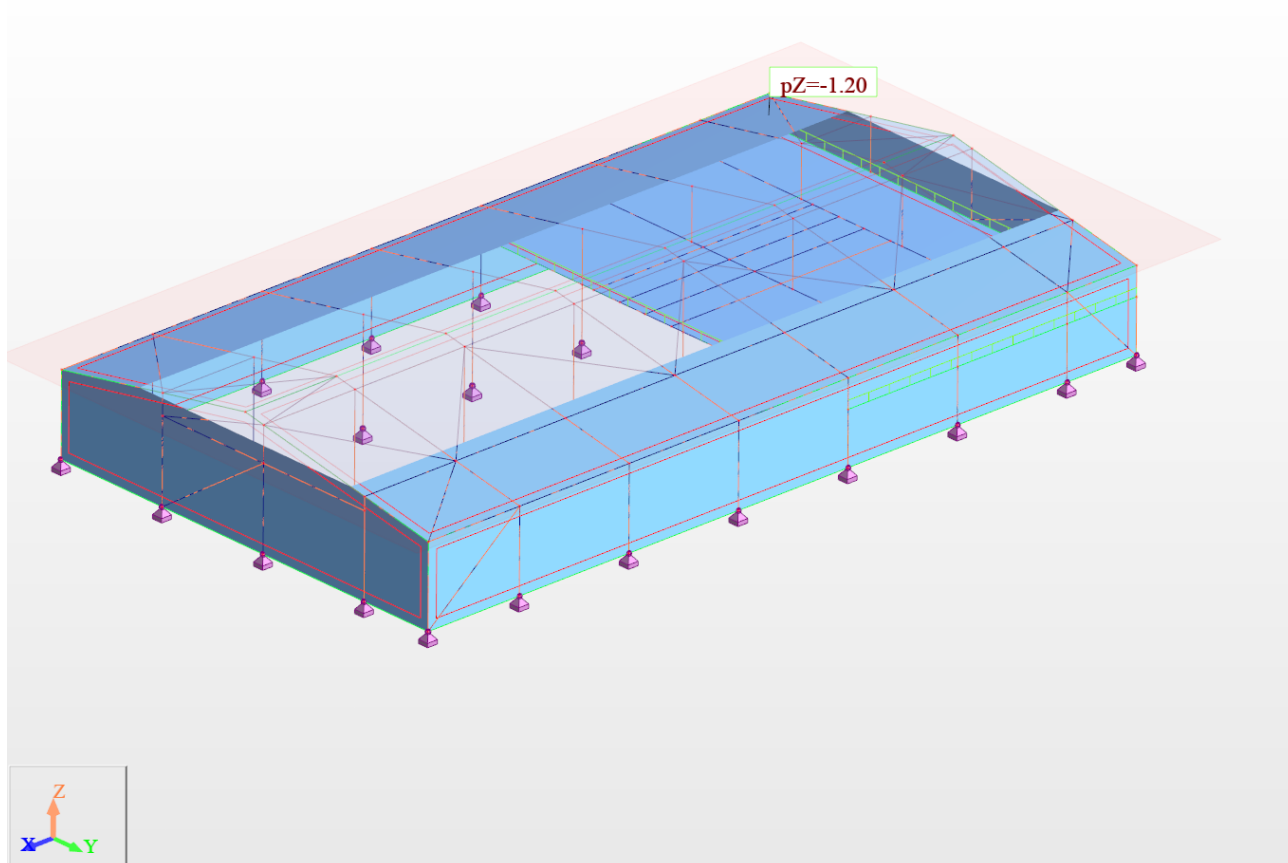
Combination s	Name	Analysis type	Combination	Case nature	Definition
9 (C)	COMB1	Линейное соче	ПС1	Structural	1*1.35
10 (C)	COMB2	Линейное соче	ПС1	Structural	(1+2)*1.35
11 (C)	COMB3	Линейное соче	ПС1	Structural	(1+2)*1.35+3*0.90
12 (C)	COMB4	Линейное соче	ПС1	Structural	(1+2)*1.35+(3+4)*0.90
13 (C)	COMB5	Линейное соче	ПС1	Structural	1*1.35+2*1.30+(3+5)*0.90
14 (C)	COMB6	Линейное соче	ПС1	Structural	1*1.35+2*1.30+(3+6)*0.90
15 (C)	COMB7	Линейное соче	ПС1	Structural	(1+2)*1.35+(3+7)*0.90
16 (C)	COMB8	Линейное соче	ПС1	Structural	1*1.35+4*1.30
17 (C)	COMB9	Линейное соче	ПС1	Structural	1*1.35+5*1.30
18 (C)	COMB10	Линейное соче	ПС1	Structural	1*1.35+6*1.30
19 (C)	COMB11	Линейное соче	ПС1	Structural	1*1.35+7*1.30
20 (C)	COMB12	Линейное соче	ПС2	Structural	(1+2+3+4)*1.00
21 (C)	COMB13	Линейное соче	ПС2	Structural	(1+2+3+5)*1.00
22 (C)	COMB14	Линейное соче	ПС2	Structural	(1+2+3+6)*1.00
23 (C)	COMB15	Линейное соче	ПС2	Structural	(1+2+3+7)*1.00
24 (C)	COMB16	Линейное соче	ПС2	Structural	(1+4)*1.00
25 (C)	COMB17	Линейное соче	ПС2	Structural	(1+5)*1.00
26 (C)	COMB18	Линейное соче	ПС2	Structural	(1+6)*1.00
27 (C)	COMB19	Линейное соче	ПС2	Structural	(1+7)*1.00

Pastabos: ULS – I ribinis būvis; SLS – II ribinis būvis.

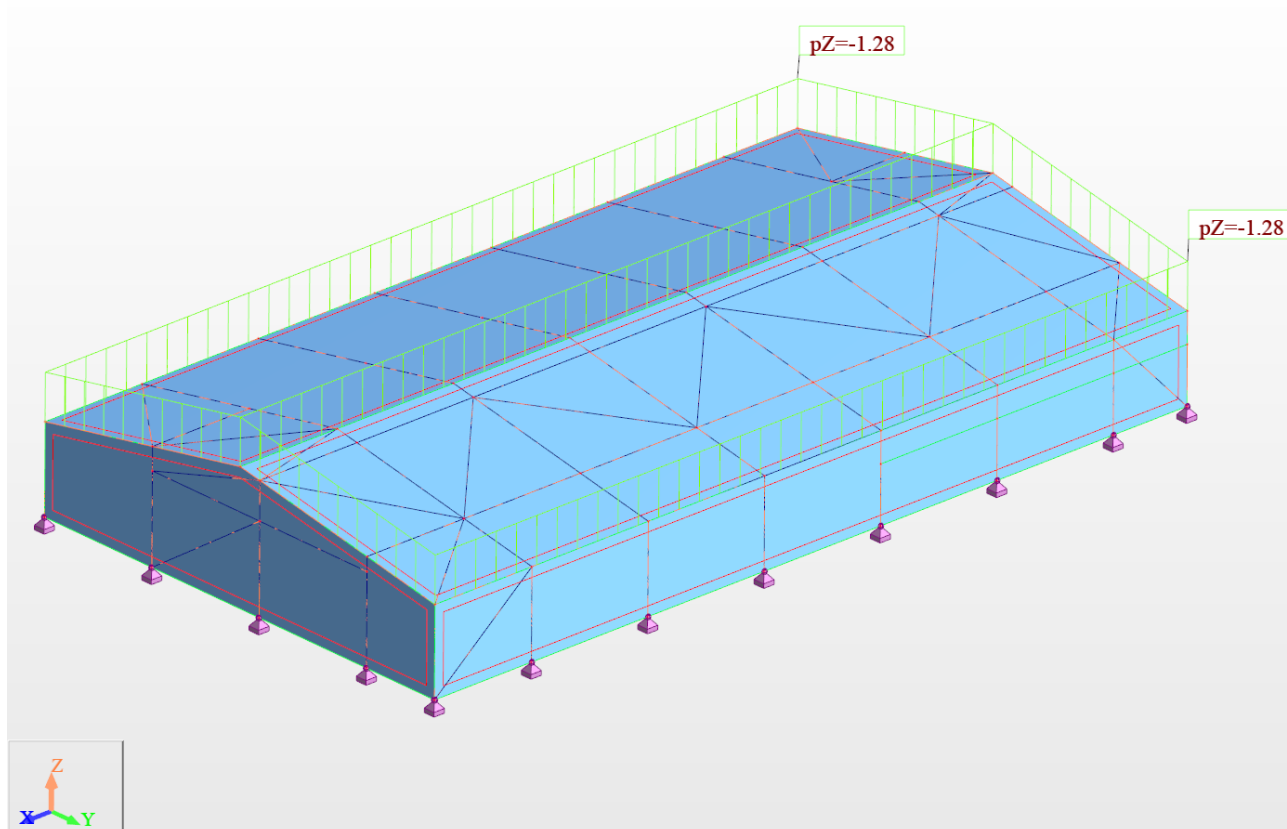
## Apkrovų schemas



1 pav. Pastovi apkrova. Technologinė apkrova 0,3 kPa, Antresoles technologinė 2.5kN/m.

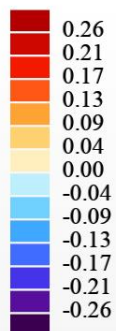


2 pav. Laikina apkrova aptarnavimo 1.2 kPa

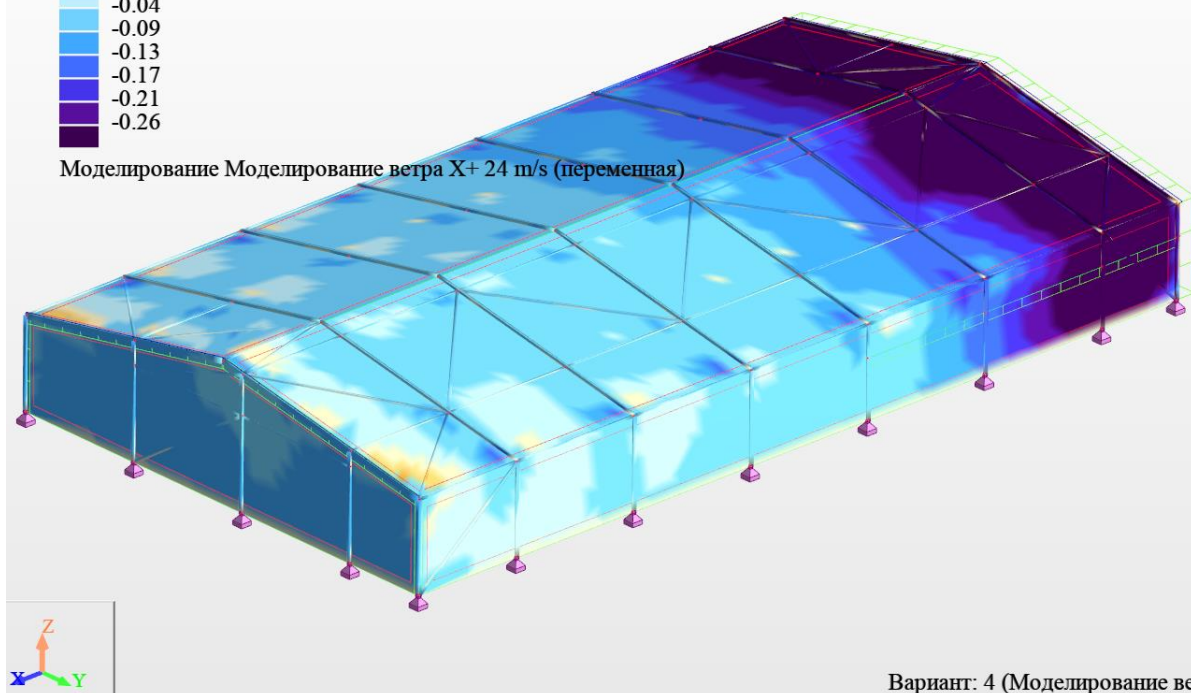


3 pav. Sniego apkrova  $1.2\text{kPa} \times 0,8 = 1.28\text{ kPa}$ .

Давление на элементы (кПа)



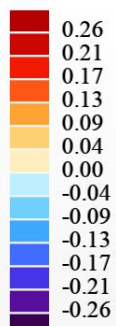
Моделирование Моделирование ветра X+ 24 m/s (переменная)



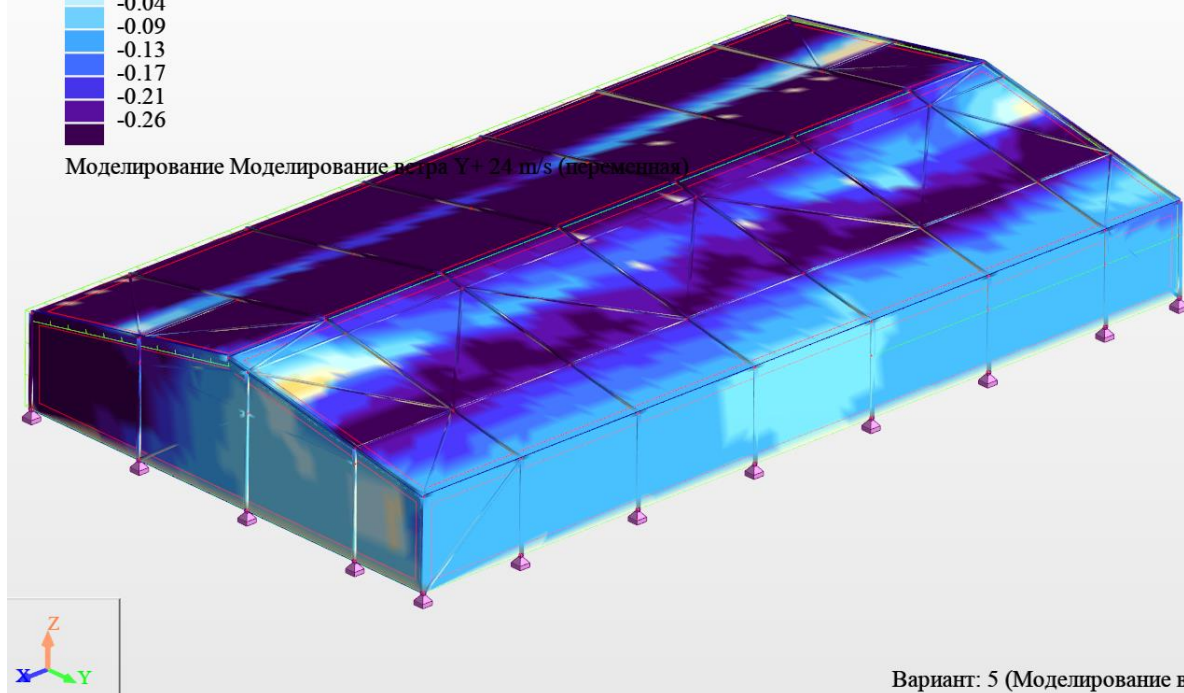
Вариант: 4 (Моделирование ветра X+ 24

4.pav. Vėjo apkrovos X+ kryptimi simuliacijos rezultatai

Давление на элементы (кПа)

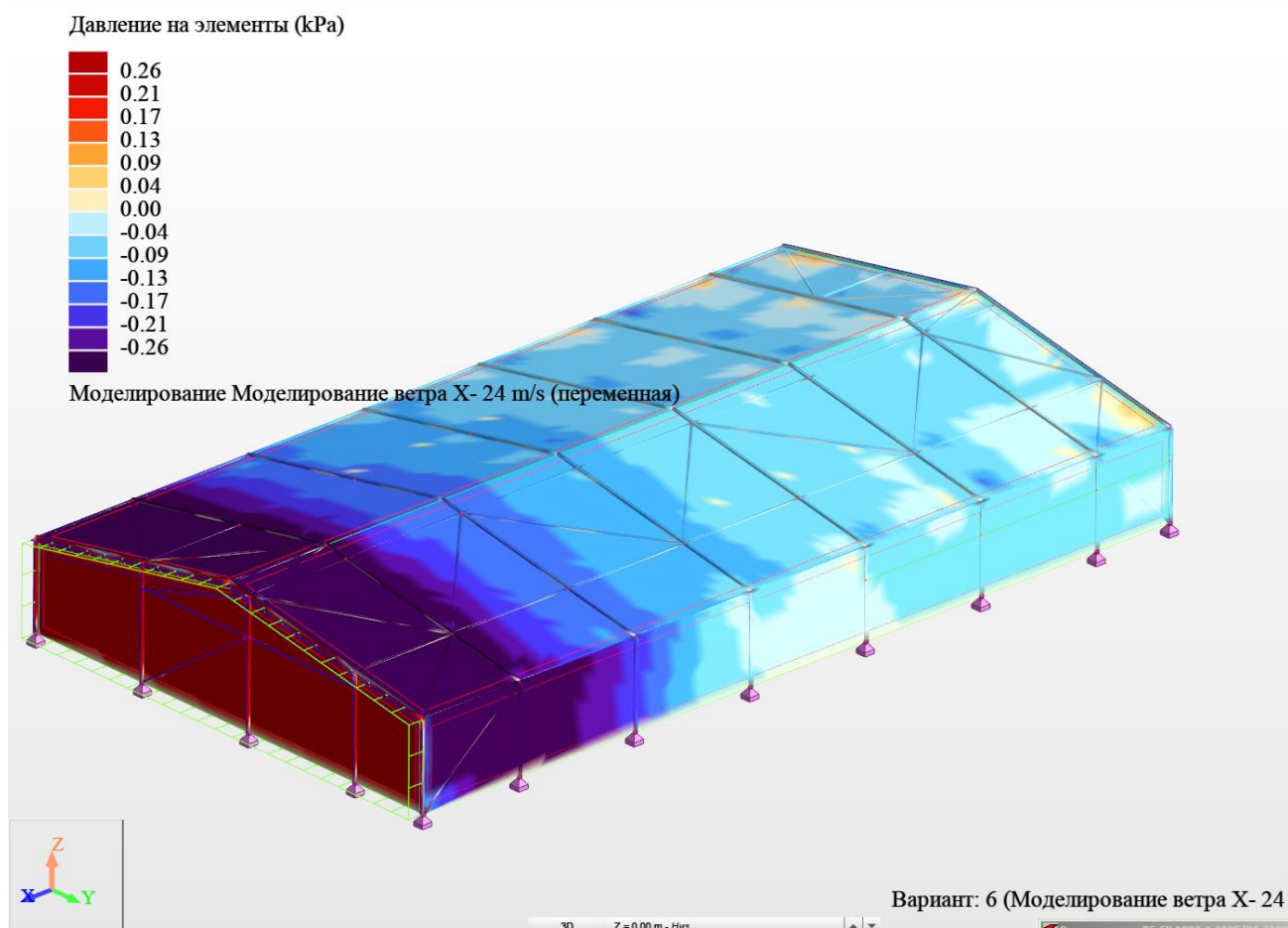


Моделирование Моделирование ветра Y+ 24 m/s (переменная)



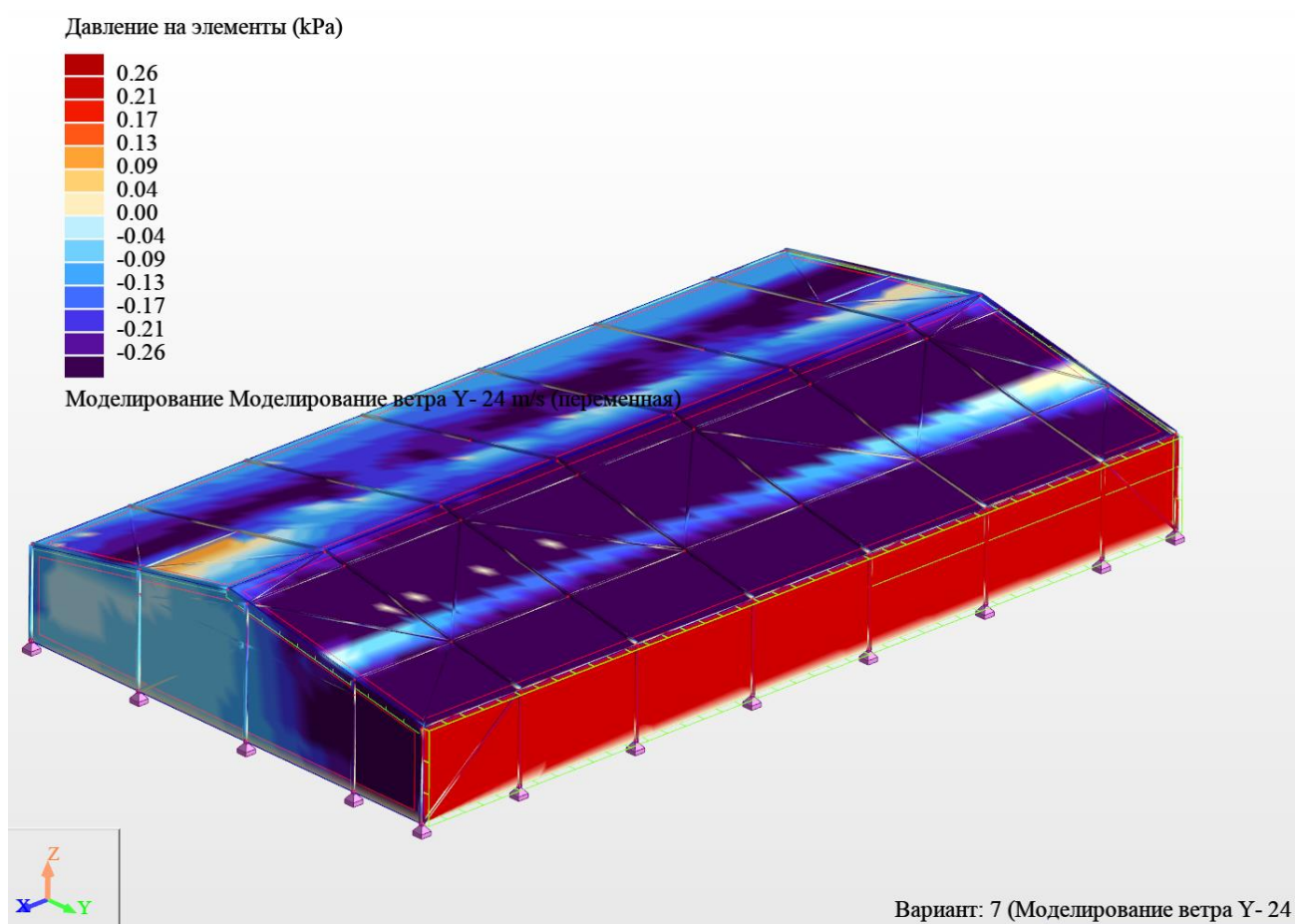
Вариант: 5 (Моделирование ветра Y+ 24

5.pav. Vėjo apkrovos Y+ kryptimi simuliacijos rezultatai



6.pav. Vējo apkrovas X- kryptimi simulācijas rezultāti

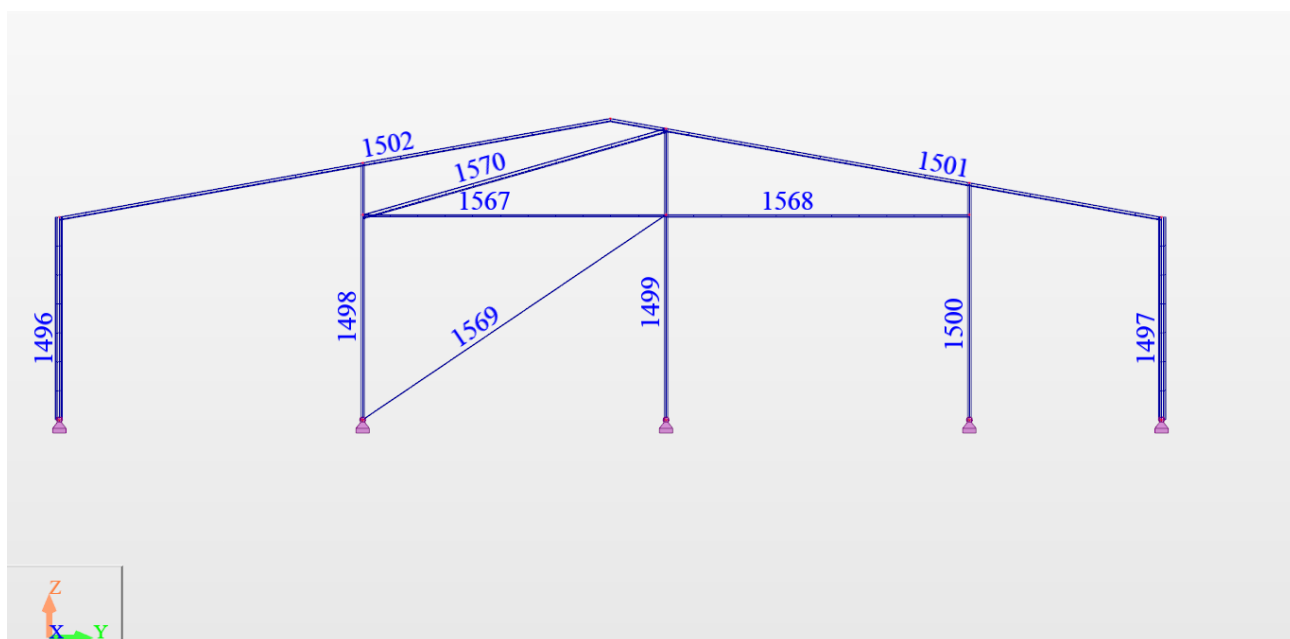




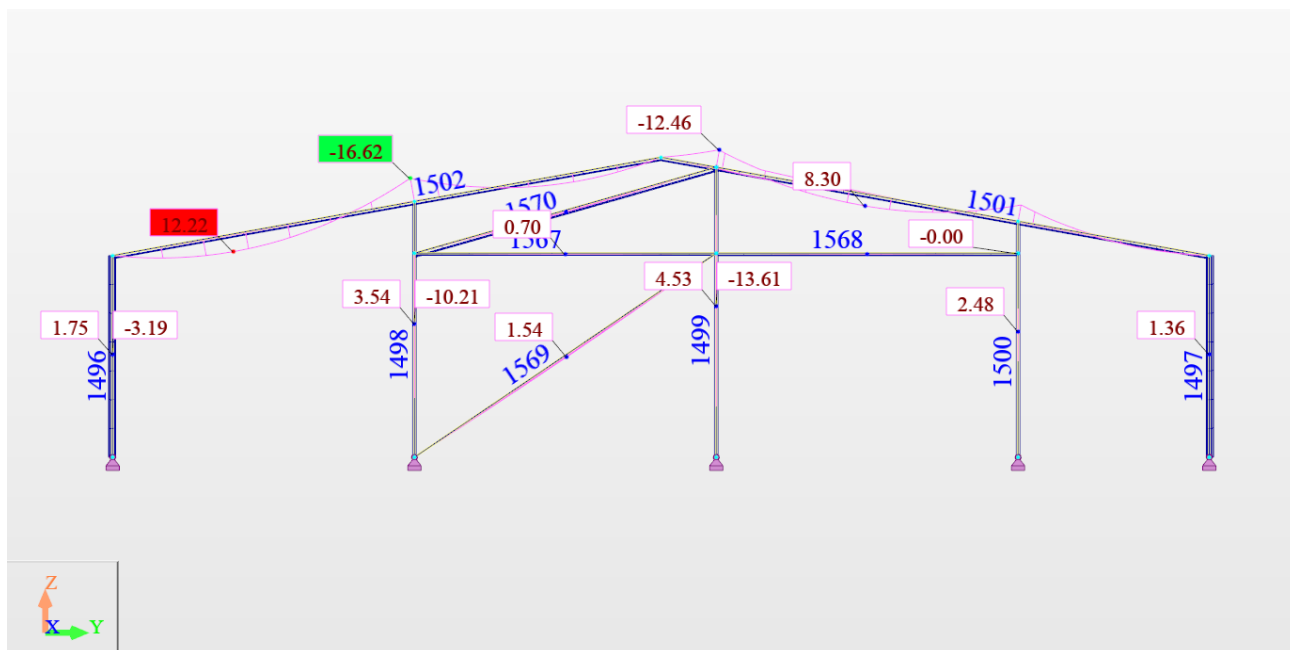
7.pav. Vėjo apkrovos Y- kryptimi simuliacijos rezultatai

## Statinių skaičiavimų rezultatai

Konstrukcijų ašyje B schema

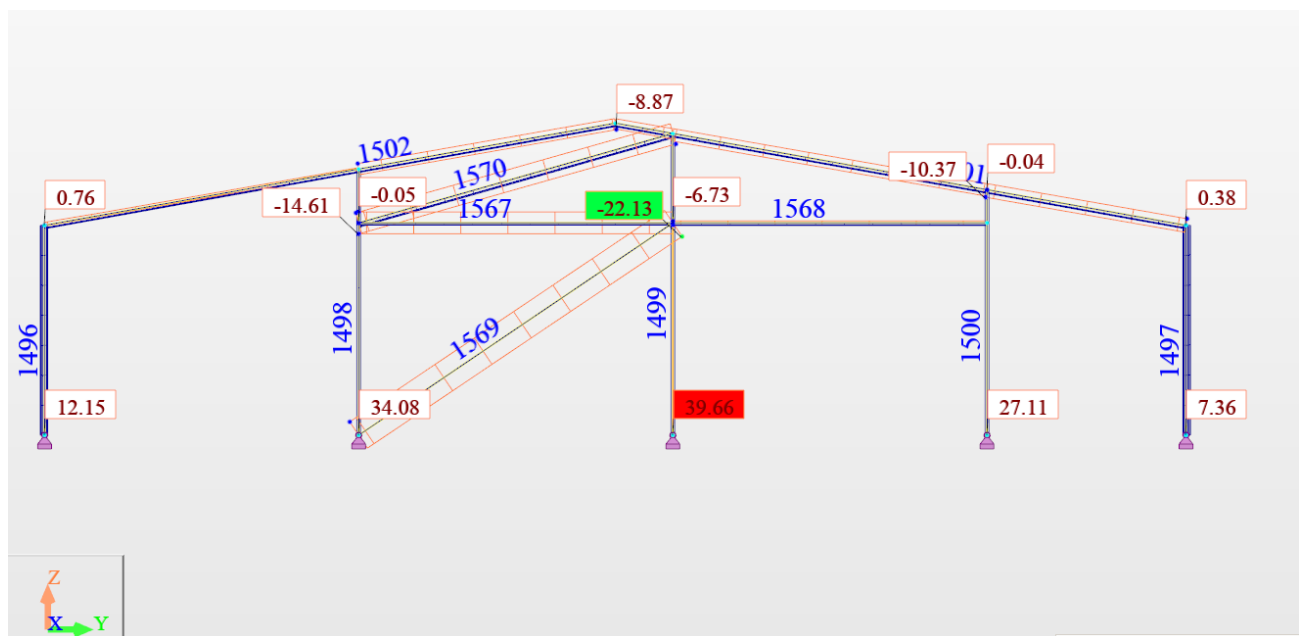


Konstrukcijų ašyje B lenkimo momentų diagramos



Konstrukcijų ašyje B ašinių jėgų diagramos





Konstrukcijų ašyje B elementų skaičiavimo rezultatai

Mem	Section	Material	Lay	Laz	Ratio	Case	Ratio(uy)	Case (uy)	Ratio(uz)	Case (uz)
1496	<input checked="" type="checkbox"/> SQUA 180x18	S 355	56.31	56.31	0.06	17 COMB9	0.05	21 COMB13	0.06	22 COMB14
1497	<input checked="" type="checkbox"/> SQUA 180x18	S 355	56.31	56.31	0.06	19 COMB11	0.05	27 COMB19	0.04	22 COMB14
1498	<input checked="" type="checkbox"/> SQUA 180x18	S 355	71.41	71.41	0.14	18 COMB10	0.02	27 COMB19	0.23	26 COMB18
1499	<input checked="" type="checkbox"/> SQUA 180x18	S 355	80.97	80.97	0.17	18 COMB10	0.01	23 COMB15	0.34	22 COMB14
1500	<input checked="" type="checkbox"/> SQUA 180x18	S 355	65.87	65.87	0.10	18 COMB10	0.02	21 COMB13	0.14	22 COMB14
1501	<input checked="" type="checkbox"/> IPE 240	S 355	111.01	37.14	0.12	14 COMB6	0.06	1*6	0.06	21 COMB13
1502	<input checked="" type="checkbox"/> IPE 240	S 355	111.01	37.14	0.15	14 COMB6	0.09	1*6	0.08	20 COMB12
1567	<input checked="" type="checkbox"/> SQUA 100x10	S 355	154.19	154.19	0.17	17 COMB9	-	-	-	-
1568	<input checked="" type="checkbox"/> SQUA 100x10	S 355	154.19	154.19	0.06	19 COMB11	-	-	-	-
1569	<input checked="" type="checkbox"/> SQUA 140x14	S 355	132.18	132.18	0.11	19 COMB11	-	-	-	-
1570	<input checked="" type="checkbox"/> SQUA 140x14	S 355	113.90	113.90	0.07	19 COMB11	-	-	-	-

## STEEL DESIGN

**CODE:** BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

**CODE GROUP:**

**MEMBER:** 1496

**POINT:** 2

**COORDINATE:** x = 0.50 L = 2.00 m

**LOADS:**

Governing Load Case: 17 COMB9 1\*1.35+5\*1.30

**MATERIAL:**

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



**SECTION PARAMETERS:** SQUA 180x180x5

h=18.0 cm

gM0=1.00

gM1=1.00

b=18.0 cm

Ay=17.18 cm<sup>2</sup>

Az=17.18 cm<sup>2</sup>

Ax=34.36 cm<sup>2</sup>

tw=0.5 cm

Iy=1736.87 cm<sup>4</sup>

Iz=1736.87 cm<sup>4</sup>

Ix=2724.16 cm<sup>4</sup>

tf=0.5 cm

Wply=224.02 cm<sup>3</sup>

Wplz=224.02 cm<sup>3</sup>

**INTERNAL FORCES AND CAPACITIES:**

N<sub>Ed</sub> = 1.92 kN

M<sub>y,Ed</sub> = 1.75 kN\*m

M<sub>z,Ed</sub> = 2.99 kN\*m

V<sub>y,Ed</sub> = -0.07 kN

Nc,Rd = 1219.65 kN	My,Ed,max = 1.75 kN*m	Mz,Ed,max = 2.99 kN*m	Vy,c,Rd = 352.08 kN
Nb,Rd = 1219.65 kN	My,c,Rd = 79.53 kN*m	Mz,c,Rd = 79.53 kN*m	Vz,Ed = 0.03 kN
	MN,y,Rd = 79.53 kN*m	MN,z,Rd = 79.53 kN*m	Vz,c,Rd = 352.08 kN
	Mb,Rd = 79.53 kN*m		

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 2384.77 kN*m	Curve,LT - d	XLT = 1.00
Lcr,upp=4.00 m	Lam_LT = 0.18	fi,LT = 0.43	XLT,mod = 1.00

#### BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

#### VERIFICATION FORMULAS:

##### Section strength check:

N,Ed/Nc,Rd = 0.00 < 1.00 (6.2.4.(1))

(My,Ed/MN,y,Rd)^1.66 + (Mz,Ed/MN,z,Rd)^1.66 = 0.01 < 1.00 (6.2.9.1.(6))

Vy,Ed/Vy,c,Rd = 0.00 < 1.00 (6.2.6.(1))

Vz,Ed/Vz,c,Rd = 0.00 < 1.00 (6.2.6.(1))

##### Global stability check of member:

My,Ed,max/Mb,Rd = 0.02 < 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) = 0.06 < 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) = 0.06 < 1.00 (6.3.3.(4))

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

uy = 0.1 cm < uy max = L/200.00 = 2.0 cm

Verified

Governing Load Case: 21 COMB13 (1+2+3+5)\*1.00

uz = 0.1 cm < uz max = L/200.00 = 2.0 cm

Verified

Governing Load Case: 22 COMB14 (1+2+3+6)\*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

## STEEL DESIGN

CODE: [BS-EN 1993-1:2005/NA:2008/A1:2014](#), Eurocode 3: Design of steel structures.

ANALYSIS TYPE: [Member Verification](#)

#### CODE GROUP:

MEMBER: 1497

POINT: 2

COORDINATE: x = 0.50 L = 2.00 m

#### LOADS:

Governing Load Case: 19 COMB11 1\*1.35+7\*1.30

#### MATERIAL:

S 355 ( S 355 ) fy = 355.00 MPa



#### SECTION PARAMETERS: SQUA 180x180x5

h=18.0 cm	gM0=1.00	gM1=1.00	
b=18.0 cm	Ay=17.18 cm <sup>2</sup>	Az=17.18 cm <sup>2</sup>	Ax=34.36 cm <sup>2</sup>
tw=0.5 cm	Iy=1736.87 cm <sup>4</sup>	Iz=1736.87 cm <sup>4</sup>	Ix=2724.16 cm <sup>4</sup>
tf=0.5 cm	Wply=224.02 cm <sup>3</sup>	Wplz=224.02 cm <sup>3</sup>	

#### INTERNAL FORCES AND CAPACITIES:

N,Ed = 2.02 kN	My,Ed = 1.36 kN*m	Mz,Ed = -2.97 kN*m	Vy,Ed = 0.06 kN
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Nc,Rd = 1219.65 kN	My,Ed,max = 1.36 kN*m	Mz,Ed,max = -2.97 kN*m	Vy,c,Rd = 352.08 kN
Nb,Rd = 1219.65 kN	My,c,Rd = 79.53 kN*m	Mz,c,Rd = 79.53 kN*m	Vz,Ed = 0.04 kN
	MN,y,Rd = 79.53 kN*m	MN,z,Rd = 79.53 kN*m	Vz,c,Rd = 352.08 kN
	Mb,Rd = 79.53 kN*m		

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 2384.77 kN*m	Curve,LT - d	XLT = 1.00
Lcr,upp=4.00 m	Lam_LT = 0.18	fi,LT = 0.43	XLT,mod = 1.00

#### BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

#### VERIFICATION FORMULAS:

##### Section strength check:

N,Ed/Nc,Rd = 0.00 < 1.00 (6.2.4.(1))  
 $(My,Ed/MN,y,Rd)^{1.66} + (Mz,Ed/MN,z,Rd)^{1.66} = 0.01 < 1.00$  (6.2.9.1.(6))  
 Vy,Ed/Vy,c,Rd = 0.00 < 1.00 (6.2.6.(1))  
 Vz,Ed/Vz,c,Rd = 0.00 < 1.00 (6.2.6.(1))

##### Global stability check of member:

My,Ed,max/Mb,Rd = 0.02 < 1.00 (6.3.2.1.(1))  
 $N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) + kyz*Mz,Ed,max/(Mz,Rk/gM1) = 0.06 < 1.00$  (6.3.3.(4))  
 $N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) + kzz*Mz,Ed,max/(Mz,Rk/gM1) = 0.06 < 1.00$  (6.3.3.(4))

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

uy = 0.1 cm < uy max = L/200.00 = 2.0 cm Verified

Governing Load Case: 27 COMB19 (1+7)\*1.00

uz = 0.1 cm < uz max = L/200.00 = 2.0 cm Verified

Governing Load Case: 22 COMB14 (1+2+3+6)\*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

**Section OK !!!**

## STEEL DESIGN

CODE: [BS-EN 1993-1:2005/NA:2008/A1:2014](#), Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

#### CODE GROUP:

MEMBER: 1498

POINT: 2

COORDINATE: x = 0.40 L = 2.02 m

#### LOADS:

Governing Load Case: 18 COMB10 1\*1.35+6\*1.30

#### MATERIAL:

S 355 ( S 355 ) fy = 355.00 MPa



#### SECTION PARAMETERS: SQUA 180x180x5

h=18.0 cm	gM0=1.00	gM1=1.00	
b=18.0 cm	Ay=17.18 cm <sup>2</sup>	Az=17.18 cm <sup>2</sup>	Ax=34.36 cm <sup>2</sup>
tw=0.5 cm	Iy=1736.87 cm <sup>4</sup>	Iz=1736.87 cm <sup>4</sup>	Ix=2724.16 cm <sup>4</sup>
tf=0.5 cm	Wply=224.02 cm <sup>3</sup>	Wplz=224.02 cm <sup>3</sup>	

#### INTERNAL FORCES AND CAPACITIES:

N,Ed = 5.56 kN	My,Ed = -9.61 kN*m	Mz,Ed = -0.26 kN*m	Vy,Ed = 0.11 kN
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Nc,Rd = 1219.65 kN = 352.08 kN	My,Ed,max = -10.19 kN*m	Mz,Ed,max = -0.44 kN*m	Vy,c,Rd
Nb,Rd = 1219.65 kN	My,c,Rd = 79.53 kN*m	Mz,c,Rd = 79.53 kN*m	Vz,Ed = -1.93 kN
	MN,y,Rd = 79.53 kN*m	MN,z,Rd = 79.53 kN*m	Vz,c,Rd = 352.08 kN
	Mb,Rd = 79.53 kN*m		
Class of section = 1			



#### LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 1897.18 kN*m	Curve,LT - d	XLT = 1.00
Lcr,low=5.08 m	Lam_LT = 0.20	fi,LT = 0.44	XLT,mod = 1.00

#### BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

#### VERIFICATION FORMULAS:

##### Section strength check:

N,Ed/Nc,Rd = 0.00 < 1.00 (6.2.4.(1))  
 $(My,Ed/MN,y,Rd)^{1.66} + (Mz,Ed/MN,z,Rd)^{1.66} = 0.03 < 1.00$  (6.2.9.1.(6))  
 Vy,Ed/Vy,c,Rd = 0.00 < 1.00 (6.2.6.(1))  
 Vz,Ed/Vz,c,Rd = 0.01 < 1.00 (6.2.6.(1))

##### Global stability check of member:

My,Ed,max/Mb,Rd = 0.13 < 1.00 (6.3.2.1.(1))  
 $N,Ed/(Xy \cdot N,Rk/gM1) + kyy \cdot My,Ed,max/(XLT \cdot My,Rk/gM1) + kyz \cdot Mz,Ed,max/(Mz,Rk/gM1) = 0.14 < 1.00$  (6.3.3.(4))  
 $N,Ed/(Xz \cdot N,Rk/gM1) + kzy \cdot My,Ed,max/(XLT \cdot My,Rk/gM1) + kzz \cdot Mz,Ed,max/(Mz,Rk/gM1) = 0.14 < 1.00$  (6.3.3.(4))

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.5 cm Verified

Governing Load Case: 27 COMB19 (1+7)\*1.00

uz = 0.6 cm < uz max = L/200.00 = 2.5 cm Verified

Governing Load Case: 26 COMB18 (1+6)\*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

**Section OK !!!**

## STEEL DESIGN

CODE: [BS-EN 1993-1:2005/NA:2008/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

#### CODE GROUP:

MEMBER: 1499

POINT: 2

COORDINATE: x = 0.35 L = 2.02 m

#### LOADS:

Governing Load Case: 18 COMB10 1\*1.35+6\*1.30

#### MATERIAL:

S 355 ( S 355 ) fy = 355.00 MPa



#### SECTION PARAMETERS: SQUA 180x180x5

h=18.0 cm	gM0=1.00	gM1=1.00	
b=18.0 cm	Ay=17.18 cm <sup>2</sup>	Az=17.18 cm <sup>2</sup>	Ax=34.36 cm <sup>2</sup>
tw=0.5 cm	Iy=1736.87 cm <sup>4</sup>	Iz=1736.87 cm <sup>4</sup>	Ix=2724.16 cm <sup>4</sup>
tf=0.5 cm	Wply=224.02 cm <sup>3</sup>	Wplz=224.02 cm <sup>3</sup>	

#### INTERNAL FORCES AND CAPACITIES:

N <sub>Ed</sub> = 1.09 kN	M <sub>y,Ed</sub> = -12.04 kN*m	M <sub>z,Ed</sub> = 0.04 kN*m	V <sub>y,Ed</sub> = -0.01 kN
N <sub>c,Rd</sub> = 1219.65 kN	M <sub>y,Ed,max</sub> = -13.58 kN*m		M <sub>z,Ed,max</sub> = 0.05 kN*m    V <sub>y,c,Rd</sub>
= 352.08 kN			
N <sub>b,Rd</sub> = 1219.65 kN	M <sub>y,c,Rd</sub> = 79.53 kN*m	M <sub>z,c,Rd</sub> = 79.53 kN*m	V <sub>z,Ed</sub> = -3.12 kN
	MN <sub>y,Rd</sub> = 79.53 kN*m	MN <sub>z,Rd</sub> = 79.53 kN*m	V <sub>z,c,Rd</sub> = 352.08 kN
	M <sub>b,Rd</sub> = 79.53 kN*m		
Class of section = 1			



#### LATERAL BUCKLING PARAMETERS:

z = 1.00	M <sub>cr</sub> = 1679.64 kN*m	Curve,LT - d	XLT = 1.00
L <sub>cr,low</sub> = 5.76 m	Lam_LT = 0.22	fi_LT = 0.45	XLT,mod = 1.00

#### BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

#### VERIFICATION FORMULAS:

##### Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.04 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$

$$V_{z,Ed}/V_{z,c,Rd} = 0.01 < 1.00 \quad (6.2.6.(1))$$

##### Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.17 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.17 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.17 < 1.00 \quad (6.3.3.(4))$$

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.9 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 23 \text{ COMB15 } (1+2+3+7) \cdot 1.00$$

$$u_z = 1.0 \text{ cm} < u_{z,max} = L/200.00 = 2.9 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 22 \text{ COMB14 } (1+2+3+6) \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

**Section OK !!!**

## STEEL DESIGN

**CODE:** [BS-EN 1993-1:2005/NA:2008/A1:2014](#), [Eurocode 3: Design of steel structures](#).

**ANALYSIS TYPE:** Member Verification

#### CODE GROUP:

**MEMBER:** 1500

**POINT:** 2

**COORDINATE:** x = 0.43 L = 2.02 m

#### LOADS:

Governing Load Case: 18 COMB10 1\*1.35+6\*1.30

#### MATERIAL:

S 355 ( S 355 )    f<sub>y</sub> = 355.00 MPa



#### SECTION PARAMETERS: SQUA 180x180x5

h=18.0 cm	gM0=1.00	gM1=1.00	
b=18.0 cm	A <sub>y</sub> =17.18 cm <sup>2</sup>	A <sub>z</sub> =17.18 cm <sup>2</sup>	A <sub>x</sub> =34.36 cm <sup>2</sup>
tw=0.5 cm	I <sub>y</sub> =1736.87 cm <sup>4</sup>	I <sub>z</sub> =1736.87 cm <sup>4</sup>	I <sub>x</sub> =2724.16 cm <sup>4</sup>
tf=0.5 cm	W <sub>ply</sub> =224.02 cm <sup>3</sup>	W <sub>plz</sub> =224.02 cm <sup>3</sup>	

### INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 4.22 \text{ kN}$	$M_{y,Ed} = -6.78 \text{ kN}\cdot\text{m}$	$M_{z,Ed} = 0.21 \text{ kN}\cdot\text{m}$	$V_{y,Ed} = -0.09 \text{ kN}$
$N_{c,Rd} = 1219.65 \text{ kN}$	$M_{y,Ed,max} = -6.98 \text{ kN}\cdot\text{m}$	$M_{z,Ed,max} = 0.36 \text{ kN}\cdot\text{m}$	$V_{y,c,Rd} = 352.08 \text{ kN}$
$N_{b,Rd} = 1219.65 \text{ kN}$	$M_{y,c,Rd} = 79.53 \text{ kN}\cdot\text{m}$	$M_{z,c,Rd} = 79.53 \text{ kN}\cdot\text{m}$	$V_{z,Ed} = -1.04 \text{ kN}$
	$MN_{y,Rd} = 79.53 \text{ kN}\cdot\text{m}$	$MN_{z,Rd} = 79.53 \text{ kN}\cdot\text{m}$	$V_{z,c,Rd} = 352.08 \text{ kN}$
	$M_{b,Rd} = 79.53 \text{ kN}\cdot\text{m}$		

Class of section = 1



### LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 2050.96 \text{ kN}\cdot\text{m}$	Curve,LT - d	$XLT = 1.00$
$L_{cr,low} = 4.68 \text{ m}$	$\lambda_{m,LT} = 0.20$	$\phi_{LT} = 0.44$	$XLT_{mod} = 1.00$

### BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

### VERIFICATION FORMULAS:

#### Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$
$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.02 < 1.00 \quad (6.2.9.1.(6))$$
$$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$
$$V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$

#### Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.09 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.10 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.10 < 1.00 \quad (6.3.3.(4))$$

### LIMIT DISPLACEMENTS



#### Deflections (LOCAL SYSTEM):

$$u_y = 0.1 \text{ cm} < u_{y,max} = L/200.00 = 2.3 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 21 \text{ COMB13 } (1+2+3+5) \cdot 1.00$$

$$u_z = 0.3 \text{ cm} < u_{z,max} = L/200.00 = 2.3 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 22 \text{ COMB14 } (1+2+3+6) \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

## STEEL DESIGN

CODE: [BS-EN 1993-1:2005/NA:2008/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

### CODE GROUP:

MEMBER: 1501 [sija\\_1501](#)

POINT: 1

COORDINATE:  $x = 0.35 L = 3.86 \text{ m}$

### LOADS:

$$\text{Governing Load Case: } 14 \text{ COMB6 } 1 \cdot 1.35 + 2 \cdot 1.30 + (3+6) \cdot 0.90$$

### MATERIAL:

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



### SECTION PARAMETERS: IPE 240

$h = 24.0 \text{ cm}$	$gM0 = 1.00$	$gM1 = 1.00$	
$b = 12.0 \text{ cm}$	$A_y = 27.31 \text{ cm}^2$	$A_z = 19.14 \text{ cm}^2$	$A_x = 39.12 \text{ cm}^2$
$t_w = 0.6 \text{ cm}$	$I_y = 3891.63 \text{ cm}^4$	$I_z = 283.63 \text{ cm}^4$	$I_x = 11.60 \text{ cm}^4$
$t_f = 1.0 \text{ cm}$	$W_{ply} = 366.68 \text{ cm}^3$	$W_{plz} = 73.93 \text{ cm}^3$	

### INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 7.05 \text{ kN}$	$M_{y,Ed} = -10.18 \text{ kN}\cdot\text{m}$	$M_{z,Ed} = 0.81 \text{ kN}\cdot\text{m}$	$V_{y,Ed} = 1.04 \text{ kN}$
$N_{c,Rd} = 1388.63 \text{ kN}$	$M_{y,Ed,max} = -10.18 \text{ kN}\cdot\text{m}$	$M_{z,Ed,max} = 0.81 \text{ kN}\cdot\text{m}$	$V_{y,c,Rd} = 559.77 \text{ kN}$
$N_{b,Rd} = 1388.63 \text{ kN}$	$M_{y,c,Rd} = 130.17 \text{ kN}\cdot\text{m}$	$M_{z,c,Rd} = 26.24 \text{ kN}\cdot\text{m}$	$V_{z,Ed} = 11.19 \text{ kN}$
	$MN_{y,Rd} = 130.17 \text{ kN}\cdot\text{m}$	$MN_{z,Rd} = 26.24 \text{ kN}\cdot\text{m}$	$V_{z,c,Rd} = 392.37 \text{ kN}$
	$M_{b,Rd} = 128.10 \text{ kN}\cdot\text{m}$		
Class of section = 1			



### LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 523.22 \text{ kN}\cdot\text{m}$	Curve,LT - b	$XLT = 0.96$
$L_{cr,low} = 1.00 \text{ m}$	$\lambda_{m,LT} = 0.50$	$\phi_{i,LT} = 0.61$	$XLT_{mod} = 0.98$

### BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

### VERIFICATION FORMULAS:

#### Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$
$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd}) = 0.04 < 1.00 \quad (6.2.9.1.(6))$$
$$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$
$$V_{z,Ed}/V_{z,c,Rd} = 0.03 < 1.00 \quad (6.2.6.(1))$$

#### Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.08 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.12 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.12 < 1.00 \quad (6.3.3.(4))$$

### LIMIT DISPLACEMENTS



#### Deflections (LOCAL SYSTEM):

$$u_y = 0.3 \text{ cm} < u_{y,max} = L/200.00 = 5.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 26 COMB18 (1+6)\*1.00

$$u_z = 0.4 \text{ cm} < u_{z,max} = L/200.00 = 5.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 21 COMB13 (1+2+3+5)\*1.00

$$u_{inst,y} = 0.3 \text{ cm} < u_{inst,max,y} = L/200.00 = 5.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 1\*6

$$u_{inst,z} = 0.2 \text{ cm} < u_{inst,max,z} = L/200.00 = 5.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 1\*7



Displacements (GLOBAL SYSTEM): Not analyzed

**Section OK !!!**

## STEEL DESIGN

CODE: BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

### CODE GROUP:

MEMBER: 1502 sija\_1502

POINT: 3

COORDINATE:  $x = 0.45 L = 4.98 \text{ m}$

### LOADS:

Governing Load Case: 14 COMB6 1\*1.35+2\*1.30+(3+6)\*0.90

### MATERIAL:

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



SECTION PARAMETERS: IPE 240



h=24.0 cm	gM0=1.00	gM1=1.00	
b=12.0 cm	Ay=27.31 cm <sup>2</sup>	Az=19.14 cm <sup>2</sup>	Ax=39.12 cm <sup>2</sup>
tw=0.6 cm	Iy=3891.63 cm <sup>4</sup>	Iz=283.63 cm <sup>4</sup>	Ix=11.60 cm <sup>4</sup>
tf=1.0 cm	Wply=366.68 cm <sup>3</sup>	Wplz=73.93 cm <sup>3</sup>	

#### INTERNAL FORCES AND CAPACITIES:

N <sub>Ed</sub> = 6.73 kN	My <sub>Ed</sub> = -13.58 kN*m	Mz <sub>Ed</sub> = 1.04 kN*m	Vy <sub>Ed</sub> = -1.05 kN
N <sub>c,Rd</sub> = 1388.63 kN	My <sub>Ed,max</sub> = -13.58 kN*m		Mz <sub>Ed,max</sub> = 1.04 kN*m    Vy <sub>c,Rd</sub>
= 559.77 kN			
Nb <sub>Rd</sub> = 1388.63 kN	My <sub>c,Rd</sub> = 130.17 kN*m	Mz <sub>c,Rd</sub> = 26.24 kN*m	Vz <sub>Ed</sub> = -11.54 kN
	MN <sub>y,Rd</sub> = 130.17 kN*m	MN <sub>z,Rd</sub> = 26.24 kN*m	Vz <sub>c,Rd</sub> = 392.37 kN
	Mb <sub>Rd</sub> = 128.10 kN*m		
			Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

z = 1.00	M <sub>cr</sub> = 523.22 kN*m	Curve,LT - b	XLT = 0.96
L <sub>cr,low</sub> = 1.00 m	Lam_LT = 0.50	fi <sub>LT</sub> = 0.61	XLT <sub>mod</sub> = 0.98

#### BUCKLING PARAMETERS:



About y axis:

k<sub>yy</sub> = 1.00



About z axis:

k<sub>zz</sub> = 1.00

#### VERIFICATION FORMULAS:

##### Section strength check:

N<sub>Ed</sub>/N<sub>c,Rd</sub> = 0.00 < 1.00 (6.2.4.(1))  
 (My<sub>Ed</sub>/MN<sub>y,Rd</sub>)<sup>2.00</sup> + (Mz<sub>Ed</sub>/MN<sub>z,Rd</sub>)<sup>1.00</sup> = 0.05 < 1.00 (6.2.9.1.(6))  
 Vy<sub>Ed</sub>/Vy<sub>c,Rd</sub> = 0.00 < 1.00 (6.2.6.(1))  
 Vz<sub>Ed</sub>/Vz<sub>c,Rd</sub> = 0.03 < 1.00 (6.2.6.(1))

##### Global stability check of member:

My<sub>Ed,max</sub>/Mb<sub>Rd</sub> = 0.11 < 1.00 (6.3.2.1.(1))  
 N<sub>Ed</sub>/(X<sub>y</sub>\*N<sub>Rk</sub>/gM1) + k<sub>yy</sub>\*My<sub>Ed,max</sub>/(XLT\*My<sub>Rk</sub>/gM1) + k<sub>yz</sub>\*Mz<sub>Ed,max</sub>/(Mz<sub>Rk</sub>/gM1) = 0.15 < 1.00 (6.3.3.(4))  
 N<sub>Ed</sub>/(X<sub>z</sub>\*N<sub>Rk</sub>/gM1) + k<sub>zy</sub>\*My<sub>Ed,max</sub>/(XLT\*My<sub>Rk</sub>/gM1) + k<sub>zz</sub>\*Mz<sub>Ed,max</sub>/(Mz<sub>Rk</sub>/gM1) = 0.15 < 1.00 (6.3.3.(4))

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

u <sub>y</sub> = 0.5 cm < u <sub>y max</sub> = L/200.00 = 5.5 cm	Verified
<b>Governing Load Case:</b> 22 COMB14 (1+2+3+6)*1.00	
u <sub>z</sub> = 0.4 cm < u <sub>z max</sub> = L/200.00 = 5.5 cm	Verified
<b>Governing Load Case:</b> 20 COMB12 (1+2+3+4)*1.00	
u <sub>inst,y</sub> = 0.5 cm < u <sub>inst,max,y</sub> = L/200.00 = 5.5 cm	Verified
<b>Governing Load Case:</b> 1*6	
u <sub>inst,z</sub> = 0.1 cm < u <sub>inst,max,z</sub> = L/200.00 = 5.5 cm	Verified
<b>Governing Load Case:</b> 1*7	



Displacements (GLOBAL SYSTEM): Not analyzed

**Section OK !!!**

## STEEL DESIGN

**CODE:** BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

#### CODE GROUP:

**MEMBER:** 1567 hor rysis\_1567 **POINT:** 2

**COORDINATE:** x = 0.50 L = 3.00 m

#### LOADS:

**Governing Load Case:** 17 COMB9 1\*1.35+5\*1.30

#### MATERIAL:

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



**SECTION PARAMETERS: SQUA 100x100x4**

$h=10.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=10.0$ cm	$A_y=7.47$ cm <sup>2</sup>	$A_z=7.47$ cm <sup>2</sup>	$A_x=14.95$ cm <sup>2</sup>
$t_w=0.4$ cm	$I_y=226.35$ cm <sup>4</sup>	$I_z=226.35$ cm <sup>4</sup>	$I_x=362.01$ cm <sup>4</sup>
$t_f=0.4$ cm	$W_{ply}=53.30$ cm <sup>3</sup>	$W_{plz}=53.30$ cm <sup>3</sup>	

**INTERNAL FORCES AND CAPACITIES:**

$N_{Ed} = 14.83$ kN	$M_{y,Ed} = 0.64$ kN*m	$M_{z,Ed} = -0.06$ kN*m
$N_{c,Rd} = 530.65$ kN	$M_{y,Ed,max} = 0.64$ kN*m	$M_{z,Ed,max} = -0.06$ kN*m
$N_{b,Rd} = 116.35$ kN	$M_{y,c,Rd} = 18.92$ kN*m	$M_{z,c,Rd} = 18.92$ kN*m
	$MN_{y,Rd} = 18.92$ kN*m	$MN_{z,Rd} = 18.92$ kN*m

Class of section = 1



**LATERAL BUCKLING PARAMETERS:**

**BUCKLING PARAMETERS:**



About y axis:

$L_y = 6.00$ m	$\Lambda_{m,y} = 2.02$
$L_{cr,y} = 6.00$ m	$X_y = 0.22$
$\Lambda_{m,y} = 154.19$	$k_{yy} = 1.06$



About z axis:

$L_z = 6.00$ m	$\Lambda_{m,z} = 2.02$
$L_{cr,z} = 6.00$ m	$X_z = 0.22$
$\Lambda_{m,z} = 154.19$	$k_{yz} = 0.70$

**VERIFICATION FORMULAS:**

**Section strength check:**

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

**Global stability check of member:**

$$\Lambda_{m,y} = 154.19 < \Lambda_{m,max} = 210.00 \quad \Lambda_{m,z} = 154.19 < \Lambda_{m,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.17 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.15 < 1.00 \quad (6.3.3.(4))$$

**Section OK !!!**

## STEEL DESIGN

**CODE:** [BS-EN 1993-1:2005/NA:2008/A1:2014](#), [Eurocode 3: Design of steel structures](#).

**ANALYSIS TYPE:** [Member Verification](#)

**CODE GROUP:**

**MEMBER:** 1568 hor rysis\_1568 **POINT:** 2

**COORDINATE:**  $x = 0.50 L = 3.00$  m

**LOADS:**

Governing Load Case: 19 COMB11 1\*1.35+7\*1.30

**MATERIAL:**

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



**SECTION PARAMETERS: SQUA 100x100x4**

$h=10.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=10.0$ cm	$A_y=7.47$ cm <sup>2</sup>	$A_z=7.47$ cm <sup>2</sup>	$A_x=14.95$ cm <sup>2</sup>
$t_w=0.4$ cm	$I_y=226.35$ cm <sup>4</sup>	$I_z=226.35$ cm <sup>4</sup>	$I_x=362.01$ cm <sup>4</sup>
$t_f=0.4$ cm	$W_{ply}=53.30$ cm <sup>3</sup>	$W_{plz}=53.30$ cm <sup>3</sup>	

**INTERNAL FORCES AND CAPACITIES:**

$N_{Ed} = 2.70$ kN	$M_{y,Ed} = 0.69$ kN*m	$M_{z,Ed} = -0.10$ kN*m
--------------------	------------------------	-------------------------

Nc,Rd = 530.65 kN  
Nb,Rd = 116.35 kN

My,Ed,max = 0.69 kN\*m  
My,c,Rd = 18.92 kN\*m  
MN,y,Rd = 18.92 kN\*m

Mz,Ed,max = -0.10 kN\*m  
Mz,c,Rd = 18.92 kN\*m  
MN,z,Rd = 18.92 kN\*m

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

#### BUCKLING PARAMETERS:



About y axis:

Ly = 6.00 m  
Lcr,y = 6.00 m  
Lamy = 154.19  
Lam\_y = 2.02  
Xy = 0.22  
ky = 1.01



About z axis:

Lz = 6.00 m  
Lcr,z = 6.00 m  
Lamz = 154.19  
Lam\_z = 2.02  
Xz = 0.22  
kyz = 0.62

#### VERIFICATION FORMULAS:

##### Section strength check:

N,Ed/Nc,Rd = 0.01 < 1.00 (6.2.4.(1))

(My,Ed/MN,y,Rd)^1.66 + (Mz,Ed/MN,z,Rd)^1.66 = 0.00 < 1.00 (6.2.9.1.(6))

##### Global stability check of member:

Lambda,y = 154.19 < Lambda,max = 210.00 Lambda,z = 154.19 < Lambda,max = 210.00 STABLE

N,Ed/(Xy\*N,Rk/gM1) + kyy\*My,Ed,max/(XLT\*My,Rk/gM1) + kyz\*Mz,Ed,max/(Mz,Rk/gM1) = 0.06 < 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) = 0.05 < 1.00 (6.3.3.(4))

**Section OK !!!**

## STEEL DESIGN

**CODE:** BS-EN 1993-1-2:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

#### CODE GROUP:

**MEMBER:** 1569 hor rysis\_1569 **POINT:** 2

**COORDINATE:** x = 0.50 L = 3.62 m

#### LOADS:

Governing Load Case: 19 COMB11 1\*1.35+7\*1.30

#### MATERIAL:

S 355 ( S 355 ) fy = 355.00 MPa



#### SECTION PARAMETERS: SQUA 140x140x5

h=14.0 cm	gM0=1.00	gM1=1.00	
b=14.0 cm	Ay=13.18 cm <sup>2</sup>	Az=13.18 cm <sup>2</sup>	Ax=26.36 cm <sup>2</sup>
tw=0.5 cm	Iy=790.56 cm <sup>4</sup>	Iz=790.56 cm <sup>4</sup>	Ix=1255.76 cm <sup>4</sup>
tf=0.5 cm	Wply=132.30 cm <sup>3</sup>	Wplz=132.30 cm <sup>3</sup>	

#### INTERNAL FORCES AND CAPACITIES:

N,Ed = 21.17 kN	My,Ed = 1.49 kN*m	Mz,Ed = -0.06 kN*m
Nc,Rd = 935.65 kN	My,Ed,max = 1.49 kN*m	Mz,Ed,max = -0.06 kN*m
Nb,Rd = 271.60 kN	My,c,Rd = 46.97 kN*m	Mz,c,Rd = 46.97 kN*m
	MN,y,Rd = 46.97 kN*m	MN,z,Rd = 46.97 kN*m

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

#### BUCKLING PARAMETERS:



About y axis:

Ly = 7.24 m  
Lam\_y = 1.73



About z axis:

Lz = 7.24 m  
Lam\_z = 1.73

Lcr,y = 7.24 m	Xy = 0.29	Lcr,z = 7.24 m	Xz = 0.29
Lamy = 132.18	ky = 1.04	Lamz = 132.18	kzy = 0.66

#### VERIFICATION FORMULAS:

##### Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

##### Global stability check of member:

$$\lambda_{y,Ed} = 132.18 < \lambda_{y,max} = 210.00 \quad \lambda_{z,Ed} = 132.18 < \lambda_{z,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.11 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.10 < 1.00 \quad (6.3.3.(4))$$

**Section OK !!!**

## STEEL DESIGN

**CODE:** BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

#### CODE GROUP:

**MEMBER:** 1570 hor rysis\_1570 **POINT:** 2

**COORDINATE:** x = 0.50 L = 3.12 m

#### LOADS:

Governing Load Case: 19 COMB11 1\*1.35+7\*1.30

#### MATERIAL:

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



#### SECTION PARAMETERS: SQUA 140x140x5

h=14.0 cm	gM0=1.00	gM1=1.00	
b=14.0 cm	Ay=13.18 cm <sup>2</sup>	Az=13.18 cm <sup>2</sup>	Ax=26.36 cm <sup>2</sup>
tw=0.5 cm	Iy=790.56 cm <sup>4</sup>	Iz=790.56 cm <sup>4</sup>	Ix=1255.76 cm <sup>4</sup>
tf=0.5 cm	Wply=132.30 cm <sup>3</sup>	Wplz=132.30 cm <sup>3</sup>	

#### INTERNAL FORCES AND CAPACITIES:

N <sub>Ed</sub> = 13.83 kN	M <sub>y,Ed</sub> = 1.27 kN*m	M <sub>z,Ed</sub> = -0.01 kN*m
N <sub>c,Rd</sub> = 935.65 kN	M <sub>y,Ed,max</sub> = 1.27 kN*m	M <sub>z,Ed,max</sub> = -0.01 kN*m
N <sub>b,Rd</sub> = 352.18 kN	M <sub>y,c,Rd</sub> = 46.97 kN*m	M <sub>z,c,Rd</sub> = 46.97 kN*m
	M <sub>N,y,Rd</sub> = 46.97 kN*m	M <sub>N,z,Rd</sub> = 46.97 kN*m

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

#### BUCKLING PARAMETERS:



About y axis:

L <sub>y</sub> = 6.24 m	Lam <sub>y</sub> = 1.49
Lcr,y = 6.24 m	Xy = 0.38
Lamy = 113.90	ky = 1.02



About z axis:

L <sub>z</sub> = 6.24 m	Lam <sub>z</sub> = 1.49
Lcr,z = 6.24 m	Xz = 0.38
Lamz = 113.90	kzy = 0.63

#### VERIFICATION FORMULAS:

##### Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

##### Global stability check of member:

$$\lambda_{y,Ed} = 113.90 < \lambda_{y,max} = 210.00 \quad \lambda_{z,Ed} = 113.90 < \lambda_{z,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

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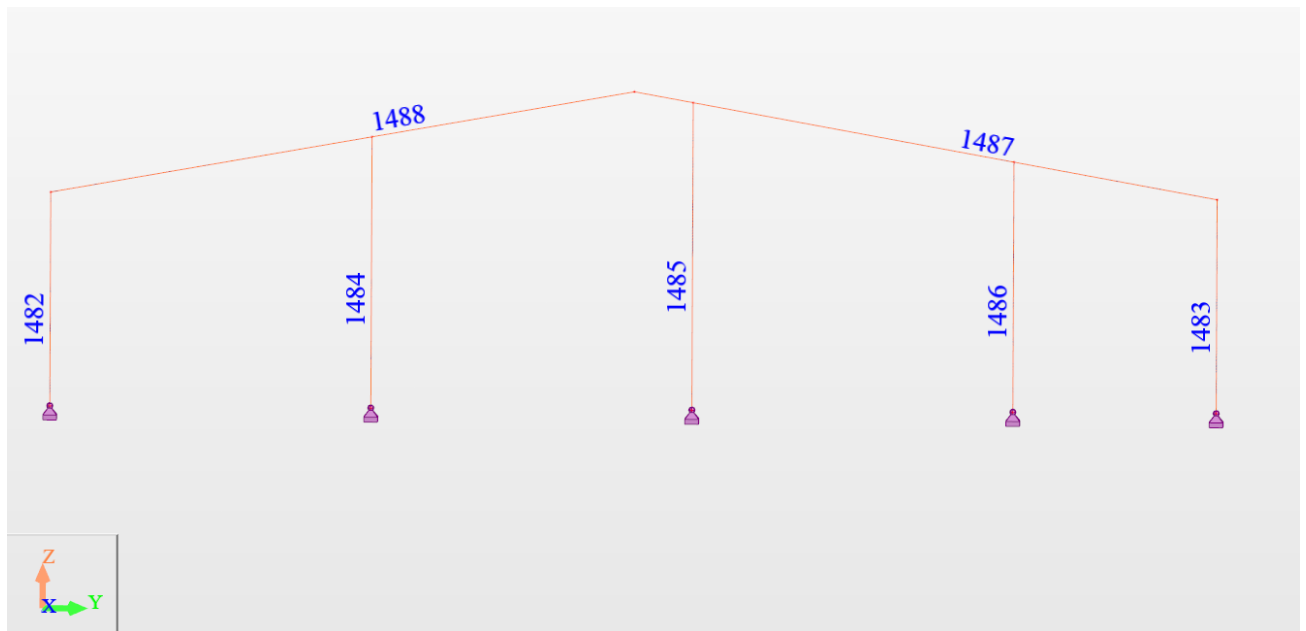
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.06 < 1.00$$

(6.3.3.(4))

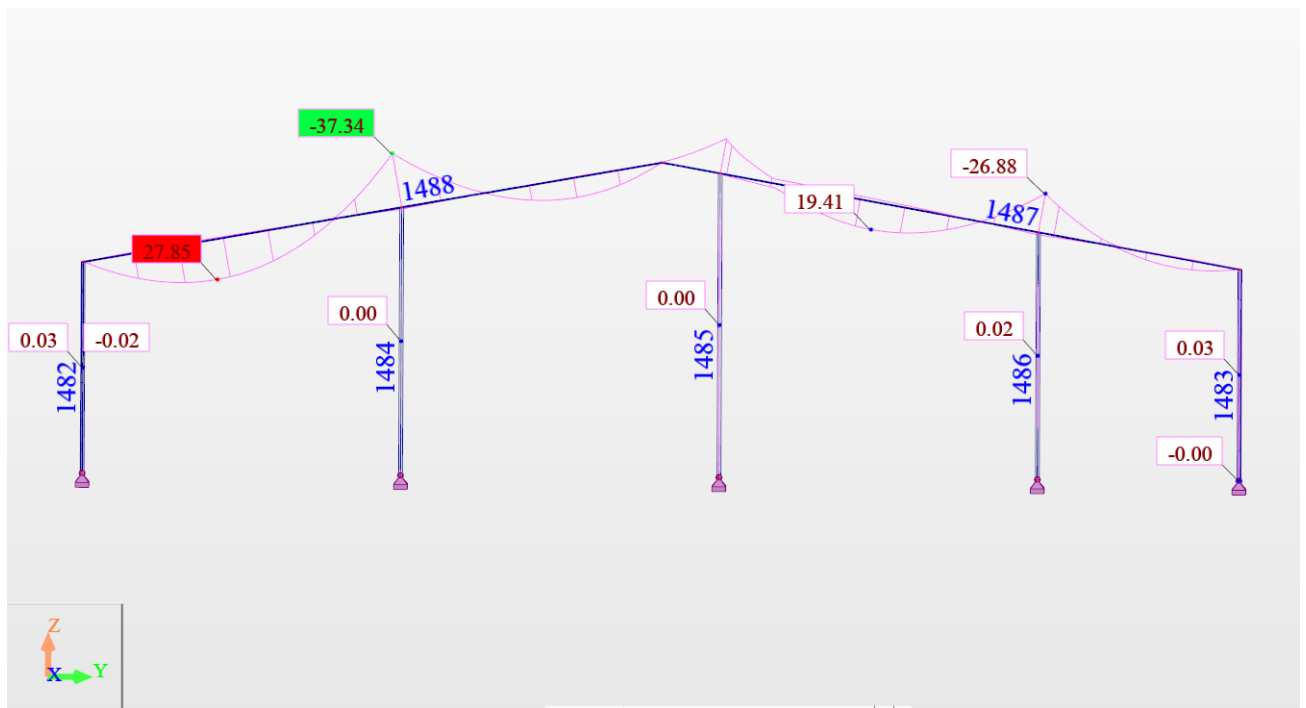
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**Section OK !!!**

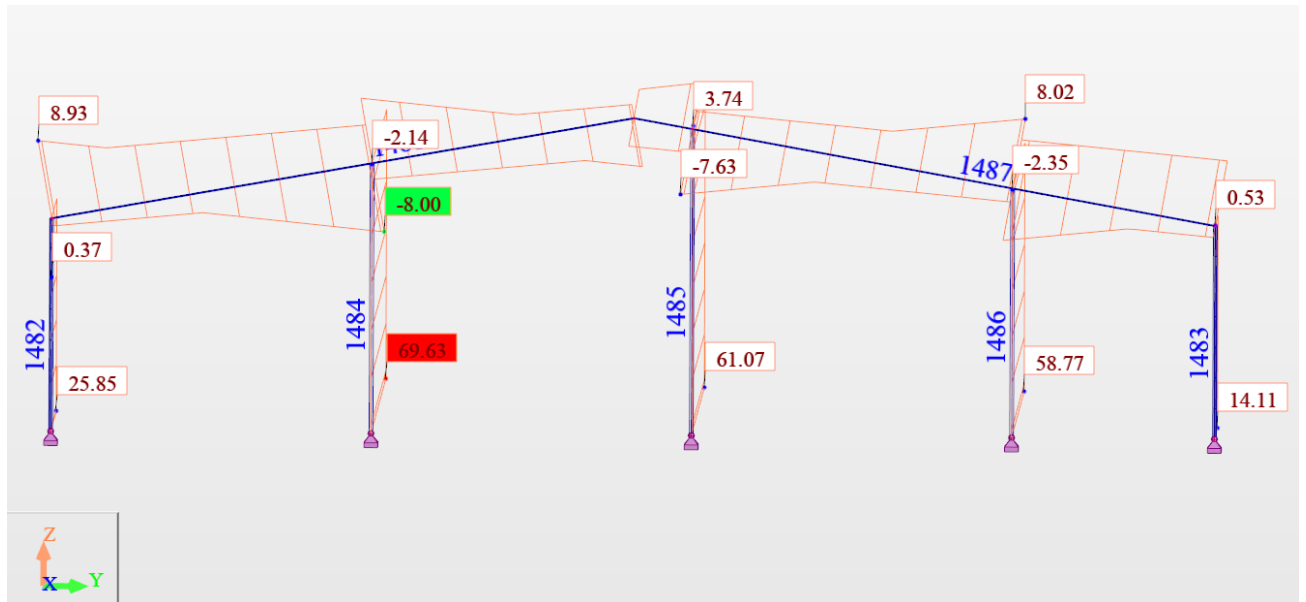
Konstrukcijų ašyje 4 schema



Konstrukcijų ašyje 4 lenkimo momentų diagramos



Konstrukcijų ašyje 4 ašinių jėgų diagramos



Konstrukcijų ašyje 4 elementų skaičiavimo rezultatai

Mem	Section	Material	Lay	Laz	Ratio	Case	Ratio(uy)	Case (uy)	Ratio(uz)	Case (uz)
1482	<input checked="" type="checkbox"/> SQUA 180x18	S 355	56.31	56.31	0.09	17 COMB9	0.12	21 COMB13	0.00	22 COMB14
1483	<input checked="" type="checkbox"/> SQUA 180x18	S 355	56.31	56.31	0.09	19 COMB11	0.12	23 COMB15	0.00	22 COMB14
1484	<input checked="" type="checkbox"/> SQUA 180x18	S 355	71.41	71.41	0.06	11 COMB3	0.00	21 COMB13	0.00	20 COMB12
1485	<input checked="" type="checkbox"/> SQUA 180x18	S 355	80.97	80.97	0.05	11 COMB3	0.00	27 COMB19	0.00	21 COMB13
1486	<input checked="" type="checkbox"/> SQUA 180x18	S 355	65.87	65.87	0.05	11 COMB3	0.00	25 COMB17	0.00	21 COMB13
1487	<input checked="" type="checkbox"/> IPE 240	S 355	111.01	37.14	0.21	11 COMB3	0.01	26 COMB18	0.13	21 COMB13
1488	<input checked="" type="checkbox"/> IPE 240	S 355	111.01	37.14	0.30	11 COMB3	0.08	1*5	0.18	20 COMB12

## STEEL DESIGN

CODE: BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1482

POINT: 2

COORDINATE:  $x = 0.50 L = 2.00 \text{ m}$ **LOADS:**Governing Load Case: 17 COMB9  $1 \cdot 1.35 + 5 \cdot 1.30$ **MATERIAL:**S 355 ( S 355 )  $f_y = 355.00 \text{ MPa}$ **SECTION PARAMETERS: SQUA 180x180x5** $h = 18.0 \text{ cm}$  $gM0 = 1.00$  $gM1 = 1.00$  $b = 18.0 \text{ cm}$  $A_y = 17.18 \text{ cm}^2$  $A_z = 17.18 \text{ cm}^2$  $A_x = 34.36 \text{ cm}^2$  $t_w = 0.5 \text{ cm}$  $I_y = 1736.87 \text{ cm}^4$  $I_z = 1736.87 \text{ cm}^4$  $I_x = 2724.16 \text{ cm}^4$  $t_f = 0.5 \text{ cm}$  $W_{ply} = 224.02 \text{ cm}^3$  $W_{plz} = 224.02 \text{ cm}^3$ **INTERNAL FORCES AND CAPACITIES:** $N_{Ed} = 0.89 \text{ kN}$  $M_{y,Ed} = -0.02 \text{ kN} \cdot \text{m}$  $M_{z,Ed} = 6.72 \text{ kN} \cdot \text{m}$  $V_{y,Ed} = -0.16 \text{ kN}$  $N_{c,Rd} = 1219.65 \text{ kN}$  $M_{y,Ed,max} = -0.02 \text{ kN} \cdot \text{m}$  $M_{z,Ed,max} = 6.72 \text{ kN} \cdot \text{m}$  $V_{y,c,Rd} = 352.08 \text{ kN}$  $N_{b,Rd} = 1219.65 \text{ kN}$  $M_{y,c,Rd} = 79.53 \text{ kN} \cdot \text{m}$  $M_{z,c,Rd} = 79.53 \text{ kN} \cdot \text{m}$  $M_{N,y,Rd} = 79.53 \text{ kN} \cdot \text{m}$  $M_{N,z,Rd} = 79.53 \text{ kN} \cdot \text{m}$  $M_{b,Rd} = 79.53 \text{ kN} \cdot \text{m}$ 

Class of section = 1

**LATERAL BUCKLING PARAMETERS:** $z = 1.00$  $M_{cr} = 2384.77 \text{ kN} \cdot \text{m}$ 

Curve,LT - d

 $X_{LT} = 1.00$  $L_{cr,low} = 4.00 \text{ m}$  $\lambda_{m,LT} = 0.18$  $\phi_{i,LT} = 0.43$  $X_{LT,mod} = 1.00$ **BUCKLING PARAMETERS:**

About y axis:

 $k_{yy} = 1.00$ 

About z axis:

 $k_{zz} = 1.00$ **VERIFICATION FORMULAS:****Section strength check:** $N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$  $(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.02 < 1.00 \quad (6.2.9.1.(6))$  $V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$ **Global stability check of member:** $M_{y,Ed,max}/M_{b,Rd} = 0.00 < 1.00 \quad (6.3.2.1.(1))$  $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$  $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$ **LIMIT DISPLACEMENTS****Deflections (LOCAL SYSTEM):** $u_y = 0.2 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$ 

Verified

Governing Load Case: 21 COMB13  $(1+2+3+5) \cdot 1.00$  $u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$ 

Verified

Governing Load Case: 22 COMB14  $(1+2+3+6) \cdot 1.00$ 

Displacements (GLOBAL SYSTEM): Not analyzed

**Section OK !!!****STEEL DESIGN**

CODE: BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

**CODE GROUP:**

MEMBER: 1483

POINT: 2

COORDINATE:  $x = 0.50 L = 2.00 \text{ m}$



## LOADS:

Governing Load Case: 19 COMB11 1\*1.35+7\*1.30

## MATERIAL:

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



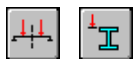
## SECTION PARAMETERS: SQUA 180x180x5

$h=18.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=18.0$ cm	$A_y=17.18$ cm <sup>2</sup>	$A_z=17.18$ cm <sup>2</sup>	$A_x=34.36$ cm <sup>2</sup>
$t_w=0.5$ cm	$I_y=1736.87$ cm <sup>4</sup>	$I_z=1736.87$ cm <sup>4</sup>	$I_x=2724.16$ cm <sup>4</sup>
$t_f=0.5$ cm	$W_{ply}=224.02$ cm <sup>3</sup>	$W_{plz}=224.02$ cm <sup>3</sup>	

## INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 1.57$ kN	$M_{y,Ed} = 0.02$ kN*m	$M_{z,Ed} = -6.79$ kN*m	$V_{y,Ed} = 0.18$ kN
$N_{c,Rd} = 1219.65$ kN	$M_{y,Ed,max} = 0.02$ kN*m	$M_{z,Ed,max} = -6.79$ kN*m	$V_{y,c,Rd} = 352.08$ kN
$N_{b,Rd} = 1219.65$ kN	$M_{y,c,Rd} = 79.53$ kN*m	$M_{z,c,Rd} = 79.53$ kN*m	
	$MN_{y,Rd} = 79.53$ kN*m	$MN_{z,Rd} = 79.53$ kN*m	
	$M_{b,Rd} = 79.53$ kN*m		

Class of section = 1



## LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 2384.77$ kN*m	Curve,LT - d	$XLT = 1.00$
$L_{cr,upp}=4.00$ m	$\lambda_{m\_LT} = 0.18$	$\bar{\phi}_{LT} = 0.43$	$XLT_{mod} = 1.00$

## BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

## VERIFICATION FORMULAS:

### Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.02 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$

### Global stability check of member:

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

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

## LIMIT DISPLACEMENTS



### Deflections (LOCAL SYSTEM):

$$u_y = 0.2 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$$

Verified

Governing Load Case: 23 COMB15 (1+2+3+7)\*1.00

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$$

Verified

Governing Load Case: 22 COMB14 (1+2+3+6)\*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

**Section OK !!!**

## STEEL DESIGN

CODE: BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1484

POINT: 1

COORDINATE:  $x = 0.00$   $L = 0.00$  m

**LOADS:**

Governing Load Case: 11 COMB3 (1+2)\*1.35+3\*0.90

**MATERIAL:**

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

**SECTION PARAMETERS: SQUA 180x180x5**

$h=18.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=18.0$ cm	$A_y=17.18$ cm <sup>2</sup>	$A_z=17.18$ cm <sup>2</sup>	$A_x=34.36$ cm <sup>2</sup>
$t_w=0.5$ cm	$I_y=1736.87$ cm <sup>4</sup>	$I_z=1736.87$ cm <sup>4</sup>	$I_x=2724.16$ cm <sup>4</sup>
$t_f=0.5$ cm	$W_{ely}=192.99$ cm <sup>3</sup>	$W_{elz}=192.99$ cm <sup>3</sup>	

**INTERNAL FORCES AND CAPACITIES:**

$N_{Ed} = 69.63$  kN

$N_{c,Rd} = 1219.65$  kN

$N_{b,Rd} = 1219.65$  kN

Class of section = 3

**LATERAL BUCKLING PARAMETERS:****BUCKLING PARAMETERS:**

About y axis:



About z axis:

**VERIFICATION FORMULAS:**

*Section strength check:*

$N_{Ed}/N_{c,Rd} = 0.06 < 1.00$  (6.2.4.(1))

**LIMIT DISPLACEMENTS**

*Deflections (LOCAL SYSTEM):*

$u_y = 0.0$  cm <  $u_{y,max} = L/200.00 = 2.5$  cm

Verified

*Governing Load Case:* 21 COMB13 (1+2+3+5)\*1.00

$u_z = 0.0$  cm <  $u_{z,max} = L/200.00 = 2.5$  cm

Verified

*Governing Load Case:* 20 COMB12 (1+2+3+4)\*1.00



*Displacements (GLOBAL SYSTEM): Not analyzed*

**Section OK !!!**

## STEEL DESIGN

**CODE:** BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

**CODE GROUP:**

**MEMBER:** 1485

**POINT:** 1

**COORDINATE:**  $x = 0.00$   $L = 0.00$  m

**LOADS:**

Governing Load Case: 11 COMB3 (1+2)\*1.35+3\*0.90

**MATERIAL:**

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

**SECTION PARAMETERS: SQUA 180x180x5**

$h=18.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=18.0$ cm	$A_y=17.18$ cm <sup>2</sup>	$A_z=17.18$ cm <sup>2</sup>	$A_x=34.36$ cm <sup>2</sup>
$t_w=0.5$ cm	$I_y=1736.87$ cm <sup>4</sup>	$I_z=1736.87$ cm <sup>4</sup>	$I_x=2724.16$ cm <sup>4</sup>
$t_f=0.5$ cm	$W_{ely}=192.99$ cm <sup>3</sup>	$W_{elz}=192.99$ cm <sup>3</sup>	

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**INTERNAL FORCES AND CAPACITIES:**

$N_{Ed} = 61.07 \text{ kN}$

$N_{c,Rd} = 1219.65 \text{ kN}$

$N_{b,Rd} = 1219.65 \text{ kN}$

Class of section = 3

**LATERAL BUCKLING PARAMETERS:****BUCKLING PARAMETERS:**

About y axis:



About z axis:

**VERIFICATION FORMULAS:**

*Section strength check:*

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00 \quad (6.2.4.(1))$

**LIMIT DISPLACEMENTS**

*Deflections (LOCAL SYSTEM):*

$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 2.9 \text{ cm}$

Verified

*Governing Load Case:* 27 COMB19 (1+7)\*1.00

$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 2.9 \text{ cm}$

Verified

*Governing Load Case:* 21 COMB13 (1+2+3+5)\*1.00



*Displacements (GLOBAL SYSTEM): Not analyzed*

**Section OK !!!**

## STEEL DESIGN

**CODE:** [BS-EN 1993-1:2005/NA:2008/A1:2014](#), [Eurocode 3: Design of steel structures](#).

**ANALYSIS TYPE:** [Member Verification](#)

**CODE GROUP:**

**MEMBER:** 1486

**POINT:** 1

**COORDINATE:**  $x = 0.00 \text{ L} = 0.00 \text{ m}$

**LOADS:**

*Governing Load Case:* 11 COMB3 (1+2)\*1.35+3\*0.90

**MATERIAL:**

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

**SECTION PARAMETERS: SQUA 180x180x5**

$h = 18.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 18.0 \text{ cm}$

$A_y = 17.18 \text{ cm}^2$

$A_z = 17.18 \text{ cm}^2$

$A_x = 34.36 \text{ cm}^2$

$tw = 0.5 \text{ cm}$

$I_y = 1736.87 \text{ cm}^4$

$I_z = 1736.87 \text{ cm}^4$

$I_x = 2724.16 \text{ cm}^4$

$tf = 0.5 \text{ cm}$

$W_{ely} = 192.99 \text{ cm}^3$

$W_{elz} = 192.99 \text{ cm}^3$

**INTERNAL FORCES AND CAPACITIES:**

$N_{Ed} = 58.77 \text{ kN}$

$N_{c,Rd} = 1219.65 \text{ kN}$

$N_{b,Rd} = 1219.65 \text{ kN}$

Class of section = 3

**LATERAL BUCKLING PARAMETERS:****BUCKLING PARAMETERS:**

About y axis:



About z axis:

## VERIFICATION FORMULAS:

### Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.05 < 1.00 \quad (6.2.4.(1))$$

## LIMIT DISPLACEMENTS



### Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.3 \text{ cm}$$

Verified

Governing Load Case: 25 COMB17 (1+5)\*1.00

$$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.3 \text{ cm}$$

Verified

Governing Load Case: 21 COMB13 (1+2+3+5)\*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

**Section OK !!!**

## STEEL DESIGN

CODE: [BS-EN 1993-1:2005/NA:2008/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

### CODE GROUP:

MEMBER: 1487 [sija\\_1487](#)

POINT: 1

COORDINATE:  $x = 0.35 L = 3.86 \text{ m}$

### LOADS:

Governing Load Case: 11 COMB3 (1+2)\*1.35+3\*0.90

### MATERIAL:

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



### SECTION PARAMETERS: IPE 240

$h=24.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=12.0 \text{ cm}$	$A_y=27.31 \text{ cm}^2$	$A_z=19.14 \text{ cm}^2$	$A_x=39.12 \text{ cm}^2$
$t_w=0.6 \text{ cm}$	$I_y=3891.63 \text{ cm}^4$	$I_z=283.63 \text{ cm}^4$	$I_x=11.60 \text{ cm}^4$
$t_f=1.0 \text{ cm}$	$W_{ply}=366.68 \text{ cm}^3$	$W_{plz}=73.93 \text{ cm}^3$	

### INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.33 \text{ kN}$	$M_{y,Ed} = -26.88 \text{ kN*m}$	$M_{z,Ed} = -0.00 \text{ kN*m}$	$V_{y,Ed} = -0.00 \text{ kN}$
$N_{c,Rd} = 1388.63 \text{ kN}$	$M_{y,Ed,max} = -26.88 \text{ kN*m}$		$M_{z,Ed,max} = 0.00 \text{ kN*m}$ $V_{y,c,Rd}$
$= 559.77 \text{ kN}$			
$N_{b,Rd} = 1388.63 \text{ kN}$	$M_{y,c,Rd} = 130.17 \text{ kN*m}$	$M_{z,c,Rd} = 26.24 \text{ kN*m}$	$V_{z,Ed} = 29.80 \text{ kN}$
	$MN_{y,Rd} = 130.17 \text{ kN*m}$	$MN_{z,Rd} = 26.24 \text{ kN*m}$	$V_{z,c,Rd} = 392.37 \text{ kN}$
	$Mb,Rd = 128.10 \text{ kN*m}$		

Class of section = 1



### LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 523.22 \text{ kN*m}$	Curve,LT - b	$XLT = 0.96$
$L_{cr,low} = 1.00 \text{ m}$	$\lambda_{m\_LT} = 0.50$	$\phi_{i,LT} = 0.61$	$XLT_{mod} = 0.98$

### BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

## VERIFICATION FORMULAS:

### Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.04 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$

$$V_{z,Ed}/V_{z,c,Rd} = 0.08 < 1.00 \quad (6.2.6.(1))$$

### Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.21 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{y,Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_z \cdot Rk/gM1) = 0.21 < 1.00 \quad (6.3.3.(4))$$

$$N_{z,Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_z \cdot Rk/gM1) = 0.21 < 1.00 \quad (6.3.3.(4))$$

### LIMIT DISPLACEMENTS



#### Deflections (LOCAL SYSTEM):

$$u_y = 0.1 \text{ cm} < u_{y \max} = L/200.00 = 5.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 26 COMB18 (1+6)\*1.00

$$u_z = 0.7 \text{ cm} < u_{z \max} = L/200.00 = 5.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 21 COMB13 (1+2+3+5)\*1.00

$$u_{\text{inst},y} = 0.1 \text{ cm} < u_{\text{inst},\max,y} = L/200.00 = 5.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 1\*6

$$u_{\text{inst},z} = 0.3 \text{ cm} < u_{\text{inst},\max,z} = L/200.00 = 5.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 1\*7



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

## STEEL DESIGN

CODE: [BS-EN 1993-1:2005/NA:2008/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

### CODE GROUP:

MEMBER: 1488 [sija\\_1488](#)

POINT: 3

COORDINATE:  $x = 0.45 L = 4.98 \text{ m}$

### LOADS:

Governing Load Case: 11 COMB3 (1+2)\*1.35+3\*0.90

### MATERIAL:

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



#### SECTION PARAMETERS: IPE 240

$h=24.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=12.0 \text{ cm}$	$A_y=27.31 \text{ cm}^2$	$A_z=19.14 \text{ cm}^2$	$A_x=39.12 \text{ cm}^2$
$t_w=0.6 \text{ cm}$	$I_y=3891.63 \text{ cm}^4$	$I_z=283.63 \text{ cm}^4$	$I_x=11.60 \text{ cm}^4$
$t_f=1.0 \text{ cm}$	$W_{ply}=366.68 \text{ cm}^3$	$W_{plz}=73.93 \text{ cm}^3$	

### INTERNAL FORCES AND CAPACITIES:

$N_{y,Ed} = 5.61 \text{ kN}$	$M_{y,Ed} = -37.34 \text{ kN}\cdot\text{m}$	
$N_{c,Rd} = 1388.63 \text{ kN}$	$M_{y,Ed,\max} = -37.34 \text{ kN}\cdot\text{m}$	
$N_{b,Rd} = 1388.63 \text{ kN}$	$M_{y,c,Rd} = 130.17 \text{ kN}\cdot\text{m}$	$V_{z,Ed} = -31.39 \text{ kN}$
	$M_{N,y,Rd} = 130.17 \text{ kN}\cdot\text{m}$	$V_{z,c,Rd} = 392.37 \text{ kN}$
	$M_{b,Rd} = 128.10 \text{ kN}\cdot\text{m}$	

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 523.22 \text{ kN}\cdot\text{m}$	Curve,LT - b	$XLT = 0.96$
$L_{cr,low} = 1.00 \text{ m}$	$\lambda_{m\_LT} = 0.50$	$f_{i,LT} = 0.61$	$XLT_{mod} = 0.98$

### BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

### VERIFICATION FORMULAS:

Section strength check:

---

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.29 < 1.00 \quad (6.2.5.(1))$$

$$V_{z,Ed}/V_{z,c,Rd} = 0.08 < 1.00 \quad (6.2.6.(1))$$

**Global stability check of member:**

$$M_{y,Ed,max}/M_{b,Rd} = 0.29 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.30 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.30 < 1.00 \quad (6.3.3.(4))$$

---

## LIMIT DISPLACEMENTS



**Deflections (LOCAL SYSTEM):**

$$u_y = 0.5 \text{ cm} < u_{y \text{ max}} = L/200.00 = 5.5 \text{ cm}$$

Verified

**Governing Load Case:** 25 COMB17 (1+5)\*1.00

$$u_z = 1.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 5.5 \text{ cm}$$

Verified

**Governing Load Case:** 20 COMB12 (1+2+3+4)\*1.00

$$u_{\text{inst},y} = 0.5 \text{ cm} < u_{\text{inst,max},y} = L/200.00 = 5.5 \text{ cm}$$

Verified

**Governing Load Case:** 1\*5

$$u_{\text{inst},z} = 0.2 \text{ cm} < u_{\text{inst,max},z} = L/200.00 = 5.5 \text{ cm}$$

Verified

**Governing Load Case:** 1\*5



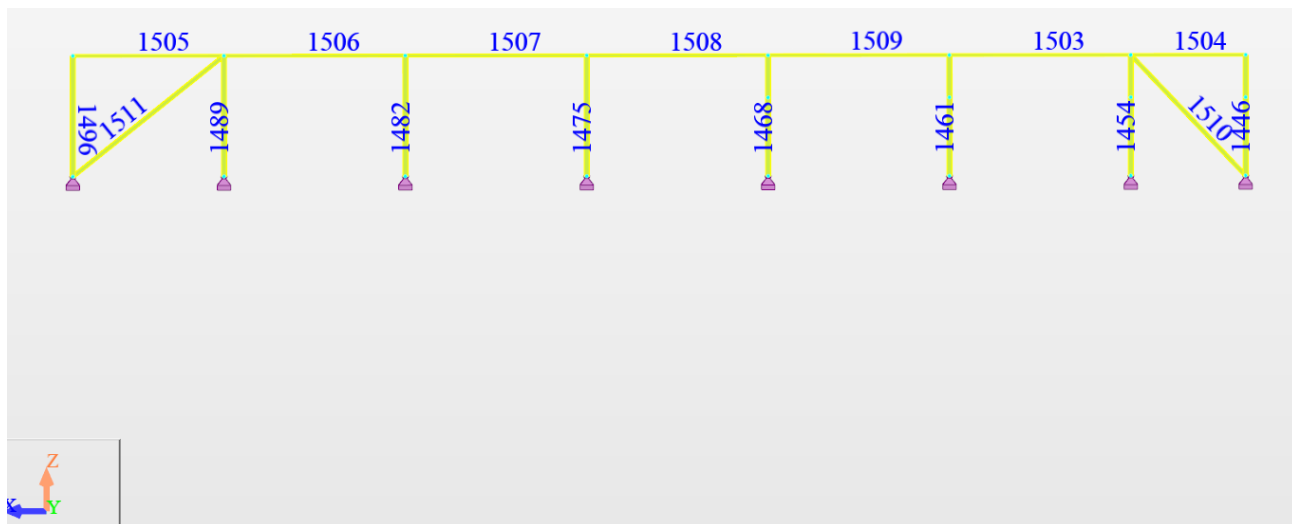
**Displacements (GLOBAL SYSTEM):** Not analyzed

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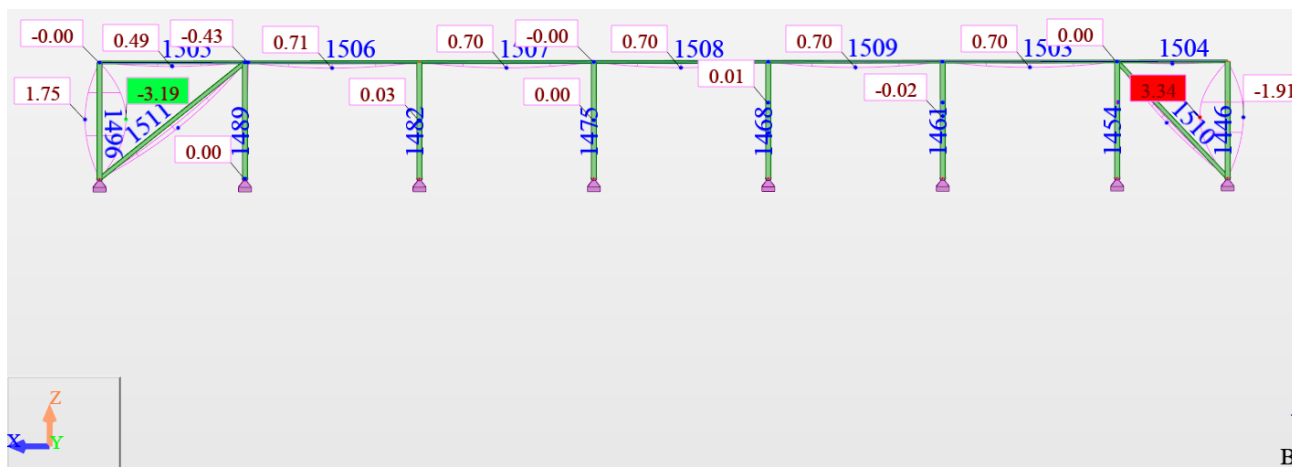
**Section OK !!!**

Konstrukcijų ašyje 4 schema

Konstrukcijų ašyje 4 schema

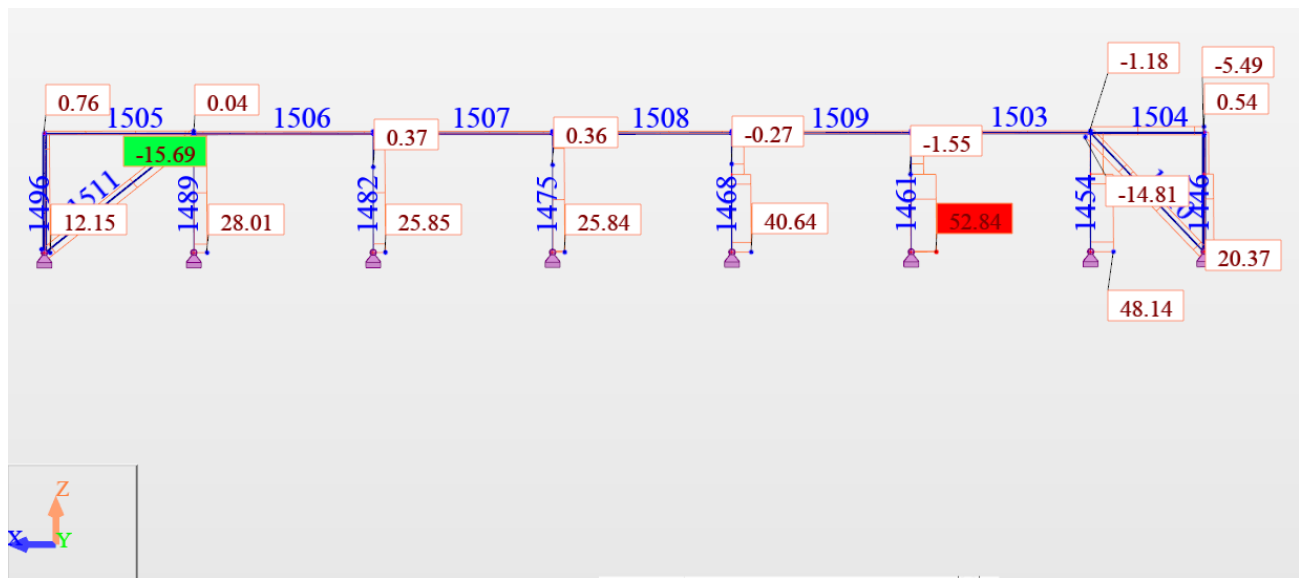


Konstrukcijų ašyje 4 lenkimo momentų diagramos



Konstrukcijų ašyje 4 ašinių jėgų diagramos





Konstrukcijų ašyje 4 elementų skaičiavimo rezultatai

Memb	Section	Material	Lay	Laz	Ratio	Case	Ratio(uy)	Case (uy)	Ratio(uz)	Case (uz)
1446	SQUA 180x18	S 355	56.31	56.31	0.09	15 COMB7	0.03	20 COMB12	0.06	20 COMB12
1454	SQUA 180x18	S 355	56.31	56.31	0.15	13 COMB5	0.07	23 COMB15	0.00	25 COMB17
1461	SQUA 180x18	S 355	56.31	56.31	0.16	15 COMB7	0.08	23 COMB15	0.00	24 COMB16
1468	SQUA 180x18	S 355	56.31	56.31	0.11	15 COMB7	0.06	23 COMB15	0.00	25 COMB17
1475	SQUA 180x18	S 355	56.31	56.31	0.09	17 COMB9	0.12	21 COMB13	0.00	25 COMB17
1482	SQUA 180x18	S 355	56.31	56.31	0.09	17 COMB9	0.12	21 COMB13	0.00	22 COMB14
1489	SQUA 180x18	S 355	56.31	56.31	0.08	17 COMB9	0.10	25 COMB17	0.00	21 COMB13
1496	SQUA 180x18	S 355	56.31	56.31	0.06	17 COMB9	0.05	21 COMB13	0.06	22 COMB14
1503 h	SQUA 100x10	S 355	154.19	154.19	0.07	12 COMB4	-	-	-	-
1504 h	SQUA 100x10	S 355	97.65	97.65	0.06	16 COMB8	-	-	-	-
1505 h	SQUA 100x10	S 355	128.49	128.49	0.05	18 COMB10	-	-	-	-
1506 h	SQUA 100x10	S 355	154.19	154.19	0.07	14 COMB6	-	-	-	-
1507 h	SQUA 100x10	S 355	154.19	154.19	0.06	14 COMB6	-	-	-	-
1508 h	SQUA 100x10	S 355	154.19	154.19	0.06	12 COMB4	-	-	-	-
1509 h	SQUA 100x10	S 355	154.19	154.19	0.06	12 COMB4	-	-	-	-
1510 h	SQUA 140x14	S 355	100.79	100.79	0.04	18 COMB10	-	-	-	-
1511 h	SQUA 140x14	S 355	116.96	116.96	0.05	16 COMB8	-	-	-	-

## STEEL DESIGN

**CODE:** BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

**CODE GROUP:**

**MEMBER:** 1446

**POINT:** 2

**COORDINATE:** x = 0.32 L = 1.30 m

**LOADS:**

Governing Load Case: 15 COMB7 (1+2)\*1.35+(3+7)\*0.90

**MATERIAL:**

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



**SECTION PARAMETERS:** SQUA 180x180x5

h=18.0 cm

gM0=1.00

gM1=1.00

b=18.0 cm

Ay=17.18 cm<sup>2</sup>

Az=17.18 cm<sup>2</sup>

Ax=34.36 cm<sup>2</sup>

tw=0.5 cm

Iy=1736.87 cm<sup>4</sup>

Iz=1736.87 cm<sup>4</sup>

Ix=2724.16 cm<sup>4</sup>

tf=0.5 cm

Wply=224.02 cm<sup>3</sup>

Wplz=224.02 cm<sup>3</sup>

**INTERNAL FORCES AND CAPACITIES:**

N <sub>Ed</sub> = 19.44 kN	M <sub>y,Ed</sub> = -0.65 kN*m	M <sub>z,Ed</sub> = -1.41 kN*m	V <sub>y,Ed</sub> = 0.98 kN
N <sub>c,Rd</sub> = 1219.65 kN	M <sub>y,Ed,max</sub> = -0.78 kN*m	M <sub>z,Ed,max</sub> = 4.90 kN*m	V <sub>y,c,Rd</sub> = 352.08 kN
N <sub>b,Rd</sub> = 1219.65 kN	M <sub>y,c,Rd</sub> = 79.53 kN*m	M <sub>z,c,Rd</sub> = 79.53 kN*m	V <sub>z,Ed</sub> = -0.30 kN
	MN <sub>y,Rd</sub> = 79.53 kN*m	MN <sub>z,Rd</sub> = 79.53 kN*m	V <sub>z,c,Rd</sub> = 352.08 kN
	M <sub>b,Rd</sub> = 79.53 kN*m		

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

z = 1.00	M <sub>cr</sub> = 2384.77 kN*m	Curve,LT - d	XLT = 1.00
L <sub>cr,low</sub> = 4.00 m	Lam_LT = 0.18	fi,LT = 0.43	XLT,mod = 1.00

#### BUCKLING PARAMETERS:



About y axis:

k<sub>yy</sub> = 1.00



About z axis:

k<sub>zz</sub> = 1.00

#### VERIFICATION FORMULAS:

##### Section strength check:

N<sub>Ed</sub>/N<sub>c,Rd</sub> = 0.02 < 1.00 (6.2.4.(1))  
 $(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00$  (6.2.9.1.(6))  
V<sub>y,Ed</sub>/V<sub>y,c,Rd</sub> = 0.00 < 1.00 (6.2.6.(1))  
V<sub>z,Ed</sub>/V<sub>z,c,Rd</sub> = 0.00 < 1.00 (6.2.6.(1))

##### Global stability check of member:

M<sub>y,Ed,max</sub>/M<sub>b,Rd</sub> = 0.01 < 1.00 (6.3.2.1.(1))  
N<sub>Ed</sub>/(X<sub>y</sub>\*N<sub>Rk</sub>/gM1) + k<sub>yy</sub>\*M<sub>y,Ed,max</sub>/(XLT\*M<sub>y,Rk</sub>/gM1) + k<sub>yz</sub>\*M<sub>z,Ed,max</sub>/(M<sub>z,Rk</sub>/gM1) = 0.09 < 1.00 (6.3.3.(4))  
N<sub>Ed</sub>/(X<sub>z</sub>\*N<sub>Rk</sub>/gM1) + k<sub>zy</sub>\*M<sub>y,Ed,max</sub>/(XLT\*M<sub>y,Rk</sub>/gM1) + k<sub>zz</sub>\*M<sub>z,Ed,max</sub>/(M<sub>z,Rk</sub>/gM1) = 0.09 < 1.00 (6.3.3.(4))

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

u<sub>y</sub> = 0.1 cm < u<sub>y</sub> max = L/200.00 = 2.0 cm Verified

**Governing Load Case:** 20 COMB12 (1+2+3+4)\*1.00

u<sub>z</sub> = 0.1 cm < u<sub>z</sub> max = L/200.00 = 2.0 cm Verified

**Governing Load Case:** 20 COMB12 (1+2+3+4)\*1.00



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

**Section OK !!!**

## STEEL DESIGN

**CODE:** BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

#### CODE GROUP:

**MEMBER:** 1454

**POINT:** 2

**COORDINATE:** x = 0.32 L = 1.30 m

#### LOADS:

**Governing Load Case:** 13 COMB5 1\*1.35+2\*1.30+(3+5)\*0.90

#### MATERIAL:

S 355 ( S 355 ) f<sub>y</sub> = 355.00 MPa



#### SECTION PARAMETERS: SQUA 180x180x5

h=18.0 cm	gM0=1.00	gM1=1.00	
b=18.0 cm	A <sub>y</sub> =17.18 cm <sup>2</sup>	A <sub>z</sub> =17.18 cm <sup>2</sup>	A <sub>x</sub> =34.36 cm <sup>2</sup>
tw=0.5 cm	I <sub>y</sub> =1736.87 cm <sup>4</sup>	I <sub>z</sub> =1736.87 cm <sup>4</sup>	I <sub>x</sub> =2724.16 cm <sup>4</sup>
tf=0.5 cm	W <sub>ply</sub> =224.02 cm <sup>3</sup>	W <sub>plz</sub> =224.02 cm <sup>3</sup>	

#### INTERNAL FORCES AND CAPACITIES:

N <sub>Ed</sub> = 37.43 kN	M <sub>y,Ed</sub> = -0.04 kN*m	M <sub>z,Ed</sub> = -1.74 kN*m	V <sub>y,Ed</sub> = 2.38 kN
N <sub>c,Rd</sub> = 1219.65 kN	M <sub>y,Ed,max</sub> = -0.06 kN*m	M <sub>z,Ed,max</sub> = 9.19 kN*m	V <sub>y,c,Rd</sub> = 352.08 kN
N <sub>b,Rd</sub> = 1219.65 kN	M <sub>y,c,Rd</sub> = 79.53 kN*m	M <sub>z,c,Rd</sub> = 79.53 kN*m	V <sub>z,Ed</sub> = -0.02 kN
	MN <sub>y,Rd</sub> = 79.53 kN*m	MN <sub>z,Rd</sub> = 79.53 kN*m	V <sub>z,c,Rd</sub> = 352.08 kN
	M <sub>b,Rd</sub> = 79.53 kN*m		

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

z = 1.00	M <sub>cr</sub> = 2384.77 kN*m	Curve,LT - d	XLT = 1.00
L <sub>cr,low</sub> = 4.00 m	Lam_LT = 0.18	fi_LT = 0.43	XLT <sub>mod</sub> = 1.00

#### BUCKLING PARAMETERS:



About y axis:

k<sub>yy</sub> = 1.00



About z axis:

k<sub>zz</sub> = 1.00

#### VERIFICATION FORMULAS:

##### Section strength check:

N<sub>Ed</sub>/N<sub>c,Rd</sub> = 0.03 < 1.00 (6.2.4.(1))  
 $(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00$  (6.2.9.1.(6))  
V<sub>y,Ed</sub>/V<sub>y,c,Rd</sub> = 0.01 < 1.00 (6.2.6.(1))  
V<sub>z,Ed</sub>/V<sub>z,c,Rd</sub> = 0.00 < 1.00 (6.2.6.(1))

##### Global stability check of member:

M<sub>y,Ed,max</sub>/M<sub>b,Rd</sub> = 0.00 < 1.00 (6.3.2.1.(1))  
N<sub>Ed</sub>/(X<sub>y</sub>\*N<sub>Rk</sub>/gM1) + k<sub>yy</sub>\*M<sub>y,Ed,max</sub>/(XLT\*M<sub>y,Rk</sub>/gM1) + k<sub>yz</sub>\*M<sub>z,Ed,max</sub>/(M<sub>z,Rk</sub>/gM1) = 0.15 < 1.00 (6.3.3.(4))  
N<sub>Ed</sub>/(X<sub>z</sub>\*N<sub>Rk</sub>/gM1) + k<sub>zy</sub>\*M<sub>y,Ed,max</sub>/(XLT\*M<sub>y,Rk</sub>/gM1) + k<sub>zz</sub>\*M<sub>z,Ed,max</sub>/(M<sub>z,Rk</sub>/gM1) = 0.15 < 1.00 (6.3.3.(4))

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

u<sub>y</sub> = 0.1 cm < u<sub>y</sub> max = L/200.00 = 2.0 cm Verified

**Governing Load Case:** 23 COMB15 (1+2+3+7)\*1.00

u<sub>z</sub> = 0.0 cm < u<sub>z</sub> max = L/200.00 = 2.0 cm Verified

**Governing Load Case:** 25 COMB17 (1+5)\*1.00



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

**Section OK !!!**

## STEEL DESIGN

**CODE:** BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

#### CODE GROUP:

**MEMBER:** 1461

**POINT:** 3

**COORDINATE:** x = 0.65 L = 2.60 m

#### LOADS:

**Governing Load Case:** 15 COMB7 (1+2)\*1.35+(3+7)\*0.90

#### MATERIAL:

S 355 ( S 355 ) f<sub>y</sub> = 355.00 MPa



#### SECTION PARAMETERS: SQUA 180x180x5

h=18.0 cm	gM0=1.00	gM1=1.00	
b=18.0 cm	A <sub>y</sub> =17.18 cm <sup>2</sup>	A <sub>z</sub> =17.18 cm <sup>2</sup>	A <sub>x</sub> =34.36 cm <sup>2</sup>
tw=0.5 cm	I <sub>y</sub> =1736.87 cm <sup>4</sup>	I <sub>z</sub> =1736.87 cm <sup>4</sup>	I <sub>x</sub> =2724.16 cm <sup>4</sup>
tf=0.5 cm	W <sub>ply</sub> =224.02 cm <sup>3</sup>	W <sub>plz</sub> =224.02 cm <sup>3</sup>	

#### INTERNAL FORCES AND CAPACITIES:

N <sub>Ed</sub> = 49.83 kN	M <sub>y,Ed</sub> = -0.00 kN*m	M <sub>z,Ed</sub> = -9.18 kN*m	V <sub>y,Ed</sub> = 2.94 kN
N <sub>c,Rd</sub> = 1219.65 kN	M <sub>y,Ed,max</sub> = -0.00 kN*m	M <sub>z,Ed,max</sub> = -9.18 kN*m	V <sub>y,c,Rd</sub> = 352.08 kN
N <sub>b,Rd</sub> = 1219.65 kN	M <sub>y,c,Rd</sub> = 79.53 kN*m	M <sub>z,c,Rd</sub> = 79.53 kN*m	V <sub>z,Ed</sub> = 0.00 kN
	MN <sub>y,Rd</sub> = 79.53 kN*m	MN <sub>z,Rd</sub> = 79.53 kN*m	V <sub>z,c,Rd</sub> = 352.08 kN
	M <sub>b,Rd</sub> = 79.53 kN*m		

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

z = 1.00	M <sub>cr</sub> = 2384.77 kN*m	Curve,LT - d	XLT = 1.00
L <sub>cr,low</sub> = 4.00 m	Lam_LT = 0.18	fi_LT = 0.43	XLT <sub>mod</sub> = 1.00

#### BUCKLING PARAMETERS:



About y axis:

k<sub>yy</sub> = 1.00



About z axis:

k<sub>zz</sub> = 1.00

#### VERIFICATION FORMULAS:

##### Section strength check:

N<sub>Ed</sub>/N<sub>c,Rd</sub> = 0.04 < 1.00 (6.2.4.(1))  
 (M<sub>y,Ed</sub>/M<sub>N,y,Rd</sub>)<sup>1.66</sup> + (M<sub>z,Ed</sub>/M<sub>N,z,Rd</sub>)<sup>1.66</sup> = 0.03 < 1.00 (6.2.9.1.(6))  
 V<sub>y,Ed</sub>/V<sub>y,c,Rd</sub> = 0.01 < 1.00 (6.2.6.(1))  
 V<sub>z,Ed</sub>/V<sub>z,c,Rd</sub> = 0.00 < 1.00 (6.2.6.(1))

##### Global stability check of member:

M<sub>y,Ed,max</sub>/M<sub>b,Rd</sub> = 0.00 < 1.00 (6.3.2.1.(1))  
 N<sub>Ed</sub>/(X<sub>y</sub>\*N<sub>Rk</sub>/gM1) + k<sub>yy</sub>\*M<sub>y,Ed,max</sub>/(XLT\*M<sub>y,Rk</sub>/gM1) + k<sub>yz</sub>\*M<sub>z,Ed,max</sub>/(M<sub>z,Rk</sub>/gM1) = 0.16 < 1.00 (6.3.3.(4))  
 N<sub>Ed</sub>/(X<sub>z</sub>\*N<sub>Rk</sub>/gM1) + k<sub>zy</sub>\*M<sub>y,Ed,max</sub>/(XLT\*M<sub>y,Rk</sub>/gM1) + k<sub>zz</sub>\*M<sub>z,Ed,max</sub>/(M<sub>z,Rk</sub>/gM1) = 0.16 < 1.00 (6.3.3.(4))

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

u<sub>y</sub> = 0.2 cm < u<sub>y</sub> max = L/200.00 = 2.0 cm Verified

Governing Load Case: 23 COMB15 (1+2+3+7)\*1.00

u<sub>z</sub> = 0.0 cm < u<sub>z</sub> max = L/200.00 = 2.0 cm Verified

Governing Load Case: 24 COMB16 (1+4)\*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

**Section OK !!!**

## STEEL DESIGN

CODE: [BS-EN 1993-1:2005/NA:2008/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

#### CODE GROUP:

MEMBER: 1468

POINT: 3

COORDINATE: x = 0.65 L = 2.60 m

#### LOADS:

Governing Load Case: 15 COMB7 (1+2)\*1.35+(3+7)\*0.90

#### MATERIAL:

S 355 ( S 355 ) f<sub>y</sub> = 355.00 MPa



#### SECTION PARAMETERS: SQUA 180x180x5

h=18.0 cm	gM0=1.00	gM1=1.00	
b=18.0 cm	A <sub>y</sub> =17.18 cm <sup>2</sup>	A <sub>z</sub> =17.18 cm <sup>2</sup>	A <sub>x</sub> =34.36 cm <sup>2</sup>
tw=0.5 cm	I <sub>y</sub> =1736.87 cm <sup>4</sup>	I <sub>z</sub> =1736.87 cm <sup>4</sup>	I <sub>x</sub> =2724.16 cm <sup>4</sup>
tf=0.5 cm	W <sub>ply</sub> =224.02 cm <sup>3</sup>	W <sub>plz</sub> =224.02 cm <sup>3</sup>	

#### INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 37.82 \text{ kN}$	$M_{y,Ed} = 0.01 \text{ kN}\cdot\text{m}$	$M_{z,Ed} = -6.12 \text{ kN}\cdot\text{m}$	$V_{y,Ed} = 1.77 \text{ kN}$
$N_{c,Rd} = 1219.65 \text{ kN}$	$M_{y,Ed,max} = 0.01 \text{ kN}\cdot\text{m}$	$M_{z,Ed,max} = -6.12 \text{ kN}\cdot\text{m}$	$V_{y,c,Rd} = 352.08 \text{ kN}$
$N_{b,Rd} = 1219.65 \text{ kN}$	$M_{y,c,Rd} = 79.53 \text{ kN}\cdot\text{m}$	$M_{z,c,Rd} = 79.53 \text{ kN}\cdot\text{m}$	$V_{z,Ed} = 0.00 \text{ kN}$
	$MN_{y,Rd} = 79.53 \text{ kN}\cdot\text{m}$	$MN_{z,Rd} = 79.53 \text{ kN}\cdot\text{m}$	$V_{z,c,Rd} = 352.08 \text{ kN}$
	$M_{b,Rd} = 79.53 \text{ kN}\cdot\text{m}$		

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 2384.77 \text{ kN}\cdot\text{m}$	Curve,LT - d	$XLT = 1.00$
$L_{cr,upp} = 4.00 \text{ m}$	$\lambda_{m,LT} = 0.18$	$\phi_{LT} = 0.43$	$XLT_{mod} = 1.00$

#### BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

#### VERIFICATION FORMULAS:

##### Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$   
 $(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.01 < 1.00 \quad (6.2.9.1.(6))$   
 $V_{y,Ed}/V_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.6.(1))$   
 $V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$

##### Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.00 < 1.00 \quad (6.3.2.1.(1))$   
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.11 < 1.00 \quad (6.3.3.(4))$   
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.11 < 1.00 \quad (6.3.3.(4))$

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

$u_y = 0.1 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$  Verified

**Governing Load Case:** 23 COMB15 (1+2+3+7)\*1.00

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$  Verified

**Governing Load Case:** 25 COMB17 (1+5)\*1.00



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

**Section OK !!!**

## STEEL DESIGN

**CODE:** BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

#### CODE GROUP:

**MEMBER:** 1475

**POINT:** 2

**COORDINATE:**  $x = 0.50 L = 2.00 \text{ m}$

#### LOADS:

**Governing Load Case:** 17 COMB9 1\*1.35+5\*1.30

#### MATERIAL:

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



#### SECTION PARAMETERS: SQUA 180x180x5

$h = 18.0 \text{ cm}$	$gM0 = 1.00$	$gM1 = 1.00$	
$b = 18.0 \text{ cm}$	$A_y = 17.18 \text{ cm}^2$	$A_z = 17.18 \text{ cm}^2$	$A_x = 34.36 \text{ cm}^2$
$t_w = 0.5 \text{ cm}$	$I_y = 1736.87 \text{ cm}^4$	$I_z = 1736.87 \text{ cm}^4$	$I_x = 2724.16 \text{ cm}^4$
$t_f = 0.5 \text{ cm}$	$W_{ply} = 224.02 \text{ cm}^3$	$W_{plz} = 224.02 \text{ cm}^3$	

#### INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 0.88 \text{ kN}$	$M_{y,Ed} = -0.01 \text{ kN}\cdot\text{m}$	$M_{z,Ed} = 6.74 \text{ kN}\cdot\text{m}$	$V_{y,Ed} = -0.16 \text{ kN}$
$N_{c,Rd} = 1219.65 \text{ kN}$	$M_{y,Ed,max} = -0.01 \text{ kN}\cdot\text{m}$	$M_{z,Ed,max} = 6.74 \text{ kN}\cdot\text{m}$	$V_{y,c,Rd} = 352.08 \text{ kN}$
$N_{b,Rd} = 1219.65 \text{ kN}$	$M_{y,c,Rd} = 79.53 \text{ kN}\cdot\text{m}$	$M_{z,c,Rd} = 79.53 \text{ kN}\cdot\text{m}$	
	$MN_{y,Rd} = 79.53 \text{ kN}\cdot\text{m}$	$MN_{z,Rd} = 79.53 \text{ kN}\cdot\text{m}$	
	$M_{b,Rd} = 79.53 \text{ kN}\cdot\text{m}$		

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 2384.77 \text{ kN}\cdot\text{m}$	Curve,LT - d	$XLT = 1.00$
$L_{cr,low} = 4.00 \text{ m}$	$\lambda_{m\_LT} = 0.18$	$\phi_{i,LT} = 0.43$	$XLT_{mod} = 1.00$

#### BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

#### VERIFICATION FORMULAS:

##### Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$  (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.02 < 1.00$  (6.2.9.1.(6))

$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00$  (6.2.6.(1))

##### Global stability check of member:

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

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.09 < 1.00$  (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.09 < 1.00$  (6.3.3.(4))

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

$u_y = 0.2 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 21 COMB13 (1+2+3+5)\*1.00

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 25 COMB17 (1+5)\*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

## STEEL DESIGN

CODE: [BS-EN 1993-1:2005/NA:2008/A1:2014](#), Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

#### CODE GROUP:

MEMBER: 1482

POINT: 2

COORDINATE:  $x = 0.50 L = 2.00 \text{ m}$

#### LOADS:

Governing Load Case: 17 COMB9 1\*1.35+5\*1.30

#### MATERIAL:

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



#### SECTION PARAMETERS: SQUA 180x180x5

$h = 18.0 \text{ cm}$	$gM0 = 1.00$	$gM1 = 1.00$	
$b = 18.0 \text{ cm}$	$A_y = 17.18 \text{ cm}^2$	$A_z = 17.18 \text{ cm}^2$	$A_x = 34.36 \text{ cm}^2$
$t_w = 0.5 \text{ cm}$	$I_y = 1736.87 \text{ cm}^4$	$I_z = 1736.87 \text{ cm}^4$	$I_x = 2724.16 \text{ cm}^4$
$t_f = 0.5 \text{ cm}$	$W_{ply} = 224.02 \text{ cm}^3$	$W_{plz} = 224.02 \text{ cm}^3$	

#### INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 0.89 \text{ kN}$	$M_{y,Ed} = -0.02 \text{ kN}\cdot\text{m}$	$M_{z,Ed} = 6.72 \text{ kN}\cdot\text{m}$	$V_{y,Ed} = -0.16 \text{ kN}$
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$N_{c,Rd} = 1219.65 \text{ kN}$      $M_{y,Ed,max} = -0.02 \text{ kN}\cdot\text{m}$      $M_{z,Ed,max} = 6.72 \text{ kN}\cdot\text{m}$      $V_{y,c,Rd} = 352.08 \text{ kN}$   
 $N_{b,Rd} = 1219.65 \text{ kN}$      $M_{y,c,Rd} = 79.53 \text{ kN}\cdot\text{m}$      $M_{z,c,Rd} = 79.53 \text{ kN}\cdot\text{m}$   
 $MN_{y,Rd} = 79.53 \text{ kN}\cdot\text{m}$      $MN_{z,Rd} = 79.53 \text{ kN}\cdot\text{m}$   
 $M_{b,Rd} = 79.53 \text{ kN}\cdot\text{m}$

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

$z = 1.00$      $M_{cr} = 2384.77 \text{ kN}\cdot\text{m}$     Curve,LT - d     $XLT = 1.00$   
 $L_{cr,low} = 4.00 \text{ m}$      $\lambda_{m,LT} = 0.18$      $\eta_{LT} = 0.43$      $XLT_{mod} = 1.00$

#### BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

#### VERIFICATION FORMULAS:

##### Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$  (6.2.4.(1))  
 $(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.02 < 1.00$  (6.2.9.1.(6))  
 $V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00$  (6.2.6.(1))

##### Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.00 < 1.00$  (6.3.2.1.(1))  
 $N_{Ed}/(X_y \cdot N_{Rk}/\gamma_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/\gamma_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/\gamma_{M1}) = 0.09 < 1.00$  (6.3.3.(4))  
 $N_{Ed}/(X_z \cdot N_{Rk}/\gamma_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/\gamma_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/\gamma_{M1}) = 0.09 < 1.00$  (6.3.3.(4))

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

$u_y = 0.2 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$     Verified

**Governing Load Case:** 21 COMB13 (1+2+3+5)\*1.00

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$     Verified

**Governing Load Case:** 22 COMB14 (1+2+3+6)\*1.00



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

**Section OK !!!**

## STEEL DESIGN

**CODE:** BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

#### CODE GROUP:

**MEMBER:** 1489

**POINT:** 3

**COORDINATE:** x = 1.00 L = 4.00 m

#### LOADS:

**Governing Load Case:** 17 COMB9 1\*1.35+5\*1.30

#### MATERIAL:

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



#### SECTION PARAMETERS: SQUA 180x180x5

$h = 18.0 \text{ cm}$      $g_{M0} = 1.00$      $g_{M1} = 1.00$   
 $b = 18.0 \text{ cm}$      $A_y = 17.18 \text{ cm}^2$      $A_z = 17.18 \text{ cm}^2$      $A_x = 34.36 \text{ cm}^2$   
 $t_w = 0.5 \text{ cm}$      $I_y = 1736.87 \text{ cm}^4$      $I_z = 1736.87 \text{ cm}^4$      $I_x = 2724.16 \text{ cm}^4$   
 $t_f = 0.5 \text{ cm}$      $W_{ply} = 224.02 \text{ cm}^3$      $W_{plz} = 224.02 \text{ cm}^3$

#### INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 2.02 \text{ kN}$      $M_{y,Ed} = -0.35 \text{ kN}\cdot\text{m}$      $M_{z,Ed} = -0.55 \text{ kN}\cdot\text{m}$      $V_{y,Ed} = 6.48 \text{ kN}$   
 $N_{c,Rd} = 1219.65 \text{ kN}$      $M_{y,Ed,max} = -0.35 \text{ kN}\cdot\text{m}$      $M_{z,Ed,max} = 5.93 \text{ kN}\cdot\text{m}$      $V_{y,c,Rd} = 352.08 \text{ kN}$



Nb,Rd = 1219.65 kN	My,c,Rd = 79.53 kN*m	Mz,c,Rd = 79.53 kN*m	Vz,Ed = -0.07 kN
	MN,y,Rd = 79.53 kN*m	MN,z,Rd = 79.53 kN*m	Vz,c,Rd = 352.08 kN
	Mb,Rd = 79.53 kN*m		

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 2384.77 kN*m	Curve,LT - d	XLT = 1.00
Lcr,low=4.00 m	Lam_LT = 0.18	fi,LT = 0.43	XLT,mod = 1.00

#### BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

#### VERIFICATION FORMULAS:

##### Section strength check:

N,Ed/Nc,Rd = 0.00 < 1.00 (6.2.4.(1))  
 $(My,Ed/MN,y,Rd)^{1.66} + (Mz,Ed/MN,z,Rd)^{1.66} = 0.00 < 1.00$  (6.2.9.1.(6))  
 Vy,Ed/Vy,c,Rd = 0.02 < 1.00 (6.2.6.(1))  
 Vz,Ed/Vz,c,Rd = 0.00 < 1.00 (6.2.6.(1))

##### Global stability check of member:

My,Ed,max/Mb,Rd = 0.00 < 1.00 (6.3.2.1.(1))  
 $N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) + kyz*Mz,Ed,max/(Mz,Rk/gM1) = 0.08 < 1.00$  (6.3.3.(4))  
 $N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) + kzz*Mz,Ed,max/(Mz,Rk/gM1) = 0.08 < 1.00$  (6.3.3.(4))

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

uy = 0.2 cm < uy max = L/200.00 = 2.0 cm Verified

Governing Load Case: 25 COMB17 (1+5)\*1.00

uz = 0.0 cm < uz max = L/200.00 = 2.0 cm Verified

Governing Load Case: 21 COMB13 (1+2+3+5)\*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

**Section OK !!!**

## STEEL DESIGN

CODE: [BS-EN 1993-1:2005/NA:2008/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

#### CODE GROUP:

MEMBER: 1496

POINT: 2

COORDINATE: x = 0.50 L = 2.00 m

#### LOADS:

Governing Load Case: 17 COMB9 1\*1.35+5\*1.30

#### MATERIAL:

S 355 ( S 355 ) fy = 355.00 MPa



#### SECTION PARAMETERS: SQUA 180x180x5

h=18.0 cm	gM0=1.00	gM1=1.00	
b=18.0 cm	Ay=17.18 cm <sup>2</sup>	Az=17.18 cm <sup>2</sup>	Ax=34.36 cm <sup>2</sup>
tw=0.5 cm	Iy=1736.87 cm <sup>4</sup>	Iz=1736.87 cm <sup>4</sup>	Ix=2724.16 cm <sup>4</sup>
tf=0.5 cm	Wply=224.02 cm <sup>3</sup>	Wplz=224.02 cm <sup>3</sup>	

#### INTERNAL FORCES AND CAPACITIES:

N,Ed = 1.92 kN	My,Ed = 1.75 kN*m	Mz,Ed = 2.99 kN*m	Vy,Ed = -0.07 kN
Nc,Rd = 1219.65 kN	My,Ed,max = 1.75 kN*m	Mz,Ed,max = 2.99 kN*m	Vy,c,Rd = 352.08 kN

Nb,Rd = 1219.65 kN	My,c,Rd = 79.53 kN*m	Mz,c,Rd = 79.53 kN*m	Vz,Ed = 0.03 kN
	MN,y,Rd = 79.53 kN*m	MN,z,Rd = 79.53 kN*m	Vz,c,Rd = 352.08 kN
	Mb,Rd = 79.53 kN*m		
			Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 2384.77 kN*m	Curve,LT - d	XLT = 1.00
Lcr,upp=4.00 m	Lam_LT = 0.18	fi,LT = 0.43	XLT,mod = 1.00

#### BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

#### VERIFICATION FORMULAS:

##### Section strength check:

N,Ed/Nc,Rd = 0.00 < 1.00 (6.2.4.(1))  
 $(M_y,Ed/MN_{y,Rd})^{1.66} + (M_z,Ed/MN_{z,Rd})^{1.66} = 0.01 < 1.00$  (6.2.9.1.(6))  
 $V_y,Ed/V_{y,c,Rd} = 0.00 < 1.00$  (6.2.6.(1))  
 $V_z,Ed/V_{z,c,Rd} = 0.00 < 1.00$  (6.2.6.(1))

##### Global stability check of member:

$M_y,Ed,max/M_{b,Rd} = 0.02 < 1.00$  (6.3.2.1.(1))  
 $N,Ed/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_y,Ed,max/(XLT \cdot M_y,Rk/gM1) + k_{yz} \cdot M_z,Ed,max/(M_z,Rk/gM1) = 0.06 < 1.00$  (6.3.3.(4))  
 $N,Ed/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_y,Ed,max/(XLT \cdot M_y,Rk/gM1) + k_{zz} \cdot M_z,Ed,max/(M_z,Rk/gM1) = 0.06 < 1.00$  (6.3.3.(4))

#### LIMIT DISPLACEMENTS



##### Deflections (LOCAL SYSTEM):

uy = 0.1 cm < uy max = L/200.00 = 2.0 cm Verified

**Governing Load Case:** 21 COMB13 (1+2+3+5)\*1.00

uz = 0.1 cm < uz max = L/200.00 = 2.0 cm Verified

**Governing Load Case:** 22 COMB14 (1+2+3+6)\*1.00



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

**Section OK !!!**

## STEEL DESIGN

**CODE:** BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

#### CODE GROUP:

**MEMBER:** 1503 hor rysis\_1503 **POINT:** 2

**COORDINATE:** x = 0.50 L = 3.00 m

#### LOADS:

**Governing Load Case:** 12 COMB4 (1+2)\*1.35+(3+4)\*0.90

#### MATERIAL:

S 355 ( S 355 ) fy = 355.00 MPa



#### SECTION PARAMETERS: SQUA 100x100x4

h=10.0 cm	gM0=1.00	gM1=1.00	
b=10.0 cm	Ay=7.47 cm <sup>2</sup>	Az=7.47 cm <sup>2</sup>	Ax=14.95 cm <sup>2</sup>
tw=0.4 cm	Iy=226.35 cm <sup>4</sup>	Iz=226.35 cm <sup>4</sup>	Ix=362.01 cm <sup>4</sup>
tf=0.4 cm	Wply=53.30 cm <sup>3</sup>	Wplz=53.30 cm <sup>3</sup>	

#### INTERNAL FORCES AND CAPACITIES:

N,Ed = 3.13 kN	My,Ed = 0.70 kN*m	Mz,Ed = -0.06 kN*m
Nc,Rd = 530.65 kN	My,Ed,max = 0.70 kN*m	Mz,Ed,max = -0.06 kN*m

Nb,Rd = 116.35 kN

My,c,Rd = 18.92 kN\*m  
MN,y,Rd = 18.92 kN\*m

Mz,c,Rd = 18.92 kN\*m  
MN,z,Rd = 18.92 kN\*m

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

#### BUCKLING PARAMETERS:



About y axis:

Ly = 6.00 m  
Lcr,y = 6.00 m  
Lamy = 154.19  
Lam\_y = 2.02  
Xy = 0.22  
ky = 1.01



About z axis:

Lz = 6.00 m  
Lcr,z = 6.00 m  
Lamz = 154.19  
Lam\_z = 2.02  
Xz = 0.22  
kyz = 0.62

#### VERIFICATION FORMULAS:

##### Section strength check:

N<sub>Ed</sub>/N<sub>c,Rd</sub> = 0.01 < 1.00 (6.2.4.(1))

(M<sub>y,Ed</sub>/M<sub>N,y,Rd</sub>)<sup>1.66</sup> + (M<sub>z,Ed</sub>/M<sub>N,z,Rd</sub>)<sup>1.66</sup> = 0.00 < 1.00 (6.2.9.1.(6))

##### Global stability check of member:

Lambda<sub>y</sub> = 154.19 < Lambda<sub>max</sub> = 210.00      Lambda<sub>z</sub> = 154.19 < Lambda<sub>max</sub> = 210.00      STABLE

N<sub>Ed</sub>/(X<sub>y</sub>\*N<sub>Rk</sub>/gM1) + k<sub>yy</sub>\*M<sub>y,Ed,max</sub>/(XLT\*M<sub>y,Rk</sub>/gM1) + k<sub>yz</sub>\*M<sub>z,Ed,max</sub>/(M<sub>z,Rk</sub>/gM1) = 0.07 < 1.00 (6.3.3.(4))

N<sub>Ed</sub>/(X<sub>z</sub>\*N<sub>Rk</sub>/gM1) + k<sub>zy</sub>\*M<sub>y,Ed,max</sub>/(XLT\*M<sub>y,Rk</sub>/gM1) + k<sub>zz</sub>\*M<sub>z,Ed,max</sub>/(M<sub>z,Rk</sub>/gM1) = 0.05 < 1.00 (6.3.3.(4))

**Section OK !!!**

## STEEL DESIGN

**CODE:** [BS-EN 1993-1:2005/NA:2008/A1:2014](#), [Eurocode 3: Design of steel structures](#).

**ANALYSIS TYPE:** [Member Verification](#)

#### CODE GROUP:

**MEMBER:** 1504 hor rysis\_1504      **POINT:** 2

**COORDINATE:** x = 0.50 L = 1.90 m

#### LOADS:

Governing Load Case: 16 COMB8 1\*1.35+4\*1.30

#### MATERIAL:

S 355 ( S 355 )      f<sub>y</sub> = 355.00 MPa



#### SECTION PARAMETERS: SQUA 100x100x4

h=10.0 cm	gM0=1.00	gM1=1.00	
b=10.0 cm	A <sub>y</sub> =7.47 cm <sup>2</sup>	A <sub>z</sub> =7.47 cm <sup>2</sup>	A <sub>x</sub> =14.95 cm <sup>2</sup>
tw=0.4 cm	I <sub>y</sub> =226.35 cm <sup>4</sup>	I <sub>z</sub> =226.35 cm <sup>4</sup>	I <sub>x</sub> =362.01 cm <sup>4</sup>
tf=0.4 cm	W <sub>ply</sub> =53.30 cm <sup>3</sup>	W <sub>plz</sub> =53.30 cm <sup>3</sup>	

#### INTERNAL FORCES AND CAPACITIES:

N <sub>Ed</sub> = 11.68 kN	M <sub>y,Ed</sub> = 0.26 kN*m	M <sub>z,Ed</sub> = -0.07 kN*m
N <sub>c,Rd</sub> = 530.65 kN	M <sub>y,Ed,max</sub> = 0.26 kN*m	M <sub>z,Ed,max</sub> = -0.07 kN*m
N <sub>b,Rd</sub> = 256.22 kN	M <sub>y,c,Rd</sub> = 18.92 kN*m	M <sub>z,c,Rd</sub> = 18.92 kN*m
	MN <sub>y,Rd</sub> = 18.92 kN*m	MN <sub>z,Rd</sub> = 18.92 kN*m

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

#### BUCKLING PARAMETERS:



About y axis:

Ly = 3.80 m  
Lcr,y = 3.80 m  
Lam\_y = 1.28  
Xy = 0.48



About z axis:

Lz = 3.80 m  
Lcr,z = 3.80 m  
Lam\_z = 1.28  
Xz = 0.48

Lamy = 97.65

kyy = 1.03

Lamz = 97.65

kyz = 0.63

**VERIFICATION FORMULAS:****Section strength check:**

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

**Global stability check of member:**

$$\lambda_{y,Ed} = 97.65 < \lambda_{y,max} = 210.00 \quad \lambda_{z,Ed} = 97.65 < \lambda_{z,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

**Section OK !!!****STEEL DESIGN****CODE:** BS-EN 1993-1-2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.**ANALYSIS TYPE:** Member Verification**CODE GROUP:****MEMBER:** 1505 hor rysis\_1505 **POINT:** 2**COORDINATE:** x = 0.50 L = 2.50 m**LOADS:**

Governing Load Case: 18 COMB10 1\*1.35+6\*1.30

**MATERIAL:**S 355 ( S 355 )  $f_y = 355.00 \text{ MPa}$ **SECTION PARAMETERS: SQUA 100x100x4**

h=10.0 cm	gM0=1.00	gM1=1.00	
b=10.0 cm	Ay=7.47 cm <sup>2</sup>	Az=7.47 cm <sup>2</sup>	Ax=14.95 cm <sup>2</sup>
tw=0.4 cm	Iy=226.35 cm <sup>4</sup>	Iz=226.35 cm <sup>4</sup>	Ix=362.01 cm <sup>4</sup>
tf=0.4 cm	Wply=53.30 cm <sup>3</sup>	Wplz=53.30 cm <sup>3</sup>	

**INTERNAL FORCES AND CAPACITIES:**

N <sub>Ed</sub> = 4.46 kN	M <sub>y,Ed</sub> = 0.43 kN*m	M <sub>z,Ed</sub> = -0.08 kN*m
N <sub>c,Rd</sub> = 530.65 kN	M <sub>y,Ed,max</sub> = 0.43 kN*m	M <sub>z,Ed,max</sub> = -0.08 kN*m
N <sub>b,Rd</sub> = 162.00 kN	M <sub>y,c,Rd</sub> = 18.92 kN*m	M <sub>z,c,Rd</sub> = 18.92 kN*m
	M <sub>N,y,Rd</sub> = 18.92 kN*m	M <sub>N,z,Rd</sub> = 18.92 kN*m

Class of section = 1

**LATERAL BUCKLING PARAMETERS:****BUCKLING PARAMETERS:**

About y axis:

L <sub>y</sub> = 5.00 m	Lam <sub>y</sub> = 1.68
L <sub>cr,y</sub> = 5.00 m	X <sub>y</sub> = 0.31
Lam <sub>y</sub> = 128.49	kyy = 1.01



About z axis:

L <sub>z</sub> = 5.00 m	Lam <sub>z</sub> = 1.68
L <sub>cr,z</sub> = 5.00 m	X <sub>z</sub> = 0.31
Lam <sub>z</sub> = 128.49	kyz = 0.62

**VERIFICATION FORMULAS:****Section strength check:**

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

**Global stability check of member:**

$$\lambda_{y,Ed} = 128.49 < \lambda_{y,max} = 210.00 \quad \lambda_{z,Ed} = 128.49 < \lambda_{z,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

Section OK !!!

## STEEL DESIGN

CODE: BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1506 hor rysis\_1506 POINT: 2

COORDINATE: x = 0.50 L = 3.00 m

LOADS:

Governing Load Case: 14 COMB6 1\*1.35+2\*1.30+(3+6)\*0.90

MATERIAL:

S 355 ( S 355 ) fy = 355.00 MPa



SECTION PARAMETERS: SQUA 100x100x4

h=10.0 cm	gM0=1.00	gM1=1.00	
b=10.0 cm	Ay=7.47 cm <sup>2</sup>	Az=7.47 cm <sup>2</sup>	Ax=14.95 cm <sup>2</sup>
tw=0.4 cm	Iy=226.35 cm <sup>4</sup>	Iz=226.35 cm <sup>4</sup>	Ix=362.01 cm <sup>4</sup>
tf=0.4 cm	Wply=53.30 cm <sup>3</sup>	Wplz=53.30 cm <sup>3</sup>	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 3.14 kN	My,Ed = 0.71 kN*m	Mz,Ed = -0.06 kN*m
Nc,Rd = 530.65 kN	My,Ed,max = 0.71 kN*m	Mz,Ed,max = -0.06 kN*m
Nb,Rd = 116.35 kN	My,c,Rd = 18.92 kN*m	Mz,c,Rd = 18.92 kN*m
	MN,y,Rd = 18.92 kN*m	MN,z,Rd = 18.92 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 6.00 m	Lam_y = 2.02
Lcr,y = 6.00 m	Xy = 0.22
Lamy = 154.19	kyy = 1.01



About z axis:

Lz = 6.00 m	Lam_z = 2.02
Lcr,z = 6.00 m	Xz = 0.22
Lamz = 154.19	kyz = 0.62

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

Global stability check of member:

$$\Lambda_{b,y} = 154.19 < \Lambda_{b,max} = 210.00 \quad \Lambda_{b,z} = 154.19 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

Section OK !!!

## STEEL DESIGN

CODE: BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1507 hor rysis\_1507 POINT: 2

COORDINATE: x = 0.50 L = 3.00 m

**LOADS:**

Governing Load Case: 14 COMB6  $1 \cdot 1.35 + 2 \cdot 1.30 + (3+6) \cdot 0.90$

**MATERIAL:**

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

**SECTION PARAMETERS: SQUA 100x100x4**

$h=10.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=10.0$ cm	$A_y=7.47$ cm <sup>2</sup>	$A_z=7.47$ cm <sup>2</sup>	$A_x=14.95$ cm <sup>2</sup>
$t_w=0.4$ cm	$I_y=226.35$ cm <sup>4</sup>	$I_z=226.35$ cm <sup>4</sup>	$I_x=362.01$ cm <sup>4</sup>
$t_f=0.4$ cm	$W_{ply}=53.30$ cm <sup>3</sup>	$W_{plz}=53.30$ cm <sup>3</sup>	

**INTERNAL FORCES AND CAPACITIES:**

$N_{Ed} = 3.11$ kN	$M_{y,Ed} = 0.70$ kN*m	$M_{z,Ed} = -0.02$ kN*m
$N_{c,Rd} = 530.65$ kN	$M_{y,Ed,max} = 0.70$ kN*m	$M_{z,Ed,max} = -0.02$ kN*m
$N_{b,Rd} = 116.35$ kN	$M_{y,c,Rd} = 18.92$ kN*m	$M_{z,c,Rd} = 18.92$ kN*m
	$MN_{y,Rd} = 18.92$ kN*m	$MN_{z,Rd} = 18.92$ kN*m

Class of section = 1

**LATERAL BUCKLING PARAMETERS:****BUCKLING PARAMETERS:**

About y axis:

$L_y = 6.00$ m	$\lambda_{m,y} = 2.02$
$L_{cr,y} = 6.00$ m	$X_y = 0.22$
$\lambda_{m,y} = 154.19$	$k_{yy} = 1.01$



About z axis:

$L_z = 6.00$ m	$\lambda_{m,z} = 2.02$
$L_{cr,z} = 6.00$ m	$X_z = 0.22$
$\lambda_{m,z} = 154.19$	$k_{yz} = 0.62$

**VERIFICATION FORMULAS:****Section strength check:**

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

**Global stability check of member:**

$$\lambda_{m,y} = 154.19 < \lambda_{m,max} = 210.00 \quad \lambda_{m,z} = 154.19 < \lambda_{m,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

**Section OK !!!**

## STEEL DESIGN

**CODE:** BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

**CODE GROUP:**

**MEMBER:** 1508 hor rysis\_1508 **POINT:** 2

**COORDINATE:** x = 0.50 L = 3.00 m

**LOADS:**

Governing Load Case: 12 COMB4  $(1+2) \cdot 1.35 + (3+4) \cdot 0.90$

**MATERIAL:**

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

**SECTION PARAMETERS: SQUA 100x100x4**

$h=10.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=10.0$ cm	$A_y=7.47$ cm <sup>2</sup>	$A_z=7.47$ cm <sup>2</sup>	$A_x=14.95$ cm <sup>2</sup>
$t_w=0.4$ cm	$I_y=226.35$ cm <sup>4</sup>	$I_z=226.35$ cm <sup>4</sup>	$I_x=362.01$ cm <sup>4</sup>

tf=0.4 cm

Wply=53.30 cm<sup>3</sup>

Wplz=53.30 cm<sup>3</sup>

#### INTERNAL FORCES AND CAPACITIES:

N<sub>Ed</sub> = 3.12 kN

M<sub>y,Ed</sub> = 0.69 kN\*m

M<sub>z,Ed</sub> = -0.01 kN\*m

N<sub>c,Rd</sub> = 530.65 kN

M<sub>y,Ed,max</sub> = 0.69 kN\*m

M<sub>z,Ed,max</sub> = -0.01 kN\*m

N<sub>b,Rd</sub> = 116.35 kN

M<sub>y,c,Rd</sub> = 18.92 kN\*m

M<sub>z,c,Rd</sub> = 18.92 kN\*m

M<sub>N,y,Rd</sub> = 18.92 kN\*m

M<sub>N,z,Rd</sub> = 18.92 kN\*m

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

#### BUCKLING PARAMETERS:



About y axis:

L<sub>y</sub> = 6.00 m

Lam<sub>y</sub> = 2.02

L<sub>cr,y</sub> = 6.00 m

X<sub>y</sub> = 0.22

Lam<sub>y</sub> = 154.19

k<sub>yy</sub> = 1.01



About z axis:

L<sub>z</sub> = 6.00 m

Lam<sub>z</sub> = 2.02

L<sub>cr,z</sub> = 6.00 m

X<sub>z</sub> = 0.22

Lam<sub>z</sub> = 154.19

k<sub>yz</sub> = 0.62

#### VERIFICATION FORMULAS:

##### Section strength check:

N<sub>Ed</sub>/N<sub>c,Rd</sub> = 0.01 < 1.00 (6.2.4.(1))

(M<sub>y,Ed</sub>/M<sub>N,y,Rd</sub>)<sup>1.66</sup> + (M<sub>z,Ed</sub>/M<sub>N,z,Rd</sub>)<sup>1.66</sup> = 0.00 < 1.00 (6.2.9.1.(6))

##### Global stability check of member:

Lam<sub>lambda,y</sub> = 154.19 < Lam<sub>lambda,max</sub> = 210.00 Lam<sub>lambda,z</sub> = 154.19 < Lam<sub>lambda,max</sub> = 210.00 STABLE

N<sub>Ed</sub>/(X<sub>y</sub>\*N<sub>Rk</sub>/gM1) + k<sub>yy</sub>\*M<sub>y,Ed,max</sub>/(XLT\*M<sub>y,Rk</sub>/gM1) + k<sub>yz</sub>\*M<sub>z,Ed,max</sub>/(M<sub>z,Rk</sub>/gM1) = 0.06 < 1.00 (6.3.3.(4))

N<sub>Ed</sub>/(X<sub>z</sub>\*N<sub>Rk</sub>/gM1) + k<sub>zy</sub>\*M<sub>y,Ed,max</sub>/(XLT\*M<sub>y,Rk</sub>/gM1) + k<sub>zz</sub>\*M<sub>z,Ed,max</sub>/(M<sub>z,Rk</sub>/gM1) = 0.05 < 1.00 (6.3.3.(4))

**Section OK !!!**

## STEEL DESIGN

**CODE:** BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

#### CODE GROUP:

**MEMBER:** 1509 hor rysis\_1509 **POINT:** 2

**COORDINATE:** x = 0.50 L = 3.00 m

#### LOADS:

Governing Load Case: 12 COMB4 (1+2)\*1.35+(3+4)\*0.90

#### MATERIAL:

S 355 ( S 355 ) f<sub>y</sub> = 355.00 MPa



#### SECTION PARAMETERS: SQUA 100x100x4

h=10.0 cm

gM0=1.00

gM1=1.00

b=10.0 cm

A<sub>y</sub>=7.47 cm<sup>2</sup>

A<sub>z</sub>=7.47 cm<sup>2</sup>

A<sub>x</sub>=14.95 cm<sup>2</sup>

tw=0.4 cm

I<sub>y</sub>=226.35 cm<sup>4</sup>

I<sub>z</sub>=226.35 cm<sup>4</sup>

I<sub>x</sub>=362.01 cm<sup>4</sup>

tf=0.4 cm

W<sub>ply</sub>=53.30 cm<sup>3</sup>

W<sub>plz</sub>=53.30 cm<sup>3</sup>

#### INTERNAL FORCES AND CAPACITIES:

N<sub>Ed</sub> = 3.11 kN

M<sub>y,Ed</sub> = 0.69 kN\*m

M<sub>z,Ed</sub> = -0.02 kN\*m

N<sub>c,Rd</sub> = 530.65 kN

M<sub>y,Ed,max</sub> = 0.69 kN\*m

M<sub>z,Ed,max</sub> = -0.02 kN\*m

N<sub>b,Rd</sub> = 116.35 kN

M<sub>y,c,Rd</sub> = 18.92 kN\*m

M<sub>z,c,Rd</sub> = 18.92 kN\*m

M<sub>N,y,Rd</sub> = 18.92 kN\*m

M<sub>N,z,Rd</sub> = 18.92 kN\*m

Class of section = 1



#### LATERAL BUCKLING PARAMETERS:

**BUCKLING PARAMETERS:**

About y axis:

Ly = 6.00 m      Lam\_y = 2.02  
 Lcr,y = 6.00 m      Xy = 0.22  
 Lamy = 154.19      kyy = 1.01



About z axis:

Lz = 6.00 m      Lam\_z = 2.02  
 Lcr,z = 6.00 m      Xz = 0.22  
 Lamz = 154.19      kyz = 0.62

**VERIFICATION FORMULAS:****Section strength check:**

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

**Global stability check of member:**

$$\lambda_{b,y} = 154.19 < \lambda_{b,max} = 210.00 \quad \lambda_{b,z} = 154.19 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

**Section OK !!!****STEEL DESIGN****CODE:** *BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.***ANALYSIS TYPE:** Member Verification**CODE GROUP:****MEMBER:** 1510 hor rysis\_1510      **POINT:** 2**COORDINATE:** x = 0.32 L = 1.79 m**LOADS:**

Governing Load Case: 18 COMB10 1\*1.35+6\*1.30

**MATERIAL:**

S 355 ( S 355 )      fy = 355.00 MPa

**SECTION PARAMETERS: SQUA 140x140x5**

h=14.0 cm	gM0=1.00	gM1=1.00	
b=14.0 cm	Ay=13.18 cm <sup>2</sup>	Az=13.18 cm <sup>2</sup>	Ax=26.36 cm <sup>2</sup>
tw=0.5 cm	Iy=790.56 cm <sup>4</sup>	Iz=790.56 cm <sup>4</sup>	Ix=1255.76 cm <sup>4</sup>
tf=0.5 cm	Wply=132.30 cm <sup>3</sup>	Wplz=132.30 cm <sup>3</sup>	

**INTERNAL FORCES AND CAPACITIES:**

N <sub>Ed</sub> = 8.68 kN	M <sub>y,Ed</sub> = 0.63 kN*m	M <sub>z,Ed</sub> = -0.03 kN*m	V <sub>y,Ed</sub> = 0.01 kN
N <sub>c,Rd</sub> = 935.65 kN	M <sub>y,Ed,max</sub> = 0.72 kN*m	M <sub>z,Ed,max</sub> = -0.03 kN*m	V <sub>y,c,Rd</sub> = 270.10 kN
N <sub>b,Rd</sub> = 430.20 kN	M <sub>y,c,Rd</sub> = 46.97 kN*m	M <sub>z,c,Rd</sub> = 46.97 kN*m	V <sub>z,Ed</sub> = 0.18 kN
	M <sub>N,y,Rd</sub> = 46.97 kN*m	M <sub>N,z,Rd</sub> = 46.97 kN*m	V <sub>z,c,Rd</sub> = 270.10 kN
			Class of section = 1

**LATERAL BUCKLING PARAMETERS:****BUCKLING PARAMETERS:**

About y axis:

Ly = 5.52 m      Lam\_y = 1.32  
 Lcr,y = 5.52 m      Xy = 0.46  
 Lamy = 100.79      kyy = 1.01



About z axis:

Lz = 5.52 m      Lam\_z = 1.32  
 Lcr,z = 5.52 m      Xz = 0.46  
 Lamz = 100.79      kyz = 0.61

**VERIFICATION FORMULAS:****Section strength check:**

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$



$$V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$

**Global stability check of member:**

$$\lambda_{y,Ed} = 100.79 < \lambda_{y,max} = 210.00 \quad \lambda_{z,Ed} = 100.79 < \lambda_{z,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.03 < 1.00 \quad (6.3.3.(4))$$

**Section OK !!!**

## STEEL DESIGN

**CODE:** BS-EN 1993-1:2005/NA:2008/A1:2014, Eurocode 3: Design of steel structures.

**ANALYSIS TYPE:** Member Verification

**CODE GROUP:**

**MEMBER:** 1511 hor rysis\_1511 **POINT:** 2

**COORDINATE:** x = 0.50 L = 3.20 m

**LOADS:**

Governing Load Case: 16 COMB8 1\*1.35+4\*1.30

**MATERIAL:**

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



**SECTION PARAMETERS: SQUA 140x140x5**

h=14.0 cm	gM0=1.00	gM1=1.00	
b=14.0 cm	A <sub>y</sub> =13.18 cm <sup>2</sup>	A <sub>z</sub> =13.18 cm <sup>2</sup>	A <sub>x</sub> =26.36 cm <sup>2</sup>
tw=0.5 cm	I <sub>y</sub> =790.56 cm <sup>4</sup>	I <sub>z</sub> =790.56 cm <sup>4</sup>	I <sub>x</sub> =1255.76 cm <sup>4</sup>
tf=0.5 cm	W <sub>ply</sub> =132.30 cm <sup>3</sup>	W <sub>plz</sub> =132.30 cm <sup>3</sup>	

**INTERNAL FORCES AND CAPACITIES:**

N <sub>Ed</sub> = 8.83 kN	M <sub>y,Ed</sub> = 1.10 kN*m	M <sub>z,Ed</sub> = 0.03 kN*m
N <sub>c,Rd</sub> = 935.65 kN	M <sub>y,Ed,max</sub> = 1.10 kN*m	M <sub>z,Ed,max</sub> = 0.03 kN*m
N <sub>b,Rd</sub> = 336.64 kN	M <sub>y,c,Rd</sub> = 46.97 kN*m	M <sub>z,c,Rd</sub> = 46.97 kN*m
	M <sub>N,y,Rd</sub> = 46.97 kN*m	M <sub>N,z,Rd</sub> = 46.97 kN*m

Class of section = 1



**LATERAL BUCKLING PARAMETERS:**

**BUCKLING PARAMETERS:**



About y axis:

L <sub>y</sub> = 6.41 m	Lam <sub>y</sub> = 1.53
L <sub>cr,y</sub> = 6.41 m	X <sub>y</sub> = 0.36
Lam <sub>y</sub> = 116.96	k <sub>yy</sub> = 1.01



About z axis:

L <sub>z</sub> = 6.41 m	Lam <sub>z</sub> = 1.53
L <sub>cr,z</sub> = 6.41 m	X <sub>z</sub> = 0.36
Lam <sub>z</sub> = 116.96	k <sub>yz</sub> = 0.62

**VERIFICATION FORMULAS:**

**Section strength check:**

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

**Global stability check of member:**

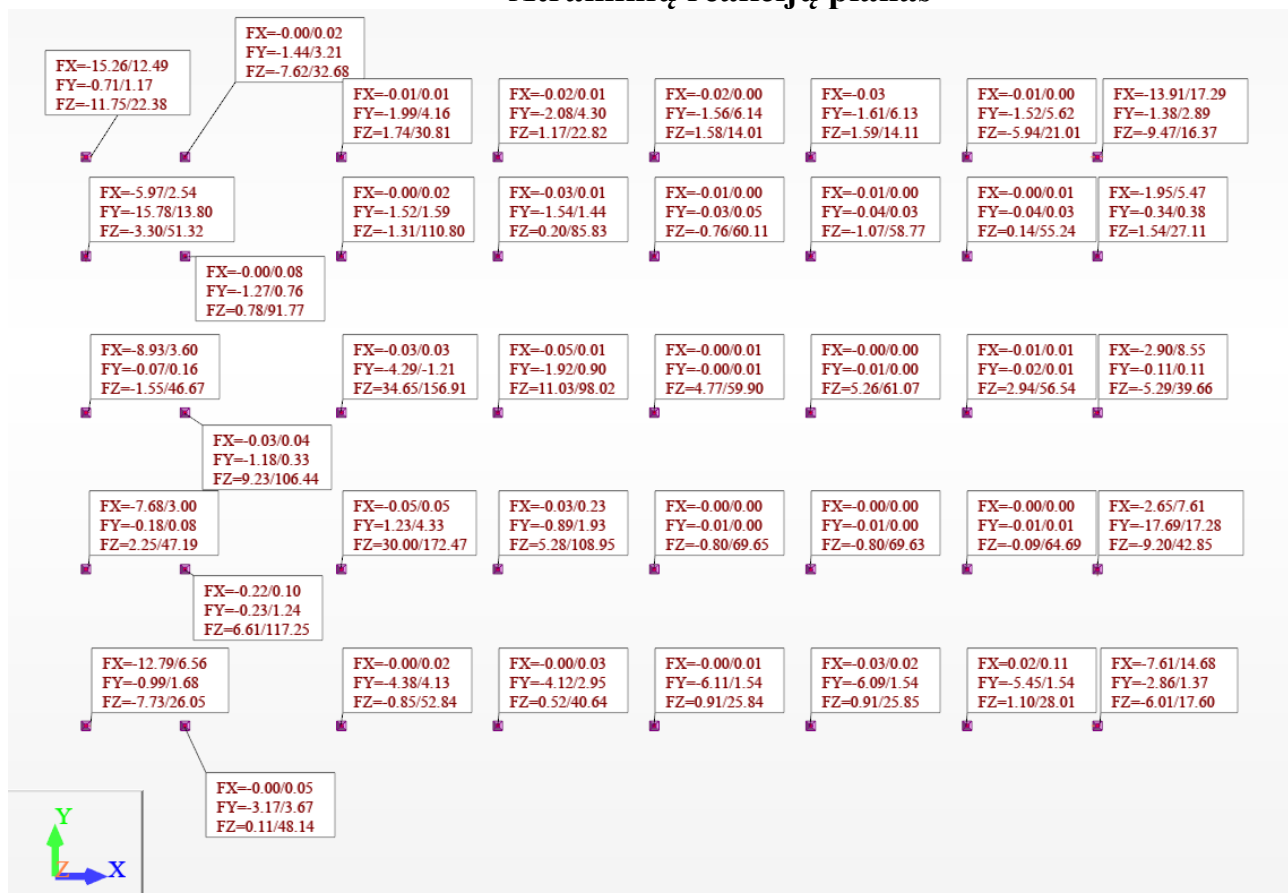
$$\lambda_{y,Ed} = 116.96 < \lambda_{y,max} = 210.00 \quad \lambda_{z,Ed} = 116.96 < \lambda_{z,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

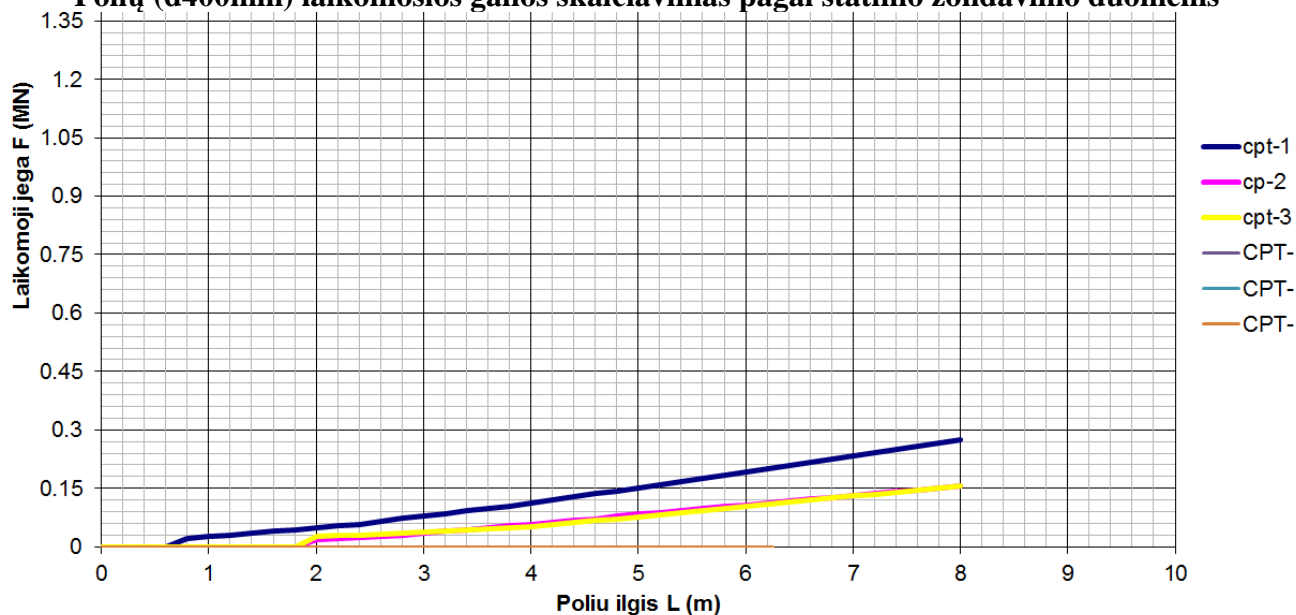
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

**Section OK !!!**

## Atraminų reakcijų planas



## Polių (d400mm) laikomosios galios skaičiavimas pagal statinio zondavimo duomenis



CPT-1																
D=		0.4	m													
Ab=		0.126	m²													
As/1m=		1.257	m²/m													
Modeliavimo koeficientas																
gama RB=		2				Rb=alfab*qc*Ab										
gama RS=		1.5														
Tyrimu tikslumo koeficientas																
ksi=		1.3														
Projektines situacijos koeficientas						0=	0 PVA	0								
gama t=		1.1				zond alt	0									
polio virsus gylyje		0														
								1	2	3	4					
								moren mo	juost mol	dulkis	smelis	skaic atv				
Gylis, m	polio ilgis	q <sub>c</sub> , MPa	Grunto tipa	fs	alfa b	Rb, MPa	Rb vid, MP	qs, MPa	qs, MPa	qs, MPa	qs, MPa	qs, MPa	Rs, MPa	Rc cal, MPa	Rc k	Rc d
0	0	0.0	2		1	0	0.0301593	0	0	0	0	0	0	0	0	0
0.2	0.2	0.0	2		1	0	0	0	0	0	0	0	0	0	0	0
0.4	0.4	0.0	2		1	0	0	0	0	0	0	0	0	0	0	0
0.6	0.6	0.0	2		1	0	0	0	0	0	0	0	0	0	0	0
0.8	0.8	0.4	2		1	0.05027	0.0578053	0.02	0.014	0.01	0.004	0.014	0.00352	0.0312484	0.02404	0.02185
1	1	0.4	2		1	0.05027	0.0653451	0.02	0.014	0.01	0.004	0.014	0.00704	0.037364	0.02874	0.02613
1.2	1.2	0.4	2		1	0.05027	0.0728849	0.02	0.014	0.01	0.004	0.014	0.01056	0.0434796	0.03345	0.03041
1.4	1.4	0.4	2		1	0.05027	0.0804248	0.02	0.014	0.01	0.004	0.014	0.01407	0.0495953	0.03815	0.03468
1.6	1.6	0.4	2		1	0.05027	0.0879646	0.02	0.014	0.01	0.004	0.014	0.01759	0.0557109	0.04285	0.03896
1.8	1.8	0.4	2		1	0.05027	0.0955044	0.02	0.014	0.01	0.004	0.014	0.02111	0.0618265	0.04756	0.04324
2	2	0.4	2		1	0.05027	0.1043009	0.02	0.014	0.01	0.004	0.014	0.02463	0.0685705	0.05275	0.04795
2.2	2.2	0.4	2		1	0.05027	0.1130973	0.02	0.014	0.01	0.004	0.014	0.02815	0.0753144	0.05793	0.05267
2.4	2.4	0.4	2		1	0.05027	0.1218938	0.02	0.014	0.01	0.004	0.014	0.03167	0.0820584	0.06312	0.05738
2.6	2.6	1.0	1		1	0.12566	0.1306903	0.05	0.035	0.025	0.01	0.05	0.04423	0.0948342	0.07295	0.06632
2.8	2.8	1.0	1		1	0.12566	0.1319469	0.05	0.035	0.025	0.01	0.05	0.0568	0.1038401	0.07988	0.07262
3	3	1.0	1		1	0.12566	0.1332035	0.05	0.035	0.025	0.01	0.05	0.06937	0.112846	0.0868	0.07891
3.2	3.2	1.0	1		1	0.12566	0.1344602	0.05	0.035	0.025	0.01	0.05	0.08193	0.1218519	0.09373	0.08521
3.4	3.4	1.0	1		1	0.12566	0.1357168	0.05	0.035	0.025	0.01	0.05	0.0945	0.1308578	0.10066	0.09151
3.6	3.6	1.0	1		1	0.12566	0.1369734	0.05	0.035	0.025	0.01	0.05	0.10707	0.1398637	0.10759	0.09781
3.8	3.8	1.1	1		1	0.13823	0.1382301	0.055	0.0385	0.0275	0.011	0.055	0.12089	0.1497074	0.11516	0.10469
4	4	1.1	1		1	0.13823	0.142	0.055	0.0385	0.0275	0.011	0.055	0.13471	0.1608077	0.1237	0.11245
4.2	4.2	1.1	1		1	0.13823	0.1457699	0.055	0.0385	0.0275	0.011	0.055	0.14853	0.171908	0.13224	0.12022
4.4	4.4	1.1	1		1	0.13823	0.1495398	0.055	0.0385	0.0275	0.011	0.055	0.16236	0.1830082	0.14078	0.12798
4.6	4.6	1.1	1		1	0.13823	0.1533097	0.055	0.0385	0.0275	0.011	0.055	0.17618	0.1941085	0.14931	0.13574
4.8	4.8	1.1	1		1	0.13823	0.1570796	0.055	0.0385	0.0275	0.011	0.055	0.19	0.2052088	0.15785	0.1435
5	5	1.1	1		1	0.13823	0.1608495	0.055	0.0385	0.0275	0.011	0.055	0.20383	0.2163091	0.16639	0.15127
5.2	5.2	1.1	1		1	0.13823	0.1646195	0.055	0.0385	0.0275	0.011	0.055	0.21765	0.2274094	0.17493	0.15903
5.4	5.4	1.1	1		1	0.13823	0.1683894	0.055	0.0385	0.0275	0.011	0.055	0.23147	0.2385097	0.18347	0.16679
5.6	5.6	1.1	1		1	0.13823	0.1721593	0.055	0.0385	0.0275	0.011	0.055	0.2453	0.24961	0.19201	0.17455
5.8	5.8	1.4	1		1	0.17593	0.1759292	0.07	0.049	0.035	0.014	0.07	0.26289	0.2632236	0.20248	0.18407
6	6	1.4	1		1	0.17593	0.1759292	0.07	0.049	0.035	0.014	0.07	0.28048	0.2749522	0.2115	0.19227
6.2	6.2	1.4	1		1	0.17593	0.1759292	0.07	0.049	0.035	0.014	0.07	0.29807	0.2866808	0.22052	0.20048
6.4	6.4	1.4	1		1	0.17593	0.1759292	0.07	0.049	0.035	0.014	0.07	0.31567	0.2984094	0.22955	0.20868
6.6	6.6	1.4	1		1	0.17593	0.1759292	0.07	0.049	0.035	0.014	0.07	0.33326	0.310138	0.23857	0.21688
6.8	6.8	1.4	1		1	0.17593	0.1759292	0.07	0.049	0.035	0.014	0.07	0.35085	0.3218666	0.24759	0.22508
7	7	1.4	1		1	0.17593	0.1759292	0.07	0.049	0.035	0.014	0.07	0.36845	0.3335953	0.25661	0.23328
7.2	7.2	1.4	1		1	0.17593	0.1759292	0.07	0.049	0.035	0.014	0.07	0.38604	0.3453239	0.26563	0.24149
7.4	7.4	1.4	1		1	0.17593	0.1759292	0.07	0.049	0.035	0.014	0.07	0.40363	0.3570525	0.27466	0.24969
7.6	7.6	1.4	1		1	0.17593	0.1759292	0.07	0.049	0.035	0.014	0.07	0.42122	0.3687811	0.28368	0.25789
7.8	7.8	1.4	1		1	0.17593	0.1759292	0.07	0.049	0.035	0.014	0.07	0.43882	0.3805097	0.2927	0.26609
8	8	1.4	1		1	0.17593	0.1759292	0.07	0.049	0.035	0.014	0.07	0.45641	0.3922383	0.30172	0.27429

CPT-2														
D=	0.4 m													
Ab=	0.126 m²													
As/lm=	1.257 m²/m													
Modeliavimo koeficientas														
gama RB=	2					Rb=alfab*qc*Ab								
gama RS=	1.5													
Tyrimu tikslumo koeficientas														
ksi=	1.3													
Projektinės situacijos koeficientas					0=	0 PVA	0							
gama t=	1				zond alt	0								
polio virusų gylyje	0							1	2	3	4			
								moren m	juost mol	dulkis	smelis	skaic atv		
Gylis, m	polio ilgi	q <sub>c</sub> , MPa	Grunto tipa	f <sub>s</sub>	alfa b	Rb, MPa	Rb vid, MP	q <sub>s</sub> , MPa	q <sub>s</sub> , MPa	q <sub>s</sub> , MPa	q <sub>s</sub> , MPa	q <sub>s</sub> , MPa	Rs, MPa	Rc cal, MP
													Rc k	Rc d
0	0	0.0	2		1	0	0	0	0	0	0	0	0	0
0.2	0.2	0.0	2		1	0	0	0	0	0	0	0	0	0
0.4	0.4	0.0	2		1	0	0	0	0	0	0	0	0	0
0.6	0.6	0.0	2		1	0	0	0	0	0	0	0	0	0
0.8	0.8	0.0	2		1	0	0	0	0	0	0	0	0	0
1	1	0.0	2		1	0	0	0	0	0	0	0	0	0
1.2	1.2	0.0	2		1	0	0	0	0	0	0	0	0	0
1.4	1.4	0.0	2		1	0	0	0	0	0	0	0	0	0
1.6	1.6	0.0	2		1	0	0	0	0	0	0	0	0	0
1.8	1.8	0.0	2		1	0	0	0	0	0	0	0	0	0
2	2	0.2	2		1	0.0251	0.046747	0.01	0.007	0.005	0.002	0.007	0.0018	0.024546
2.2	2.2	0.2	2		1	0.0251	0.051019	0.01	0.007	0.005	0.002	0.007	0.0035	0.027855
2.4	2.4	0.2	2		1	0.0251	0.055292	0.01	0.007	0.005	0.002	0.007	0.0053	0.031165
2.6	2.6	0.2	2		1	0.0251	0.059565	0.01	0.007	0.005	0.002	0.007	0.007	0.034474
2.8	2.8	0.2	2		1	0.0251	0.063837	0.01	0.007	0.005	0.002	0.007	0.0088	0.037783
3	3	0.2	2		1	0.0251	0.072634	0.01	0.007	0.005	0.002	0.007	0.0106	0.043354
3.2	3.2	0.9	2		1	0.1131	0.08143	0.045	0.0315	0.0225	0.009	0.0315	0.0185	0.053303
3.4	3.4	0.9	3		0.6	0.0679	0.08143	0.045	0.0315	0.0225	0.009	0.0225	0.0241	0.0568
3.6	3.6	0.9	3		0.6	0.0679	0.085954	0.045	0.0315	0.0225	0.009	0.0225	0.0298	0.062832
3.8	3.8	0.9	3		0.6	0.0679	0.090478	0.045	0.0315	0.0225	0.009	0.0225	0.0354	0.068864
4	4	0.9	3		0.6	0.0679	0.095002	0.045	0.0315	0.0225	0.009	0.0225	0.0411	0.074896
4.2	4.2	0.9	3		0.6	0.0679	0.099526	0.045	0.0315	0.0225	0.009	0.0225	0.0467	0.080927
4.4	4.4	0.9	3		0.6	0.0679	0.10405	0.045	0.0315	0.0225	0.009	0.0225	0.0524	0.086959
4.6	4.6	0.9	3		0.6	0.0679	0.108573	0.045	0.0315	0.0225	0.009	0.0225	0.0581	0.092991
4.8	4.8	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.0675	0.101536
5	5	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.0769	0.107819
5.2	5.2	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.0863	0.114103
5.4	5.4	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.0958	0.120386
5.6	5.6	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.1052	0.126669
5.8	5.8	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.1146	0.132952
6	6	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.124	0.139235
6.2	6.2	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.1335	0.145519
6.4	6.4	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.1429	0.151802
6.6	6.6	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.1523	0.158085
6.8	6.8	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.1617	0.164368
7	7	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.1712	0.170651
7.2	7.2	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.1806	0.176934
7.4	7.4	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.19	0.183218
7.6	7.6	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.1994	0.189501
7.8	7.8	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.2089	0.195784
8	8	1.5	3		0.6	0.1131	0.113097	0.075	0.0525	0.0375	0.015	0.0375	0.2183	0.202067

CPT-3																
D=	0.4	m														
Ab=	0.126	m <sup>2</sup>														
As/lm=	1.257	m <sup>2</sup> /m														
Modeliavimo koeficientas																
gama RB=	2					Rb=alfab*qc*Ab										
gama RS=	1.5															
Tyrimu tikslumo koeficientas																
kai=	1.3															
Projektines situacijos koeficientas						0=	0 PVA	0								
gama t=	1					zond alt	0									
polio virusus gylyje	0							1	2	3	4					
Gylis, m	polio ilgi	q <sub>c</sub> , MPa	Grunto tipa	f <sub>s</sub>	alfa b	Rb, MPa	Rb vid, MP	moren m	juost mol	dulkis	smelis	skaic atv	Rs, MPa	Rc cal, MP	Rc k	Rc d
0	0	0.0	2		1	0	0	0	0	0	0	0	0	0	0	0
0.2	0.2	0.0	2		1	0	0	0	0	0	0	0	0	0	0	0
0.4	0.4	0.0	2		1	0	0	0	0	0	0	0	0	0	0	0
0.6	0.6	0.0	2		1	0	0	0	0	0	0	0	0	0	0	0
0.8	0.8	0.0	2		1	0	0	0	0	0	0	0	0	0	0	0
1	1	0.0	2		1	0	0	0	0	0	0	0	0	0	0	0
1.2	1.2	0.0	2		1	0	0	0	0	0	0	0	0	0	0	0
1.4	1.4	0.0	2		1	0	0	0	0	0	0	0	0	0	0	0
1.6	1.6	0.0	2		1	0	0	0	0	0	0	0	0	0	0	0
1.8	1.8	0.0	2		1	0	0	0	0	0	0	0	0	0	0	0
2	2	0.5	2		1	0.0628	0.061575	0.025	0.0175	0.0125	0.005	0.0175	0.0044	0.03372	0.0259	0.0259
2.2	2.2	0.5	2		1	0.0628	0.061324	0.025	0.0175	0.0125	0.005	0.0175	0.0088	0.036526	0.0281	0.0281
2.4	2.4	0.5	2		1	0.0628	0.061073	0.025	0.0175	0.0125	0.005	0.0175	0.0132	0.039333	0.0303	0.0303
2.6	2.6	0.5	2		1	0.0628	0.060821	0.025	0.0175	0.0125	0.005	0.0175	0.0176	0.042139	0.0324	0.0324
2.8	2.8	0.5	2		1	0.0628	0.06057	0.025	0.0175	0.0125	0.005	0.0175	0.022	0.044946	0.0346	0.0346
3	3	0.8	3		0.6	0.0603	0.060319	0.04	0.028	0.02	0.008	0.02	0.027	0.048171	0.0371	0.0371
3.2	3.2	0.8	3		0.6	0.0603	0.060319	0.04	0.028	0.02	0.008	0.02	0.032	0.051522	0.0396	0.0396
3.4	3.4	0.8	3		0.6	0.0603	0.060319	0.04	0.028	0.02	0.008	0.02	0.0371	0.054873	0.0422	0.0422
3.6	3.6	0.8	3		0.6	0.0603	0.060319	0.04	0.028	0.02	0.008	0.02	0.0421	0.058224	0.0448	0.0448
3.8	3.8	0.8	3		0.6	0.0603	0.060319	0.04	0.028	0.02	0.008	0.02	0.0471	0.061575	0.0474	0.0474
4	4	0.8	3		0.6	0.0603	0.06635	0.04	0.028	0.02	0.008	0.02	0.0522	0.067942	0.0523	0.0523
4.2	4.2	0.8	3		0.6	0.0603	0.072382	0.04	0.028	0.02	0.008	0.02	0.0572	0.074309	0.0572	0.0572
4.4	4.4	0.8	3		0.6	0.0603	0.078414	0.04	0.028	0.02	0.008	0.02	0.0622	0.080676	0.0621	0.0621
4.6	4.6	0.8	3		0.6	0.0603	0.084446	0.04	0.028	0.02	0.008	0.02	0.0672	0.087043	0.067	0.067
4.8	4.8	0.8	3		0.6	0.0603	0.090478	0.04	0.028	0.02	0.008	0.02	0.0723	0.09341	0.0719	0.0719
5	5	0.8	3		0.6	0.0603	0.09651	0.04	0.028	0.02	0.008	0.02	0.0773	0.099777	0.0768	0.0768
5.2	5.2	0.8	3		0.6	0.0603	0.102542	0.04	0.028	0.02	0.008	0.02	0.0823	0.106144	0.0816	0.0816
5.4	5.4	0.8	3		0.6	0.0603	0.108573	0.04	0.028	0.02	0.008	0.02	0.0873	0.112511	0.0865	0.0865
5.6	5.6	0.8	3		0.6	0.0603	0.114605	0.04	0.028	0.02	0.008	0.02	0.0924	0.118878	0.0914	0.0914
5.8	5.8	1.6	3		0.6	0.1206	0.120637	0.08	0.056	0.04	0.016	0.04	0.1024	0.128596	0.0989	0.0989
6	6	1.6	3		0.6	0.1206	0.120637	0.08	0.056	0.04	0.016	0.04	0.1125	0.135298	0.1041	0.1041
6.2	6.2	1.6	3		0.6	0.1206	0.120637	0.08	0.056	0.04	0.016	0.04	0.1225	0.142	0.1092	0.1092
6.4	6.4	1.6	3		0.6	0.1206	0.120637	0.08	0.056	0.04	0.016	0.04	0.1326	0.148702	0.1144	0.1144
6.6	6.6	1.6	3		0.6	0.1206	0.120637	0.08	0.056	0.04	0.016	0.04	0.1426	0.155404	0.1195	0.1195
6.8	6.8	1.6	3		0.6	0.1206	0.120637	0.08	0.056	0.04	0.016	0.04	0.1527	0.162106	0.1247	0.1247
7	7	1.6	3		0.6	0.1206	0.120637	0.08	0.056	0.04	0.016	0.04	0.1627	0.168808	0.1299	0.1299
7.2	7.2	1.6	3		0.6	0.1206	0.120637	0.08	0.056	0.04	0.016	0.04	0.1728	0.17551	0.135	0.135
7.4	7.4	1.6	3		0.6	0.1206	0.120637	0.08	0.056	0.04	0.016	0.04	0.1828	0.182212	0.1402	0.1402
7.6	7.6	1.6	3		0.6	0.1206	0.120637	0.08	0.056	0.04	0.016	0.04	0.1929	0.188914	0.1453	0.1453
7.8	7.8	1.6	3		0.6	0.1206	0.120637	0.08	0.056	0.04	0.016	0.04	0.2029	0.195617	0.1505	0.1505
8	8	1.6	3		0.6	0.1206	0.120637	0.08	0.056	0.04	0.016	0.04	0.213	0.202319	0.1556	0.1556

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## Varzu skaičiavimai

### DETALĖ

Sieninė plokštė

Poz.	Sluoksniai	$d$ <i>m</i>	$\lambda_{ds}$ <i>W/(m·K)</i>	$\lambda_{dec}$ <i>W/(m·K)</i>			$R$ <i>m<sup>2</sup>·K/W</i>	$R_s$ <i>m<sup>2</sup>·K/W</i>	$R_{si}$ <i>m<sup>2</sup>·K/W</i>	$R_{se}$ <i>m<sup>2</sup>·K/W</i>	$R_t$ <i>m<sup>2</sup>·K/W</i>	$\theta_i$ °C	$\theta_e$ °C	$\kappa$	$U_{pr}$ <i>W/(m<sup>2</sup>·K)</i>
1	EPS	0.20	0.037	0.037			5.405	5.405	0.13	0.04	5.575			1.000	0.179

$$U_N = 0.15 \times \kappa = 0.150 \text{ W/(m}^2\cdot\text{K)} > U_{pr} = 0.179 \text{ W/(m}^2\cdot\text{K)}$$

$d$  atitvaros sluoksnio storis

$$R = d / \lambda_{ds}$$

$\lambda_{ds}$  projektinis šilumos laidumo koeficientas (STR 2.01.02:2016 8. lentelė)

$\lambda_{dec}$  deklaruojamasis šilumos laidumo koeficientas

$$R_s = R_1 + R_2 + R_{\dots}$$

$$R_t = R_{si} + R_s + R_{se}$$

$$U = 1 / R_t$$

$$\kappa = 20 / (\theta_i - \theta_e)$$

$R$  šiluminė varža

$R_s$  suminė šiluminė varža

$R_{si}$  vidaus paviršiaus šiluminė varža (STR 2.01.02:2016 2.3 lentelė)

$R_{se}$  išorės paviršiaus šiluminė varža (STR 2.01.02:2016 2.3 lentelė)

$R_t$  visuminė šiluminė varža

$\theta_i$  patalpų vidaus oro temperatūra

$\theta_e$  šildymo sezono vidutinė išorės oro temperatūra (RSN 156-94 2.6 lentelė)

$U_N$  nominalinis atitvaros šilumos perdavimo koeficientas

$U_{pr}$  atitvaros šilumos perdavimo koeficientas

### DETALĖ

Stoginė plokštė

Poz.	Sluoksniai	$d$ <i>m</i>	$\lambda_{ds}$ <i>W/(m·K)</i>	$\lambda_{dec}$ <i>W/(m·K)</i>			$R$ <i>m<sup>2</sup>·K/W</i>	$R_s$ <i>m<sup>2</sup>·K/W</i>	$R_{si}$ <i>m<sup>2</sup>·K/W</i>	$R_{se}$ <i>m<sup>2</sup>·K/W</i>	$R_t$ <i>m<sup>2</sup>·K/W</i>	$\theta_i$ °C	$\theta_e$ °C	$\kappa$	$U_{pr}$ <i>W/(m<sup>2</sup>·K)</i>
1	PUR	0.16	0.022	0.022			7.273	7.273	0.10	0.04	7.413			1.000	0.135

$$U_N = 0.15 \times \kappa = 0.150 \text{ W/(m}^2\cdot\text{K)} > U_{pr} = 0.135 \text{ W/(m}^2\cdot\text{K)}$$

$d$  atitvaros sluoksnio storis

$$R = d / \lambda_{ds}$$

$\lambda_{ds}$  projektinis šilumos laidumo koeficientas (STR 2.01.02:2016 8. lentelė)

$\lambda_{dec}$  deklaruojamasis šilumos laidumo koeficientas

$$R_s = R_1 + R_2 + R_{\dots}$$

$$R_t = R_{si} + R_s + R_{se}$$

$$U = 1 / R_t$$

$$\kappa = 20 / (\theta_i - \theta_e)$$

$R$  šiluminė varža

$R_s$  suminė šiluminė varža

$R_{si}$  vidaus paviršiaus šiluminė varža (STR 2.01.02:2016 2.3 lentelė)

$R_{se}$  išorės paviršiaus šiluminė varža (STR 2.01.02:2016 2.3 lentelė)

$R_t$  visuminė šiluminė varža

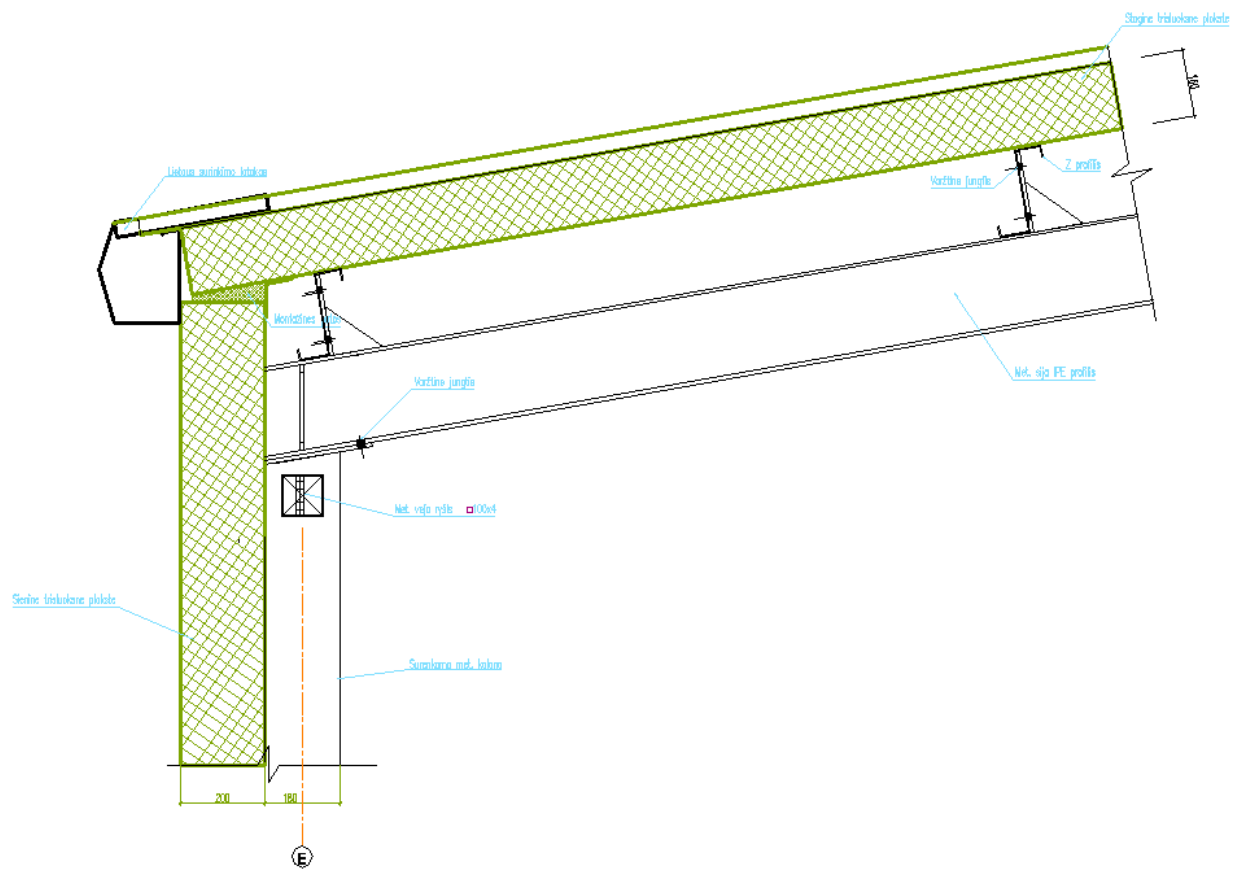
$\theta_i$  patalpų vidaus oro temperatūra

$\theta_e$  šildymo sezono vidutinė išorės oro temperatūra (RSN 156-94 2.6 lentelė)

$U_N$  nominalinis atitvaros šilumos perdavimo koeficientas

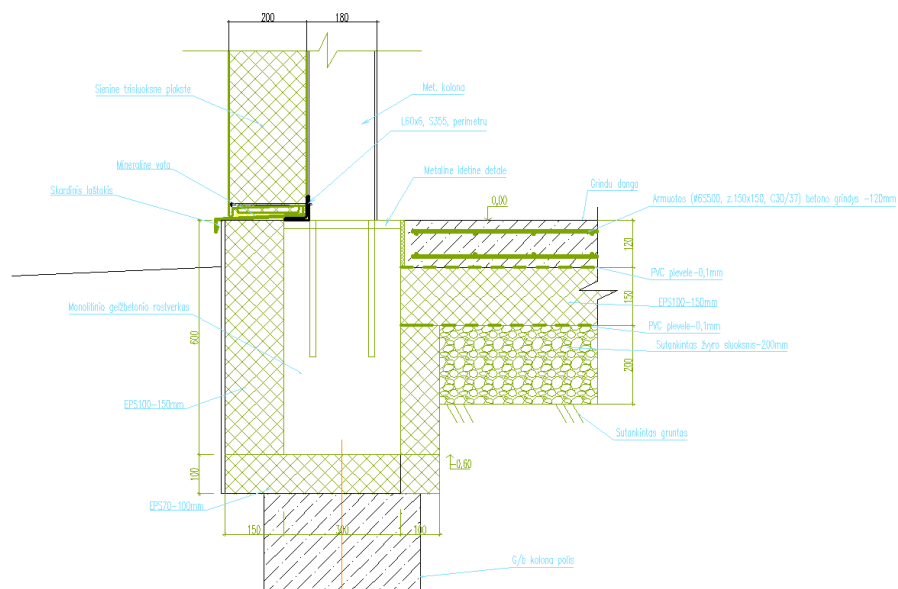
$U_{pr}$  atitvaros šilumos perdavimo koeficientas







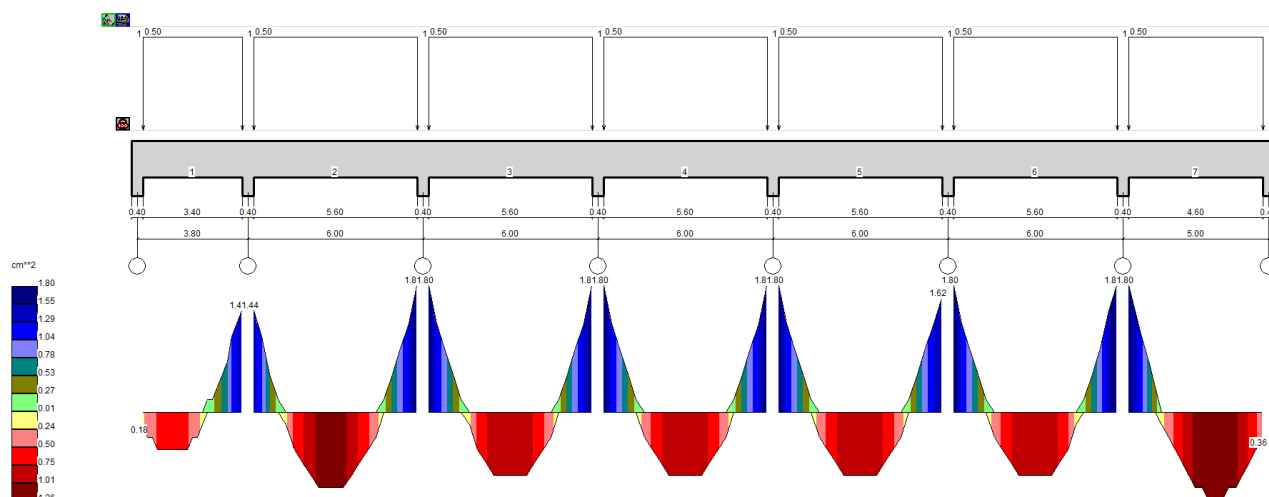
<b>Mazgas "1"</b>					
<b>Grindys ant grunto</b>					
Grindu plotas	A	856	m <sup>2</sup>		
Grindu perimetras	P	122	m		
Silumos izoliacijos storis visu plotu	h	0.15	m		
Papildomos vertikalios silumos izoliacijos storis	h	0.7	m		
Papildomos vertikalios silumos izoliacijos aukštis	D	0.15	m		
izoliacijos varža lemda					
		0.031			
	Rf	4.84	m <sup>2</sup> K/W		
	B'	14.03	m		
	dt	10.30	m		
Be šonines izoliacijos					
	Uo	0.12			
	Ro	8.36			
	Rint	12.15	m <sup>2</sup> K/W		
	d'	24.30	m		
	ΔΨ	-0.013	W/m <sup>2</sup> K	0.02008	$\Delta \Psi = -\frac{\lambda_{gr}}{\pi} \left[ \ln \left( \frac{2D}{d_t} + 1 \right) - \ln \left( \frac{2D}{d_t + d'} + 1 \right) \right]$
Ivertinus šoninę izoliaciją					
	U	0.12			
	R	8.48			
- jei grindys gerai apšiltintos ( $d_{t,x} \geq B'_{t,x}$ ):					
		$U_{fg,x} = \frac{\lambda_{gr}}{0.457 \cdot B'_{t,x} + d_{t,x}}$			(2.31)
čia: $B'_{t,x}$ – atitinkamų „x“ grindų ant grunto, kai grindys neapšiltintos arba jose įrengtas iššinis horizontalusis termoizoliacinis sluoksnis, būdingasis grindų matmuo (m);					
$\lambda_{gr}$ – grunto šilumos laidumo koeficientas (W/(m·K)). $\lambda_{gr} = 2$ W/(m·K);					
$d_{t,x}$ – atitinkamų „x“ grindų ant grunto, kai grindys neapšiltintos arba jose įrengtas iššinis horizontalusis termoizoliacinis sluoksnis, atstojamasis grindų plokštės storis, išreikštas grunto sluoksnio storio (m):					
		$d_{t,x} = w_x + \lambda_{gr} \cdot (R_{se} + R_{fx} + R_{si})$			(2.32)
čia: $R_{fx}$ – atitinkamų „x“ grindų ant grunto, kai grindys neapšiltintos arba jose įrengtas iššinis horizontalusis termoizoliacinis sluoksnis, grindų plokštės šiluminė varža (m <sup>2</sup> ·K/W) (žr. 2.3. pav.);					
$w_x$ – atitinkamas „x“ grindis ant grunto, kai grindys neapšiltintos arba jose įrengtas iššinis horizontalusis termoizoliacinis sluoksnis, ribojančios sienos storis (m) (žr. 2.3. pav.).					
Galima nevertinti grindų betoninės plokštės ir plonos grindų dangos. Išlyginamojo grunto pasluoksnio $\lambda$ toks pats kaip ir grunto, todėl jo šiluminė varža taip pat gali būti nevertinama.					
- kai termoizoliacinis sluoksnis įrengtas pagal pastato perimetrą vertikaliai, pamatų vidinėje arba išorinėje pusėje (2.5. pav.):					
		$\Psi_{ge2,x} = -\frac{\lambda_{gr}}{\pi} \left[ \ln \left( \frac{2 \cdot D_{v,x}}{d_{t2,x}} + 1 \right) - \ln \left( \frac{2 \cdot D_{v,x}}{d_{t2,x} + d'_{v,x}} + 1 \right) \right]$			(2.47)



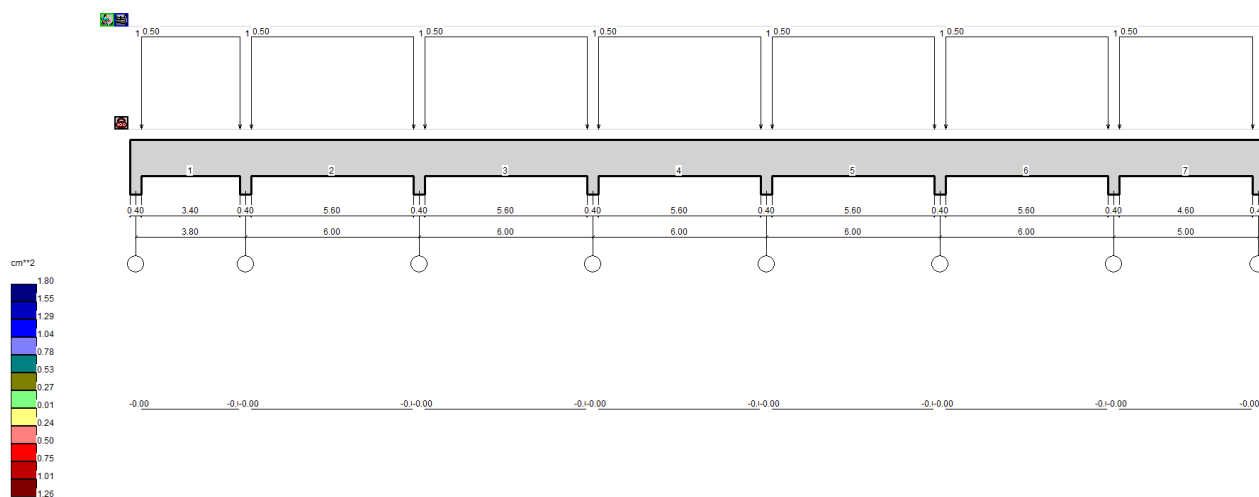
## ROSTVERKO ARMAVIMO SKAICIAVIMAS

Rostverko skerspjūvis 300x600h, betonas C25/30 XC0, armatūra S500, charakteristinė apkrova 500 kg/m<sup>2</sup>

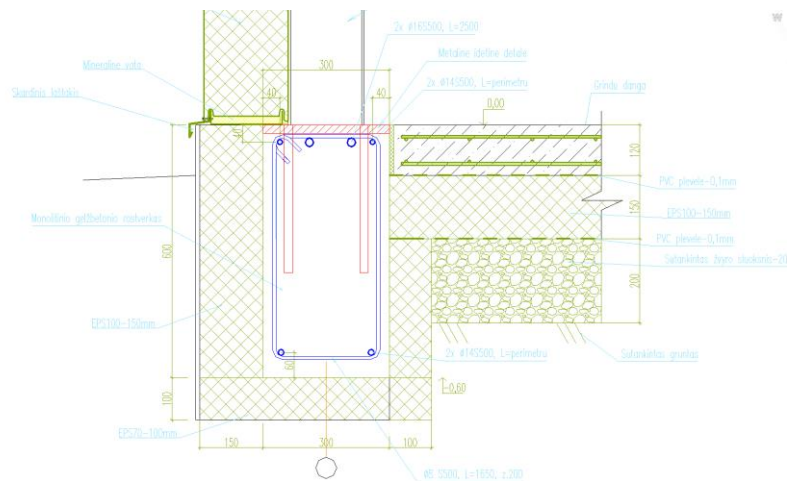
Išilginio armavimo diagramos



Skersinio armavimo diagramos



Pagal skaičiavimus skersinė armatūra nebūtina, armuojame konstruktyviai.



## STIPRUMO PRIE ĮDĖTINIŲ DELALIŲ TIKRINIMAS

Metalinės įdėtine plokštes veikia tik ašinės jėgos max 180kN ir skersinės jėgos max 20kN.

Kolona virinama perimetru 180mm x 4= 720mm

Virinimo siule 6mm, rankinio suvirinimo elektrodas E42.

Siūlės stiprumo skaičiavimas

ASINE\skersine				
siules storis	6 mm	656.0 kN	pagal siules metala	
Siules ilgis	720 mm	629.2 kN	pagal elemento metala	
Siules met skaicstiprumas	220 Mpa			
metalo skaic stiprumas	211 Mpa			
virinimo budas	0.7			

Įdėtinės detalės inkarinių strypų skaičiavimas kirpimui:

Bendras 4x d20 strypų skerspjūvis 0.0012m<sup>2</sup>

$150000 \cdot 0.0012 = 180 \text{ kN} > 20 \text{ kN}$

Kirpimo stiprumas pakankamas